UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/525,142	03/22/2022	11283261	84008-321859	7602

23644 7590 03/02/2022

Barnes & Thornburg LLP (CH)
P.O. Box 2786
Chicago, IL 60690-2786

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 95 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

INVENTOR(s) (Please see PAIR WEB site http://pair.uspto.gov for additional inventors):

Michael T. McNamara, Newport Beach, CA;
David J. Henson, Houston, TX;
Raymond E. Cline JR., Houston, TX;

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Lancium LLC, Houston, TX;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

PATENT
Attorney Docket No. 84008-321859
(18-1490-CON)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First named inventor:

Michael T. McNamara

Application No. 16/525,142

Filed: July 29, 2019

Confirmation No. 7602

Group Art Unit: 2444

Examiner: Serrao, Ranodhi N.

For: MANAGING QUEUE DISTRIBUTION BETWEEN CRITICAL DATACENTER AND FLEXIBLE DATACENTER

INTERVIEW SUMMARY

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Dear Sir:

The undersigned wishes to thank Examiner Serrao for the telephonic conversation on February 2, 2022, initiated by our firm's paralegal. The Examiner's Interview Summary, mailed February 7, 2022, which is repeated below verbatim, accurately reflects the substance of the interview.

Examiner's Interview Summary: Applicant's representative pointed out that the Notice Requiring Inventor's Oath or Declaration (PTO-2306) attached in the Notice of Allowance mailed on 1/24/22 is in error because the Oath was fixed on 8/14/19 with the fee paid under 37 CFR 1.17(i). The Examiner confirmed that this Notice is in error since the correction of inventorship was accepted on 11/07/19 by the Office.

Respectfully submitted,

February 8, 2022
Date

/Kurt W. Rohde/
Kurt W. Rohde, Reg. No. 62923
Attorney for Applicant

BARNES & THORNBURG
1 N. Wacker Drive
Suite 4400
Chicago, IL 60606
Customer Number 23644

Electronic Patent Application Fee Transmittal

Application Number:	16525142
Filing Date:	29-Jul-2019
Title of Invention:	Managing Queue Distribution between Critical Datacenter and Flexible Datacenter
First Named Inventor/Applicant Name:	Michael T. McNamara
Filer:	Kurt William Rohde/Mark Sweetin
Attorney Docket Number:	84008-321859

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1200	1200

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1200**

Electronic Acknowledgement Receipt	
EFS ID:	44941935
Application Number:	16525142
International Application Number:	
Confirmation Number:	7602
Title of Invention:	Managing Queue Distribution between Critical Datacenter and Flexible Datacenter
First Named Inventor/Applicant Name:	Michael T. McNamara
Customer Number:	23644
Filer:	Kurt William Rohde/Mark Sweetin
Filer Authorized By:	Kurt William Rohde
Attorney Docket Number:	84008-321859
Receipt Date:	08-FEB-2022
Filing Date:	29-JUL-2019
Time Stamp:	12:48:03
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1200
RAM confirmation Number	E202228C48350898
Deposit Account	120913
Authorized User	Mark Sweetin
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.17 (Patent application and reexamination processing fees) 37 CFR 1.21 (Miscellaneous fees and charges)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	321859_Issue_Fee.pdf	172133 602262ad8c0fe88ce44c8a50d147c841606edb3d	no	1
Warnings:					
Information:					
2	Applicant summary of interview with examiner	321859_Interview_Summary_220208.pdf	35016 7a8f88237405038da21d12dac5fb4a43418b40aa	no	2
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	38313 7a8780580f023c39083b8024ec705171098811ed	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	245462		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

23644 7590 01/24/2022

Barnes & Thornburg LLP (CH)
P.O. Box 2786
Chicago, IL 60690-2786

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/525,142	07/29/2019	Michael T. McNamara	84008-321859	7602

TITLE OF INVENTION: Managing Queue Distribution between Critical Datacenter and Flexible Datacenter

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	04/25/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
SERRAO, RANODHI N	2444	709-203000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Barnes & Thornburg LLP
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE	(B) RESIDENCE: (CITY and STATE OR COUNTRY)
LANCIUM LLC	Houston, Texas

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ☒ Corporation or other private group entity ❑ Government

4a. Fees submitted: ☒ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 12-0913

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Kurt W. Rohde/ Date February 8, 2022

Typed or printed name Kurt W. Rohde Registration No. 62923

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/525,142	07/29/2019	Michael T. McNamara	84008-321859	7602

23644 7590 02/07/2022

Barnes & Thornburg LLP (CH)
P.O. Box 2786
Chicago, IL 60690-2786

EXAMINER
SERRAO, RANODHI N

ART UNIT	PAPER NUMBER
2444	

NOTIFICATION DATE	DELIVERY MODE
02/07/2022	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Patent-ch@btlaw.com

Applicant-Initiated Interview Summary	**Application No.** 16/525,142	**Applicant(s)** McNamara et al.		
	Examiner RANODHI N SERRAO	**Art Unit** 2444	**AIA (First Inventor to File) Status** Yes	**Page** 1 of 1

All Participants (applicant, applicants representative, PTO personnel)	**Title**	**Type**
RANODHI N SERRAO	Primary Examiner	Telephonic
Mark Sweetin	Paralegal	

Date of Interview: 02 February 2022

Issues Discussed:

Other

Applicant's representative pointed out that the Notice Requiring Inventor's Oath or Declaration (PTO-2306) attached in the Notice of Allowance mailed on 1/24/22 is in error because the Oath was fixed on 8/14/19 with the fee paid under 37 CFR 1.17(i). The Examiner confirmed that this Notice is in error since the correction of inventorship was accepted on 11/07/19 by the Office.

/RANODHI SERRAO/ Primary Examiner, Art Unit 2444	

Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicants responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04
Please further see:
MPEP 713.04
Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)
37 CFR § 1.2 Business to be transacted in writing

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/525,142	07/29/2019	Michael T. McNamara	84008-321859	7602

23644 7590 02/04/2022

Barnes & Thornburg LLP (CH)
P.O. Box 2786
Chicago, IL 60690-2786

EXAMINER	
SERRAO, RANODHI N	

ART UNIT	PAPER NUMBER
2444	

NOTIFICATION DATE	DELIVERY MODE
02/04/2022	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Patent-ch@btlaw.com

Letter Withdrawing a Notice Requiring Inventor's Oath or Declaration	Application No. 16/525,142	Applicant(s) McNamara et al.

The Notice Requiring Inventor's Oath or Declaration mailed on 24 January 2022 was sent in error, and is hereby withdrawn. The time period set forth in the Notice of Allowance and Fee(s) Due to file a reply and pay the required fees continues to run from the mailing date of the Notice of Allowance and Fee(s) Due. Any time period set forth in the Notice of Allowability continues to run from the mailing date of the Notice of Allowability.

Questions relating to this Notice should be directed to the Application Assistance Unit at 571-272-4200.

/Brian Broadfoot/
Office of Data Management, Art Unit 3974
571-272-4200 or 1-888-786-0101
Patent Publication Branch
Office of Data Management

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/525,142	07/29/2019	Michael T. McNamara	84008-321859	7602

23644 7590 02/02/2022

Barnes & Thornburg LLP (CH)
P.O. Box 2786
Chicago, IL 60690-2786

EXAMINER
SERRAO, RANODHI N

ART UNIT	PAPER NUMBER
2444	

NOTIFICATION DATE	DELIVERY MODE
02/02/2022	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Patent-ch@btlaw.com

Corrected ***Notice of Allowability***	**Application No.** 16/525,142	**Applicant(s)** McNamara et al.	
	Examiner RANODHI N SERRAO	**Art Unit** 2444	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to 12/8/21.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-8 and 10-17 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information , please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/RANODHI SERRAO/
Primary Examiner, Art Unit 2444

Corrected Notice of Allowance

The Notice of Allowance mailed on 1/24/22 indicates claim 9 as being allowable however it was previously cancelled. This matter is being corrected herein.

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/8/21 has been entered.

Response to Arguments

Applicant's arguments and amendments, filed 12/8/21, overcome the rejection of the claims under 35 U.S.C. 103. Therefore the rejection has been withdrawn.

Terminal Disclaimer

The terminal disclaimer filed on 12/16/21 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of U.S. Patent No. 10,367,353 has been reviewed and is accepted. The terminal disclaimer has been recorded.

The nonstatutory double patenting rejection of the claims has been withdrawn in view of the Terminal Disclaimer.

Allowable Subject Matter

Claims 1-8 and 10-17 are allowed. The following is an examiner's statement of reasons for allowance: In interpreting the currently presented claims, in light of the specification, the Examiner finds the claimed invention to be patentably distinct from the prior art of record. The prior art of record does not disclose with respect to the independent claims, *a behind-the-meter ("BTM") power input system configured to receive power from the power generation system prior to the power undergoing step-up transformation for transmission to the grid and provide the received power to the flexible datacenter instead of sending the received power to the grid*. When considered as a whole, these limitations in combination with the other limitations, overcome the prior art of record. Therefore the claims are allowed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RANODHI N SERRAO whose telephone number is (571)272-7967. The examiner can normally be reached on Monday to Friday 9:00 am to 5:00 pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Follansbee can be reached on (571) 272-3964. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Ranodhi N. Serrao

/RANODHI SERRAO/
Primary Examiner, Art Unit 2444

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/525,142	McNamara et al.
	Examiner	**Art Unit**
	RANODHI N SERRAO	2444

CPC						
Symbol					**Type**	**Version**
H02J	/	3	/	12	F	2013-01-01
G06F	/	9	/	4893	I	2013-01-01
G06F	/	1	/	3206	I	2013-01-01
G06F	/	9	/	5088	I	2013-01-01
G06F	/	1	/	329	I	2013-01-01
G06F	/	9	/	5094	I	2013-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	16	
/RANODHI SERRAO/ Primary Examiner, Art Unit 2444	26 January 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20220125

Ex.1002 / Page 18 of 767
Cholla Energy LLC & OBM, Inc.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/525,142	McNamara et al.
	Examiner	**Art Unit**
	RANODHI N SERRAO	2444

INTERNATIONAL CLASSIFICATION					
CLAIMED					
H02J3/12	/	3	/	12	
G06F9/48	/	9	/	48	
G06F1/3206	/	1	/	3206	

NON-CLAIMED					
G06F9/50	/	9	/	50	
G06F1/329	/	1	/	329	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	16	
/RANODHI SERRAO/ Primary Examiner, Art Unit 2444	26 January 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20220125

Ex.1002 / Page 19 of 767
Cholla Energy LLC & OBM, Inc.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/525,142	McNamara et al.
	Examiner	Art Unit
	RANODHI N SERRAO	2444

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	9	10		19										
2	2	10	11		20										
3	3	11	12												
4	4	12	13												
5	5	13	14												
6	6	14	15												
7	7	15	16												
8	8	16	17												
	9		18												

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 16	
/RANODHI SERRAO/ Primary Examiner, Art Unit 2444 (Primary Examiner)	26 January 2022 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 4

U.S. Patent and Trademark Office

Part of Paper No.: 20220125

Ex.1002 / Page 20 of 767
Cholla Energy LLC & OBM, Inc.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

23644 7590 01/24/2022

Barnes & Thornburg LLP (CH)
P.O. Box 2786
Chicago, IL 60690-2786

EXAMINER	
SERRAO, RANODHI N	
ART UNIT	PAPER NUMBER
2444	

DATE MAILED: 01/24/2022

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/525,142	07/29/2019	Michael T. McNamara	84008-321859	7602

TITLE OF INVENTION: Managing Queue Distribution between Critical Datacenter and Flexible Datacenter

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	04/25/2022

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PTOL-85 (Rev. 02/11)

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

23644 7590 01/24/2022
Barnes & Thornburg LLP (CH)
P.O. Box 2786
Chicago, IL 60690-2786

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/525,142	07/29/2019	Michael T. McNamara	84008-321859	7602

TITLE OF INVENTION: Managing Queue Distribution between Critical Datacenter and Flexible Datacenter

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	04/25/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
SERRAO, RANODHI N	2444	709-203000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/525,142	07/29/2019	Michael T. McNamara	84008-321859	7602

23644 7590 01/24/2022

Barnes & Thornburg LLP (CH)
P.O. Box 2786
Chicago, IL 60690-2786

EXAMINER	
SERRAO, RANODHI N	
ART UNIT	PAPER NUMBER
2444	

DATE MAILED: 01/24/2022

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 02/11)

Notice Requiring Inventor's Oath or Declaration	Application No. 16/525,142	Applicant(s) Michael T. McNamara	
	Examiner SERRAO, RANODHI N	Art Unit 2444	

This notice is an attachment to the Notice of Allowability (PTOL-37), or the Notice of Allowability For A Design Application (PTOL-37D).

An inventor's oath or declaration in compliance with 37 CFR 1.63 or 1.64 executed by or with respect to each inventor has not yet been submitted.

An oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each inventor (for any inventor for which a compliant oath, declaration, or substitute statement has not yet been submitted) MUST be filed no later than the date on which the issue fee is paid. See 35 U.S.C. 115(f). Failure to timely comply will result in ABANDONMENT of this application.

A properly executed inventor's oath to declaration has not been received for the following inventor(s):

If applicant previously filed one or more oaths, declarations, or substitute statements, applicant may have received an informational notice regarding deficiencies therein.

The following deficiencies are noted:

INFORMAL ACTION PROBLEMS

Questions relating to this Notice should be directed to the Application Assistance Unit at 571-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/525,142	Applicant(s) McNamara et al.	
	Examiner RANODHI N SERRAO	Art Unit 2444	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to 12/8/21.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-17 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☑ Interview Summary (PTO-413), Paper No./Mail Date. 12/16/21.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/RANODHI SERRAO/
Primary Examiner, Art Unit 2444

Notice of Allowance

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/8/21 has been entered.

Response to Arguments

Applicant's arguments and amendments, filed 12/8/21, overcome the rejection of the claims under 35 U.S.C. 103. Therefore the rejection has been withdrawn.

Terminal Disclaimer

The terminal disclaimer filed on 12/16/21 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of U.S. Patent No. 10,367,353 has been reviewed and is accepted. The terminal disclaimer has been recorded.

The nonstatutory double patenting rejection of the claims has been withdrawn in view of the Terminal Disclaimer.

Allowable Subject Matter

Claims 1-17 are allowed. The following is an examiner's statement of reasons for allowance: In interpreting the currently presented claims, in light of the specification, the

Examiner finds the claimed invention to be patentably distinct from the prior art of record. The prior art of record does not disclose with respect to the independent claims, *a behind-the-meter ("BTM") power input system configured to receive power from the power generation system prior to the power undergoing step-up transformation for transmission to the grid and provide the received power to the flexible datacenter instead of sending the received power to the grid*. When considered as a whole, these limitations in combination with the other limitations, overcome the prior art of record. Therefore the claims are allowed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RANODHI N SERRAO whose telephone number is (571) 272-7967. The examiner can normally be reached on Monday to Friday 9:00 am to 5:00 pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Follansbee can be reached on (571) 272-3964. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Ranodhi N. Serrao

/RANODHI SERRAO/
Primary Examiner, Art Unit 2444

Examiner-Initiated Interview Summary	**Application No.** 16/525,142	**Applicant(s)** McNamara et al.		
	Examiner RANODHI N SERRAO	**Art Unit** 2444	**AIA (First Inventor to File) Status** Yes	**Page** 1 of 1

All Participants (applicant, applicants representative, PTO personnel)	**Title**	**Type**
RANODHI N SERRAO	Primary Examiner	Telephonic
Stephen C. Smith (Reg. No. 56,250)	Attorney of Record	

Date of Interview: 16 December 2021

Issues Discussed:

Non-statutory Double Patenting

The Examiner proposed filing a Terminal Disclaimer in order to advance prosecution of the application. Applicant agreed.

/RANODHI SERRAO/ Primary Examiner, Art Unit 2444	

Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicants responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04
Please further see:
MPEP 713.04
Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)
37 CFR § 1.2 Business to be transacted in writing

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/525,142	McNamara et al.
	Examiner	Art Unit
	RANODHI N SERRAO	2444

CPC - Searched*		
Symbol	**Date**	**Examiner**
Search of CPC classes listed in Application	02/19/21	RNS
Search of CPC classes listed in Application	06/30/21	RNS
Search of CPC classes listed in Application	12/17/21	RNS

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
See search history printout included with this form to determine scope of search	02/19/21	RNS
IP.com (attached)	02/19/21	RNS
See search history printout included with this form to determine scope of search	06/30/21	RNS
IP.com (attached)	06/30/21	RNS
See search history printout included with this form to determine scope of search	12/17/21	RNS
IP.com (attached)	12/17/21	RNS

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/525,142	McNamara et al.
	Examiner	Art Unit
	RANODHI N SERRAO	2444

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	Interference Searched	02/19/21	RNS
	Interference Searched	06/30/21	RNS
	Interference Searched	12/17/21	RNS

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/525,142	McNamara et al.
	Examiner	**Art Unit**
	RANODHI N SERRAO	2444

CPC						
Symbol					**Type**	**Version**
H02J	/	3	/	12	F	2013-01-01
G06F	/	9	/	4893	I	2013-01-01
G06F	/	1	/	3206	I	2013-01-01
G06F	/	9	/	5088	I	2013-01-01
G06F	/	1	/	329	I	2013-01-01
G06F	/	9	/	5094	I	2013-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	17	
/RANODHI SERRAO/ Primary Examiner, Art Unit 2444	17 December 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20211208

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/525,142	McNamara et al.
	Examiner	**Art Unit**
	RANODHI N SERRAO	2444

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H02J3/12	/	3	/	12
G06F9/48	/	9	/	48
G06F1/3206	/	1	/	3206

NON-CLAIMED				
G06F9/50	/	9	/	50
G06F1/329	/	1	/	329

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	17	
/RANODHI SERRAO/ Primary Examiner, Art Unit 2444	17 December 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20211208

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/525,142	McNamara et al.
	Examiner	Art Unit
	RANODHI N SERRAO	2444

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	10	10		19										
2	2	11	11		20										
3	3	12	12												
4	4	13	13												
5	5	14	14												
6	6	15	15												
7	7	16	16												
8	8	17	17												
9	9		18												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	17	
/RANODHI SERRAO/ Primary Examiner, Art Unit 2444	17 December 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20211208

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L85	2	("10367353" "16573577").pn.	(US-PGPUB; USPAT; USOCR; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/14 09:39 AM
L86	18	(L81 L82) and (power and grid and transform$5 and (step-up stepup (step adj up))).clm.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/14 09:43 AM
L87	261	((("MCNAMARA") near3 ("Michael")) OR (("HENSON") near3 ("David")) OR (("CLINE") near3 ("Raymond"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2021/12/14 09:44 AM
L88	42	lancium.AS,AANM.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/14 09:44 AM
L89	3	(L88 L87) AND (power AND datacenter AND grid AND operation AND queue).clm.	(US-PGPUB; USPAT; USOCR; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/14 09:45 AM
L90	3	(L88 L87) AND (power AND (data$center datacenter) AND grid AND operation AND queue).clm.	(US-PGPUB; USPAT; USOCR; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/14 09:48 AM
L351	309	L76 AND (queu$4 AND operation)	(US-PGPUB; USPAT; USOCR; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/17 02:05 PM
L352	261	((("MCNAMARA") near3 ("Michael")) OR (("HENSON") near3 ("David")) OR (("CLINE") near3 ("Raymond"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2021/12/17 02:07 PM
L353	17	lancium.as.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L354	34	(L1 L2) and (datacenter and power).clm.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L355	40	("20080030078"|"20080094797"|"20100211810"|"20100328849"|"20110238342"|"20120000121"|"20120300524"|"20130006401"|"20130063991"|"20130187464"|"20130306276"|"20140137468"|"20150155712"|"20150229227"|"20160198656"|"20160212954"|"20160324077"|"201701	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM

		04336"|"6633823"|"7143300"|"7647516"|"7702931"|"7779276"|"7861102"|"7921315"|"7970561"|"8001403"|"8006108"|"8214843"|"8374928"|"8447993"|"8571820"|"8627123"|"8789061"|"8799690"|"9003211"|"9026814"|"9207993"|"9218035"|"9552234").PN.					
L356	40	L5 and (@ad<"20181030" @rlad<"20181030")	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L357	40	L6 and (energy power)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L358	35	L6 and ((load near2 balanc$3) load$4 load-balanc$4 loadbalanc$4 (load near2 shar$4) load-shar$3 loadshar$3 work-load (work near2 load) workload balance$4)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L359	9	L8 and meter	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L360	6	L8 and queu$4	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L361	261	((("MCNAMARA") near3 ("Michael")) OR (("HENSON") near3 ("David")) OR (("CLINE") near3 ("Raymond"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2021/12/17 02:07 PM
L362	17	lancium.as.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L363	34	(L11 L12) and (datacenter and power).clm.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L364	47	(L11 L12) and (power).clm.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L365	40	("20080030078"|"20080094797"|"20100211810"|"20100328849"|"20110238342"|"20120000121"|"20120300524"|"20130006401"|"20130063991"|"20130187464"|"20130306276"|"20140137468"|"20150155712"|"20150229227"|"20160198656"|"20160212954"|"20160324077"|"20170104336"|"6633823"|"7143300"|"7647516"|"7702	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM

		931"|"7779276"|"7861102"|"7921315"|"7970561"|"8001403"|"8006108"|"8214843"|"8374928"|"8447993"|"8571820"|"8627123"|"8789061"|"8799690"|"9003211"|"9026814"|"9207993"|"9218035"|"9552234").PN.					
L366	2	(US-6633823-$ or US-7143300-$).did.	(USPAT)	OR	ON	ON	2021/12/17 02:07 PM
L367	11	L15 AND ((G06F1/3203 OR G06F1/3209 OR H02J13/0017 OR H02J13/0086 OR H02J3/14 OR H04W24/00 OR H04W52/34 OR Y02B70/3225 OR Y02B70/3266 OR Y02E60/74 OR Y04S10/30 OR Y04S20/222 OR Y04S20/242).CPC.)	(USPAT)	OR	ON	ON	2021/12/17 02:07 PM
L368	17	((("LANCIUM") near3 ("LLC"))).AS,AANM.	(USPAT)	OR	ON	ON	2021/12/17 02:07 PM
L369	42	lancium.AS,AANM.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L370	3	(L19 L20) and (power and queue and datacenter).clm.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L371	3	"20020072868" "20030023885"	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L372	81	("20130006401"|"8789061"|"9026814"|"10444818"|"20120324259"|"20150121113"|"20180202825"|"20130187464"|"20140379156"|"9003211"|"9552234"|"20060161765"|"20130227139"|"20160170469"|"20180240112"|"20190168630"|"20120072745"|"20160198656"|"8214843"|"8447993"|"8799690"|"9207993"|"20170023969"|"20180366978"|"20190052094"|"20190318327"|"8700929"|"20080094797"|"20090055665"|"20110238342"|"20160212954"|"20160324077"|"6633823"|"7647516"|"7970561"|"8571820"|"2002	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM

		0072868"|"20110072289"|"20080030078"|"20120000121"|"20170104336"|"6288456"|"7143300"|"7861102"|"7921315"|"8001403"|"8374928"|"10497072"|"20150278968"|"20050203761"|"20090089595"|"20130063991"|"20150229227"|"7702931"|"8006108"|"10367535"|"20150277410"|"20160172900"|"20170261949"|"20190324820"|"20090070611"|"20100211810"|"20100328849"|"20130306276"|"20150155712"|"9003216"|"20180367320"|"20190280521"|"20040117330"|"20120300524"|"20130086404"|"20140137468"|"20180144414"|"7779276"|"8627123"|"9218035"|"10367353"|"10452127"|"20030074464"|"20190258307"|"20160187906").PN.				
L373	17	L24 and behind	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L374	15	L25 and (@ad<"20181030" @rlad<"20181030")	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L375	11	(US-20020072868-$ or US-20030023885-$ or US-20150278968-$ or US-20180144414-$ or US-20180367320-$ or US-20180366978-$ or US-20190052094-$ or US-20190168630-$).did. or (US-6633823-$ or US-7143300-$ or US-10444818-$).did.	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/17 02:07 PM
L376	9	L27 and ((data adj center) datacenter data-center)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L377	0	L27 and ((data adj center) datacenter data-center) and queu$3	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L378	25	"20200091727" "20200136432" "20200091766" "20200089307" "20200091717" "20200379537"	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM

		"20160109916" "20180052431" "20110282982" "20130212410" "20200359572" "20160187395" "20040027004" "20120324245" "20040030457"					
L379	22	L30 and (@ad<"20181030" @rlad<"20181030")	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L380	5	L31 and ((data adj center) datacenter data-center) and queu$3	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L381	81	("20130006401"|"8789061"|"9026814"|"10444818"|"20120324259"|"20150121113"|"20180202825"|"20130187464"|"20140379156"|"9003211"|"9552234"|"20060161765"|"20130227139"|"20160170469"|"20180240112"|"20190168630"|"20120072745"|"20160198656"|"8214843"|"8447993"|"8799690"|"9207993"|"20170023969"|"20180366978"|"20190052094"|"20190318327"|"8700929"|"20080094797"|"20090055665"|"20110238342"|"20160212954"|"20160324077"|"6633823"|"7647516"|"7970561"|"8571820"|"20020072868"|"20110072289"|"20080030078"|"20120000121"|"20170104336"|"6288456"|"7143300"|"7861102"|"7921315"|"8001403"|"8374928"|"10497072"|"20150278968"|"20050203761"|"20090089595"|"20130063991"|"20150229227"|"7702931"|"8006108"|"10367535"|"20150277410"|"20160172900"|"20170261949"|"20190324820"|"20090070611"|"20100211810"|"20100328849"|"20130306276"|"20150155712"|"9003216"|"20180367320"|"20190280521"|"20040117330	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM

		"|"20120300524"|"20130086404"|"20140137468"|"20180144414"|"7779276"|"8627123"|"9218035"|"10367353"|"10452127"|"20030074464"|"20190258307"|"20160187906").PN.					
L382	13	L33 and ((data adj center) datacenter data-center) and queu$3	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L383	4	L33 and ((data adj center) datacenter data-center) and queu$3 and behind	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L384	33	"20130117621" "20190098081" "20190097933" "20180300964" "20130306276" "20160248631" "20140317315" "20090216910" "20130238785" "20180060106" "20200091727" "20130304903" "20190005576" "20130107872" "20130117426"	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L385	25	L36 and ((data adj center) datacenter data-center) and queu$3	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L386	25	L37 and (@ad<"20181030" @rlad<"20181030")	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L387	25	L38 and (power grid transformer)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L388	25	L38 and (power grid utility transformer)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L389	49	("20130006401"|"8789061"|"9026814"|"20130187464"|"20140379156"|"9003211"|"9552234"|"20020072868"|"20120072745"|"20160198656"|"8214843"|"8447993"|"8799690"|"9207993"|"20080094797"|"20090055665"|"20110238342"|"20160212954"|"20160324077"|"6633823"|"7647516"|"7970561"|"8571820"|"20080030078"|"20120000121"|"20170104	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM

		336"|"6288456"|"7143300"|"7861102"|"7921315"|"8001403"|"8374928"|"20130063991"|"20150229227"|"7702931"|"8006108"|"20100211810"|"20100328849"|"20130306276"|"20150155712"|"9003216"|"20120324259"|"20120300524"|"20130086404"|"20140137468"|"20180144414"|"7779276"|"8627123"|"9218035").PN.					
L390	19	(US-20020072868-$ or US-20030023885-$ or US-20150278968-$ or US-20180144414-$ or US-20180367320-$ or US-20180366978-$ or US-20190052094-$ or US-20190168630-$ or US-20130306276-$ or US-20130117621-$ or US-20190005576-$ or US-20180060106-$ or US-20160248631-$ or US-20120324259-$).did. or (US-6633823-$ or US-7143300-$ or US-10444818-$ or US-9143392-$ or US-9027024-$).did.	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/17 02:07 PM
L391	9	L42 and queu$3	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L392	142	serrao.xp,xa. and queu$3	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L393	28	serrao.xp,xa. and queu$3.clm.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L394	7	serrao.xp,xa. and queu$3.clm. and ((data adj center) datacenter data-center)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L395	62	("20080030078" | "20080094797" | "20090055665" | "20100211810" | "20100328849" | "20110238342" | "20120000121" | "20120072745" | "20120300524" | "20130006401" | "20130063991" | "20130086404" | "20130187464" |	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2021/12/17 02:07 PM

		"20130306276" | "20140137468" | "20140379156" | "20150155712" | "20150229227" | "20160198656" | "20160212954" | "20160324077" | "20170104336" | "20180144414" | "6288456" | "6633823" | "7143300" | "7647516" | "7702931" | "7779276" | "7861102" | "7921315" | "7970561" | "8001403" | "8006108" | "8214843" | "8374928" | "8447993" | "8571820" | "8627123" | "8789061" | "8799690" | "9003211" | "9003216" | "9026814" | "9207993" | "9218035" | "9552234").PN. OR ("10367353").URPN.					
L396	13	L47 and queu$3	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L397	7	L48 and (@ad<"20181030" @rlad<"20181030")	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L398	9	L43 and (power grid utility transformer)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L399	9	L43 and (power electricity grid utility transformer)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L400	2	"20130306276" and queu$3	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L401	2	"20130117621" and (power electricity grid utility transformer) and queu$3	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L402	2	"20130304903" and (power electricity grid utility transformer) and queu$3	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L403	2	"20130304903" and (power electricity grid utility transformer) and queu$3 and datacenter	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L404	2	"20130304903" and (power electricity grid utility transformer) and queu$3 and ((data adj center) datacenter)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L405	2	"20130304903" and (power electricity grid	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM

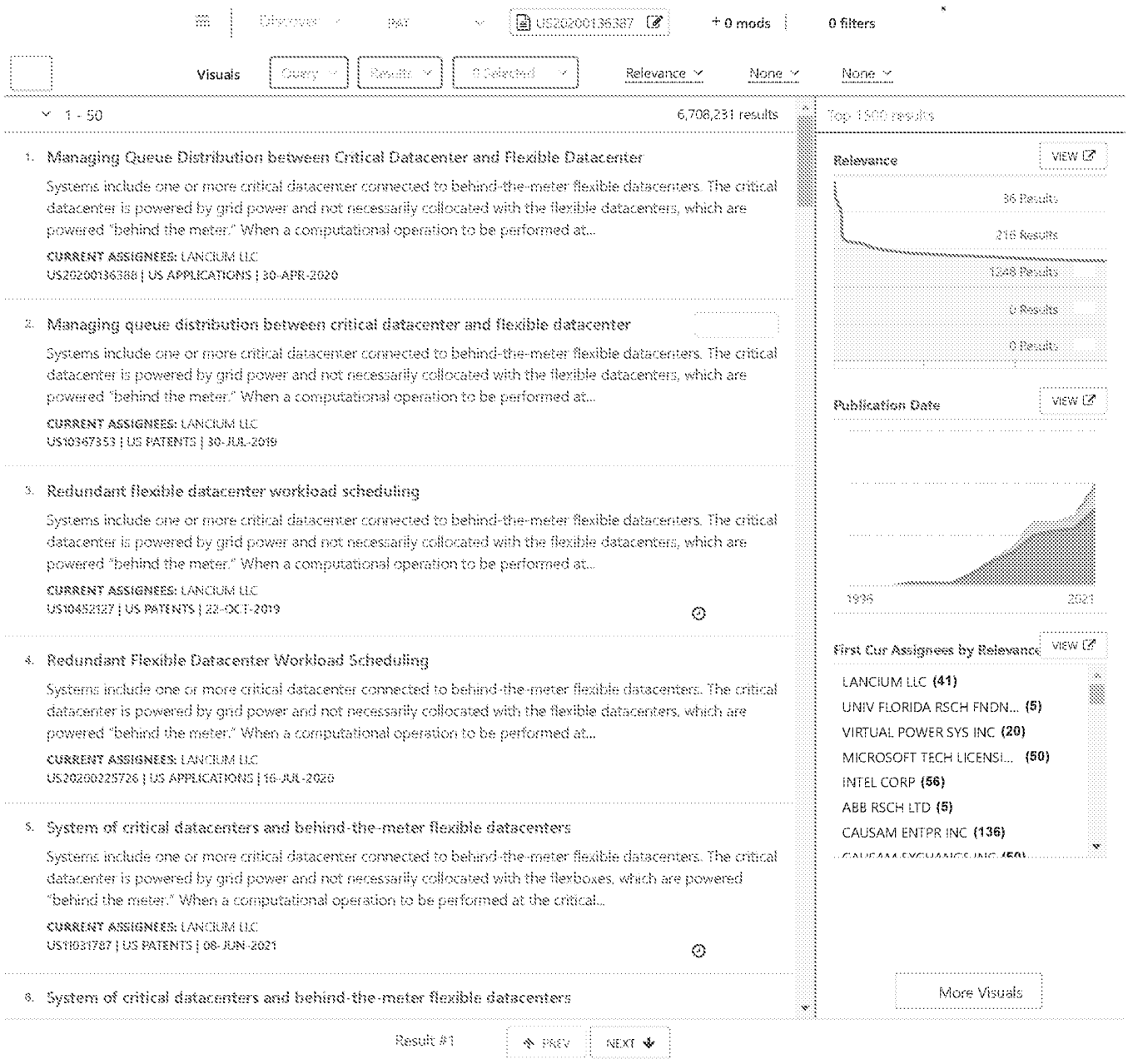
		utility transformer) and queu$3 and schedul$3 and task and ((data adj center) datacenter) and ((load near2 balanc$3) load$4 load-balanc$4 loadbalanc$4 (load near2 shar$4) load-shar$3 loadshar$3 work-load (work near2 load) workload balance$4)					
L406	2	"20130117621" and (power electricity grid utility transformer)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L407	3	"20130304903" and (power electricity grid utility transformer)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L408	19	(US-20020072868-$ or US-20030023885-$ or US-20150278968-$ or US-20180144414-$ or US-20180367320-$ or US-20180366978-$ or US-20190052094-$ or US-20190168630-$ or US-20130306276-$ or US-20130117621-$ or US-20190005576-$ or US-20180060106-$ or US-20160248631-$ or US-20120324259-$).did. or (US-6633823-$ or US-7143300-$ or US-10444818-$ or US-9143392-$ or US-9027024-$).did.	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/17 02:07 PM
L409	10	L60 and behind	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L410	1	"20200136387"	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L411	21929	((G06F1/3206 OR G06F1/329 OR G06F9/4893 OR G06F9/5088 OR G06F9/5094 OR H02J1/14 OR H02J2300/20 OR H02J2310/16 OR H02J3/12 OR H02J3/14).CPC.)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L412	20948	L63 and (power grid utility transformer)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L413	925	L64 and ((data adj center) datacenter data-	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM

		center) and queu$3					
L414	261	((("MCNAMARA") near3 ("Michael")) OR (("HENSON") near3 ("David")) OR (("CLINE") near3 ("Raymond"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2021/12/17 02:07 PM
L415	42	lancium.AS,AANM.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L416	18	(L67 L68) and (step-up stepup (step adj up)).clm.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L417	2	(US-20130304903-$ or US-20150278968-$).did.	(US-PGPUB)	OR	ON	ON	2021/12/17 02:07 PM
L418	0	L70 and (step-up stepup (step adj up)) and grid and transform$5	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L419	1	L70 and (step-up stepup (step adj up))	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L420	1	L70 and grid and transform$5	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L421	1	L70 and transform$5	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L422	21929	((G06F1/3206 OR G06F1/329 OR G06F9/4893 OR G06F9/5088 OR G06F9/5094 OR H02J1/14 OR H02J2300/20 OR H02J2310/16 OR H02J3/12 OR H02J3/14).CPC.)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L423	2813	L75 and (power and grid and transform$4)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L424	329	L76 and (step-up stepup (step adj up))	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L425	65	L77 and meter and behind	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L426	449	L75 and meter and behind	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L427	180	L75 and queu$3.clm. and ((data adj center) datacenter data-center)	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L428	261	((("MCNAMARA") near3 ("Michael")) OR (("HENSON") near3 ("David")) OR (("CLINE") near3 ("Raymond"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2021/12/17 02:07 PM
L429	42	lancium.AS,AANM.	(US-PGPUB; USPAT;	OR	ON	ON	2021/12/17

			USOCR; IBM_TDB)				02:07 PM
L430	18	(L81 L82) and (power and grid and transform$5 and (step-up stepup (step adj up))).clm.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L431	2	(L81 L82) and (power and grid and transform$5 and queu$3 and (step-up stepup (step adj up))).clm.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L432	2	("10367353" "16573577").pn.	(US-PGPUB; USPAT; USOCR; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L433	18	(L81 L82) and (power and grid and transform$5 and (step-up stepup (step adj up))).clm.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L434	261	((("MCNAMARA") near3 ("Michael")) OR (("HENSON") near3 ("David")) OR (("CLINE") near3 ("Raymond"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2021/12/17 02:07 PM
L435	42	lancium.AS,AANM.	(US-PGPUB; USPAT; USOCR; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L436	3	(L88 L87) AND (power AND datacenter AND grid AND operation AND queue).clm.	(US-PGPUB; USPAT; USOCR; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L437	3	(L88 L87) AND (power AND (data$center datacenter) AND grid AND operation AND queue).clm.	(US-PGPUB; USPAT; USOCR; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM
L438	309	L76 AND (queu$4 AND operation)	(US-PGPUB; USPAT; USOCR; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/17 02:07 PM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N86	1	(behind and meter and power and input and queue and set and grid).clm.	(USPAT)	OR	ON	ON	2021/12/17 02:01 PM


Discover
PAT
US20200136387
+ 0 mods
0 filters
Visuals
Query
Results
0 Selected
Relevance
None
None
1 - 50
6,708,231 results
Top 1500 results
1. Managing Queue Distribution between Critical Datacenter and Flexible Datacenter
Systems include one or more critical datacenter connected to behind-the-meter flexible datacenters. The critical datacenter is powered by grid power and not necessarily collocated with the flexible datacenters, which are powered "behind the meter." When a computational operation to be performed at...
CURRENT ASSIGNEES: LANCIUM LLC
US20200136388 | US APPLICATIONS | 30-APR-2020
2. Managing queue distribution between critical datacenter and flexible datacenter
Systems include one or more critical datacenter connected to behind-the-meter flexible datacenters. The critical datacenter is powered by grid power and not necessarily collocated with the flexible datacenters, which are powered "behind the meter." When a computational operation to be performed at...
CURRENT ASSIGNEES: LANCIUM LLC
US10367353 | US PATENTS | 30-JUL-2019
3. Redundant flexible datacenter workload scheduling
Systems include one or more critical datacenter connected to behind-the-meter flexible datacenters. The critical datacenter is powered by grid power and not necessarily collocated with the flexible datacenters, which are powered "behind the meter." When a computational operation to be performed at...
CURRENT ASSIGNEES: LANCIUM LLC
US10452127 | US PATENTS | 22-OCT-2019
4. Redundant Flexible Datacenter Workload Scheduling
Systems include one or more critical datacenter connected to behind-the-meter flexible datacenters. The critical datacenter is powered by grid power and not necessarily collocated with the flexible datacenters, which are powered "behind the meter." When a computational operation to be performed at...
CURRENT ASSIGNEES: LANCIUM LLC
US20200225726 | US APPLICATIONS | 16-JUL-2020
5. System of critical datacenters and behind-the-meter flexible datacenters
Systems include one or more critical datacenter connected to behind-the-meter flexible datacenters. The critical datacenter is powered by grid power and not necessarily collocated with the flexiboxes, which are powered "behind the meter." When a computational operation to be performed at the critical...
CURRENT ASSIGNEES: LANCIUM LLC
US11031787 | US PATENTS | 08-JUN-2021
6. System of critical datacenters and behind-the-meter flexible datacenters
Relevance
VIEW
36 Results
216 Results
1248 Results
0 Results
0 Results
Publication Date
VIEW
1996
2021
First Cur Assignees by Relevance
VIEW
LANCIUM LLC (41)
UNIV FLORIDA RSCH FNDN... (5)
VIRTUAL POWER SYS INC (20)
MICROSOFT TECH LICENSI... (50)
INTEL CORP (56)
ABB RSCH LTD (5)
CAUSAM ENTPR INC (136)
More Visuals
Result #1
PREV
NEXT

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 3

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	001	US-20120326511	12-27-2012	JOHNSON; Lars	
	002	US-20160087909	03-24-2016	CHATTERJEE; Aveek N. et al.	
	003	US-20180116070	04-26-2018	BROADBENT; Craig et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
	001	CN-101803148-A	08-11-2010	EXAFLOP LLC.		☒
	002	CN-103748757-A	04-23-2014	AES CORP.		☒
	003	CN-104969434-A	10-07-2015	GEN COMPRESSION INC.		☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.N.S./

Examiner Signature	/RANODHI SERRAO/	Date Considered	12/17/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

Confirmation No. 7602

Substitute for form 1449/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)	Application Number	16/525142
	Filing Date	07-29-2019
	First Named Inventor	MCNAMARA; Michael T.
	Art Unit	2444
	Examiner Name	SERRAO, RANODHI N
Sheet 2 of 3	Attorney Docket Number	84008-321859 (18-1490-CON)

NON-PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.[1]	Include name of the author(in CAPITAL LETTERS),title of the article(when appropriate), title of the item (book,magazine,journal,serial,symposium,catalog,etc.),date,page(s),volume-issue number(s),publisher, city and/or country where published.	T[2]
		None	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.N.S./

Examiner Signature	/RANODHI SERRAO/	Date Considered	12/17/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

Confirmation No. 7602

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)				Application Number	16/525142
				Filing Date	07-29-2019
				First Named Inventor	MCNAMARA; Michael T.
				Art Unit	2444
				Examiner Name	SERRAO, RANODHI N
Sheet	3	of	3	Attorney Docket Number	84008-321859 (18-1490-CON)

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ Please charge any required fees or credit any overpayments in connection with this communication to Deposit Account No. 12-0913.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Stephen C. Smith/	Date (YYYY-MM-DD)	December 16, 2021
Name/Print	Stephen C. Smith	Registration Number	56250

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 4

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	001	US-6748932	06-15-2004	SORTER; Richard L. et al.	
	002	US-7278273	10-09-2007	WHITTED; William H. et al.	
	003	US-9252598	02-02-2016	BELADY; Christian L. et al.	
	004	US-9416904	08-16-2016	BELADY; Christian L. et al.	
	005	US-9618991	04-11-2017	CLIDARAS; Jimmy et al.	
	006	US-10033210	07-24-2018	PETERSON; Eric C. et al.	
	007	US-10340696	07-02-2019	PAINE; Miles et al.	
	008	US-10795428	10-06-2020	WALSH; Sean	
	009	US-10822992	11-03-2020	SPEARS; Christopher Steele	
	010	US-10862307	12-08-2020	CAVNESS; Charles et al.	
	011	US-10873211	12-22-2020	McNAMARA; Michael T. et al.	
	012	US-10931117	02-23-2021	SHOEMAKER; Patrick Robert	
	013	US-11016458	05-25-2021	McNAMARA; Michael T. et al.	
	014	US-11016553	05-25-2021	McNAMARA; Michael T. et al.	
	015	US-11025060	06-01-2021	McNAMARA; Michael T. et al.	
	016	US-11031787	06-08-2021	McNAMARA; Michael T. et al.	
	017	US-20030037150	02-20-2003	NAKAGAWA; O. Sam	
	018	US-20050034128	02-10-2005	NAGASHIMA; Noritake et al.	
	019	US-20060253675	11-09-2006	JOHANNES BLOKS; Rudolf Henricus	
	020	US-20100333113	12-30-2010	JOHNSON; Darrin P. et al.	
	021	US-20130054987	02-28-2013	PFEIFFER; Clemens et al.	
	022	US-20130328395	12-12-2013	KRIZMAN; Robert et al.	
	023	US-20160202744	07-14-2016	CASTRO-LEON; Enrique G.	
	024	US-20200167197	05-28-2020	BAHRAMSHAHRY; Armin et al.	
	025	US-20210175710	06-10-2021	CAMPBELL; Jeffrey et al.	

Examiner Signature	/RANODHI SERRAO/	Date Considered	12/17/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.N.S./

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 4

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	026	US-20210287309	09-16-2021	GEBHARDT; Eric et al.	
	027	US-20210298195	09-23-2021	BARBOUR; Stephen	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
	001	WO-2020227811-A1	11-19-2020	UPSTREAM DATA INC [CA]		☐

Examiner Signature	/RANODHI SERRAO/	Date Considered	12/17/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.N.S./

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 3 of 4

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author(in CAPITAL LETTERS),title of the article(when appropriate), title of the item (book,magazine,journal,serial,symposium,catalog,etc.),date,page(s),volume-issue number(s),publisher, city and/or country where published.	T[2]
	001	European Patent Application No. EP18900411.2, Partial Supplementary European Search Report dated September 09, 2021.	☐
	002	Final Office Action mailed 09 August 2021 on for U.S. Patent Application No. 16/529,402, filed on 01 August 2019, 43 pages.	☐
	003	Final Office Action mailed 09 August 2021 on for U.S. Patent Application No. 16/573,577, filed on 17 September 2019, 16 pages.	☐
	004	GHATIKAR et al., "Demand Response Opportunities and Enabling Technologies for DataCenters: Findings from Field Studies," Lawrence Berkeley National Laboratory, August 2012, 57 pages.	☐
	005	International Search Report and Written Opinion of PCT Application No. PCT/US2021/045972, mailed on 15 November 2021, 16 pages.	☐
	006	Notice of Allowance mailed on 09 June 2021 for U.S. Patent Application No. 16/528,348, filed on 31 July 2019, 11 pages.	☐
	007	Notice of Allowance mailed 26 July 2021 on for U.S. Patent Application No. 16/284,610, filed on 25 February 2019, 2 pages.	☐
	008	Notice of Allowance mailed 8 October 2021 on for U.S. Patent Application No. 16/528,348, filed on 31 July 2019, 3 pages.	☐
	009	Notice of Allowance mailed on 24 September 2021 for U.S. Patent Application No. 16/528,348, filed on 31 July 2019, 06 pages.	☐

Examiner Signature	/RANODHI SERRAO/	Date Considered	12/17/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.N.S./

Confirmation No. 7602

Substitute for form 1449/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)	Application Number	16/525142
	Filing Date	07-29-2019
	First Named Inventor	MCNAMARA; Michael T.
	Art Unit	2444
	Examiner Name	SERRAO, RANODHI N
Sheet 4 of 4	Attorney Docket Number	84008-321859 (18-1490-CON)

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ Please charge any required fees or credit any overpayments in connection with this communication to Deposit Account No. 12-0913.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Stephen C. Smith/	Date (YYYY-MM-DD)	December 8, 2021
Name/Print	Stephen C. Smith	Registration Number	56250

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 3

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	001	US-20120326511	12-27-2012	JOHNSON; Lars	
	002	US-20160087909	03-24-2016	CHATTERJEE; Aveek N. et al.	
	003	US-20180116070	04-26-2018	BROADBENT; Craig et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
	001	CN-101803148-A	08-11-2010	EXAFLOP LLC.		☒
	002	CN-103748757-A	04-23-2014	AES CORP.		☒
	003	CN-104969434-A	10-07-2015	GEN COMPRESSION INC.		☒

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

Confirmation No. 7602

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)				Application Number	16/525142
				Filing Date	07-29-2019
				First Named Inventor	MCNAMARA; Michael T.
				Art Unit	2444
				Examiner Name	SERRAO, RANODHI N
Sheet	2	of	3	Attorney Docket Number	84008-321859 (18-1490-CON)

NON-PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.[1]	Include name of the author(in CAPITAL LETTERS),title of the article(when appropriate), title of the item (book,magazine,journal,serial,symposium,catalog,etc.),date,page(s),volume-issue number(s),publisher, city and/or country where published.	T[2]
		None	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

Confirmation No. 7602

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)				Application Number	16/525142
				Filing Date	07-29-2019
				First Named Inventor	MCNAMARA; Michael T.
				Art Unit	2444
				Examiner Name	SERRAO, RANODHI N
Sheet	3	of	3	Attorney Docket Number	84008-321859 (18-1490-CON)

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ Please charge any required fees or credit any overpayments in connection with this communication to Deposit Account No. 12-0913.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Stephen C. Smith/	Date (YYYY-MM-DD)	December 16, 2021
Name/Print	Stephen C. Smith	Registration Number	56250

CERTIFICATE OF EFS FILING UNDER 37 CFR §1.8

I hereby certify that this correspondence is being electronically transmitted to the United States Patent and Trademark Office, Commissioner for Patents, via the EFS pursuant to 37 CFR §1.8 on the below date:

Date: December 16, 2021 Name: Stephen C. Smith (Reg. No. 56,250) Signature: /Stephen C. Smith/

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of:	McNamara et al.		
Appln. No.:	16/525,142	Examiner:	SERRAO, Ranodhi N.
Filed:	July 29, 2019	Art Unit:	2444
For:	Managing Queue Distribution between Critical Datacenter and Flexible Datacenter	Conf. No.:	7602
Attorney Docket No.:	84008-321859		

COMMUNICATION

Mail Stop Amendment
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The undersigned submits herewith a Terminal Disclaimer to link the ownership and term with commonly assigned U.S. Pat. No. 10,367,353.

In view of the above, Applicant respectfully requests allowance of the application.

Respectfully submitted,

December 16, 2021
Date

/ Stephen C. Smith/
Stephen C. Smith, Reg. No. 56,250
Attorney for Applicant

BARNES & THORNBURG
1 N. Wacker Drive
Suite 4400
Chicago, IL 60606
Customer Number 23644

Bibliographic data

Title:	Power supply for a data center
Pub/Pat no:	CN101803148A
Pub/Issue Date:	2010-08-11
Inventor(s):	SELVER CORHODZIC| CARLSON ANDREW B| WHITTED WILLIAM H| MONTGOMERY SYKORA| KEN KRIEGER| WILLIAM HAMBURGEN| BEATY DONALD L| GERALD AIGNER| JIMMY CLIDARAS |CORHODZIC SELVER |CARLSON ANDREW B |WHITTED WILLIAM H |SYKORA MONTGOMERY |KRIEGER KEN |HAMBURGEN WILLIAM |BEATY DONALD L |AIGNER GERALD |CLIDARAS JIMMY
Applicant(s):	EXAFLOP LLC
Classification:	H02J9/06AI; G06F1/26AI; H02J1/14AI; H02M1/42AI; H02M3/335AI
Application number:	CN200880106672 2008-07-18
Priority number:	WO2008US70475 2008-07-18; US20070779606 2007-07-18;

Abstract of CN101803148A

Apparatus and associated method and computer program products involve a highly efficient uninterruptible power distribution architecture to support modular processing units. As an illustrative example, a modular processing unit includes an integrated uninterruptible power system in which a PFC-boost AC-to- DC conversion occurs between the utility AC grid and the processing circuit (e.g., microprocessor) loads. In an illustrative data center facility, a power distribution architecture includes a modular array of rack-mountable processing units, each of which has processing circuitry to handle network-related processing tasks. Associated with each modular processing unit is an integrated uninterruptible power supply (UPS) to supply operating power to the network processing circuitry. Each UPS includes a battery selectively connectable across a DC bus, and a AC-to-DC rectifier that converts an AC input voltage to a single output voltage on the DC bus. The regulated DC bus voltage may be close to the battery's fully charged voltage.

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 101803148 A
(43)申请公布日 2010.08.11

(21)申请号 200880106672.3

(22)申请日 2008.07.18

(30)优先权数据
11/779,606 2007.07.18 US

(85)PCT申请进入国家阶段日
2010.03.11

(86)PCT申请的申请数据
PCT/US2008/070475 2008.07.18

(87)PCT申请的公布数据
WO2009/012451 EN 2009.01.22

(71)申请人 埃克弗洛普公司
地址 美国加利福尼亚州

(72)发明人 塞尔韦特·康赫德兹克
安德鲁·B·卡尔森
威廉·H·维特德
蒙哥马利·西科拉 肯·克里格
威廉·哈姆伯根 唐纳德·L·比提
杰拉尔德·艾格纳
吉米·克里达拉斯

(74)专利代理机构 中原信达知识产权代理有限责任公司 11219
代理人 张焕生 安翔

(51)Int.Cl.
H02J 9/06(2006.01)
G06F 1/26(2006.01)
H02M 3/335(2006.01)
H02J 1/14(2006.01)
H02M 1/42(2006.01)

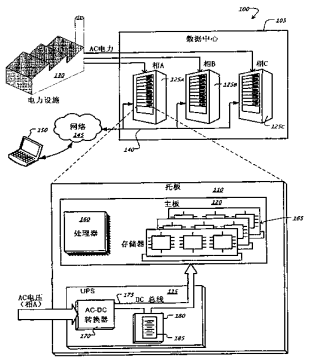
权利要求书 4 页 说明书 17 页 附图 11 页

(54)发明名称

用于数据中心的电源

(57)摘要

装置和相关联的方法以及计算机程序产品涉及支持模块化处理单元的高效不间断配电架构。作为说明性的示例，模块化处理单元包括集成的不间断电力系统，在其中在设施AC线路网和处理电路（例如，微处理器）负载之间发生PFC升压AC到DC转换。在说明性的数据中心设施中，配电架构包括机架可安装的处理单元的模块化阵列，每一个机架可安装的处理单元具有处理网络相关的处理任务的处理电路。与每一个模块化处理单元相关联的是向网络处理电路供应操作电力的集成的不间断电源(UPS)。每一个UPS包括跨DC总线能够选择性地连接的电池以及将AC输入电压转换为DC总线上的单个输出电压的AC到DC整流器。调节的DC总线电压可以接近于电池的全充满电压。



CN 101803148 A

1. 一种用于数据中心的配电系统，所述系统包括：

DC 负载，包括可操作地处理通过网络接收的数据的至少一个数字处理器；

DC 总线，被配置来向所述 DC 负载输送操作电力，所述电力从跨所述 DC 总线连接的电源接收；以及

不间断电源 (UPS)，与所述 DC 负载集成，所述 UPS 包括：

电池电路，被配置来在故障条件期间跨所述 DC 总线操作地连接电池，在所述故障条件中 AC 输入电压信号降至正常操作范围之外，其中所述 AC 输入电压信号源自旋转 AC 发电机处；

AC 到 DC 整流级，包括 AC 到 DC 转换电路，所述 AC 到 DC 转换电路被配置来当所述 AC 输入电压信号在所述正常操作范围内时接收基本上未调整的 AC 输入电压并且将所述 AC 输入电压信号转换为跨所述 DC 总线的单个 DC 输出电压信号，其中所述 AC 到 DC 转换电路被配置来将所述 DC 输出电压信号调节至高于并基本上接近所述电池的最大标称充电电压的电压水平；以及

控制器，被配置来响应于指示所述 AC 输入电压信号已返回至所述正常操作范围的信号，选择性地激活所述 AC 到 DC 转换电路以恢复向所述 DC 负载供应操作电力。

2. 如权利要求 1 所述的系统，其中所述控制器进一步控制开关以跨所述 DC 总线选择性地连接所述电池。

3. 如权利要求 1 所述的系统，其中所述电池包括以串联的方式电连接的一个或多个单元电池。

4. 如权利要求 1 所述的系统，其中所述电池包括以并联的方式电连接的一个或多个单元电池。

5. 如权利要求 1 所述的系统，其中所述 AC 输入电压信号源自从由下列组成的组中所选择的一个或多个发电机类型：在电力设施工厂中的发电机；燃气涡轮机；蒸汽轮机；以及燃料驱动的电动发电机。

6. 如权利要求 1 所述的系统，其中所述 AC 输入电压信号包括来自三相 AC 系统的相电压信号和中性线信号。

7. 如权利要求 1 所述的系统，其中所述 AC 输入电压具有大约 208 伏特至大约 277 伏特的均方根值。

8. 如权利要求 1 所述的系统，其中所述 AC 输入电压具有在大约 85 伏特和至少大约 480 伏特之间的均方根值。

9. 如权利要求 1 所述的系统，其中所述 AC 输入电压基本上包括在大约 45Hz 和至少大约 500Hz 之间的频率的正弦曲线波形。

10. 如权利要求 1 所述的系统，其中所述 AC 输入电压被连接到 WYE 连接的电压源。

11. 如权利要求 1 所述的系统，其中在所述电池中的单元电池包括从由下列组成的组中所选择的电池化学性：铅酸；镍金属氢化物；镍镉；碱性；以及锂离子。

12. 如权利要求 1 所述的系统，进一步包括充电器，被配置来通过跨所述 DC 总线连接的路径对所述电池进行充电。

13. 如权利要求 1 所述的系统，其中所述单个 DC 总线电压小于大约 26 伏特。

14. 如权利要求 1 所述的系统，其中所述单个 DC 总线电压在大约 10 伏特和大约 15 伏

Ex.1002 / Page 61 of 767
Cholla Energy LLC & OBM, Inc.

特之间。

15. 如权利要求 1 所述的系统，其中所述单个 DC 总线电压是大约 13.65 伏特。

16. 如权利要求 1 所述的系统，其中所述 AC 到 DC 转换电路将所述 DC 输出电压信号调节至高于所述电池的所述最大标称充电电压约 1 伏特。

17. 如权利要求 1 所述的系统，其中所述 DC 总线电压向线性调节器提供充足的电压以根据电池规范将所述电池涓流充电至全充满状态，所述线性调节器跨所述 DC 总线与所述电池串联连接。

18. 如权利要求 1 所述的系统，其中所述 DC 总线包括以第一电压的第一电路径，并且进一步包括以第二电压的第二电路径。

19. 如权利要求 1 所述的系统，其中所述第一和第二电压中的一个基本上在地基准电势。

20. 如权利要求 1 所述的系统，其中所述系统具有仅一个整流电路，所述整流电路被配置来将 AC 波形转换为 DC 波形。

21. 如权利要求 1 所述的系统，其中所述电池的第一端子被配置来直接连接到所述 DC 总线的第一轨，以及所述电池的第二端子被选择性地连接到所述 DC 总线的第二轨。

22. 如权利要求 1 所述的系统，进一步包括数据存储，其中所述 AC 到 DC 转换器在所述至少一个处理器接收指示去除了在所述 AC 电压输入信号中的所述故障的信号后的一延迟时间后，恢复调节所述 DC 输出电压信号，所述延迟时间与所述数据存储中的延迟时间参数相对应。

23. 如权利要求 22 所述的系统，其中所述至少一个数字处理器中的一个确定所存储的延迟时间参数。

24. 如权利要求 22 所述的系统，其中所存储的延迟时间参数包括伪随机生成的值。

25. 如权利要求 1 所述的系统，其中所述 DC 负载、所述 DC 总线以及所述 AC 到 DC 整流级都被包括在模块化的基座上，所述模块化的基座被配置来支撑在机架安装结构上的多个位置中的一个中，所述基座用于安装在机架或框架中的多个位置中的任何可用的一个中。

26. 如权利要求 1 所述的系统，其中所述 DC 负载包括由下列组成的组中的至少一个：中央处理单元；数据存储设备；数学协处理器；以及数字信号处理器。

27. 如权利要求 26 所述的系统，进一步包括至少一个 DC-DC 转换器，被配置来将在所述 DC 总线上供应的电压转换为至少一个另外的 DC 电压。

28. 如权利要求 27 所述的系统，其中所述至少一个另外的 DC 电压中的一个或多个约是由下列组成的组中的一个的电压：-5；1；3；3.3；5；7.5；10；大约 18-20；以及大约 20-26 伏特。

29. 如权利要求 27 所述的系统，其中所述至少一个 DC-DC 转换器中的所述一个或多个被配置来提供改进的输出阻抗。

30. 如权利要求 27 所述的系统，其中所述至少一个 DC-DC 转换器中的所述一个或多个被配置来从所述 DC 总线上供应的所述电压过滤噪声。

31. 如权利要求 1 所述的系统，其中所述 AC 输入电压信号源自从下列组成的组中所选择的一个或多个电能源：至少一个太阳电池板；至少一个风力涡轮机；以及至少一个飞轮。

32. 如权利要求 1 所述的系统，其中所述 DC 负载进一步包括一个或多个包含信息的信

Ex.1002 / Page 62 of 767
Cholla Energy LLC & OBM, Inc.

号，所述信号被传送到在所述 DC 负载外部的负载。

33. 如权利要求 1 所述的系统，进一步包括与所述 AC 输入电压并联连接的所述 DC 负载的至少 10 个实例。

34. 一种用于在数据中心中使用的 DC 负载，所述负载包括：

主板，包括可操作地处理通过网络接收的数据的至少一个数字处理器；

DC 总线，被配置来将操作电力输送到所述主板，所述电力从跨所述 DC 总线连接的电源接收；以及

不间断电源 (UPS)，与所述 DC 负载集成，所述 UPS 包括：

电池电路，被配置来在故障条件期间跨所述 DC 总线操作地连接电池，在所述故障条件中 AC 输入电压信号降至正常操作范围之外；

AC 到 DC 整流级，包括 PFC 升压 AC 到 DC 转换电路，所述 PFC 升压 AC 到 DC 转换电路被配置来在所述 AC 输入电压信号在所述正常操作范围内时将基本上未调整的 AC 输入电压信号转换为跨所述 DC 总线的单个 DC 输出电压信号，其中所述 AC 到 DC 转换电路被配置来将所述 DC 输出电压信号调节至高于并基本上接近于所述电池的最大标称充电电压的电压水平；以及

控制器，被配置来响应于指示所述 AC 输入电压信号已返回至所述正常操作范围的信号，选择性地激活所述 AC 到 DC 转换电路以恢复向所述 DC 负载供应操作电力。

35. 如权利要求 34 所述的 DC 负载，进一步包括所述主板上的至少一个负载点 DC-DC 转换器，被配置来从所述 DC 总线接收 DC 电压并且向所述主板上的操作电路提供调整的 DC 电压。

36. 如权利要求 35 所述的 DC 负载，其中所述至少一个负载点 DC-DC 转换器中的一个或多个被配置来提供改进的 DC 输出阻抗。

37. 如权利要求 34 所述的 DC 负载，其中所述 PFC 升压 AC 到 DC 转换电路是包括平均电流模式控制 (ACMC) 的连续导电模式 (CCM) 类型的。

38. 如权利要求 34 所述的 DC 负载，其中所述 PFC 升压 AC 到 DC 转换电路是临界导电模式 (CRM) 类型的。

39. 如权利要求 34 所述的 DC 负载，被连接在数据中心中，所述数据中心进一步包括与所述 AC 输入电压并联连接的 50 个或更多个如权利要求 34 所述的 DC 负载。

40. 一种向数据中心中的主板处提供不间断电力的方法，所述方法包括：

将供应单个 DC 电压的 DC 总线连接到至少一个 DC 负载，每一个 DC 负载包括至少一个数字处理器；

在来自电力设施线路网的 AC 输入电压信号在正常电压范围内时操作 PFC 升压 AC 到 DC 转换器，所述操作步骤包括：

将所述 AC 输入电压信号转换为所述 DC 总线上的 DC 电压，其中所述转换步骤包括所述电力设施线路网生成并输送到所述 DC 负载的电力的仅有的 AC 到 DC 整流；

将所述转换的 DC 总线电压调节至设定点电压，所述设定点电压基本上接近于用于备用电池的标称电压范围中的电压；

响应于检测到所述 AC 输入电压信号的故障条件，跨所述 DC 总线直接连接电池电路以使所述电池电路中的所述备用电池能够向所述 DC 负载提供操作电力，使得所述 DC 负载在

Ex.1002 / Page 63 of 767
Cholla Energy LLC & OBM, Inc.

检测到所述故障后继续操作一段时间。

41. 如权利要求38所述的方法，进一步包括连续提供操作电力以在至少10秒钟基本上不间断的情况下操作所述DC负载。

42. 如权利要求38所述的方法，其中所述设定点电压基本上接近于用于所述备用电池的标称全充满电压。

43. 如权利要求38所述的方法，进一步包括基于所述备用电池的操作条件动态地选择所述设定点电压。

44. 如权利要求38所述的方法，进一步包括检测所述AC输入电压信号的故障条件。

45. 一种向在数据中心中操作的主板的实质部分提供不间断电力的方法，所述方法包括：

将基本上未调整的AC供应电压连接到至少50个负载，每一个负载包括PFC升压AC到DC转换器，所述转换器将转换的DC总线电压调节至设定点电压，所述设定点电压基本上接近于用于备用电池的标称电压范围中的电压；

检测所述AC输入电压信号的故障条件；

响应于检测到所述AC输入电压信号的故障条件，跨所述DC总线直接连接电池电路以使所述电池电路中的所述备用电池能够向所述DC负载提供操作电力，使得所述DC负载在检测到所述故障后继续操作一段时间。

46. 如权利要求45所述的方法，其中所述至少50个负载中的一个或多个进一步包括向处理器供应过滤的DC电压的负载点DC-DC转换器。

47. 如权利要求45所述的方法，其中所述至少50个负载中的一个或多个进一步包括向处理器供应改进的输出阻抗DC电压的负载点DC-DC转换器。

48. 如权利要求45所述的方法，其中所述PFC升压AC到DC转换器是包括平均电流模式控制(ACMC)的连续导电模式(CCM)类型的。

49. 如权利要求45所述的方法，其中所述PFC升压AC到DC转换器是临界导电模式(CRM)类型的。

50. 如权利要求45所述的方法，进一步包括将所述至少50个负载的组合功率因数提供给所述AC供应电压，所述组合功率因数是至少0.95。

51. 如权利要求45所述的方法，进一步包括将所述至少50个负载的组合功率因数提供给所述AC供应电压，所述组合功率因数是至少0.98。

52. 如权利要求45所述的方法，进一步包括将所述至少50个负载的组合功率因数提供给所述AC供应电压，所述组合功率因数是至少0.98超前。

Ex.1002 / Page 64 of 767
Cholla Energy LLC & OBM, Inc.

用于数据中心的电源

技术领域

[0001] 以下公开涉及在数据中心中的配电，例如用于向可扩缩的和 / 或模块化的数据处理设备高效地输送不间断电力的技术和相关联的装置。

背景技术

[0002] 电力通常始于其纯净的生命——发电厂发电机以恒定的速度旋转来产生平滑的、恒定频率的正弦交流电信号。该信号如新生婴儿般美好地进入世界，但是其开始迅速变老。闪电的袭击将巨大的尖峰插入平滑的正弦曲线。工业设备中的电动机将噪音反馈回用电系统中，更加干扰来自发电厂的平滑地变化的电压。即使家用电器也可以引起这样的干扰，如同人们可以经常从音响设备听到的那样。

[0003] 高保真音响爱好者不是担心在其电力线上的噪音、尖峰和其它问题的唯一人群。相反，诸如计算机的其它电子设备的操作者也希望具有“干净的”电力以阻止对其敏感设备的损害。对于诸如计算机数据中心的可能正操作成千上万的计算机服务器的大型商用计算机站的操作者，尤其如此。计算机中心的操作者也想要恒定的电力——没有中断、没有哔哔声以及没有突然的重启。因此，这样的操作者可以安装不间断电源 (UPS) 来在电力故障期间保持系统操作或者给予系统足够的时间来安全并利落地关机，所述不间断电源可以调整电力（例如，以将电力返回其原始平滑的、正弦的形式）和提供某一层级的电池备用。在大型计算机数据中心中，这样的 UPS 可以在电力进入数据中心时调整该电力，并且可以调整多兆瓦的电力。

[0004] 购买和操作适于大型数据中心的大型 UPS 系统是很昂贵的。这样的系统可能花费数百万美元来购买和安装。同时，其低于 100％的效率，因此“从顶值”扣除少许电力——这作为百分率基准可能是微小的，但是对于每年使用数百万美元的电力的设施可以是非常巨大的。

发明内容

[0005] 如关于本文档中的某些实施方式所描述的，装置和相关联的方法以及计算机程序产品涉及支持模块化处理单元的高效不间断配电架构。作为说明性的示例，模块化处理单元包括集成的不间断电力系统，在该集成的不间断电力系统中在设施 AC 线路网和处理电路（例如，微处理器）负载之间发生仅一个 AC 到 DC 整流。

[0006] 在说明性的数据中心设施中，配电架构包括机架可安装的处理单元的模块化阵列，每一个机架可安装的处理单元具有处理网络相关的处理任务的处理电路。与每一个模块化处理单元相关联的是向网络处理电路供应操作电力的集成的不间断电源 (UPS)。每一个 UPS 包括跨 DC 总线能够选择性地连接的电池以及将 AC 输入电压转换为 DC 总线上的单个输出电压的 AC 到 DC 整流器。调节的 DC 总线电压可以接近于电池的全充满电压。以这种方式，可以提供不具有大型中央 UPS 而作为替代具有许多小型分布式 UPS 的设施，所述小型分布式 UPS 诸如在安装机架的计算机系统中或在一小组托板中的每一个托板处。

Ex.1002 / Page 65 of 767
Cholla Energy LLC & OBM, Inc.

[0007] 一些实施例可以提供一个或多个优势。例如，单个整流 UPS 架构可以充分减少复杂度和部件数量，并且可以增加故障之间的预期平均时间。另外，对于这样的系统可以实现制造的灵活性和组件采购和 / 或量定价益处。

[0008] 在一些实施例中，模块化分布式架构可以促进用于安装、维护和 / 或替换数据中心处理单元的减少的物资和 / 或人工成本。此外，可以根据需要在可扩缩的系统中或在广泛范围的设施中快速部署或重新部署带有集成的不间断电源的低成本、重量轻、高容量模块化处理单元。一些实施例也可以提供热插拔能力。

[0009] 各种实施方式可以例如通过提供带有不间断电力系统的模块化处理单元来充分提高电力转换效率，在所述不间断电力系统中在设施干线和微处理器之间发生仅单个 AC 到 DC 整流。提高的电力转换效率可以产生大量的能量节省，其可以产生更多的益处，诸如减少的导体（例如，铜）需求和减少的热量（例如，空气调整）负载。

[0010] 在一个实施方式中，公开了用于数据中心的配电系统。该系统包括包含可操作地处理通过网络接收的数据的至少一个数字处理器的 DC 负载、被配置来将操作电力输送到 DC 负载的 DC 总线、从跨 DC 总线连接的电源接收的电力、以及与 DC 负载集成的不间断电源 (UPS)。UPS 可以进而包括：被配置来在故障条件期间跨 DC 总线操作地连接电池的电池电路，在所述故障条件中 AC 输入电压信号降至正常操作范围之外，其中 AC 输入电压信号源自旋转 AC 发电机处；包括 AC 到 DC 转换电路的 AC 到 DC 整流级，所述 AC 到 DC 转换电路被配置来接收基本上未调整的 AC 输入电压以及在 AC 输入电压信号在正常操作范围内时将 AC 输入电压信号转换为跨 DC 总线的单个 DC 输出电压信号，其中 AC 到 DC 转换电路被配置来将 DC 输出电压信号调节至高于并基本上接近于电池的最大标称充电电压的电压水平；以及控制器，所述控制器被配置来响应于指示 AC 输入电压信号已返回至正常操作范围的信号，选择性地激活 AC 到 DC 转换电路以恢复向 DC 负载供应操作电力。

[0011] 控制器可以进一步控制开关以跨 DC 总线选择性地连接电池。同时，电池可以包括以串联或并联的方式电连接的一个或多个单元电池。AC 输入电压信号可以源自从由下列组成的组中所选择的一个或多个发电机类型：在电力设施工厂中的发电机；燃气涡轮机；蒸汽轮机；以及燃料驱动的电动发电机。另外，AC 输入电压信号可以包括来自三相 AC 系统的相电压信号和中性线信号。AC 输入电压可以具有大约 208 伏特至大约 277 伏特的均方根 (r.m.s.) 值或者在大约 85 伏特和至少大约 480 伏特之间的均方根值。AC 输入电压也可以基本上包括在大约 45Hz 和至少大约 500Hz 之间的频率的正弦曲线波形。AC 输入电压也可以被连接到 WYE 连接的电压源。

[0012] 在一些方面中，电池中的单元电池包括从由下列组成的组中所选择的电池化学性：铅酸；镍金属氢化物；镍镉；碱性；以及锂离子。系统可以进一步包括被配置来通过跨 DC 总线连接的路径对电池进行充电的充电器。单个 DC 总线电压也可以小于大约 26 伏特、在大约 10 伏特和大约 15 伏特之间、以及大约 13.65 伏特。

[0013] 在某些方面中，AC 到 DC 转换电路可以将 DC 输出电压信号调节至高于电池的最大标称充电电压约 1 伏特。并且，DC 总线电压可以向线性调节器提供充足的电压以根据电池规范将电池涓流充电至全充满状态，该线性调节器跨 DC 总线与电池串联连接。另外，DC 总线可以包括以第一电压的第一电路径，并且进一步包括以第二电压的第二电路径。此外，第一和第二电压中的一个可以基本上在地基准电势。另外，系统可以具有仅一个整流电路，该

Ex.1002 / Page 66 of 767
Cholla Energy LLC & OBM, Inc.

整流电路被配置来将 AC 波形转换为 DC 波形。电池的第一端子也可以被配置来直接连接到 DC 总线的第一轨，以及电池的第二端子被选择性地连接到 DC 总线的第二轨。

[0014] 在某些其它方面中，系统进一步包括数据存储器，其中 AC 到 DC 转换器在至少一个处理器接收指示去除了在 AC 电压输入信号中的故障的信号后的一延迟时间后，恢复调节 DC 输出电压信号，所述延迟时间与数据存储器中的延迟时间参数相对应。至少一个数字处理器可以确定所存储的延迟时间参数，以及所存储的延迟时间参数可以包括伪随机生成的值。在系统中，DC 负载、DC 总线和 AC 到 DC 整流级都可被包括在模块化的基座上，该模块化的基座被配置来支撑在机架安装结构上的多个位置中的一个中，所述基座用于安装在机架或框架中的多个位置中的任何可用的一个中。

[0015] 在某些方面中，DC 负载包括由下列组成的组中的至少一个：中央处理单元；数据存储设备；数学协处理器；以及数字信号处理器。系统可以进一步包括至少一个 DC-DC 转换器，所述至少一个 DC-DC 转换器被配置来将在 DC 总线上供应的电压转换为至少一个另外的 DC 电压。并且，至少一个另外的 DC 电压中的一个或多个可以约是由下列组成的组中的一个的电压：-5；1；3；3.3；5；7.5；10；大约 18-20；以及大约 20-26 伏特。另外，至少一个 DC-DC 转换器中的一个或多个可以被配置来提供改进的输出阻抗，和 / 或从 DC 总线上供应的电压过滤噪声。

[0016] 在又其它的方面中，AC 输入电压信号源自从下列组成的组中所选择的一个或多个电能源：至少一个太阳电池板；至少一个风力涡轮机；以及至少一个飞轮。另外，DC 负载可以进一步包括一个或多个包含信息的信号，所述信号被传送到在 DC 负载外部的负载。系统也可以包括与 AC 输入电压并联连接的 DC 负载的至少 10 个实例。

[0017] 在另一个实施方式中，公开了在数据中心中使用的 DC 负载。负载包括：主板，其包括可操作地处理通过网络接收的数据的至少一个数字处理器；被配置来将操作电力输送到主板的 DC 总线，电力从跨 DC 总线连接的电源接收；以及与 DC 负载集成的不间断电源 (UPS)。UPS 包括被配置来在故障条件期间跨 DC 总线操作地连接电池的电池电路，在所述故障条件中 AC 输入电压信号降至正常操作范围之外；包括 PFC 升压 AC 到 DC 转换电路的 AC 到 DC 整流级，所述 PFC 升压 AC 到 DC 转换电路被配置来在 AC 输入电压信号在正常操作范围内时将基本上未调整的 AC 输入电压信号转换为跨 DC 总线的单个 DC 输出电压信号，其中 AC 到 DC 转换电路被配置来将 DC 输出电压信号调节至高于并基本上接近于电池的最大标称充电电压的电压水平；以及控制器，所述控制器被配置来响应于指示 AC 输入电压信号已返回至正常操作范围的信号，选择性地激活 AC 到 DC 转换电路以恢复向 DC 负载供应操作电力。

[0018] 负载可以进一步包括主板上的至少一个负载点 DC-DC 转换器，其被配置来从 DC 总线接收 DC 电压并且向主板上的操作电路提供调整的 DC 电压。并且，至少一个负载点 DC-DC 转换器中的一个或多个可以被配置来提供改进的 DC 输出阻抗。另外，PFC 升压 AC 到 DC 转换电路是包括平均电流模式控制 (ACMC) 的连续导电模式 (CCM) 类型的，并且可以是临界导电模式 (CRM) 类型的。在某些方面中，DC 负载可以被连接在数据中心中，该数据中心进一步包括与 AC 输入电压并联连接的 50 个或更多的 DC 负载。

[0019] 在又一个实施方式中，公开了向数据中心中的主板处提供不间断电力的方法，并且该方法包括：将供应单个 DC 电压的 DC 总线连接到至少一个 DC 负载，每一个 DC 负载包括

Ex.1002 / Page 67 of 767
Cholla Energy LLC & OBM, Inc.

至少一个数字处理器；在来自电力设施线路网的 AC 输入电压信号在正常电压范围内时操作 PFC 升压 AC 到 DC 转换器。操作步骤可以包括：将 AC 输入电压信号转换为 DC 总线上的 DC 电压，其中转换步骤包括电力设施线路网生成并输送到 DC 负载的电力的仅有的 AC 到 DC 整流；将转换的 DC 总线电压调节至设定点电压，该设定点电压基本上接近于用于备用电池的标称电压范围中的电压；响应于检测到 AC 输入电压信号的故障条件，跨 DC 总线直接连接电池电路以使电池电路中的备用电池能够向 DC 负载提供操作电力，使得 DC 负载在检测到故障后继续操作一段时间。

[0020] 方法也可以包括连续提供操作电力以在至少 10 秒钟基本上不间断的情况下操作 DC 负载。并且，设定点电压可以基本上接近于用于备用电池的标称全充满电压。方法也可以包括基于备用电池的操作条件来动态地选择设定点电压。另外，方法可以包括检测 AC 输入电压信号的故障条件。

[0021] 在另一个实施方式中，公开了向在数据中心中操作的主板的实质部分提供不间断电力的方法。方法包括：将基本上未调整的 AC 供应电压连接到至少 50 个负载，每一个负载包括 PFC 升压 AC 到 DC 转换器，该转换器将转换的 DC 总线电压调节至设定点电压，该设定点电压基本上接近于用于备用电池的标称电压范围中的电压；检测 AC 输入电压信号的故障条件；响应于检测到 AC 输入电压信号的故障条件，跨 DC 总线直接连接电池电路以使电池电路中的备用电池能够向 DC 负载提供操作电力，使得 DC 负载在检测到故障后继续操作一段时间。在方法中，至少 50 个负载中的一个或多个可以进一步包括向处理器供应过滤的 DC 电压的负载点 DC-DC 转换器。在一些方面中，至少 50 个负载中的一个或多个可以进一步包括向处理器供应改进的输出阻抗 DC 电压的负载点 DC-DC 转换器。并且，PFC 升压 AC 到 DC 转换器可以是包括平均电流模式控制 (ACMC) 的连续导电模式 (CCM) 类型的，和 / 或临界导电模式 (CRM) 类型的。

[0022] 在一些方面中，方法也可以包括将至少 50 个负载的组合功率因数提供给 AC 供应电压，该组合功率因数是至少 0.95 或至少 0.98、或者至少 0.98 超前。

[0023] 在附图和下面的描述中阐明了一个或多个实施例的细节。从描述和附图中以及从权利要求中，其它特征和优势将显而易见。

附图说明

[0024] 图 1A 是示出了具有多个线路网耦接的负载的数据中心的概念图。

[0025] 图 1B-1C 是图示了用于数据中心的示例配电架构的示意图，在其中多个模块化的安装在机架上的托板中的每一个包括与计算机主板集成的不间断电源 (UPS)。

[0026] 图 2-4 是图示了用于输送电力来操作具有处理器的 DC 负载的示例配电架构的框图。

[0027] 图 5A-5B 是示出了在示例配电架构中的电池电路的细节的示意图。

[0028] 图 6A-6B 是示出了示例功率因数校正电路的示意图。

[0029] 图 7-8 是图示了可以在配电架构的实施例中执行的示例方法的流程图。

[0030] 在各个附图中的相同的参考标记指示相同的要素。

具体实施方式

[0031] 图 1A 是示出了具有多个线路网耦接的负载的数据中心 104 的概念图。在图示的

Ex.1002 / Page 68 of 767
Cholla Energy LLC & OBM, Inc.

系统 102 中，电力从设施线路网 106 到达数据中心 104。这样的电力可以在 110KV 被接收，并且可由变压器 108 将电压下降至 22KV。也可以接收并提供其它适当的电压。

[0032] 在某些常规的数据中心系统中，UPS 112 然后可以调整该电力，并且可以提供备用。例如，UPS 112 将通过去除电压尖峰和电压下降、调整过压或欠压条件、去除线路噪声、使频率变化平滑以及消除切换瞬态和谐波畸变来调整电力。并且，如果电力故障已出现，则 UPS 112 可以几乎瞬间将数据中心 104 从线路电力切换到其自身的电力（例如电池）。

[0033] 然而，如图 1A 中的交叉影线所示，中央 UPS 112 未被用来调整电力或向数据中心 104 提供备用电力。作为替代，在没有任何实质的调整的情况下电力进入数据中心 104 中的各种负载 118。负载可以通过可以包括多个汇流条和其它配电设备的分发线路网 116 连接到电源。

[0034] 负载 118 中的每一个可以包括一小组电子设备，诸如计算机服务器机架中的计算机托板。如在下面更详细地描述的，为了提供分布式的 UPS 功能性，可以为负载 118 的每一个提供本地 UPS。

[0035] 图 1B 是图示了用于数据中心 105 的示例配电架构 100 的示意图，在其中多个模块化的安装在机架上的基座（其也可以被称为托板）110 的每一个包括操作来向计算机主板 120 上的组件供电的不间断电源 (UPS)115。通过配置 UPS 115 以执行仅有的 AC 到 DC 整流可以实现有效的电力输送（其可遍及数据中心 105 在每一个计算机或一小组计算机处被重复数千次），所述 AC 到 DC 整流在从电力设施线路网接收的 AC 干线电力 (AC mains power) 与主板 120 所消耗的 DC 电力之间发生。在该示例中，AC 干线是指在数据中心 105 中的使用点处可获得的 AC 电源。

[0036] 当在数据中心 105 中在 UPS 115 处接收时，AC 干线电压是由电力设施生成、传输和分发的基本上为正弦曲线的 AC 信号（例如 50Hz，60Hz）。这样的 AC 干线电压可以被称为“基本上未调整的”，指示 AC 干线不具有带有谐波过滤、噪声过滤或者下降保护的传统 UPS 系统或其它种类的传统信号调整系统。当然，基本上未调整的 AC 电力可以通过典型地由电力设施提供的各种电路，所述电力设施诸如变压器、保险丝以及诸如许多电力设施提供者或大型发电机系统提供的典型的金属氧化物或硅间隙电涌放电器 (arrestor) 的浪涌电压保护器。AC 干线输入电压被转换为 DC 总线上的单个 DC 电压，所述 DC 总线向主板 120 输送操作电力。在 AC 干线上产生故障的情况下，电池电路跨 DC 总线而被电连接以向主板 120 供应操作电力。

[0037] 在所描述的示例中，数据中心 105 包括包含多个托板 110 的多个机架 125A、125B、125C。可以通过三相 AC 电力向机架 125A-125C 供电，所述三相 AC 电力从电力设施 130 被输送到数据中心 105。输送到机架 125A-125C 的每一个的 AC 电力可以例如源自由电力设施操作并由蒸汽或燃气涡轮机驱动的旋转发电机。基本上为正弦曲线的 AC 电压信号可以被传输到分发点，诸如在设施线路网中的变电站（未示出）。可以从变电站向数据中心 105 分发电力线电压（例如 480 伏火线对火线 (line-to-line)）。

[0038] 在数据中心 105 中，各个相电压（例如 230 或 277 伏火线对中性线 (line-to-neutral)）被路由到各个机架 125A-125C。根据需要可以使用合适的 AC 到 AC 变压器（未示出）来以指定的 AC 电压输送 AC 电力。例如，降压变压器可以将适于传输的高电压水平变压到基本上能够被直接应用到 UPS 115 的低电压水平。例如，在一些三相配置

Ex.1002 / Page 69 of 767
Cholla Energy LLC & OBM, Inc.

中，这样的变压器可以根据需要在 WYE 和 DELTA 连接之间做出适当的变压。

[0039] 在一些实施方式中，数据中心 105 所接收的 AC 电力信号可以是基本上未调整的，包含低功率因数（例如，在有功功率和视在功率之间的比率）和谐波分量。例如，电力设施线路网可以将谐波和噪声引入 AC 电力信号。在一些实施方式中，UPS 115 接收基本上未调整的 AC 电力信号以向主板 120 和 / 或托板 110 中的其它 DC 负载供应。

[0040] 除非另外说明，对 AC 电压的引用应被理解为是指基本上为正弦曲线的电压，并且电压幅度应被理解为是指均方根 (r.m.s.) 值。设施 130 可以输送适于对基本上均衡的三相负载进行供电的基本上对称的三相电压。

[0041] 在所描述的示例中，将一个相电压和中性线 (neutral line) 分发到每一个机架 125。机架 125 和托板 110 可被配置以形成基本上均衡的负载。在其它的实施例中，如果数据中心 105 包括额外（或更少的）机架 125，则可以使用类似的分发。作为示例，在机架 125A 中的示例托板 110（以放大的细节示出）接收相 A 电压和中性线。机架 125A 中的托板 110 的每一个接收相同的 AC 输入电压信号，即相 A 对中性线电压。

[0042] 类似地，机架 125B 中的托板 110 的每一个接收相 B 对中性线作为 AC 输入电压信号，并且机架 125C 中的托板 110 的每一个接收相 C 对中性线作为 AC 输入电压信号。在其它的实施方式中，可以将不同的相电压分发到机架 125A-125C 的一个中的托板 110，和 / 或到托板 110 的每一个的 AC 输入电压信号可以是火线对火线电压而非火线对中性线电压。在各种实施例中，可以将任何实际数量的相（例如，1、2、3、4、5、6...12 或更多）进行分发以向各个托板 110 提供操作电力。

[0043] 在所描述的示例中，托板 110 的每一个被耦接到网络连接 140。网络连接 140 向网络 145 提供信息通道，所述网络 145 可以包括例如局域网、虚拟专用网络、广域网（例如因特网）或这样的网络的组合，所述网络可以是有线的、光纤的和 / 或无线的。远程计算机 150 表示许多可能的设备中的一个，所述可能的设备可以使用在主板 120 上的处理器 160 和相关联的存储器 165 与一个或多个托板直接或间接地通信数据，以访问、存储、处理和 / 或检索信息。在一些实施方式中，额外的处理器（例如服务器）可以促进这样的通信。例如，示例远程计算机设备 150 可以被包括在服务器、桌面计算机、膝上型计算机和 / 或基于手持式处理器的设备中。一个或多个服务器可以对与该通信相关联的数据流进行预处理或后处理、监控、路由和 / 或平衡。

[0044] 在各种实施例中，主板 120 可以包括二个、三个、四个或任何其它实际数量的处理器 160。在一些实施例中，主板 120 可以由数据存储设备（例如，硬盘驱动、闪存、RAM 或任何这些或其它类型的存储器的组合）的托板替代或扩增。在这样的实施例中，可以将带有电池 185 的 UPS 115 与数据存储设备集成并支撑在托板 110 上。

[0045] 在各种实施例中，数字处理器可以包括可以是集成的或分离的模拟和 / 或数字逻辑电路的任何组合，并且可以进一步包括可以执行存储在存储器中的指令的可编程和 / 或已编程的设备。存储器 165 可以包括可以由处理器 160 读取和 / 或写入的易失性和 / 或非易失性存储器。主板 120 可以进一步包括例如中央处理器单元 (CPU)、存储器（例如缓存、非易失性、闪存）和 / 或盘片驱动中的一些或全部，以及各种存储器、芯片组和相关联的支持电路。

[0046] 在一些实施例中，主板 120 可以提供一个或多个 DC 到 DC 转换器以将 DC 总线电压

Ex.1002 / Page 70 of 767
Cholla Energy LLC & OBM, Inc.

转换为适于操作在主板 120 中的电路的电压。例如，一个或多个 DC 到 DC 转换器可以提供调节的输出电压，该输出电压可以包括例如 +3.3VDC 电力信号、+5VDC 电力信号、-5VDC 电力信号、+12VDC 电力信号以及 -12VDC 电力信号。

[0047] 在示例实施方式中，在主板 120 上的处理器 160 和存储器 165 可以形成被配置来处理网络操作的处理系统的至少一部分。作为说明性的示例，主板 120 可以帮助处理因特网请求。主板可以单独处理信息，或与在其它基于处理器的设备上运行的其它并行处理一起处理信息，其它基于处理器的设备诸如在数据中心 105 中的一个或多个其它托板 110。

[0048] 将 AC 输入电压信号输送到托板 110 的每一个以由 UPS 115 处理。在一些示例中，AC 输入电压信号可以从 AC 干线接收。UPS 115 包括将 AC 输入电压信号转换为调节的 DC 电压的 AC 到 DC 转换器 170。转换器 170 将所调节的 DC 电压输出到 DC 总线 175 上。在一些实施例中，AC 到 DC 转换器 170 可以将 DC 电压调节至静态的设定点。在一些其它的实施例中，设定点可以被动态确定。在一些静态的和动态的实施例中，设定点可以基于电池的特性。将参考图 3 进一步详细地描述这样的设定点调节的示例。

[0049] 在一些实施方式中，AC 到 DC 转换器 170 可以包括功率因数校正 (PFC) 电路。例如，AC 到 DC 转换器 170 可以使用 PFC 电路来抽取在相位上与 AC 电压匹配得更为接近的 AC 电流，从而改进负载的功率因数。AC 到 DC 转换器 170 优选地过滤来自 AC 信号的噪声、减少噪声电力以及允许 DC 电路容忍所接收的 AC 电力中的谐波含量和噪声。

[0050] 在一些示例中，UPS 115 可以接收基本上未调整的 AC 电力。例如，所接收的电力可以包括噪声和高谐波畸变，并且所接收的 AC 电力的功率因数可以基本上小于 1。例如，在一些实施方式中，AC 到 DC 转换器 170 将输入电力的功率因数校正到大于 0.97 滞后（例如 0.98 超前）。在这样的情况中，多个类似的转换器 170 的共同影响提供相类似的共同的功率因数改进。

[0051] 使用 PFC 电路，AC 到 DC 转换器 170 可以提高数据中心 105 的电效率。例如，改进功率因数减少了由 AC 到 DC 转换器 170 接收的电流。通过减少接收的电流，AC 到 DC 转换器 170 可以减少托板 110 中产生的电力损失和热量。因此，可以提高数据中心 105 的电力效率。参考图 6A-6B 描述了 PFC 电路的一些示例。

[0052] 系统 115 也可以阻止在设备 110 上产生的谐波进入设施网络。例如，如所述，可以向每一个分布式电源提供功率因数校正控制器以执行活动的功率因数校正。这样的校正也可以控制感应的总谐波畸变 (ITHD)，并且可以包括复合谐波滤波器。用于执行这样的活动的组件可以包括来自德州仪器（德州的达拉斯市）的 UCC3818 BiCMOS 功率因数预调节器。这样的特征可以阻止有害的信号或谐波进入在特定设施的内部和外部的配电系统。

[0053] 当 AC 输入电压信号在正常范围之内时，AC 到 DC 转换器 170 可以维持对 DC 总线 175 的电压调节。可以以各种方式来指定用于典型的正弦曲线的 AC 信号的正常范围。例如，对于可以是在大约 40Hz 和 1000Hz 之间的线路频率，诸如大约 50Hz、60Hz、100Hz、120Hz、180Hz、200Hz、300Hz、400Hz、500Hz、..... 直至大约 1000Hz 或更大，可以在大约 80 伏和 500 伏之间指定一个或多个阈值。作为说明性的示例，对于 120 伏标称 AC 输入电压信号，如果 AC 峰值输入电压在任意半周期中降至 90 伏的第一阈值以下，或者如果均方根电压下降至 100 伏的第二阈值以下达到预定量的时间，则可以识别故障。

[0054] 故障条件可以包括但不限于全面停电 (blackout)、部分停电 (brownout)、电压下

Ex.1002 / Page 71 of 767
Cholla Energy LLC & OBM, Inc.

降、电涌、与开关设备操作相关的不稳定、或与 AC 干线相关联的其它的电瞬变。在一些实施方式中，故障条件可以造成或潜在地造成 DC 负载中的处理单元的不当操作，例如，如果 AC 到 DC 转换器 170 无法维持对 DC 总线 175 上的电压的充分的调节，和 / 或无法供应充足的电流以操作由 DC 总线 175 所服务的 DC 负载。

[0055] 如果 AC 输入电压信号降至正常范围之外，诸如在故障条件期间，检测电路（未示出）可以发送指示该条件的信号。响应于检测到该故障条件，电池电路 180 可以被配置来将电池 185 跨 DC 总线 175 连接，使得主板 120 能够在基本上不中断的情况下继续操作。电池 185 可以继续向主板 115 上的电路提供操作电力直到电池 185 基本上放完电。电池电路 180 可以包括能够在各种操作模式中跨 DC 总线 175 对电池的充电和 / 或放电进行控制的电路。参考图 5A、5B 进一步详细描述示例电池电路。

[0056] 在一些实施方式中，数据中心 105 可以包括超过 100 个托板。例如，数据中心 105 可以包括超过 100 个处理器内核。在一些示例中，数据中心 105 可以同时执行超过 1000 个线程。在某些实施方式中，数据中心 105 可以包括总计超过 1 兆兆字节的存储器和 1 千兆兆字节的数据存储。

[0057] 在一些示例中，数据中心 105 从电力设施 130 抽取大量的电力。例如，数据中心 105 中的每一个服务器系统可以消耗 100W-500W 的电力。例如，机架 125A-C 的每一个可以消耗 2kW 到 30kW 的电力。例如，小型数据中心可以提供 5000 个处理器，每一个具有一个或多个内核。随着处理器技术改进，每一个处理器或内核可以抽取更少的电力，但是每一个处理器的内核的数量可以增加。更大型数据中心可以使用更多的处理器，包括 10,000、20,000、50,000 或甚至 100,000 个处理器。这些可以分布在例如每一个机架具有 20、30 或 40 个处理器的机架中。

[0058] 在一些实施方式中，数据中心 105 的 AC 到 DC 转换器 170 被配置来能够从电力设施 130 接收基本上未调整的电力，其将由 115 通过基本上减轻噪声和谐波含量来调整。并且，如上所述，AC 到 DC 转换器可以阻止内部地生成的谐波电流进入设施网络 130。

[0059] 图 1C 示出了架构 100 的示例配电方面。如图 1C 中所示，电力设施 130 经由传输系统 195 向数据中心 105 供应 3 相 AC 电力。例如，传输系统 195 可以包括可被连接到由传输系统 195 支撑的各种负载的一个或多个节点。例如，传输系统 195 包括将节点连接至电力设施的传输线。

[0060] 数据中心 105 使用来自传输系统 195 的未调整的电力来操作并且从传输系统 195 抽取带有基本上减少的噪声和谐波含量的电流并且改进功率因数。例如，由此抽取的电力可以具有基本上接近于 1 的功率因数。一些设施强加与数据中心功率因数有关的需求量或费用。例如，数据中心可被要求具有高于 .9、.95 或 .97 滞后的功率因数以达到某一有利的定价。通过向 AC 电源提供具有几乎一致的功率因数的多个电路，从而提供在期望的范围内的共同的功率因数，各种实施例可以帮助实现这样的目标。例如，如在此所述，通过并行地操作多个 PFC 升压 AC 到 DC 转换器可以实现这样的共同影响。

[0061] 在一些示例中，功率因数可以是对输送的电力中的有功功率的测量。具有更高功率因数（例如功率因数更接近于一）的 AC 电力可以包括可由数据中心 105 使用的更高部分的有功功率。在一些示例中，传输系统 195 的各种负载和其它结构可以引入可以降低输送的 AC 电力的电力质量和功率因数的噪音和谐波含量。例如，传输线中的阻抗和在节点处

Ex.1002 / Page 72 of 767
Cholla Energy LLC & OBM, Inc.

的非线性 / 间歇电力负载可以将功率因数偏离 1 并且产生谐波畸变。

[0062] 在所描述的示例中，数据中心 105 从传输系统 195 接收未调整的 3 相 AC 电力。例如，数据中心 105 中的 AC 到 DC 转换器 170 可以包括 PFC 电路以在使用未调整的 AC 电力时提高数据中心 105 的电力效率。在一些实施方式中，数据中心 105 可以从传输系统 195 抽取具有校正的功率因数的电力。

[0063] 图 2-4 是图示了用于输送电力来操作具有至少一个处理器的 DC 负载的示例配电架构的框图。例如，在各种实施例中，主板 120 可以构成 DC 负载。在这些示例中，AC 到 DC 转换器 170 提供发生在 AC 设施线路网（例如，变电站变压器、传输线、发电机等）和在任一个托板 110 中的微处理器 160 之间的仅有的 AC 到 DC 整流。

[0064] 图 2 示出了在系统 200 中的示例配电架构，其可以例如实现在具有巨大电力需求的大型设施中。系统 200 包括设施 AC 干线发电机 205，用于从诸如电力设施 130 的设施供应 AC 干线电压。示例系统 200 还包括两个备用 AC 发电机，包括柴油燃料驱动的发电机 210 和协同定位的（例如燃气）发电机 215。来自发电机 205、210、215 的电力可以由 AC 开关设备 220 组合和 / 或选择，然后经由 AC 总线 225 被输送到托板 110。在来自发电机 205 的 AC 干线上发生故障的情况下，发电机 210、215 可以向 AC 总线 225 提供备用 AC 输入电压信号。

[0065] 在一些实施方式中，可以使用基本上异步的能量源来产生基本上为正弦曲线的 AC 电压信号。例如，可以使用飞轮能量存储和恢复系统。风力或太阳产生的能量，诸如由风场或太阳场分别提供的能量，可以用作为能量源以产生在电力设施线路网中基本上为正弦曲线的 AC 电压。在这样的实施方式中，所产生的基本上为正弦曲线的信号通过设施线路网被传输到 AC 到 DC 转换器 170 的输入而不介入 AC 到 DC 整流。

[0066] 在与由电池 185 提供的电池备用的协作过程中，发电机 205、210、215 可以在短的、中等长度的和 / 或更长的时间期间上提供基本上不间断的电力来操作在托板 110 上的 DC 负载 230。

[0067] 在一些实施方式中，AC 到 DC 转换器 170 被配置来容忍来自来自 AC 开关设备 220 的输入电力的线路噪声。例如，托板 110 可以从设施干线 205、柴油发电机 210 和 / 或协同定位的发电机 215 接收未调整的 AC 电力。在一些实施方式中，托板 110 和数据中心 105 可以使用未调整的 AC 电力来操作。在该示例中，UPS 115 使用未调整的 AC 电力来向 DC 负载 230 进行供应。在某些实施方式中，AC 到 DC 转换器 170 包括增加向 DC 负载 230 供应的电力信号的功率因数的 PFC 电路。如所示，AC 到 DC 转换器 170 从返回到 AC 开关设备 220 的电力信号过滤 DC 侧噪声。例如，返回的谐波电流（从数据中心 105 流到电力设施线路网）可以包括显著减少的量的噪声和谐波含量。在一些示例中，通过对托板 110 进行配置以容忍来自输入 AC 电力的线路噪声，可以减少用于创建数据中心 105 的成本。

[0068] 对发电机 210、215 的示例使用可以在以下情况中说明：来自发电机 205 的 AC 干线电压的故障（例如，部分停电、全面停电）或不可获得（例如，电路维护）。响应于检测到 AC 输入电压信号上的故障，将电池 185 连接以跨 DC 总线 175 基本上输送电池电压。这样，DC 负载的短期（例如，全负载至少 10、20、30、40、50、60 秒）的操作由从电池 185 供应的电力维持。可以将柴油发电机 210 启动以向 AC 总线 225 提供电力，优选地在电池 185 完全放完电之前。对于范围更大的 AC 电力故障，可以将协同定位的发电机 215 接上线以提供更有成本效益的操作，或者避免超过对柴油燃料发电的政府规定的限制。

Ex.1002 / Page 73 of 767
Cholla Energy LLC & OBM, Inc.

[0069] 在一些实施方式中，发电机 210、215 中的一个或两个可以提供峰值负载卸负 (shedding) 能力。例如，可以在每天预期的需求高峰时段期间使用协同定位的发电机 215。在一些情况下，这可以允许从电力设施 130 处协商取得优惠的电力费率。

[0070] 图 3 以进一步的细节示出了示例示意图。在各种实施例中，AC 到 DC 转换器 170 可以将在 DC 总线上的单个输出电压调节到设定点。在一些实施例中该设定点可以是静态值，或者其可以在操作期间被动态地确定。例如，该设定点可以至少部分地基于电池的一个或多个电特性。

[0071] 能够针对其建立设定点的特性可以包括诸如以下的电池特性：电池化学性、电池寿命、充电 / 放电历史、标称最大充电、温度、充电分布型 (profile)（例如，在恒定电流下的电压充电率）、对电池内部阻抗的估计值、或者与电池的电性能有关的其它参数。

[0072] 除了内部电池特性，设定点可以至少部分地基于电池电路 180 和 DC 总线 175 的电路参数。在一些实施例中，AC 到 DC 转换器 170 将对 DC 总线 175 上的电压调节至的设定点可以是电池充电电路拓扑结构的函数。如果电池充电电路提供电压升压电路（例如，升压转换器、电荷泵、反激 (flyback)），则设定点电压可以基本上位于或低于期望的最大充电电压。如果电池充电电路仅提供电压降压（例如，线性调节器、降压转换器）能力，则设定点能够被设定到足够高于最大标称充电电压的值，以在相关温度上实现所需要的充电性能，其中考虑了在电力损失和充电电流以及相应的充电时间中的折衷 (tradeoff)。根据这样的折衷，设定点可以仅是满足充电时间的具体要求所需要的高度。例如，设定点可以被设定为在标称期望电池电压之上大约 0.050 和大约 1 伏之间。

[0073] 在各种实施例中，可以基于指定的温度设定设定点电压，诸如 0、10、25、30、40、50、.....、80 摄氏度。在说明性的示例中，设定点可以基于由至少一个温度传感器（未示出）所测量的在电池 185 内的或电池 185 周围的温度而被动态地调整。

[0074] 在所描述的实施例中，UPS 115 包括与电池 185 串联连接的充电 / 放电控制电路 305，并且进一步包括与非易失性存储器 (NVM) 310 操作连接的控制器 245。

[0075] 串联连接的电池 185 和电路 305 跨 DC 总线 175 连接。响应于指示 AC 输入电压信号上的故障的信号，电路 305 能够跨 DC 总线 175 操作地连接电池 185 以允许电池通过低阻抗路径向 DC 负载 230 放电。当在 AC 总线 225 上的 AC 输入电压信号没有发生故障时，电路 305 可以选择性地允许充电电流从 DC 总线 175 流出以向电池 185 充电。如果以电并联的方式连接多个电池或电池串，则可以根据定义的充电算法以不同速率对各个串或串组独立地进行充电。

[0076] 在所描述的实施例中，NVM 310 可以存储用于调节 AC 到 DC 转换器 170 的输出的设定点信息。设定点信息可以在制造期间、首次使用时被存储，和 / 或在托板 110 的操作期间被动态更新。控制器 245 和 / 或 AC 到 DC 转换器 170 可以读取和 / 或使用所存储的设定点信息来确定如何控制 AC 到 DC 转换器 170。除了设定点信息，例如与用于在 AC 输入和电池操作之间切换的阈值条件有关的信息可以被存储在 NVM 310 中。

[0077] 例如在 NVM 310 和在 DC 负载 230 上的一个或多个处理器 160 之间，可以通过串行或并行接口（其可以具有有线的和 / 或红外线物理层）提供对存储在 NVM 310 中的信息的访问。可以使用处理器 160 来经由到每一个托板 110 的网络连接 140（图 1B）访问和 / 或更新在 NVM 310 中的信息。

Ex.1002 / Page 74 of 767
Cholla Energy LLC & OBM, Inc.

[0078] 可以在 DC 负载 230 上提供额外的数据存储设备。在所描述的示例中，DC 负载 230 包括与存储器 165 和硬盘驱动 (HDD) 315 操作连接的两个处理器 160。

[0079] 图 4 图示了在机架 125 上的示例配电架构 400。在架构 400 中，UPS 115 通过 DC 总线 175 向处理单元 405 中的多个 DC 负载 230 输送电力。每一个 DC 负载 230 跨 DC 总线 175 并联连接。输送至 DC 负载 230 的电力在设施干线 205 和 DC 负载 230 之间仅进行一次从 AC 到 DC 的整流。在一个实施例中，处理单元 405 包括盘片阵列、互联卡以及与电池一起的不间断电源。

[0080] 在各种实施方式中，每一个 DC 负载 230 可以具有类似的电路或不同的电路。DC 负载的各种负载可以主要提供数据存储、数据处理、数据通信或这些或其它功能的组合。在一个实施例中，DC 负载 230 位于在机架 125 中的多个托板上。在另一个实施例中，整个处理单元 405 位于托板 110 中的一个上。在一些实施例中，UPS 115 与处理单元 110 集成在单个托板 110 上。在其它的实施例中，UPS 115 可以位于机架 125 上的别处。处理单元 405 可以指一个或多个托板、机架或包含一个或多个 DC 负载 230 的其它结构，所述结构可以包括至少一个隔室 (bay)、壳体、可移动的或固定的建筑或整个设施，诸如数据中心 105。

[0081] 各种实施方式也可以向各种负载供应多个 DC 电压，所述 DC 电压可以相互孤立。电压可以是类似的或者不同的。例如，可以供应 12V、5V、3.3V 或更少，以及 -12V DC 电压。这些电压可以由配置来提供多个 DC 电压的 AC 到 DC 转换器 170 提供。此外，可以由另外的 DC 到 DC 转换器向负载供应变化的 DC 电压，所述 DC 到 DC 转换器通常被称为“负载点”转换器，并被放置在 AC 到 DC 转换器 170 和其特定的消耗 DC 的负载之间。

[0082] 这样的转换器通常为噪声敏感的 DC 电路提供进一步的噪声过滤。其也可以为具有高瞬时电流变化的负载提供改进的输出阻抗。例如，处理器可以在 2.7V、3.3V 或其它电压上运行，并且可以非常迅速地从低电流切换到高电流。这样的快速转变可能波及 AC 到 DC 转换器 170 的一些设计中的输出电压。负载点电压转换器帮助提供不随负载抽取而极大变化的低阻抗电压。例如，负载点转换器可以与描述的 DC 负载 230 集成，或者可被放置在主板 120 上的这样的负载附近。更低输出阻抗负载点转换器典型地比更高阻抗转换器更昂贵，因此根据每一个 DC 负载的需求对负载点转换器的输出阻抗进行典型地大小调整。例如，当总线控制器或风扇可以与廉价的更高输出阻抗负载点转换器一起被配置时处理器可以要求低输出阻抗负载点转换器。

[0083] 图 5A-5B 是示出了在示例配电架构中的电池电路的细节的示意图。

[0084] 图 5A 示出了用于参考图 3 描述的充电 / 放电控制电路 305 的部分的示例示意图 500。示意图 500 包括比较器电路 505，用来当在 DC 总线 175 上的电压降至阈值 Voff 以下时切换信号 Vups。示意图 500 也包括比较器电路 510，用来当在 DC 总线 175 上的电压降至阈值 Batt_Low 以下时切换信号 VBatt。参考图 7-8 进一步详细描述信号 Vups 和 Vbatt。

[0085] 示意图 500 进一步包括过流保护元件 515，在本示例中该过流保护元件 515 包括保险丝。保险丝 515 的一个端子连接到电池的正端子，而另一个端子连接到 DC 总线 175 的正轨 (postive rail)。在其它的示例中，额外的串联和 / 或分流设备用于提供过电流、过电压、倒流保护、EMI 缓解和 / 或其它功能。

[0086] 在所描述的实施例中，一对端子 (+ 电池，- 电池) 可连接到电池。负的电池端子 (- 电池) 连接到两个并联路径，通过开关的操作可控制并联路径的每一个。并联路径中的

Ex.1002 / Page 75 of 767
Cholla Energy LLC & OBM, Inc.

一个通过电阻器520和开关525将负的电池端子连接到DC总线175的负轨。该路径允许在开关闭合时充电电流流过。充电电流的幅度实质上由电阻520的值和在DC总线175上的电压与电池（未示出）之间的差异限制。电池的内部电阻典型地比电阻520的值小得多。在一些应用中，可以使用电阻520两端的电压降来测量和/或控制充电电流。

[0087] 另一个并联路径通过开关530将负的电池端子连接到DC总线175的负轨。当开关530闭合时，电池跨DC总线175可操作连接。在该状态下，电池能够向也被跨DC总线175连接的任何DC负载（未示出）放电和供应操作电力。

[0088] 开关525、530可被无源地和/或有源地控制。图5B所示出的示例实施例说明了一个实施方式，并且不应将其看作是限制性的。

[0089] 在图5B中，以例如可以表示内部和/或接触电阻的串联电阻540建立电池185的模型。用于对电池充电的理想的开关525（图5A）被实现为不具有有源控制输入的二极管。在该实施方式中，AC到DC转换器170（未示出）可以将DC总线175调节到足以在感兴趣的温度上正向偏压二极管（开关）525并且足够提供所期望的充电电流的电压。这样，设定点可以是至少为最大充电电压加上二极管压降电压。

[0090] 在图5B的所描述的示例中，至少部分地通过串联电阻和诸如二极管或其它半导体开关的单向电流机制来确定电池充电电流。在其它的实施例中，电池充电器可以包括串联旁路（series-pass）调节器（例如，低压降差（LDO）线性调节器）或开关模式电力转换器（例如，降压式、升压式、降压-升压式、Cepic式、Cuk式、反激式、充电泵式或谐振式等）中的单个或其组合。可以通过电流镜像技术或使用涉及例如电流感知电阻或电感耦合测量的电流测量反馈技术来控制电池充电电流。

[0091] 用于将电池放电的理想的开关530（图5A）被实现为背靠背（back-to-back）MOSFET（金属氧化物半导体场效应晶体管）开关，所述背靠背MOSFET开关被配置来在非导通状态中在两个方向上均阻止电流。该开关530响应于可以例如通过控制器245（图3）产生的控制信号535而断开和闭合。在各种实施例中，开关525、530可以包括；肖特基二极管、绝缘栅双极晶体管（IGBT）、或其它半导体或电机械开关（例如继电器）。

[0092] 图6A-6B示出了在AC到DC转换器170中使用来接收基本上未调整的AC输入电力的PFC升压电路900、950的一些示例。例如，电路900、950可以过滤基本上未调整的AC输入电力中的噪声和谐波含量。在另一个示例中，电路900、950可以将输入AC电力的功率因数校正至接近于一的功率因数。在某些实施方式中，PFC升压电路900、950可以提高数据中心105和传输系统195的稳定性和效率。在一些示例中，AC到DC转换器170可以容忍来自输入AC电力的线路噪声并且从返回电力过滤由DC负载230生成的噪声。

[0093] 虽然示出了两个PFC升压电路，但是可以使用任何适当的PFC电路。对于更高的电力电路（例如高于200W），选择的传统拓扑结构是以连续导电模式（CCM）且用平均电流模式控制（ACMC）来操作的升压转换器。对于更低的电力应用，典型地使用典型的临界导电模式（CRM）升压拓扑结构。在一些实施方式中，诸如降压、降压-升压或反激转换器电路的其它类型的切换转换器电路可被用来替代升压转换器而执行功率因数校正。在一些实施方式中，无源PFC电路可被用来执行功率因数校正。例如，DC滤波感应器可被用来减少输入AC电力中的谐波分量并且改进功率因数。这些各种电路的构造对本领域的技术人员是众所周知的。

Ex.1002 / Page 76 of 767
Cholla Energy LLC & OBM, Inc.

[0094] 如图 6A 中所示，PFC 升压电路 900 包括整流级 905、开关转换器电路 910 以及输出级 915。如所示，整流级 905 从 AC 电源 920 接收未调整的 AC 电力。在一个示例中，AC 电源可以是 AC 开关设备 220。在一些示例中，整流级 905 的输出可以是整流的 DC 电力信号。

[0095] 切换转换器电路 910 被耦接到整流级 905 的输出端。在一些实施方式中，切换转换器电路 910 用比 AC 电源 920 的频率更高的切换频率来操作。在一些示例中，切换转换器电路 910 可表现为用于整流级 905 的输出端的理想的电阻性负载。例如，切换转换器 905 可以消除线路电流谐波。

[0096] 切换转换器电路 910 包括 PFC 控制器 925、开关 930 以及感应器 935。PFC 控制器 925 可以是专用集成电路 (ASIC) 芯片或包括分离和集成的组件两者的电路。在一个实施方式中，PFC 控制器 925 可以接收整流级 905 的整流的输出和来自输出级 915 的反馈信号。使用所接收的输入，PFC 控制器 925 可以控制切换转换器电路 910 来维持输入电流形状并且控制该输入电流与输入 AC 电压同相。

[0097] 在一些示例中，PFC 控制器 925 可以包括倍增器电路和脉宽调制 (PWM) 电路。例如，倍增器电路可以从整流级 905 的整流的输出端接收电流基准和输入电压基准。使用反馈信号，PFC 控制器 925 可以感知在输出电压和基准 DC 电压之间的变化。在一些实施方式中，基准 DC 电压可以由电池 185 供应。在一个示例中，倍增器电路可以使用感知的变化、输入电流的相位以及输入 AC 电压来确定控制信号。PWM 电路将控制信号与输入电流相比较以生成切换信号来控制开关 930。例如，切换信号可以控制流入感应器 935 的电流幅度并且将恒定输出电压维持在 Vout。例如，输出电压可以是 280VDC。

[0098] 如图 6B 中所示，PFC 升压电路 950 通过将平均输入电流与基准电流相匹配而执行功率因数校正。PFC 升压电路 950 包括平均输入电流模式控制器 955。控制器 955 基于控制信号 Icp 来调节平均电流。在一个实施方式中，Icp 可以由低频 DC 回路误差放大器生成。例如，可以通过将输出 DC 电压与基准电压进行比较来生成 Icp。

[0099] 如所示，控制器 955 包括电流放大器 960、振荡器 965 以及 PWM 比较器 970。在一些实施方式中，电流放大器 950 可以是电流信号的积分器。在一些示例中，电流放大器 950 的输出可以是基于通过分流电阻器 Rshunt 流入的平均电流和 Icp 信号的低频误差信号。

[0100] 在所描述的示例中，将误差信号与振荡器 965 生成的波形进行比较。例如，波形可以是锯齿波形、正弦曲线波形或其它周期性的波形。基于所生成的波形与误差信号之间的差异，PWM 比较器 970 可以生成到开关 930 的占空信号。例如，PWM 比较器 970 可以使用占空信号来控制输出端处的输出电压和输入电流的形状与输入电压的相位相匹配。

[0101] 在一些实施方式中，PFC 升压电路可以包括两个级联的电力级。例如，PFC 升压电路的第一级可以包括升压转换器，用于控制输入电流波形并维持接近一的功率因数。例如，第二级可以包括第二切换转换器，用于将来自第一级的输出电压转换成用于托板 110 的 DC 负载 230 的各种 DC 电压水平（例如 3.3V、5V、12V 等）。在一些实施方式中，PFC 升压电路的第二级可在主板 120 上实现。

[0102] 图 7-8 是图示了可以在配电架构的实施例中执行的示例方法的流程图。

[0103] 参考图 7，流程图 600 图示了 UPS 115 可以执行来处理 AC 输入电压信号上的故障条件的示例方法。在一些实施例中，UPS 115 可以执行该方法来调整到作为临时电源的电池和 / 或离开该电池的切换。在一些情况下，执行该方法可以充分地减少和 / 或防止作为

Ex.1002 / Page 77 of 767
Cholla Energy LLC & OBM, Inc.

AC 故障条件的结果的性能失调（例如数据错误）。例如，电池 185 可以提供足够的操作电力以维持 DC 负载 230 的操作直到能够将诸如设施干线 205 或备用发电机 210、215 的 AC 源放上线。在一些实施例中，电池 185 可以在 DC 负载 230 执行指令以完成适度的下电操作时继续提供操作电力。这样的适度的下电操作可以变化很大，但是通常试图减弱可能由故障条件导致的性能失调。这样的失调自身例如可以表现为当处理系统随后被重启时的陈旧数据。

[0104] 通常，该方法包括可以由控制器（例如控制器 245）执行的操作。可以进一步在系统 100 中的一个或多个处理器 160 的控制、监控和 / 或监视下执行操作。也可以由可以是通过耦接到托板 110 的网络连接 140 与控制器可操作通信的其它处理和 / 或控制元件补充或扩增操作。可以由执行有形地实现在信号中的指令的一个或多个处理器来执行一些或所有的操作。可以单独地或与执行指令的一个或多个处理器相协作，使用模拟和 / 或数字硬件或技术来实现该处理。

[0105] 该方法在当控制器确定 AC 输入电压信号上存在故障时在步骤 605 开始。例如，控制器可以通过例如监视 AC 总线 225、由在托板 110 上的电压监视 / 故障检测电路提供的电压状态条件信号、和 / 或在 DC 总线 175 处的输出电压（例如图 5A 中的 VUPS），来识别 AC 电力故障的出现。

[0106] 在一些实施例中，UPS 115 可以包括将 VUPS 转换为数字值（例如 10 位的数字值）的模拟到数字转换器。当控制器检测到关键的电压降落至阈值以下时，控制器可以启动 AC 电力故障程序。在其它的实施例中，控制器可以从外部的组件接收信号，诸如在 AC 开关设备 220 中的电力组合器。这样的信号可以指示 AC 输入电压信号中的故障。在其它的实施例中，AC 到 DC 转换器 170 可以向控制器发送消息以指示 AC 电力故障。

[0107] 如果控制器确定 AC 电力未发生故障，则重复步骤 605。如果控制器确定 AC 电力处在故障条件中，则在步骤 610 中，控制器将 UPS 115 从 AC 操作切换至电池操作。例如，控制器可以发送信号以断开开关 525 并且闭合开关 530（图 5A），以跨 DC 总线 175 将电池 185 可操作地连接，使得电池 185 能够支持 DC 负载 230。接着，在步骤 615 中，控制器将计时器设定为备用持续时间 (back duration time)。定时器可以是控制器中的寄存器，其随着时间的前推而被递减或递增。在一些实施例中，备用持续时间可以表示可以使用或依靠电池电力的持续时间。例如，控制器可以使用期望的电池寿命的估计减去 DC 负载 230 执行适度的下电操作所需要的时间来计算备用持续时间。在其它的实施例中，控制器可以从 NVM 310 加载备用持续时间。

[0108] 在步骤 620 中，控制器确定 AC 电力是否被恢复。例如，控制器可以从 AC 到 DC 转换器接收关于 AC 输入电力的当前状态的消息。作为另一个示例，控制器可以轮询 AC 到 DC 转换器以确定 AC 电力是否已恢复。如果控制器确定 AC 电力已恢复，则控制器可以在步骤 625 执行操作以切换回至从 AC 电力操作，并且方法 600 然后结束。参考图 8 更详细地描述了用于从电池电力切换至 AC 电力的示例方法。

[0109] 如果在步骤 620 控制器确定 AC 电力未恢复，则在步骤 630 中，控制器检查 VUPS 是否小于电池备用 (VOFF) 的最小电压。如果控制器确定 VUPS 小于 VOFF，则控制器可以在步骤 630 将计时器设定为下电时间。例如，下电时间可以是 DC 负载执行下电操作所需要的时间的估计。在一些示例中，DC 负载的下电操作可以防止数据损失和 / 或避免因 DC 电力的

Ex.1002 / Page 78 of 767
Cholla Energy LLC & OBM, Inc.

突然丧失而导致的损害。如果在步骤 630 中，控制器确定 VUPS 不小于 VOFF，则在步骤 640 中控制器可以确定电池的输出电压 (VBATT) 是否低于电池低阈值 (BATT_LOW)。在一些实施例中，当 VBATT 低于 BATT_LOW 时，这可以指示例如存储在电池中的电力是低的并且可以执行适当的下电操作以防止例如数据损失。如果控制器确定 VBATT 低于 BATT_LOW，则执行步骤 635。如果控制器确定 VBATT 不低于 BATT_LOW，则控制器可以检查备用持续时间是否期满。如果控制器确定备用持续时间期满，则执行步骤 635。如果控制器确定备用持续时间未期满，则重复步骤 620。

[0110] 在控制器在步骤 635 中将计时器设定为下电时间之后，控制器可以在步骤 650 中检查 AC 电力是否被恢复。如果控制器确定 AC 电力被恢复，则执行步骤 625。如果控制器确定 AC 电力未恢复，则控制器在步骤 655 中确定下电时间是否已期满。如果控制器确定下电时间尚未期满，则重复步骤 650。如果控制器确定下电时间已期满，则控制器可以在步骤 660 中将 UPS 下电（例如，将图 5 中的开关 530 断开）并且该方法结束。

[0111] 图 8 示出了图示用于从电池备用电力切换至 AC 输入电力的操作的示例方法 700 的流程图。例如，在 AC 电力在 AC 电力故障之后被恢复（例如，参见图 7 的步骤 625）之后、或者在维护操作（例如电池测试操作）之后，控制器可以从电池操作切换至 AC 操作。

[0112] 在一些实施例中，控制器可以延迟从电池电力操作到 AC 电力操作的转移以减弱例如到数据中心 105 的高峰值（例如涌入）电流。可以进一步提供小的固定延迟以确保 AC 输入电压是稳定的。

[0113] 如参考步骤 625（图 7）所描述的，当控制器确定 AC 输入电力已恢复时，方法 700 可以开始。首先，在步骤 710 中，控制器可以确定随机延迟参数。例如，随机延迟参数可以存储在 NVM 310 中，该随机延迟参数表示在切换至 AC 供电的操作之前延迟（例如 1 毫秒、0.5 毫秒、0.025 毫秒等）的时间长度（例如，时间、时钟周期）。

[0114] 在一些实施例中，可以随机地或伪随机地确定随机延迟参数。例如，控制器可以使用种子（例如，存储在 UPS 115 上和 / 或主板 120 上的存储寄存器中的序列号，当托板首次被启动时的机器时间等）生成伪随机延迟参数。延迟参数接着可以由控制器 245 使用和 / 或被存储在 NVM 310 中。在另一个示例中，延迟参数可以是随机数（例如，从诸如放射性衰变的物理过程记录的），其在 UPS 115 的制造过程期间被存储在 NVM 310 中。

[0115] 在一个实施例中，控制器在步骤 715 将计时器设定为随机延迟。在其它的实施例中，控制器可以使用计数器、实时时钟、具有阈值比较器的模拟上升或衰减电路、或其它适当的延迟设备来监视该延迟。然后，控制器在步骤 720 中确定 VBATT 是否低于 BATT_LOW。如果 VBATT 低于 BATT_LOW，指示该电池将耗尽电量，则控制器可以在步骤 725 中从电池电力切换至 AC 电力，并且方法 700 结束。例如，控制器可以通过断开电路 500 中的开关 530（图 5A）将电池电力关闭。在示例数据中心 105 中，所有的电池将在相同的时间达到放电界限不太可能，因而预计在大多数的实施例中该方法不会大大增加在 AC 输入电压线上的峰值电流。

[0116] 如果在步骤 725 中 VBATT 不低于 BATT_LOW，则在步骤 730 中控制器检查计时器是否期满。如果未达到所指定的延迟，则重复步骤 725。如果达到了所指定的延迟，则重复步骤 720 并且方法 700 结束。

[0117] 在各种实施例中，电池电压可以是高于和 / 或低于 DC 总线上的所调节的电压。在

Ex.1002 / Page 79 of 767
Cholla Energy LLC & OBM, Inc.

一些实施例中，AC 到 DC 转换器可以调节至设定点电压，所述设定点电压在电池的标称全充满电压的 50、100、200、250、400、500、.....、1000 毫伏内。在各种实施方式中，调节设定点可被动态地确定，例如基于电池特性，诸如寿命、使用历史、温度、内部电阻、充电时间响应、放电时间响应或其它与电池电路相关的特性。如果电池电压高于设定点电压，则充电器可以包括升压和 / 或降压 - 升压类型的转换器电路。

[0118] 在一些实施例中，托板 110 可以是模块化的支持结构，其被配置以安装在机架 125 中的多个位点、槽或位置中的一个中。每一个托板 120 可以包括诸如印刷电路板 (PCB) 的基底，UPS 175 和主板 120 和 / 或其它 DC 负载 230 可被集成在该基底上。当被安装在机架 125 中的一个中时，托板 110 可以提供用于热量管理系统的特征，包括用于空气流动的端口。

[0119] 术语“托板”并不意在指特定的布置，而是指耦接在一起以服务于特定目的的计算机相关组件的任何布置，诸如在主板上。托板通常可以与其它托板平行地安装在水平的或垂直的堆叠中，以便允许比具有自由支撑壳体和其它组件的计算机在其它情况下可能达到的更密的群集。术语“刀片”也可以被用来指这样的设备。托板可以在特定的配置中实现，包括作为计算机服务器、交换机（例如电交换机和光交换机）、路由器、驱动器或驱动器组以及其它计算相关设备。

[0120] UPS 115 的实施例可以被配置来接受各种主或副电池技术。技术可以包括但不限于密封铅酸、镍金属氢化物、镍镉、线绕铅酸、碱性以及锂离子。UPS 115 可以包括自动检测电池化学性质的电路，并且根据所确定的电池特性调整充电和放电概要信息。在一些实施例中，AC 到 DC 转换器 170 将 DC 总线 175 调节至的设定点可以是对自动检测到的电池特性的响应。在各种实施例中，电池电压可以在大约 8 伏特和大约 26 伏特之间，诸如大约 9、10、11、12、13、.....、23、24 或 25 伏特。

[0121] 例如，标称 12 伏特铅酸电池可以具有例如大约 13.65 伏特的对 DC 总线的对应的设定点调节，以提供对电池的充足充电。在从对 DC 总线的 13.65 伏特调节切换至电池电压的情况下，在到 DC 负载的输入上的电压的瞬变梯级（在该情况中是下降）将是相对小的，诸如小于 1 伏特。输入电压中的这样的小的改变可以充分减弱 DC 负载中的反向瞬变。

[0122] 电池 185 可以是单个单元电池，或者串联和 / 或并联布置的单元电池的组合。在一些实施例中，UPS 中的一个或多个电池在不同于电池备用模式的模式中可以是可热调换 (hot swappable) 的，在所述不同于电池备用模式的模式中，电池在 AC 总线 225 上的故障条件期间正在向负载放电。可以提供可视的或可听的指示器以向保养人员警示电池是否可以被热调换。

[0123] 当安装到托板 110 上时，电池可以被定位和支撑用于快速和便捷的更换。各种快速连接 / 快速断开的铠装线（例如快接型连接器）、弹簧偏置的电接触、卡扣特征、闭锁调整片等可以被用来夹持电池用于稳固连接和快速更换。

[0124] AC 干线电压，如在此所使用的，可以指典型地具有在大约 47Hz 和大约 500Hz 之间的基础频率的 AC 电压源，但不必然地受此限制。AC 电压的源可以出自静止的或移动的源，其示例可以包括在运输车辆、卡车、火车、轮船、飞机等上面的旋转电力发电机。旋转发电机是指基本上从将时变磁场耦接到一个或多个导体以产生基本上为正弦曲线的电压而获得的电力的源。在一些实施方式中，将磁场相对于一个或多个导电绕组旋转。在一些其它的

Ex.1002 / Page 80 of 767
Cholla Energy LLC & OBM, Inc.

实施方式中，将一个或多个导电绕组相对于静止的磁场旋转。

[0125] 作为在从 AC 发电机到 DC 负载 230 的电力路径中的仅有的 AC 到 DC 整流，AC 到 DC 转换器 170 可以包括用来减少谐波畸变、减弱传导发射、管理突入电流等的特征。因此，转换器 170 可以并入硬件、软件或其组合，以提供例如功率因数校正、展布频谱（例如跳频）切换频率、过滤和 / 或控制电流的启动。

[0126] 通过使用任何适当的切换转换器和控制策略来提供在确定的设定点的单个输出电压，可以实现转换器 170 对 DC 总线电压输出的调节。切换拓扑结构可以包括但不限于正激式、反激式、Cuk 式、SEPIC 式、降压式、降压 - 升压式或任何适当的谐振式或准谐振式 AC 到 DC 转换器。在一个说明性的实施例中，至少部分地以具有四个可控制的开关的有源切换矩阵的适当操作来实现 AC 到 DC 整流和转换，所述四个可控制的开关对施加到为降压式安排的感应元件上的 AC 输入电压进行调制。

[0127] 在另一个说明性的实施例中，AC 输入电压由不受控制的二极管整流器级所整流，随后被例如使用正激或反激拓扑结构磁耦接到 DC 到 DC 转换级。在又一个说明性示例中，在功率因数输入级的后面是一个或多个级联降压的 DC 到 DC 转换器级，以产生在确定的设定点上的调节的电压。可以与开关模式电力转换相组合使用线性调节。从本公开中，本领域的普通技术人员将认识到用于 AC 到 DC 转换器 170 的多个实施方式。适当的转换器为本领域所知并且随应用而变化。仅作为示例目的，参考图 6A 和 6B 描述了两个转换器设计。

[0128] 参考例如图 4 作为说明性的示例，系统 400 的一些实施例可以以至少四个模式中的任一个来操作。在第一模式中，处理单元 405 与 UPS115 一样被关闭。在第二模式中，使用从 DC 总线 175 接收的电力对电池 185 充电。在该第二模式中，电池 185 可以根据充电算法进行快速充电或涓流充电。在第三模式中，由于电池从 DC 总线有效地断开并且在 AC 到 DC 转换器向 DC 负载 230 供应操作电力期间既不充电也不放电，电池是“浮置的”。在第四模式中，电池可操作地连接到 DC 总线 175，并且放电以向 DC 负载 230 供应操作电力。该四个条件可以响应于在 AC 总线 225 上的故障条件而被启动。

[0129] 在各种实施方式中，在电压源之间的转换可以涉及某些转换次序。例如，AC 开关设备 220（图 2）可以使用基本上“先接后断”或基本上“先断后接”的转换次序来在任何发电机 205、210、215 之间转换。当从 AC 输入操作切换至电池操作时，在一些实施例中，UPS 115 可以在电池 185 跨 DC 总线 175 连接之前、基本上在这期间或者之后禁用 AC 到 DC 转换器的操作。如果所有的转换器 175 输出电流通过例如串联二极管，则可以通过简单地在开关模式控制器（未示出）处禁用 DC 到 DC 切换的操作来禁用转换器 175。在其它的实施例中，可以通过例如半导体开关来主动地断开输出。

[0130] 已经描述了多个实施例。然而，应当理解，在不背离所描述的精神和范围的情况下可以进行各种修改。例如，如果以不同的次序来执行所公开的技术的步骤，如果将所公开的系统中的组件以不同的方式组合，或者如果以其它组件替换或增补了所述组件，则可以实现有利的结果。因此，其它的实施例也在权利要求的范围之内。

Ex.1002 / Page 81 of 767
Cholla Energy LLC & OBM, Inc.

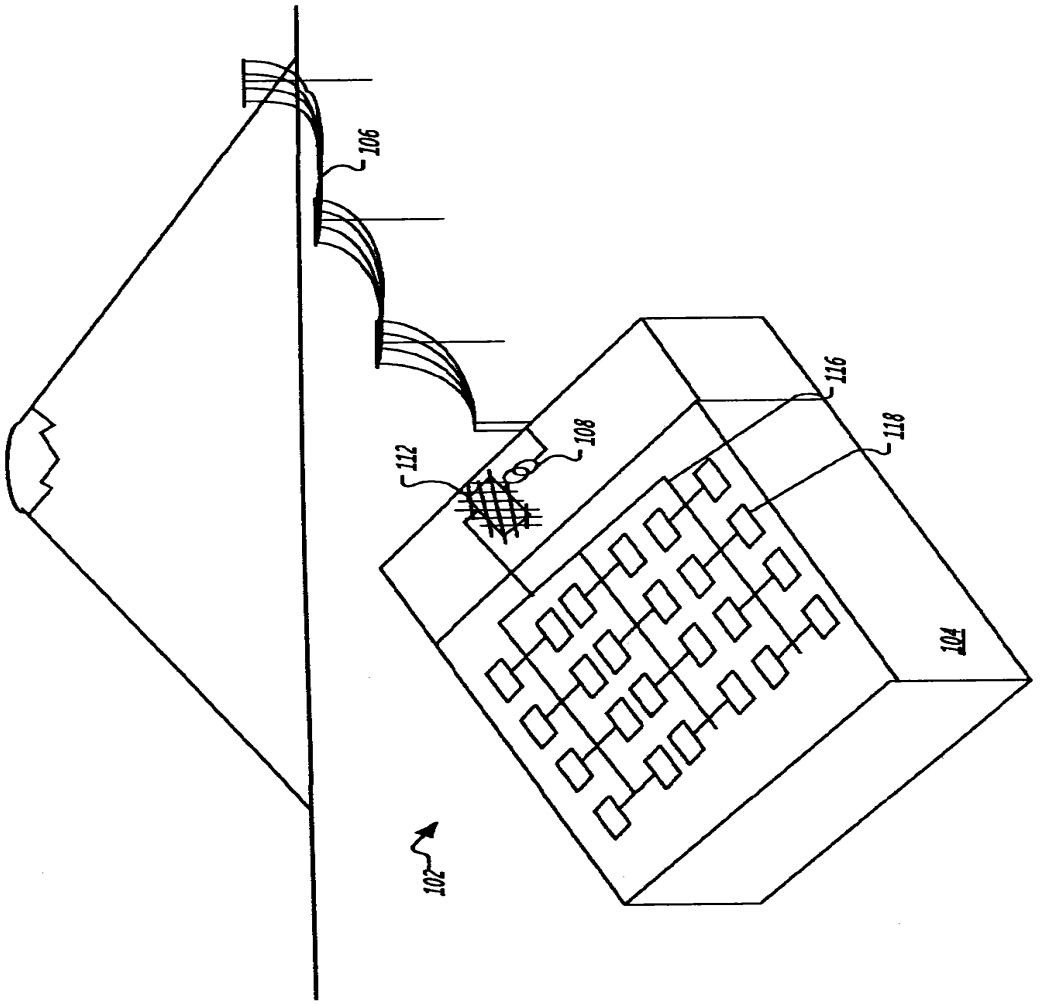


图 1A

Ex.1002 / Page 82 of 767
Cholla Energy LLC & OBM, Inc.

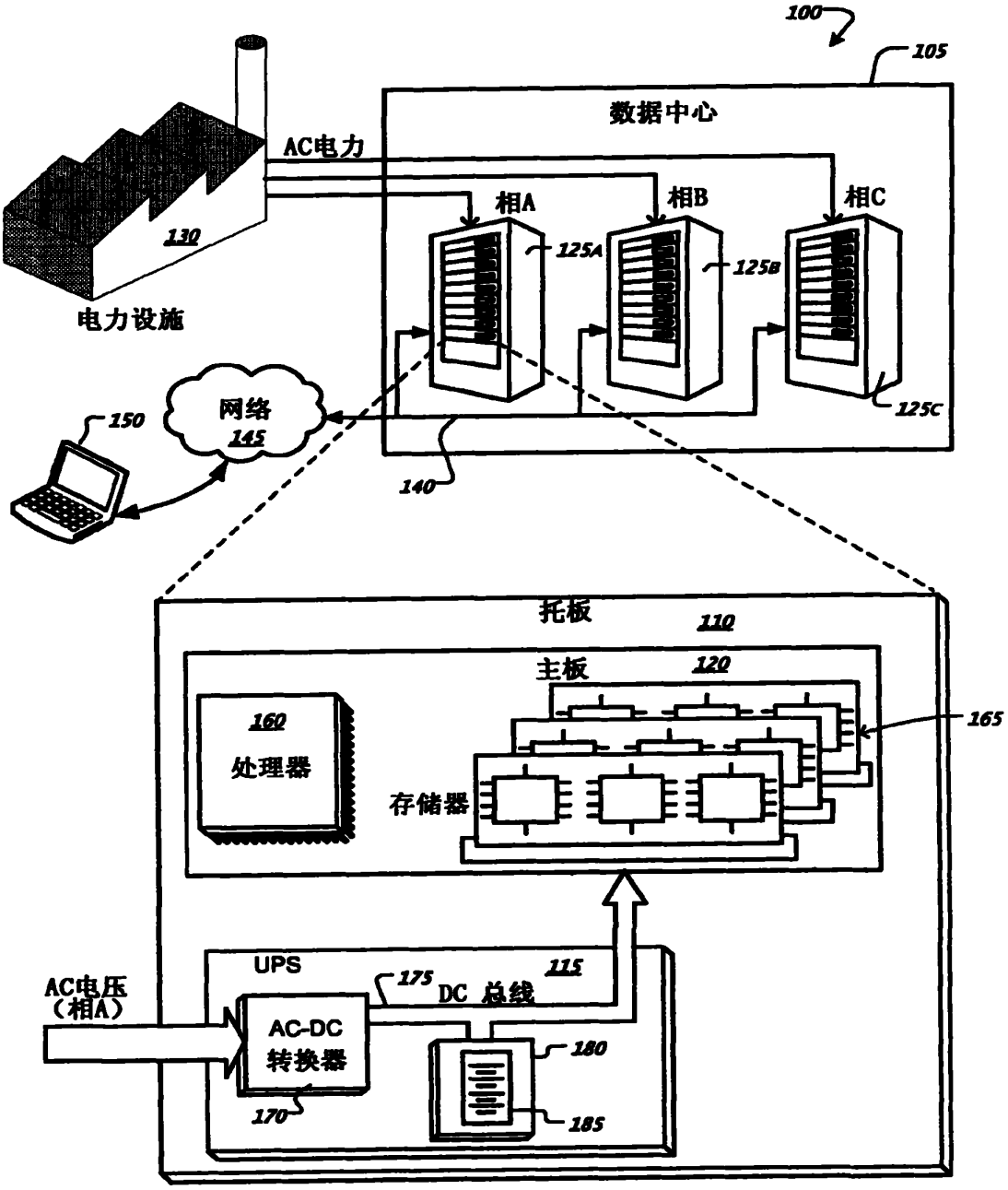


图 1B

Ex.1002 / Page 83 of 767
Cholla Energy LLC & OBM, Inc.

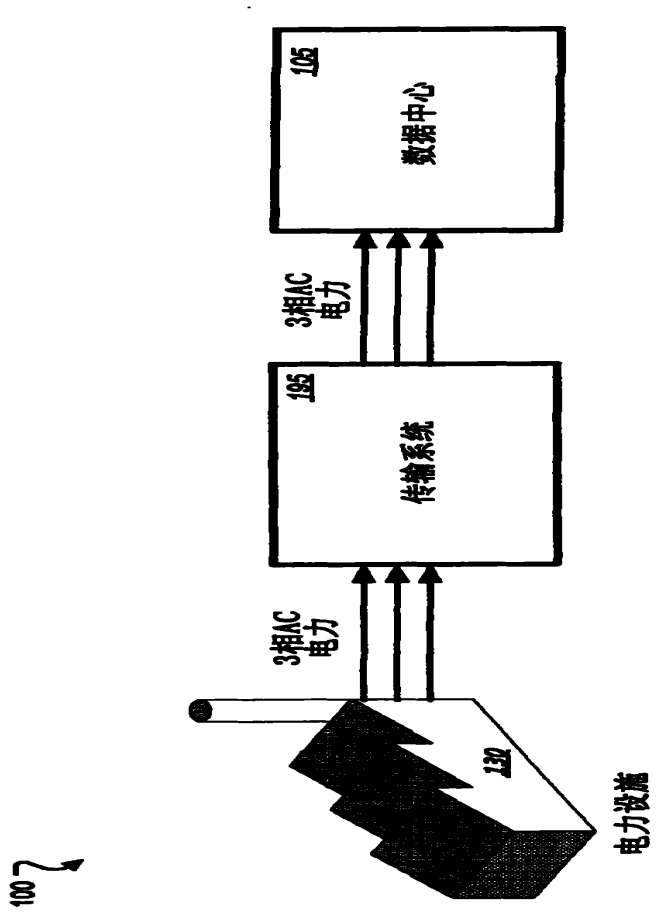


图 1C

Ex.1002 / Page 84 of 767
Cholla Energy LLC & OBM, Inc.

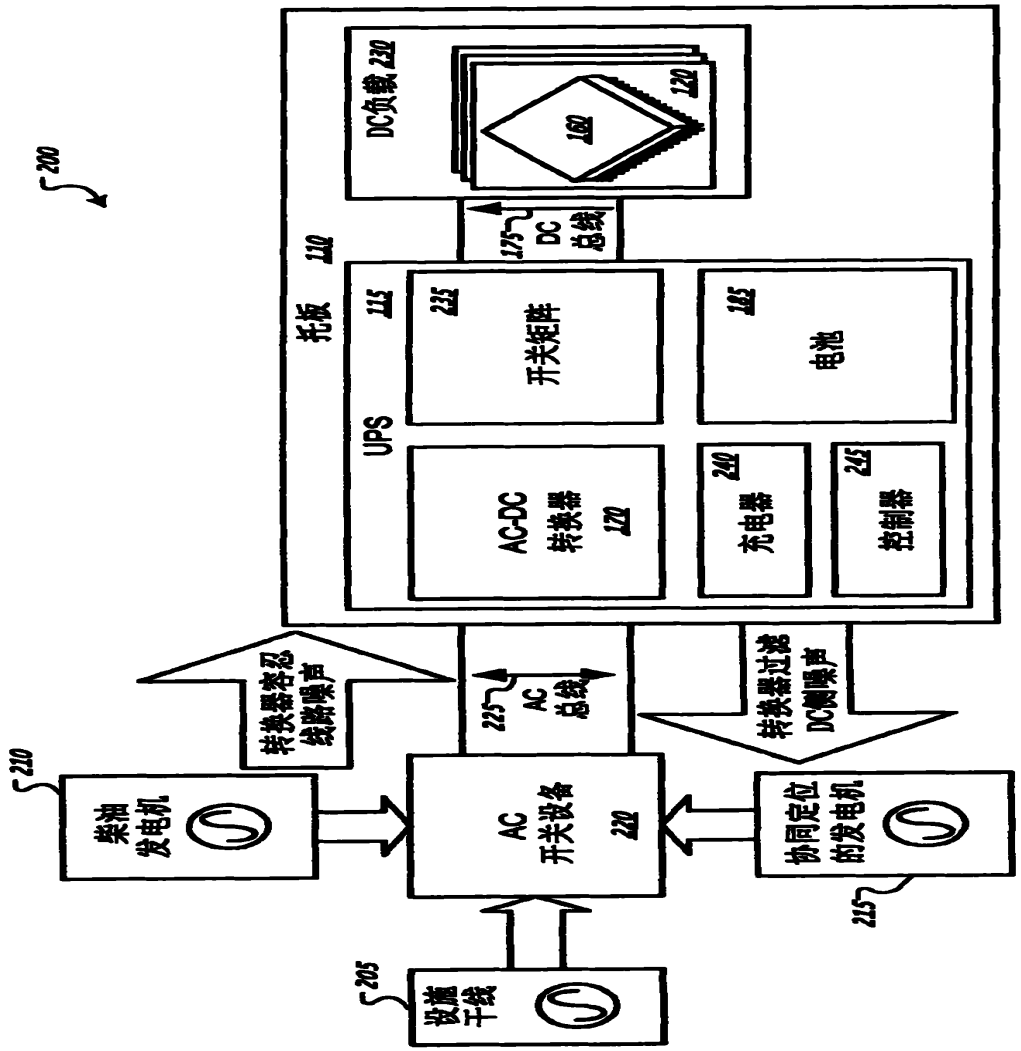


图 2

Ex.1002 / Page 85 of 767
Cholla Energy LLC & OBM, Inc.

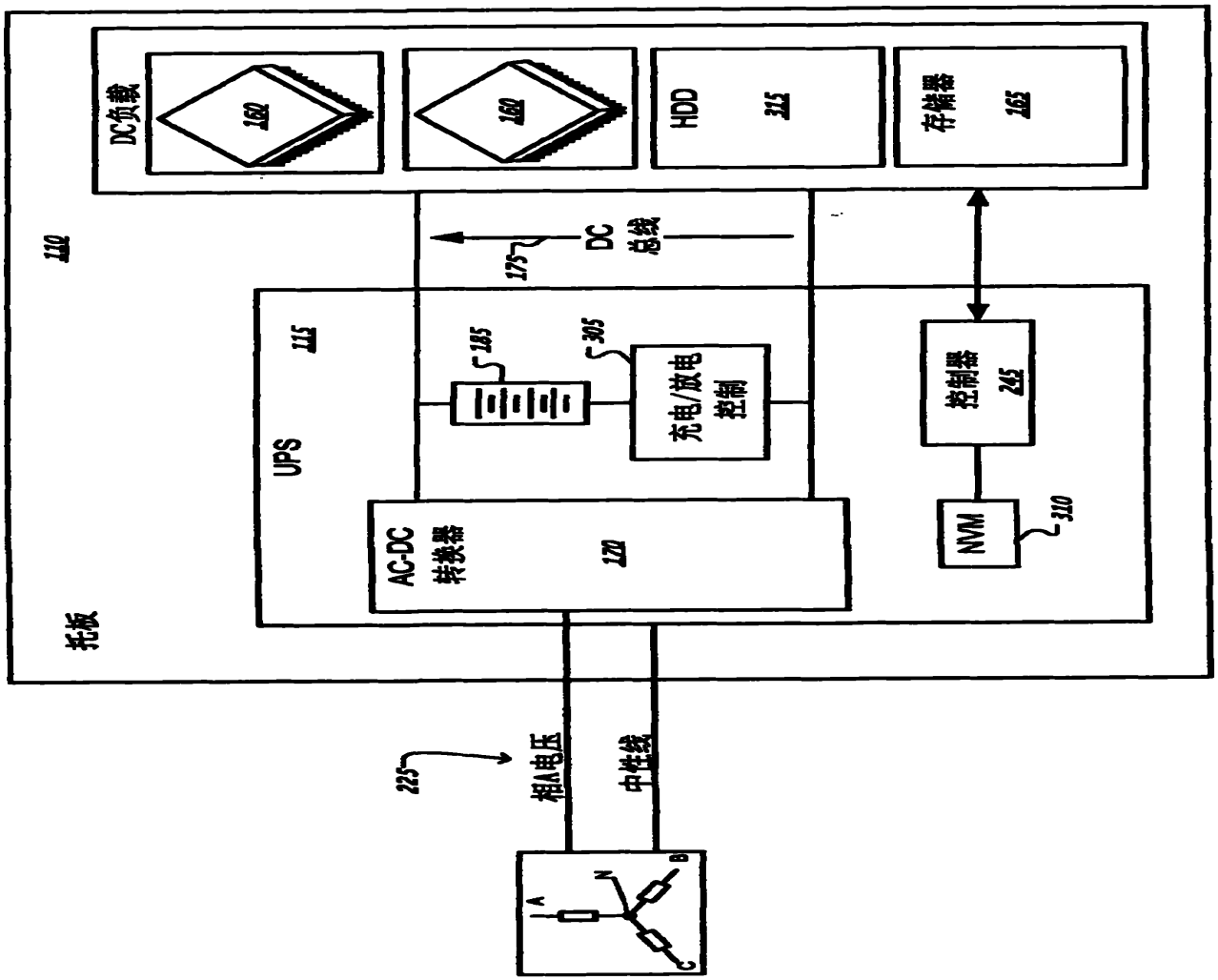


图 3

Ex.1002 / Page 86 of 767
Cholla Energy LLC & OBM, Inc.

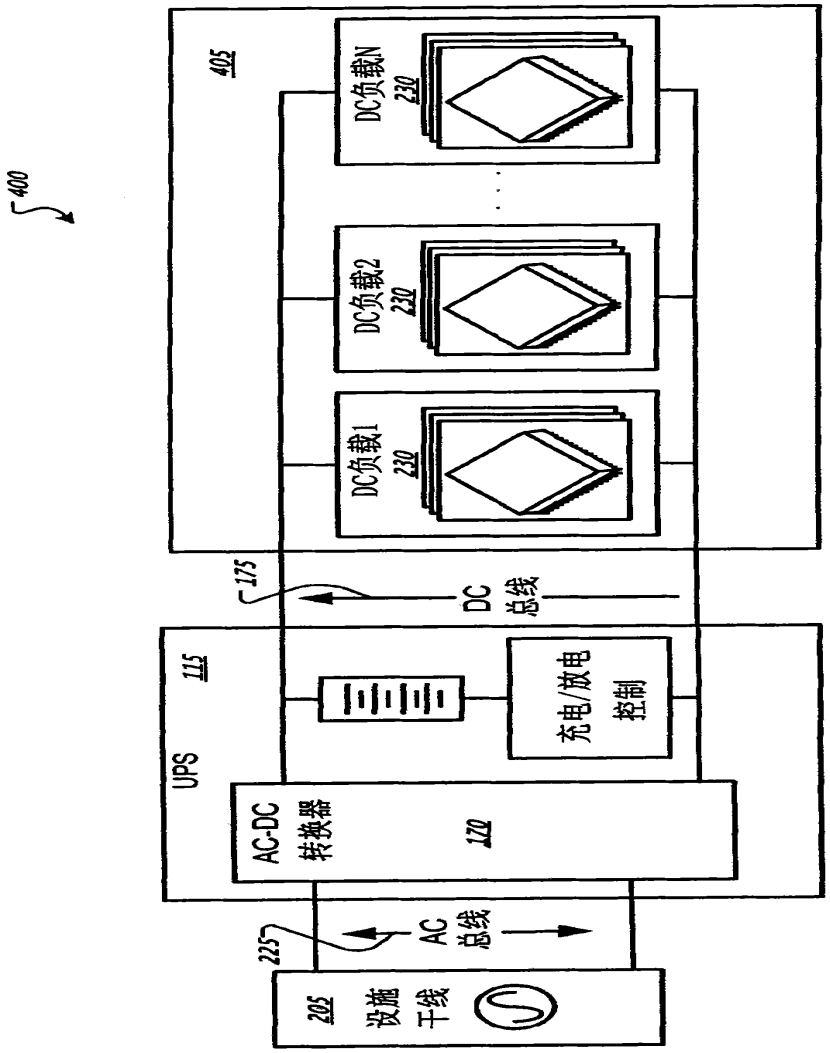


图 4

Ex.1002 / Page 87 of 767
Cholla Energy LLC & OBM, Inc.

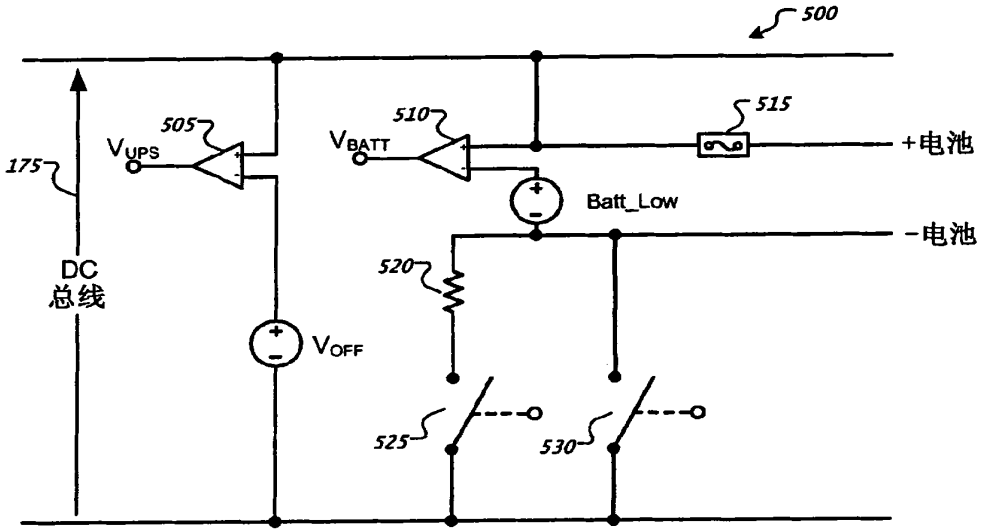


图 5A

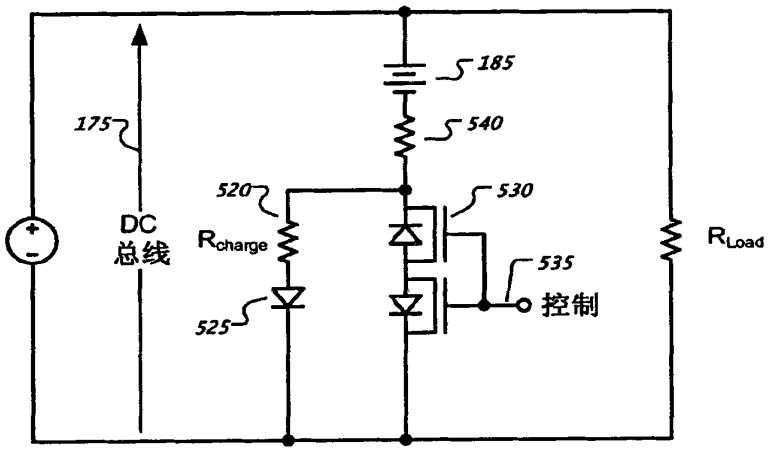


图 5B

Ex.1002 / Page 88 of 767
Cholla Energy LLC & OBM, Inc.

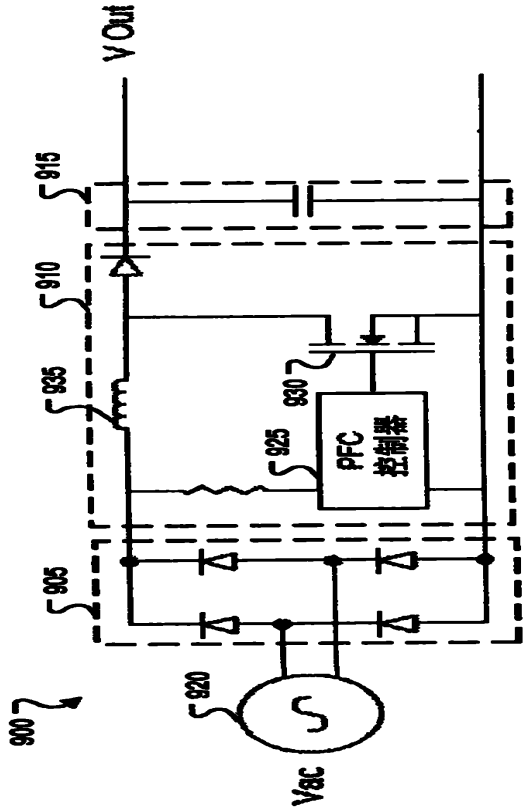


图 6A

Ex.1002 / Page 89 of 767
Cholla Energy LLC & OBM, Inc.

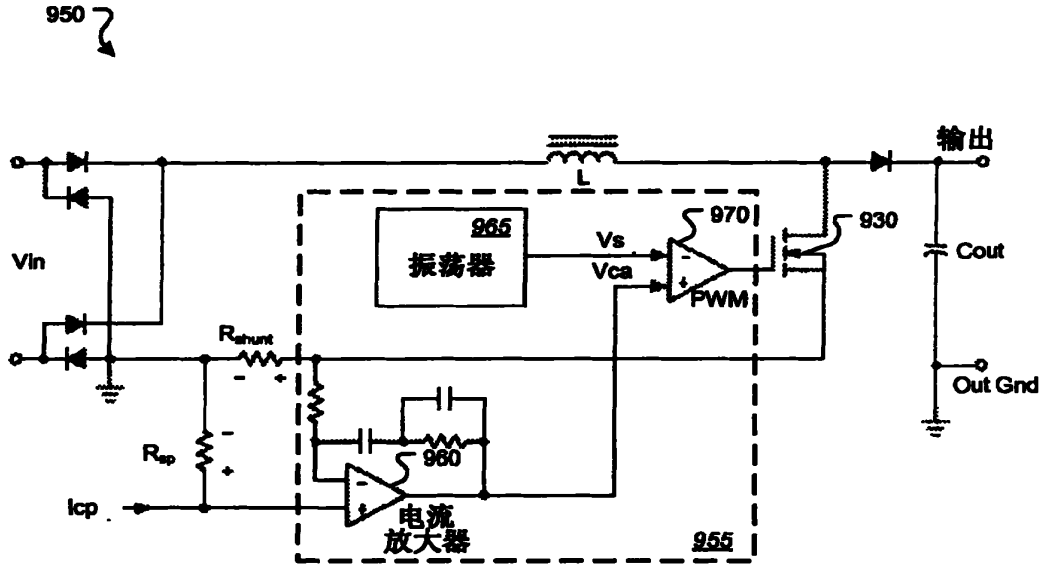


图 6B

Ex.1002 / Page 90 of 767
Cholla Energy LLC & OBM, Inc.

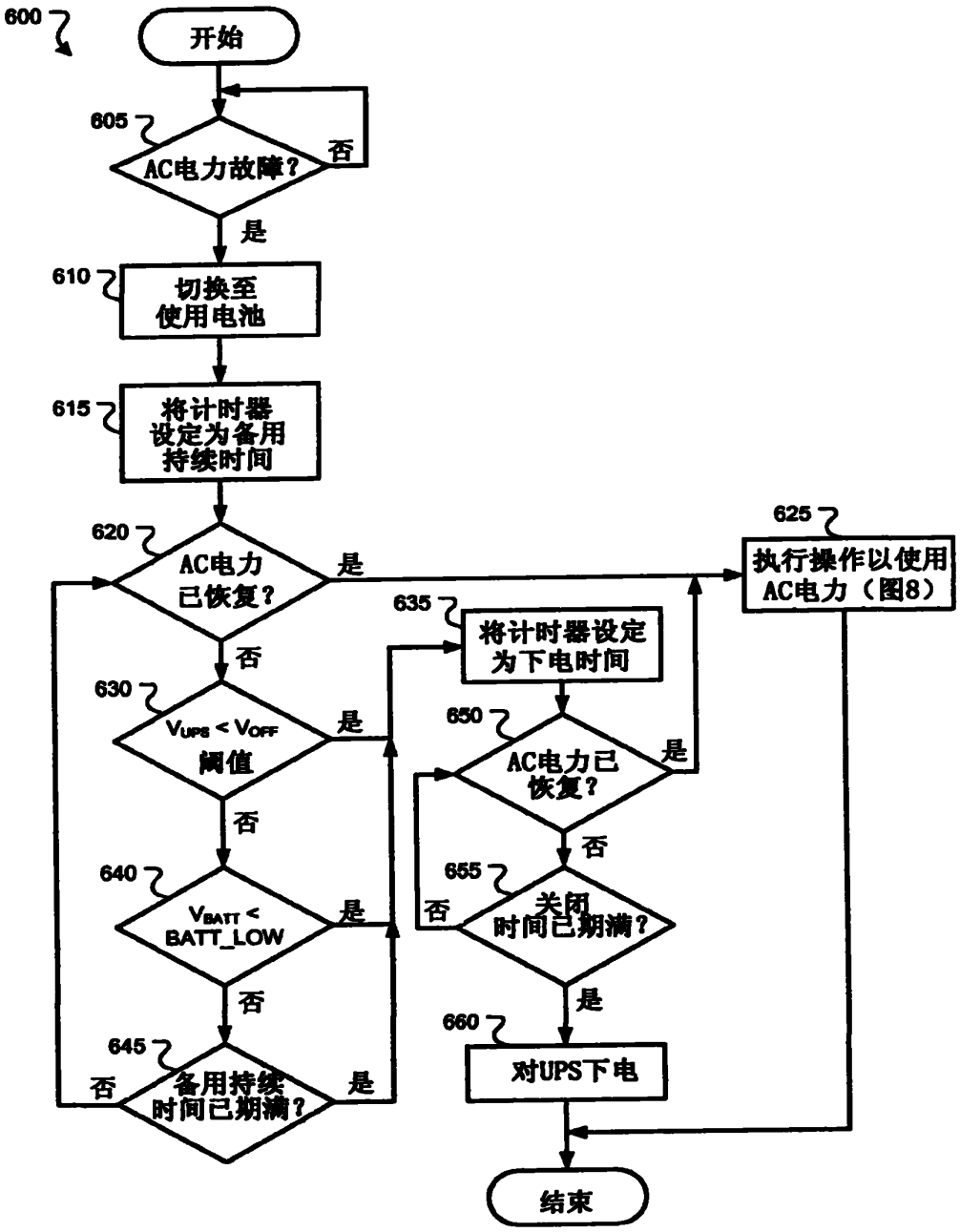


图 7

Ex.1002 / Page 91 of 767
Cholla Energy LLC & OBM, Inc.

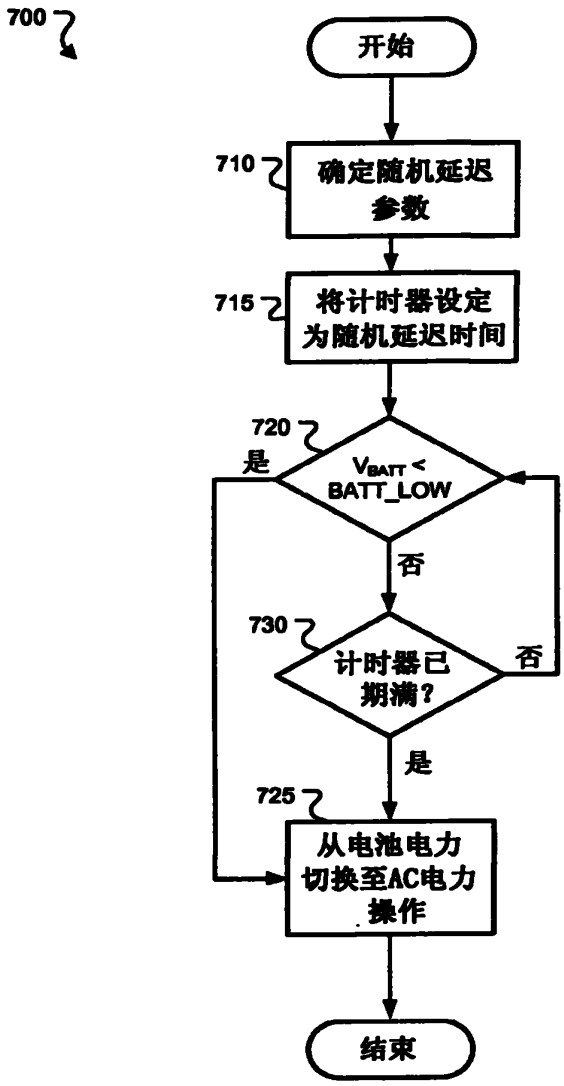


图 8

Ex.1002 / Page 92 of 767
Cholla Energy LLC & OBM, Inc.

Bibliographic data

Title:	Hybrid electric generating power plant using a combination of real-time generation facilities and energy storage system
Pub/Pat no:	CN103748757A
Pub/Issue Date:	2014-04-23
Inventor(s):	SHELTON JOHN CHRISTOPHER| GEINZER JAY CRAIG| GALURA BRETT LANCE| MEERSMAN STEVEN CHRISTIANNE GERARD|SHELTON JOHN CHRISTOPHER |GEINZER JAY CRAIG |GALURA BRETT LANCE |MEERSMAN STEVEN CHRISTIANNE GERARD |·· |·· |·· |···
Applicant(s):	AES CORP
Classification:	H02J3/36AI
Application number:	CN20128040497 2012-06-19
Priority number:	WO2012US43138 2012-06-19; US201161499065P 2011-06-20;

Abstract of CN103748757A

Approaches for controlling power supplied to an electric grid are disclosed. In embodiments, methods and systems control power supplied to an electric grid using an energy storage device. In an embodiment, a method receives an indication of power to be supplied to the electric grid, generates power from a power generator and adjusts, using the generated power, an energy level of the energy storage device to control power supplied to the grid in accordance with the received indication. In another embodiment, a system comprises a grid indication receiver for receiving an indication of power to be supplied to the electric grid; a power generator connected to the grid; an energy storage device coupled to the power generator; and a controller for adjusting, using the generated power from the generator, an energy level of the energy storage device to control power supplied to the grid in accordance with the received indication.

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 103748757 A
(43)申请公布日 2014.04.23

(21)申请号 201280040497.9
(22)申请日 2012.06.19
(30)优先权数据
61/499,065 2011.06.20 US
(85)PCT国际申请进入国家阶段日
2014.02.19
(86)PCT国际申请的申请数据
PCT/US2012/043138 2012.06.19
(87)PCT国际申请的公布数据
WO2012/177633 EN 2012.12.27
(71)申请人 AES有限公司
地址 美国弗吉尼亚州
(72)发明人 约翰·克里斯多夫·谢尔顿
杰伊·克雷格·根泽尔
布雷特·兰斯·加卢拉
史蒂文·克里斯蒂安娜·杰勒德·梅尔斯曼
(74)专利代理机构 北京聿宏知识产权代理有限公司 11372
代理人 吴大建 刘华联
(51)Int.Cl.
H02J 3/36(2006.01)

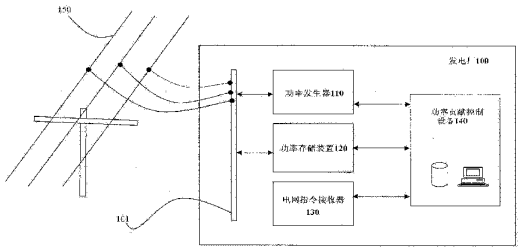
权利要求书5页 说明书13页 附图6页

(54)发明名称

使用实时发生设备与能量存储系统组合的混合电力发电厂

(57)摘要

本发明提供一种控制供应给电网的功率的方法。在实施例中，方法及系统使用能量存储装置来控制供应给电网的功率。在一个实施例中，方法接收将要向电网供应功率的指令，从至少一个功率发生器产生功率，并且使用产生的功率来调节能量存储装置的能量水平，从而根据所接收的指令控制供应给电网的功率。在另一实施例中，系统包括：电网指令接收器，其用于接收将要向电网供应功率的指令；与电网连接的功率发生器；与功率发生器耦合的能量存储装置；控制器，其使用从功率发生器产生的功率来调节能量存储装置的能量水平，从而根据所接收的指令控制供应给电网的功率。



CN 103748757 A

1. 一种使用能量存储装置存储能量来控制供应给电网的功率的方法，所述方法包括：

接收将要向所述电网供应功率的指令；

从至少一个功率发生器中产生功率；以及

使用由所述功率发生器产生的功率来调节所述能量存储装置的能量水平，从而根据所接收的所述指令来控制所述供应给所述电网的功率。

2. 如权利要求 1 所述的方法，还包括：

将所述至少一个功率发生器和所述能量存储装置共同布置在功率发生场中；并且

经由位于所功率发生场的站变压器来将所述至少一个功率发生器的输出和所述能量存储装置的输出与所述电网耦合。

3. 如权利要求 1 所述的方法，其中，响应于接收指示了针对所述至少一个功率发生器和所述能量存储装置的组合的一个或多个操作设定点的一个或多个参数，通过控制器来确定针对所述至少一个功率发生器和所述能量存储装置中的每一项的一个或多个其他设定点，使得所述至少一个功率发生器和所述能量存储装置的所述组合满足由所接收的一个或多个参数指示的所述一个或多个操作设定点。

4. 如权利要求 1 所述的方法，还包括：

在所述能量存储装置的能量水平的调节的同时对由所述至少一个功率发生器产生的功率进行调节，从而符合所述将要供应给所述电网的功率。

5. 如权利要求 4 所述的方法，其中，在所述能量存储装置的能量水平的调节的同时对由所述至少一个功率发生器产生的功率进行调节的做法包括如下任一项：

（1）将所述能量存储装置放电并且增加由所述至少一个功率发生器供应的功率；

（2）将所述能量存储装置放电并且降低由所述至少一个功率发生器供应的功率；

（3）对所述能量存储装置充电并且降低由所述至少一个功率发生器供应的功率；或者

（4）对所述能量存储装置充电并且增加由所述至少一个功率发生器供应的功率。

6. 如权利要求 5 所述的方法，其中，

将所述能量存储装置放电并且增加由所述至少一个功率发生器供应的功率的做法包括在通过所述至少一个功率发生器的功率产生中的初始加速向上期间释放所存储的功率；

对所述能量存储装置充电并且降低由所述至少一个功率发生器供应的功率的做法包括在通过所述至少一个功率发生器的功率产生中的减速向下期间为电网上的后续传输而存储功率。

7. 如权利要求 1 所述的方法，其中，所述能量存储装置包括用于将直流电流转换为交流电流和将交流电流转化成直流电流的转换器。

8. 如权利要求 1 所述的方法，其中，所述指令的接收包括如下至少一项：

（1）接收指示将要供应给所述电网的目前功率供应水平的信号；

（2）接收指示电网频率的信号，用于确定对将要供应给所述电网的功率的目前调节；或者

（3）接收一个或多个操作参数，所述一个或多个操作参数指示了针对至少一个所述功率发生器和所述能量存储装置的组合的操作的一个或多个操作设定点。

9. 如权利要求 8 所述的方法，还包括：

Ex.1002 / Page 95 of 767
Cholla Energy LLC & OBM, Inc.

响应于接收指示所述电网频率的所述信号，确定对将要供应给所述电网的功率的目前调节；以及

确定来自所述至少一个功率发生器的功率贡献和来自所述能量存储装置的功率贡献，从而满足所确定的所述目前调节。

10. 如权利要求 8 所述的方法，还包括，响应于接收指示将要供应给所述电网的目前功率供应水平的所述信号，确定来自所述至少一个功率发生器的功率贡献和来自所述能量存储装置的功率贡献，从而满足所指示的所述目前功率供应水平。

11. 如权利要求 8 所述的方法，其中，接收指示所述电网频率的所述信号包括检测瞬时电网频率。

12. 如权利要求 1 所述的方法，其中：

所接收的所述指令是指示某时段期间将要供应给所述电网的功率的指令序列；并且

所述能量存储装置和所述至少一个功率发生器具有不同的功率瞬态响应。

13. 如权利要求 12 所述的方法，还包括：

使用所述能量存储装置和所述至少一个功率发生器中的具有更快的功率瞬态响应的那一个来调节供应给所述电网的功率。

14. 如权利要求 12 所述的方法，还包括：

确定与低于阈值频率的功率供应波动相关联的第一分量和与等于或高于阈值频率的功率供应波动相关联的第二分量；

根据所述第一分量来调节所述能量存储装置的能量水平；并且

根据所述第二分量来调节来自所述至少一个功率发生器的功率产生。

15. 如权利要求 1 所述的方法，还包括：

(1) 在预计到所述电网上的功率需求会下降的时段期间，在低于容量的第一水平下将能量存储在所述能量存储装置；以及(2) 在预计到所述电网上的功率需求会增加的时段期间，在高于所述第一水平的第二水平下将能量存储在所述能量存储装置。

16. 如权利要求 1 所述的方法，还包括：

根据所述能量存储装置的最优的功率释放及存储配置文件或预设的功率释放及存储配置文件对通过所述能量存储装置存储的能量水平进行调节；以及

基于所述最优的或预设的功率释放及存储配置文件，对来自所述至少一个功率发生器的功率产生进行调节，从而满足所接收的所述指令。

17. 如权利要求 16 所述的方法，其中，所述能量存储装置的所述最优或所述预设的功率释放及存储配置文件以及所述至少一个功率发生器的最佳或预设的斜率配置文件基于由如下项组成的组中选出的至少两个因素：

(1) 各个设备的磨损及损坏；

(2) 所述至少一个功率发生器的最大变化速率；

(3) 所述至少一个功率发生器的最优变化速率；

(4) 所述至少一个功率发生器的燃油消耗率配置；

(5) 所述能量存储装置的充电状态(SOC)；

(6) 所述各个设备的耐用性；

(7) 所述至少一个功率发生器和所述能量存储装置的初始获取和折损的成本；以及

Ex.1002 / Page 96 of 767
Cholla Energy LLC & OBM, Inc.

(8) 由电网分配的功率的传输损耗。

18. 如权利要求 1 所述的方法,还包括 :

根据所述至少一个功率发生器的最优的斜率配置文件或预设的斜率配置文件,调节来自所述至少一个功率发生器的功率产生 ;

基于所述最佳或预设的斜率配置文件,调节所述能量存储装置的能量水平以满足所接收的所述指令。

19. 一种使用耦合于电网的至少一个功率发生器和能量存储装置来控制供应给所述电网的功率的装置,所述装置包括 :

电网指令接收器,其配置为接收将要向所述电网供应功率的指令 ;

控制器,其配置为使用从所述功率发生器产生的功率来调节所述能量存储装置的能量水平,从而根据由所述电网指令接收器接收的所述指令来控制所述供应给所述电网的功率。

20. 如权利要求 19 所述的装置,其中,所述电网指令接收器进一步配置为接收包括如下至少一项的指令 :

(1) 指示将要供应给所述电网的目前功率供应水平的信号 ;

(2) 指示电网频率的信号,其用于确定对将要供应给所述电网的功率的目前调节 ;或者

(3) 一个或多个操作参数,其指示了针对至少一个所述功率发生器和所述能量存储装置的组合的操作的一个或多个操作设定点。

21. 如权利要求 19 所述的装置,其中,响应于接收指示了针对所述至少一个功率发生器和所述能量存储装置的组合的一个或多个操作设定点的所述一个或多个参数,所述控制器配置为确定针对所述至少一个功率发生器和所述能量存储装置中的每一个的一个或多个其他设定点,使得所述至少一个功率发生器和所述能量存储装置的所述组合满足由所接收的所述一个或多个参数指示的所述一个或多个操作设定点。

22. 如权利要求 19 所述的装置,其中,所述控制器在对所述能量存储装置的能量水平进行调节的同时对由所述至少一个功率发生器产生的功率进行调节,从而符合所述将要供应给所述电网的功率。

23. 如权利要求 22 所述的装置,其中,所述控制器进一步配置为基于从所述电网指令接收器接收的所述指令而控制如下任一项 :

(1) 将所述能量存储装置放电并且增加由所述至少一个功率发生器供应的功率 ;

(2) 将所述能量存储装置放电并且降低由所述至少一个功率发生器供应的功率 ;

(3) 对所述能量存储装置充电并且降低由所述至少一个功率发生器供应的功率 ;或者

(4) 对所述能量存储装置充电并且增加由所述至少一个功率发生器供应的功率。

24. 如权利要求 19 所述的装置,其中 :

所述电网指令接收器进一步配置为接收指示了某时段期间将要供应给所述电网的功率的指令序列 ;并且

所述能量存储装置和所述至少一个功率发生器具有不同的功率瞬态响应,使得所述能量存储装置和所述至少一个功率发生器之中的具有更快的功率瞬态响应的那一个来调节供应给所述电网的功率。

25. 如权利要求 19 所述的装置,还包括 :

Ex.1002 / Page 97 of 767
Cholla Energy LLC & OBM, Inc.

过滤单元，其配置为确定与低于阈值频率的功率供应波动相关联的第一分量和与等于或高于于阈值频率的功率供应波动相关联的第二分量；

所述控制器进一步配置为根据所述第一分量来调节所述能量存储装置的能量水平，并且根据所述第二分量来调节来自所述至少一个功率发生器的功率产生。

26. 如权利要求 19 所述的装置，其中：

所述至少一个功率发生器包括如下至少一项：

（1）水电发电机；

（2）化石燃料发电机；

（3）核发电机；

（4）风力发电机；

（5）潮汐发电机；

（6）地热发电机；或者

（7）太阳能发电机；并且

所述能量存储装置包括如下至少一项：

（1）电池；

（2）电容器；

（3）惯性功率存储系统；

（4）气动系统；或者

（5）悬挂质量系统。

27. 如权利要求 19 所述的装置，其中，所述能量存储装置包括用于将直流电流转换为交流电流和将交流电流转化成直流电流的转换器。

28. 如权利要求 19 所述的装置，其中，所述控制器进一步配置为：

（1）在预计到所述电网上的功率需求会下降的时段期间，在低于容量的第一水平下将能量存储在所述能量存储装置；以及

（2）在预计到所述电网上的功率需求会增加的时段期间，在高于所述第一水平的第二水平下将能量存储在所述能量存储装置。

29. 如权利要求 19 所述的装置，其中，所述控制器进一步配置为根据所述能量存储装置的最优的功率释放及存储配置文件或预设的功率释放及存储配置文件对通过所述能量存储装置存储的能量水平进行调节，并且基于所述最优的或预设的功率释放及存储配置文件对来自所述至少一个功率发生器的功率产生进行调节，从而满足所接收的所述指令。

30. 如权利要求 19 所述的装置，其中，所述控制器进一步配置为根据所述至少一个功率发生器的最佳的斜率配置文件或预设的斜率配置文件，调节来自所述至少一个功率发生器的功率产生，并且基于所述最佳或预设的斜率配置文件调节所述能量存储装置的能量存储以满足所接收的所述指令。

31. 一种控制供应给电网的功率的系统，所述系统包括：

电网指令接收器，其配置为接收将要向所述电网供应功率的指令；

配置为产生功率的至少一个功率发生器，所述至少一个功率发生器与所述电网连接；

配置为存储能量的能量存储装置，所述能量存储装置与所述至少一个功率发生器和所述电网耦合；

Ex.1002 / Page 98 of 767
Cholla Energy LLC & OBM, Inc.

控制器，其配置为使用从所述功率发生器产生的功率来调节所述能量存储装置的能量水平，从而根据由所述电网指令接收器接收的所述指令控制所述供应给所述电网的功率。

32. 一种具有存储在其上的指令的非暂时性计算机可读存储介质，响应于计算设备的执行，使得所述计算设备使用能量存储装置存储能量来执行用于控制供应给电网的功率的操作，所述操作包括：

接收将要向所述电网供应功率的指令；

从至少一个功率发生器产生功率；以及

使用由所述功率发生器产生的功率来调节所述能量存储装置的能量水平，从而根据所接收的所述指令控制所述供应给所述电网的功率。

Ex.1002 / Page 99 of 767
Cholla Energy LLC & OBM, Inc.

使用实时发生设备与能量存储系统组合的混合电力发电厂

[0001] 相关申请的交叉参考

[0002] 本申请要求于 2011 年 6 月 20 日提交的名称为“Hybrid Electric Generating Power Plant That Uses a Combination of Real-Time Generation Facilities and Energy Storage System”的美国临时申请 NO.61/499,065 的权益，其全部内容通过引用并入本文。

技术领域

[0003] 本发明涉及一种用于为电网提供发电服务的系统及方法，更具体地涉及，使用能量存储系统的混合电力发电厂。

背景技术

[0004] 通常，公用设施从诸如燃气、燃煤、核和 / 或水力发电厂的一个或多个主要发生源获得电力，经由配电网传送至用户。由这些来源提供的功率可能时刻变化。一般来说，可以对来源进行调节以满足用户的需求，与此同时符合针对该功率的标准，诸如标称电压和频率水平。

[0005] 为了补充由这些主要来源所提供的功率，将诸如太阳能电池板和风车的辅助功率源连接到配电网的做法变得越来越常见。除了其他的优点之外，与主要来源相比，这种辅助形式的能量是可再生的。

发明内容

[0006] 本发明涉及一种使用能量存储装置来存储能量以控制供应给电网的功率的装置、系统、计算机可读介质及方法。一个示例性方法包括：接收将要向所述电网供应功率的指令，从至少一个功率发生器中产生功率，以及使用由所述功率发生器产生的功率来调节所述能量存储装置的能量水平，从而根据所接收的所述指令来控制所述供应给所述电网的功率。

附图说明

[0007] 结合附图对下文的详细描述进行阅读，将更好地理解示例性实施例。需要强调的是，根据常规实践，附图的各种特征并非是按比例的。相反，出于清楚，各种特征的尺寸可以任意地扩大或缩小。附图中包含如下特征：

[0008] 图 1A 是示出了根据本发明实施例的与电网连接的示例性发电厂的示意图；

[0009] 图 1B 是示出了根据本发明实施例的与电网连接的另一示例性发电厂的示意图；

[0010] 图 2 是示出了根据本发明实施例的与电网连接的发电厂的更详细示意图；

[0011] 图 3 是示出了根据本发明实施例的对供应给电网的功率进行控制的方法的流程图；

[0012] 图 4 是示出了根据本发明实施例的对通过产生和 / 或存储而获得的功率贡献进行

Ex.1002 / Page 100 of 767
Cholla Energy LLC & OBM, Inc.

调节或优化的流程图；

[0013] 图 5 是示出了根据本发明实施例的与热电发电厂和电网稳定性电存储系统的联合响应曲线相匹配的需求曲线的曲线图；以及

[0014] 图 6 是能够执行实施例的示例性计算机系统的示意图。

具体实施方式

[0015] 与主要发生源的相对稳定的输出不同的是，由辅助源产生的能量的量可能在相对短的时间间隔内(例如，以几秒或几分钟测算)在较宽的范围内变化。例如，太阳能电池板的输出不仅根据一天中的时间而改变，而且还作为诸如云层突然出现和经过而遮挡阳光直射的气象事件的结果而改变。同样，风车场的输出可能受到瞬间起风和 / 或平息的风速的影响。

[0016] 辅助源的输出中的突然向上的尖峰(例如，增加) 可以通过电网来吸收，并且可以通过如下方式来调解：(1)降低例如一个或多个主要来源和 / 或其他辅助源的输出；(2)由能量存储装置存储功率；和 / 或(3) 增加公用电网的负载。

[0017] 辅助源的输出的突然下降可以通过电网来吸收，并且可以通过如下方式来调解：(1) 增加例如一个或多个主要来源和 / 或其他辅助源的输出；(2) 由能量存储装置释放功率；和 / 或(3)降低电网的负载。在某些示例性实施例中，突然上升或突然下降可能会超过设备固有的传输容量，并可能导致例如所产生功率的损失或者可能的停电情况。这些突然变化可能会切断主要功率源而导致停电，或者可能造成主要功率源的额外成本，诸如与在非理想操作设置点处的操作相关联的工作容量的降低，以及维护和 / 或额外燃油成本的增加。

[0018] 大的频率波动也可能超过正常操作的配电系统的响应能力。例如，如果发生器突然脱机或者如果传输线路发生故障，则可能出现频率和 / 或电压电平的下降，这可能由于与正常操作设置点的频率和 / 或电压的偏差而造成多个发生器脱机的级联效应(例如，可能出现停电)。传统的功率发生设备对这种变化不是总能足够迅速地做出反应。电网频率会随着负载的波动而变化，因为功率发生器会由于负载增加而速度放缓，或者由于负载减小而速度增加，由此改变了所产生的交流电流(AC) 的频率。

[0019] 当管理电网上的一些情况的波动时，电气系统操作员(ESO) 可以改变所选定的功率发生站的输出以适应该波动(例如，通过操作电网使公用电网稳定，使得公用电网中任何一个部件的损失不会造成级联效应(例如以防止停电))。现有的功率发生单元可以具有关于一个输出电平向另一输出电平的进级速度的约束(这里也称为“斜率(ramp rate)”)。斜率可以根据电力发生单元的类型(例如，煤或天然气等) 和发电单元的操作等级(例如，设定点)而改变。尽管可以对系统总容量进行限制以满足斜率，但是现有的电力系统的斜率通常足以满足与主要功率源相关联的斜率。然而，小型电力系统可能难以维持供应 / 需求平衡和足够的加速能力(ramping capability)。随着辅助功率源的出现，有必要改进加速能力。

[0020] 此外，包括例如电池的能量存储装置的混合发电厂允许更有效地利用现有的功率发生器。通常，发电厂保留输出的一部分以作为用于快速加速上升和 / 或调节服务的运转备用。运转备用通常指代已联机、已同步的发生器以及产生它们的总输出容量的一部分(即，子集) 的发生器。使用这种运转备用发生器可能是成本昂贵的，因为：(1) 功率发生器

Ex.1002 / Page 101 of 767
Cholla Energy LLC & OBM, Inc.

的输出的一部分不能用于基本的负载容量；(2)在运转备用功率发生器上可能出现额外的磨损和损坏；和/或(3)由于运转备用功率发生器的操作，可能损失额外的能量，花费额外的燃料成本并且导致额外的排放。

[0021] 通过使功率发生器包括有斜率较快的能量储存装置，功率发生器可以用于基本的负载容量，并且能量存储装置可以提供调节和快速斜率控制，以给予功率发生器额外的时间来调节功率发生器的输出，或者干脆放弃对输出的改变。

[0022] 一种在保持电力发电站的高操作速率(例如，效率)的同时为功率输出提供及时快速的调节(例如，减少或增加)的功率发生系统可以更好地服务于电网的目前要求。

[0023] 在某些示例性实施例中，系统、装置及方法可以通过将一个或多个功率发生器和一个或多个能量储存装置对电网频率和/或电压波动的响应进行联合，以保持电网频率和/或电压电平的稳定。联合响应可以由功率贡献控制设备(PCCE)来支配(例如，控制)。应当指出，本系统可以与名称为“Frequency Responsive Charge Sustaining Control of Electricity Storage Systems for Ancillary Services on an Electrical Power Grid”的美国专利申请公报No.2010/0090532中的系统结合使用。

[0024] 在某些示例性实施例中，控制器可以根据所接收的信息(例如，指令)使用由功率发生器产生的功率来调节通过能量存储装置(例如电池、电容器、化学存储单元和/或机械存储单元等)所存储的能量，并且根据所接收的信息来控制供应给电网的功率。

[0025] 本文描述了用于响应电网频率或电网电压电平的变化的方法及装置，从而使得发电厂能够以固定的操作速率运作。该装置可以包括：(1)至少一个功率发生器，其配置为产生分布于电网(例如，功率网)的交流电流；和(2)至少一个功率存储装置，其通过与功率发生器相同或者不同的连接方式与电网进行连接。功率发生器和功率存储装置可以共同布置在单个发电厂或发生场处，或者可以分布在不同的位置并且与电网耦合。该装置可以包括电网频率检测器和PCCE。电网频率检测器可以配置为针对分布在电网上的交流电流的频率变化来检测电网频率。PCCE可以配置为通过(1)关于至少一个功率存储装置来控制功率存储器的放电和(2)增加或减少来自至少一个功率发生器的功率产生，从而控制对电网的功率贡献。PCCE可以配置为对所接收的输入、诸如所检测到的电网上的频率波动或电网上的电压波动而提供响应。例如，PCCE可以通过如下方式提供稳定性：在功率产生的变化期间(例如，在加速向上的期间)通过至少一个功率发生器释放存储的功率，和/或在功率产生的变化期间(例如，在减速向下的期间)通过至少一个功率发生器存储功率从而防止电网上的功率传输。释放存储功率与存储功率的联合响应可以遵循提供给PCCE的瞬时(例如，实时或近乎实时)需求信息。

[0026] 某些示例性实施例可以有利地减少磨损和损坏，降低燃料成本，提高操作效率和/或降低主要功率源对环境的影响，并且可以为大额负载荷的波动、短缺以及设备故障等提供更快的突发事件响应，否则这些突发事件将导致电压和/或电网频率的波动。一般来说，发电厂过度建设并且包括多余的产能。例如，水力发电厂可以具有用于电网调节的运转但脱机的发生器(例如，备用发生器)，使得当出现电网频率或电压电平波动(例如，快速波动)时可以使用备用发生器(例如，可以变成联机状态)，这可能会增加备用发生器的磨损和损坏，并且可能需要发电厂过度建设并同时利用不足。

[0027] 图1A是示出了根据本发明实施例的与电网150连接的示例性发电厂100的示意

Ex.1002 / Page 102 of 767
Cholla Energy LLC & OBM, Inc.

图。

[0028] 参考图 1，发电厂 100 可以与电网 150（例如，公用电网）连接。为了清楚起见，已经简化图示以示出典型的三相电力系统，但是相关领域技术人员应当了解，其他配置也是可行的。发电厂 100 可以包括功率发生器 110、功率（或能量）存储装置 120、电网指令接收器 130、功率汇流排 101 和功率贡献控制设备（PCCE）140。

[0029] 功率发生器 110 可以与 PCCE140 和功率汇流排 101 连接或耦合，并且可以配置为将一种形式的能量产生为（即，转换为）电能。功率发生器 110 可形成为分散的功率发生器，或者作为被连接或被选择性地相互连接以产生功率的单独功率发生器的汇集组。功率发生器 110 可以是水力发电机、化石燃料发电机（例如，煤发电机、天然气发电机、汽油发电机、柴油发电机或者任何其他形式的化石燃料发电机）、核发电机，和 / 或可再生能源发生器发电机，诸如风力治理发电机、潮汐发电机、地热发电机和 / 或太阳能发电机，以及可以由 PCCE140 控制的其他形式的发电机。

[0030] 功率存储装置 120 可以与 PCCE140 和功率汇流排 101 连接或耦合，并且可以配置为选择性地向电网 150 提供能量或选择性地从电网 150 接收能量。

[0031] 功率存储装置 120 例如可以是电池或结合有电池的电容器，以便提供能量脉冲（例如，小于门限持续时间的短期能量脉冲串）。作为替代或附加，功率存储装置 120 例如为惯性功率系统（诸如飞轮）、气动系统（将要释放到机械系统中的气体进行压缩以旋转发电机），或者悬挂质量系统（诸如水泵系统，其将水输送到水力发电厂附近的较高水平处以备稍后发电使用）。然而，功率存储装置 120 绝不限于这些示例。

[0032] 尽管如图 1 所示且如上所述的功率存储装置 120 与功率发生器 110 共同布置在发电厂 100 中，但可以设想，其他配置也是可行的。例如，在一些示例性实施例中，功率存储装置可以沿着电网 150 分布。在其他示例性实施例中，功率存储装置可以与功率发生器共同布置在发电厂中并且沿着电网 150 分布。这些配置在功率存储装置趋于分散和紧凑的情况下是有利的，并且可以放置在所分配的位置而无需大量成本。功率发生器 110 可以取决于水力发电、水供应和 / 或燃料供应等的位置。通过这种方式，功率存储装置 120 可以位于更靠近负载的位置，或者分布开以用于电网 150 内的负载平衡。用于将能量存储装置 120 与功率发生器 110 共同布置的协同配置包括但不限于共用能量存储装置 120 和功率发生器 110 之间的控制及监视系统、操作及维护人员、变电站、电气开关装置以及变压器。此外，当功率发生器 110 与能量存储装置 120 共同布置时，能够提供本地功率发生器 110 所要求的伏特 - 安培反应（VAR）支持。

[0033] 功率发生器 110 的输出与能量存储装置 120 的输出可以耦合于功率汇流排 101，所述功率汇流排 101 经由站变压器（未示出）与电网 150 耦合。功率汇流排 101 可以与功率发生器 110、功率存储装置 120 和电网 150 连接，并且可以配置为从发电厂 100 向电网 150 传输电力用于分配。

[0034] 尽管功率汇流排 101 和功率存储装置 120 在图 1 中示出并如上所述地进行电连接，但在一些示例性实施例中，功率存储装置 120 可以直接耦合于电网 150。在某些示例性实施例中，存储在能量存储装置 120 中的能量可以是 DC 功率，并且 AC/DC 双向转换器可以包括在能量存储装置 120 与功率汇流排 101 之间，从而在功率汇流排 101 上的 AC 功率和能量存储装置 120 的 DC 功率之间进行转换。

Ex.1002 / Page 103 of 767
Cholla Energy LLC & OBM, Inc.

[0035] 电网指令接收器 130 可以可操作地耦合于(例如,有线或无线连接于)PCCE140,用于接收关于将要供应给电网 150 的功率的指令。电网指令接收器 130 可以接收 :(1)指示将要供应给电网的当前(即,目前的)功率供应水平的信号 ;(2)指示用于确定对将要供应给电网 150 的功率的当前调节的电网频率的信号 ;和 / 或(3)指示针对功率发生器 110 和功率(能量)存储装置 120 的组合的一个或多个操作设定点的一个或多个操作参数。

[0036] 响应于接收指示了一个或多个设定点的一个或多个参数,PCCE140 (例如,控制器)可以为功率存储装置 120 和功率发生器 110 之中的每一项确定一个或多个其他操作设定点,使得至少一个功率发生器 110 与能量存储装置 120 的设定点的组合能够满足与所接收的一个或多个操作参数相关联的设定点。

[0037] PCCE140 在调节能量存储装置 120 (中)所存储的能量(或功率)的同时可以控制(例如,调节)由功率发生器 110 所产生的功率,从而符合或满足将要供应给电网 150 的功率。例如,PCCE140 通过同时地进行如下操作来对由功率发生器 110 所产生功率的调节进行控制 :(1)使能量存储装置 120 放电并增加从功率发生器 110 供应的功率 ;(2)使能量存储装置 120 放电并降低从功率发生器 110 供应的功率 ;(3)对能量存储装置 120 充电并降低从功率发生器 110 供应的功率 ;和 / 或(4)对能量存储装置 120 充电并增加从功率发生器 110 供应的功率。

[0038] 正如相关领域技术人员将理解的那样,对能量储存装置的充电和 / 或放电的控制例如可以通过用于 AC 至 DC 功率转换的双向逆变器或者用于 DC 至 DC 转换的双向 DC 至 DC 转换器来实现,并且这种双向装置的充电模式和放电模式可以基于诸如各种设定点和 / 或电压 / 频率指示符的外部信号来控制。相关领域技术人员也将理解,功率发生器的控制可以独立于能量存储装置的控制。例如,可以对来自功率发生器和能量存储装置的净输进行控制 :(1)以优化用于功率发生器与能量存储装置的组合的斜率 ;(2)以减少对能量存储装置和 / 或功率发生器的维护 ;和 / 或(3)以减少功率发生器的运转备用服务等。

[0039] 响应于接收到指示将要从发电厂 100 向电网供应的当前组合功率供应水平的信号,PCCE140 可以确定来自功率发生器 110 (例如,每个发生器)的功率贡献和来自能量存储装置 120 的功率贡献,以满足所指示的针对电网 150 的当前功率供应水平。

[0040] 例如,PCCE140 可以在通过功率发生器 110 进行的功率产生中的初始加速向上期间对由功率存储装置所存储的能量的释放进行控制,和 / 或可以在经由功率发生器 110 进行的功率产生中的减速向下期间控制通过功率存储装置 120 的且用于电网 150 的后续传输的功率存储。

[0041] 用于能量存储装置 120 的能量存储的设定点可以基于电网 150 上所预计的功率需求而改变。例如,能量可以在预计电网 150 上的功率需求会降低的周期期间以低于容量的较低水平存储在能量存储装置 120 中,而在预计电网 150 上的功率需求会增加的周期期间以较高水平存储在能量存储装置 120 中。

[0042] PCCE140 可以根据能量存储装置 120 的最佳或预设的配置文件(例如,功率释放和存储配置文件)来控制或调节能量存储装置 120 的能量存储,并且基于能量存储装置 120 的最佳或预设的配置文件来控制或调节功率发生器 110 的功率产生,从而满足由电网指令接收器 130 所接收的指令。

[0043] PCCE140 可以根据功率发生器 110 的最佳或预设的斜率配置文件控制或调节来自

Ex.1002 / Page 104 of 767
Cholla Energy LLC & OBM, Inc.

功率发生器 110 的功率产生，并且基于最佳或预设的斜率配置文件控制或调节能量存储装置 120 的能量水平，从而满足由电网指令接收器 130 所接收的指令。

[0044] 尽管针对多个发生器对功率发生器 110 进行了描述，但可以设想，在某些示例性实施例中可以使用单个的功率发生器 110。尽管针对多个存储装置对能量存储装置 120 进行了描述，但可以设想，在某些示例性实施例中可以使用单个的能量存储装置 120。

[0045] 在某些示例性实施例中，所接收的指令可以是指示了在一段时间内将要供应给电网的功率的指令序列。例如，所接收的指令可以是包括了将要供应给电网 150 的功率的实时指令的通信消息序列。

[0046] 在各种示例性实施例中，功率存储装置 120 可以具有比功率发生器 110 的斜率或功率瞬态响应更快的斜率或功率瞬态响应，使得可以由功率存储装置 120 提供调节（例如调节服务）。

[0047] 在各种示例性实施例中，PCCE140 可以确定所接收的与低于阈值频率的功率供应波动相关联的指令序列的低频分量，以及所接收的与等于或高于阈值频率的功率波动相关联的指令序列的高频分量。PCCE140 可以根据所确定的高频分量来控制或调节能量存储装置 120 的能量水平，并且根据所确定的低频分量调节通过功率发生器 110 进行的功率产生。

[0048] 正如相关领域技术人员将理解的那样，PCCE140 可以包括各种开关和继电器、数据库和包括非暂时性计算机可读存储介质的计算机设备，所述非暂时性计算机可读存储介质具有存储于其中的计算机软件，例如至少控制功率存储装置 120 的程序代码。

[0049] 在本文中，术语“计算机程序介质”、“非暂时性计算机可读介质”和“计算机可用介质”通常均用于指代诸如硬盘、存储器的存储介质，其可以是半导体存储器（例如 DRAM 等）。

[0050] 图 1B 是示出了根据示例性实施例与电网连接（耦合）的另一示例性发电厂 170 的示意图。

[0051] 参考图 1B，发电厂 170 与发电厂 100 相类似，不同在于发电厂 170 可以不包括电网指令接收器 130 而是可以包括电网频率检测器 160。

[0052] 电网频率检测器 160 可以耦合于（例如，连接于）PCCE140 和功率汇流排 101（或者直接连接到电网 150），并可以配置为检测和报告电网频率中的变化。基于来自电网频率检测器 160 的报告、信号或消息，PCCE140 可以控制用于存储由功率发生器 110 产生的功率的功率存储装置 120，由此有效地防止能量到达电网 150。相反，PCCE140 可以控制功率存储装置 120，以主动地从电网 150 去除能量。

[0053] 响应于接收指示了电网频率和 / 或在电网频率中的变化方向的指令（例如，响应于电网频率走低，可以增加将要供应给电网 150 的功率，而响应于电网频率走高，可以降低将要供应给电网 150 的功率），PCCE140 可以确定对将要供应给电网 150 的功率的当前调节。功率贡献控制设备可以确定通过功率发生器 110（例如，每个发生器）的功率贡献和通过功率存储装置 120（例如，每个装置）的功率贡献，以满足（符合）所确定的功率调节。各个功率贡献例如可以基于电网频率与标称频率的偏差和电网频率的偏差的变化率。例如，功率存储装置 120 可以分配用于充电或放电，而功率发生器 120 可以提供的剩余容量。

[0054] 图 2 是示出了根据示例性实施例的示例性调节单元 200 的更详细的示意图。

[0055] 参考图 2，调节单元 200（例如，频率或功率调节等）可以向从电网 150 提供能量（功率），并且可以从电网 150 接收能量。例如，能量可以经由本地变电站或传输线提供。通

Ex.1002 / Page 105 of 767
Cholla Energy LLC & OBM, Inc.

过这种方式，电网 150 可以在指定的标称频率（例如，在美国通常为 60Hz 和 / 或在世界的其他一些地区为 50Hz）下为当前负载提供适当量的功率。

[0056] 调节单元 200 可以包括至少一个功率发生器 205、数据库或存储装置 207（诸如光存储单元或磁存储单元）以及一组能量存储单元 210。功率发生器 205 可以配置为产生分布于整个电力网的交流电流，并且功率发生器 205 可以与数据库 207 耦合，从而使得功率发生器 205 能够具有它自己的唯一配置文件（独特配置文件）。配置文件一般指代用于功率发生器 205 正常运行的操作参数，可以包括 :（1）针对功率发生器 205 的操作限制 ;（2）针对功率发生器 205 的最大、最小和 / 或最优的操作设定点，和 / 或（3）针对功率发生器 205 的斜率或功率瞬态响应速率。

[0057] 能量存储装置或单元（例如，电池）210 可以与电网 150 电耦合和 / 或能量耦合，并且可以是适于存储能量的任何装置。例如，在一些示例性实施例中，可以使用先进的锂离子电池。本文所使用的术语“能量耦合”通常指能量能够从一个对象流到另一对象。例如，以 AC 或 DC 电流形式的电能可以以双向的方式从一个对象流到另一对象。电池 210 可以向电网 150 或功率发生器 205 提供能量，或者从电网 150 或功率发生器 205 接收能量，例如用于针对频率、电压电平和 / 或功率因数等来调节和 / 或稳定电网的调节服务。这种服务可以包括调节服务、运转备用服务、补充储备服务、更换储备服务和 / 或电压控制的服务等。

[0058] 当向电网 150 提供能量时，DC 电流可以从电池 210 行进至将 DC 电流转换为 AC 电流的双向 AC/DC 转换器 215。在一些示例性实施例中，逆变器用于 DC 至 AC 的转换。当存储来自电网 150 的能量时，整流器可用于 AC 至 DC 的转换。正如相关领域技术人员显而易见的那样，可以使用不同类型的逆变器和整流器。AC 电流经由变压器 220 在双向 AC/DC 转换器 215 与电网 150 之间流动。

[0059] 功率转换系统（PCS）225 可以包括用于 AC/DC 双向转换器 215 的逻辑控制系统。可编程逻辑控制器（PLC）230 可以指示 PCS225 将 AC/DC 双向转换器 215 与电池 210 和 / 或电网 150 连接或断开。

[0060] 在某些示例性实施例中，变压器 220 与电网 150 之间的连接可以包括手动开关或者可以是手动开关，其在调节单元 200 的操作过程中是常闭的。

[0061] 在某些示例性实施例中，诸如电容器存储系统或电感存储系统的 AC 功率储存装置可以针对伏特 - 安培反应（VAR）支持进行充电或放电，例如以调节电网上的功率因数。

[0062] 在各种示例性实施例中，诸如电池存储单元的 DC 功率存储装置可以经由双向逆变器进行充电或放电。可以对逆变器进行控制以提供 VAR 支持，以例如通过用于向电网 150 供应的高功率因数（例如，高于阈值水平）将 DC 功率转换为 AC 功率以调节电网 150 上的功率因数。对 VAR 支持的控制可以包括 :确定功率因数（例如，电网 150 上的电流和电压之间的相位差）或者接收指示了电网 150 的功率因数的外部信号（例如，从电网操作员），以及响应于所确定或所指示的处于特定阈值以下的功率因素而以高于阈值水平的功率因素来供应功率。

[0063] 在某些示例性实施例中，PLC230 可以使用程序梯形图逻辑来产生实时控制。PLC230 可以经由数据接口向 PCS225 发送数据信号，和 / 或可以经由数据接口从 PCS225 接收数据信号。从 PCS225 至 PLC230 的示例性输入可以包括准备信号的状态，并且来自 PLC230 的示例性输出可以包括指示进行充电或放电的能量的量的信号，和 / 或将 AC/DC 转换器与

Ex.1002 / Page 106 of 767
Cholla Energy LLC & OBM, Inc.

电网 150 和 / 或电池 210 进行连接和 / 或将 AC/DC 转换器与电网 150 和 / 或电池 210 断开的指令。执行特定程序代码的计算机也可用于该功能。这种计算机可以是具有一个或多个处理器、用户输入装置(例如,鼠标、QWERTY 键盘、触摸屏、麦克风或 T9 键盘)以及能够经由网络接收并发送数据的通信基础设施的任何类型的计算设备。例如,计算机可以包括但不限于台式计算机、台式计算机集群、服务器、服务器集群、机顶盒,或者能够处理指令并从 / 向电网和其他计算设备接收、发送数据的其他相似类型的设备。

[0064] 为了将电池 210 保持在能够使电池 210 响应于请求而向电网 105 添加能量或者从电网 105 中吸收能量的状态,调节单元 200 可以包括电池管理系统(BMS)235。BMS235 平衡电池单元 210,并且保持对电池单元 210 的充电状态(SOC)的获知。电池 210 的 SOC 是对电池 210 发送和接收能量(例如,充电或放电)的电流能力的测量。从 BMS235 至 PLC230 的示例性输入可以包括电池 210 的功率容量(例如,以 MWsec 为单位)、故障、电池 210 的温度、引流电池 210 上的电流或由电池 210 引流的电流、和 SOC 等。

[0065] 在某些示例性实施例中,SOC 可以是从 0% 至 100% 变化的百分比,其中 100% 是指在电池 210 中再不能存储更多能量。SOC 可以根据开路和 / 或闭路电压电平来计算。然而可以设想,SOC 可以通过本领域技术人员已知的多种方式来计算。

[0066] 远程终端单元(RTU)(未示出)可用于与监控及数据采集(SCADA)系统 255 连接。在某些示例性实施例中,SCADA 系统 255 可以与操作电网 150 的操作员(例如 ESO)相关联。从 SCADA 系统 255 至 PLC230 的示例性输入可以包括对电网频率、电压电平或其他调节服务进行调节的请求。该请求可以包括进行充电或放电的能量的量(例如以 MW 为单位),并且例如可以包括电网频率或针对电网 150 的其他操作参数。

[0067] 来自 PLC230 的示例性输出可以包括调节单元 200 的状态和可用性。在某些示例性实施方式中,PLC230 可以将有关 SOC 或其容量的信息发送到 SCADA 系统 255,使得 SCADA 系统 255 可以得知调节单元 200 是否能够提供将由 ESO 调遣的服务(例如,提前知道调节单元 200 是否能够提供这种服务)。

[0068] PLC230 可以从耦合于电网 150 的换能器 260 中接收数据信号。换能器 260 可以配置为感测电网 150 上的 AC 信号,以确定经由电网 150 所传送的电力的频率、电压电平和 / 或功率参数等。尽管已示出一个换能器 260,但可以设想,可以将任何数目的这种换能器用于可靠地检测不同位置上的相应电网参数。

[0069] 不间断功率供应装置(未示出)可以向 PLC230 供应功率。PLC230 可以向 HVAC 单元(未示出)发送并且从 HVAC 单元接收信号,从而为电池 210 和其他部件保持适当的环境条件。从 HVAC 单元向 PLC230 的示例性输入可以包括温度、湿度和关于 HVAC 单元的其他操作参数,并且来自 HVAC 单元的示例性输出可以包括一个或多个温控设定或其他控制设定点。

[0070] 在某些示例性实施例中,计算机 245 可以耦合(例如连接)于 PLC230,以用于对 PLC230 进行控制、编程或设置参数。计算机 245 可以用于监测调节单元 200。从计算机 245 向 PLC230 的示例性输入可以包括关闭和 / 或启动信号。通向计算机 245 的示例性输出可以包括记录事件、记录数据和警报报告等。

[0071] 当执行频率或电压调节时,可以经由 SCADA 系统 255 和 RTU (或者使用任何其他通信网络)在 PLC230 处接收来自电网 150 的操作员(ESO)的请求。该请求可以包括从电网 105 中吸收能量,或向电网 105 添加能量的指令。在某些示例性实施例中,该请求可以指定

Ex.1002 / Page 107 of 767
Cholla Energy LLC & OBM, Inc.

要转移多少能量或者转移的速率。作为响应，能量可以进行如下转移：(1)从能量存储装置向电网 150 转移以增加当前的电网频率或者以增加电网的电压电平；(2) 从电网 150 向能量存储装置转移以降低当前的电网频率或者以降低电网的电压电平。

[0072] 响应于来自 ESO 或操作员(例如，操作员可以包括自动化的计算机监控系统，并且无需人为干预就可以发生) 的另一调度请求，可以停止调节。例如，操作员或计算机监控系统可以确定电网频率和 / 或电压电平处于或接近所期望的标称频率或电压电平。在另一示例中，基于调节单元 200 进行的关于电网频率或电网电压电平的测量处于或接近期望值的测量，频率调节可以停止。调节也可由于其他原因而停止，诸如检测出故障。

[0073] 在调节过程中，电池 210 的 SOC 可能大幅上升或下降。例如，电池 210 可以向电网 150 传输相当大量的能量，因此例如使得电池 210 具有很少的电荷(例如，SOC 在大约 10% 至 30% 的范围内，大约为 20%)。在另一示例中，电池 210 可以从电网 150 接收许多能量，因此使得电池 210 具有大量的电荷(例如，SOC 在大约 75% 至 90% 的范围内，可以是 85%)。例如为从 10% 至 85% 的 SOC 的范围的充电范围可以取决于包括所使用的电池化学特性(例如，铅酸或锂等)在内的许多因素。在这两种示例中，如果分别需要添加或吸收更多的能量，则电池 210 可能会处于不良条件下，从而继续调节电网频率或电网电压电平。为了提供更可靠的服务，可以根据本发明所公开的系统的原理和 / 或根据美国专利申请公报 No. 2010/0090532A1 的原理进行修改，从而尽可能在最长的时间下将电池保持在期望的范围内。修改可以是适当地有选择地增加或减少能量水平(充电)。当进行修改是有利的情况下，可以进行该修改(例如仅仅进行该修改)，以平衡对适当的 SOC 的需要与功率分配系统的整体需求。

[0074] 根据一个示例性实施例，当电网频率或电网电压电平处于不使用调节的死区时，可以执行这种修改。在此期间，可以添加或移除能量(或电荷)，直到 SOC 值处于指定的范围内，所述 SOC 值可以基于来自 BMS230 的信息在 PLC230 处被监控。例如，范围可以集中在约 50% 的 SOC 左右，从而使调节单元 200 能够均等地提供或接收能量。在其他实施例中，例如当已知可能发生特定方向上的大幅能量转移时，目标状态可以高于或低于约 50%。

[0075] 图 3 是示出了根据示例性实施例对供应给电网 150 的功率进行控制的方法 300 的流程图。

[0076] 参考图 3，在框 310 中，电网指令接收器 130 可以接收将要供应给电网 150 的功率的指令。在框 320 中，至少一个功率发生器 110 可以产生功率。在框 330 中，PCCE140 可以使用功率发生器 110 所产生的功率对能量存储装置 120 的能量水平进行调节，从而根据所接收的指令来控制供应给电网 150 的功率。

[0077] 可以设想，功率可以存储为 DC 功率，当在功率存储装置 120 中存储功率时功率可以在 AC 功率和 DC 之间转换，并且当从功率存储装置 120 向电网 150 分配功率时功率可以从 DC 功率转换为 AC 功率。

[0078] 在某些示例性实施例中，在框 310 中所述指令的接收可以包括：(1)通过检测器检测电网频率的变化和能量存储装置 120 的能量调节，(2) 通过由功率发生器 110 产生额外功率的方式来控制功率贡献和 / 或从能量存储装置 120 分配所存储的功率。控制对电网的功率贡献可以通过如下方式执行：对来自至少一个功率存储装置 120 的功率的释放或存储中的任一种进行控制，以及增加或减少来自从至少一个功率发生器 110 的功率贡献。控制对功率贡献的控制可以通过如下方式来实现：使用诸如 SCADA 系统 255 的系统来控制功率

Ex.1002 / Page 108 of 767
Cholla Energy LLC & OBM, Inc.

的产生，从而对来自至少一个功率存储装置的功率的释放或存储进行控制。

[0079] 本发明的方法和装置因此是一种控制从功率存储装置到遗留系统(legacysystem)的功率存储及分配的扩展。备选地，该系统可以优化为允许由PCCE140既控制功率存储器又控制功率发生器。PCCE140可以提供给对电网150上检测到的电压和/或频率波动的响应，以确保电网150的稳定性。例如，当功率发生器110加速向上时能量存储装置120可以向电网150提供额外的功率，并且当功率发生器减速向下时能量存储装置120可以从电网150吸收功率。功率发生器110和能量存储装置120的联合响应可以实现比单独的功率发生器110更快的瞬态响应，并且由于使用了被设计为相对于单独的功率发生器具有更慢的斜率(或瞬态响应)的更小的功率发生器容量，可以实现改进的操作效率和更低的维护成本。

[0080] 电网参数(例如，频率)的变化例如可以使用换能器260(如图2所示)来检测，所述换能器260能够测量瞬时电网频率的变化、电网电压的变化或其他电网运行参数的变化。可以基于检测到的电网频率和/或电网电压的变化对电池120的操作级别(例如，SOC)进行选择。电池的SOC也可基于所检测到的参数的相对短的历史趋势(例如，在约15秒至约10分钟的趋势范围内)来调节。如果PCCE140基于历史趋势确定出可能期望功率会降低，则电池120可以在下降的SOC状态下运行，从而在总功率分布的下行趋势中吸收额外的功率。如果PCCE140基于历史趋势确定出可能期望功率会增加，则电池120可以在增长的SOC状态下运行，从而在总功率分布的上行趋势中提供额外的功率。而且，电池的SOC可以根据同为未决的专利申请公报No.2010/0090532所公开的那样进行控制。

[0081] 图4是示出了根据实施例的对通过发电和/或存储获得的功率贡献进行调节的流程图。

[0082] 参考图4，在框410中，PCCE140可以确定功率发生器的优选或最优的功率贡献配置文件，或者可以使用预设的发生器配置文件。该配置文件例如可以存储在产生配置数据库207中。产生配置数据库207可以形成为连接于PLC230的数据库的一部分，或者可以直接与功率发生器205(例如，如图2所示)连接，使得每个功率发生器205可以具有自己的唯一(例如，独特的)配置文件。

[0083] 在框420中，PCCE140可以确定能量存储装置的优选或最佳的功率贡献配置文件，或者可以使用预设的能量存储配置文件。该配置文件例如可以存储在存储配置数据库212中，使得每个能量存储装置可以具有自己的唯一(例如，独特)配置文件。尽管示出了产生配置数据库207和存储配置数据库212，但可以设想，一个通用数据库可以包括这两套配置文件。

[0084] 在框430中，PLC230或与其连接的计算机可以基于各自的配置文件优化功率发生器110和/或存储装置120的功率贡献，从而优化各种因素。这些因素可以包括磨损及损坏、功率发生器110的最大变化速率、功率发生器110的最优变化速率、功率发生器110的燃油消耗率分布、至少一个功率存储装置120的充电状态(SOC)、各个设备110和120的耐用性、最初的获取成本和折损成本以及经由电网150的传输损耗等。例如，PCCE140可以基于所确定的或预设的配置文件来确定针对能量存储装置120和/或功率发生器110的优选的操作设定点，并且可以将当前(目前)的操作设定点调节至优选的操作设定点。

[0085] 图5是示出了根据示例性实施例的与热电厂响应530和电网稳定性电存储系统响

Ex.1002 / Page 109 of 767
Cholla Energy LLC & OBM, Inc.

应 540 的联合响应曲线 520 相匹配的需求曲线 510 的曲线图 500。曲线并非按比例绘制，更确切的说，是根据特定实施例绘制的。

[0086] 参考图 5，通过将基于电池的能量储存系统 120 与发电厂 100 或 170 相结合（即，发电厂 100 或 170 可以与基于电池的存储系统协同操作），相对于独立的功率发生器而言，发电厂 100 或 170 的加速能力（ramping capability）得到了提高。发电厂可以从设定点加速向上或减速向下，同时基于电池的能量储存系统 120 可以对电厂能进行调节以满足需求曲线。

[0087] 相关领域的技术人员可以理解，需求曲线 510 是实时地由 ESO 或操作员通过电网指令接收器 130 顺序地提供的负载需求的曲线图，作为所需求负载等级的序列。由于实时地对电网 150 进行控制，因此需求曲线中相对短的历史趋势可以由 PCCE140 用于建立针对功率发生器 110 和能量存储装置 120 的实际设定点。

[0088] 在某些示例性实施例中，电池型能量存储装置 120 可以充当通向电网 150 的缓冲器，并且能够提供比单独的发电厂的情况更快的加速。

[0089] 上述示例已经在有关频率调节的内容中描述，其中出于负载跟踪的目的将功率添加于电网 150 或由电网 150 吸收。在这种情况下，添加或吸收功率的决定是基于与斜率界限和最优性能有关的操作频率瞬时值或瞬时操作电压。本文所描述的原理同样适用于电网的其他辅助服务。例如，响应于操作频率的快速下降，可以作为操作频率瞬时值的附加或替代而采用诸如频率变化率的参数，作为向电网添加功率的指令的触发。在针对辅助服务的不同应用中，可以使用针对频率或电压调节所描述的相同控制和逻辑结构，针对该服务对装置的设定点进行修正。

[0090] 尽管将混合发电厂描述为包括一个或多个能量储存装置，但可以设想，具有足以稳定电网的斜率的任何发生器或任何发电汇流箱均可以附加于或代替能量存储装置使用。这种发生器或发电汇流箱可以通过降低或移除运转备用容量来提高现有功率发生器的效率。

[0091] 应当理解，如上所述的示例性实施例可以通过以模块化或集成方式使用硬件和 / 或使用计算机软件的控制逻辑的形式来实施。基于本文提供的公开内容及教导，相关领域的技术人员将知晓并理解使用诸如图 6 所示的计算机系统 600 的硬件和 / 或硬件与软件的组合来实施示例性实施例的其他方式和 / 或方法。

[0092] 任何在本申请中所描述的软件部件或功能可以实施为将通过计算设备和 / 或处理器使用传统或面向对象技术的通过使用例如 Java、C++ 或 Perl 的任何合适的计算机语言来执行的软件代码。软件代码可以存储为一系列指令，或者在用于储存和 / 或传输的计算机可读介质上的命令，合适的介质包括 ：随机存取存储器（RAM）、只读存储器（ROM）、磁介质（诸如硬盘驱动器或软盘）、或光学介质（诸如压缩盘（CD）或 DVD （数字通用光盘））、闪存等。非暂时性计算机可读介质可以包括存储装置例如但不限于磁盘或光盘或磁带、固态存储器装置、程序盒和盒接口（诸如在视频游戏设备发现的那种）、可移动存储器芯片（诸如 EPROM 或 PROM）及相关的插槽，以及允许软件和数据从存储器向计算机设备传输的其他计算机可读介质和接口。

[0093] 图 1-5 所示的本发明的各个方面或者他们的部件或功能可以使用硬件、软件模块、固件、上面存储有指令的有形计算机可读介质或者他们的组合来实施，并且可以在一个

Ex.1002 / Page 110 of 767
Cholla Energy LLC & OBM, Inc.

或多个计算机系统或其他处理系统中实施。

[0094] 图 6 示出示例性计算机系统 600，其中本发明的实施例或其部分可以实施为计算机可读代码。例如，图 1-4 中的发电厂 100、调节单元 200 和方法 300 及 400 可以使用硬件、软件、固件、上面存储有指令的非暂时性计算机可读介质或者他们的组合来实施于计算机系统 600 中，并且可以在一个或多个计算机系统或其他处理系统中实施。硬件、软件或这些的任意组合可以体现为用于实现图 1-5 中的部件的任何模块和部件。例如，显示器 630 和显示器接口 602 可以配置为来呈现图 5 所示的与热电厂响应和电网稳定性电存储系统响应的联合响应曲线相匹配的需求曲线的曲线图 500。

[0095] 如果使用到可编程逻辑，那么可以在商业可获得的处理平台或专用设备上执行这种逻辑。本领域普通技术人员可以理解，所公开主题的实施例可以用各种计算机系统配置进行实践，包括多核处理器系统、小型计算机、大型计算机、以分布函数链接或群集的计算机、以及实际上可以嵌入到任何设备中的普及或微型计算机。

[0096] 例如，至少一个处理器装置和存储器可用于实施上述实施例。处理器装置可以是单个处理器、多个处理器或者它们的组合。处理器装置可以具有一个或多个处理器“核心”。

[0097] 根据该示例性计算机系统 600 对本发明的各种实施例进行描述。在阅读本说明书后，相关领域技术人员将明了该如何使用其他计算机系统和 / 或计算机体系结构来实施本发明。尽管可以将操作描述为顺序过程，但一些操作实际上可以并行、同时和 / 或在分布式环境中执行，并且通过存储于本地或远程的程序代码用于单处理器或多处理器机器进行访问。此外，在一些实施例中，可以在不脱离所公开的主题的精神的情况下对操作顺序进行重新排列。

[0098] 处理器装置 604 可以是专用或通用处理器装置。正如相关领域技术人员将理解的那样，处理器装置 704 也可以是独立运行的多核 / 多处理器系统中的单个处理器，或者是在集群或服务器场中运行的计算设备的群集中的单个处理器。处理器装置 604 与例如总线、消息队列、网络或者多核消息传递方案的通信基础设施 606 连接。

[0099] 计算机系统 600 还包括主存储器 608，例如随机访问存储器（RAM），并且还可以包括辅助存储器 610。辅助存储器 610 例如可以包括硬盘驱动器 612、可移动存储驱动器 614。可移动存储驱动器 614 可以包括软盘驱动器、磁带驱动器、光盘驱动器、闪存等。

[0100] 可移动存储驱动器 614 以已知的方式对可移动存储单元 618 进行读取和 / 或写入。可移动存储单元 618 可以包括由可移动存储驱动器 614 读取和写入的软盘、磁带、光盘等。正如相关领域技术人员将理解的那样，可移动存储单元 618 包括上面存储有计算机软件和 / 或数据的非暂时性计算机可用存储介质。

[0101] 在替代性实施例中，辅助存储器 610 可以包括用于允许将计算机程序或其他指令加载到计算机系统 600 的其他类似装置。这种装置例如可以包括可移动存储单元 622 和接口 620。这种装置的示例可以包括程序盒和盒接口（诸如在视频游戏设备中发现的那种）、可移动存储器芯片（诸如 EPROM 或 PROM）及相关的插槽，以及允许软件和数据从可移动存储单元 622 向计算机系统 600 传输的其他可移动存储单元 622 和接口 620。

[0102] 计算机系统 600 还可包括通信接口 624。通信接口 624 允许软件和数据在计算机系统 600 与外部设备之间传输。通信接口 624 可以包括调制解调器、网络接口（诸如以太网卡）、通信端口、PCMCIA 插槽及卡等。经由通信接口 624 传输的软件和数据可以是信号的形

Ex.1002 / Page 111 of 767
Cholla Energy LLC & OBM, Inc.

式，所述信号可以是电子、电磁、光学信号或者能够被通信接口 624 接收的其他信号。这些信号可以经由通信路径 626 提供给通信接口 624。通信路径 626 承载信号并且可以使用电线或电缆、光纤、电话线、手机链路、RF 链路或者其他通信信道来实现。

[0103] 在本文中，术语“计算机程序介质”、“非暂时性计算机可读介质”和“计算机可用介质”通常均用来指代诸如可移动存储单元 618、可移动存储单元 622 和安装有硬盘驱动器 612 的硬盘等的介质。通过通信路径 626 承载的信号也能够体现本文所描述的逻辑。计算机程序介质和计算机可用介质还可以指代诸如主存储器 608 和辅助存储器 610 的存储器，其可以是半导体存储器(例如，DRAM 等)。这些计算机程序产品是用于将软件提供给计算机系统 600 的装置。

[0104] 计算机程序(也称为计算机控制逻辑)存储在主存储器 608 和 / 或辅助存储器 610 中。计算机程序也可以经由通信接口 624 来接收。这种计算机程序当执行时能够使计算机系统 600 如本文所讨论地那样执行本发明。特别是，该计算机程序当执行时能够使处理器装置 604 执行本发明的处理，诸如上述图 3 和 4 中由流程图 300 和 400 所示的方法中的步骤。因此，这种计算机程序代表计算机系统 600 的控制器。在采用软件来执行本发明的情况下，可以使用可移动存储驱动器 614、接口 620 以及硬盘驱动器 612 或通信接口 624 将软件存储于计算机程序产品并加载到计算机系统 600 中。

[0105] 本发明的实施例也可以是针对包括存储在任何计算机可用介质上的软件的计算机程序产品。当执行于一个或多个数据处理装置中时，这种软件使得数据处理装置可如本文中所描述的那样进行操作。本发明的实施例采用任何计算机可用或可读介质。计算机可用介质的示例包括，但不限于，主要存储设备(例如，任何类型的随机访问存储器)、辅助存储设备(例如，硬盘驱动器、软盘、CD ROM、ZIP 磁盘、磁带、磁存储设备和光存储设备、MEMS、纳米技术存储设备等)以及通信介质(例如，有线和无线的通信网络、局域网、广域网、内联网等)。

[0106] 应当理解，与发明内容和摘要部分不同，具体实施方式部分旨在用于解释权利要求。发明内容和摘要部分可以阐明一个或多个示例性实施例，但并非本发明人所设想到的所有示例性实施例，因此，其并非旨在以任何方式对本发明及所附权利要求进行限制。

[0107] 上面借助示出了特定功能的实施及其关系的功能构造模块已经对本发明的实施例进行描述。为了便于描述，这里任意地对这些功能构造模块的界限做出定义。只要能够适当地执行指定功能及关系，则可以定义可替代的界限。

[0108] 具体实施例的上述描述将充分揭示本发明的一般性质，使得在不背离本发明的一般概念的情况下，他人无需过多的实验就能够通过应用本技术领域范围内的知识来容易地修改这些具体实施例和 / 或使其适应于各种应用。因此，基于本文所呈现的教导和指导，这种调整和修改旨在落入本发明所公开的实施例的等同项的含义及范围内。应当理解，本文的措词或术语是用于描述而非限制的目的，因此本说明书的术语或措词应当由技术人员根据所述教导和指导来解释。

[0109] 本发明的广度和范围不应限制于上述任何示例性实施例，而是应当仅根据所附权利要求书及其等同项作出限定。

Ex.1002 / Page 112 of 767
Cholla Energy LLC & OBM, Inc.

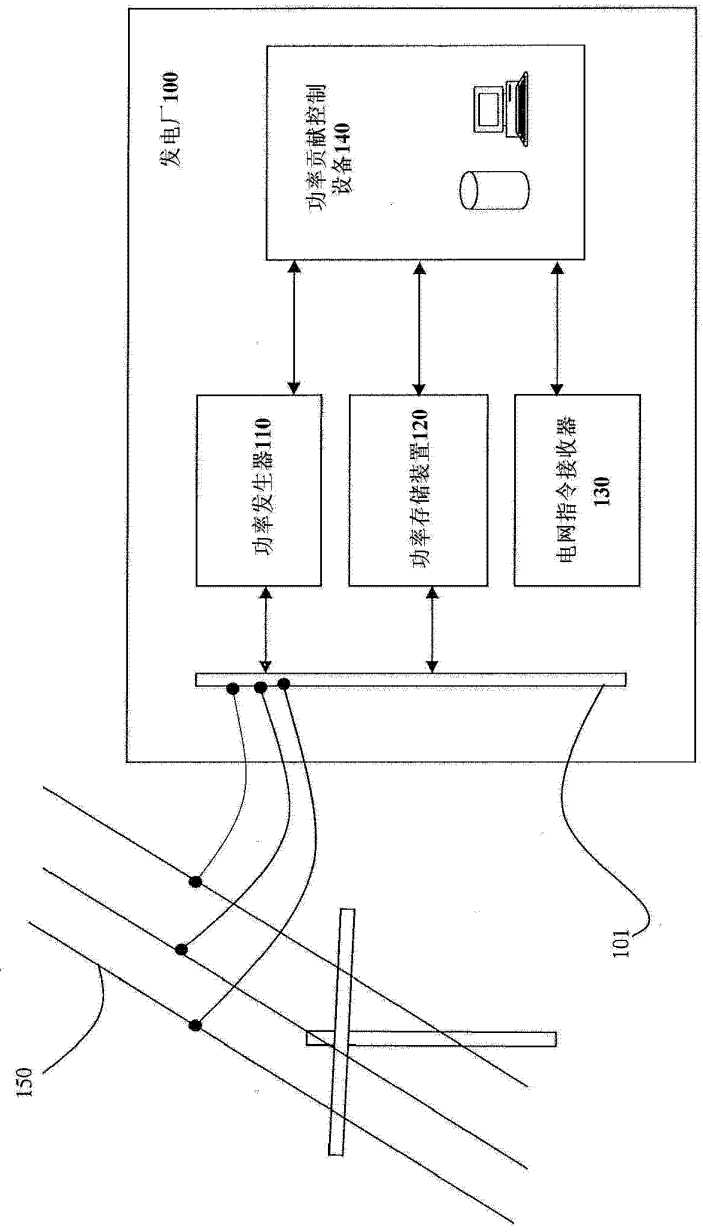


图 1A

Ex.1002 / Page 113 of 767
Cholla Energy LLC & OBM, Inc.

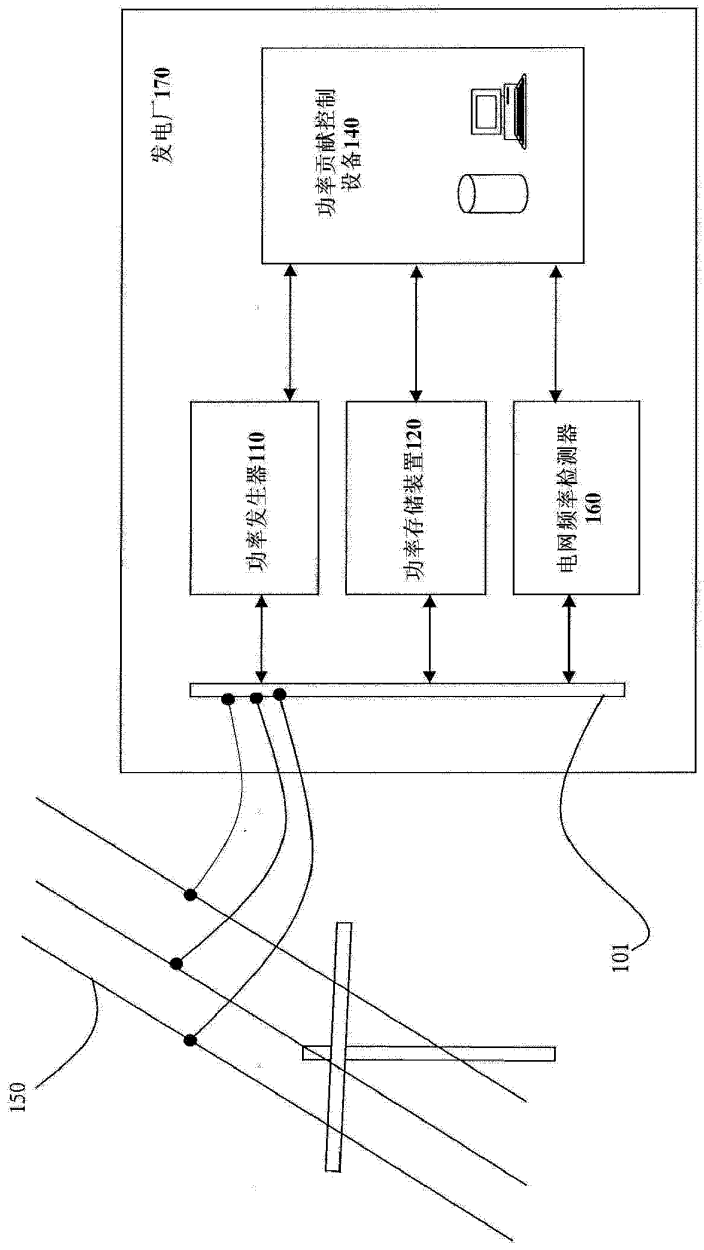


图 1B

Ex.1002 / Page 114 of 767
Cholla Energy LLC & OBM, Inc.

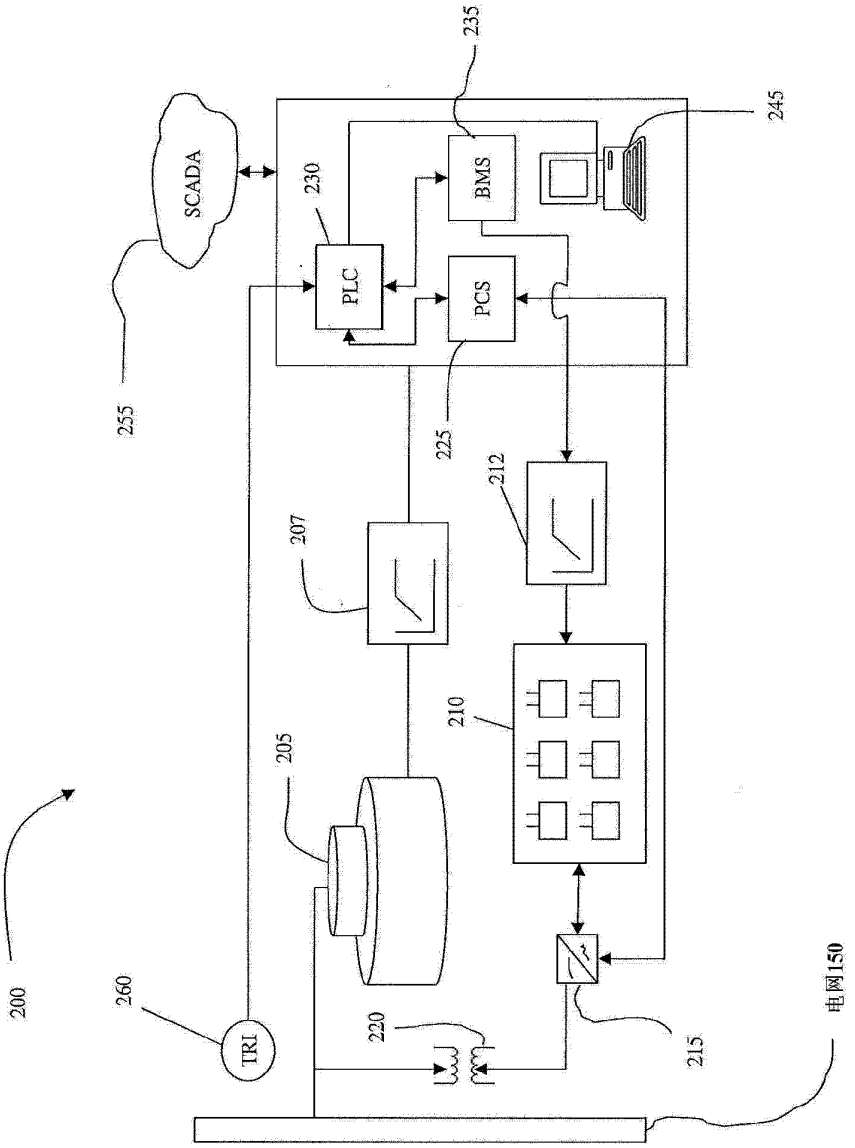


图 2

Ex.1002 / Page 115 of 767
Cholla Energy LLC & OBM, Inc.

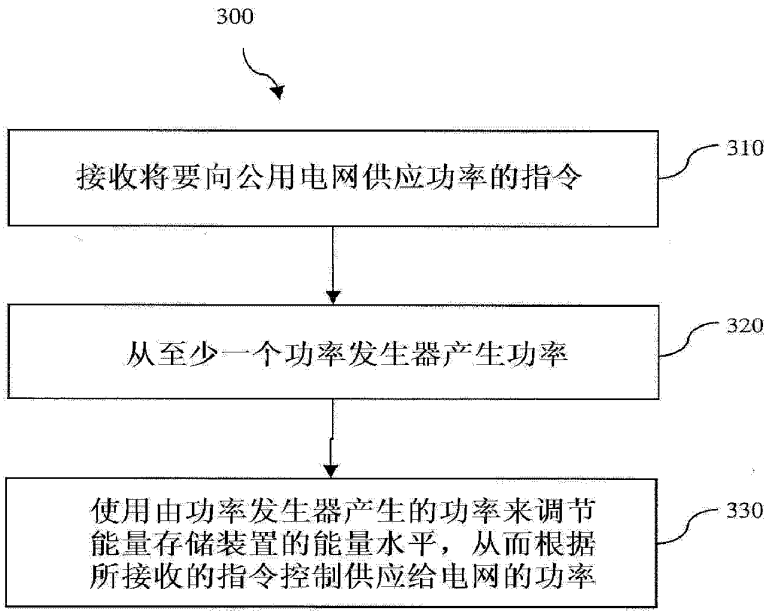


图 3

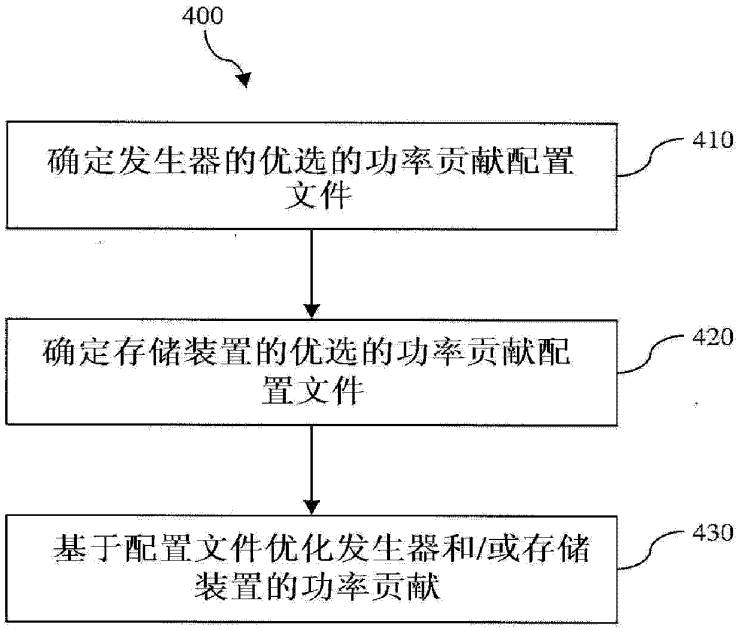


图 4

Ex.1002 / Page 116 of 767
Cholla Energy LLC & OBM, Inc.

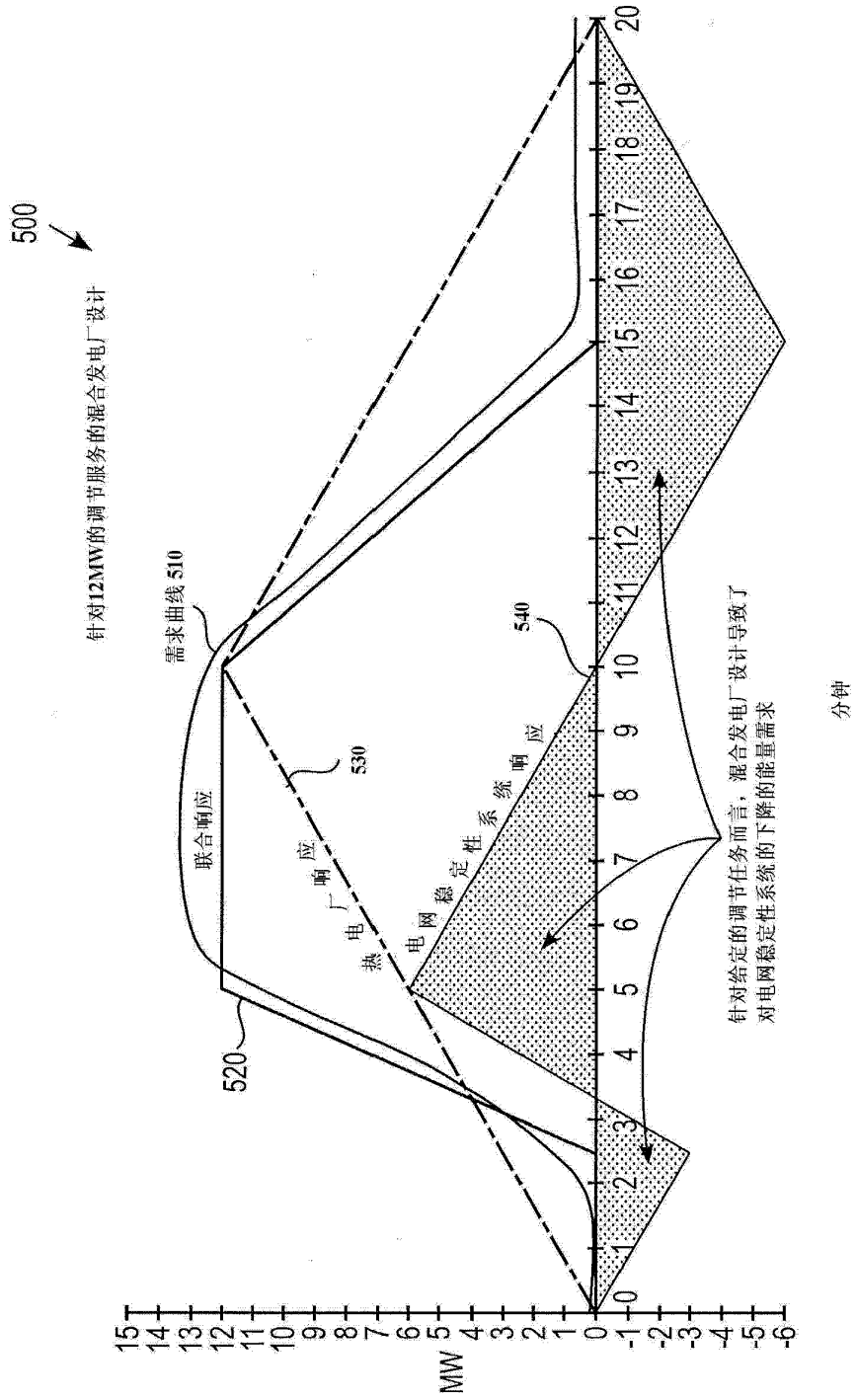


图 5

Ex.1002 / Page 117 of 767
Cholla Energy LLC & OBM, Inc.

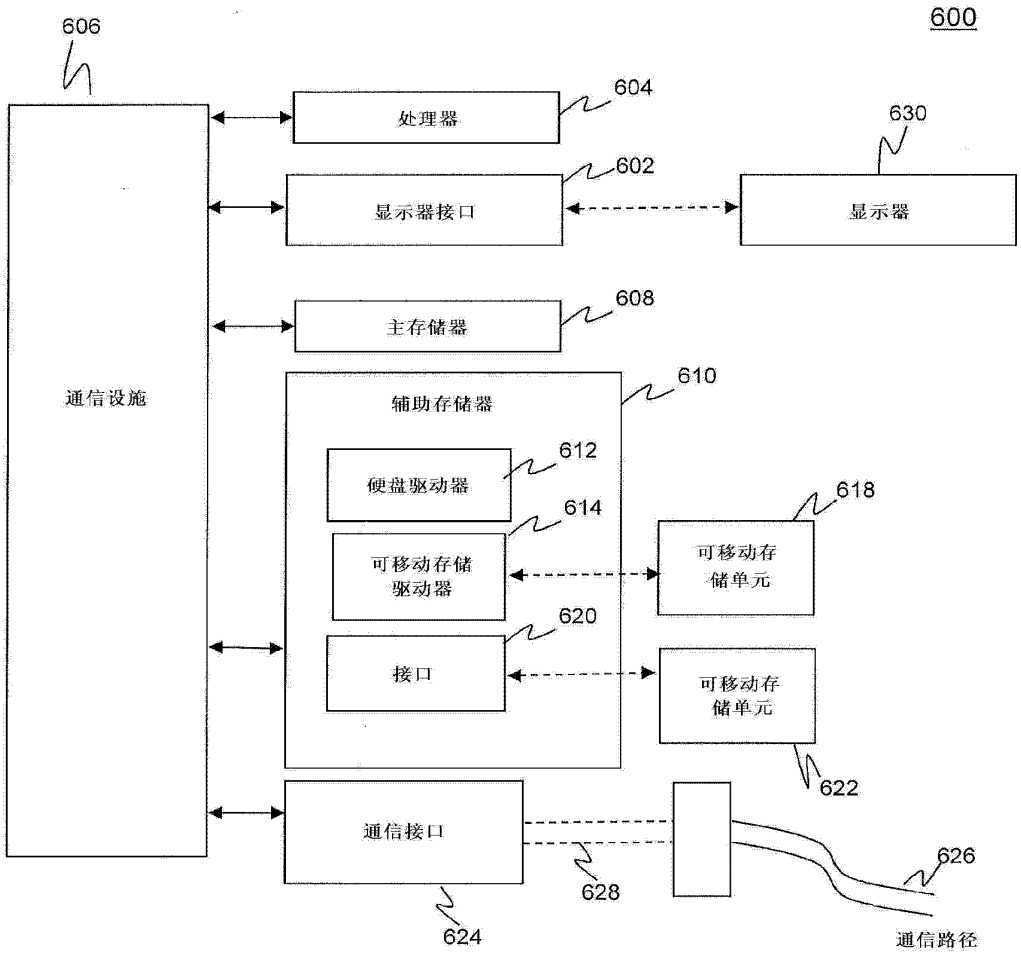


图 6

Ex.1002 / Page 118 of 767
Cholla Energy LLC & OBM, Inc.

Bibliographic data

Title:	System and method for conserving energy resources through storage and delivery of renewable energy
Pub/Pat no:	CN104969434A
Pub/Issue Date:	2015-10-07
Inventor(s):	MARCUS DAVID|MARCUS DAVID
Applicant(s):	GEN COMPRESSION INC
Classification:	H02J3/28AI; G06Q30/02AI; G06Q40/04AI
Application number:	CN20138014803 2013-01-18
Priority number:	WO2013US22146 2013-01-18; US201261588461P 2012-01-19;

Abstract of CN104969434A

The invention provides a system for encouraging the use of renewable energy sources and suitable for the conservation of energy resources through the efficient management of energy storage and delivery includes connections to a power source, an energy storage subsystem, and a power grid. The system includes a power routing subsystem coupled to the source and grid, and adapted to operate in a bypass mode, in which energy is transferred from the source to the grid. The system includes a conversion subsystem coupled to the routing and storage subsystems, and switchable in substantially real-time between a storage mode, in which energy is transferred from the routing to the storage subsystem, and a generation mode, in which energy is transferred from the storage to the routing subsystem for delivery to the grid. The system also includes a controller for directing the modes based at least in part on a market factor.

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 104969434 A
(43)申请公布日 2015.10.07

(21)申请号 201380014803.6
(22)申请日 2013.01.18
(30)优先权数据
61/588,461 2012.01.19 US
(85)PCT国际申请进入国家阶段日
2014.09.17
(86)PCT国际申请的申请数据
PCT/US2013/022146 2013.01.18
(87)PCT国际申请的公布数据
WO2013/109890 EN 2013.07.25
(71)申请人 通用压缩股份有限公司
地址 美国马萨诸塞
(72)发明人 D·马库斯
(74)专利代理机构 中国国际贸易促进委员会专利商标事务所 11038
代理人 张荣海
(51)Int.Cl.
H02J 3/28(2006.01)
G06Q 30/02(2012.01)
G06Q 40/04(2012.01)

权利要求书3页 说明书15页 附图9页

(54)发明名称

通过可再生能量的存储和输送节约能源的系统和方法

(57)摘要

一种通过能量存储和输送的有效管理，鼓励可再生能源的使用，和适合于能源的节约的系统，所述系统包括与电源、储能子系统和电网的连接。系统包括电力路由子系统，所述电力路由子系统耦接到电源和电网，适合于按照能量从电源传送到电网的旁路模式工作。系统包括变换子系统，所述变换子系统耦接到电力路由子系统和储能子系统，可大体实时地在能量从电力路由子系统被传送给储能子系统的储能模式，和能量从储能子系统被传送给电力路由子系统，以便输送到电网的产生模式之间切换。系统还包括控制器，所述控制器至少部分根据市场因素，指示模式。

CN 104969434 A

1. 一种通过能量存储和输送的高效管理，鼓励可再生能源的使用并且适合于节约能源的系统，所述系统包括：

与电源的连接；

与储能子系统的连接；

与电网的连接；

电力路由子系统，所述电力路由子系统耦接到电源和电网，并且适合于按照能量从电源传送到电网的旁路模式工作；

变换子系统，所述变换子系统耦接到电力路由子系统和储能子系统，并且能够大体实时地在能量从电力路由子系统被传送给储能子系统的储能模式，和能量从储能子系统被传送给电力路由子系统以便输送到电网的产生模式之间切换；以及

控制子系统，所述控制子系统至少部分基于市场因素，指令变换子系统和电力路由子系统中的至少一个按特定模式工作。

2. 按照权利要求 1 所述的系统，其中所述电源是间歇性电源，所述间歇性电源选自包含风能、太阳能、波能、潮汐能、落水、水能、生物能和地热能的组。

3. 按照权利要求 1 所述的系统，其中储能子系统包括存储介质，所述存储介质选自包含流体储能介质、机械储能介质、动能储能介质、电储能介质、电化学储能介质和热储能介质的组。

4. 按照权利要求 1 所述的系统，其中储能子系统包括存储体，所述存储体呈选自压力容器、地下洞穴、井、飞轮、电池、管道系统、囊状物、静液压力补偿容器、湖、池、储液容器、蓄水结构和电容器的形式。

5. 按照权利要求 1 所述的系统，其中变换子系统适合于把能量变换成压缩气体，并且包括串联或并联连接的电动机 / 发电机、液压泵 / 发动机、液压致动器和压缩机 / 膨胀机。

6. 按照权利要求 1 所述的系统，其中控制子系统的指令还基于市场因素和阈值的比较。

7. 按照权利要求 1 所述的系统，其中控制子系统的指令还至少部分地基于储能子系统的可用容量。

8. 按照权利要求 1 所述的系统，其中当市场因素比阈值至少低预定限度，并且存在可用储能容量时，控制器把变换子系统切换成按储能模式工作。

9. 按照权利要求 1 所述的系统，其中当可用容量大于预定值时，所述预定限度被减小，而当可用容量小于预定值时，所述预定限度被增大。

10. 按照权利要求 1 所述的系统，其中当市场因素比所述阈值至少高预定限度时，控制器指示系统按产生模式和旁路模式中的至少一个工作。

11. 按照权利要求 10 所述的系统，其中当可用容量大于预定值时，所述预定限度被增大，而当可用容量小于预定值时，所述预定限度被减小。

12. 按照权利要求 1 所述的系统，其中所述指令还至少部分基于选自当前本地环境状况、预计的本地环境状况、当前远程环境状况和预计的远程环境状况的环境状况。

13. 按照权利要求 1 所述的系统，其中所述指令还至少部分基于选自风速、风向、气温、气压、湿度、降水量、云量、季节、日照时间、潮汐状态、存储温度、存储时间、存储压力和昼 / 夜温差的环境状况。

Ex.1002 / Page 121 of 767
Cholla Energy LLC & OBM, Inc.

14. 按照权利要求 1 所述的系统，其中所述阈值选自当前供给、未来供给、当前需求、未来需求、平均市场价以及当前市场价。

15. 按照权利要求 1 所述的系统，其中市场因素选自电力的市场价、电力的当前市场价、电力的未来市场价、电力的趋势价格、电力的供给和电力的需求。

16. 按照权利要求 1 所述的系统，其中控制器还包括电力输送算法，所述电力输送算法适合于履行选自基荷、中间、调峰、负载跟踪、频率调节、旋转备用、非旋转备用、黑启动、无功功率控制、负载源按需响应和机组爬坡速率控制的电力服务。

17. 按照权利要求 1 所述的系统，其中电力输送算法适合于与至少一种辅助电力服务同时地履行长期电力服务。

18. 按照权利要求 1 所述的系统，其中电力输送算法适合于通过同时按储能模式和旁路模式运转系统，或通过同时按产生模式和旁路模式运转系统，来履行电力服务。

19. 按照权利要求 1 所述的系统，还包括发起电力的购买、购买电力的出价、电力的销售、以及销售电力的报价中的至少一个的交易子系统。

20. 按照权利要求 1 所述的系统，其中交易子系统适合于通过以市场价购买电力并且以合同价格出售电力，履行电力服务。

21. 一种通过能量存储和输送的高效管理，鼓励可再生能源的使用并且适合于节约能源的方法，所述方法包括以下步骤：

连接到电源；

连接到储能子系统；

连接到电网；

把电源产生的至少一些能量路由到电网；以及

大体实时地在通过把能量从电源和电网中的至少一个传送给储能子系统来存储能量，和通过把能量从储能子系统传送给电网来产生能量之间自动切换，其中所述切换至少部分地基于市场因素。

22. 按照权利要求 1 所述的方法，其中所述电源是间歇性电源，所述间歇性电源选自风能、太阳能、波能、潮汐能、落水、水能、生物能和地热能。

23. 按照权利要求 1 所述的方法，其中储能子系统包括存储介质，所述存储介质选自流体储能介质、机械储能介质、动能储能介质、电储能介质、电化学储能介质和热储能介质。

24. 按照权利要求 1 所述的方法，其中储能子系统包括存储体，所述存储体呈选自压力容器、地下洞穴、井、飞轮、电池、管道系统、囊状物、静液压力补偿容器、湖、池、储液容器、蓄水结构和电容器的形式。

25. 按照权利要求 1 所述的方法，其中储能步骤包括压缩气体。

26. 按照权利要求 1 所述的方法，其中路由和切换步骤还基于市场因素和阈值的比较。

27. 按照权利要求 1 所述的方法，其中路由和切换步骤还至少部分地基于储能子系统的可用容量。

28. 按照权利要求 1 所述的方法，其中切换步骤还包括当市场因素比阈值至少低预定限度，并且存在可用储能容量时，切换成存储能量。

29. 按照权利要求 1 所述的方法，还包括当可用容量大于预定值时，减小所述预定限度，而当可用容量小于预定值时，增大所述预定限度。

Ex.1002 / Page 122 of 767
Cholla Energy LLC & OBM, Inc.

30. 按照权利要求 1 所述的方法，其中切换步骤还包括当市场因素比所述阈值至少高预定限度时，切换成产生能量。

31. 按照权利要求 30 所述的方法，还包括当可用容量大于预定值时，增大所述预定限度，而当可用容量小于预定值时，减小所述预定限度。

32. 按照权利要求 1 所述的方法，其中路由和切换步骤至少部分地基于选自当前本地环境状况、预计的本地环境状况、当前远程环境状况和预计的远程环境状况的环境状况。

33. 按照权利要求 1 所述的方法，其中路由和切换步骤还至少部分地基于选自风速、风向、气温、气压、湿度、降水量、云量、季节、日照时间、潮汐状态、存储温度、存储时间、存储压力、和昼 / 夜温差的环境状况。

34. 按照权利要求 1 所述的方法，其中所述阈值选自当前供给、未来供给、当前需求、未来需求、平均市场价以及当前市场价。

35. 按照权利要求 1 所述的方法，其中市场因素选自电力的市场价、电力的当前市场价、电力的未来市场价、电力的趋势价格、电力的供给和电力的需求。

36. 按照权利要求 1 所述的方法，还包括把电力输送给电网，以履行选自基荷、中间、调峰、负载跟踪、频率调节、旋转备用、非旋转备用、黑启动、无功功率控制、负载源按需响应和机组爬坡速率控制的电力服务的步骤。

37. 按照权利要求 1 所述的方法，其中输送步骤还包括向电网输送电力，以便与至少一种辅助电力服务同时地履行长期电力服务。

38. 按照权利要求 1 所述的方法，其中输送步骤还包括通过同时存储能量和路由通量或同时产生能量和路由能量，向电网输送电力，以便履行电力服务。

39. 按照权利要求 1 所述的方法，还包括通过发起电力的购买、购买电力的出价、电力的销售、和销售电力的报价中的至少一个，交易能量的步骤。

40. 按照权利要求 1 所述的方法，其中交易步骤包括通过以市场价购买电力并且以合同价格出售电力，履行电力服务。

Ex.1002 / Page 123 of 767
Cholla Energy LLC & OBM, Inc.

通过可再生能量的存储和输送节约能源的系统和方法

[0001] 相关申请的引用

[0002] 本申请要求2012年1月19日提交的美国临时专利申请No.61/588,461的优先权，该专利申请在此整体引为参考。

技术领域

[0003] 本发明总体涉及管理能量存储和输送的系统和方法，更具体地，涉及通过能量存储和输送的有效管理，鼓励使用可再生能源和节约不可再生资源的系统和方法。

背景技术

[0004] 现有的发电方法一般分成特定的几组，即：(1) 基荷 (baseload) 电力输送，基荷电力输送来自于具有使其能够经济地签订合同，以便每天 24 小时，每周 7 天地出售电力的技术的发电厂，比如核电厂、燃煤电厂、水电厂、生物发电厂、和某个联合循环燃气发电厂；(2) 间歇性电力输送，间歇性电力输送是主要来自联合循环燃气发电厂的大约每天 16 小时，每周 5 天或 7 天的电力输送；(3) 峰值电力输送，峰值电力输送是主要来自简单及联合循环燃气发电厂，和某些柴油发电厂，大致与峰值负载一致的每天约 8 小时，每周 5 天的电力输送；和 (4) 不能被调度的间歇性能源，比如风能发电和太阳能发电。除了这些发电服务之外，还存在关于电力质量服务，比如频率上调、频率下调、容量、黑启动、机组爬坡速率控制、旋转备用和非旋转备用的市场。

[0005] 针对可再生能源的当前技术主要把诸如波浪能、风能和太阳能之类的间歇性资源变换成间歇性电力。这些可再生资源中的许多可再生资源难以预测和调度。全球风力发电的广泛开发已导致就为电网产生电力而论，致力于应对间歇性能源的挑战的努力。这些努力中的许多涉及研发调节向电网供电的间歇性电源，以使否则会不良地影响电网的干扰降至最小或者消除所述干扰的手段。其他工作涉及研发能够有利于风电场和其它间歇性可再生能源地工作的储能手段。通过在超过当前电力需求地产生电力期间，把所谓的超额能力收获在存储器中，储能手段为间歇性能源提供益处。在风能超过电网的能量消耗期间，由风电场产生的电力可被定于较低的电价或者负电价，或者风电场减少（脱离）向电网供电。类似地，在相当大程度上由间歇性电源供电的电网中，在能量需求大于可获得的风能的时期内，电网能量需求得不到满足。

[0006] 可便利增大地利用风能和类似的间歇性可再生能源的一种重要形式的电力调节是研发把风能从间歇性电源变换成能够提供固定电力合同的完全可调度的电源的手段。固定电力合同是在规定时间内，向规定地点输送规定量的能量，并且如果售电方不能满足合同条款，那么要求售电方支付罚金的合同。在大多数市场，固定合同赢得超过间歇合同的价格溢价，于是有价值。迄今为止，把间歇性风电转换成稳定电力的努力一直取决于预测未来的风速（以便出售给日前市场），和协调风力发电和其它相隔遥远的间歇性电源的运转，和/或与更恒定的电源，比如其功率流速可被向上或向下变化，以补偿来自风电场的更高或更低流速的水电协同，和/或与能够响应风电场的实时输出，连续上升或下降的诸如简单循

Ex.1002 / Page 124 of 767
Cholla Energy LLC & OBM, Inc.

环燃气发电厂和柴油发电厂之类的热电厂协同。这种协同工作不把间歇性风能变换成稳定电力，但是它们确实有助于间歇性风电被并入电网中。发电厂必须逐渐参与为管控电力产生 / 销售 / 交易而建立的竞争市场。于是，美国（和世界其它地区）的风电（和其它间歇性可再生能源）的发展因其较低的市场价值而受到严重阻碍。

[0007] 增强风电和其它间歇性可再生能源在解除管制的竞争性电力交易市场中的经济价值的手段对于增强可再生能量产生的部署来说至关重要。对美国的可再生能量发展来说，提高风电的经济价值可能是最重要的长期决定性因素。考虑到维持和发展竞争性的电力产生 / 销售 / 交易市场的联盟承诺，对可再生能量的使用来说，不言而喻的竞争驱动力是提高的价格和降低的成本。关于可再生能量的未来前景的政府研究和学术研究明确认识到价格和成本因素在当前的竞争性市场中的重要性。

[0008] 至今，向风电场提供能量存储的各种努力都未在电网的定价范围内，把风力发电产生的电力变换成稳定电力，即使存储器的增加在一定程度上改善了风电的间歇性。压缩空气储能 (CAES)，抽水储能，电池，飞轮，热储能和其它储能手段的实现在这方面受技术限制。现有技术未显示产生被竞争性电网视为优质电力而重视的电力输出的能力。

[0009] 因而，需要提供把间歇性电力变换成稳定电力，以致进一步鼓励使用可再生能源的系统和方法。

发明内容

[0010] 本发明通过结合间歇性电源，比如风电和诸如 CAES 之类的储能手段，获得稳定电力。本发明用于以不因风力的缺少或者其它典型间歇因素而中断的方式，实现非常适合于作为给电网的输入 - 比如基荷电力、负载跟踪电力、间歇性电力、峰值电力、补充储备、重置储备、旋转备用、非旋转备用、黑启动和频率调节，赢得溢价的电力的灵活、反应迅速的产生。

[0011] 系统的灵活性能够沿两个方向中的每个方向（可逆地，遭受效率损失），实现压缩气体能量和电力之间的受控变换 - 从而能够实现以十足的市场价格，而不是以贬低的间歇性风电价格往来于电网（经济地）购买和出售电力的方法。所述系统还能够实现基于当前价格、过去平均价格、预测的未来价格、间歇性电源的当前状态、预测的所述间歇性电源的未来状态、CAES 系统中的能量存储容量的当前状态、电动发电机的当前利用状态、风力涡轮机或者其它间歇性电力发动机的当前容量、系统成本、交易成本、电力供给和需求、和影响能量定价、存储和分配的其它因素中的一个或多个因素的电力交易策略。

[0012] 因而，在本发明的一个方面，管理能量存储和输送的系统包括与电源的连接，与储能子系统的连接，与电网的连接，电力路由子系统、变换子系统和控制子系统。电力路由子系统耦接到电源和电网，适合于按照能量从电源传送到电网的旁路模式工作。变换子系统耦接到电力路由子系统和储能子系统，可大体实时地在能量从电力路由子系统被传送给储能子系统的储能模式，和能量从储能子系统被传送给电力路由子系统，以便输送到电网的产生模式之间切换。控制子系统至少部分根据市场因素，指令变换子系统和 / 或电力路由子系统按特定模式工作。

[0013] 电源可以是间歇性电源，间歇性电源可以是风能、太阳能、波能、潮汐能、落水、水能、生物能和地热能任意之一。此外，间歇性电源可产生电力。

Ex.1002 / Page 125 of 767
Cholla Energy LLC & OBM, Inc.

[0014] 储能子系统可以是诸如流体储能、机械储能、动能储能、电储能、电化学储能和热储能之类的介质，可包括存储体，所述存储体可以是压力容器、地下洞穴、井、飞轮、电池、管道系统、囊状物、静液压力补偿容器、湖、池、储液容器、蓄水结构和电容器任意之一。

[0015] 在一个实施例中，系统适合于以压缩气体的形式保存能量。变换系统还包括串联或并联连接的电动机 / 发电机、液压泵 / 发动机、液压致动器和压缩机 / 膨胀机。

[0016] 控制器可通过比较市场因素和阈值，指示工作模式。模式指示还可至少部分基于储能子系统的可用容量。

[0017] 在一个实施例中，当市场因素低于阈值，并且存在可用储能容量时，控制器可把变换子系统切换成按储能模式工作，在一些情况下，当市场因素比阈值至少低预定限度时，控制器可切换变换子系统。当可用容量大于预定值时，所述预定限度可被减小，而当可用容量小于预定值时，所述预定限度可被增大。

[0018] 在又一个实施例中，当市场因素大于阈值时，控制器指示系统按产生模式和旁路模式至少之一工作，在一些情况下，当市场因素比所述阈值至少高预定限度时，控制器可指示系统按一种模式工作。当可用容量大于预定值时，所述预定限度可被增大，而当可用容量小于预定值时，所述预定限度可被减小。

[0019] 在另一个实施例中，控制器至少部分根据环境状况，指令工作模式。环境状况可以是本地环境状况和 / 或远程环境状况，以及当前状况和 / 或预计状况。环境状况可包括风速、风向、气温、气压、湿度、降水量、云量、季节、日照时间、潮汐状态、存储温度、存储压力、存储时间和昼 / 夜温差。

[0020] 阈值可以是例如当前供给、未来供给、当前需求、未来需求、平均市场价或者当前市场价。在一些情况下，市场因素可以是电力的市场价、电力的当前市场价、电力的未来市场价、电力的趋势价格、电力的供给或者电力的需求。

[0021] 在一个实施例中，控制器还包括电力输送算法。电力输送算法可适合于与至少一种辅助电力服务同时地履行长期电力服务。电力输送算法可适合于履行诸如基荷、中间、调峰、负载跟踪、频率调节、旋转备用、非旋转备用、黑启动、无功功率控制、负载源按需响应和 / 或机组爬坡速率控制之类的电力服务。在一些实施例中，电力输送算法适合于通过同时按储能模式和旁路模式运转系统，履行电力服务。在其它实施例中，电力输送算法适合于通过同时按产生模式和旁路模式运转系统，履行电力服务。

[0022] 在另外的实施例中，系统包括发起电力的购买，购买电力的出价，电力的销售，和销售电力的报价至少之一的交易子系统。交易子系统适合于通过以市场价购电，和以合同价格出售电力，履行电力服务。

[0023] 在本发明的另一个方面，管理能量存储和输送的方法包括以下步骤 :连接到电源，连接到储能子系统，连接到电网，把电源产生的至少一些能量路由到电网，和大体实时地在通过把能量从电源和 / 或电网传送给储能子系统，存储能量，和通过把能量从储能子系统传送给电网，产生能量之间自动切换。所述切换可至少部分基于市场因素。

[0024] 电源可以是间歇性电源，间歇性电源可以是风能、太阳能、波能、潮汐能、落水、水能、生物能和地热能任意之一。此外，间歇性电源可产生电力。

[0025] 储能子系统可以是诸如流体储能、机械储能、动能储能、电储能、电化学储能和热储能之类的介质，可包括存储体，所述存储体可以是压力容器、地下洞穴、井、飞轮、电池、管

Ex.1002 / Page 126 of 767
Cholla Energy LLC & OBM, Inc.

道系统、囊状物、静液压力补偿容器、湖、池、储液容器、蓄水结构和电容器任意之一。

[0026] 在一个实施例中，自动地进行路由步骤。在一个实施例中，储能步骤包括压缩气体。

[0027] 路由和切换步骤可以基于市场因素与阈值的比较。路由和切换步骤还可至少部分基于储能子系统的可用容量。

[0028] 在一个实施例中，切换步骤还包括当市场因素低于阈值，并且存在可用储能容量时，切换成存储能量，在一些情况下，包括当市场因素比阈值至少低预定限度时，切换成存储能量。当可用容量大于预定值时，所述预定限度可被减小，而当可用容量小于预定值时，所述预定限度可被增大。

[0029] 在另一个实施例中，切换步骤还包括当市场因素大于阈值时，切换成产生能量，在一些情况下，包括当市场因素比所述阈值至少高预定限度时，切换成产生能量。当可用容量大于预定值时，所述预定限度可被增大，而当可用容量小于预定值时，所述预定限度可被减小。

[0030] 在另一个实施例中，路由和切换步骤还至少部分基于环境状况。环境状况可以是本地环境状况和 / 或远程环境状况，以及当前状况和 / 或预计状况。环境状况可包括风速、风向、气温、气压、湿度、降水量、云量、季节、日照时间、潮汐状态、存储温度、存储压力和昼 / 夜温差。

[0031] 阈值可以是例如当前供给、未来供给、当前需求、未来需求、平均市场价或当前市场价。在一些情况下，市场因素可以是电力的市场价、电力的当前市场价、电力的未来市场价、电力的交易价、电力的供给或者电力的需求。

[0032] 在一个实施例中，所述方法还包括向电网输送电力，以履行电力服务。输送步骤还包括向电网输送电力，以便与至少一种辅助电力服务同时地履行长期电力服务。电力服务可以是基荷、中间、调峰、负载跟踪、频率调节、旋转备用、非旋转备用、黑启动、无功功率控制、负载源按需响应和 / 或机组爬坡速率控制。在一些实施例中，输送步骤还包括通过同时存储能量和路由能量，向电网输送电力，以便履行电力服务。在其它实施例中，输送步骤还包括通过同时产生能量和路由通量，向电网输送电力，以便履行电力服务。

[0033] 在另外的实施例中，所述方法包括通过发起电力的购买，购买电力的出价，电力的销售，和销售电力的报价至少之一，交易能量的步骤。交易步骤可包括通过以市场价购电，和以合同价格出售电力，履行电力服务。

附图说明

[0034] 因为参考结合附图进行的以下详细说明，本发明及其许多附随优点变得更好理解，因此易于更全面地认识本发明及其许多附随优点，附图中：

[0035] 图 1 是举例说明按照本发明的实施例的能量存储和输送系统的系统图。

[0036] 图 2 是举例说明与本发明的实施例相关的技术参数的表格。

[0037] 图 3A 是举例说明按照本发明的实施例的基线能量平衡情况的表格。

[0038] 图 3B 是举例说明按照本发明的实施例的高价格 / 可用供给情况的表格。

[0039] 图 3C 是举例说明按照本发明的实施例的低价格 / 可用容量情况的表格。

[0040] 图 4A 是举例说明按照本发明的实施例的基线能量市场情况的图表。

Ex.1002 / Page 127 of 767
Cholla Energy LLC & OBM, Inc.

[0041] 图 4B 是举例说明按照本发明的实施例的低容量存储情况的图表。

[0042] 图 4C 是举例说明按照本发明的实施例的高容量存储情况的图表。

[0043] 图 5 是举例说明与本发明的实施例相关的固定区间交易参数的表格。

[0044] 图 6 是举例说明按照本发明的实施例的优化模型的模型图。

[0045] 图 7 是举例说明按照本发明的实施例的调度算法的输入和输出的示图。

[0046] 图 8 是举例说明按照本发明的实施例的调度算法输出的直观表示的曲线图。

[0047] 图 9 是举例说明与本发明的实施例相关的预测交易参数的表格。

[0048] 图 10 是举例说明按照本发明的实施例的计算机系统的方框图。

具体实施方式

[0049] 作为背景，图 1 是其中可以利用能量转换子系统（例如，压缩机 / 膨胀机设备）存储能量和释放以前存储的能量的能量存储和输送系统 100 的实施例的例示。

[0050] 在 2010 年 12 月 23 日提交的美国专利申请 12/977,724（现在的美国专利公报 No. 2011/0258996A1）中，记载了可用于实践本发明主题的例证气体压缩和膨胀系统，该专利申请在此引为参考。

[0051] 如图 1 中所示和这里说明的系统可按照从 General Compression Advanced Energy Storage(GCAES™) 的名称，从 Newton, Massachusetts 的 General Compression 获得。这里说明的本发明的实施例包括 GCAES 系统。不过，本领域的技术人员应理解，本发明可以利用适合于实践这里说明的发明主题的任何能量转换系统。所述系统能够传输和转换电力或者所述系统兼容的任何其它形式的动力，比如水力。

[0052] 如图 1 中所示，电源 102（例如，包括多个风力涡轮机的风电场）可用于收获和把风能或其它种类的能量转换成电力，以便输送给电力路由子系统 110 和变换子系统 112。要理解系统 100 可以和除风电场外的电源，比如和电网或太阳能电源一起使用。在一些实施例中，电源 102 与 GCAES 系统并置。不过应注意，电源 102 可以远离 GCAES 系统，电源 102 产生的电力经电网或其它传输手段，被引导到 GCAES 系统。电力路由子系统 110 不但在电网 124 和变换子系统 112 之间引导电力，而且把电力从电源 102 引导到电网 124 或者变换子系统 112。

[0053] 变换子系统 112 把来自风力涡轮机或其它来源的输入电力变换成压缩气体，压缩气体稍后可由变换子系统 112 膨胀，以获得先前保存的能量。变换子系统 112 可包括互连（串联或并联）电动机 / 发电机、液压泵 / 马达、液压致动器和压缩机 / 膨胀机，以帮助能量变换处理。随后，例如，当电网上对电力的需求较高时，或者当电价高时，可从储能子系统 122 传送压缩气体，并通过变换子系统 112 中的压缩机 / 膨胀机膨胀。压缩气体的膨胀驱动发电机，从而产生电力，以便输送给电网 124。在一些实施例中，多个变换系统可并行工作，以使 GCAES 系统在固定时间内，变换更大量的能量。

[0054] GCAES 系统能够与很大的存储容器，比如地下洞穴面接，所述很大的存储容器能够保存足够以商业上可行的水平，供给数百小时电力的能量。具有从存储器获得 5-300 小时电力的能力使得可以形成否则当结合相当小的储能罐，以间歇性电源供给电力时不可能形成的长期电力合同（例如，20-25 年基荷合同）。此外，GCAES 单元能够毫秒级到秒级（与其它各种能量产生系统的分钟级、小时级或者甚至天级相比）地在产生 / 空闲 / 储能模式

Ex.1002 / Page 128 of 767
Cholla Energy LLC & OBM, Inc.

之间切换，这使GCAES能量提供者可以立即提供诸如频率调节之类的辅助服务。此外，在一些情况下，可以与长期电力服务或者其它短期或辅助服务的履行同时地提供辅助服务。如果需要，可以启动或停用一个或多个单独的GCAES单元，以满足当前需求，在电力市场上交易能量，或者保存能量供以后使用。

[0055] 相反地，如果最佳地工作，那么一些种类的能量产生系统，比如燃气发电厂一天之内能够升降多次，不过这会导致发电厂的涡轮机的额外磨损。就在峰值电力使用时间内，必须以更高的速率运行的调峰发电厂来说，可预期这种行动。然而，发电厂涡轮机会因频繁循环而显著磨损；即，存在由因起转和停转期间的加热和冷却引起的涡轮叶片膨胀和收缩而导致的损坏。于是在循环之间，必须提供足够的时间，以避免会因温度的快速变化而发生的损坏。

[0056] 不太灵活的能量生产者的其它例子包括关闭和重新启动需要数天的火电厂，和能够快速关闭，但是恢复上线需要数天的核电厂。这些电厂之间的循环限制的共同主线是热限制。不过，GCAES系统不会类似地遇到这样的热问题，能够在一天之内多次循环。

[0057] 所述系统的上述能力，以及与伴随其它各种发电（例如，火电、核电）的燃料定价、管制、环境和全球性事件风险中的许多风险的无关性使GCAES电厂能够签订提供长期电力服务的合同，比如长期调峰合同（例如，每天8小时，每周5天售电），中间合同（例如，除非高峰期外的所有时间售电（一周5-7天，16小时）），和基荷合同（例如，一周7天，一天24小时售电）。GCAES系统还允许长期负荷跟踪合同，其中电力的供给可随能量消费者的需求而极大地变化。

[0058] GCAES电厂的性能超越其利用与CGAES单元结合的间歇性和稳态能量源提供长期电力，比如基荷、容量或中间电力的独特能力。例如，电厂系统的分割提供通过多个子系统，供给电力的灵活性，每个子系统能够与其它子系统无关地快速响应电力需求。为了满足这些各种需求，除了其它子系统之外，GCAES电厂包括可彼此独立地运行的多个GCAES能量变换单元。与容量极大的储能子系统和从各个能量源获取电力的能力组合，GCAES系统结合高速响应和与其它储能和产生系统（例如，飞轮，超级电容器等）相比持续时间更长的响应。

[0059] 特别地，GCAES电厂能够与履行长期电力服务同时地向电网提供所有持续时间较短的辅助服务中的一种或多种服务。GCAES电厂还可只提供辅助服务，只提供长期电力服务，或者它们的任意组合。就辅助服务的提供来说，GCAES系统能够与现有系统相比，实现提供的电力量的增减幅度的增大，以及更快的机组爬坡速率升降，和上下爬坡的更频繁重复性。

[0060] 辅助服务是按照满足特殊需求的方式，向电网提供电力的手段，所述特殊需求是电力市场的不可预测和随机状况的函数，例如，不可预测的需求变化，因为最终用户在每天中都会改变其用量，和不可预测的供给变化，比如发电机单元的停机，和由间歇性来源供给的电量的变化。辅助服务通常被表征为响应和储备。这样的服务一般是用从最短的响应时限到较长的响应时限的类别表征的。目前通常指的是响应和储备，或者辅助服务的3种基本类别，虽然共有基本特性，不过其命名和度量可随涉及的地区、国家或区域输电组织(RTO)而部分变化。

[0061] 在同时履行长期电力服务的时候，GCAES电厂能够提供的一种辅助服务是频率响应，有时称为一次调频备用。为了提供这种服务，GCAES电厂对系统频率的瞬间降低和升高

Ex.1002 / Page 129 of 767
Cholla Energy LLC & OBM, Inc.

（例如，在美国体系中偏离 60Hz，或者在欧洲体系中偏离 50Hz）作出反应，增大或减小在数秒（或者可能一秒的若干分之几）的时限内，供给电网的电量，和持续指定的时间维持这样的响应，所述指定的时间在一些情况下可以短至 30 秒，或者可被定义为若干分钟。

[0062] GCAES 电厂还能够提供旋转备用（有时称为二次调频备用），它要求电厂在依据一次调频备用或频率响应的持续时间设定的时限内作出反应。例如，如果 RTO 要求频率响应辅助服务提供至少 30 秒的持续时间，那么二次调频备用或旋转备用必须能够在最多 30 秒内作出反应。在美国的例子是加利福尼亚独立系统运营公司（ISO），它要求旋转备用能够在在 ISO 确定需要调度来自旋转备用的电力之后的 60 之内，增大电力输出；对于非旋转备用，加利福尼亚 ISO 要求类似的响应时间，以减少电力产生或增大需要，要求额外负荷的数量至少为 1MW，并且能够持续至少 2 个小时。通过利用其存储和产生能力，GCAES 系统能够在履行基荷或中间合同的同时，满足各种负荷和持续时间需求。

[0063] 三级调频备用包括命名为重置备用、热备用（standing reserve）、紧急备用、响应备用或同步备用的辅助服务，在由二次调频备用的持续时间设定的时限内提供响应，所述时限一般是利用分钟或者一小时或两小时定义的时限。三次调频备用必须可维持较长的持续时间。GCAES 电厂还能够满足提供三次调频备用的这些响应和持续时间要求。

[0064] 除了提供诸如负荷跟踪、频率调节、旋转备用、非旋转备用、黑启动和机组爬坡速率控制之类的辅助服务之外，GCAES 电厂能够提供无功功率控制，以帮助控制整个电气系统内的电压电平。GCAES 电厂还能够提供负荷源按需响应，其中能量源需要从电网吸收能量，从而有效地充当能阱（energy sink）。在这种情况下，GCAES 系统能够变换能量，并把能量传送给存储器，供以后使用。GCAES 电厂还能够提供辅助服务需求响应，以确保输电网的正确运行。

[0065] 辅助服务的提供者一般必须具有最小额定产生容量，比如 1MW，并且一般必须满足通信和控制标准，比如在无人工干预的情况下，响应 ISO 指示和控制（包括调度指令）的能力。一般要求辅助服务的可能提供者向 RTO/ISO 申请提供这种服务的批准和认证。除了辅助服务之外，RTO/ISO 建立并运行日前和更长时间的基荷电力市场，以及中间或跟踪负荷电力市场。满足地区容量和其它要求的 GCAES 电厂能够利用这些辅助服务和长期电力服务市场。

[0066] 如果电源不满足当前需求（例如，如果电源是风电场，并且风力不足），那么通过与从存储器获得的能量结合地利用可从所述电源获得的能量，GCAES 电厂仍然能够履行基荷电力购买协议。如果存储容量足够大，那么它可包含足以在上述情况下，时期延长地履行基荷合同的存储能量（例如，压缩空气）。就较小的存储单元来说，超过限定时期地借助来源的这种组合供给能量并不可行；因而，能量交易在履行基荷合同方面起更大的作用。

[0067] 利用 GCAES 系统的发电还消除了建立错误种类的电厂的风险。整个系统具有其相对大小会影响重要的电力性能特性的至少 3 个基本方面：电源（例如，风力涡轮机），洞穴容量和 GCAES 设备。可以确定每个设备的大小，以满足消费者的能量需求；即，风力涡轮机，GCAES 单元的数目，或者可以调整洞穴容量的大小，以随着能量需求和 / 或能量市场而变化。

[0068] 例如，如果调峰电厂被构造成具有连续上升或下降的容量，不过稍后的情况需要额外的基荷，那么会建立错误的发电机，从而浪费大量的基建投资。相反地，GCAES 系统灵

Ex.1002 / Page 130 of 767
Cholla Energy LLC & OBM, Inc.

活，以致它不被固定为基荷或调峰电厂。如果最初建立 GCAES 电厂主要是供给基荷，但是后来出现调峰需求，那么所需的只是把额外的 GCAES 单元和相关设备并入电厂中，并使风力涡轮机或其它中间电源相同。另一方面，如果建立 GCAES 调峰电厂，而在后来需要额外的基荷容量，那么可不对 GCAES 设备进行改变，只需要增加更多的风力涡轮机。

[0069] 图 2 中说明了与能量存储和输送相关的 GCAES 电厂和关联系统的操作的各种最小值、最大值和典型值以及范围。连接到 GCAES 电厂的电源可供给 1.5MW-2000MW 的电力，一般的供给约为 100MW。GCAES 电厂利用的存储容量，即洞穴容量为 20kcf-4bcf，常见范围约为十亿立方英尺。利用 GCAES 系统压缩的气体在 70-95Bar 下被存储在储能子系统中，不过压力可约为 20-200Bar。GCAES 单元分两个阶段压缩气体：在第一阶段，气体被压缩到 1-7Bar，而在第二阶段，气体被压缩到 7-90Bar。膨胀也是在大体相似的压力下，分两个阶段进行的。不过，GCAES 单元可利用阶段数各不相同的过程，把气体压缩到 5Bar-200Bar 的压力。

[0070] 当切换模式时，GCAES 单元具有快速响应速率。一般可在 0.25 秒 -4.2 秒内，完成在储能模式和产生模式之间的交替，在最佳条件下，可以短至 50ms 地完成切换。在约 0.25 秒 -4.2 秒内，也可完成从空闲模式到储能模式或产生模式的切换，最佳条件下，最短时间为 50ms。

[0071] 针对为满足可预测的消费者需求所需的能量性能，确定电厂元件的大小。另外，GCAES 电厂的元件的大小也可被确定成包括允许电厂参与电力市场电力交易的额外容量。电厂元件大小确定可涉及例如额外的风力涡轮机或 GCAES 单元或存储容量的相对大小确定。此外，对需要参与电力交易的额外设备的需求极小，或者甚至没有，因为可关于预测的，而不是确定地已知的天气和其它因素的经济效果，考虑所述需求。此外，对额外设备或存储容量的需求认识到支持长期电力合同的设备也可支持短期电力交易，于是使运营公司能够在投资于或不投资于电力交易专用设备的情况下，受益于了解短期能量价格、供给和需求。

[0072] 包含在 GCAES 系统中的电力交易组件通过使风电和其它间歇性可再生电源能够分享十足的市场价格，结果利润和投资回报提高，从而推进可再生能源在美国和世界其它地区的竞争性电力市场中的发展，改善创建和开拓电力市场的现有方法和系统。

[0073] 应注意，可与风电场或者其它间歇性能量源结合地，或者单独利用从电网获得的电力，或者它们的组合，实践用于基于 GCAES 的电力交易的所述系统；可以在有或没有供给长期电力的合同的情况下，实践所述系统。所述系统不仅可用于减少对电网的电力输出，而且可以接受来自电网的负荷。于是，GCAES 系统能够同时或者分别按各种模式起作用；例如，系统可提供长期电力服务和 / 或辅助电力服务，以及参与电力交易，以履行服务和 / 或往来于存储器转换能量。GCAES 系统可按照这些模式任意之一，或者它们的任意组合工作。在一些情况下，系统可提供长期电力服务和辅助电力服务。在其它情况下，例如，系统可在参与电力交易的时候，提供辅助服务。

[0074] 作为电力交易组成的一部分，按时间增量，最好很短的增量，从 30 秒到 1 小时，或者任何其它适当的时段，分析市场状况。如果在所述增量期间，电力的市场价低于特定阈值，比如历史平均值、日均值、24 小时滚动平均值或者某个其它指标，那么可购买所述电力，并且空闲的 GCAES 设备可用于把能量放入存储器中。此外，如果市场价低于基荷合同的价格，那么可以利用更便宜的电力在所述时间增量，履行该合同。换句话说，可以直接通过市场交易，按低市场价购买电力，并按合同价出售电力 - 不需要与 GCAES 变换系统的相互作

Ex.1002 / Page 131 of 767
Cholla Energy LLC & OBM, Inc.

用。同样地，如果电力的市场价高于特定阈值，并且 GCAES 设备目前未用于为稳定电力合同供给电力，那么 GCAES 电厂可从存储器释放能量，并把所述能量按市场价提供给电网。

[0075] 在一些实施例中，一个或多个市场因素可用于作出交易决策，比如是否购买或提出购买电力，和是否出售或提出出售电力，以及多少电力和按什么价格。例如，市场因素可以是电力的过去市场价、电力的当前市场价、电力的未来市场价、电力的趋势价格、在固定时限内确定的电力的平均价、在可变时限内确定的电力的平均价、电力的供给、电力的需求、供给趋势、需求趋势、或者上述的任何历史或预测值。市场因素可包括单个值、多个值和 / 或数值的范围。

[0076] 在一个更具体的例子中，如果具有 200MW 风力涡轮机的 GCAES 电厂有义务依据 100MW 中间合同，按 $70/MW-h 的价格供给电力，并且风力处于非高峰时段内的半功率状态，那么存在取决于市场状况可采取的几种可能的行动。例如，如果电力现货价格足够低于平均价和合同价（例如，现货价为 $5/MW-h），并且电厂中的所有 GCAES 单元并非都正被使用，那么有利的是在该时间增量内，购买电力，并压缩存储，达到可用 GCAES 设备和存储容量的最大程度为止。在相反的例子中，如果在白天（当必须按合同供给电力），风力涡轮机正产生 200MW，并且现货市场的电价为 $200/MW-h，那么电厂可按照多种方式利用这些状况。首先，必须按合同以 $70/MW-h 的价格供给 100MW。如果可能，那么随后可在现货市场按 $200/MW-h 的价格，出售来自风力涡轮机的额外 100MW（即，把额外的 100MW 绕过 GCAES 变换和储能设备，从风力涡轮机发送到电网）。更进一步地，由于 GCAES 单元可能处于空闲状态（不需要压缩），可以使所述单元进入膨胀模式，以在该时间增量期间，出售存储的能量。即，如果存储的 100MW 能量最初是以 $5/MW-h 的价格购买的，那么可按 $200 的现货市场价格出售所述存储的 100MW 能量。于是在这些条件下，为满足 100MW 供给合同而建立的 GCAES 电厂实际能够供给 300MW，从而从供给额外的 200MW 获得可能相当大的利润。

[0077] 参见图 3A-3C，表格表示来自电源和存储器的能量如何与交易结合，以满足基荷合同的例子。“电源 (MW)”列指示每个时间单位，从电源获得多少电力（单位 MW）。“GCAES(MW)”列指示每个时间单位，通过 GCAES 单元传送多少电力（单位 MW），同时正数指示来自存储器的能量的膨胀，而负数指示到存储器的能量的压缩。“电网 (MW)”列指示每个时间单位，向电网传送多少电力（单位 MW）。在图 3A-3C 中，均假定以下例证限制。首先，对电网的期望输出至少为 100MW，以履行 100MW 基荷合同。其次，每个时间单位，GCAES 电厂能够变换最多 100MW。

[0078] 图 3A 说明其中不利用交易来满足基荷合同的例证基线能量平衡结构。在第一行中，高风速状况产生 100MW 的超额电力输出，所述超额电力输出被 GCAES 系统变换成压缩气体存储。剩余的 100MW 被直接供给电网，从而避免与储能系统相关的任何效率损失。第二行表示其中电源刚好满足基荷要求的情况；从而，全部的 100MW 从电源被引导到电网。第三行显示其中电源未供给能量，利用 GCAES 单元，从存储的气体膨胀获得全部 100MW。

[0079] 图 3B 通过在市场价超过在平均值之上的阈值时，把能量销售包含在内，进一步阐述基线情况。在这种情况下，有利的是取回存储的能量，并把存储的能量提供给电网。因而，GCAES 设备将与它从电源获得的电力量结合地提供其 100MW 的最大电力。从而，对于每种风力等级，向电网供给的总电力是从电源接收的数量加上 100MW。

[0080] 参见图 3C，当市场价低于小于平均值的阈值时，可取的是购买并存储能量，以便以

Ex.1002 / Page 132 of 767
Cholla Energy LLC & OBM, Inc.

后当市场价升高时出售。如表中所示，GCAES 设备将压缩存储最多 100MW。在高风速情况下，向电网供给 100MW，以满足基荷合同，并存储 100MW。在平均风速情况下，来自电源的 100MW 可用于履行基荷合同，或者它可被变换，以便存储。如果被存储，那么可通过按较低的价格，从市场购买电力，并按较高的合同价格出售所述电力，履行基荷合同。如果被用于直接履行所述合同，那么以较低的价格购买并变换 100MW，以便存储。在无风的情况下，所述表格显示以低市场价，购买 200MW 的能量：按基荷合同供给 100MW，并变换 100MW，以便存储。应注意在一些情况下，最好部分或完全通过存储能量的膨胀，履行基荷合同；不过，图 3C 中未针对这种情形。此外，可以单独利用电力购买来满足基荷合同。

[0081] 在其它情况下，市场价、设备可用性、开销成本和其它因素可导致这些值变化。例如，某些情形会导致可取的是利用电源、存储器和能量市场销售的任意组合，向电网提供电力的状况。类似地，可利用电源和能量市场购买的任意组合，获得供存储之用的能量。

[0082] 应注意，在图 3A-3C 中提供的表格是发明主题的基本操作的例子，因而，使用的数值只是用于举例说明，而不反映存在于系统中的实际值。此外，说明的状况可能被过度简化，以举例说明系统的基本原理，于是并不代表当运行系统时，可考虑到的所有可能情况、结果和考虑因素。

[0083] 在其核心，系统的交易方面包括致力于 3 个问题的 3 条交易规则：首先，何时应交易能量？其次，应交易多少能量？和第三，储能如何影响交易？

[0084] 规则 1 规定当购买或出售电力增量地有利可图时，应购买或出售电力。例如，如果关于电力的平均价格（不论是 1 小时、1 天、滚动 24 小时周期、1 周、1 月、1 年或者某个其它时段）定义“有利可图”，那么当现货市场价（或者其它市场因素）比平均价小阈值量时，将购买电力。同样地，当现货市场价（或者其它市场因素）比平均价大阈值量时，将出售电力。购买阈值量可以和出售阈值量相同或不同。

[0085] 这里说明的交易系统和方法的一些实施例不需要进行关于市场或环境状况的任何预测，以实现本发明的目的。在一些情况下，如果在当前时间，递增地有利可图，那么进行能量交易，而不等待判定稍后的时间增量是否更多或更少地有利可图。在例证估计中，为了递增地有利可图，必须按比平均市场价低 20％的价格购买电力。该百分率主要来源于 GCAES 设备的效率损失（在压缩模式下，GCAES 设备的效率约为 86-87％），加上设备的运行成本（所述运行成本可变化，不过为了举例说明，为 $2.50/MW-h）。另外，交易成本必须包含在公式之中。为了有利可图地出售电力，必须按比平均价高相似比率，或者如这里所述的 20％的价格，出售电力。这些百分率阈值可随设备效率、运行成本、交易成本和其它因素而变。

[0086] 可包含在购买和出售阈值的计算中的某些交易成本包括由电力现货市场控制者作出的电价更改。所述控制者的一个例子是区域输电组织 (RTO)，RTO 是美国和世界的许多其它地区的主要电力现货市场。RTO 现货市场以提供卖盘价的发电者，和提供买盘价，以购买电力的负荷（相对于最终用户的电力分配者）为基础。RTO 每 5 分钟公布卖盘价和买盘价。随后，RTO 设定价格，并向发电者发送指定他们要向电网供给多少电力，和他们将因所述电力而被支付的价格的指令（调度）。现货市场价格（称为节点边际价格或 LMP）是根据买盘价和卖盘价，备用要求，输电阻塞、需求和供给的位置，以及许多其它因素设定的。RTO 有权改变来自发电者的报价，并利用改变的报价计算 LMP。通常，发电者不具备拒绝 RTO 指定

Ex.1002 / Page 133 of 767
Cholla Energy LLC & OBM, Inc.

的价格，或者决定向电网供给多少电力或备用的能力。考虑到所有这些，在向现货市场控制者提出买盘价和卖盘价时，系统可考虑 RTO 的设定电价的能力，以及其它买盘价和卖盘价的存在、需求和供给、以及与 LMP 的计算相关的其它因素。GCAES 系统可进一步考虑上述因素来确定购买或出售多少电力，或者提出购买或出售，以及存储或从存储器取回多少能量。

[0087] 参见图 4A，例证的曲线图表示随着时间变化的电力市场价。平均市场价被表示成均匀的虚线，出售阈值比平均市场价高一定量（例如高 20％），购买阈值比平均市场价低相同或不同的量（例如，低 20％）。根据随着时间变化的市场价，当价格高于出售阈值时（假定存在存储供给时），将在时间 T_0 和 T_1 之间出售电力。同样地，当价格低于购买阈值时，将在时间 T_2 和 T_3 之间购买电力（假定存在存储容量）。

[0088] 规则 2 规定应购买或出售的在该交易时期内可获得的最高容量；不过，该数量可随其它条件而变。在该时间增量期间可处理的能量的数量取决于电厂的 GCAES 设备的可用性和能力。在不为稍后的时间增量预先作准备的情况下，能够由 GCAES 单元处理的全部功率容量被交易，最好不考虑能量存储。与汽车的动力设备相比，GCAES 单元可被视为发动机，存储器可被视为气罐。按照规则 2，关切的主要之事是在下一个时间增量期间，发动机可被利用到什么程度，而不考虑气罐的容量。

[0089] 规则 3 指示当进行交易决策时，应考虑可用存储容量。就上面讨论的例证的平均价格 ±20％区间来说，取决于存储器有多满，所述 40％定价区间应被上移和下移。在一些情况下，两个区间边界以相同的速率移动，而在其它情况下，可以独立地移动边界。例如，如果储能容量充满 95％，那么交易模型应表示出售优先于购买的交易。为此，在存储容量达到 95％水平的时间增量期间，40％的定价区间应被下移，以致更靠近平均价格，按平均价格，或者甚至低于平均价格地出售电力，以便避免充满或过度充满储罐。在所述区间的另一端，除非远低于平均价格，例如低大约 40％或者更低，否则将不购买电力。相反，当储罐接近于空时，定价区间被上移，以致购买电力优先于出售电力。例如，将按低于平均价 10％的价格进行购买，和按高于平均价 30％的价格进行出售，而不是按低于 / 高于平均价 20％的价格购买 / 出售。利用这种交易方法，使系统不必预测未来的环境或营销状况，从而避免固有地与之相关的风险。

[0090] 参见图 4B，当存储器接近于满时，出售 / 购买阈值向下移动，使电力以与图 4A 的基线情况相比，更低的价格被出售（即，在 T_0 和 T_1 之间），和以更低的价格被购买，假定在图 4A-C 之间，平均市场价恒定。如图 4B 中所示，购买阈值降低到最低市场价之下，导致不存在电力购买。

[0091] 相反，在图 4C 中，当存储器接近于空时，出售 / 购买阈值向上移动，使电力以与图 4A 的基线情况相比，更高的价格被出售，和以更高的价格被购买（即，在 T_0 和 T_1 之间），假定在图 4A-C 之间，平均市场价恒定。如图 4C 中所示，销售阈值已升到最高市场价之上，导致不存在电力销售。

[0092] 在一些实施例中，包括第四条规则，第四条规则规定可变更电力购买协议 (PPA) 中要求的额定可用性，以产生更有利的交易结果。PPA 中的额定可用性是系统可用于产生电力的时间的百分率。例如，核电站和火电厂通常具有 90％的可用性，核电站可用性稍高，火电厂可用性稍低。为了避免使消费者不方便，这些电厂主要在负荷最低的春季和秋季进行服务。GCAES 电厂是模块化的，通常不需要使整个电厂都投入服务。此外，一些 GCAES 电厂

Ex.1002 / Page 134 of 767
Cholla Energy LLC & OBM, Inc.

安装有额外的 GCAES 单元，从而允许各个单元的换入换出，以便维护，导致对电厂的发电能力没有显著影响。

[0093] 至少存在两种可把 PPA 结合到交易逻辑中的独立方式。首先，可以利用交易避免满足 PPA 的失败。例如，如果在较长时间内，从间歇性电源产生的电力不足，那么交易算法将确保购买电力，以填充储罐，按照 PPA 的可用性从而将上升。相反，如果电源供给过多的能量，并且存储器接近于充满，那么交易算法将酌情移动定价区间，以致出售更多的电力。通过出售电力和维持足够的存储容量，多余的能量不会被浪费，可在以后的时期满足 PPA，即使电源的发电能力降低。

[0094] PPA 和能量交易相互作用的第二种方式涉及在 PPA 周围进行交易。出于举例说明的目的，考虑具有按 $70/MW-h 价格的基荷合同的 GCAES 电厂，同时可用性要求为 90％。在一个例子中，如果气价升高，导致现货和调峰电价升高到 $110/MW-h，那么将激励交易者按 $70/MW-h 的价格，满足 90％可用性目标，并按 $110/MW-h 的价格，出售剩余的可用电力输出。更一般地，如果电价较高，那么可取的是仅仅满足按照 PPA 的最低可用性要求。另一方面，如果气价显著降低，导致现货和调峰电价降低到 $40/MW-h，那么可取的是超过按照 PPA 的所需最小可用性（即，按照合同以 $70/MW-h 的价格进行出售），尤其是如果预期市场价不会升高到 PPA 合同价。从而，第二种方法允许响应市场状况，灵活地满足按照 PPA 的可用性，同时确保长期电力供给合同的履行。

[0095] 图 5 中说明上述固定区间能量交易系统和方法的各种最小值、最大值和典型值及范围。在典型情况下，出售和购买限度被设定成比电力的平均市场价，或者其它因素高或低预定量。根据可用的存储容量的大小，所述限度可被上移或下移一定量。当当前市场价或者其它因素在出售 / 购买限度之外时，按设定的时间间隔交易 GCAES 电厂、一个或多个 GCAES 单元的储能或发电的全部能力（或者其它数量的能量）。

[0096] 在一些实施例中，在是否购买 / 出售和压缩 / 膨胀能量的判定中，结合预测要素。参见图 6，优化模型可利用例如环境预报（例如，预期的风力，温度、压力、湿度）、市场状况预测（例如，未来的价格、需求）、或者其它未来因素来优化储能和输送。整体考虑可用输入，优化模型确定不同类别中的最有利配置来最大化内部收益率 (IRR) 和长期净现值 (NPV)。

[0097] 除了各个预测特征之外，在优化模型中最好考虑的 3 个主要类别是项目的物理配置、项目的不同运营方法、和市场参与。模型评估电厂的物理能力，它可包括例如风力涡轮机的大小和数目，可用的 GCAES 单元的能力，存储洞穴的大小，和取回热能的能力。运营优化的例子包括下面更详细讨论的调度算法，所述调度算法确定是满负载地开动 50％的 GCAES 单元，还是半负载地开动 100％的 GCAES 单元。在最后的类别中，模型根据特定的地区，确定电厂应如何参与和参与哪几个潜在的市场。

[0098] 图 7 是可被并入调度算法中的输入，及其可能的输出的例证示图。调度算法可以是用于优化电厂的能量调度操作的优化系统的模块。首先，利用一组配置参数（例如，存储容量、起始存量、压缩成本、膨胀成本、GCAES 单元的数目、最大风电场输出、膨胀损失率、压缩损失率、每个 GCAES 单元的每小时最大压缩量，每个 GCAES 单元的每小时最大膨胀量），初始化所述算法。在初始化之后，在基于地区的时间间隔（例如，5 分钟、30 分钟、1 小时、或者基于区域市场的任何其它时段）的开始，算法关于预测时期（例如，24 小时、168 小时、或者

Ex.1002 / Page 135 of 767
Cholla Energy LLC & OBM, Inc.

任何适当的时段）考虑实际存储水平，预测价格和风速数据，并执行优化方法，以提出关于当前时间间隔的操作室和交易室的最佳解决方案。具体地，所述算法输出应被压缩或膨胀的能量的数量，以及在该时间间隔内，应购买或出售多少电力，以使总收益达到最大。可在各个时间间隔的开始，重复所述过程或其部分，以使收益达到最大，同时满足诸如把存储水平始终保持在其最小容量和最大容量之间之类的约束。

[0099] 参见图 8，在 24 小时时期内，表示了运行优化系统及其伴随算法模块的样本结果，时间间隔为 1 小时。该图表图解说明 100MW-h 电力购买协议的满足，同时通过以较低的价格购电，和以较高的价格售电，使收益达到最大。该算法考虑到价格和风速因素，以确定在给定时间，压缩 / 膨胀和购买 / 出售多少。

[0100] 图 9 中说明了上述预测性能量交易系统和方法的各种最小值、最大值和典型值及范围。在评估是否要存储、产生和 / 或交易能量时，系统可考虑当前合同价格（例如，基荷或其它长期，或者辅助服务合同），能量的市场价（过去、当前和 / 或未来），电力的供给和 / 或需求（过去、当前和 / 或未来），和各种过去、当前或未来的环境状况，包括（但不限于）风速、风向、气温、气压、湿度、降水量、云量、季节、日照时间、潮汐状态、存储温度、存储时间、存储压力、和昼 / 夜温差。

[0101] 在一些实施例中，本发明包含便利系统的各种操作的一个或多个计算机控制器设备。例如，计算设备可单独地，或者相互或与多个其它子系统结合地便利电力路由子系统电力变换系统的运行。可在计算设备上实现指令，以致自动指示电力路由子系统把能量从电源传送到电网。此外，计算设备可包括自动指令变换子系统存储或产生电力的指令。计算设备指示这些子系统工作，以致电力被引导到电网，并且同时往来于存储器被变换。此外，计算设备可以考虑任意数目的输入，以确定系统及其各个子组件应如何运行。例如，计算设备可评估 GCAES 电厂的当前运行状况，存储容量，当前、过去和 / 或未来环境状况，市场状况，并确定系统应如何运行，以满足当前和未来电力需求。

[0102] 可以诸如智能或非智能终端、网络计算机、工作站、小型计算机、大型计算机、或者起通用计算机或专用硬件设备作用的其它计算设备上，实现计算机控制器。参见图 10，控制器可包括呈计算机 1000 形式的计算设备，计算机 1000 包括处理器 1002、系统存储器 1004、输入和输出设备 1008，和把包括系统存储器在内的名个系统组件耦接到处理器的系统总线。

[0103] 在一些实施例中，控制器包括用于自动指示系统的工作和 / 或允许用户面接系统和其各个子组件的控制器软件。控制器软件可以是用多平台语言 / 构架，比如 Java、.Net、Objective C，或者用本地处理器可执行代码实现的独立应用程序。按照本发明的各个实施例，可以利用任何适当的编程语言。例示地，使用的编程语言例如可包括汇编语言、Ada、APL、Basic、C、C++、C#、Objective C、COBOL、dBase、Forth、FORTRAN、Java、Modula-2、Pascal、Prolog、REXX 和 / 或 JavaScript。此外，不一定结合本发明的系统和方法的工作，利用仅仅一种指令或编程语言。相反，如果必要或者可取，那么可以利用任意多种不同的编程语言。

[0104] 在一个实施例中，通信网络 1010 连接计算机 1000 和其它系统及设备，比如远程系统控制器和电力市场服务器。可通过任意介质，比如标准电话线路、LAN 或 WAN 链路（例如，T1、T3、56kb、X.25）、宽带连接（ISDN、Frame Delay、ATM）、无线链路（802.11、蓝牙、GSM、

Ex.1002 / Page 136 of 767
Cholla Energy LLC & OBM, Inc.

CDMA 等），等等，进行通信。不过，网络的种类不是限制性的，可以利用任何适当的网络。可以充当通信网络 1010，或者成为通信网络 1010 的一部分的网络的非限制性例子包括基于无线或有线以太网的企业内部网，局部网或广域网 (LAN 或 WAN)，和 / 或可以适应许多不同通信介质和协议的称为因特网的全球通信网络。当用在 LAN 连网环境中时，计算机可通过网络接口或适配器，连接到 LAN。当用在 WAN 连网环境中时，计算机一般包括调制解调器或者其它通信机构。调制解调器可在内部或外部，可通过用户输入接口，连接到系统总线，通过无线或有线以太网，连接到网络，或者连接到其它适当的机构。可通过因特网、企业内部网、外部网、以太网、或者提供通信的任何其它系统，连接计算机。一些适当的通信协议可包括例如 TCP/IP、UDP、或者 OSI。对无线通信来说，通信协议可包括蓝牙、Zigbee、IrDa 和其它适当的协议。此外，系统的各个组件可通过有线或无线路径的组合进行通信。

[0105] 可在其中复用通过通信网络连接的远程处理设备执行任务的分布式计算环境中，实践本发明。在分布式计算环境中，程序模块可以位于包括存储设备的本地和远程计算机存储介质两者之中。

[0106] 在一些情况下，关系（或结构）数据库可提供诸如保存与系统的运行相关的数据的数据库管理系统之类的功能。数据库的例子包括由 Redwood Shores, CA 的 ORACLE 公司提供的 MySQL Database Server 或 ORACLE Database Server，由 Berkeley, CA 的 PostgreSQL Global Development Group 提供的 PostgreSQL Database Server，或者由 IBM 提供的 DB2Database Server。

[0107] 计算机一般包括各种计算机可读介质，所述计算机可读介质可构成系统存储器的一部分，可由处理器读取。例如（但不限于），计算机可读介质可包括计算机存储介质和通信介质。系统存储器可包括呈易失性和 / 或非易失性存储器形式的计算机存储介质，比如只读存储器 (ROM) 和随机存取存储器 (RAM)。包含比如在启动期间，帮助在元件之间传送信息的基本例程的基本输入 / 输出系统 (BIOS) 一般保存在 ROM 中。RAM 一般包含可由处理器直接访问和 / 或目前正由处理器运行的数据和 / 或程序模块。所述数据或程序模块可包括操作系统、应用程序、其它程序模块和程序数据。

[0108] 计算环境还可包括其它可拆卸 / 不可拆卸，易失性 / 非易失性计算机存储介质。例如，硬盘驱动器可以读写不可拆卸的非易失性磁性介质。磁盘驱动器可以读写可拆卸的非易失性磁盘，光盘驱动器可读写可拆卸的非易失性光盘，比如 CD-ROM 或其它光学介质。可在例证的工作环境中使用的其它可拆卸 / 不可拆卸的易失性 / 非易失性计算机存储介质包括（但不限于）盒式磁带、闪存卡、数字通用光盘、数字录像带、固态 RAM、固态 ROM 等。存储介质一般通过可拆卸或不可拆卸的存储接口，连接到系统总线。

[0109] 存储器至少包括被永久或临时保存的至少一个指令集。处理器执行保存的指令，以便处理数据。指令集可包括执行一个或多个特定任务的各种指令。用于执行特定任务的这种指令集可被表征为程序、软件程序、软件、引擎、模块、组件、机制或工具。

[0110] 系统可包括保存在上述存储器中，并按照这里说明的方式在处理器上执行的多个软件处理模块。程序模块可以呈任何适当的编程语言的形式，所述编程语言被转换成机器语言或目标代码，以允许处理器读取指令。即，通过利用编译器、汇编程序或解释器，利用特定编程语言编写的多行编程代码或源代码可被转换成机器语言。机器语言可以是特定于特殊计算机的二进制编码机器指令。

Ex.1002 / Page 137 of 767
Cholla Energy LLC & OBM, Inc.

[0111] 执行命令和指令的处理器可以是通用计算机，不过可以利用任意的各种各样的其它技术，包括专用计算机、微计算机、小型计算机、大型计算机、程控微处理器、微控制器、外围集成电路元件、CSIC（用户专用集成电路）、ASIC（专用集成电路）、逻辑电路、数字信号处理器、诸如FPGA（现场可编程门阵列）、PLD（可编程逻辑器件）、PLA（可编程逻辑阵列）、RFID集成电路、智能芯片之类的可编程逻辑器件，或者能够实现本发明的处理的步骤的任何其它器件或者器件的布置。

[0112] 应理解计算机系统的处理器和/或存储器不必物理地位于相同位置。计算机系统使用的各个处理器和各个存储器可在不同的地理位置，可按照任何适当的方式被连接，以便相互通信。另外，应理解各个处理器和/或存储器可由不同的物理设备构成。

[0113] 用户可通过用户接口，把命令和信息输入计算机1000，用户接口包括诸如键盘和指示设备之类的输入设备1008，所述指示设备通常指的是鼠标、跟踪球或触控板。其它输入设备可包括麦克风、操纵杆、游戏手柄、碟形卫星天线、扫描仪、语音识别设备、键盘、触摸屏、拨动开关、按钮等。这些和其它输入设备通常通过耦接到系统总线的用户输入接口，连接到处理器，不过可用其它接口和总线结构，比如并行端口、游戏端口和通用串行总线(USB)连接。

[0114] 一个或多个监视器或显示器也可通过接口，连接到系统总线。除了显示器之外，计算机还可包括可通过输出外围接口连接的其它外围输出设备1008。实现本发明的计算机可利用与一个或更多的远程计算机的逻辑连接，在连网环境中工作，所述远程计算机一般包括许多或者所有的上述元件。

[0115] 尽管未表示计算机的内部组件，不过，本领域的普通技术人员会意识到这样的组件和互连是众所周知的。因而，不需要结合本发明，公开涉及计算机的内部结构的另外细节。

[0116] 以上讨论仅仅公开和说明了本发明的例证实施例。本领域的技术人员会理解，可以其它具体的形式实现本发明，而不脱离本发明的精神或基本特征。可以增加或从这里说明的处理中除去如在附图和说明书中说明的各个步骤，可以按照和本发明的精神一致的另外的顺序执行说明的步骤。因而，像其它权利要求一样，本发明的公开是例证性的，而不是对本发明范围的限制。包括这里的教导的任何易于辨识变体的公开内容部分限定前述权利要求术语的范围。

Ex.1002 / Page 138 of 767
Cholla Energy LLC & OBM, Inc.

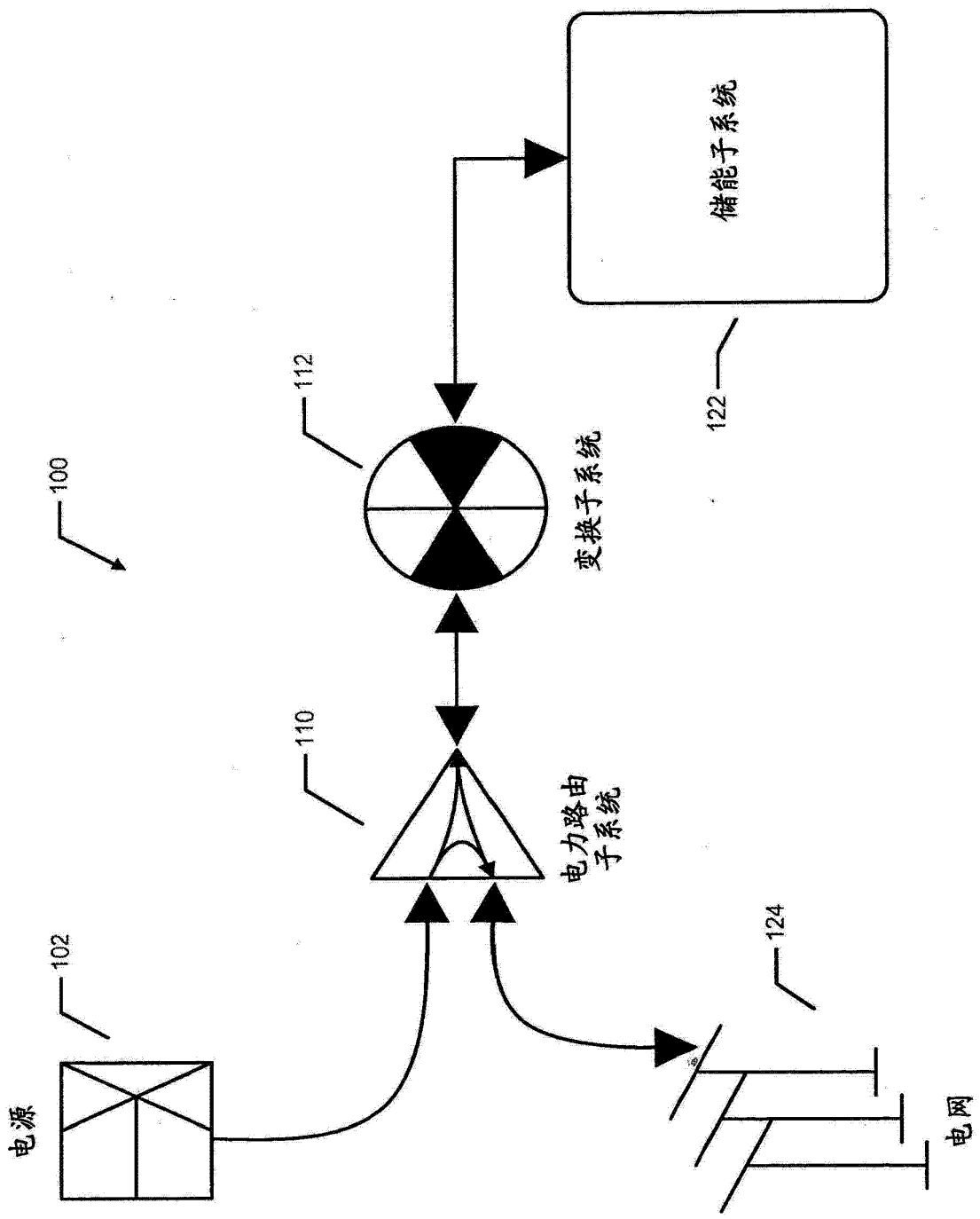


图 1

Ex.1002 / Page 139 of 767
Cholla Energy LLC & OBM, Inc.

技术参数	最小值或范围	最大值或范围	典型值或范围
电源(例如，风电场)的输出	1.5MW	2000MW	100MW
洞穴容量(气体的体积)	20 kcf	4 bcf	1 bcf
存储气体的压力	~20 Bar	200 Bar	70-95 Bar FEP
GCAES 压缩率(气体)	5 Bar	200 Bar	第一阶段 1-7 Bar，第二阶段 7-90 Bar
GCAES 膨胀率(能量)	5 Bar	200 Bar	第一阶段 7-90 Bar，第二阶段 1-7 Bar
GCAES 产生-存储模式切换时间	50ms.	<=4.2秒	.25秒到 <= 4.2秒
GCAES 存储-产生模式切换时间	50ms.	<=4.2秒	.25秒到 <=4.2秒
GCAES 空闲-膨胀时间	50ms.	<=4.2秒	.25秒到 <=4.2秒
GCAES 空闲-压缩时间	50ms.	<=4.2秒	.25秒到 <=4.2秒

图 2

表 1-基线能量平衡情况(无交易)			
电源(MW)	GCAES (MW)	→	电网(MW)
200(高风速)	-100	→	100
100(平均风速)	0	→	100
0(无风)	100	→	100

图 3A

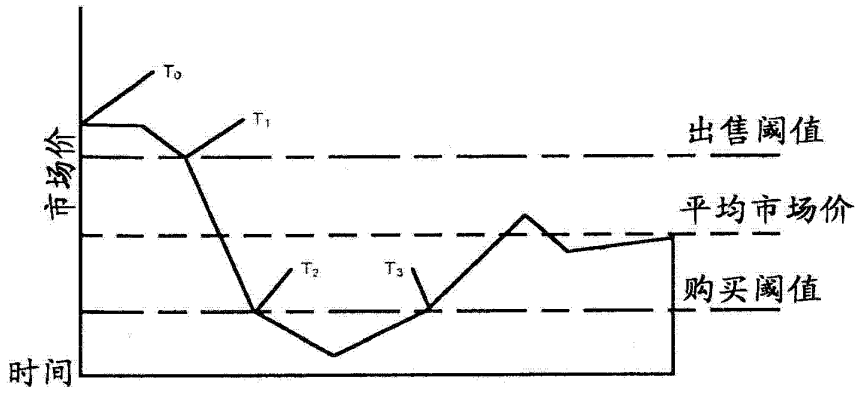
表 2-高价格/可用供给情况(出售/膨胀)			
电源(MW)	GCAES (MW)	→	电网(MW)
200(高风速)	100	→	300
100(平均风速)	100	→	200
0(无风)	100	→	100

图 3B

Ex.1002 / Page 140 of 767
Cholla Energy LLC & OBM, Inc.

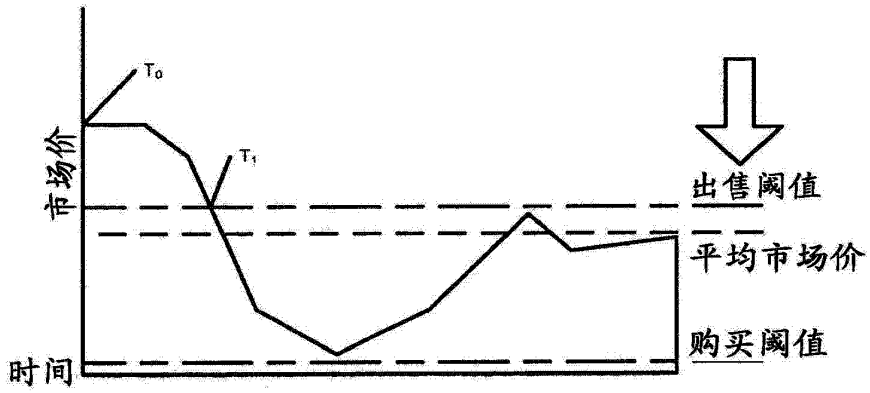
表 3-低价格/可用容量情况(购买/压缩)			
电源(MW)	GCAES (MW)	→	电网(MW)
200(高风速)	-100	→	100
100(平均风速)	-100	→	100
0(无风)	-100	→	100

图 3C



基线情况

图 4A



存储器接近于满

图 4B

Ex.1002 / Page 141 of 767
Cholla Energy LLC & OBM, Inc.

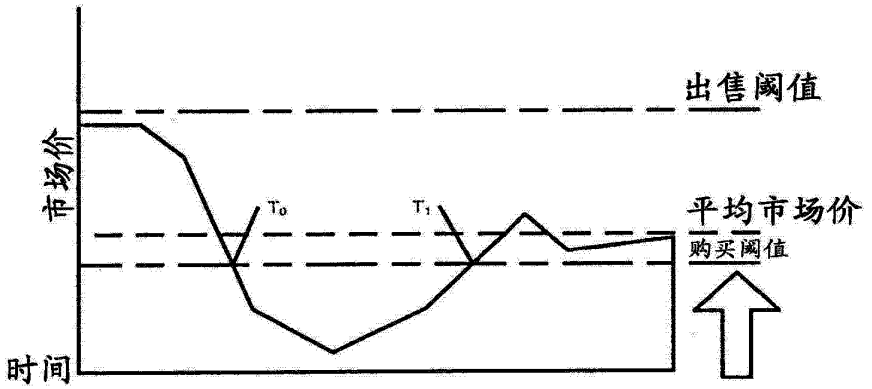


图 4C

例证的固定区间交易参数
能量的平均市场价
高于其，能量将被出售的在能量价格附近的预定限度
低于其，能量将被购买的在能量价格附近的预定限度
导致限度上移(少买，多卖)的可用存储容量的数量
使购买限度上移的数量
使出售限度上移的数量
导致限度下移(多买，少卖)的可用存储容量的数量
使购买限度下移的数量
使出售限度下移的数量
每个交易时间间隔(时间单位)出售的能量(满容量)
交易时间间隔的长度(时间单位)

图 5

Ex.1002 / Page 142 of 767
Cholla Energy LLC & OBM, Inc.

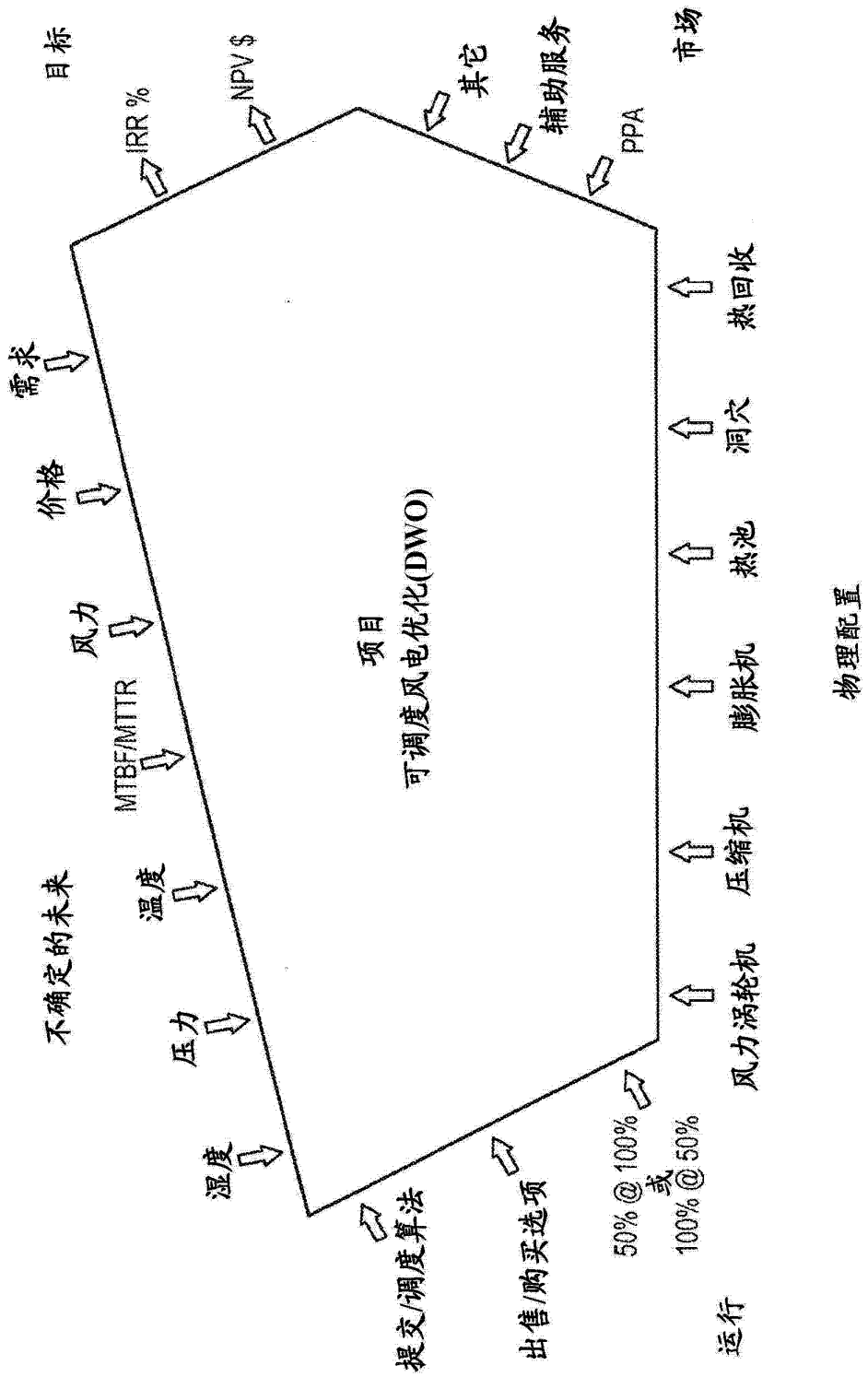


图 6

Ex.1002 / Page 143 of 767
Cholla Energy LLC & OBM, Inc.

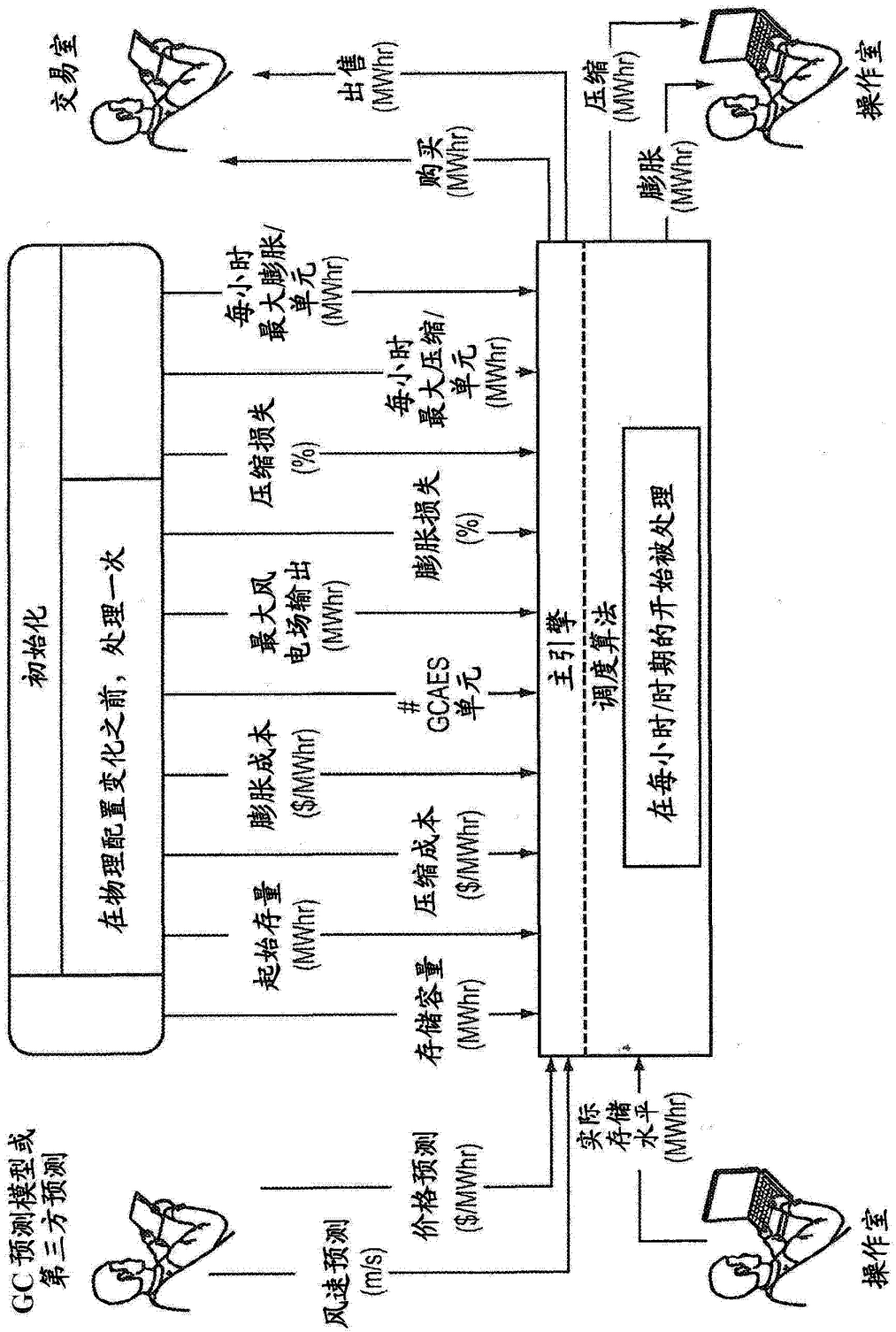
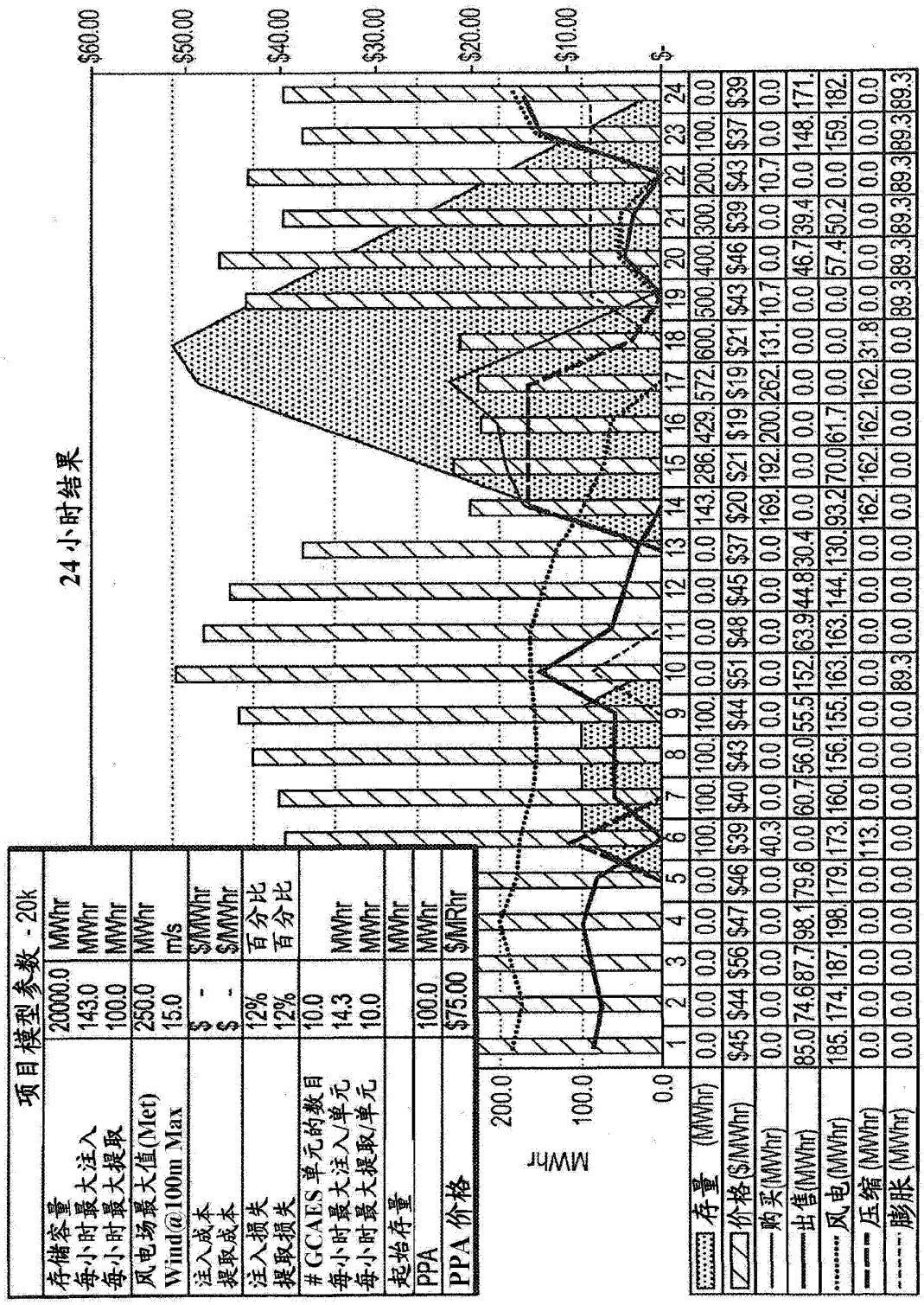


图 7

Ex.1002 / Page 144 of 767
Cholla Energy LLC & OBM, Inc.



项目模型参数 - 20k		
存储容量	20000.0	MWhr
每小时最大注入	143.0	MWhr
每小时最大提取	100.0	MWhr
风电场最大值(Met)	250.0	MWhr
Wind@100m Max	15.0	m/s
注入成本	$ -	$/MWhr
提取成本	$ -	$/MWhr
注入损失	12%	百分比
提取损失	12%	百分比
# GCAES 单元的数目	10.0	
每小时最大注入/单元	14.3	MWhr
每小时最大提取/单元	10.0	MWhr
起始存量		MWhr
PPA	100.0	MWhr
PPA 价格	$75.00	$/MRhr

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
存量 (MWhr)	0.0	0.0	0.0	0.0	0.0	100.	100.	100.	100.	0.0	0.0	0.0	0.0	143.	286.	429.	572.	600.	500.	400.	300.	200.	100.	0.0
价格 ($/MWhr)	$45	$44	$56	$47	$46	$39	$40	$43	$44	$51	$48	$45	$37	$20	$21	$19	$19	$21	$43	$46	$39	$43	$37	$39
购买(MWhr)	0.0	0.0	0.0	0.0	0.0	40.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	169.	192.	200.	262.	131.	10.7	0.0	0.0	10.7	0.0	0.0
出售(MWhr)	85.0	74.6	87.7	98.1	79.6	0.0	60.7	56.0	55.5	152.	63.9	44.8	30.4	0.0	0.0	0.0	0.0	0.0	0.0	46.7	39.4	0.0	148.	171.
风电(MWhr)	185.	174.	187.	198.	179.	173.	160.	156.	155.	163.	163.	144.	130.	93.2	70.0	61.7	0.0	0.0	0.0	57.4	50.2	0.0	159.	182.
压缩 (MWhr)	0.0	0.0	0.0	0.0	0.0	113.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	162.	162.	162.	162.	31.8	0.0	0.0	0.0	0.0	0.0	0.0
膨胀 (MWhr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89.3	89.3	89.3	89.3	89.3	89.3

图 8

Ex.1002 / Page 145 of 767
Cholla Energy LLC & OBM, Inc.

例证的预测交易参数
基荷合同价格
能量/电力的市场价(当前)
能量/电力的市场价(未来)
电力的供给
电力的需求
环境状况
风速
风向
气温
气压
湿度
降水量
云量
季节
日照时间
潮汐状态
存储温度
存储时间
存储压力
昼/夜温差

图 9

Ex.1002 / Page 146 of 767
Cholla Energy LLC & OBM, Inc.

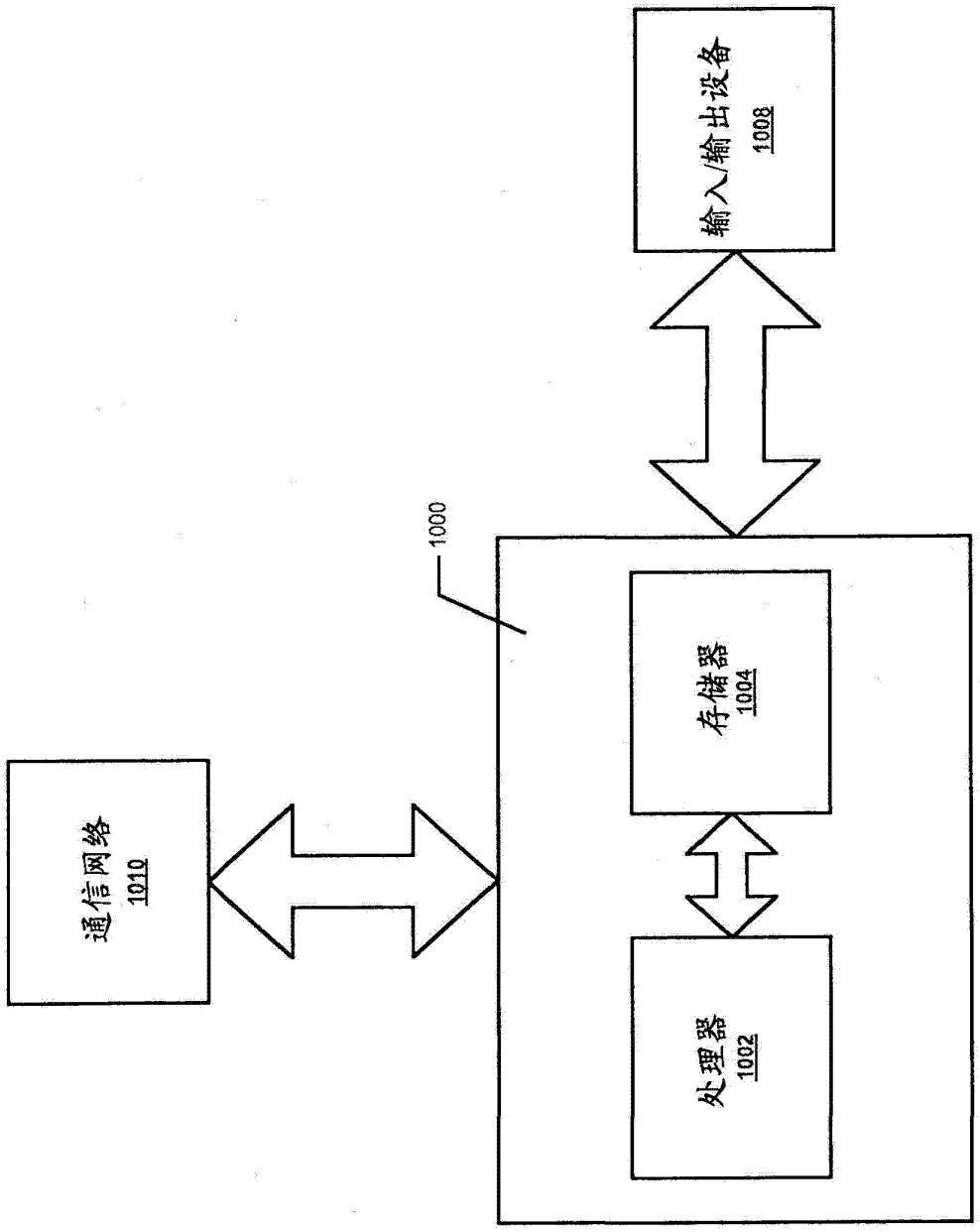


图 10

Ex.1002 / Page 147 of 767
Cholla Energy LLC & OBM, Inc.

Electronic Acknowledgement Receipt

EFS ID:	44531839
Application Number:	16525142
International Application Number:	
Confirmation Number:	7602
Title of Invention:	Managing Queue Distribution between Critical Datacenter and Flexible Datacenter
First Named Inventor/Applicant Name:	Michael T. McNamara
Customer Number:	23644
Filer:	Stephen Conrad Smith/Mark Sweetin
Filer Authorized By:	Stephen Conrad Smith
Attorney Docket Number:	84008-321859
Receipt Date:	16-DEC-2021
Filing Date:	29-JUL-2019
Time Stamp:	10:51:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	321859_18-1490-CON_Supp_IDS_211216.pdf	39406 25ffdf2891ee1c638b5846e09fd171d278449f37	no	3

Warnings:

Information:					
This is not an USPTO supplied IDS fillable form					
2	Transmittal Letter	321859_18-1490-CON_Communication_eTerminal-Disclaimer_211216.pdf	14609 63b1bd52c5cbf39f003a63ff4429f9db9ea64fa9	no	1
Warnings:					
Information:					
3	Foreign Reference	CN101803148A_EFS.pdf	2035481 4649aa472bd9f0c3f490baf62960f2778698607f	no	34
Warnings:					
Information:					
4	Foreign Reference	CN103748757A_EFS.pdf	1760446 bd0d5b0757296ce6c9d8e8dec53d7c0b317d5a0d	no	26
Warnings:					
Information:					
5	Foreign Reference	CN104969434A_EFS.pdf	2390784 a1b6a51af1c242a23dcefae6154edcdf4f9559e7	no	29
Warnings:					
Information:					
		Total Files Size (in bytes):	6240726		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed	PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT**
Application Number	16525142
Filing Date	29-Jul-2019
First Named Inventor	Michael McNamara
Attorney Docket Number	84008-321859
Title of Invention	Managing Queue Distribution between Critical Datacenter and Flexible Datacenter

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent Interest
LANCIUM LLC	100%

The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)

10367353

as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:
- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

◉ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

○ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.	
Applicant claims the following fee status: ○ Small Entity ○ Micro Entity ◉ Regular Undiscounted I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ◉ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application Registration Number 56250 ○ A sole inventor ○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application ○ A joint inventor; all of whom are signing this request	
Signature	/Stephen C. Smith/
Name	Stephen C. Smith

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	16525142
Filing Date:	29-Jul-2019
Title of Invention:	Managing Queue Distribution between Critical Datacenter and Flexible Datacenter
First Named Inventor/Applicant Name:	Michael T. McNamara
Filer:	Stephen Conrad Smith/Mark Sweetin
Attorney Docket Number:	84008-321859

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	170	170
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**170**

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 16525142

Filing Date: 29-Jul-2019

Applicant/Patent under Reexamination: McNamara

Electronic Terminal Disclaimer filed on December 16, 2021

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt

EFS ID:	44531384
Application Number:	16525142
International Application Number:	
Confirmation Number:	7602
Title of Invention:	Managing Queue Distribution between Critical Datacenter and Flexible Datacenter
First Named Inventor/Applicant Name:	Michael T. McNamara
Customer Number:	23644
Filer:	Stephen Conrad Smith/Mark Sweetin
Filer Authorized By:	Stephen Conrad Smith
Attorney Docket Number:	84008-321859
Receipt Date:	16-DEC-2021
Filing Date:	29-JUL-2019
Time Stamp:	10:49:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$170
RAM confirmation Number	E2021BFA49362289
Deposit Account	120913
Authorized User	Mark Sweetin

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.21 (Miscellaneous fees and charges)

37 CFR 1.17 (Patent application and reexamination processing fees)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	41244 cb06e0d0259d0c04421dd41c4994cc411ada6893	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	38266 d5ef27e2f061930355317b3168509948990 5e1d7	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	79510		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 4

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	001	US-6748932	06-15-2004	SORTER; Richard L. et al.	
	002	US-7278273	10-09-2007	WHITTED; William H. et al.	
	003	US-9252598	02-02-2016	BELADY; Christian L. et al.	
	004	US-9416904	08-16-2016	BELADY; Christian L. et al.	
	005	US-9618991	04-11-2017	CLIDARAS; Jimmy et al.	
	006	US-10033210	07-24-2018	PETERSON; Eric C. et al.	
	007	US-10340696	07-02-2019	PAINE; Miles et al.	
	008	US-10795428	10-06-2020	WALSH; Sean	
	009	US-10822992	11-03-2020	SPEARS; Christopher Steele	
	010	US-10862307	12-08-2020	CAVNESS; Charles et al.	
	011	US-10873211	12-22-2020	McNAMARA; Michael T. et al.	
	012	US-10931117	02-23-2021	SHOEMAKER; Patrick Robert	
	013	US-11016458	05-25-2021	McNAMARA; Michael T. et al.	
	014	US-11016553	05-25-2021	McNAMARA; Michael T. et al.	
	015	US-11025060	06-01-2021	McNAMARA; Michael T. et al.	
	016	US-11031787	06-08-2021	McNAMARA; Michael T. et al.	
	017	US-20030037150	02-20-2003	NAKAGAWA; O. Sam	
	018	US-20050034128	02-10-2005	NAGASHIMA; Noritake et al.	
	019	US-20060253675	11-09-2006	JOHANNES BLOKS; Rudolf Henricus	
	020	US-20100333113	12-30-2010	JOHNSON; Darrin P. et al.	
	021	US-20130054987	02-28-2013	PFEIFFER; Clemens et al.	
	022	US-20130328395	12-12-2013	KRIZMAN; Robert et al.	
	023	US-20160202744	07-14-2016	CASTRO-LEON; Enrique G.	
	024	US-20200167197	05-28-2020	BAHRAMSHAHRY; Armin et al.	
	025	US-20210175710	06-10-2021	CAMPBELL; Jeffrey et al.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 4

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	026	US-20210287309	09-16-2021	GEBHARDT; Eric et al.	
	027	US-20210298195	09-23-2021	BARBOUR; Stephen	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
	001	WO-2020227811-A1	11-19-2020	UPSTREAM DATA INC [CA]		☐

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 3 of 4

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author(in CAPITAL LETTERS),title of the article(when appropriate), title of the item (book,magazine,journal,serial,symposium,catalog,etc.),date,page(s),volume-issue number(s),publisher, city and/or country where published.	T[2]
	001	European Patent Application No. EP18900411.2, Partial Supplementary European Search Report dated September 09, 2021.	☐
	002	Final Office Action mailed 09 August 2021 on for U.S. Patent Application No. 16/529,402, filed on 01 August 2019, 43 pages.	☐
	003	Final Office Action mailed 09 August 2021 on for U.S. Patent Application No. 16/573,577, filed on 17 September 2019, 16 pages.	☐
	004	GHATIKAR et al., "Demand Response Opportunities and Enabling Technologies for DataCenters: Findings from Field Studies," Lawrence Berkeley National Laboratory, August 2012, 57 pages.	☐
	005	International Search Report and Written Opinion of PCT Application No. PCT/US2021/045972, mailed on 15 November 2021, 16 pages.	☐
	006	Notice of Allowance mailed on 09 June 2021 for U.S. Patent Application No. 16/528,348, filed on 31 July 2019, 11 pages.	☐
	007	Notice of Allowance mailed 26 July 2021 on for U.S. Patent Application No. 16/284,610, filed on 25 February 2019, 2 pages.	☐
	008	Notice of Allowance mailed 8 October 2021 on for U.S. Patent Application No. 16/528,348, filed on 31 July 2019, 3 pages.	☐
	009	Notice of Allowance mailed on 24 September 2021 for U.S. Patent Application No. 16/528,348, filed on 31 July 2019, 06 pages.	☐

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

Confirmation No. 7602

Substitute for form 1449/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)	Application Number	16/525142
	Filing Date	07-29-2019
	First Named Inventor	MCNAMARA; Michael T.
	Art Unit	2444
	Examiner Name	SERRAO, RANODHI N
Sheet 4 of 4	Attorney Docket Number	84008-321859 (18-1490-CON)

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ Please charge any required fees or credit any overpayments in connection with this communication to Deposit Account No. 12-0913.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Stephen C. Smith/	Date (YYYY-MM-DD)	December 8, 2021
Name/Print	Stephen C. Smith	Registration Number	56250

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	16525142	Filing Date	2019-07-29	Docket Number (if applicable)	84008-321859	Art Unit	2444
First Named Inventor	Michael T. McNamara			Examiner Name	Serrao, Ranodhi N.		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☒ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____ (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 120913

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

Applicant Signature

PTO/SB/30EFS (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/Stephen C. Smith/	Date (YYYY-MM-DD)	2021-12-08
Name	Stephen C. Smith	Registration Number	56250

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PATENT
Attorney Docket No. 84008-321859
(18-1490-CON)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First named inventor:

Michael T. McNamara

Application No. 16/525,142

Filed: July 29, 2019

Confirmation No. 7602

Group Art Unit: 2444

Examiner: Serrao, Ranodhi N.

For: MANAGING QUEUE DISTRIBUTION BETWEEN CRITICAL DATACENTER AND FLEXIBLE DATACENTER

RESPONSE TO JULY 9, 2021 OFFICE ACTION

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Dear Sir:

This paper responds to the final office action dated July 9, 2021. Applicant submits this paper with a Request for Continued Examination. This response is timely filed and is submitted prior to the statutory filing deadline. Applicant requests a two-month extension of time and directs the USPTO to charge the Applicant's Deposit Account No. 12-0913 the fee associated with this extension. Applicant submits that the rejection dated July 9, 2021 is deficient by failing to establish a *prima facia* case of obviousness and Applicant respectfully requests reconsideration and determination that the claims pending this application are patentable over the prior art of record.

A. Claims

1. (Currently Amended) A system comprising:

a flexible datacenter that is positioned to receive electrical power directly from a power generation system without the received power flowing through a grid comprising:

a behind-the-meter ("BTM") power input system configured to receive power from the [[a]] power generation system prior to the power undergoing step-up transformation for transmission to [[a]]the grid and provide the received power to the flexible datacenter instead of sending the received power to the grid;

a power distribution system; and

a plurality of computing systems powered by the BTM power input system via the power distribution system;

a queue system configured to organize a plurality of computational operations, wherein the queue system comprises multiple queue subsystems, and wherein each queue subsystem organizes a set of computational operations according to rules associated with the queue subsystem; and

a routing control system configured to:

determine, using the queue system, a computational operation to be performed;

determine an amount of BTM power that is available to the plurality of computing systems;

determine whether to route the computational operation to the flexible datacenter using the amount of BTM power that is available; and

based on a determination to route the computational operation to the flexible datacenter, assign the computational operation for performance at the flexible datacenter.

2. (Original) The system of claim 1, wherein the routing control system is a remote master control system positioned remotely from the flexible datacenter.

3. (Original) The system of claim 1, wherein the routing control system is a remote master control system positioned at the flexible datacenter.

4. (Original) The system of claim 1, wherein the flexible datacenter further comprises:

a datacenter control system, wherein the datacenter control system is configured to modulate power delivery to the plurality of computing systems based on one or more monitored power system conditions.

5. (Original) The system of claim 4, wherein the one or more monitored power system conditions comprises:

behind-the-meter ("BTM") power availability at the plurality of computing systems.

6. (Original) The system of claim 4, wherein the one or more monitored power system conditions comprises:

one or more of excess local power generation at a local station level, excess local power generation that a grid cannot receive, local power generation subject to economic curtailment, local power generation subject to reliability curtailment, local power generation subject to power factor correction, low local power generation, start up local power generation situations, transient local power generation situations, or testing local power generation situations where there is an economic advantage to using local behind-the-meter power generation.

7. (Original) The system of claim 1, wherein the flexible datacenter further comprises:

a datacenter control system, wherein the datacenter control system is configured to modulate power delivery to the plurality of computing systems based on an operational directive.

8. (Original) The system of claim 7, wherein the operational directive originates from the routing control system and depends on behind-the-meter ("BTM") power availability at the plurality of computing systems.

9. (Canceled)

10. (Original) The system of claim 1, wherein the routing control system controls distribution of the plurality of computational operations from the queue system.

11. (Original) The system of claim 1, wherein a first queue subsystem of the queue system is located at the flexible datacenter.

12. (Original) The system of claim 11, further comprising:

a second datacenter, wherein a second queue subsystem of the queue system is located at the second datacenter.

13. (Original) The system of claim 12, wherein the second datacenter is a second flexible datacenter.

14. (Currently Amended) A flexible datacenter comprising:

a behind-the-meter ("BTM") power input system configured to receive power from a power generation system prior to the power undergoing step-up transformation for transmission to a grid and provide the received power to the flexible datacenter instead of sending the received power to the grid;

a power distribution system;

a datacenter control system;

a plurality of computing systems, wherein the plurality of computing systems are powered by the BTM power input system via the power distribution system; and

a queue subsystem configured to organize a set of computational operations for performance by the plurality of computing systems, wherein the queue subsystem is part of a distributed queue system;

wherein the datacenter control system is configured to:

determine, using the queue system, a computational operation to be performed;

determine an amount of BTM power that is available to the plurality of computing systems;

determine whether to route the computational operation to the flexible datacenter using the amount of BTM power that is available; and

based on a determination to route the computational operation to the flexible datacenter, assign the computational operation for performance at the flexible datacenter.

15. (Original) The flexible datacenter of claim 14, wherein the distributed queue system includes at least two queue subsystems having different rules for organizing computational operations.

16. (Original) The flexible datacenter of claim 14, wherein the datacenter control system is configured to modulate power delivery to the plurality of computing systems based on an operational directive received from a remote master control system.

17. (Original) The flexible datacenter of claim 16, wherein the remote master control system is positioned remotely from the flexible datacenter.

18-20. (Canceled)

B. Remarks

Claims 1-8 and 10-17 are pending in the application and are rejected. Applicant hereby amends claims 1 and 14. The claim amendments are fully supported by the as-filed specification, such as in paragraphs 33, 50, 73, 75, 79, and 160. Applicant submits that the claims presented herewith are patentable over the prior art of record and expedited reconsideration and allowance is respectfully requested.

Applicant submits that the previously pending claims were patentable over the prior art of record. Applicant submits amended claims in this application to advance prosecution in the subject matter claimed herein and Applicant reserves the right to pursue the prior claimed subject matter in a subsequent continuation application.

I. Double Patenting Rejections

Claim 14 stands rejected under the non-statutory ground of double patenting as being unpatentable over the claims of U.S. Patent No. 10,367,353. Claim 14 also stands rejected under the non-statutory ground of double patenting as being unpatentable over the claims of co-pending U.S. Patent Application No. 16/573,577. The Examiner has agreed to hold these rejections in abeyance until further prosecution is completed.

II. Rejections Under Section 103

Claims 1-8 and 10-17 stand rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent Application Publication No. 2013/0304903 ("Mick") in view of U.S. Patent Application Publication No. 2015/0278968 ("Steven"). Claims 2-8 and 10-13 each ultimately depend from independent claim 1. Claim 14 is in independent form and claims 15-17 each ultimately depend from claim 14. Applicant respectfully traverses.

A. Claims 1-8 and 10-13

Claim 1 is directed to a system and requires:

> a flexible datacenter that is positioned to receive electrical power directly from a power generation system without the received power flowing through a grid comprising:
>
> **a behind-the-meter ("BTM") power input system configured to receive power from the power generation system prior**

to the power undergoing step-up transformation for transmission to the grid and provide the received power to the flexible datacenter instead of sending the received power to the grid;

a power distribution system; and

a plurality of computing systems powered by the BTM power input system via the power distribution system;

a queue system configured to organize a plurality of computational operations, wherein the queue system comprises multiple queue subsystems, and wherein each queue subsystem organizes a set of computational operations according to rules associated with the queue subsystem; and

a routing control system configured to:

determine, using the queue system, a computational operation to be performed;

determine an amount of BTM power that is available to the plurality of computing systems;

determine whether to route the computational operation to the flexible datacenter using the amount of BTM power that is available; and

based on a determination to route the computational operation to the flexible datacenter, assign the computational operation for performance at the flexible datacenter.

The combination of Mick and Steven does not establish a *prima facia* case of obviousness of claim 1 let alone the claims that ultimately depend from claim 1.

Initially, when discussing the prior response submitted by the Applicant, the examiner stated "Since the flexible datacenter is recited in the preamble of the claim, it does not carry patentable weight." The claim term "flexible datacenter" is an limitation of claim 1 (along with the limitations that form a part of the flexible datacenter) and the "flexible datacenter" is not a part of the preamble of the claim. To the extent that the Examiner's rejection discounts the recitation of the structural term "flexible datacenter" this is improper.

Mick is titled "Market-Based Virtual Machine Allocation" and is directed to a system where computing devices that are connected to a cloud computing system that can be

manipulated to manage the load (tasks to be performed) across different cloud computing systems, via bids through a scheduler to optimize performance of the networked computing devices. *See Abstract*, paragraphs 4-5. Mick's cloud computing system include a network that is connected to computing resources that are located in different locations, with a scheduler that is operable to selectively use the different computing resources to balance competing demands for computing capacity on the system. *See* paragraph 10.

The Examiner found that Mick disclosed the claimed "queue system configured to organize a plurality of computational operations" and the claimed "routing control system." The previously claimed "routing control system" limitation has been amended in this response to distinguish Mick (as well as Steven, as discussed below). Specifically, claim 1 now requires "a routing control system configured to determine, using the queue system, a computational operation to be performed; determine an amount of BTM power that is available to the plurality of computing systems; determine whether to route the computational operation to the flexible datacenter using the amount of BTM power that is available … ." This underlined structure is not found in Mick.

Mick does not disclose this subject matter as related to flexible datacenters that are operated with reference to controlling the use of behind-the-meter generated electrical power. In contrast, Mick is solely focused on allocating computing power, or computer processing capability, via an array of computing resources that are operable via a scheduler. Mick discloses:

> Efficient scheduling of a series of short-running tasks can be considered to be an implementation of various box-packing algorithms. Optimal usage is achieved by efficiently allocating lots of small, dynamic tasks across a set of resources. The small nature of each task also for better granularity in scheduling and more even resource usage. Even if a poor allocation is made for one particular task, the long-run impact of that task is minimal. In contrast, a long-running task can have substantial effects over a course of days, months, or even years, making dynamic allocation and rebalancing of tasks a substantial advantage. Further, long-running tasks cannot just be

> canceled and rescheduled; they have state and availability requirements that must be maintained. Mick, paragraph 198.

Mick is not concerned with managing available electrical power to operate computing systems. For example, in paragraph 210, Mick discusses managing the aggregate load of a computer system against its optimal load. One of ordinary skill in the art would understand that this discussion, as well as the remainder of Mick is purely related to computing capability, and not directed in any manner to managing or using electrical power needed to generate that computing power, let alone managing BTM power.

The Examined admitted that Mick failed to teach "a behind-the-meter (BTM) power input system configured to receive power from a power generation system prior to the power undergoing step-up transformation to a transmission grid," "a power distribution system," and "a plurality of computing systems powered by the BTM power input system via the power distribution system." These limitations have been modified herein to require "a behind-the-meter power input system configured to … provide the received power to the flexible datacenter of sending the received power to the grid." Moreover, the claim has been further amended to require "a routing control system configured to … determine an amount of BTM power that is available to the plurality of computing systems; determine whether to route the computational operation to the flexible datacenter using the amount of BTM power that is available." These amended limitations are further not disclosed nor suggested by Mick.

The Examiner applied Steven to purportedly disclose the limitations of claim 1 that are missing from Mick. Steven is directed to "Facilitating Revenue Generation from Data Shifting by Data Centers" (Title) and is directed to a system for "facilitat[ing] data center utilization for generating energy-related revenue from energy markets." Steven, Abstract. The Examiner identified that the limitations missing from Mick were purportedly disclosed in Steven's paragraphs 102, 126, 213, and 440. Steven has been carefully reviewed and Applicant submits that Steven does not disclose or suggest anything related to using BTM power *that is received from a power generation system prior to the power undergoing*

step-up transformation for transmission to the grid, and does not relate to *providing power to a flexible datacenter instead of sending the received power to the grid*, as required by claim 1.

Steven does disclose the concept of "behind the meter" power, but Steven's disclosure of any use of behind the meter power is solely related to *the use of behind the meter power within the facilities of an energy consumer*. Steven has no applicability to the use of BTM power produced by a power generation system.

For example, Steven discloses the following:

- As depicted in the non-limiting example of FIG. 1, the controller 2, the energy storage asset 1 and the energy consuming asset 3 may be located behind a power meter 5. For example, all of the controller 2, the energy storage asset 1 and the energy consuming asset 3 *may be located at one or more facilities of the energy consumer*. Steven, paragraph 102 (emphasis added);

- As depicted in the non-limiting example of FIG. 1, the controller 32, the energy storage asset 31, the energy generating asset 33, and the energy consuming asset 34 may be located behind a power meter 35. For example, all of the controller 32, the energy storage asset 31, the energy generating asset 33, and the energy consuming asset 34 *may be located at one or more facilities of the energy consumer*. Steven, paragraph 123 (emphasis added);

- As depicted in the non-limiting example of FIG. 4, the controller 42, the energy storage asset 41, and the energy generating asset 43 may be located behind a power meter 45. For example, all of the controller 42, the energy storage asset 41, and the energy generating asset 33 *may be located at one or more facilities of the energy consumer*. Steven, paragraph 126 (emphasis added);

- As depicted in the non-limiting example of FIG. 5, the controller 52, and the energy storage asset 51 may be located behind a power meter 53. For example, the controller 52 and the energy storage asset 51 *may be located*

at one or more facilities of the energy consumer. Steven, paragraph 133 (emphasis added).

Figure 1 is reproduced below in an annotated fashion to depict the difference between the subject matter involved by Steven and the subject matter related to the claims of the subject application.

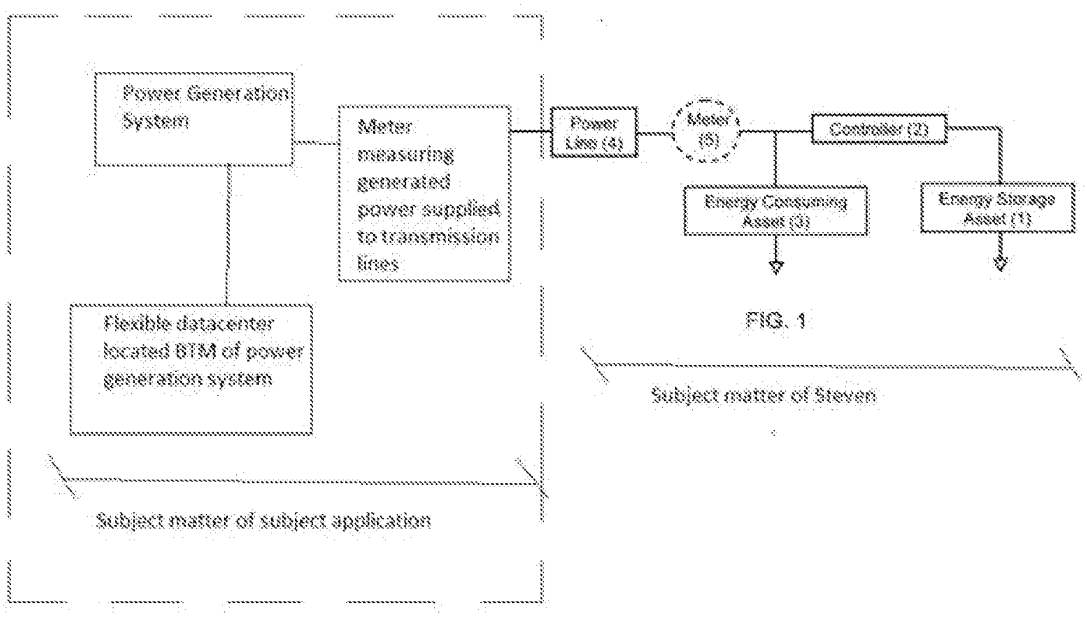


Figure 1 of Steven – annotated to include the subject matter of the claims of the subject application on the opposite side of the transmission power line (4)

One of ordinary skill in the art would understand that in Figure 1 a "power generation system" (as claimed in the claims of the subject application) would be located on the opposite side of the power line (4) from the components depicted in the figure and described in Steven's paragraph 102 that references the figure. Similar annotated versions of Steven's Figures 4 and 5 could also be presented.

Based upon a thorough review of Steven, Applicant submits that Steven does not disclose or suggest the subject matter that is missing from Mick. Steven does not disclose "a behind-the-meter (BTM) power input system configured to receive power from the

power generation system prior to the power undergoing a step-up transformation to the grid and provide the received power to the flexible datacenter instead of sending the received power to the grid" as required by claim 1. Steven further does not disclose or suggest "a routing control system configured to … determine an amount of BTM power that is available to the plurality of computing systems; [and] determine whether to route the computational operation to the flexible datacenter using the amount of BTM power that is available." In contrast, Steven discloses systems where power consumers may take actions and use power behind the consumer's power meter. This is different from the claimed subject matter. A modification of Mick with the limitations of Steven is improper. Because Mick and Steven, assuming arguendo that these references can be properly combined, which Applicant does not admit, the combination of Mick and Steven fails to disclose or suggest all of the limitations of claim 1, let alone claims 2-8 and 10-13 that ultimately depend from claim 1. This rejection should be withdrawn.

B. Claims 14-17

Independent claim 14 is directed to a flexible datacenter and requires:

> **a behind-the-meter ("BTM") power input system configured to receive power from a power generation system prior to the power undergoing step-up transformation for transmission to a grid and provide the received power to the flexible datacenter instead of sending the received power to the grid**;
>
> a power distribution system;
>
> a datacenter control system;
>
> a plurality of computing systems, wherein the plurality of computing systems are powered by the BTM power input system via the power distribution system; and
>
> a queue subsystem configured to organize a set of computational operations for performance by the plurality of computing systems, wherein the queue subsystem is part of a distributed queue system;
>
> **wherein the datacenter control system** is configured to:
>
> determine, using the queue system, a computational operation to be performed;
>
> **determine an amount of BTM power that is available to the plurality of computing systems;**

determine whether to route the computational operation to the flexible datacenter using the amount of BTM power that is available; and

based on a determination to route the computational operation to the flexible datacenter, assign the computational operation for performance at the flexible datacenter.

The Examiner's rejection of independent claim 14-17 as obvious over Mick and Steven is improper because the Examiner has not established a *prima facia* case of obviousness. Mick in combination with Steven does not disclose or suggest all of the limitations of claim 14, let alone the claims that ultimately depend from claim 14.

For example, as discussed above with reference to claim 1, Mick is concerned with scheduling cloud computer resources, but is not concerned with providing or controlling electrical power (from any source) to operate the cloud computing resources that are described by Mick. Mick does not disclose this subject matter as related to flexible datacenters that are operated with reference to controlling the use of behind-the-meter generated electrical power.

Mick is not concerned with managing available electrical power to operate computing systems. For example, in paragraph 210, Mick discusses managing the aggregate load of a computer system against its optimal load. One of ordinary skill in the art would understand that this discussion, as well as the remainder of Mick is purely related to computing capability, and not directed in any manner to managing or using electrical power needed to generate that computing power, let alone managing BTM power.

The Examiner admitted that Mick failed to teach the following limitations: "a behind-the-meter (BTM) power input system configured to receive power from a power generation system prior to the power undergoing step-up transformation for transmission to a grid," "a power distribution system; a datacenter control system," and "a plurality of computing systems, wherein the plurality of computing systems are powered by the BTM power input system via the power distribution system." The Examiner found that these limitations were disclosed by Steven. Mick further does not disclose a BTM system configured to "provide the received power to the set of flexible datacenters instead of

sending the received power to the grid" and a datacenter control system that is configured to "determine an amount of BTM power that is available to the plurality of computing systems; [and] determine whether to route the computational operation to the flexible datacenter using the amount of BTM power that is available" as required by claim 14 herein.

As discussed above with reference to claim 1, Applicant submits that Steven does not disclose or suggest anything related to using BTM power that is received from a power generation system prior to the power undergoing step-up transformation for transmission to the grid, and does not relate to providing the received power to datacenters instead of sending the received power to the grid, as required by claim 16.

Steven does disclose the concept of "behind the meter" power, but Steven's disclosure of any use of behind the meter power is solely related to the *use of behind the meter power within the facilities of an energy consumer*. *See* Steven paragraphs 102, 123, 126, 133; FIGs. 1, 4, 5. Because Steven's disclosure relates to energy manipulation by an energy consumer, Steven does not disclose or suggest the limitations missing from Mick. This rejection should be withdrawn, as well as the rejections of claims 15-17 that each ultimately depend from claim 14.

SUMMARY

Applicant requests expedited examination of the claims submitted herewith. The Examiner is invited to contact the undersigned attorney at 312-214-2112 if such communication would expedite the prosecution of this application.

The Director is authorized to charge any appropriate fees that may be required by this paper, and to credit any overpayment, to Deposit Account No. 12-0913.

Respectfully submitted,

December 8, 2021	/Stephen C. Smith/
Date	Stephen C. Smith, Reg. No. 56,250 Attorney for Applicant

BARNES & THORNBURG
1 N. Wacker Drive
Suite 4400
Chicago, IL 60606
Customer Number 23644

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 November 2020 (19.11.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/227811 A1

(51) International Patent Classification:
G06F 1/20 (2006.01) *G06F 15/00* (2006.01)
G06F 1/26 (2006.01) *H04Q 1/02* (2006.01)

(21) International Application Number:
PCT/CA2020/050426

(22) International Filing Date:
31 March 2020 (31.03.2020)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/848,573 15 May 2019 (15.05.2019) US

(71) Applicant: **UPSTREAM DATA INC.** [CA/CA]; 3210 65 Avenue, Lloydminster, Alberta T9V 3G9 (CA).

(72) Inventor: **BARBOUR, Stephen**; 3210 65 Avenue, Lloydminster, Alberta T9V 3G9 (CA).

(74) Agent: **NISSEN, Robert**; Suite 200, 10328 - 81 Ave., Edmonton, T6E 1X2 (CA).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: PORTABLE BLOCKCHAIN MINING SYSTEM AND METHODS OF USE

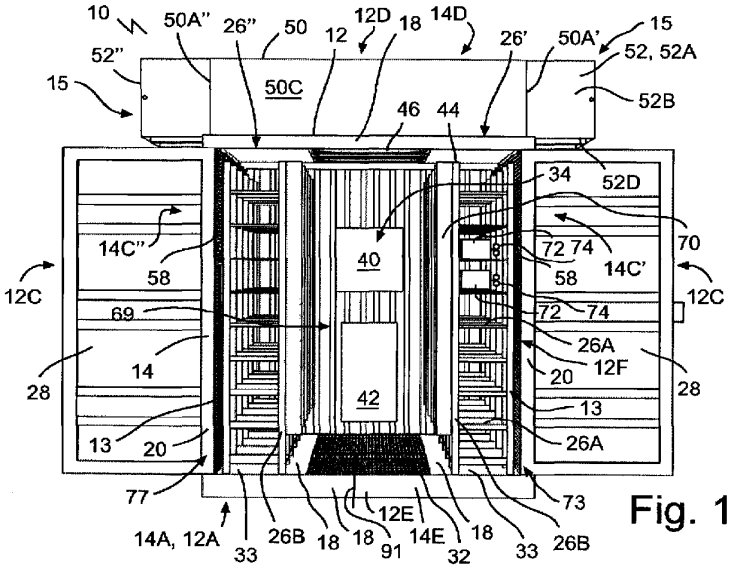


Fig. 1

(57) Abstract: A portable blockchain mining system is disclosed comprising: a portable building; a plurality of blockchain mining processors mounted within, or a plurality of blockchain mining processor mounts located within, an interior of the portable building; an air inlet defined in the portable building; an air outlet defined in the portable building above the air inlet and oriented to direct exhaust air out of the portable building; and a cooling fan connected to convey air through the air inlet, across the plurality of blockchain mining processors and out the air outlet.

[Continued on next page]

WO 2020/227811 A1

Published:
— *with international search report (Art. 21(3))*
— *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

PORTABLE BLOCKCHAIN MINING SYSTEM AND METHODS OF USE

TECHNICAL FIELD

[0001] This document relates to portable blockchain mining systems and methods of use.

BACKGROUND

[0002] Intermodal transport container units are known to be used to house plural cryptocurrency mining processors connected through the internet to verify cryptocurrency transactions. Such units consume enormous amounts of electricity and generate excessive heat as a result.

SUMMARY

[0003] A portable blockchain mining system is disclosed comprising: a portable building; a plurality of blockchain mining processors mounted within, or a plurality of blockchain mining processor mounts located within, an interior of the portable building; an air inlet defined in the portable building; an air outlet defined in the portable building above the air inlet and oriented to direct exhaust air in, for example an upward direction, out of the portable building; and a cooling fan connected to convey air through the air inlet, across the plurality of blockchain mining processors and out the air outlet.

[0004] A plurality of the portable blockchain mining systems may be positioned laterally adjacent one another in close proximity.

[0005] A system is disclosed comprising a portable blockchain mining system and a power source connected to supply power to the portable blockchain mining system.

[0006] A method is disclosed comprising operating the plurality of blockchain mining processors of the portable blockchain mining system.

[0007] A method is disclosed comprising: operating a plurality of blockchain mining processors mounted within an interior of a portable building; and operating a cooling fan to convey air in sequence: through an air inlet into the interior of the portable building; across the plurality of blockchain mining processors; and out of the portable building through an air outlet that is above the air inlet.

[0008] A portable Bitcoin mining data center is disclosed comprising:

a. Two racks / shelves of Bitcoin ASICs separated by an aisle,
b. Airflow from ASICs pointed toward the aisle,
c. Fans drawing negative pressure (below ambient pressure), with fans mounted above the interior, and air drawn in through the side walls through filters, through the intake of the ASICs and out the discharge, into the aisle, upward into the fan intake and discharged into ducting, with air directed out of the building, and the ability to change whether

exhausted air is directed upward and away and/or downward toward the intake, by an adjustable baffle or similar mechanism,

d. optionally the floor is breathable,
e. optionally the portable mining data center building is a seacan,
f. the intake louvers are removable & filters are replaceable from the outside,
g. the side walls are reinforced with a strong, secure and breathable material such as steel grating,
h. two or more portable mining datacenters can be placed in close proximity without warm air entering the other datacenter's intake.

[0009] A portable Bitcoin mining data center is disclosed comprising:

a. two racks / shelves of Bitcoin ASICs separated by an aisle,
b. airflow from ASICs is pointed away from the aisle,
c. the floor is elevated from the ground level, air drawn in through the lower side wall through filters, up through fans mounted under the breathable floor, up into the mining datacenter room creating positive pressure, through the intake of the ASICs on both aisles and out the discharge, out of exhaust louvers, and exhausted upwards and away from datacenter via ducts,
d. optionally the portable mining data center building is a seacan,
e. the intake louvers are removable & filters are replaceable from the outside,
f. the side walls are reinforced with a strong, secure and breathable material such as a steel grating to increase difficulty of break-in,
g. two or more portable mining datacenters can be placed in close proximity without warm air entering the other datacenter's intake,
h. the pusher fans are integral to the mining datacenter, and
i. the pusher fans are integral to a separate skid base stand for the mining datacenter.

[0010] In various embodiments, there may be included any one or more of the following features: The air outlet is oriented to direct exhaust air in an upward direction out of the portable building. A first group of the plurality of blockchain mining processors are mounted adjacent a first side wall of the portable building. A second group of the plurality of blockchain mining processors are mounted adjacent a second side wall of the portable building, the second side wall opposed to the first side wall, with an aisle defined between the first group and the second group. The first group and the second group are mounted on a first rack and a second rack, respectively, with the aisle defined between the first rack and the second rack. The air inlet is defined in a side wall of the portable building. Each blockchain mining processor has associated with it a processor fan, which is oriented to direct air from the air inlet laterally across the respective blockchain mining processor and toward a center of the

interior of the portable building. A security grating defining the air inlet in the side wall. The security grating is one of a plurality of metal security grating panels that collectively define the air inlet; the side wall is formed of a structural frame of beams and columns; and the plurality of metal security grating panels are mounted between the beams and columns. An air filter positioned across the security grating. The air filter is mounted adjacent an exterior of the security grating, with the portable blockchain mining system structured to permit access to the air filter from outside the portable blockchain mining system. A gate securing the air filter adjacent the exterior of the security grating. The gate comprises a louver panel. At least 75% of a total external surface area of the side wall forms the air inlet. The side wall is a first side wall, and the air inlet is also defined in a second side wall of the portable building, the second side wall being opposed to the first side wall. The air outlet and the air inlet are defined in the same side wall or side walls of the portable building. The plurality of blockchain mining processors are mounted adjacent the air outlet above the air inlet. In which the portable building is structured such that in use air moves in sequence: into the portable building through the air inlet; below the plurality of blockchain processors toward a center of an interior of the portable building; and up and laterally over the plurality of blockchain processors and out the air outlet in the side wall. The air outlet and the air inlet are oriented to recirculate air exhausted from the air outlet back into the air inlet. The cooling fan is mounted adjacent the air outlet to pull air through the interior to the air outlet. A roof of the portable building defines an air outlet or a roof air passage to the air outlet. A plenum is mounted on the roof and defines the air outlet. The plenum comprises ducting that extends along the roof to over a lateral side of the portable building where the air outlet is defined by the ducting. The ducting has an open lateral end, and an exhaust guide is mounted for telescopic lateral movement in the open lateral end between a retracted, closed position, and an extended, open position. In the retracted, closed position, the exhaust guide is inset within a plane defined by a respective side wall directly below the open lateral end; and in the extended, open position, the exhaust guide extends laterally away from the side wall and beyond the plane. The exhaust guide has an upper exhaust and a lower exhaust that direct exhaust air in the upward direction and a downward direction, respectively. The exhaust guide has a baffle that is structured to move between: a recirculation position where exhaust air is directed in the downward direction to the air inlet; and a regular position where exhaust air is directed in the upward direction. The baffle has an intermediate position where exhaust air is directed in both the downward direction and the upward direction. The cooling fan is mounted adjacent the roof to pull air through the interior to the air outlet. At least 20% of a total external surface area of the roof forms the air inlet or the roof air passage to the air outlet. A floor of the portable building defines the air inlet or a floor air passage to the air inlet. A floor of the portable building defines the air inlet or a floor air passage to the air inlet. The portable building comprises an upper frame and a lower frame separated by the floor, with the plurality of blockchain mining processors mounted within the upper frame. The cooling fan is mounted adjacent the

floor to push air through the air inlet or floor air passage into the interior. The air inlet is defined in a side wall of the lower frame. A security grating defining the air inlet in the side wall. The security grating is one of a plurality of metal security grating panels that collectively define the air inlet; the side wall is formed of a structural frame of beams and columns; and the plurality of metal security grating panels are mounted between the beams and columns. An air filter positioned across the security grating. The air filter is mounted adjacent an exterior of the security grating, with the portable blockchain mining system structured to permit access to the air filter from outside the portable blockchain mining system. A gate securing the air filter adjacent the exterior of the security grating. The gate comprises a louver panel. At least 75% of a total external surface area of the side wall forms the air inlet. The side wall is a first side wall, and the air inlet is also defined in a second side wall of the lower frame, the second side wall being opposed to the first side wall. The air inlet is also defined in a first end wall and a second end wall of the lower frame, the second end wall being opposed to the first end wall. The air outlet is defined in a side wall of the upper frame. Each blockchain mining processor has associated with it a processor fan, which is oriented to direct air from a center of the interior laterally across the respective blockchain mining processor and toward the air outlet in the side wall of the upper frame. A security grating defining the air outlet in the side wall of the upper frame. The security grating is one of a plurality of metal security grating panels that collectively define the air outlet; the side wall of the upper frame is formed of a structural frame of beams and columns; and the plurality of metal security grating panels are mounted between the beams and columns of the side wall of the upper frame. The side wall of the upper frame comprises a louver panel across the air outlet. At least 75% of a total external surface area of the side wall of the upper frame forms the air outlet. The side wall of the upper frame is a first side wall, and the air outlet is also defined in a second side wall of the upper frame, the second side wall of the upper frame being opposed to the first side wall of the upper frame. An exhaust guide mounted to an exterior of the side wall of the upper frame to direct exhaust air in an upward direction. The exhaust guide comprises a scoop that extends laterally outward from the exterior of the side wall of the upper frame and has an open top end that defines the air outlet. The exhaust guide is moveable between an open position, and a closed position where the exhaust guide is laterally retracted adjacent or into the exterior of the side wall of the upper frame. The exhaust guide is moveable between: an upward position where the exhaust guide directs exhaust air in an upward direction; and a recirculation position where the exhaust guide directs exhaust air in a downward direction toward the air inlet. The air outlet directs exhausted air to recirculate back into the interior of the portable building through the air outlet. The method is carried out in winter. The power source comprises: a source of combustible gas produced from an oil production, storage, or processing facility; and a generator connected to the source of combustible gas. The power source comprises a source of power from other than an oil or gas well, for example the power source comprises grid or other utility power. The

blockchain mining processor has a network interface; the network interface is connected to receive and transmit data through the internet to a network that stores or has access to a blockchain database; and the mining processor is connected to the network interface and adapted to mine transactions into blocks associated with the blockchain database and to communicate with the blockchain database. The network is a peer to peer network; the blockchain database is a distributed database stored on plural nodes in the peer to peer network; and the blockchain database stores transactional information for a digital currency. A controller is connected to operate a ventilation, heating and cooling system to maintain the blockchain mining processor within a predetermined operating range of temperature. The blockchain mining system is mounted on a skid or trailer. The skid or trailer comprises a generator driven by an engine, which is connected to the source of combustible gas. The engine comprises a turbine. The generator and engine may be mounted integral to the skid, trailer, or blockchain mining system. The blockchain mining system comprises an intermodal transport container as the portable building. Operating the blockchain mining system to: mine transactions with the blockchain mining system, for example by mining the most recent block on the blockchain with the blockchain mining system; and communicate wirelessly through the internet to communicate with a blockchain database. The network interfaces comprise one or more of a satellite, cellular, or radio antenna, connected to a modem. Successfully mining a block by a mining processor provides a reward of the digital currency, and the reward is assigned to a digital wallet or address stored on a computer readable medium. The system may run on polyphase (three phase) power or single-phase power.

[0011] These and other aspects of the device and method are set out in the claims, which are incorporated here by reference.

BRIEF DESCRIPTION OF THE FIGURES

[0012] Embodiments will now be described with reference to the figures, in which like reference characters denote like elements, by way of example, and in which:

[0013] Fig. 1 is a perspective rear end view of a portable blockchain mining system.

[0014] Fig. 2 is a perspective rear end view of the portable blockchain mining system of Fig. 1 with the doors removed and the internal fans and plenums shown in dashed lines.

[0015] Fig. 3 is a rear end view of the portable blockchain mining system of Fig. 1 with the exhaust guides of the plenum extended, and dashed lines used to indicate the position of a baffle within the plenum oriented to direct exhaust air downward.

[0016] Fig. 4 is a rear end view of the portable blockchain mining system of Fig. 1 with the exhaust guides of the plenum extended, and dashed lines used to indicate the position of a baffle within the plenum oriented to direct exhaust air upward (the guide on the right) and upward and downward (the guide on the left).

[0017] Fig. 5 is a rear end view of the portable blockchain mining system of Fig. 1 with the exhaust guides of the plenum retracted in a transport mode.

[0018] Figs. 6 and 7 are different rear end perspective views of the portable blockchain mining system of Fig. 1 with the doors closed.

[0019] Figs. 8 and 9 are upper perspective views of a rear end of the portable blockchain mining system of Fig. 1, with Fig. 9 differing from Fig. 8 in that in Fig. 9 one of the plenums is removed to illustrate the location of the cooling fan.

[0020] Fig. 10 is an upper perspective view of a rear end of the blockchain mining system of Fig. 1 with two of the louver gates open and a replacement air filter being inserted.

[0021] Fig. 11 is an upper perspective view of a front end of the blockchain mining system of Fig. 1.

[0022] Fig. 12 is a rear end perspective view of a second embodiment of a blockchain mining system.

[0023] Fig. 13 is a rear end perspective view of the blockchain mining system of Fig. 12 with the doors and the rear wall of the lower frame removed.

[0024] Figs. 14-15 are rear end perspective views of the blockchain mining system of Fig. 12.

[0025] Fig. 16 is an upper perspective view of a rear end of the blockchain mining system of Fig. 12, illustrating the left most exhaust guide in the closed position.

[0026] Fig. 16A is a section view taken along the 16A section lines in Fig. 16, showing the exhaust guide in the open position (solid lines) and closed position (dashed lines).

[0027] Fig. 17 is an upper perspective view of a front end of the blockchain mining system of Fig. 12.

[0028] Fig. 18 is an upper perspective view of a front end of a lower frame of the blockchain mining system of Fig. 12, with one of the louver gates open and a replacement air filter being inserted.

[0029] Fig. 19 is a schematic of the electrical and network components of the blockchain mining system of Figs. 1 and 12.

[0030] Fig. 19A is a top plan view of a plurality of blockchain mining systems in close lateral proximity at a location.

[0031] Fig. 20 is a front perspective view of a further embodiment of a blockchain mining system, with air inlets and outlets on the same side wall and ducting to guide exhaust to recirculate back into the air inlets.

[0032] Figs. 21 and 22 are front and rear perspective view, respectively, of the system of Fig. 20 with the roof removed and made partially transparent to show the interior components.

[0033] Fig. 23 is a front perspective view of the system of Fig. 20 with the roof, door, and exhaust guides removed.

[0034] Fig. 24 is a simplified front elevation view of the system of Fig. 20 with the front door and rear wall removed for clarity.

[0035] Fig. 25 is a simplified front elevation view of the system of Fig. 20 with the front door and exhaust guides removed for clarity.

[0036] Figs. 26 and 27 are simplified front elevation views of the system of Fig. 20 with the front door and rear walls removed, and with the exhaust guides in an upward exhaust mode and a downward, recirculating exhaust mode, respectively, that may be used for summer and winter operation.

DETAILED DESCRIPTION

[0037] Immaterial modifications may be made to the embodiments described here without departing from what is covered by the claims.

[0038] A cryptocurrency (or crypto currency) is a digital asset designed to work as a medium of exchange that uses strong cryptography to secure financial transactions, control the creation of additional units, and verify the transfer of assets. Cryptocurrencies use decentralized control as opposed to centralized digital currency and central banking systems. The decentralized control of each cryptocurrency works through distributed ledger technology, typically a blockchain that serves as a public financial transaction database.

[0039] A blockchain is a form of database, which may be saved as a distributed ledger in a network of nodes that maintains a continuously-growing list of records called blocks. Each block contains a timestamp and a link to a previous block. The data in a block cannot be altered retrospectively without significant computational effort and majority consensus of the network. The first blockchain was conceptualized by Satoshi Nakamoto in 2008 and implemented the following year as a core component of the digital currency, Bitcoin where it serves as the public ledger for all transactions. Through the use of a peer-to-peer network and a distributed timestamping server, a blockchain database is managed autonomously. The administration of Bitcoin currency is currently the primary use for blockchain technology, but there are other use cases for blockchain technology to maintain accurate, tamper-proof databases. Examples include maintaining records of land titles and historical events. While the potential in blockchain technology is vast, Bitcoin remains the most widely used today.

[0040] Altcoins are cryptocurrencies other than Bitcoin. The majority of altcoins are forks of Bitcoin with small uninteresting changes. There are various ways of which altcoins differ from standard Bitcoin processing or structure. For example, altcoins may differ from Bitcoin by having one or more of a) a different proof-of-work algorithm, b) a proof of stake model, or c) an application that either is not

itself a currency or is built on top of a cryptocurrency, such as asset tracking in a supply chain system, or a digital contract system. Since the release of Bitcoin, over 4,000 altcoins have been created.

[0041] By design blockchains are inherently resistant (and assumed to be effectively impervious) to modification of the data — once recorded, the data in a block cannot be altered retroactively without network consensus. Blockchains are an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way. The ledger itself can also be programmed to trigger transactions automatically. Blockchains are secure by design and an example of a distributed computing system with high byzantine fault tolerance. Decentralized consensus can therefore be achieved with a blockchain. This makes the blockchain model suitable for the recording of events, medical records, and other records management activities, identity management, transaction processing and proving provenance. This offers the potential of mass disintermediation and vast repercussions for how global trade is conducted.

[0042] A blockchain facilitates secure online transactions. A blockchain is a decentralized digital ledger that records transactions on thousands of computers globally in such a way that the registered transactions cannot be altered retrospectively. This allows the participants to verify and audit transactions in an inexpensive manner. Transactions are authenticated by mass collaboration powered by collective self-interests. The result is a robust workflow where participants' uncertainty regarding data security is marginal. The use of a blockchain removes the characteristic of infinite reproducibility from a digital asset. It confirms that each unit of digital cash was spent only once, solving the long-standing problem of double spending. Blockchains have been described as a value-exchange protocol. This exchange of value can be completed more quickly, more safely and more cheaply with a blockchain. A blockchain can assign title rights because it provides a record that compels offer and acceptance. From the technical point of view a blockchain is a hashchain inside another hashchain.

[0043] A blockchain database may comprise two kinds of records: transactions and blocks. Blocks may hold batches of valid transactions that are hashed and encoded into a Merkle tree. Each block may include the hash of the prior block in the blockchain, linking the two. Variants of this format were used previously, for example in Git, and may not by itself be sufficient to qualify as a blockchain. The linked blocks form a chain. This iterative process confirms the integrity of the previous block, all the way back to the original genesis block. Some blockchains create a new block as frequently as every five or fewer seconds. As blockchains age they are said to grow in height. Blocks are structured by division into layers.

[0044] Sometimes separate blocks may be validated concurrently, creating a temporary fork. In addition to a secure hash based history, each blockchain has a specified algorithm for scoring different versions of the history so that one with a higher value can be selected over others. Blocks that are not selected for inclusion in the chain are called orphan blocks. Peers supporting the database don't have

exactly the same version of the history at all times, rather they keep the highest scoring version of the database that they currently know of. Whenever a peer receives a higher scoring version (usually the old version with a single new block added) they extend or overwrite their own database and retransmit the improvement to their peers. There is never an absolute guarantee that any particular entry will remain in the best version of the history forever, but because blockchains are typically built to add the score of new blocks onto old blocks and there are incentives to only work on extending with new blocks rather than overwriting old blocks, the probability of an entry becoming superseded goes down exponentially as more blocks are built on top of it, eventually becoming very low. For example, in a blockchain using the proof-of-work system, the chain with the most cumulative proof-of-work is always considered the valid one by the network. In practice there are a number of methods that can demonstrate a sufficient level of computation. Within a blockchain the computation is carried out redundantly rather than in the traditional segregated and parallel manner.

[0045] Maintaining a blockchain database is referred to as mining, which refers to the distributed computational review process performed on each block of data in a block-chain. This allows for achievement of consensus in an environment where neither party knows or trusts each other. Those engaged in Bitcoin mining are rewarded for their effort with newly created Bitcoins and transaction fees, which may be transferred to a digital wallet of a user upon completion of a designated task. Bitcoin miners may be located anywhere globally and may be operated by anyone. The mining hardware is tied to the blockchain network via an internet connection. Thus, little infrastructure is needed to operate and contribute to the system. All that is required to become a Bitcoin miner is the appropriate computer hardware, an internet connection and low cost electricity. The cheaper the electricity the more reward the miner will receive relative to competition, other miners.

[0046] Mining also includes the process of adding transaction records to Bitcoin's public ledger of past transactions. This ledger of past transactions is referred to as the blockchain as it is essentially a chain of blocks. The blockchain serves to confirm transactions to the rest of the network as having taken place. Bitcoin nodes use the blockchain to distinguish legitimate Bitcoin transactions from attempts to re-spend coins that have already been spent elsewhere. Mining may be intentionally designed to be resource-intensive and difficult so that the number of blocks found each day by miners remains steady. Individual blocks may be required to contain a proof-of-work to be considered valid. This proof-of-work is verified by other Bitcoin nodes each time they receive a block. Bitcoin presently uses the hashcash proof-of-work function.

[0047] One purpose of mining is to allow Bitcoin nodes to reach a secure, tamper-resistant consensus. Mining may also be the mechanism used to introduce Bitcoins into the system: Miners are paid any transaction fees as well as a subsidy of newly created coins. This both serves the purpose of disseminating new coins in a decentralized manner as well as motivating people to provide security for

the system. Bitcoin mining is so called because it resembles the mining of other commodities: it requires exertion and it slowly makes new currency available at a rate that resembles the rate at which commodities like gold are mined from the ground.

[0048] Mining requires computational effort in the form of CPU cycles (CPU = central processing unit or central processor) to run a cryptographic hashing algorithm associated with the particular blockchain protocol. For a given mining processor, one can modify the computational effort through changing the core voltage or the clock rate of the processor. Doing so may result in more or less power consumed by the mining processor, and in some embodiments within this document such changes are described as changing the mining activity, or hashrate.

[0049] As the total network computational effort (or hashrate) increases on a blockchain over time, the probability for an individual miner to find a block and receive a reward diminishes. Today the Bitcoin network is so large that most individuals engaged in mining Bitcoin typically mine in pools using protocols such as the Stratum Mining Protocol. Pooling resources allows individual miners to increase their reward frequency as a trade-off for splitting the block reward with the rest of the pool. Miners who are pool mining do not need the associated equipment needed to run a mining node as they only need compute and submit proof-of-work shares issued by the mining pool.

[0050] Since the energy cost of running blockchain mining equipment is its primary operating cost, a trend towards mining on low-cost hydroelectric power has become prevalent. This trend has promoted the centralization of blockchain miners in specific countries with abundant hydroelectric power, as miners who do not have access to cheap hydroelectricity cannot mine profitably because they are competing with the miners who do have access. Bitcoin mining centralization has been occurring in China where there is abundant low cost hydroelectric power. Centralization in blockchain mining is undesirable because the premise behind the blockchain innovation is not to have to trust a third party and to have inherent confidence and security through a decentralized, distributed network. Thus, there exists a need to further decentralize Bitcoin and other blockchain mining through a more decentralized source of low-cost power.

[0051] An intermodal transport container is a large standardized shipping container, designed and built for intermodal freight transport, meaning these containers can be used across different modes of transport – from ship to rail to truck – without unloading and reloading their cargo. Intermodal containers are primarily used to store and transport materials and products efficiently and securely in the global containerized intermodal freight transport system, but smaller numbers are in regional use as well. These containers are known under a number of names, such as simply container, cargo or freight container, ISO container, shipping, sea or ocean container, sea van or (Conex) box, sea can or C can.

[0052] Intermodal transport containers exist in many types and a number of standardized sizes, but ninety percent of the global container fleet are so-called "dry freight" or "general purpose"

containers, durable closed steel boxes, mostly of either twenty or forty feet standard length, although other lengths may be used. In some cases transport containers have a range of lengths from eight to sixty feet. Common heights are eight feet six inches and nine feet six inches, with the latter often referred to as High Cube or Hi-Cube containers, although other heights may be used. Common widths are eight feet, although other widths may be used such as six foot three inches, eight foot six inches, or larger or smaller. Transport containers are a means to bundle cargo and goods into larger, unitized loads, that can be easily handled, moved, and stacked, and that will pack tightly in a ship or yard. Intermodal containers share a number of key construction features to withstand the stresses of intermodal shipping, to facilitate their handling and to allow stacking, as well as being identifiable through their individual, unique ISO 6346 reporting mark.

[0053] Transport containers may be transferred between rail, truck, and ship by container cranes at container terminals. Forklifts, reach stackers, straddle carriers, and cranes may be used to load and unload trucks or trains outside of container terminals. Swap bodies, sidelifters, tilt deck trucks, and hook trucks may allow transfer to and from trucks with no extra equipment. ISO-standard containers can be handled and lifted in a variety of ways by their corner fixtures, but the structure and strength of forty five-foot (type E) containers limits their tolerance of side-lifting, nor can they be forklifted, based on ISO 3874 (1997).

[0054] Transport containers can be transported by container ship, truck and freight trains as part of a single journey without unpacking. Transport containers often include corrugated walls for strength. Each corner of the container may include a twistlock fitting or other fitting for securing the container to other containers and to various transportation devices such as a container trailer for a road-based tractor unit. Reinforcing beams may span the edges of the container, for example the vertical columns that make up the four corners between sidewalls, and the horizontal beams that make up the longitudinal and lateral side edges of the base of the container.

[0055] Half the containers that enter the United States are believed to leave empty. The value of such containers in the U.S. is thus lower than in China, and such containers are thus available for use with non-freight-related purposes. For example, the U.S. military often used its Conex containers as on-site storage, or easily transportable housing for command staff and medical clinics. Repurposing used shipping containers offers a practical solution to both social and ecological problems.

[0056] A transport container may be used to provide a modular data center system, which is a portable method of deploying data center capacity at a remote location. A modular data center may be placed anywhere data capacity is needed. A modular data center system may include purpose-engineered modules and components to offer scalable data center capacity with multiple power and cooling options. Modules may be shipped to be added, integrated or retrofitted into an existing data center or combined into a system of modules. Modular data centers typically consist of standardized

components. A modular data center may fit data center equipment (servers, storage and networking equipment) into a standard shipping container, which is then transported to a desired location. A containerized data center may come outfitted with its own cooling system.

[0057] Referring to Figs. 1-11, a portable blockchain mining system 10 is disclosed, comprising a portable building, such as a transport container 12, an air inlet 13, an air outlet 15, and a cooling fan 48. The portable building / portable system 10 may be a self-contained unit that can be moved by truck, trailer, railcar, forklift, container lifter, or other suitable method of lifting an intermodal shipping container, and placed on a ground surface at a suitable remote location, with the ability to operate fully self-contained or only requiring a source of power to be connected (although other connections may be made such as connections to internet lines, utility lines, and others). Referring to Fig. 1, system 10 a plurality of mounts (such as racks 26) suitable for blockchain mining processors 72 may be structured within interior 12F. In some embodiments the racks 26 or other mounts are vacant, and in some cases a plurality of processors 72 may themselves be mounted within an interior 12F of the transport container 12. Referring to Figs. 1, 2, 10, and 11, the transport container 12 may have a front end wall 12A, a rear end wall 12B, side walls 12C, a roof 12D, and a base 12E, which may collectively define interior 12F. In this document, the suffixes ‘ and ‘‘ may be appended to reference characters to indicate that there are more than one of the respective part, for example there are two side walls 12C’ and 12C’’, and it should be understood that a reference to a part name without the suffix in one of the description or drawings may refer to a part name with the respective suffix in the other of the description or drawings. The air inlet 13 and air outlet 15 may be defined in the transport container 12. For example inlet 13 may be defined by side walls 12C, and the outlet 15 may be defined by roof 12D. Referring to Figs. 2 and 9, the cooling fan 48 may be connected to convey air through the air inlet 13 (for example into interior 12F), across the plurality of blockchain mining processors 72 (Fig. 1) and out the air outlet 15. The air outlet 15 may be defined above the air inlet 13 (when the base 12E is resting on a horizontal ground surface as shown) and oriented to direct exhaust air out of the transport container 12, for example in an upward direction 17.

[0058] Referring to Figs. 1-2, 8-9, and 11, the container 12 may be formed by a structural frame 14. Frame 14 may have a front end wall 14A, a rear end wall 14B, side walls 14C, a roof 14D, and a base (floor 14E), which may collectively define interior 12F of container 12. In the example of Figs. 1-11, at least end walls 12A and 14A, end walls 12B and 14B, side walls 12C and 14C, and base 12E and floor 14E, respectively, are effectively the same parts, however, such parts may be different in the example of Figs. 12-18 where the container 12 includes a lower structural frame 16 below the upper frame 14 as will be discussed below in further detail. References to characteristics of walls 14C or 12C may be applicable to the other of walls 12C and 14C. Referring to Figs. 1-2, 8-9, and 11, frame 14 may be formed by a network of beams 18 and columns 20, for example horizontal beams 18 and vertical

columns 20 as shown. Beams 18 and columns 20 may support a suitable cladding, such as doors, metal gratings (such as steel grating panels 32, 46, and 58 discussed further below) and panels (such as corrugated rear end panel 19 discussed further below) that may collectively define the exterior 12G of the container 12. Columns and beams may be formed by suitable structural components, such as metal planks, box-beams, I-beams, angle-beams, or C-beams, made of sufficient rigidity and strength to support the frame 14 and parts mounted thereon in use. The transport container 12 may be an intermodal transport container, or may be a modified intermodal transport container, or may have the dimensions of an intermodal transport container. Referring to Figs. 1 and 6-7, container 12 may provide a suitable mechanism to access the interior of the container 12. Container 12 may mount a door or doors 28. In the example shown doors 28 secure open rear end 12A to selectively permit or restrict access to the interior 12F. Doors 28 may include a suitable lock 30 to secure the interior 12F from unwanted intrusion. Other surfaces, such as end wall 12B may themselves form part of the cladding envelope of the container (such as if end wall 12B was one of the corrugated steel walls of a transport container as shown) or be covered by cladding panels.

[0059] Referring to Figs. 1-2 and 8-9, suitable racks 26 or other mounts may be provided to mount processors 72 within interior 12F of container 12. In the example shown one or more racks 26 may be used to mount the processors 72. Each rack 26 may have a suitable structural frame, for example made of shelves 26A and columns 26B. Beams (not shown) may be used for each rack 26. Suitable computing infrastructure may be provided, such as power distribution units (PDUs) 70 that may be used to bus cabling between electrical and network equipment. Processors 72 (Fig. 1) may be mounted in a suitable fashion, such as fastened by fasteners to racks 26, or may rest by gravity upon shelves 26A. Shelves 26A and other processor mounts may be stacked horizontally and vertically to efficiently populate the interior 12F of container 12, for example shelves 26A may run substantially or entirely from end 12A to end wall 12B, and from floor 14E to roof 14D.

[0060] Referring to Figs. 1-2 and 8-9, processors 72 may be arranged in a suitable fashion within interior 12F. A group 73, such as a first group, of the plurality of blockchain mining processors 72 may be mounted adjacent a first wall, such as side wall 14C'. A second group 77 of processors 72 may be mounted adjacent a second wall, such as side wall 14C'' opposed to wall 14C'. An aisle 34 may be defined between the first group 73 and the second group 77 (for example between racks 26' and 26'). The aisle 34 may be of sufficient width to permit a user to access all the processors 72 of either group 73 or 77. Processors 72 in each rack 26 may be mounted in a suitable series of rows, such as a vertical stack of plural rows each a single processor 72 deep laterally between aisle 34 and respective wall 14C. Racks 26 may be designed to maximize air flow laterally across each shelf 26A for maximum cooling of each processor 72.

[0061] Referring to Figs. 2, 8, and 9, the air inlet 13 may be defined in a side wall 12C, such as wall 14C, of the transport container 12. By forming the inlet 13 in wall 14C, airflow may travel from exterior 12G of container 12, through wall 14C, and laterally across processors 72, absorbing heat from processors 72 in the process. Referring to Fig. 2, each blockchain mining processor 72 may have associated with it a processor fan 74, which is oriented to direct air from the air inlet 13 laterally (for example horizontally) across the respective blockchain mining processor 72 and toward a center aisle 69 of the interior 12F of the transport container 12.

[0062] Referring to Figs. 2, 9, and 10, the system 10 may incorporate a mechanism for securing the air inlet 13 in the side walls 14C from unwanted intrusion, whilst permitting sufficient airflow therethrough. A security grating panel 58 may define the air inlet 13 in the side wall 14C. The security grating panel 58 may be one of a plurality of metal security grating panels 58 that collectively define the air inlet 13 as shown. The plurality of metal security grating panels 58 may be mounted across gaps between a lattice of beams 18 and columns 20 of frame 14. Suitable metal grating panels may comprise chain link fence panels, forming air gaps structured to have maximum lateral dimensions of insufficient size to permit unwanted entry into interior 12F of a limb of a potential thief.

[0063] Referring to Figs. 2, 9, and 10, the air inlet 13 may be defined in more than one side surface of container 12, for example the air inlet 13 may be defined in opposed side walls 14C, and in some cases in one or both end walls 14A and 14B. The air inlet 13 may be structured to provide sufficient breathability to adequately cool the processors 72 operating within interior 12F. For example, at least 75%, for example 90% or higher, of a total external surface area of side wall 14C, for example side walls 14C' and 14C'', may form the air inlet 13. In the example shown the only part of the total external surface area of each side wall 14C that is not breathable are the portions attributable to beams and columns 18 and 20, respectively. The inlet 13 may be structured with uniform porosity or pressure drop across the breathable surface area of the inlet 13 to maximize the chance of uniform and consistent air flow across each processor 72 regardless of location of the processor 72 adjacent the side wall 14C.

[0064] Referring to Figs. 2 and 8-10, air inlet 13 may be provided with a suitable air filter 60 to remove unwanted contaminants from incoming air flow. Unwanted contaminants include dirt, oil, smoke, debris, and some chemicals, all of which may otherwise damage over time processors 72 or other network or electrical equipment operating within container 12. A suitable air filter may comprise a porous foam filter, such as comparable to a cabin air filter in a vehicle, or a furnace filter for a home or commercial furnace. In some cases, a fiberglass or hair filter may be used, such as a blue hogs hair style filter roll (synthetic). The filter may be cut to fit and breathable. The air filter 60 may be positioned across the security grating panel 58, for example in use a plurality of filters 60 may be positioned across the plurality of panels 58 (only one filter 60 is shown in Figs. 9 and 10 but each inlet 13 defined between beams 18 and columns 20 may locate a respective filter 60).

[0065] Referring to Figs. 2, 8-9, 9A, and 10, each air filter 60 may be mounted to permit access to the air filter 60 from outside the portable blockchain mining system 10. Each air filter 60 may be mounted adjacent a security grating panel 58, for example adjacent an exterior face 58A of the security grating panel 58. A gate, such as a louver panel 56, may secure the air filter 60 adjacent the exterior face 58A of the security grating panel 58. A louver panel 56 may comprise a suitable frame 56A mounting rows of louvers 56B, which in some cases are adjustable as to pitch (for example if the louvers are mounted to pivot about axial hinges - in some cases an actuator is provided to control all or groups of louvers). In other cases, a grating panel, an open perimeter frame, or another suitable securing mechanism may be used to secure the air filter 60 to the container 12. A lock (not shown) may be provided on each such gate to secure same in the closed position to prevent unwanted removal of the air filter 60. By permitting access to air filter 60 from outside the system 10, maintenance can be carried out on the system 10 (i.e. filter replacement, see Fig. 10), without requiring access to the interior 12F. Referring to Fig. 10, each gate, such as louver panels 56, may be mounted to open and close, for example to swing about a hinge 56C as shown, or to be removable for example by sliding out of a retainer frame (not shown) on side wall 14C to gain access to filters 60. Louver panels may form rain guards (for example when louvers 56 are pointed downward in a direction moving away from the container 12) that keep moisture and other elements out of contact with grating panels.

[0066] Referring to Figs. 2 and 8-9, a roof 12D of the transport container 12 may be structured to pass exhaust air from interior 12F to outside the container 12. For example, the roof 12D may define air outlet 15 or a roof air passage 79 to the air outlet 15. The roof 12D may comprising one or more grating panels (not shown) or other openings to define roof air passage 79. In the example shown roof 12D defines circular openings 48D arranged in a series down the center of the roof 12D from end 12A to end wall 12B. Each opening 48D may mount a respective cooling fan 48 (in the example shown there are five fans 48 each located at a respective opening 48D) from end 12A to end wall 12B. The roof 12D (which is also the roof 14D of frame 14 in the example) may be formed with non-breathable panels 44, for example on either side of the series of fans 48. The fans 48 are shown mounted on top of the roof 12D, but could be mounted to an underside of the roof 12D, or otherwise adjacent the roof 12D above or below the roof 12D at a suitable location. The roof 12D may form an air flow passage 79 or air outlet 15 of sufficient cross-sectional area to minimize drag on exhaust air and improve cooling and efficiency. In one case at least 20% or higher, such as at least 33%, 50%, 75%, or higher, of a total external surface area of the roof 12D forms the air outlet 15 or the roof air passage 79 to the air outlet 15. Total external surface areas in this document refer to the area of an external face of the part referenced.

[0067] Referring to Figs. 2, 3, and 9, each cooling fan 48 may be mounted adjacent the roof 12D to pull air through the interior 12F to the air outlet 15. In some cases, the fans 48 may themselves define the outlet 15, for example if plenum 50 were omitted (plenum 50 is discussed further below).

With an air outlet 15 in the roof 12D, or adjacent or above the roof 12D, heated exhaust air is discharged from a relatively higher position than intake air is drawn into container 12, reducing the chance of unwanted recirculation of heated exhaust air into the inlets of adjacent systems 10, thus reducing a minimum lateral separation distance between laterally adjacent systems 10. By mounting fan 48 downstream of processors 72, the fans 48 create negative pressure in the data center (interior 12F). Referring to Fig. 19, an example top plan schematic is shown to illustrate the lateral spacing distances 82 possible between adjacent systems 10. In some cases, an acceptable spacing distance 82 may be five feet, ten feet, or greater between adjacent side walls 14C. In some cases, spacing distances 82 are four to six feet.

[0068] Referring to Fig. 9, each fan 48 may have a suitable structure. In the example shown the fan 48 is an axial fan, with a motor 48A and a propeller 48B attached thereto. The propeller 48B is mounted to rotate within a suitable frame 48C, which may define a circular axial opening 48D. A grating panel (not shown) may be provided across the opening 48D for safety or to otherwise protect the fan 48 and prevent inadvertent contact with the operating fan 48. Other types of fans 48 may be used, such as a centrifugal fan (not shown).

[0069] Referring to Figs. 2-5 and 8-9, ducting may be provided to selectively guide exhaust air out of container 12. In the example shown a plenum 50 is mounted on the roof 12D and defines the air outlet 15. The plenum 50 may comprise (for example form as shown) ducting that extends along the roof 12D to direct exhaust air out (from an outlet 15 defined) at a location above a lateral side or side walls 12C of the transport container 12. Each plenum 50 may have a top wall 50B, rear and front walls 50C, and lateral ends 50A, which may be open ends as shown. Thus, in the example shown, exhaust air passes upward from interior 12F through passage 79, into plenum 50, and out toward lateral ends 50A. Ducting may be made of suitable materials such as sheet metal.

[0070] Referring to Figs. 3 and 9, the lateral end or ends 50A may guide exhaust air selectively up, down, or both up and down as the user may select or desire depending on context. One or both lateral ends 50A may be open ended or otherwise structured to exhaust air. Referring to Figs. 3-5, an exhaust guide 52 may be mounted or structured in each open lateral end 50A. In the example shown each guide 52 has a lateral end wall 52A bounded by side walls 52B, and with an open top end 52C defining the air outlet 15. Thus, as exhaust air travels through shroud or plenum 50, such air may exit plenum 50 via open top end 52C.

[0071] Referring to Figs. 3-5, guide 52 may be structured to extend and retract. In the example shown each guide 52 is telescopically moveable relative to (for example with an interior of, plenum 50, between a retracted, closed position (Fig. 5), and an extended, open position (Figs. 3-4). The retracted, closed position (Fig. 5) may be used for transport or while the system 10 is non-operational, or another suitable time. In some cases, some of the guides 52 may be closed and some opened, for example all the

guides 52 on one side of the container may be closed and the guides on the other side open. The extended, open position (Figs. 3-4 may be used while the system 10 is operating. Referring to Fig. 5, while in the retracted, closed position, the exhaust guide 52 may be inset within a plane 86 defined by a respective side wall 12C directly below the open lateral end 50A. Referring to Figs. 3-4, while in the extended, open position, the exhaust guide 52 may extend laterally away from the side wall 12C and beyond the plane 86.

[0072] Referring to Figs. 3-4, each guide 52 (or another suitable part of plenum 50 or roof 12D) may be structured to selectively recirculate warmed exhaust air into the air inlet 13. Referring to Fig. 4, in a regular mode / regular position, the guide 52 may be oriented to direct exhaust air in an upward direction 90. Such direction may be achieved using a suitable part such as a baffle 54. The baffle 54 may be mounted to adjust orientation, for example the baffle 54 may be pivotally mounted to end wall 52A at a pivot hinge 54C. By pointing a tip end 54E of baffle 54 downward onto a base of plenum 50 or a top of roof 12D, exhaust air travels up the slope of baffle 54 and exits open top end 52C of guide 52. Referring to Fig. 3, in a recirculation mode / recirculation position, the guide 52 may be oriented to direct exhaust air in a downward direction 92, for example toward inlet 13. In order to achieve selective exhausting as previously described, the exhaust guide 52 may have an upper exhaust (open top end 52C), and a lower exhaust (open base end 52D) that direct exhaust air in the upward direction and a downward direction, respectively. With the baffle 54 adjusted such that the tip end 54E contacts or is adjacent an underside of top wall 50B of plenum 50, exhaust air travels down the slope of baffle 54 and exits open bottom end 52D of guide 52. Because guides 52 are shown located above inlet 13, by directing air downward, warmed exhaust air recirculates into inlet 13. Recirculating exhaust air into the air inlet 13 may seem counterintuitive, however, such may be advantageous in colder weather, where the ambient temperature is below a threshold temperature, such as minus twenty degrees Celsius, of desired operation of the processors 72. If the intake air is too cold, it may cause damage or lowered functionality of processors 72, and may frost up and block the air inlet 13.

[0073] The baffle 54 or other suitable selective air direction control may be controlled by suitable means. The baffle 54 may be adjusted by manual, mechanical, or electronic means, and may be done on demand or automatically according to a schedule. A controller, such as controller 40 (Fig. 19) may be used to adjust the position of baffle 54. In one case, the container 12 mounts a thermometer (not shown), and the controller 40 adjusts baffle 54 in response to signals from the thermometer, for example to increase recirculation as temperature drops or crosses a threshold temperature. Referring to Fig. 4, in the example shown, the baffle 54 may have an intermediate position (shown in the dashed lines on the left most baffle 54) where the baffle 54 exhausts heated air in upward and downward directions 90, 92, respectively. The intermediate position may comprise a range of positions and may the precise position of the baffle 54 may be selected to optimize operation of processors 72. Adjustable baffles may allow

air to be efficiently moved back to the intake without requiring a secondary fan or blower, or more complicated apparatus.

[0074] Referring to Figs. 1, 2, and 8, a floor of the container 12 may be structured to pass air into the interior 12F. For example, the floor 14E may be made to be breathable as shown. Thus, the floor 14E may function as an air inlet 13, for example a secondary inlet in the case of the embodiment shown. The floor 14E may comprise one or more grating panels 32 or other openings. In the example shown floor 14E may form an air flow passage 91 or air inlet 13 of sufficient cross-sectional area to minimize drag on intake air and improve cooling and efficiency. In one case at least 20% or higher, such as at least 33%, 50%, 75%, or higher, of a total external surface area of the floor 14E forms the air inlet 13 or the air passage 91 from the air inlet 13. The base 12E (which is also the floor 14E of frame 14 in the example) may be formed with non-breathable panels 33, for example on either side of grating panel 32. A breathable floor may be advantageous in a negative pressure cooling example (as shown) by reducing the possibility of a deleterious pressure drop (that would otherwise result in stoppage of air circulation) within the interior 12F caused by a blockage at one or more inlets 13.

[0075] Referring to Fig. 19, a schematic is illustrated for carrying out a method of mining a blockchain. A power source 64, such as a generator (or generator set or grid / utility power source) is connected to provide electricity to plurality of blockchain mining processors 72. One example of a power source 64 is provided by a generator connected to use a source of fuel, such as combustible gas produced from an oil production, storage, or processing facility, such as a production well 65, to supply generator (power source 64). Electricity may travel from power source 64 through suitable components, such as overload protection systems such as breakers 38 and/or fusible disconnects. A transformer 66 may be provided to modify the incoming voltage and current as desired. The incoming current may pass through a splitter 36, for example a busgutter that splits power along various busbars. The incoming electricity may be used for various functions. For example, electricity passes from splitter 36 into processors 72, optionally passing through breakers 38 and power distribution units 70 (PDU) as desired. Each processor 72, such as an ASIC (application specific integrated circuit) or GPU (graphic processing unit) unit, may have an onboard fan 74 associated with the processor 72 for cooling the processor 72. Each PDU 70 may power one or a group of more than one processor 72. Each processor 72 carries out a mining-related calculation or other suitable process, and communicates with the internet via a suitable system, such as a modem 75. Suitable componentry such as a transmitter / receiver (satellite or otherwise, including components that are connected to the internet via wireless or wired methods) may be provided to permit communication between the modem 75 and internet.

[0076] Referring to Fig. 19, various control or monitoring devices may be used, such as switch 76 and controller 40, to regulate operation of processors 72, PDUs 70, power source 64, breakers, fans, and/or to permit remote or on-site operation and control of each processor 72. The splitter 36 may power

such components, including modem 75, in a suitable fashion. Power (electricity) may travel to a lighting panel 42 (such as a panelboard), and provide power to various components. Power may travel from panel 42 to a battery 68 (which may form an uninterrupted power supply) that powers modem 75, switch(es) 76 and controller 40 as needed, to maintain operations even in the event of a power outage. Other backup power sources may be provided, such as a secondary generator, which may be programmed or controlled to start up in the event of an outage. Panel 42 may also control various basic functions in container 12, such as operation of lighting systems 78 or heating or cooling systems. Fans 48 may be controlled, for example by passing power to one or more variable frequency drives 80 to control fan speed, with such drives 80 each being connected, for example via a fuse 83 or fuse box, to a respective fan motor 48A, to operate and rotate a respective set of fan propeller 48B.

[0077] Referring to Figs. 1 and 11, electrical and network components may be mounted at suitable locations on or in the container 12. For example, referring to Fig. 1, controller 40 and lighting panel 42 may be mounted to front end wall 12B in interior 12F, to be accessible only within interior 12F. Referring to Fig. 11, various other components may be suitable to mount to the exterior of the container 12. For example, splitter 36 and fuses or breakers 38 may be mounted to front end 12B of container 12. Power and network cables may be run about the interior 12F and exterior of the container 12 as is required to make the container 12 operational and connect the device to an external power source. In some cases, a power source is provided on board, for example a generator mounted on the container 12 (not shown).

[0078] Referring to Figs. 1-2, 4, and 8, and 19, a method of operation of the embodiment shown is now described. Referring to Fig. 19, with the system 10 turned on and power connected from power source 64 to operate processors 72, processors 72 may carry out a blockchain mining operation or other data processing or computational task. The blockchain mining processors 72 may be used to mine transactions, and communicate through the internet with a blockchain database, such as the Bitcoin public ledger. While the processors 72 are operating, they generate heat, which must be dissipated to ensure maximum longevity and optimal operation of processors 72. Thus, fans 48 are operated to draw air into interior 12F through air inlets 13 in side walls 14C. Cool air enters container 12 laterally through opposed side walls 14C and crosses laterally past processors 72 via direction lines 93, where the air is directed toward center aisle 34, with additional energy provided to incoming air via fans 74 on each processor 72. The air has now been warmed by contact with processors 72, and the warm exhaust air passes along direction lines 95 through roof 12D past the fans 48 into plenum 50, towards lateral ends 50A of plenum 50.

[0079] Referring to Figs. 1-2, 4, and 8, once in plenum 50, the warmed exhaust air is directed upward by baffles 54 and exits guides 52 in upward directions 90. Referring to Fig. 3, if it is desired to recirculate any of the warmed exhaust air back through the inlet 13, for example if the external ambient

temperature has dropped below a threshold low temperature, then baffle 54 may be adjusted such that, at the end of the circulation cycle, warmed exhaust air exits guides 52 in downward directions 92 toward inlets 13. Referring to Fig. 4, if only some recirculation is desired, for example at ambient temperatures within a range of temperatures above the threshold low temperature but below a threshold high temperature (above which the baffle 54 would exhaust fully in the upward direction 90), then baffle 54 is adjusted to an intermediate position to permit an intermediate proportion of recirculation of warmed exhaust air. Sensors (not shown) may monitor internal temperature in the container 12 and/or processors 72, and fan 48 speed and proportion of recirculation may be adjusted to maintain such temperatures within a desired range of acceptable operating temperatures.

[0080] Referring to Figs. 12-17, another embodiment of a portable blockchain mining system 10 is disclosed, comprising a transport container 12, an air inlet 13, an air outlet 15, and a cooling fan 48. System 10 of Figs. 12-17 incorporates many of the components and operates according to many of the same principles as system 10 of Figs. 1 - 11, with some exceptions discussed below. The primary distinction between the two example systems 10 is that both systems operate via a different air flow process.

[0081] Referring to Figs. 12-13, a floor of the container 12 may be structured to pass air into the interior 12F. A floor of the transport container 12 may define the air inlet 13 or a floor air passage 98 to the air inlet 13. In the example shown, floor 14E defines a floor air passage 98. In the example shown, the transport container 12 comprises an upper frame 14 and a lower frame 16 separated by a floor 14E. The plurality of blockchain mining processors 72 may be mounted within the upper frame 14.

[0082] Referring to Figs. 13 and 18, the cooling fan 48 may be located at a suitable position. The cooling fan 48 may be mounted adjacent the floor 14E to push air through the air inlet 13 or floor air passage 98 into the interior 12F. In the example shown the fan 48 is mounted to an underside of floor 14E, although in other cases fan 48 may be mounted to a top side of floor 14E, or otherwise adjacent floor 14E. By mounting fan 48 upstream of processors 72, the fans 48 create positive pressure in the data center (interior 12F). Positive pressure may be advantageous over negative pressure as higher air pressure means increased air density and relatively more heat exchange, and thus higher potential power consumption by processors 72.

[0083] Referring to Figs. 13 and 18, lower frame 16 may have a suitable structure. Frame 16 may be formed as a ground skid or other structural framework for elevating (boosting) frame 14 a suitable distance, such as between one to three feet or more or less off of the ground in use. Structural frame 16 may be formed by a network of beams 22 and columns 24, for example horizontal beams 22 and vertical columns 24 as shown. Beams 22 and columns 24 may have any of the characteristics and incorporate any of the features as described above for beams 18 and columns 20, respectively, of upper frame 14, and frame 16 may have any of the characteristics and incorporate any of the features as frame

14 as described above. Frame 16 may support a suitable cladding, such as doors, metal gratings (such as gratings 32, 46, and 58 discussed elsewhere) and panels (such as a corrugated panel discussed elsewhere) that may collectively define an exterior 16G of the frame 16. Suitable gratings include steel or aluminum square or rectangular grating, such as walkway panel grating.

[0084] Referring to Figs. 13 and 18, the air inlet 13 may be defined in a side wall 16C of frame 16. Similar to as described above for the embodiment of Fig. 1, the system 10 of Figs. 13 and 18 may incorporate a mechanism for securing the air inlet 13 in the side walls 16C from unwanted intrusion, whilst permitting sufficient airflow therethrough. Referring to Fig. 18, a security grating panel 58 may define the air inlet 13 in the side wall 16C. The security grating panel 58 may be one of a plurality of metal security grating panels 58 that collectively define the air inlet 13 as shown. The plurality of metal security grating panels 58 may be mounted across gaps between a lattice of beams 22 and columns 24 of frame 16. Suitable metal grating panels may comprise chain link fence panels, forming air gaps structured to have maximum lateral dimensions of insufficient size to permit unwanted entry into interior 16F of a limb of a potential thief. In some cases, no security panels or security features are used to protect the interior 16F due to the fact that there is no expensive equipment (computers, network equipment) present within interior 16F if such is the case.

[0085] Referring to Fig. 13, the air inlet 13 may be defined in more than one side surface of frame 16, for example the air inlet 13 may be defined in opposed side walls 16C, and in some cases in one or both end walls 16A and 16B of frame 16. The air inlet 13 may be structured to provide sufficient breathability to adequately cool the processors 72 operating within interior 12F. For example, at least 75%, for example 90% or higher, of a total external surface area of side wall 16C, for example side walls 16C' and 16C'', may form the air inlet 13. In the example shown the only part of the total external surface area of each side wall 16C that is not breathable are the portions attributable to beams and columns 22 and 24, respectively. The inlet 13 may be structured with uniform porosity or pressure drop across the breathable surface area of the inlet 13 to maximize the chance of uniform and consistent air flow across the walls 16A-C.

[0086] Referring to Fig. 18, air inlet 13 may be provided with a suitable air filter 60 to remove unwanted contaminants from incoming air flow. A suitable air filter may comprise a porous foam filter, such as comparable to a cabin air filter in a vehicle, or a furnace filter for a home or commercial furnace. The air filter 60 may be positioned across the security grating panel 58, for example in use a plurality of filters 60 may be positioned across the plurality of panels 58.

[0087] Referring to Fig. 18, each air filter 60 may be mounted to permit access to the air filter 60 from outside the portable blockchain mining system 10. Each air filter 60 may be mounted adjacent a security grating panel 58, for example adjacent an exterior face 58A of the security grating panel 58. A gate, such as a louver panel 56, may secure the air filter 60 adjacent the exterior face 58A of the security

grating panel 58. A lock (not shown) may be provided on each such gate to secure same in the closed position to prevent unwanted removal of the air filter 60. By permitting access to air filter 60 from outside the system 10, maintenance can be carried out on the system 10 (i.e. filter replacement, see Fig. 10), without requiring access to the interior 16F. Each gate, such as louver panels 56, may be mounted to open and close, or to be removable for example by sliding out of a retainer frame.

[0088] Referring to Figs. 12-13 and 16-17, the air outlet 15 may be defined in a side wall 14C of the upper frame 14. Referring to Figs. 12 and 13, the fans 74 of each blockchain mining processor 72 may be oriented to direct air from a center of the interior 12F laterally across the respective blockchain mining processor 72 and toward the air outlet 15 in the side wall 14C of the upper frame 14. Similar to as described above for the embodiment of Fig. 1, the system 10 of Figs. 12 - 13 and 16, the side walls 14C may incorporate a mechanism for securing the air outlet 15 in the side walls 14C from unwanted intrusion, whilst permitting sufficient airflow therethrough. In the example shown, side walls 14C mount security grating panels 58 whose exterior faces are covered by louver panels 56. The side walls 14C may be formed with any of the characteristics and features of the side walls 14C of the embodiment of Fig. 1, although in the example shown no air filter 60 is required (though one may be used) on the air outlet 15, i.e. over the grating panels 58.

[0089] Referring to Figs. 13 and 16, the air outlet 15 may be defined in more than one side surface of frame 14, for example the air outlet 15 may be defined in opposed side walls 14C, and in some cases in one or both end walls 14A and 14B of frame 14. The air outlet 15 may be structured to provide sufficient breathability to adequately cool the processors 72 operating within interior 12F. For example, at least 75%, for example 90% or higher, of a total external surface area of side wall 14C, for example side walls 14C' and 14C'', may form the air outlet 15. In the example shown the only part of the total external surface area of each side wall 14C that is not breathable are the portions attributable to beams and columns 18 and 20, respectively. The outlet 15 may be structured with uniform porosity or pressure drop across the breathable surface area of the outlet 15 to maximize the chance of uniform and consistent air flow across the walls 14A-C. End walls 14A and/or 14B may be made to be breathable in a similar fashion as side walls 14C, and/or end walls 14A and/or 14B may be breathable whereas one or both of side walls 14C may not be.

[0090] Referring to Figs. 13, 16, and 16A, an exhaust guide 62, such as a plurality of exhaust guides 62, may be mounted to an exterior 14G of the side wall 14C of the upper frame 14 to direct exhaust air in an upward direction 90. The exhaust guide or guides 62 may each comprise a scoop or baffle (for example made of sheet metal) that extends laterally outward from the exterior 14G of the side wall 14C of the upper frame 14. Each scoop may have an opening, such as an open top end 62D that defines the air outlet 15. The scoop or guide 62 may have an end wall 62A and opposed side walls 62B. Referring to Figs. 16 and 16A, the exhaust guide 62 may be moveable between an open position (guide

62' in Fig. 16, solid lines in Fig. 16A), and a closed position (guide 62'' in Fig. 16, dashed lines in Fig. 16A) where the exhaust guide is laterally retracted adjacent or into (for example inset within plane 86 of side wall 14C) the exterior 14G of the upper frame 14. The guide 62 may be pivotally mounted to side wall 14C, for example by a hinge 62C, with side walls 62B mounted to extend out of and retract into respective slots 62E in side wall 14C to open and close the guide 62. The guide 62 may be closed at suitable times such as when the system 10 is not operating, or when system 10 is being transported. Guides 62 may also be removed in such circumstances or when not need. Guides 62 assist in direction warmed exhaust gases upward. Guides 62 may also assist in preventing recirculation of warmed exhaust air back into interior 12F through side walls 14C.

[0091] Referring to Figs. 12-13, and 16-19, a method of operation of the embodiment shown is now described, although only distinctions from the operation of the embodiment of Fig. 1 are described. Referring to Fig. 13, fans 48 are operated to draw air into interior 16F through air inlets 13 in side walls 16C. Cool air enters frame 16 laterally through opposed side walls 16C and end walls 16A and 16B, via direction lines 101, where the air is directed upward via direction lines 103 through passage 98 across floor 14E. The air flow travels into aisle 34 of interior 12F, and then changes direction and passes laterally across processors 72 via direction lines 105, with additional energy provided to incoming air via fans 74 on each processor 72. The air has now been warmed by contact with processors 72, and the warm exhaust air passes along direction lines 90 through side walls 14C and guides 62. The embodiment of Figs. 12-18 may be advantageously used in warm ambient temperatures, as the system 10 is designed to avoid recirculation of exhaust air into the inlets 13 or the inlets of other portable mining systems in close proximity to system 10.

[0092] Referring to Figs. 20-27, another embodiment of a blockchain mining system is illustrated, with an air inlet 13 and air outlet 15 on the same side wall 12C or (in the example shown) the same side walls 12C. The system 10 may comprise a portable building 12, a plurality of blockchain mining processors 72 (two are shown in Fig. 23 for reference), and one or more exhaust guides 62. As above, the air outlet 15 and the air inlet 13 may be defined in the same side wall or side walls of the portable building. The processors 72, which in the examples shown would be mounted on the racks 26 on one or both sides of the interior 12F of the container 12, may be mounted adjacent the air outlet 15 above the air inlet 13. The cooling fan 48 or fans 48 may be mounted adjacent the air outlet 15 (for example mounted on the side walls 12C between the processors 72 and the outlet 15 or defining the outlet 15) to pull air through the interior 12F to the air outlet 15. In other cases pusher fans may be used, such as intake fans (not shown).

[0093] Referring to Figs. 20-27, the system 10 may draw in and move cooling air through the interior 12F and over the processors 72 in a suitable fashion. The portable building 12 may be structured such that in use air moves through a suitable sequence of travel. In one case air first moves into the

portable building through the air inlet 13, for example in direction lines 112. The cooling air may pass below the plurality of blockchain processors 72 toward a center (in the example shown the aisle 34) of the interior 12F of the portable building. The air may then move up and laterally over the plurality of blockchain processors 72 and out the air outlet 15 in the side wall 12C, for example following direction lines 114 and 116.

[0094] Referring to Figs. 20 - 27, air may be guided into the interior 12F through the inlet 13 via a suitable guiding mechanism. In the example shown, ducting via inlet guides 110 or manifolds is provided. Each guide 110 (which may form a base shelf or filter housing) may have an entry end 110A structured to receive incoming air via the air inlet 13. The inlet 13 may have louvers 56 (for example fixed louvers that cannot be removed) and filters 60 as above. The entry end 110A may secure to the inlet 13. Side walls 110C and a top wall 110D may guide air toward an exit end 110B that opens into the interior 12F, for example laterally into the aisle 34. A filter 60 may be positioned on the exit end 110B or at another suitable point in the guide such as at end 110A. The guides 110 may form a framework upon which the processors 72 are raised and sit upon, as an example of a way to raise the processors 72 above the inlet 13.

[0095] Referring to Figs. 20-22, 24, and 26-27, the system 10 may be structured to exhaust cooling air via a suitable mechanism. In the example shown, the system 10 incorporates one more exhaust guides 62 to direct exhaust air out of the building. The guides 62 may be mounted on the side wall or side walls 12C, or at other suitable locations on or as part of the air outlet 15. The guides 62 may form ducting that has one or more of opposed side walls 62B, a top wall 62A, and an open end 62D. The guides 62 may be angled to direct exhaust air in a particular direction.

[0096] Referring to Figs. 20-22 and 26, the guide 62 may be one or both structured or oriented to recirculate exhaust air back into the interior 12F. In the example shown the guides 62 are oriented to exhaust warmed cooling air in a downward direction. Since the inlet 13 and outlet 15 are on the same side walls 12C, some or all of the downwardly exhausted air then recirculates back into the interior 12F via the inlet 13. Recirculating warmed cooling air may be advantageous in winter or in relatively cold ambient temperatures. In some cases, the ambient air temperature may be sufficiently low that the processors 72 may become damaged upon long or short term exposure to a continual supply of incoming fresh air at ambient temperature. The ability to recirculate may also reduce or prevent snow from blocking the intake (inlet 13) or from getting inside the datacenter and damaging computers (processors 72) on the racks. Because the processors are raised above the inlet, for example on raised racks above the intake, even if the snow gets through the filter panels 60 on the guides 110 that are below the racks, then the snow (such as fine snow) is unlikely to be lifted up into the processors 72. Thus, the ability to recirculate may increase the operating efficiency of the system 10 in cold climates while also preventing snow or rain from damaging the processors. Also, having both discharge (outlet

15) and intake (inlet 13) on the same wall may allow for each side wall 12C to be made symmetrical, meaning that the interior 12F may be arranged with computer racks 34 on each wall 12C for more space-effective structuring of the interior components.

[0097] Referring to Figs. 26 and 27, the system 10 may provide a user with the opportunity to selectively control the level of recirculation of expelled cooling air. The system 10 shown provides flexibility to allow the unit to be used in a normal exhaust mode (Fig. 27) or a recirculating exhaust mode (Fig. 26). The modes may be selected by rotating the guides 62 to point up or down. In other cases, a baffle of other system may be used such as above with exhaust guides 52) to direct air to one or more of upward, laterally outward, or downward paths of travel. The controller 40 may control the orientation or operation of the guides 62. In some cases, the guides 62 are oriented to direct some air upward and some air downward. The extent of recirculation may be selected to maintain the processors 72 or interior 12F to within a desired range of operating temperature. The system may be feedback controlled, such that if the temperature rises, the extent of recirculation is decreased, and if the temperature drops, the extent of recirculation increases.

[0098] Overall, Figs. 20-27 are an example of a portable building that may incorporate an air intake low, a discharge up high, and puller fans in the side wall. For a datacenter of this style the walls of the building may have an access door 28, intake / discharge / computer racks on the long side walls, and an end wall with the electrical, control and networking equipment. The electrical panel 118 may be on the exterior 12G of the seacan, with the inside housing the control panel (controller 40) and the contactor / relay panel 42.

[0099] The network equipment used may provide a source of internet connection. A satellite / cellular / and/or radio antenna or other network communication equipment may be fitted on the mining system and connected to a modem. The modem may feed a network switch that has Ethernet ports. Each mining processor controller may have one Ethernet port. The network connection may also feed a controller, which may be a programmable logic controller (PLC), or other, which may be accessed remotely. The controller may be connected to at least a thermocouple (temperature sensor) within the mining system, to allow the controller to control the ventilation and chilling loads within the enclosure. The controller may control the contactor panel switches to open and close circuits to add or remove mining processors from operation. Each mining processor may have a variety of configurations, but generally may include at least a power supply, a controller board and mining circuitry, such as an ASIC circuit. Various mining circuitry examples include CPU (central processing unit), GPU (graphics processing unit), FPGA (Field-Programmable Gate Array), and ASIC (application specific integrated circuit). The components of an ASIC mining processor include the hash boards (each board has numerous chips that is doing the hashing), a controller (to communicate with the network and optimize the mining processors chip frequency and fans for cooling), and a power supply (typically converts AC

input power to DC power for the ASIC). Each mining processor may be positioned on racks or shelving units.

[00100] The blockchain mining system may comprise a controller connected to operate one or more aspects of the blockchain mining processor. The controller may be connected to operate a cooling system, for example having a ventilation fan and a chiller, to maintain the mining processors within a predetermined operating range of temperature. For example, if the internal temperature within the mining system spikes above a predetermined maximum predetermined temperature, the air ventilation system may initiate or ramp up, and if the temperature contains past a second, relatively higher maximum predetermined temperature, the chilling unit may initiate or ramp up to achieve an air-conditioning effect. Similarly, if the temperature drops below a minimum predetermined temperature, a heating system (not shown) or recirculation system may initiate that may or may not leverage the air ventilation infrastructure to distribute heat. Plural controllers may be incorporated, for example to carry out different tasks, for example one controller for temperature control and another for mining processor control. The enclosure (interior 12F) may be structured to insulate its contents from the elements. The container may have a back-up heating device such as a space heater (not shown), for example to be used to heat the enclosure in case of shut down in cold weather.

[00101] In both embodiments disclosed here, air moves laterally across processors either into or out of adjacent side walls of the container. Also, in both embodiments, air flow changes direction from vertical to horizontal, thus permitting the outlet to be located above the inlet to avoid recirculation of warmed exhaust gases (unless same is desired, for example as described above). Such bidirectional flow may more efficiently cool processors 72 within the context that the processors 72 are located (processors 72 mounted horizontally within racks, with processors 72 vertically stacked one above the other), than would unidirectional flow, particularly in an embodiment where plural racks of processors 72 are located within interior 12F.

[00102] Relative words such as front and rear, sides, left and right, up and down are arbitrary and do not refer to absolute orientations unless context dictates otherwise. For example, although the description refers to rear and front ends, it should be understood that this orientation could be reversed. Similarly, side walls need not be the walls with the longest lateral dimensions (although in many cases they will be), for example in the case of a cube container. Features in various embodiments may be interchanged, for example to provide an air inlet in the floor and an outlet in the roof. The system 10 may form a skid, or may form a wheeled or tracked unit, such as a trailer. In some cases, system 10 may incorporate a motor to drive the system 10 to different locations. A reference to a floor may refer to a base of a component, or it may refer to a floor above a base. Stairs may lead up to the double doors and on the opposite end to the Splitter and Breakers / Disconnects. The booster skid (frame 16) with the fans is shown as a separate component in which the seacan sits on top but it can also be built into the skid.

[00103] In the claims, the word "comprising" is used in its inclusive sense and does not exclude other elements being present. The indefinite articles "a" and "an" before a claim feature do not exclude more than one of the feature being present. Each one of the individual features described here may be used in one or more embodiments and is not, by virtue only of being described here, to be construed as essential to all embodiments as defined by the claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A portable blockchain mining system comprising:

a portable building;

a plurality of blockchain mining processors mounted within an interior of the portable building;

an air inlet defined in the portable building;

an air outlet defined in the portable building above the air inlet and oriented to direct exhaust air out of the portable building; and

a cooling fan connected to convey air through the air inlet, across the plurality of blockchain mining processors and out the air outlet.

2. The portable blockchain mining system of claim 1 in which the air outlet is oriented to direct exhaust air in an upward direction out of the portable building.

3. The portable blockchain mining system of any one of claim 1 - 2 in which a first group of the plurality of blockchain mining processors are mounted adjacent a first side wall of the portable building.

4. The portable blockchain mining system of claim 3 in which a second group of the plurality of blockchain mining processors are mounted adjacent a second side wall of the portable building, the second side wall opposed to the first side wall, with an aisle defined between the first group and the second group.

5. The portable blockchain mining system of claim 4 in which the first group and the second group are mounted on a first rack and a second rack, respectively, with the aisle defined between the first rack and the second rack.

6. The portable blockchain mining system of any one of claim 1 - 5 in which the air inlet is defined in a side wall of the portable building.

7. The portable blockchain mining system of claim 6 in which each blockchain mining processor has associated with it a processor fan, which is oriented to direct air from the air inlet laterally across the respective blockchain mining processor and toward a center of the interior of the portable building.

8. The portable blockchain mining system of any one of claim 6 - 7 further comprising a security grating defining the air inlet in the side wall.

9. The portable blockchain mining system of claim 8 in which:

the security grating is one of a plurality of metal security grating panels that collectively define the air inlet;

the side wall is formed of a structural frame of beams and columns; and

the plurality of metal security grating panels are mounted between the beams and columns.

10. The portable blockchain mining system of any one of claim 8 - 9 further comprising an air filter positioned across the security grating.

11. The portable blockchain mining system of claim 10 in which the air filter is mounted adjacent an exterior of the security grating, with the portable blockchain mining system structured to permit access to the air filter from outside the portable blockchain mining system.

12. The portable blockchain mining system of claim 11 further comprising a gate securing the air filter adjacent the exterior of the security grating.

13. The portable blockchain mining system of claim 12 in which the gate comprises a louver panel.

14. The portable blockchain mining system of any one of claim 6 - 13 in which the side wall is a first side wall, and the air inlet is also defined in a second side wall of the portable building, the second side wall being opposed to the first side wall.

15. The portable blockchain mining system of any one of claim 6 – 14 in which the air outlet and the air inlet are defined in the same side wall or side walls of the portable building.

16. The portable blockchain mining system of claim 15 in which the plurality of blockchain mining processors are mounted adjacent the air outlet above the air inlet.

17. The portable blockchain mining system of any one of claim 15 - 16 in which the portable building is structured such that in use air moves in sequence:

into the portable building through the air inlet;

below the plurality of blockchain processors toward a center of an interior of the portable building; and

up and laterally over the plurality of blockchain processors and out the air outlet in the side wall.

18. The portable blockchain mining system of claim 17 in which the air outlet and the air inlet are oriented to recirculate air exhausted from the air outlet back into the air inlet.

19. The portable blockchain mining system of any one of claim 15 – 18 in which the cooling fan is mounted adjacent the air outlet to pull air through the interior to the air outlet.

20. The portable blockchain mining system of any one of claim 1 - 19 in which a roof of the portable building defines an air outlet or a roof air passage to the air outlet.

21. The portable blockchain mining system of claim 20 in which a plenum is mounted on the roof and defines the air outlet.

22. The portable blockchain mining system of claim 21 in which the plenum comprises ducting that extends along the roof to over a lateral side of the portable building where the air outlet is defined by the ducting.

23. The portable blockchain mining system of claim 22 in which the ducting has an open lateral end, and an exhaust guide is mounted for telescopic lateral movement in the open lateral end between a retracted, closed position, and an extended, open position.

24. The portable blockchain mining system of claim 23 in which:

in the retracted, closed position, the exhaust guide is inset within a plane defined by a respective side wall directly below the open lateral end; and

in the extended, open position, the exhaust guide extends laterally away from the side wall and beyond the plane.

25. The portable blockchain mining system of any one of claim 23 - 24 in which the exhaust guide has an upper exhaust and a lower exhaust that direct exhaust air in an upward direction and a downward direction, respectively.

26. The portable blockchain mining system of claim 25 in which the exhaust guide has a baffle that is structured to move between:

a recirculation position where exhaust air is directed in the downward direction to the air inlet; and

a regular position where exhaust air is directed in the upward direction.

27. The portable blockchain mining system of claim 26 in which the baffle has an intermediate position where exhaust air is directed in both the downward direction and the upward direction.

28. The portable blockchain mining system of any one of claim 20 - 27 in which the cooling fan is mounted adjacent the roof to pull air through the interior to the air outlet.

29. The portable blockchain mining system of any one of claim 20 - 28 in which at least 20% of a total external surface area of the roof forms the air inlet or the roof air passage to the air outlet.

30. The portable blockchain mining system of any one of claim 20 - 29 in which a floor of the portable building defines the air inlet or a floor air passage to the air inlet.

31. The portable blockchain mining system of any one of claim 1 - 5 in which a floor of the portable building defines the air inlet or a floor air passage to the air inlet.

32. The portable blockchain mining system of claim 31 in which the portable building comprises an upper frame and a lower frame separated by the floor, with the plurality of blockchain mining processors mounted within the upper frame.

33. The portable blockchain mining system of claim 32 in which the cooling fan is mounted adjacent the floor to push air through the air inlet or floor air passage into the interior.

34. The portable blockchain mining system of any one of claim 32 - 33 in which the air inlet is defined in a side wall of the lower frame.

35. The portable blockchain mining system of claim 34 further comprising a security grating defining the air inlet in the side wall.

36. The portable blockchain mining system of claim 35 in which:

the security grating is one of a plurality of metal security grating panels that collectively define the air inlet;

the side wall is formed of a structural frame of beams and columns; and

the plurality of metal security grating panels are mounted between the beams and columns.

37. The portable blockchain mining system of any one of claim 35 - 36 further comprising an air filter positioned across the security grating.

38. The portable blockchain mining system of claim 37 in which the air filter is mounted adjacent an exterior of the security grating, with the portable blockchain mining system structured to permit access to the air filter from outside the portable blockchain mining system.

39. The portable blockchain mining system of claim 38 further comprising a gate securing the air filter adjacent the exterior of the security grating.

40. The portable blockchain mining system of claim 39 in which the gate comprises a louver panel.

41. The portable blockchain mining system of any one of claim 35 - 40 in which at least 75% of a total external surface area of the side wall forms the air inlet.

42. The portable blockchain mining system of any one of claim 34 - 41 in which the side wall is a first side wall, and the air inlet is also defined in a second side wall of the lower frame, the second side wall being opposed to the first side wall.

43. The portable blockchain mining system of claim 42 in which the air inlet is also defined in a first end wall and a second end wall of the lower frame, the second end wall being opposed to the first end wall.

44. The portable blockchain mining system of any one of claim 31 - 43 in which the air outlet is defined in a side wall of the upper frame.

45. The portable blockchain mining system of claim 44 in which each blockchain mining processor has associated with it a processor fan, which is oriented to direct air from a center of the interior laterally across the respective blockchain mining processor and toward the air outlet in the side wall of the upper frame.

46. The portable blockchain mining system of any one of claim 44 - 45 further comprising a security grating defining the air outlet in the side wall of the upper frame.

47. The portable blockchain mining system of claim 46 in which:

the security grating is one of a plurality of metal security grating panels that collectively define the air outlet;

the side wall of the upper frame is formed of a structural frame of beams and columns; and

the plurality of metal security grating panels are mounted between the beams and columns of the side wall of the upper frame.

48. The portable blockchain mining system of claim 44 - 47 in which the side wall of the upper frame comprises a louver panel across the air outlet.

49. The portable blockchain mining system of any one of claim 44 - 48 in which at least 75% of a total external surface area of the side wall of the upper frame forms the air outlet.

50. The portable blockchain mining system of any one of claim 44 - 49 in which the side wall of the upper frame is a first side wall, and the air outlet is also defined in a second side wall of the of the upper frame, the second side wall of the upper frame being opposed to the first side wall of the upper frame.

51. The portable blockchain mining of any one of claim 1 - 50 in which the air outlet is defined in a side wall of portable building, and further comprising an exhaust guide mounted to an exterior of the side wall to direct exhaust air in an upward direction.

52. The portable blockchain mining system of claim 51 in which the exhaust guide comprises a scoop that extends laterally outward from the exterior of the side wall and has an open top end that defines the air outlet.

53. The portable blockchain mining system of claim 52 in which the exhaust guide is moveable between an open position, and a closed position where the exhaust guide is laterally retracted adjacent or into the exterior of the side wall.

54. The portable blockchain mining system of any one of claim 51 – 53 in which the exhaust guide is moveable between:

an upward position where the exhaust guide directs exhaust air in an upward direction; and

a recirculation position where the exhaust guide directs exhaust air in a downward direction toward the air inlet.

55. The portable blockchain mining system of any one of claim 1 - 54 in which the portable building comprises an intermodal transport container.

56. A plurality of the portable blockchain mining systems of any one of claims 1 - 55 positioned laterally adjacent one another in close proximity.

57. A system comprising the portable blockchain mining system of any one of claim 1 - 55, and a power source connected to supply power to the portable blockchain mining system.

58. The system of claim 57 in which:

the power source comprises:

a source of combustible gas produced from an oil production, storage, or processing facility; and

a generator connected to the source of combustible gas.

59. A method comprising operating the plurality of blockchain mining processors of the portable blockchain mining system of any one of claim 1 - 58 to process mining transactions.

60. A method comprising:

operating a plurality of blockchain mining processors mounted within an interior of a portable building; and

operating a cooling fan to convey air in sequence:

through an air inlet into the interior of the portable building;

across the plurality of blockchain mining processors; and

out of the portable building through an air outlet that is above the air inlet.

61. The method of claim 60 in which the air outlet is structured to convey air through the air outlet and in an upward direction outside of and away from the portable building.

62. The method of any one of claim 60 - 61 in which the air outlet directs exhausted air to recirculate back into the interior of the portable building through the air outlet.

63. The method of claim 62 carried out in winter.

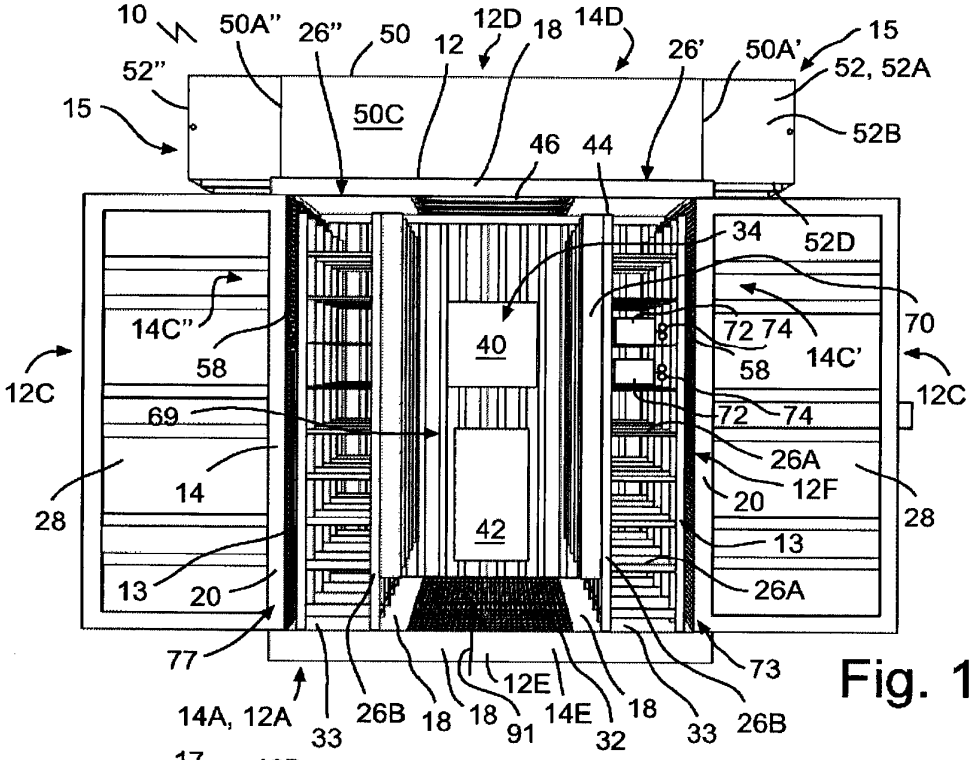


Fig. 1

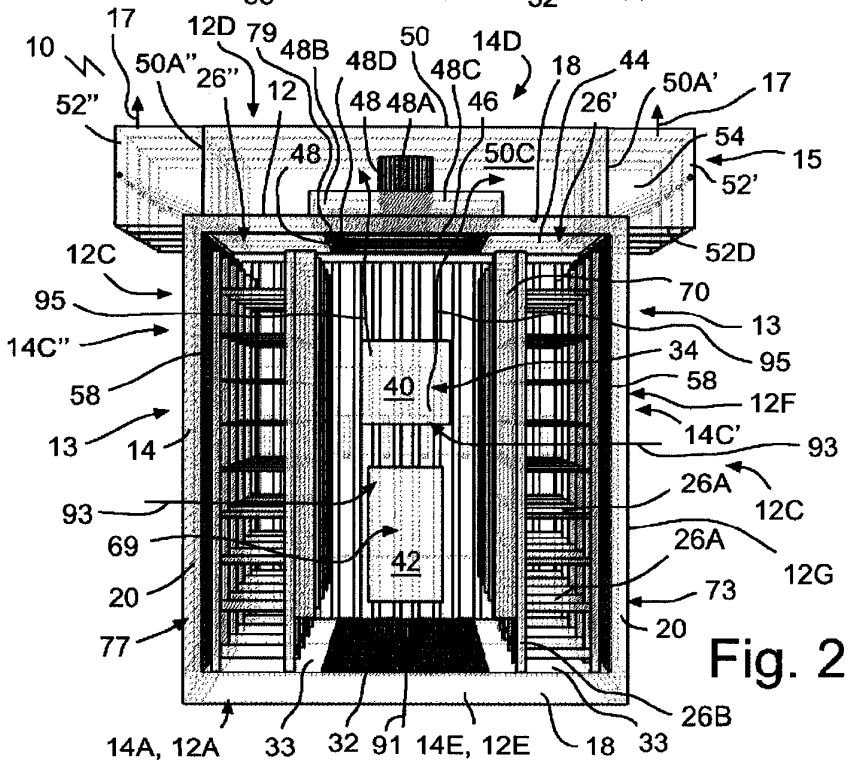


Fig. 2

Ex.1002 / Page 216 of 767
Cholla Energy LLC & OBM, Inc.

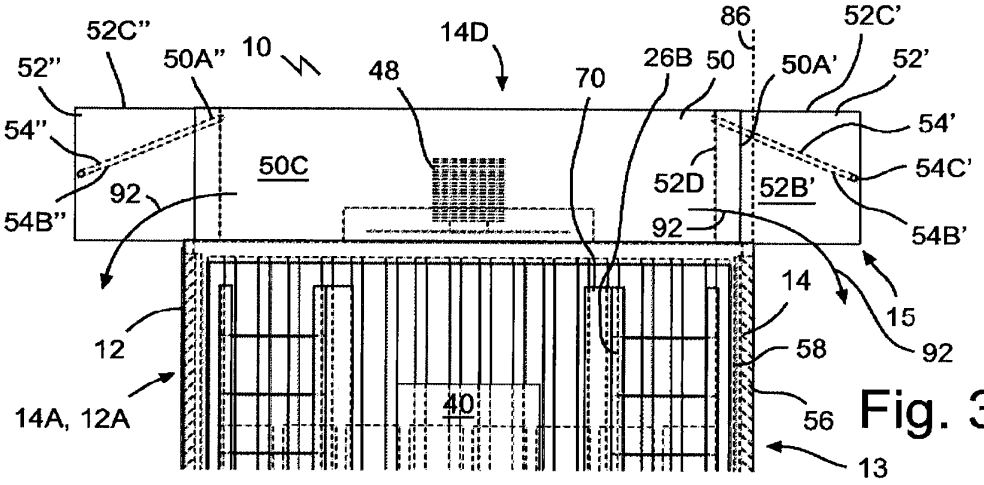


Fig. 3

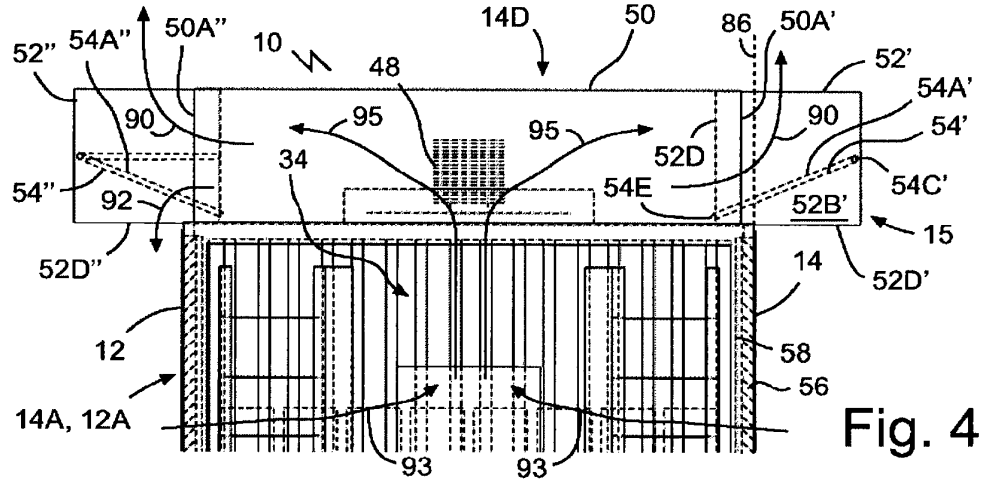


Fig. 4

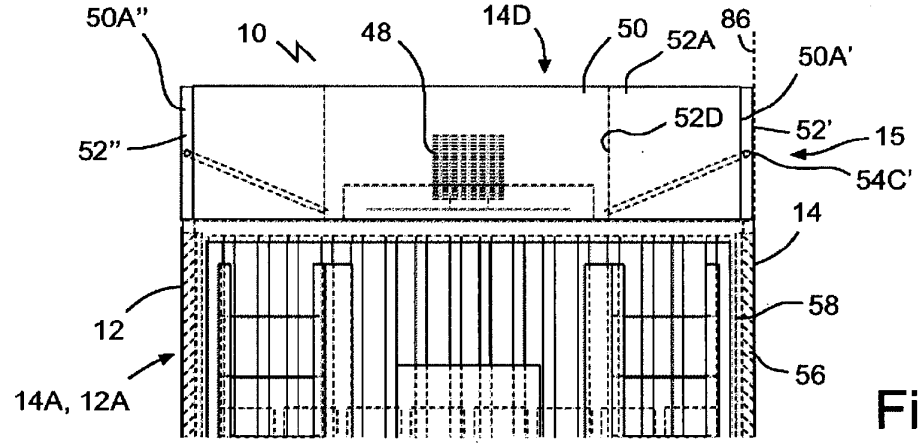


Fig. 5

Ex.1002 / Page 217 of 767
Cholla Energy LLC & OBM, Inc.

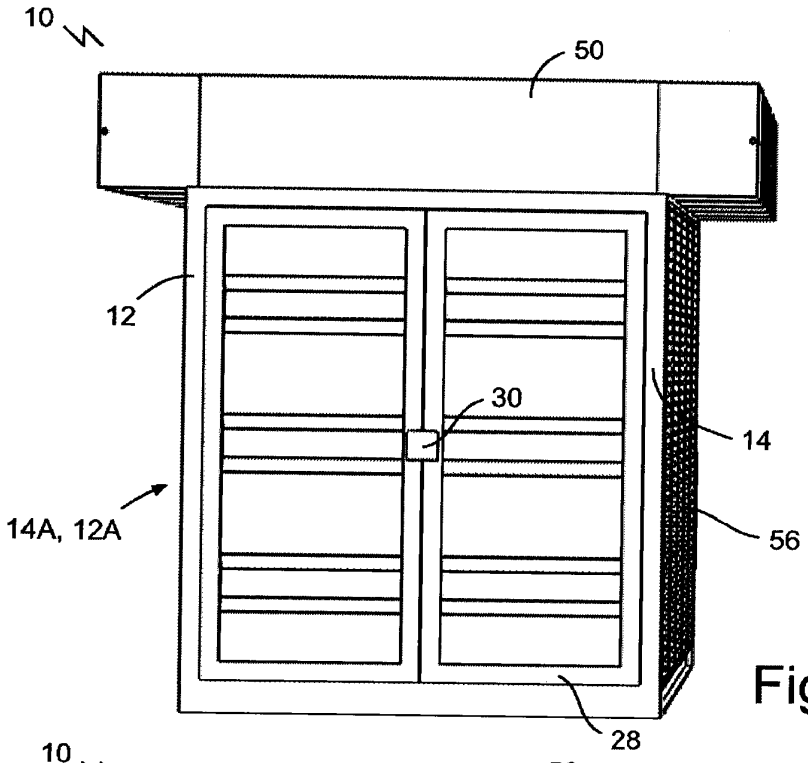


Fig. 6

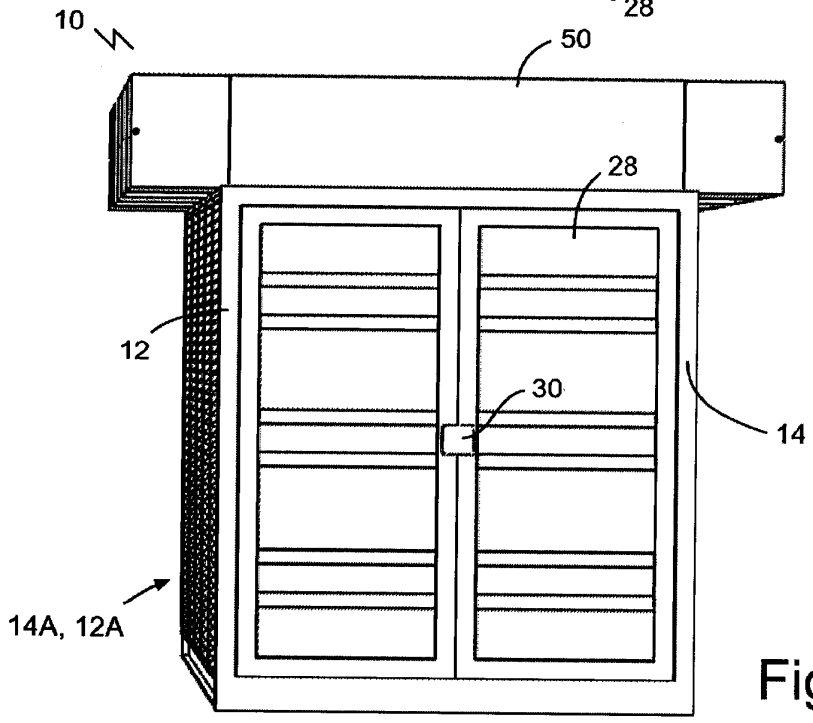


Fig. 7

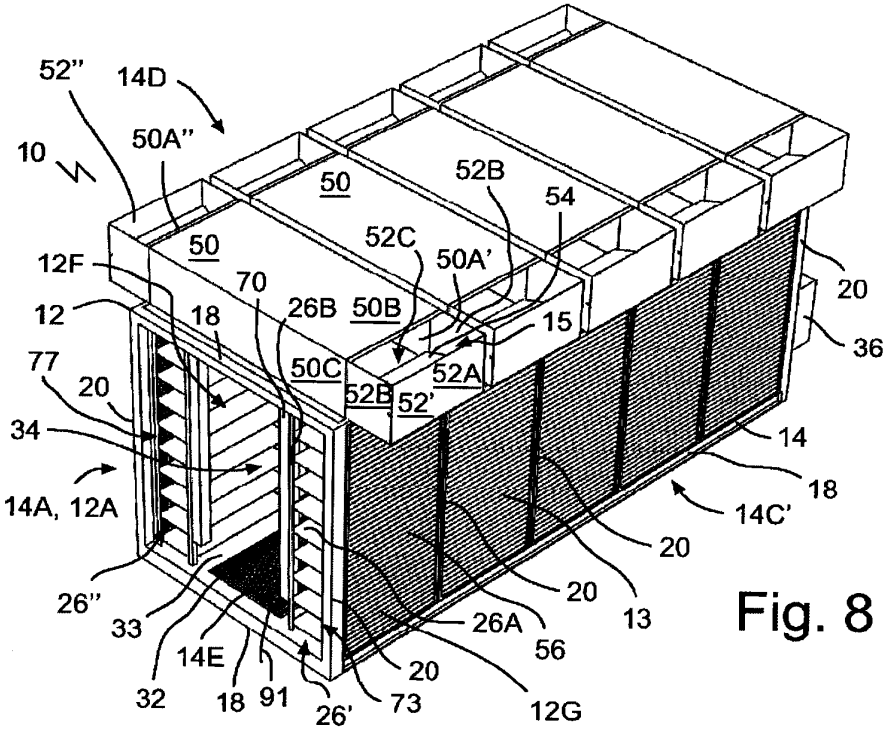


Fig. 8

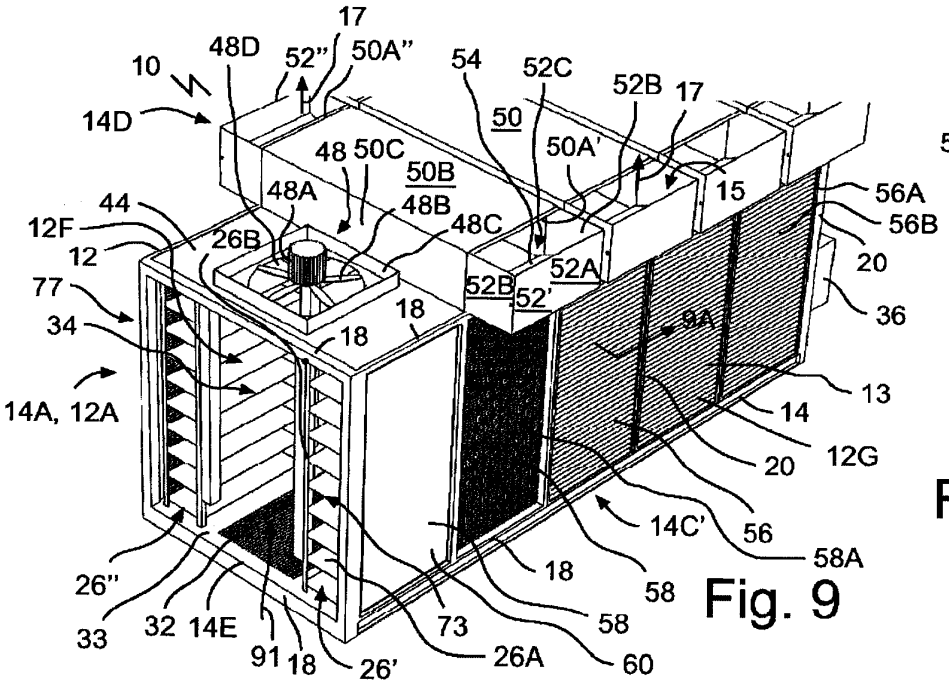


Fig. 9

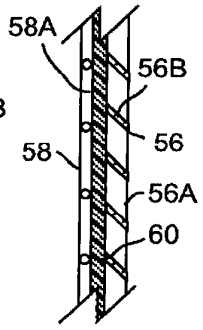


Fig. 9A

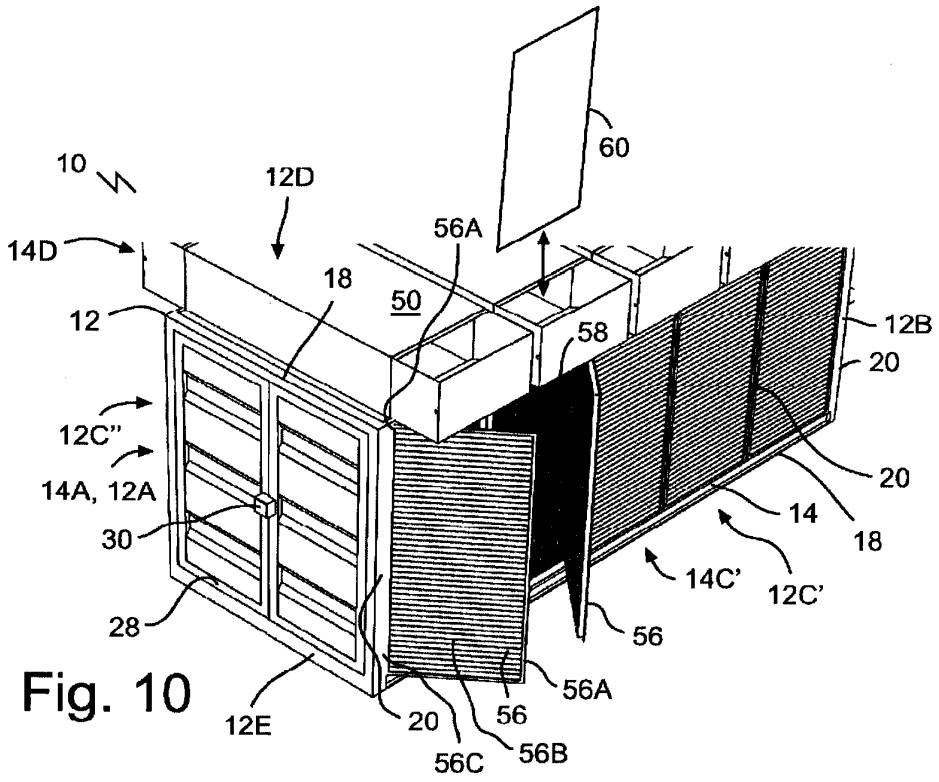

10
12D
60
14D
56A
18
50
12
58
12B
20
12C"
14A, 12A
20
14
18
30
14C'
12C'
28
56
56A
12E
20
56
56C
56B

Fig. 10

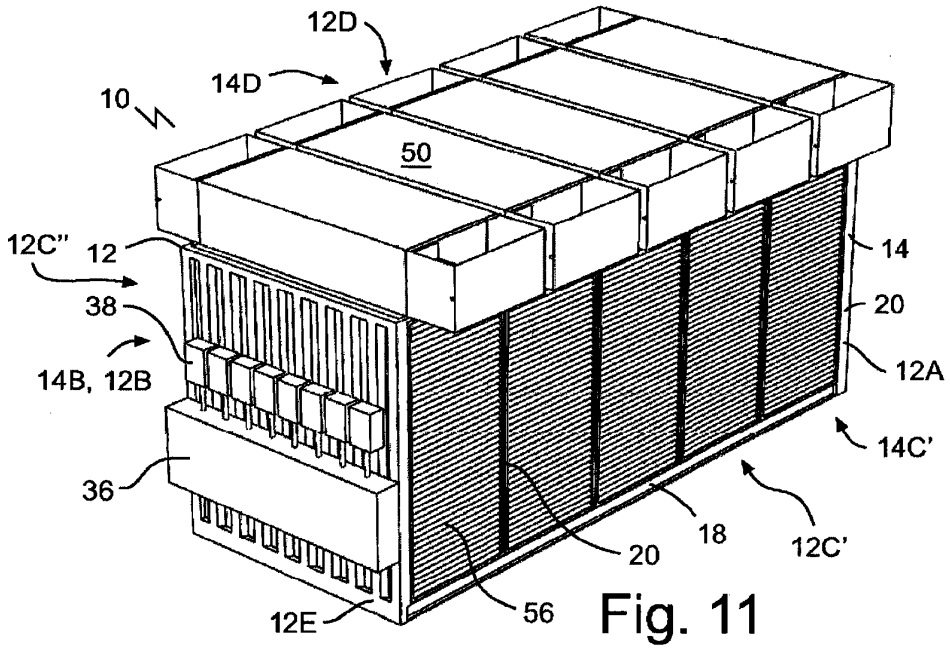

12D
14D
10
50
12C"
12
14
38
20
14B, 12B
12A
14C'
36
18
12C'
20
56
12E

Fig. 11

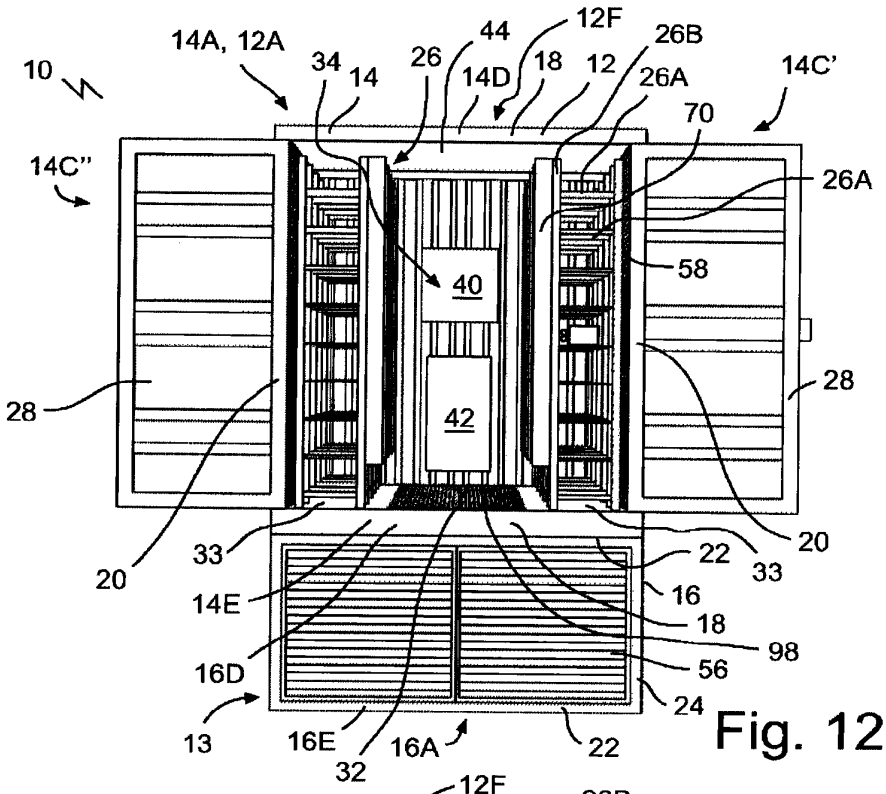

14A, 12A
10
34
14
26
44
14D
12F
18
12
26B
26A
14C'
70
14C"
26A
58
40
42
28
28
20
33
22
33
20
14E
16
18
98
16D
56
24
13
16E
16A
22
32

Fig. 12

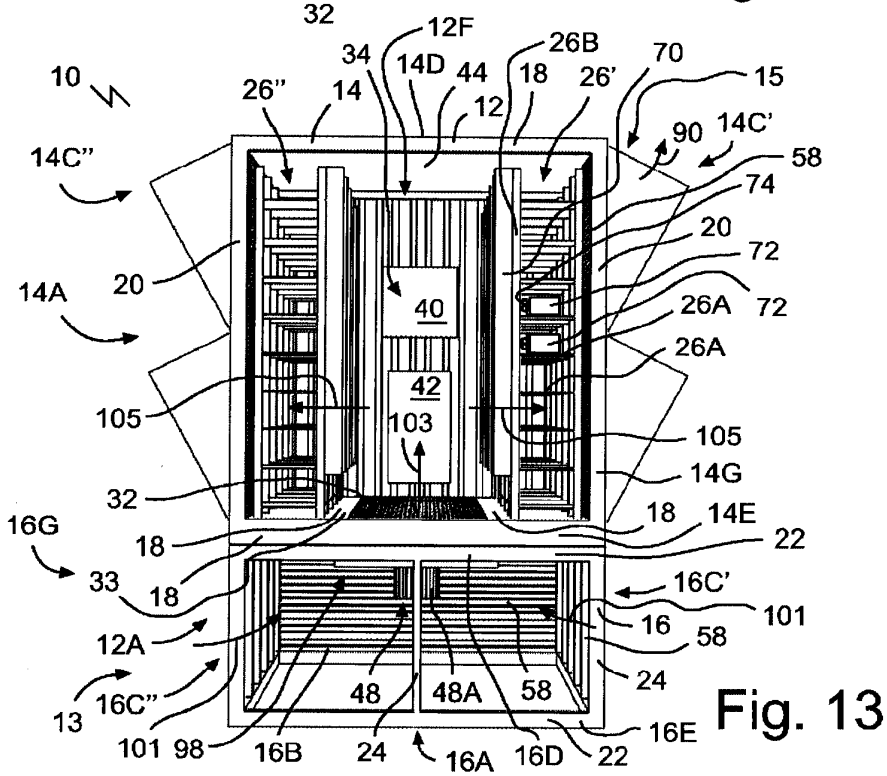

10
34
12F
14D
44
26B
18
26'
70
15
26"
14
12
90
14C'
14C"
58
74
20
72
14A
20
40
26A
72
26A
42
105
103
105
14G
32
18
14E
16G
18
22
18
33
16C'
18
101
16
58
12A
24
13
16C"
48
48A
58
101
98
16B
24
16A
16D
22
16E

Fig. 13

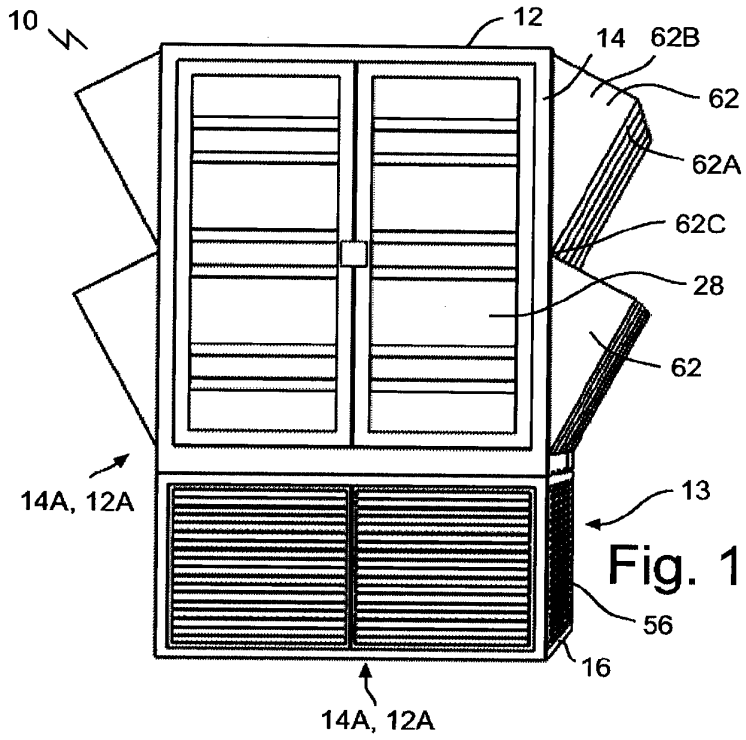

10
12
14
62B
62
62A
62C
28
62
14A, 12A
13
56
16
14A, 12A

Fig. 14

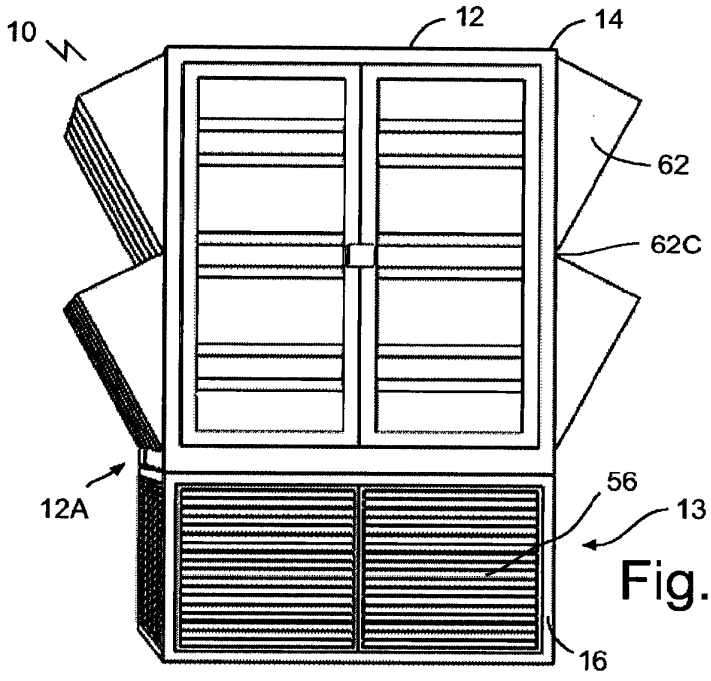

10
12
14
62
62C
12A
56
13
16

Fig. 15

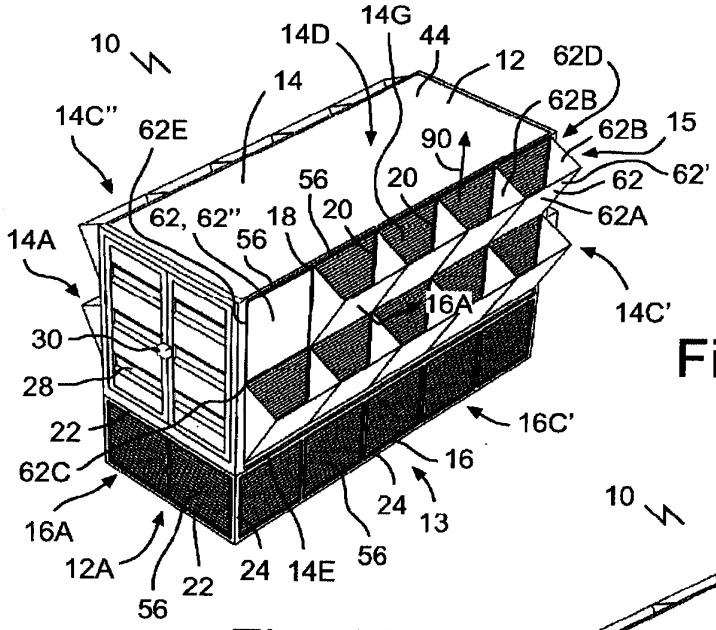


Fig. 16

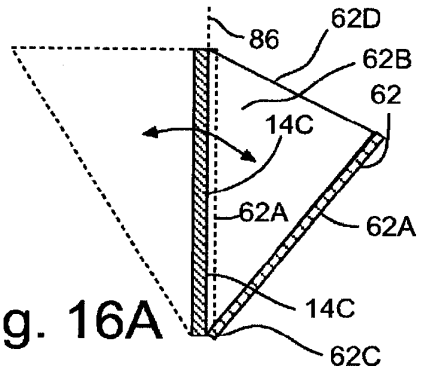


Fig. 16A

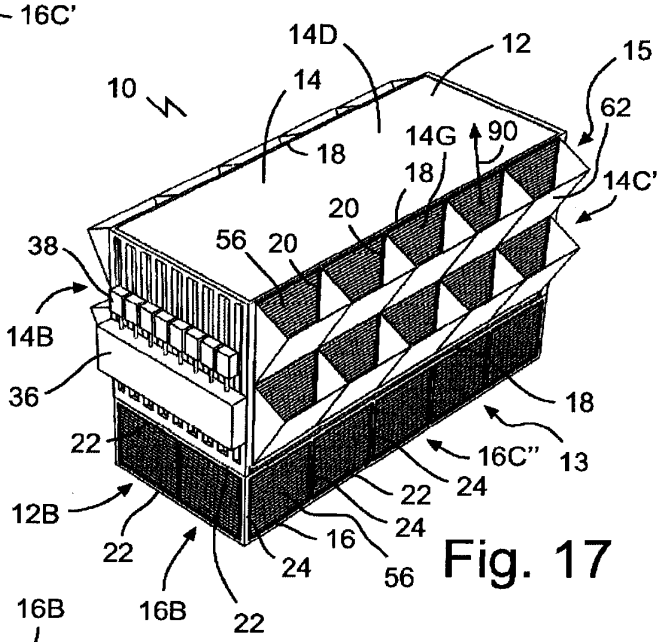


Fig. 17

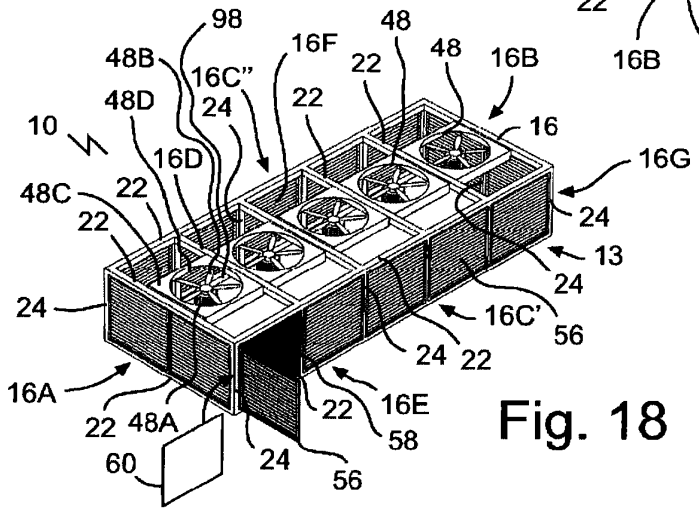


Fig. 18

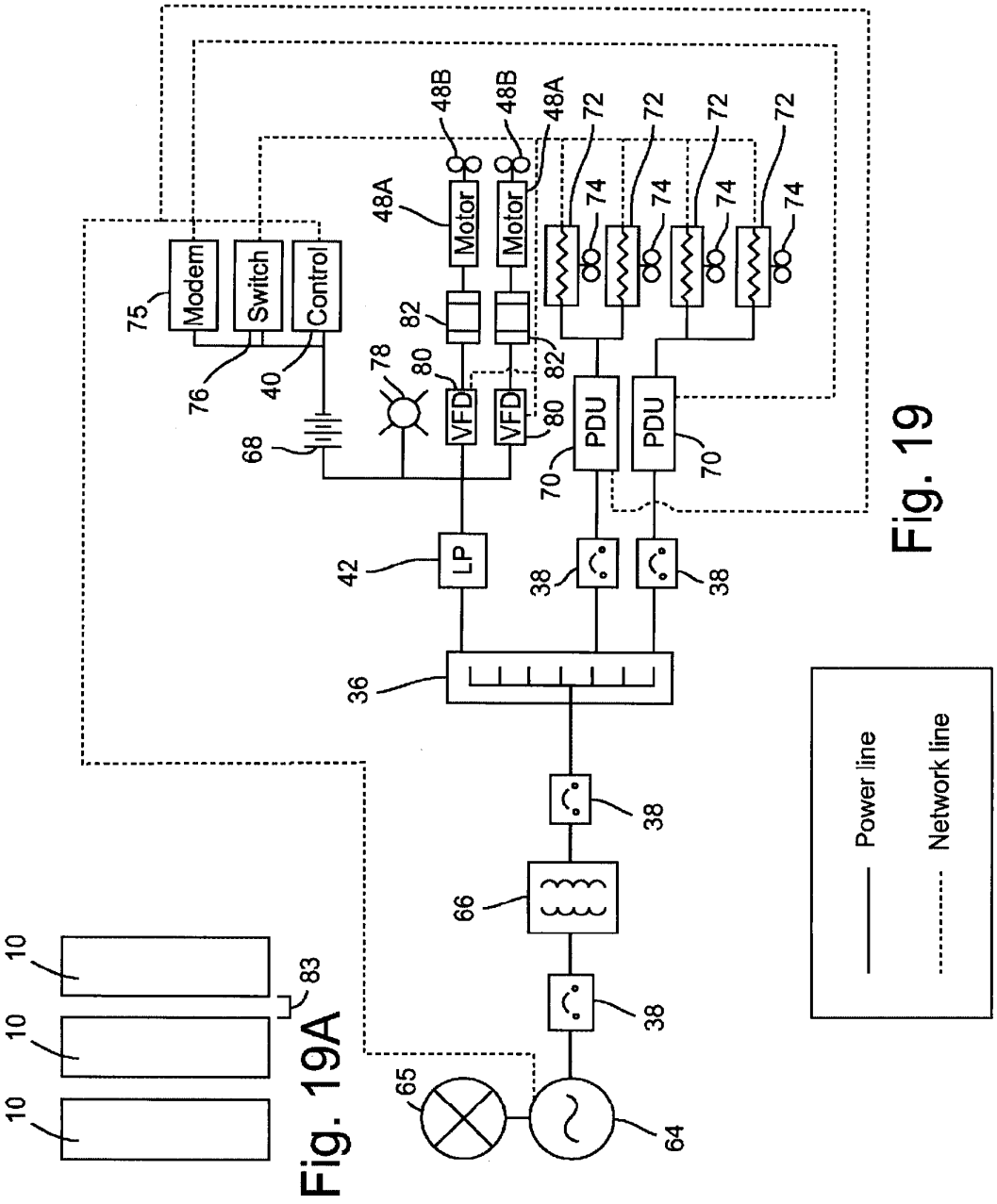


Fig. 19

Fig. 19A

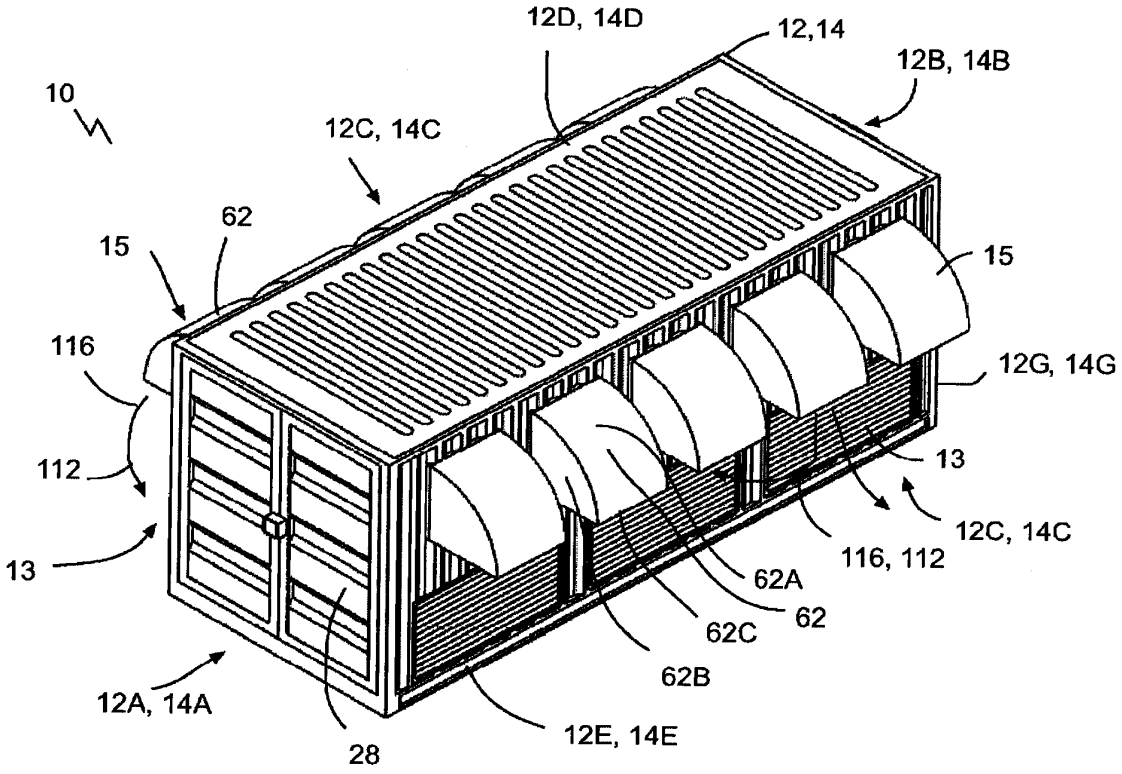
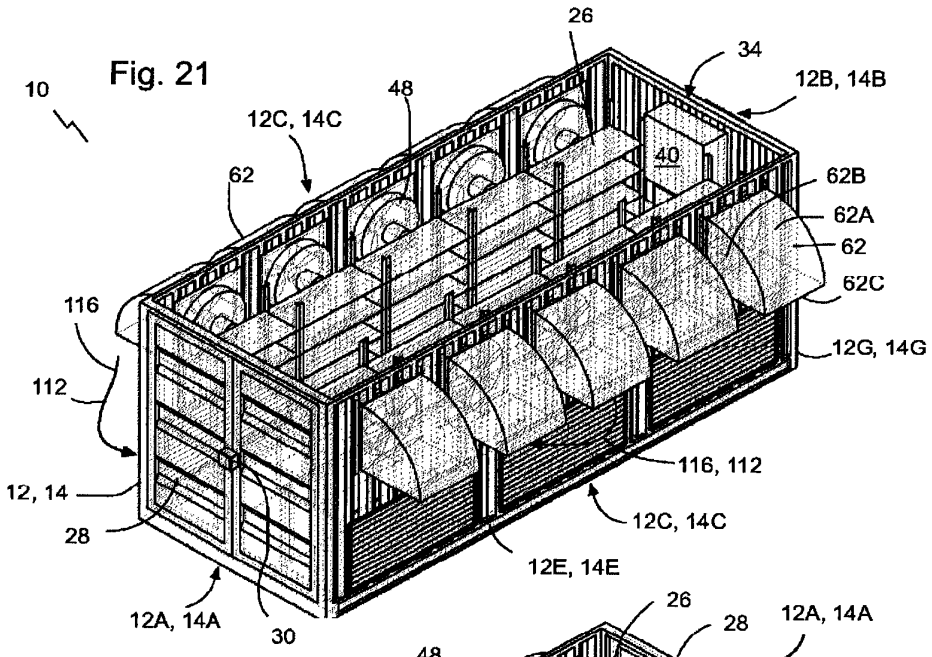

12D, 14D
12,14
12B, 14B
10
12C, 14C
62
15
15
116
12G, 14G
112
13
12C, 14C
116, 112
62A
62
62C
62B
13
12A, 14A
12E, 14E
28

Fig. 20

Fig. 21


10
26
34
12B, 14B
48
12C, 14C
40
62
62B
62A
62
62C
116
12G, 14G
112
116, 112
12, 14
12C, 14C
28
12E, 14E
12A, 14A
30

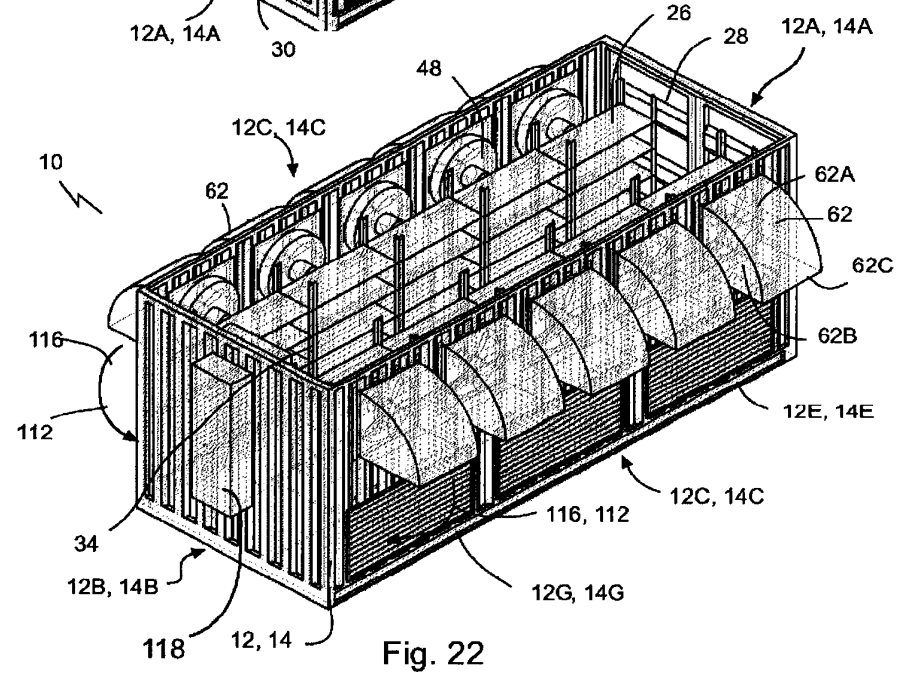

26
28
12A, 14A
48
12C, 14C
10
62
62A
62
62C
62B
116
12E, 14E
112
12C, 14C
116, 112
34
12B, 14B
12G, 14G
118
12, 14

Fig. 22

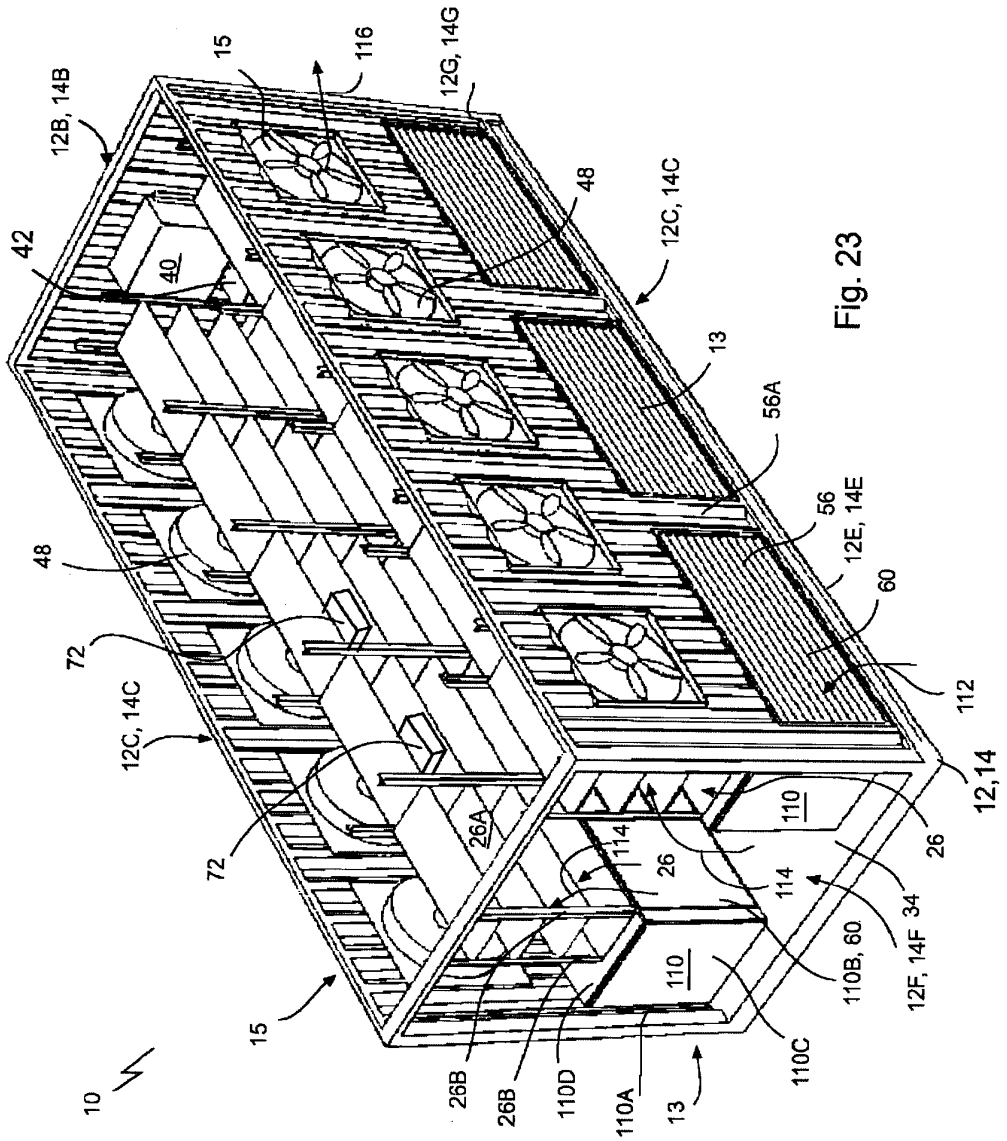

12B, 14B
15
116
12G, 14G
42
40
48
12C, 14C
13
56A
56
12E, 14E
60
112
12,14
48
72
12C, 14C
72
26A
114
26
110
114
26
34
12F, 14F
110B, 60
110C
15
10
26B
26B
110D
110A
13

Fig. 23

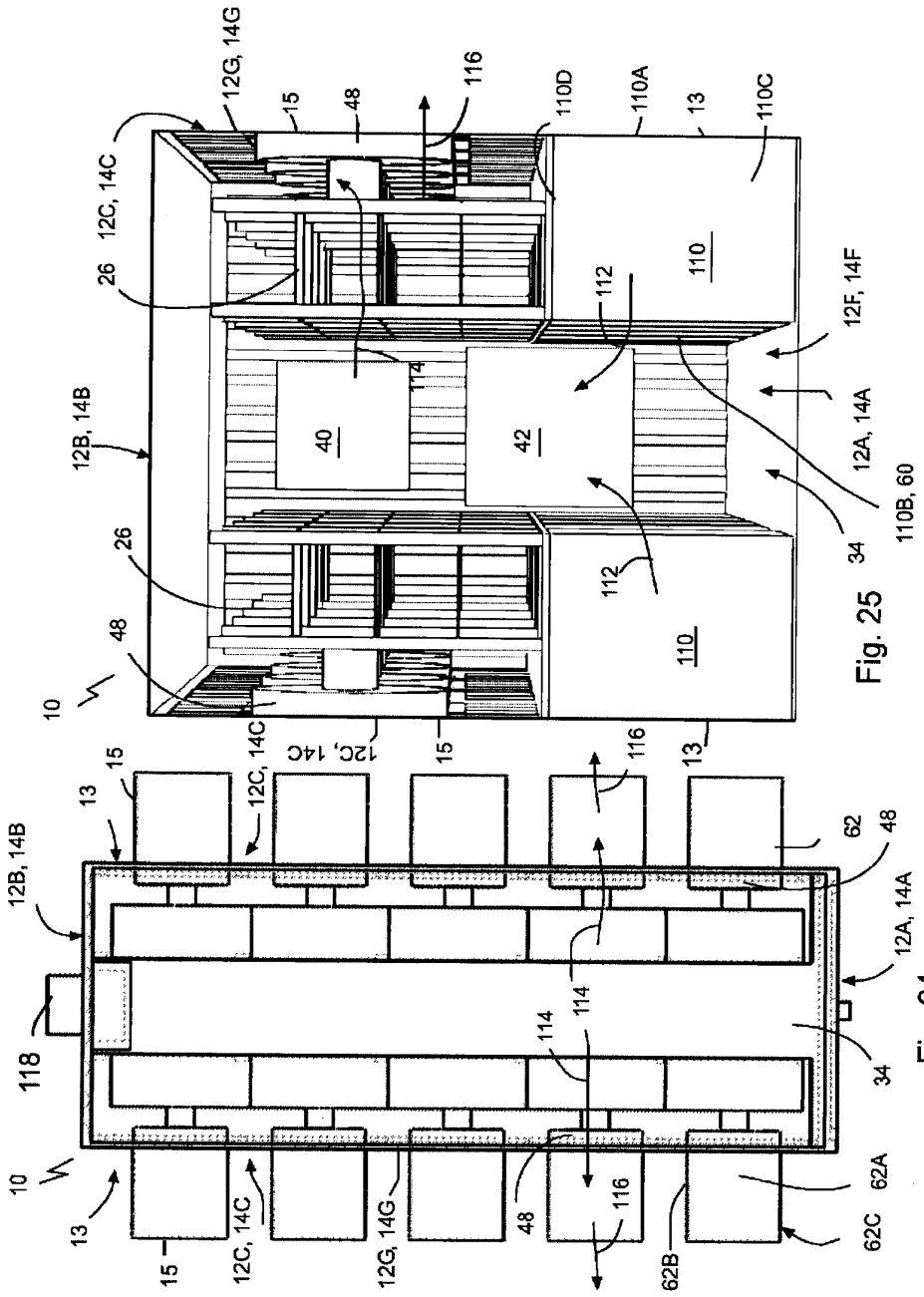

12G, 14G
15
48
116
110D
110A
13
110C
12C, 14C
26
112
110
12F, 14F
12B, 14B
114
40
42
12A, 14A
110B, 60
34
112
110
48
10
12C, 14C
15
116
13
13
15
12C, 14C
62
48
12B, 14B
12A, 14A
118
114
114
34
10
62A
13
48
116
62C
15
12C, 14C
12G, 14G
62B

Fig. 25

Fig. 24

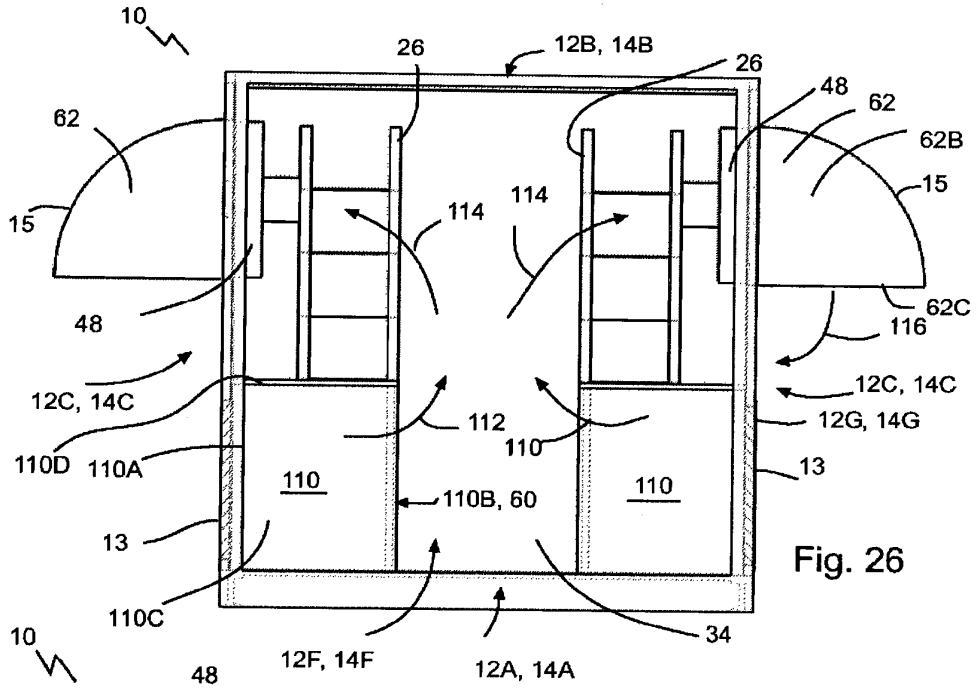

10
26
12B, 14B
26
48
62
62B
15
62
15
114
114
48
62C
116
12C, 14C
12C, 14C
112
12G, 14G
110D
110A
110
110
110
13
110B, 60
13
110C
34
12F, 14F
12A, 14A

Fig. 26

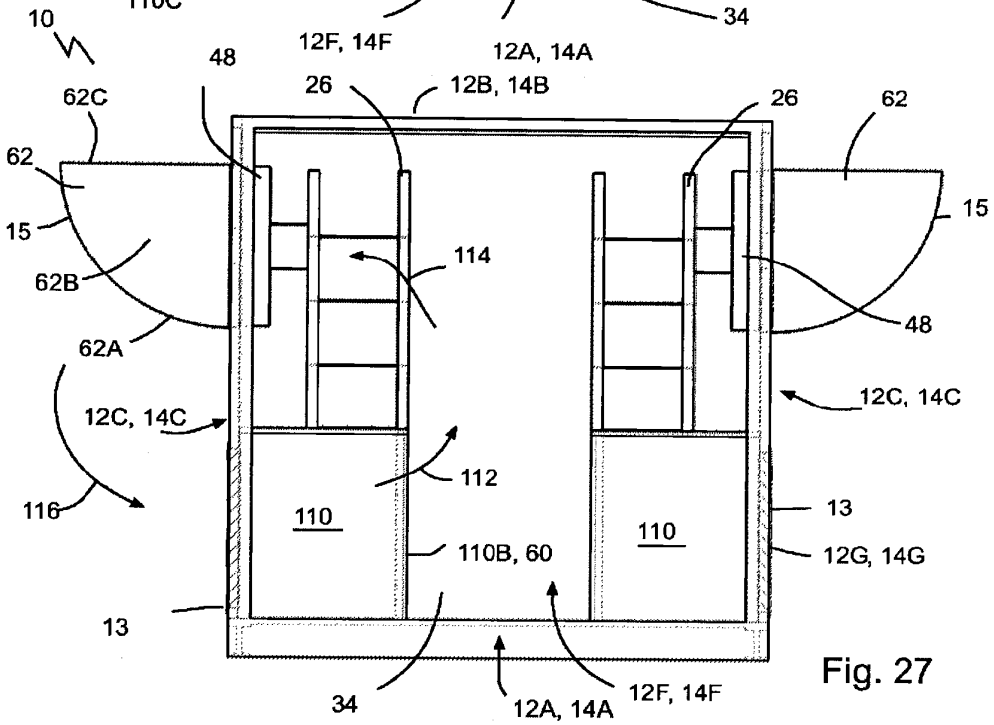

10
48
62C
26
12B, 14B
26
62
62
15
15
62B
114
48
62A
12C, 14C
12C, 14C
112
116
110
110
13
110B, 60
12G, 14G
13
34
12A, 14A
12F, 14F

Fig. 27

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2020/050426

A. CLASSIFICATION OF SUBJECT MATTER
IPC: ***G06F 1/20*** (2006.01) , ***G06F 1/26*** (2006.01) , ***G06F 15/00*** (2006.01) , ***H04Q 1/02*** (2006.01) , *H04L 12/16* (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: ***ALL***

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
QUESTEL-ORBIT & keywords:
shippable/portable/movable/mobile/transportable/tamper-proof/self-contained/modular/scalable datacenter/database/"blockchain mining"; exhaust/cooling/discharge fan

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 2018/145201 A1 (*Barbour*) - 16 August 2018 (16-8-2018) * Abstract; [0013]; [0037]; [0065]; Fig. 6 *	1, 2, 6, 15, 17, 19, 20, 28, 29 51-61 3-5, 7-14, 16, 18, 21-27, 30-50, 56, 62, 63
Y	EP 2648496 B1 (*Keisling et al.*) - 1 May 2019 (01-05-2019) * p. 4, l. 17; [0018]; [0023]; [0025]; [0028]; [0054]; [0087]; Figs. 3, 9 *	3-5, 16, 18, 62, 63
Y	US 2017/0280594 A1 (*Sato et al.*) - 28 September 2017 (28-09-2017) * [0041]; Fig. 1 *	7, 45
Y	US 2012/0300391 A1 (*Keisling et al.*) - 29 November 2012 (21-11-2012) * [0212]; Fig. 18 *	14, 21-27, 54, 56

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"D"	document cited by the applicant in the international application	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"E"	earlier application or patent but published on or after the international filing date	"&"	document member of the same patent family
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)		
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 22 May 2020 (22-05-2020)	Date of mailing of the international search report 25 June 2020 (25-06-2020)
Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 819-953-2476	Authorized officer Cristian S. Popa (819) 639-8274

Ex.1002 / Page 230 of 767
Cholla Energy LLC & OBM, Inc.

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2012/0077427 A1 (*Wei*) - 29 March 2012 (29-03-2012) * Abstract; [0009]-[0013]; Figs. 1, 2 *	8-13, 30-50

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2020/050426

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
WO2018145201A1	16 August 2018 (16-08-2018)	WO2018145201A1	16 August 2018 (16-08-2018)
	US2020051184A1	13 February 2020 (13-02-2020)	
EP2648496B1	01 May 2019 (01-05-2019)	EP2648496A2	09 October 2013 (09-10-2013)
	EP2648496A3	01 November 2017 (01-11-2017)	
	AU2011270812A1	10 January 2013 (10-01-2013)	
	AU2011270812B2	19 January 2017 (19-01-2017)	
	AU2011270812C1	11 May 2017 (11-05-2017)	
	AU2011360944A1	19 September 2013 (19-09-2013)	
	AU2011360945A1	05 September 2013 (05-09-2013)	
	AU2017202585A1	11 May 2017 (11-05-2017)	
	AU2017202585B2	28 February 2019 (28-02-2019)	
	CA2803168A1	29 December 2011 (29-12-2011)	
	CA2803168C	11 September 2018 (11-09-2018)	
	CA2827960A1	07 September 2012 (07-09-2012)	
	CA2827960C	18 February 2020 (18-02-2020)	
	CA2828694A1	07 September 2012 (07-09-2012)	
	CA3013470A1	29 December 2011 (29-12-2011)	
	EP2586281A2	01 May 2013 (01-05-2013)	
	EP2586281B1	09 August 2017 (09-08-2017)	
	EP2681637A2	08 January 2014 (08-01-2014)	
	EP2681978A1	08 January 2014 (08-01-2014)	
	JP2013532341A	15 August 2013 (15-08-2013)	
	JP5748849B2	15 July 2015 (15-07-2015)	
	JP2014509726A	21 April 2014 (21-04-2014)	
	JP2014513336A	29 May 2014 (29-05-2014)	
	KR20130041124A	24 April 2013 (24-04-2013)	
	KR101817277B1	10 January 2018 (10-01-2018)	
	KR20180006485A	17 January 2018 (17-01-2018)	
	KR101911350B1	25 October 2018 (25-10-2018)	
	KR20180116480A	24 October 2018 (24-10-2018)	
	KR102062074B1	03 January 2020 (03-01-2020)	
	KR20140015416A	06 February 2014 (06-02-2014)	
	KR20140023296A	26 February 2014 (26-02-2014)	
	SG186785A1	28 February 2013 (28-02-2013)	
	SG192974A1	30 September 2013 (30-09-2013)	
	SG193259A1	30 October 2013 (30-10-2013)	
	SG10201507946QA	29 October 2015 (29-10-2015)	
	US2012127657A1	24 May 2012 (24-05-2012)	
	US8254124B2	28 August 2012 (28-08-2012)	
	US2012125028A1	24 May 2012 (24-05-2012)	
	US8297067B2	30 October 2012 (30-10-2012)	
	US2012127653A1	24 May 2012 (24-05-2012)	
	US8305757B2	06 November 2012 (06-11-2012)	
	US2013047653A1	28 February 2013 (28-02-2013)	
	US8601827B2	10 December 2013 (10-12-2013)	
	US2012318492A1	20 December 2012 (20-12-2012)	
	US9282684B2	08 March 2016 (08-03-2016)	
	US2012133256A1	31 May 2012 (31-05-2012)	
	US9763366B2	12 September 2017 (12-09-2017)	
	US2017079165A1	16 March 2017 (16-03-2017)	
	US9839163B2	05 December 2017 (05-12-2017)	
	US2012300391A1	29 November 2012 (29-11-2012)	
	US2015195958A1	09 July 2015 (09-07-2015)	
	US2020107475A1	02 April 2020 (02-04-2020)	
	WO2011163532A2	29 December 2011 (29-12-2011)	
	WO2011163532A3	16 August 2012 (16-08-2012)	
	WO2012118553A2	07 September 2012 (07-09-2012)	
	WO2012118553A3	26 October 2012 (26-10-2012)	
	WO2012118554A1	07 September 2012 (07-09-2012)	

Ex.1002 / Page 232 of 767
Cholla Energy LLC & OBM, Inc.

		WO2012118554A1	07 September 2012 (07-09-2012)
US2017280594A1	28 September 2017 (28-09-2017)	US2017280594A1	28 September 2017 (28-09-2017)
		JPWO2016031197A1	15 June 2017 (15-06-2017)
		WO2016031197A1	03 March 2016 (03-03-2016)
US2012300391A1	29 November 2012 (29-11-2012)	US2012300391A1	29 November 2012 (29-11-2012)
		AU2011270812A1	10 January 2013 (10-01-2013)
		AU2011270812B2	19 January 2017 (19-01-2017)
		AU2011270812C1	11 May 2017 (11-05-2017)
		AU2011360944A1	19 September 2013 (19-09-2013)
		AU2011360945A1	05 September 2013 (05-09-2013)
		AU2017202585A1	11 May 2017 (11-05-2017)
		AU2017202585B2	28 February 2019 (28-02-2019)
		CA2803168A1	29 December 2011 (29-12-2011)
		CA2803168C	11 September 2018 (11-09-2018)
		CA2827960A1	07 September 2012 (07-09-2012)
		CA2827960C	18 February 2020 (18-02-2020)
		CA2828694A1	07 September 2012 (07-09-2012)
		CA3013470A1	29 December 2011 (29-12-2011)
		EP2586281A2	01 May 2013 (01-05-2013)
		EP2586281B1	09 August 2017 (09-08-2017)
		EP2648496A2	09 October 2013 (09-10-2013)
		EP2648496A3	01 November 2017 (01-11-2017)
		EP2648496B1	01 May 2019 (01-05-2019)
		EP2681637A2	08 January 2014 (08-01-2014)
		EP2681978A1	08 January 2014 (08-01-2014)
		JP2013532341A	15 August 2013 (15-08-2013)
		JP5748849B2	15 July 2015 (15-07-2015)
		JP2014509726A	21 April 2014 (21-04-2014)
		JP2014513336A	29 May 2014 (29-05-2014)
		KR20130041124A	24 April 2013 (24-04-2013)
		KR101817277B1	10 January 2018 (10-01-2018)
		KR20180006485A	17 January 2018 (17-01-2018)
		KR101911350B1	25 October 2018 (25-10-2018)
		KR20180116480A	24 October 2018 (24-10-2018)
		KR102062074B1	03 January 2020 (03-01-2020)
		KR20140015416A	06 February 2014 (06-02-2014)
		KR20140023296A	26 February 2014 (26-02-2014)
		SG186785A1	28 February 2013 (28-02-2013)
		SG192974A1	30 September 2013 (30-09-2013)
		SG193259A1	30 October 2013 (30-10-2013)
		SG10201507946QA	29 October 2015 (29-10-2015)
		US2012127657A1	24 May 2012 (24-05-2012)
		US8254124B2	28 August 2012 (28-08-2012)
		US2012125028A1	24 May 2012 (24-05-2012)
		US8297067B2	30 October 2012 (30-10-2012)
		US2012127653A1	24 May 2012 (24-05-2012)
		US8305757B2	06 November 2012 (06-11-2012)
		US2013047653A1	28 February 2013 (28-02-2013)
		US8601827B2	10 December 2013 (10-12-2013)
		US2012318492A1	20 December 2012 (20-12-2012)
		US9282684B2	08 March 2016 (08-03-2016)
		US2012133256A1	31 May 2012 (31-05-2012)
		US9763366B2	12 September 2017 (12-09-2017)
		US2017079165A1	16 March 2017 (16-03-2017)
		US9839163B2	05 December 2017 (05-12-2017)
		US2015195958A1	09 July 2015 (09-07-2015)
		US2020107475A1	02 April 2020 (02-04-2020)
		WO2011163532A2	29 December 2011 (29-12-2011)
		WO2011163532A3	16 August 2012 (16-08-2012)
		WO2012118553A2	07 September 2012 (07-09-2012)

Ex.1002 / Page 233 of 767
Cholla Energy LLC & OBM, Inc.

		WO2012118554A1	07 September 2012 (07-09-2012)
US2012077427A1	29 March 2012 (29-03-2012)	US2012077427A1	29 March 2012 (29-03-2012)
		TW201213212A	01 April 2012 (01-04-2012)

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: IRINA N. SULLIVAN
BARNES & THORNBURG LLP
P.O. BOX 2786
CHICAGO, IL 60690-2786

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference 84008-346091	Date of mailing *(day/month/year)* NOV 15 2021 **FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/US 21/45972	International filing date *(day/month/year)* 13 August 2021 (13.08.2021)
Applicant LANCIUM LLC	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

   How? Directly to the International Bureau preferably through ePCT, or on paper to:
   The International Bureau of WIPO, 34, chemin des Colombettes, 1211 Geneva 20, Switzerland

   For more detailed instructions, see the *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
   ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.
   ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may **submit comments on an informal basis on the written opinion of the International Searching Authority** to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

   Shortly after the expiration of **18 months from the priority date, the international application will be published** by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for **entry into the national phase** before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

   Within **22 months from the priority date, the applicant may request that a supplementary international search be carried out** by a different International Searching Authority that offers this service (Rule 45*bis*.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Kari Rodriquez Telephone No. PCT Helpdesk: 571-272-4300

Form PCT/ISA/220 (revised January 2020)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference		FOR FURTHER ACTION
84008-346091		see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US 21/45972	13 August 2021 (13.08.2021)	14 August 2020 (14.08.2020)
Applicant LANCIUM LLC		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

☒ the international application in the language in which it was filed.

☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

a. the figure of the **drawings** to be published with the abstract is Figure No. 5

☐ as suggested by the applicant.

☒ as selected by this Authority, because the applicant failed to suggest a figure.

☐ as selected by this Authority, because this figure better characterizes the invention.

b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 21/45972

A. CLASSIFICATION OF SUBJECT MATTER

IPC - G06F 9/46 (2021.01)

CPC - G06F 9/4881, G06F 9/4843, G06F 9/52, G06F 9/3851, G06F 9/4887, G06F 9/4812, G06F 9/505, G06F 9/5083, H04L 29/08144, H04L 29/08171, G06F 9/5088

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X – Y	US 2020/0167197 A1 (salesforce.com), 28 May 2020 (28.05.2020), para [0045], [0047], [0053]-[0054], [0058], [0061]-[0062], [0066], [0070], [0079], [0085], [0088], [0095]-[0096], [0111], [0141], [0175], [0200], and [0221].	1, 2, 5-10, 13, 14 --- 3-4, 11-12, 15-20
Y	US 2005/0034128 A1 (Nagashima et al.), 10 February 2005 (10.02.2005), para [0041].	3, 11
Y	US 2006/0253675 A1 (Bloks), 09 November 2006 (09.11.2006), para [0030].	4, 12
Y	US 2016/0202744 A1 (Intel Corporation), 14 July 2016 (14.07.2016), para para [0034], [0036], [0045], [0062], [0064], and [0071]-[0072].	15, 18-20
Y	US 2010/0333113 A1 (Johnson et al.), 30 December 2010 (30.12.2010), para [0012] and [0025].	16-17

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
07 October 2021 (07.10.2021)	NOV 15 2021
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Kari Rodriquez Telephone No. PCT Helpdesk: 571-272-4300

Form PCT/ISA/210 (second sheet) (July 2019)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: IRINA N. SULLIVAN
BARNES & THORNBURG LLP
P.O. BOX 2786
CHICAGO, IL 60690-2786

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	NOV 15 2021

Applicant's or agent's file reference	FOR FURTHER ACTION
84008-346091	See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 21/45972	13 August 2021 (13.08.2021)	14 August 2020 (14.08.2020)

International Patent Classification (IPC) or both national classification and IPC

IPC - G06F 9/46 (2021.01)

CPC - G06F 9/4881, G06F 9/4843, G06F 9/52, G06F 9/3851, G06F 9/4887, G06F 9/4812, G06F 9/505, G06F 9/5083, H04L 29/08144, H04L 29/08171, G06F 9/5088

Applicant LANCIUM LLC

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	07 October 2021 (07.10.2021)	Kari Rodriquez PCT Help Desk Telephone No. 571-272-4300

Form PCT/ISA/237 (cover sheet) (revised January 2019)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 21/45972

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
   - ☒ the international application in the language in which it was filed.
   - ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(b)).

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:
   - a. ☐ forming part of the international application as filed:
     - ☐ in the form of an Annex C/ST.25 text file.
     - ☐ on paper or in the form of an image file.
   - b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
   - c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
     - ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).
     - ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Form PCT/ISA/237 (Box No. I) (revised January 2019)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 21/45972

Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	3-4, 11-12, 15-20	YES
	Claims	1-2, 5-10, 13-14	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-20	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-2, 5-10, 13 and 14 lack novelty under PCT Article 33(2) as being anticipated by US 2020/0167197 A1 to salesforce.com (hereinafter 'Salesforce').

Regarding claim 1, Salesforce discloses a method comprising: by a scheduling controller (para [0047] - "Still further depicted within the hosted computing environment 111 is the scheduling service 145 having therein both a scheduler 191..."), receiving from a user a request for an application to be executed by a computing system associated with a data center (para [0043] - "In one embodiment, requests 117 are received at, or submitted to, a web-server 175 within hose organizations 150."; para [0058] - "Such a scheduler 125 may be utilized for scheduling in general application workloads... used for Software Defined Data Center... and cyclical workloads."), wherein the application includes a plurality of tasks (para [0197] - "In accordance with one embodiment of the system 601, the system implements a scheduling service 665, in which the system includes... a workload discovery engine 643 to identify a plurality of workload tasks 640 to be scheduled for execution in response to queries 639... a portion of the plurality of workload tasks 640 for execution via the one or more computing resources 628 based on the infraction requested."), and wherein the request includes an estimated execution time corresponding to an estimated amount of real-world time that the tasks will be actively running on the computing system to fully execute the application (para [0061] - "According to described embodiments, the scheduler takes into account the quality of service or a Service Level Target (SLT) for every workload type performed. For instance, workload tasks will require some amount of time to process... the SLT for a given workload type may specify a priority or an expected completion time or an acceptable amount of processing time or an acceptable cost to complete the processing and so forth." - The times are taken from the type of request received.); receiving from the user a service level objective indicating a target percentage of a total amount of real-world time that the tasks will be actively running on the computing system (para [0061] - "For instance, workload tasks will require some amount of time to process... the SLT for a given workload type may specify a priority or an expected completion time or an acceptable amount of processing time or an acceptable cost to complete the processing and so forth." - The amount of acceptable cost to complete a task could be represented as a percentage. SLT percentages are mentioned in the reference summary.); generating, in response to determining that the job can be completed according to the service level objective and the estimated execution time (para [0061] - "For instance, workload tasks will require some amount of time to process... the SLT for a given workload type may specify a priority or an expected completion time or an acceptable amount of processing time or an acceptable cost to complete the processing and so forth."; para [0141] - "In such a way, the scheduler models a forward-looking view when creating a plan 230 to determine whether everything schedules will complete within an acceptable period."), a notification indicating acceptance of the job (para [0045] - "Request interface 176 further supports the return of response packets or other replies and responses 116 in an outgoing direction from host organizations 150 to the user client devices 106A-C."; para [0221] - "For example, in one embodiment, system 716 includes application servers configured to... provide related data, code, forms, webpages, and other information to and from user systems 712 and to store to, and retrieve... related data...content." - The related information could be an indication that the request was accepted.); scheduling a job corresponding to the tasks of the application to be executed by the computing system (para [0054] - "The scheduling service 145 provides means by which to dynamically allocate compute capacity at any time... as necessary for performing a specific type of work according to need."), wherein scheduling is based on the service level objective and the estimated execution time (para [0061] - "For instance, workload tasks will require some amount of time to process... the SLT for a given workload type may specify a priority or an expected completion time or an acceptable amount of processing time or an acceptable cost to complete the processing and so forth."; para [0143] - "Because the scheduler executes in an iterative fasion... the priority or age or SLT/QoS requirements associated with such a task change over time... the scheduler will respond to these changes... for any given workload or task."); and notifying, in response to the scheduled job being fully executed (para [0053] - "According to a particular embodiment, every time a new compute cloud is discover... the workload discovery 135 component will then... compute cloud requesting all running tasks and completed tasks, at which point the workload discovery 135 component will then update... on behalf of the... compute cloud."), the user that the application execution completed (para [0045] - "Request interface 176 further supports the return of response packets or other replies and responses 116 in an outgoing direction from host organizations 150 to the user client devices 106A-C."; para [0221] - "For example, in one embodiment, system 716 includes application servers configured to... provide related data, code, forms, webpages, and other information to and from user systems 712 and to store to, and retrieve... related data...content." - The related information could be an indication that the request was accepted.).

Regarding claim 2, Salesforce discloses the method of claim 1. Salesforce further discloses wherein the target percentage is a numerical value between zero and one (para [0111] - "According to at least one embodiment, the reserved portion of available compute capacity is set as a percentage of total compute capacity (e.g., such as 10% OR 15%) within which the scheduler does not plan selected workload tasks for execution..." - The percentage could be between zero and one.).

-- Continued in supplemental box --

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 21/45972

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:
-- Continuation of box V.2 --

Regarding claim 5, Salesforce discloses the method of claim 1. Salesforce further discloses wherein a value of the service level objective is selected according to a first cost to the user in response to selection of a first numerical value for the target percentage is greater than a second cost to the user in response to selection of a second numerical value for the target percentage (para [0095] - "According to a particular embodiment, there are hundreds of supported workload types capable of being produced, selected, and planned for execution based on their respective properties, SLT expectations, execution requirements, and current capacity."; para [0175] - "Because the internally available resources represent a fixed capital cost, they are essentially free or nearly free to utilize... It may therefore be preferable to kill or terminate planned work, even currently executing work... in favor of scheduling and performing such work on the locally available computing resources within the host organization's computing infrastructure." - The workloads may be selected by the STL parameters (target percentage), and the workloads may be selected or terminated according to the financial cost of execution.), wherein the first numerical value is greater than the second numerical value (para [0175] - "Because the internally available resources represent a fixed capital cost, they are essentially free or nearly free to utilize... It may therefore be preferable to kill or terminate planned work, even currently executing work... in favor of scheduling and performing such work on the locally available computing resources within the host organization's computing infrastructure.").

Regarding claim 6, Salesforce discloses the method of claim 5. Salesforce further discloses wherein the first cost and the second cost correspond to monetary costs (para [0070] - "The compute sources discovery 115 component discovers and defines the available compute clouds 105 as well as their hardware and performance characteristics and other metrics such as... cost or budgets to utilize a particular machine... and so forth."; para [0096] - "Eash listed workload tasks may additionally be associated with supporting information by the produce operation 126, such as... cost constrainers or cost budgets for execution of that workload task... and so forth."; para [0175] - "Because the internally available resources represent a fixed capital cost, they are essentially free or nearly free to utilize...").

Regarding claim 7, Salesforce discloses the method of claim 5. Salesforce further discloses wherein the first cost and the second cost corresponds to allocation units provided to the user (para [0079] - "Additionally depicted is the discovery engine 192 capable of identifying accessible... information such as currently executing workload tasks... and other possible metrics, such as cost, performance, etc."; para [0081] - "Selection 129 to capacity then proceeds by first selecting tasks for each workload type from the produced set of tasks according to both the round's priority and also the workload type's resource allocation."; para [0088] - "At the planning 127 phase, the scheduler knows precisely which tasks for which workload types are selected from execution... such as the lowest cost resources or the most preferred among the two or more resources from competing clouds." - The cost per tasks corresponds to the amount of resource allocation for each workload tasks.), and wherein the user has a limited number of the allocation units (para [0062] - "Not all workload tasks are equal... this, the scheduler must accommodate the different computational burdens... and the different Quality of Service (QoS) or SLT expectations for each workload task, with every scheduled task being in contention for limited resources with all other scheduled workload tasks."").

Regarding claim 8, Salesforce discloses the method of claim 1. Salesforce further discloses wherein fully executing the schedule job includes: in response to a change in available power from a first level to a second level (para [0085] - "Therefore, according to one embodiment, starvation is avoided by configuring the capacity round to begin allocating at very low percentage of the total resources and then gradually increasing the allocated percentage subsequent rounds."), suspending execution of the application (para [0141] - "Where selected workload tasks cannot meet the requirements based on available capacity at the computing resources the scheduler may need to evict previously scheduled workloads... or re-enqueue the workload task with a higher priority such that it is scheduled with greater preference during a subsequent scheduling cycle."), wherein the first level is less than the second level (para [0085] - "Therefore, according to one embodiment, starvation is avoided by configuring the capacity round to begin allocating at very low percentage of the total resources and then gradually increasing the allocated percentage subsequent rounds." - Gradually increasing the subsequent iterations will leave the first iteration with less power than the subsequent iterations.); and restoring, based on a quotient of the estimated execution time and the target percentage (para [0141] - "Where selected workload tasks cannot meet the requirements based on available capacity at the computing resources the scheduler may need to evict previously scheduled workloads... or re-enqueue the workload task with a higher priority such that it is scheduled with greater preference during a subsequent scheduling cycle." - The estimated time and target percentage would be part of the computing requirements.), execution of the application, wherein restoring occurs while the available power is at the second level (para [0141] - "Where selected workload tasks cannot meet the requirements based on available capacity at the computing resources the scheduler may need to evict previously scheduled workloads... or re-enqueue the workload task with a higher priority such that it is scheduled with greater preference during a subsequent scheduling cycle." - Re-queueing the tasks for a later iteration will essentially restore the task at an iteration with more allocated resources.).

Regarding claim 9, Salesforce discloses a system comprising: a computing system of a data center (para [0058] - "Such a scheduler 125 may be utilized for scheduling in general application workloads... used for Software Defined Data Center... and cyclical workloads."); and a scheduling controller communicatively connected to the computing system (para [0058] - "Such a scheduler 125 may be utilized for scheduling in general application workloads... used for Software Defined Data Center... and cyclical workloads."), the controller being configured to: receive a request for an application to be executed by the computing system (para [0043] - "In one embodiment, requests 117 are received at, or submitted to, a web-server 175 within hose organizations 150."), wherein the application includes a plurality of tasks (para [0197] - "In accordance with one embodiment of the system 601, the system implements a scheduling service 665, in which the system includes... a workload discovery engine 643 to identify a plurality of workload tasks 640 to be scheduled for execution in response to queries 639... a portion of the plurality of workload tasks 640 for execution via the one or more computing resources 628 based on the infraction requested."), and wherein the request includes an estimated execution time corresponding to an estimated amount of real-world time that the tasks will be actively running on the computing system to fully execute the application (para [0061] - "According to described embodiments, the scheduler takes into account the quality of service or a Service Level Target (SLT) for every workload type performed. For instance, workload tasks will require some amount of time to process... the SLT for a given workload type may specify a priority or an expected completion time or an acceptable amount of processing time or an acceptable cost to complete the processing and so forth." - The times are taken from the type of request received.); cont.--

-- Continued in supplemental box --

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 21/45972

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:
– Continuation of box V.2 –

CLAIM 9 cont.–receive a service level objective indicating a target percentage of a total amount of real-world time that the tasks will be actively running on the computing system (para [0061] - "For instance, workload tasks will require some amount of time to process... the SLT for a given workload type may specify a priority or an expected completion time or an acceptable amount of processing time or an acceptable cost to complete the processing and so forth." - The amount of acceptable cost to complete a task could be represented as a percentage. SLT percentages are mentioned in the reference summary.); generate, in response to determining that the job can be completed according to the service level objective and the estimated execution time (para [0061] - "For instance, workload tasks will require some amount of time to process... the SLT for a given workload type may specify a priority or an expected completion time or an acceptable amount of processing time or an acceptable cost to complete the processing and so forth."; para [0141] - "In such a way, the scheduler models a forward-looking view when creating a plan 230 to determine whether everything schedules will complete within an acceptable period."), a notification indicating acceptance of the job (para [0045] - "Request interface 176 further supports the return of response packets or other replies and responses 116 in an outgoing direction from host organizations 150 to the user client devices 106A-C."; para [0221] - "For example, in one embodiment, system 716 includes application servers configured to... provide related data, code, forms, webpages, and other information to and from user systems 712 and to store to, and retrieve... related data...content." - The related information could be an indication that the request was accepted.); schedule, based on the service level objective and the estimated execution time (para [0061] - "For instance, workload tasks will require some amount of time to process... the SLT for a given workload type may specify a priority or an expected completion time or an acceptable amount of processing time or an acceptable cost to complete the processing and so forth."; para [0143] - "Because the scheduler executes in an iterative fasion... the priority or age or SLT/QoS requirements associated with such a task change over time... the scheduler will respond to these changes... for any given workload or task."), a job corresponding to the tasks of the application to be executed by the computing system (para [0054] - "The scheduling service 145 provides means by which to dynamically allocate compute capacity at any time... as necessary for performing a specific type of work according to need."); and notify, in response to the scheduled job being fully executed (para [0053] - "According to a particular embodiment, every time a new compute cloud is discover... the workload discovery 135 component will then... compute cloud requesting all running tasks and completed tasks, at which point the workload discovery 135 component will then update... on behalf of the... compute cloud."), the user that the application execution has completed (para [0045] - "Request interface 176 further supports the return of response packets or other replies and responses 116 in an outgoing direction from host organizations 150 to the user client devices 106A-C."; para [0221] - "For example, in one embodiment, system 716 includes application servers configured to... provide related data, code, forms, webpages, and other information to and from user systems 712 and to store to, and retrieve... related data...content." - The related information could be an indication that the request was accepted.).

Regarding claim 10, Salesforce discloses the system of claim 9. Salesforce further discloses wherein the target percentage is a numerical value between zero and one (para [0111] - "According to at least one embodiment, the reserved portion of available compute capacity is set as a percentage of total compute capacity (e.g., such as 10% OR 15%) within which the scheduler does not plan selected workload tasks for execution..." - The percentage could be between zero and one.).

Regarding claim 13, Salesforce discloses the system of claim 9. Salesforce further discloses wherein a value of the service level objective is selected according to a first cost to the user in response to selection of a first numerical value for the target percentage is greater than a second cost to the user in response to selection of a second numerical value for the target percentage (para [0095] - "According to a particular embodiment, there are hundreds of supported workload types capable of being produced, selected, and planned for execution based on their respective properties, SLT expectations, execution requirements, and current capacity."; para [0175] - "Because the internally available resources represent a fixed capital cost, they are essentially free or nearly free to utilize... It may therefore be preferable to kill or terminate planned work, even currently executing work... in favor of scheduling and performing such work on the locally available computing resources within the host organization's computing infrastructure." - The workloads may be selected by the STL parameters (target percentage), and the workloads may be selected or terminated according to the financial cost of execution.), wherein the first numerical value is greater than the second numerical value (para [0175] - "Because the internally available resources represent a fixed capital cost, they are essentially free or nearly free to utilize... It may therefore be preferable to kill or terminate planned work, even currently executing work... in favor of scheduling and performing such work on the locally available computing resources within the host organization's computing infrastructure.").

Regarding claim 14, Salesforce discloses the system of claim 9. Salesforce further discloses wherein fully executing the schedule job includes: in response to a change in available power from a first level to a second level (para [0085] - "Therefore, according to one embodiment, starvation is avoided by configuring the capacity round to begin allocating at very low percentage of the total resources and then gradually increasing the allocated percentage subsequent rounds."), suspending execution of the application (para [0141] - "Where selected workload tasks cannot meet the requirements based on available capacity at the computing resources the scheduler may need to evict previously scheduled workloads... or re-enqueue the workload task with a higher priority such that it is scheduled with greater preference during a subsequent scheduling cycle.), wherein the first level is less than the second level (para [0085] - "Therefore, according to one embodiment, starvation is avoided by configuring the capacity round to begin allocating at very low percentage of the total resources and then gradually increasing the allocated percentage subsequent rounds." - Gradually increasing the subsequent iterations will leave the first iteration with less power than the subsequent iterations.); and restoring, based on a quotient of the estimated execution time and the target percentage (para [0141] - "Where selected workload tasks cannot meet the requirements based on available capacity at the computing resources the scheduler may need to evict previously scheduled workloads... or re-enqueue the workload task with a higher priority such that it is scheduled with greater preference during a subsequent scheduling cycle." - The estimated time and target percentage would be part of the computing requirements.), execution of the application, wherein restoring occurs while the available power is at the second level (para [0141] - "Where selected workload tasks cannot meet the requirements based on available capacity at the computing resources the scheduler may need to evict previously scheduled workloads... or re-enqueue the workload task with a higher priority such that it is scheduled with greater preference during a subsequent scheduling cycle." - Re-queueing the tasks for a later iteration will essentially restore the task at an iteration with more allocated resources.).

– Continued in supplemental box –

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 21/45972

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:
-- Continuation of box V.2 --

Claims 3 and 11 lack inventive step under PCT Article 33(3) as being obvious over Salesforce in view of US 2005/0034128 A1 to Nagashima et al. (hereinafter 'Nagashima').

Regarding claim 3, Salesforce discloses the method of claim 1. Salesforce further discloses a time-to-complete (para [0061] - "For instance, workload tasks will require some amount of time to process... the SLT for a given workload type may specify a priority or an expected completion time or an acceptable amount of processing time or an acceptable cost to complete the processing and so forth." - The "time-to-complete" would be the acceptable amount of processing time.). Salesforce does not disclose determining based on a quotient of the estimated execution time and the target percentage. However, Nagashima does disclose determining based on a quotient of the estimated execution time and the target percentage (para [0041] - "In FIG. 5a, before automatic adjustment, the execution period... id divvied according to predetermined execution percentages."). It would have been obvious to one skilled in the art to compute the time-to-complete time through division, as taught by Nagashima to the system of Salesforce, as it would provide the completion time top the system, as specified by the tenant application (see Nagashima para [0041]).

Regarding claim 11, Salesforce discloses the system of claim 9. Salesforce further discloses a time-to-complete (para [0061] - "For instance, workload tasks will require some amount of time to process... the SLT for a given workload type may specify a priority or an expected completion time or an acceptable amount of processing time or an acceptable cost to complete the processing and so forth." - The "time-to-complete" would be the acceptable amount of processing time.). Salesforce does not disclose determining based on a quotient of the estimated execution time and the target percentage. However, Nagashima does disclose determining based on a quotient of the estimated execution time and the target percentage (para [0041] - "In FIG. 5a, before automatic adjustment, the execution period... id divvied according to predetermined execution percentages."). It would have been obvious to one skilled in the art to compute the time-to-complete time through division, as taught by Nagashima to the system of Salesforce, as it would provide the completion time top the system, as specified by the tenant application (see Nagashima para [0041]).

Claim 4 and 12 lack inventive step under PCT Article 33(3) as being obvious over Salesforce in view of US 2006/0253675 A1 to Bloks.

Regarding claim 4, salesforce discloses the method of claim 1. Salesforce does not disclose wherein the total amount of real-world time is a period of time beginning in response to the request being accepted and ending in response to the fully executed application being delivered to the user. However, Bloks does disclose wherein the total amount of real-world time is a period of time beginning in response to the request being accepted and ending in response to the fully executed application being delivered to the user (para [0030] - "As discussed above, the latency... represents the time between the requestor of request... issues the request at current time T for service to the scheduler 205 and the required service completion time... "- The latency will take into account the total time to execute the request beginning at then when the request is received.). It would have been obvious to one skilled in the art to calculate the total real time, as taught by Bloks to the system of Salesforce, as it would determine the total time for execution starting from receiving the request, as specified by the tenant application (see Bloks para [0030]).

Regarding claim 12, Salesforce discloses the system of claim 9. Salesforce does not disclose wherein the total amount of real-world time is a period of time beginning in response to the request being accepted and ending in response to the fully executed application being delivered to the user. However, Bloks does disclose wherein the total amount of real-world time is a period of time beginning in response to the request being accepted and ending in response to the fully executed application being delivered to the user (para [0030] - "As discussed above, the latency... represents the time between the requestor of request... issues the request at current time T for service to the scheduler 205 and the required service completion time... "- The latency will take into account the total time to execute the request beginning at then when the request is received.). It would have been obvious to one skilled in the art to calculate the total real time, as taught by Bloks to the system of Salesforce, as it would determine the total time for execution starting from receiving the request, as specified by the tenant application (see Bloks para [0030]).

Claim 15 lacks inventive step under PCT Article 33(3) as being obvious over Salesforce in view of US 2016/0202744 A1 to Intel Corporation (hereinafter 'Intel').

Regarding claim 15, Salesforce discloses the system of claim 9. Salesforce does not disclose wherein the scheduling controller is further configured to migrate execution of a first class of applications from the first plurality of computing systems in the first data center to the second plurality of computing systems in the second data center in response to the determination that the availability of the power that is accessible to the first data center has decreased below the threshold level, wherein the first application is associated with the first class of applications. However, Intel does disclose wherein the scheduling controller is further configured to migrate execution of a first class of applications from the first plurality of computing systems in the first data center to the second plurality of computing systems in the second data center in response to the determination that the availability of the power that is accessible to the first data center has decreased below the threshold level (para [0064] - "According to embodiments, the method may further include, in response to instructions from the customer server, transferring tasks from first partially loaded ones of the one or more remote computing servers that provide the power management services to second partially loaded ones of the one or more remote computing servers that provide power management service; and causing the first partially loaded ones of the one or more remote computing servers to power-down or to enter a low-power mode"), wherein the first application is associated with the first class of applications (para [0064] - "According to embodiments, the method may further include, in response to instructions from the customer server, transferring tasks from first partially loaded ones of the one or more remote computing servers that provide the power management services to second partially loaded ones of the one or more remote computing servers that provide power management service; and causing the first partially loaded ones of the one or more remote computing servers to power-down or to enter a low-power mode" - The first partially lorded tasks would be associated with the first applications received.). It would have been obvious to one skilled in the art to migrate the applications, as taught by Intel to the system of Salesforce, as it would save power in the datacenters, as specified by the tenant application (see Intel para [0064]). Continued in next box

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 21/45972

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:
-- Continuation of box V.2 --

Claims 16-17 lack inventive step under PCT Article 33(3) as being obvious over Salesforce in view of US 2010/0333113 A1 to Johnson et al. (hereinafter 'Johnson').

Regarding claim 16, Salesforce discloses the system of claim 9. Salesforce does not disclose wherein the scheduling controller operates based on a centralized heuristic algorithm. However, Johnson does disclose wherein the scheduling controller operates based on a centralized heuristic algorithm (para [0012] - "In general, embodiments of the invention provide a system and method for heuristics-based task scheduling in an event-driven system."). It would have been obvious to one skilled in the art to utilize heuristics, as taught by Johnson to the system of Salesforce, as it would provide a means of task scheduling, as specified by the tenant application (see Johnson para [0012]).

Regarding claim 17, salesforce discloses the system of claim 9. Salesforce does not disclose wherein the scheduling controller operates based on one of a distributed heuristic algorithm or a centralized machine-learning algorithm. However, Johnson does disclose wherein the scheduling controller operates based on one of a distributed heuristic algorithm or a centralized machine-learning algorithm (para [0025] -" In one or more embodiments, a task scheduler)126) is configured to receive a task object... Subsequently, the task scheduler (126) uses a heuristic policy to determine how to schedule the task object relative to other task objects in the queue."). It would have been obvious to one skilled in the art to utilize heuristics, as taught by Johnson to the system of Salesforce, as it would provide a means of task scheduling, as specified by the tenant application (see Johnson para [0025]).

Claims 18-20 lack inventive step under PCT Article 33(2) as being obvious over Intel in view of Salesforce.

Regarding claim 18, Intel discloses a system comprising: a data center comprising a plurality of computing systems configured to receive power from a power source (para [0034] - "According to various embodiments, cloud servers 122 may be configured with power management (PM) control module 137 to receive power management commands from cloud customer server 108 to reduce overall power consumption of cloud servers 122 in order to reduce operating costs. In embodiments, cloud servers 122 may be shared, providing cloud services to a plurality of cloud customer data centers 102."); and monitor an availability of the power that is accessible to the data center (para [0036] - "Power management controller 140 may be configured to monitor power consumption of one or more of storage 138, processor 136, and/or power supply 134."), receive an application and a service level objective associated with the application (para [0062] - "According to various embodiments, a method may include receiving a request, by a remote computing management server from a customer server, for a record of power management services available by a number of remote computing servers that are networked to provide remote computing services and that are managed by the remote computing management server.") and in response to a determination that the availability of the power has decreased (para [0071] - "The number of instructions may enable the remote computer server to, in response to power management commands received from at least one of the one or more customer servers, decrease power consumption by the remote computing server."). Intel does not disclose a scheduling controller configured to: initiate execution of the application by at least one of the computing systems, below a threshold level, suspend execution of the application, and restore, without the availability of the power having increased, execution of the application based on a quotient of an estimated amount of real-world time that at least a portion of the application will be actively running on at least one of the computing systems to fully execute the application and a target percentage of a total amount of real-world time that the tasks will be actively running on at least one of the computing systems. However, Salesforce does disclose a scheduling controller configured to (para [0047] - "Still further depicted within the hosted computing environment 111 is the scheduling service 145 having therein both a scheduler 191..."): initiate execution of the application by at least one of the computing systems (para [0200] - "According to another embodiment of the system 601, the scheduler is to further perform additional operations, including: initiating execution of the selected workload tasks..."), below a threshold level (para [0110] - "In certain instances, the excessive allocation 114 may be permitted to remain until the computing cloud completes planned work and this recedes back below to maximum SLT allocation 143 threshold..."), suspend execution of the application (para [0141] - "Where selected workload tasks cannot meet the requirements based on available capacity at the computing resources the scheduler may need to evict previously scheduled workloads... or re-enqueue the workload task with a higher priority such that it is scheduled with greater preference during a subsequent scheduling cycle."), and restore, without the availability of the power having increased (para [0141] - "Where selected workload tasks cannot meet the requirements based on available capacity at the computing resources the scheduler may need to evict previously scheduled workloads... or re-enqueue the workload task with a higher priority such that it is scheduled with greater preference during a subsequent scheduling cycle."), execution of the application based on a quotient of an estimated amount of real-world time that at least a portion of the application will be actively running on at least one of the computing systems to fully execute the application and a target percentage of a total amount of real-world time that the tasks will be actively running on at least one of the computing systems (para [0061] - "For instance, workload tasks will require some amount of time to process... the SLT for a given workload type may specify a priority or an expected completion time or an acceptable amount of processing time or an acceptable cost to complete the processing and so forth."; para [0200] - "According to another embodiment of the system 601, the scheduler is to further perform additional operations, including: initiating execution of the selected workload tasks...").

-- Continued in supplemental box --

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 21/45972

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:
-- Continuation of box V.2

Regarding claim 19, Intel, in view of Salesforce, disclose the system of claim 18. Intel further discloses wherein, in response to the determination that the availability of the power has decreased (para [0072] - "In embodiments, decreasing power consumption may include causing the remote computing server to enter a shut down sequence."), the scheduling controller is further configured to send a hibernation command to the at least one of the computing systems associated with the suspended application to cause the at least one of the computing systems to hibernate (para [0045] - "For example, DCM control module 115 may transmit, e.g., via IPMI or Redfish API, power management commands to cause cloud servers 122 to hibernate, enter standby, enter another low-power mode, power down, or issue power limitation commands.").

Regarding claim 20, Intel, in view of Salesforce, disclose the system of claim 18. Intel further discloses wherein, in response to the determination that the availability of the power has decreased (para [0072] - "In embodiments, decreasing power consumption may include causing the remote computing server to enter a shut down sequence."), the scheduling controller is further configured to send a power down command to the at least one of the computing systems to cause the at least one of the computing systems to power down (para [0045] - "For example, DCM control module 115 may transmit, e.g., via IPMI or Redfish API, power management commands to cause cloud servers 122 to hibernate, enter standby, enter another low-power mode, power down, or issue power limitation commands.).

Claims 1-20 have industrial applicability as defined by PCT Article 33(4), because the subject matter can be made or used in industry.

SEARCH HISTORY

Application Number	PCT/US 21/45972
Search Conducted By	KY
Search Approved By	PCL

CPC/IPC Classifications Searched	IPC: G06F 9/46 (2021.01) CPC: G06F 9/4881, G06F 9/4843, G06F 9/52, G06F 9/3851, G06F 9/4887, G06F 9/4812, G06F 9/505, G06F 9/5083, H04L 29/08144, H04L 29/08171, G06F 9/5088 I
Date Conducted	05 October 2021 (05.10.2021)

Documentation Searched	IPC: G06F 9/46 (2021.01) CPC: G06F 9/4881, G06F 9/4843, G06F 9/52, G06F 9/3851, G06F 9/4887, G06F 9/4812, G06F 9/505, G06F 9/5083, H04L 29/08144, H04L 29/08171, G06F 9/5088 UC: 718/102; 718/103; 718/105
Search Terms Used	receive, accept, request, user, application(s), task(s), estimated execution time, run time, completion time, estimated real world time, real time, active time, service objective, target(ed), percentage, cost, amount, total, generate, produce, create, response(s), determine(ing), notification, alert, message, acceptance, job, service, data center(s), numerical value, number(s), quotient, computation, result(s), beginning, end, start(ing), select(ed), objective, monetary cost, money, allocation unit(s), heuristic(s), machine learning, deep learning, AI, artificial intelligence, hibernation command, sleep command, power down command, decrease(d) power
Date Conducted	05 October 2021 (05.10.2021)

Electronic Database Searched	Patbase
Files Searched	Full-text: AU BE BR CA CH CN DE DK EP ES FI FR GB IN JP KR SE TH TW US WO Bibliographic: (Europe) AT BA BE BG CH CS CY CZ DD DK EE ES FI GE GR HR HU IE IS IT LT LU LV MC MD MT NL NO PL PT RO RS SE SI SK SM TR UA YU (Asia) EA GC HK ID IL IN KZ MN MY PH RU SG SU TH TJ TW

	UZ VN (North America) CA CR CU DO GT HN MX NI PA SV TT (South America) AR BR CL CO EC PE UY (Australasia) AU NZ (Africa) AP DZ EG KE MA MW OA ZA ZM ZW
Date Conducted	05 October 2021 (05.10.2021)

Search Logic:

Search 1: IPC = (G06F 9/46) (Results 59609)
Search 2: CPC = (G06F 9/4881 OR G06F 9/4843 OR G06F 9/52 OR G06F 9/3851 OR G06F 9/4887 OR G06F 9/4812 OR G06F 9/505 OR G06F 9/5083 OR H04L 29/08144 OR H04L 29/08171 OR G06F 9/5088) (Results 31093)
Search 3: UC = (718/102 OR 718/103 OR 718/105) (Results 8075)
Search 4: 1 OR 2 OR 3 (Results 82320)
Search 5: 4 AND FT = (receiv* OR accept* OR input*) w5 (request* OR application%) (Results 30854)
Search 6: 5 AND FT = (plraul* OR multipl* OR more_than_one OR one_or_more) w6 (task%) (Results 4882)
Search 7: 6 AND FT = (estimat* OR determin*) w5 (execution% OR complet*) (Results 1678)
Search 8: 7 AND FT = (real% OR real_world% OR actual*) w5 (time% OR duration%) (Results 902)
Search 9: 8 AND FT = (percentage%) w6 (time% OR total%) (Results 170)
Search 10: 6 AND FT = (estimat*) w5 (execution_time OR execution% OR complet*) (Results 278)
Search 11: 10 AND FT =(real% OR actual% OR real_world% OR run*) w5 (time%) (Results 199)
Search 12: 11 NOT 9 (Results 162)
Search 13: 4 AND FT = (plraul* OR multipl* OR more_than_one OR one_or_more) w8 (task%) (Results 9784)
Search 14: 13 AND FT = (receiv* OR accept* OR input*) w7 (request* OR application%) (Results 5649)
Search 15: 14 AND FT = (notif* OR display* OR alert*) w6 (accept* OR complet*) (Results 780)
Search 16: 15 AND FT = (percent*) (Results 384)
Search 17: 16 AND FT = (estimat* OR complet* OR real OR actual% OR real_world) w6 (time%) (Results 319)
Search 18: 17 AND FT = (service%) w5 (level% OR objective% OR agreement% OR target%) (Results 112)
Search 19: 18 NOT (9 OR 11) (Results 93)
Search 20: 15 AND FT = (data_center%) (Results 123)
Search 21: 20 NOT (9 OR 11 OR 18) (Results 78)
Search 22: FT = (data_center%) (Results 119441)
Search 23: 22 AND FT = (receiv* OR accept* OR input*) w7 (request* OR application%) (Results 55513)
Search 24: 23 AND FT = (service_level%) (Results 9162)
Search 25: 24 AND FT = (percent*) w7 (time% OR total% OR real% OR real_world% OR complet*) (Results 1598)
Search 26: 25 AND FT = (notif* OR display* OR alert* OR output*) w7 (agreement% OR complet* OR execut* OR accept*) (Results 673)
Search 27: 26 AND FT = (estimat*) w6 (complet* OR execution% OR run%) (Results 86)
Search 28: 27 NOT (9 OR 11 OR 18 OR 20) (Results 67)
Search 29: 25 AND FT = (determin*) w8 (complet*) (Results 514)
Search 30: 29 AND FT = (cost%) w9 (financial* OR monetary* OR money%) (Results 162)
Search 31: 30 NOT (9 OR 11 OR 18 OR 20 OR 27) (Results 145)

Search 32: FT = (receiv* OR accept* OR input*) w4 (request* OR application%) (Results 922412)
Search 33: 32 AND FT = (plraul* OR multipl* OR more_than_one OR one_or_more) w6 (task% OR job%) (Results 46573)
Search 34: 33 AND FT = (heuristic%) (Results 3797)
Search 35: 34 AND FT = (total% OR complet* OR run% OR execut* OR real_world%) w6 (time%) (Results 2024)
Search 36: 35 AND FT = (data_center%) (Results 642)
Search 37: 36 AND FT = (percent*) w6 (time% OR real_world% OR actual%) (Results 258)
Search 38: 37 NOT (9 OR 11 OR 18 OR 20 OR 27 OR 30) (Results 108)
Search 39: 34 AND FT = (time%) w6 (total% OR complet* OR real_world%) (Results 1374)
Search 40: 39 AND FT = (service_level%) (Results 461)
Search 41: 40 AND FT = (percent*) (Results 366)
Search 42: 41 AND FT = (notif* OR display* OR alert* OR update*) w6 (user%) (Results 328)
Search 43: 42 NOT (9 OR 11 OR 18 OR 20 OR 27 OR 30 OR 37) (Results 70)
Search 44: PN=(US2020167197 AA OR US2016202744 AA OR US2005034128 AA) (Results 3)
Search 45: CTB 44 OR CTF 44 (Results 198)
Search 46: 45 NOT (9 OR 11 OR 18 OR 20 OR 27 OR 30 OR 37 OR 42) (Results 189)

Electronic Database Searched	Google
Files Searched	Scholar (Articles excluding patents)
Date Conducted	05 October 2021 (05.10.2021)
Search Logic:	
data center scheduling user request application estimated execution time (About 68,600 results) data center scheduling user request application estimated execution time and real world time (About 49,000 results) data center scheduling user request application target percentage of real execution time (About 41,500 result) data center scheduling user request application completion time quotient of execution and target (About 9,000 results) data center scheduling user request application completion time and cost (About 121,000 result) data center scheduling user request service level value cost (About 186,000 results) data center user request cost of allocation units (About 187,000 results) data center user request execution time and real world time computed to determine total time (About 60,300 results) data center user request execution and real world time determine total and notify of completion (About 28,500 results) data center user request execution suspend power based on available power (About 30,900 results)	

Electronic Database Searched	Google
Files Searched	Patents (US Patents/Published Applications, EPO publications, International, China, Germany, Canada)

Date Conducted	05 October 2021 (05.10.2021)

Search Logic:

data center accept user request target percentage of time and estimated time (About 142,406 results)
data center scheduling accept user request estimated execution and real world time (About 132,563 results)
data center scheduling accept user request service level objective target percentage of execution time (About 136,884 results)
data center scheduling change in power suspend execution (About 135,828 results)
data center scheduling service level objective estimated times (About 148,308 results)
data center scheduling service level objective estimated times suspend application (About 135,678 results)
data center scheduling service level objective estimated times and monetary cost (About 63,242 results)
data center user service objective estimated completion times (About 136,950 results)
data center user service objective estimated completion times plural tasks (About 68,048 results)
data center user service objective percentage target time plural tasks (About 92,463 results)
data center user service objective estimate completion times and suspend application (About 135,828 results)

Supplemental Search:

Electronic Database Searched	PatBase
Files Searched	Full-text: AU BE BR CA CH CN DE DK EP ES FI FR GB IN JP KR SE TH TW US WO Bibliographic: (Europe) AT BA BE BG CH CS CY CZ DD DK EE ES FI GE GR HR HU IE IS IT LT LU LV MC MD MT NL NO PL PT RO RS SE SI SK SM TR UA YU (Asia) EA GC HK ID IL IN KZ MN MY PH RU SG SU TH TJ TW UZ VN (North America) CA CR CU DO GT HN MX NI PA SV TT (South America) AR BR CL CO EC PE UY (Australasia) AU NZ (Africa) AP DZ EG KE MA MW OA ZA ZM ZW
Date Conducted	12 October 2021
Search Logic:	
Search 1: data w3 center and task* (Results 41242) Search 2: 1 and service w3 level and objective (Results 1821) Search 3: 2 and estimat* and execution w3 time (Results 284) Search 4: 3 and target and percentage (Results 197) Search 4: 3 and target w3 percentage (Results 1)	

Electronic Database Searched	Google
Files Searched	Web, Scholar with patents
Date Conducted	12 October 2021
Search Logic:	
Scholar: data center task estimated execution time About 607,000 results (0.13 sec) data center task estimated execution time target percentage of time About 199,000 results (0.19 sec) data center task estimated execution time target percentage of time cost About 148,000 results (0.22 sec) Web: data center task estimated execution time (top results reviewed) data center task estimated execution time target percentage of time (top results reviewed) data center task estimated execution time target percentage of time cost (top results reviewed)	

Electronic Patent Application Fee Transmittal	
Application Number:	16525142
Filing Date:	29-Jul-2019
Title of Invention:	Managing Queue Distribution between Critical Datacenter and Flexible Datacenter
First Named Inventor/Applicant Name:	Michael T. McNamara
Filer:	Stephen Conrad Smith/Mark Sweetin
Attorney Docket Number:	84008-321859
Filed as Large Entity	
Filing Fees for Utility under 35 USC 111(a)	

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 2 months with $0 paid	1252	1	640	640
Miscellaneous:				
RCE- 1ST REQUEST	1801	1	1360	1360
		Total in USD ($)		**2000**

Electronic Acknowledgement Receipt	
EFS ID:	44462450
Application Number:	16525142
International Application Number:	
Confirmation Number:	7602
Title of Invention:	Managing Queue Distribution between Critical Datacenter and Flexible Datacenter
First Named Inventor/Applicant Name:	Michael T. McNamara
Customer Number:	23644
Filer:	Stephen Conrad Smith/Mark Sweetin
Filer Authorized By:	Stephen Conrad Smith
Attorney Docket Number:	84008-321859
Receipt Date:	08-DEC-2021
Filing Date:	29-JUL-2019
Time Stamp:	11:41:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$2000
RAM confirmation Number	E2021B8B41512576
Deposit Account	120913
Authorized User	Mark Sweetin
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	321859_18-1490-CON_Supp_IDS_211208.pdf	54105 99c52d9a9fa1dfb3090d9f6c7724ab8dfe171285	no	4
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
2	Request for Continued Examination (RCE)	321859_eRCE_211208-scs.pdf	1349947 0ddabf199fc7d91b5d648ae88ba0fdd69e4c867d	no	3
Warnings:					
Information:					
3		321859_Response_210709_FOA_211208.pdf	122037 46208f435af8021f74f5f396449918d5484fec6c	yes	15

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment Submitted/Entered with Filing of CPA/RCE	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	15

Warnings:					
Information:					
4	Foreign Reference	WO2020227811A1.pdf	3031626 81e5d27f7e633c9bec687b45f23e0ef1e0ae3fdd	no	56
Warnings:					
Information:					

5	Non Patent Literature	PESR_EP18900411_09Sep2021_EFS.pdf	4285337 d169c4091d8c608d188f5e9d28db0335101f3f3a	no	24
Warnings:					
Information:					
6	Non Patent Literature	FOA_US16529402_09AUG2021_EFS.PDF	8814868 60a8b48d84fa6d677866933b367657dc9fa50d32	no	43
Warnings:					
Information:					
7	Non Patent Literature	FOA_US16573577_09AUG2021_EFS.PDF	4479616 e01ee80e7ab4d95f108fad4b4c1cb3f603c6f51e	no	16
Warnings:					
Information:					
8	Non Patent Literature	GHATIKAR_DemRespOpp_LawBerNatLab_2012_Red.pdf	12700149 58994f8fe29764b26b1792fd6b28c678ff3bafda	no	57
Warnings:					
Information:					
9	Non Patent Literature	ISR_WO_PCTUS2021045972_15NOV2021.pdf	1072872 9bb29daaf1d94143f7c8120683c101d55bf34f21	no	16
Warnings:					
Information:					
10	Non Patent Literature	NOA_US16528348_09June2021_EFS.pdf	1143149 86b4c5a6854c0b6dd6cd468c6f1e16230a05e2a9	no	11
Warnings:					
Information:					
11	Non Patent Literature	NOA_US16284610_26JULY2021_EFS.PDF	413502 fe792e9f140cc224f1d17adc581a3d8a5e928824	no	2
Warnings:					
Information:					

12	Non Patent Literature	NOA_US16528348_08OCT2021_EFS.pdf	169785 da6b2eaa0f8bb3490a44c4b695451a22e937e980	no	5
Warnings:					
Information:					
13	Non Patent Literature	NOA_US16528348_24SEP2021_EFS.PDF	1618564 a5ead4e85e7d5eb19835eeff89a8cc30776c9f53	no	6
Warnings:					
Information:					
14	Fee Worksheet (SB06)	fee-info.pdf	40388 b8eb9bde3cde61e3fe0a745a581cfdbf3ac54d09	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	39295945		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/525,142	Filing Date 07/29/2019	☐ To be Mailed

ENTITY: ☐ LARGE ☑ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $50 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $230 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	12/08/2021	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 16	Minus	** 20	= 0		x $50 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x $240 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	SLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/APRIL L. WALKER/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/525,142	07/29/2019	Michael T. McNamara	84008-321859	7602

23644 7590 07/09/2021

Barnes & Thornburg LLP (CH)
P.O. Box 2786
Chicago, IL 60690-2786

EXAMINER
SERRAO, RANODHI N

ART UNIT	PAPER NUMBER
2444	

NOTIFICATION DATE	DELIVERY MODE
07/09/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Patent-ch@btlaw.com

Office Action Summary	**Application No.** 16/525,142	**Applicant(s)** McNamara et al.	
	Examiner RANODHI N SERRAO	**Art Unit** 2444	**AIA (FITF) Status** Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 6/8/21.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☑ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-8 and 10-17 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-8 and 10-17 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Response to Arguments

Applicant's arguments and amendments, filed 6/8/21, regarding the rejection of the claims under 35 U.S.C. 103 have been fully considered but they are not persuasive.

As per Applicant's request, the nonstatutory double patenting rejection of the claims will be held in abeyance until the remaining issues in the application have been resolved.

Applicant argued:

> The examiner has relied on Steven Para. 0048 as teaching "wherein the BTM power input system is configured to receive power from a power generation system prior to the power undergoing step-up transformation for transmission to a grid." Para. 0048 of Steven, however, neither discloses nor suggests this feature. Instead, Para 0048 of Steven is directed to determining an operating schedule for a datacenter operate by an energy customer of an electrical supplier. One skilled in the art would understand that energy provided to an energy customer of an electrical supplier comes from a power grid located in front of a meter with respect to the energy customer, not from a power generation system located behind a meter with respect to the first recited flexible datacenter.

The Examiner respectfully disagrees and points out that claim 1 does not specify the location of the flexible datacenter in relation to the recited meter or the grid. The claim merely states "a flexible datacenter comprising: a behind-the-meter ("BTM") power input system…" Since the flexible datacenter is recited in the preamble of the claim, it does not carry patentable

weight and is an intended environment of the claimed system. A preamble is generally not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure, and where the body of the claim does not depend on the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone. See *In re Hirao*, 535 F.2d 67,190 USPQ15 (CCPA 1976) and *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951).

Furthermore, paragraphs [0102] and [0440] of Steven states,

> [0102] The apparatuses and methods described herein are applicable to a system that includes an energy storage asset 1, a controller 2 in communication with the energy storage asset 1, and an energy consuming asset 3 in communication with a power line 4 (as depicted in the example of FIG. 1). The controller 2 facilitates charging of the energy storage asset 31 using the electricity supplied by power line 4 or feeding power generated by a discharge of the energy storage asset 31 to the power line 4. As depicted in the non-limiting example of FIG. 1, the controller 2, the energy storage asset 1 and the energy consuming asset 3 may be located behind a power meter 5. For example, all of the controller 2, the energy storage asset 1 and the energy consuming asset 3 may be located at one or more facilities of the energy consumer. (Emphasis added).
>
> [0440] VAR refers to the reactive power (measured in volt-ampere reactive (VARs)). VAR is the electrical energy that energizes capacitive components and inductive components in a power system. A non-limiting example of a capacitive component is overhead conductors, which are continuously charged and discharged by an alternating current (AC) waveform. Non-limiting examples of inductive components are electric motors and transformers, which can store energy in magnetic fields that are used for device operation. By reducing the amount of VARs flowing on the distribution feeder, an electricity supplier can reduce electrical losses and improve the voltage profile along the feeder. Where reactive power varies throughout the day, the capacitive components of a energy asset that are equipped with switches can be placed in or out of service as needs vary during the day. These capacitive components of the energy asset may be equipped with controllers. A system, apparatus, or method may be used to determine when to switch the switches on or off. For example, when the voltage at the location of the capacitive component is low, the operating schedule determined according to a principle herein may include instructions for the controller to close the switch to place

> the capacitive component in service. When the voltage is high, the operating schedule may include instructions for the controller to open the switch to remove the capacitive component from service. (Emphasis added).

Since Steven states that the controller 2, the energy storage asset 1 and the energy consuming asset 3 may be located behind a power meter 5 and because Steven also discloses transformers, which can store energy in magnetic fields that are used for device operation, Steven teaches *a behind-the-meter ("BTM") power input system configured to receive power from a power generation system prior to the power undergoing step-up transformation for transmission to a grid.* Therefore Steven teaches the claimed limitations.

The rejection of claim 14 is maintained for the same rationale as claim 1.

The Examiner respectfully reminds applicant of the broadest reasonable interpretation standard (See MPEP 2111), "During examination, the claims must be interpreted as broadly as their terms reasonably allow." In re American Academy of Science Tech Center, 367 F.3d 1359, 1369, 70 USPQ2d 1827, 1834 (Fed. Cir. 2004) (The USPTO uses a different standard for construing claims than that used by district courts; during examination the USPTO must give claims their broadest reasonable interpretation.) In Phillips v. AWH Corp., 415 F.3d 1303, 75 USPQ2d 1321 (Fed. Cir. 2005), the court further elaborated on the “broadest reasonable interpretation" standard and recognized that “The Patent and Trademark Office (“PTO") determines the scope of claims in patent applications not solely on the basis of the claim language, but upon giving claims their broadest reasonable construction." Thus, when interpreting claims, the courts have held that Examiners should (1) interpret claim terms as broadly as their terms reasonably allows and (2) interpret claim phrases as broadly as their construction reasonably allows. In conclusion, upon taking the broadest reasonable

interpretation of the claims, the cited references teach all of the claimed limitations and the rejections are maintained as below.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP § 2146 *et seq.* for applications not subject to examination under the first inventor to

file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claim 14 is rejected on the ground of nonstatutory double patenting as being unpatentable over the claims of U.S. Patent No. 10,367,353. Although the claims at issue are not identical, they are not patentably distinct from each other because the examined application claims are anticipated by the reference claim(s). Claim 1 of the Patent contains every element of claim 14 of the instant application as shown in the table below and as such anticipate(s) the claim of the instant application.

Claim 14 is also provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of copending Application No. 16/573,577 (reference application). Although the claims at issue are not identical, they are not patentably distinct from each other because the examined application claims are anticipated by the reference claim(s). Claim 1 of the reference Application contains every element of claim 14 of the instant application as shown in the table below and as such anticipate(s) the claim of the instant

application. This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

"A later patent claim is not patentably distinct from an earlier patent claim if the later claim is obvious over, or **anticipated by**, the earlier claim. In re Longi, 759 F.2d at 896, 225 USPQ at 651 (affirming a holding of obviousness-type double patenting because the claims at issue were obvious over claims in four prior art patents); In re Berg, 140 F.3d at 1437, 46 USPQ2d at 1233 (Fed. Cir. 1998) (affirming a holding of obviousness-type double patenting where a patent application claim to a genus is anticipated by a patent claim to a species within that genus). " ELI LILLY AND COMPANY v BARR LABORATORIES, INC., United States Court of Appeals for the Federal Circuit, ON PETITION FOR REHEARING EN BANC (DECIDED: May 30, 2001).

Instant Application – Claim 14	Patent No. 10,367,353 – Claim 1
14. A flexible datacenter comprising: a behind-the-meter ("BTM") power input system; a power distribution system; a datacenter control system; a plurality of computing systems, wherein the plurality of computing systems are powered by the BTM power input system via the power distribution system; and a queue subsystem configured to organize a set of computational	1. A system comprising a flexible datacenter comprising: a behind-the-meter power input system, a first power distribution system, a datacenter control system, and a first plurality of computing systems powered by the behind-the-meter power input system via the first power distribution system, wherein the flexible datacenter control system is configured to modulate power delivery to

operations for performance by the plurality of computing systems, wherein the queue subsystem is part of a distributed queue system.	the plurality of computing systems based on one or more monitored power system conditions or an operational directive; a critical datacenter comprising: a power input system, a second power distribution system, a critical datacenter control system, and a second plurality of computing systems powered by the power input system via the second power distribution system; a queue system configured to organize a plurality of computational operations, wherein the queue system is distributed into multiple queue subsystems with each queue subsystem organizing a set of computational operations according to rules associated with that queue subsystem; a first communication link connecting the flexible datacenter, the critical datacenter, and the queue system; and a routing control system configured to (i) identify, using the queue system, a computational operation to be performed, (ii) determine whether to route the

	computational operation to the flexible datacenter, and (iii) based on a determination to route the computational operation to the flexible datacenter, cause the computational operation to be sent to the flexible datacenter via the first communication link.

Instant Application – Claim 14	Patent Application No. 16/573,577 – Claim 1
14. A flexible datacenter comprising: a behind-the-meter ("BTM") power input system; a power distribution system; a datacenter control system; a plurality of computing systems, wherein the plurality of computing systems are powered by the BTM power input system via the power distribution system; and a queue subsystem configured to organize a set of computational operations for performance by the plurality of computing systems, wherein the queue	1. A system comprising: a flexible datacenter comprising: a power input system; a first computing system powered by the power input system; a queue system configured to organize a plurality of computational operations; and a second computing system configured to: determine, using the queue system, a computational operation for performance; determine whether to assign the computational operation for performance at the first computing system; and based on a determination to assign the

subsystem is part of a distributed queue system.	computational operation for performance at the first computing system, assign the computational operation for performance at the first computing system.

Claim Rejections - 35 USC § 103

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-8 and 10-17 are rejected under 35 U.S.C. 103 as being unpatentable over Mick et al. (2013/0304903) in view of Steven et al. (2015/0278968).

As per claim 1, **Mick et al.** teaches a system comprising: a flexible datacenter comprising:

a queue system configured to organize a plurality of computational operations, wherein the queue system comprises multiple queue subsystems, and wherein each queue subsystem organizes a set of computational operations according to rules associated with the queue subsystem **[see Mick et al., paragraphs 0122-0126 and 0132-0133]**; and

a routing control system configured to: determine, using the queue system, a computational operation to be performed;

determine whether to route the computational operation to the flexible datacenter; and

based on a determination to route the computational operation to the flexible datacenter, assign the computational operation for performance at the flexible datacenter **[see Mick et al., paragraphs 0178-0179]**.

Mick et al. fails to teach however **Steven et al.** in the same field of endeavor teaches a behind-the-meter ("BTM") power input system configured to receive power from a power generation system prior to the power undergoing step-up transformation for transmission to a grid **[see Steven et al., paragraphs 0102 and 0440]**; a power distribution system **[see Steven et al., paragraph 0126]**; a plurality of computing systems powered by the BTM power input system via the power distribution system **[see Steven et al., paragraph 0213]**.

It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to combine the teachings of **Mick et al.** with **Steven et al.** in order to relieve time-dependent and/or geographically-dependent limitations on the power grid's ability to support transmission of electricity.

As per claim 2, **Mick-Steven** teaches the system of claim 1, wherein the routing control system is a remote master control system positioned remotely from the flexible datacenter **[see Mick et al., paragraph 0038]**.

As per claim 3, **Mick-Steven** teaches the system of claim 1, wherein the routing control system is a remote master control system positioned at the flexible datacenter **[see Mick et al., paragraph 0052]**.

As per claim 4, **Mick-Steven** teaches the system of claim 1, wherein the flexible datacenter further comprises: a datacenter control system, wherein the datacenter control system is configured to modulate power delivery to the plurality of computing systems based on one or more monitored power system conditions **[see Mick et al., paragraph 0055]**.

As per claim 5, **Mick-Steven** teaches the system of claim 4, wherein the one or more monitored power system conditions comprises: behind-the-meter ("BTM") power availability at the plurality of computing systems **[see Steven et al., paragraph 0213]**.

As per claim 6, **Mick-Steven** teaches the system of claim 4, wherein the one or more monitored power system conditions comprises: one or more of excess local power generation at a local station level, excess local power generation that a grid cannot receive, local power generation subject to economic curtailment, local power generation subject to reliability curtailment, local power generation subject to power factor correction, low local power

generation, start up local power generation situations, transient local power generation situations, or testing local power generation situations where there is an economic advantage to using local behind-the-meter power generation **[see Mick et al., paragraph 0070]**.

As per claim 7, **Mick-Steven** teaches the system of claim 1, wherein the flexible datacenter further comprises: a datacenter control system, wherein the datacenter control system is configured to modulate power delivery to the plurality of computing systems based on an operational directive **[see Mick et al., paragraph 0090]**.

As per claim 8, **Mick-Steven** teaches the system of claim 7, wherein the operational directive originates from the routing control system and depends on behind-the-meter ("BTM") power availability at the plurality of computing systems **[see Steven et al., paragraph 0026]**.

As per claim 10, **Mick-Steven** teaches the system of claim 1, wherein the routing control system controls distribution of the plurality of computational operations from the queue system **[see Mick et al., paragraph 0128].**

As per claim 11, **Mick-Steven** teaches the system of claim 1, wherein a first queue subsystem of the queue system is located at the flexible datacenter **[see Mick et al., paragraph 0161].**

As per claim 12, **Mick-Steven** teaches the system of claim 11, further comprising: a second datacenter, wherein a second queue subsystem of the queue system is located at the second datacenter **[see Mick et al., paragraph 0175].**

As per claim 13, **Mick-Steven** teaches the system of claim 12, wherein the second datacenter is a second flexible datacenter **[see Mick et al., paragraph 0133].**

As per claim 14, **Mick et al.** teaches a flexible datacenter comprising:

a queue subsystem configured to organize a set of computational operations for performance by the plurality of computing systems, wherein the queue subsystem is part of a distributed queue system **[see Mick et al., paragraphs 0122-0126 and 0132-0133]**.

Mick et al. fails to teach however **Steven et al.** in the same field of endeavor teaches a behind-the-meter ("BTM") power input system configured to receive power from a power generation system prior to the power undergoing step-up transformation for transmission to a grid **[see Steven et al., paragraphs 0102 and 0440]**; a power distribution system; a datacenter control system **[see Steven et al., paragraph 0126]**; a plurality of computing systems, wherein the plurality of computing systems are powered by the BTM power input system via the power distribution system **[see Steven et al., paragraph 0213]**.

It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to combine the teachings of **Mick et al.** with **Steven et al.** in order to relieve time-dependent and/or geographically-dependent limitations on the power grid's ability to support transmission of electricity.

As per claim 15, **Mick-Steven** teaches the flexible datacenter of claim 14, wherein the distributed queue system includes at least two queue subsystems having different rules for organizing computational operations **[see Mick et al., paragraph 0109].**

As per claim 16, **Mick-Steven** teaches the flexible datacenter of claim 14, wherein the datacenter control system is configured to modulate power delivery to the plurality of computing systems based on an operational directive received from a remote master control system **[see Mick et al., paragraph 0098].**

As per claim 17, **Mick-Steven** teaches the flexible datacenter of claim 16, wherein the remote master control system is positioned remotely from the flexible datacenter **[see Mick et al., paragraph 0210].**

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a)

will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RANODHI N SERRAO whose telephone number is (571)272-7967. The examiner can normally be reached on Monday to Friday 9:00 am to 5:00 pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Follansbee can be reached on (571) 272-3964. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Ranodhi N. Serrao

/RANODHI SERRAO/
Primary Examiner, Art Unit 2444

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/525,142	McNamara et al.
	Examiner	Art Unit
	RANODHI N SERRAO	2444

CPC - Searched*		
Symbol	**Date**	**Examiner**
Search of CPC classes listed in Application	02/19/21	RNS
Search of CPC classes listed in Application	06/30/21	RNS

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

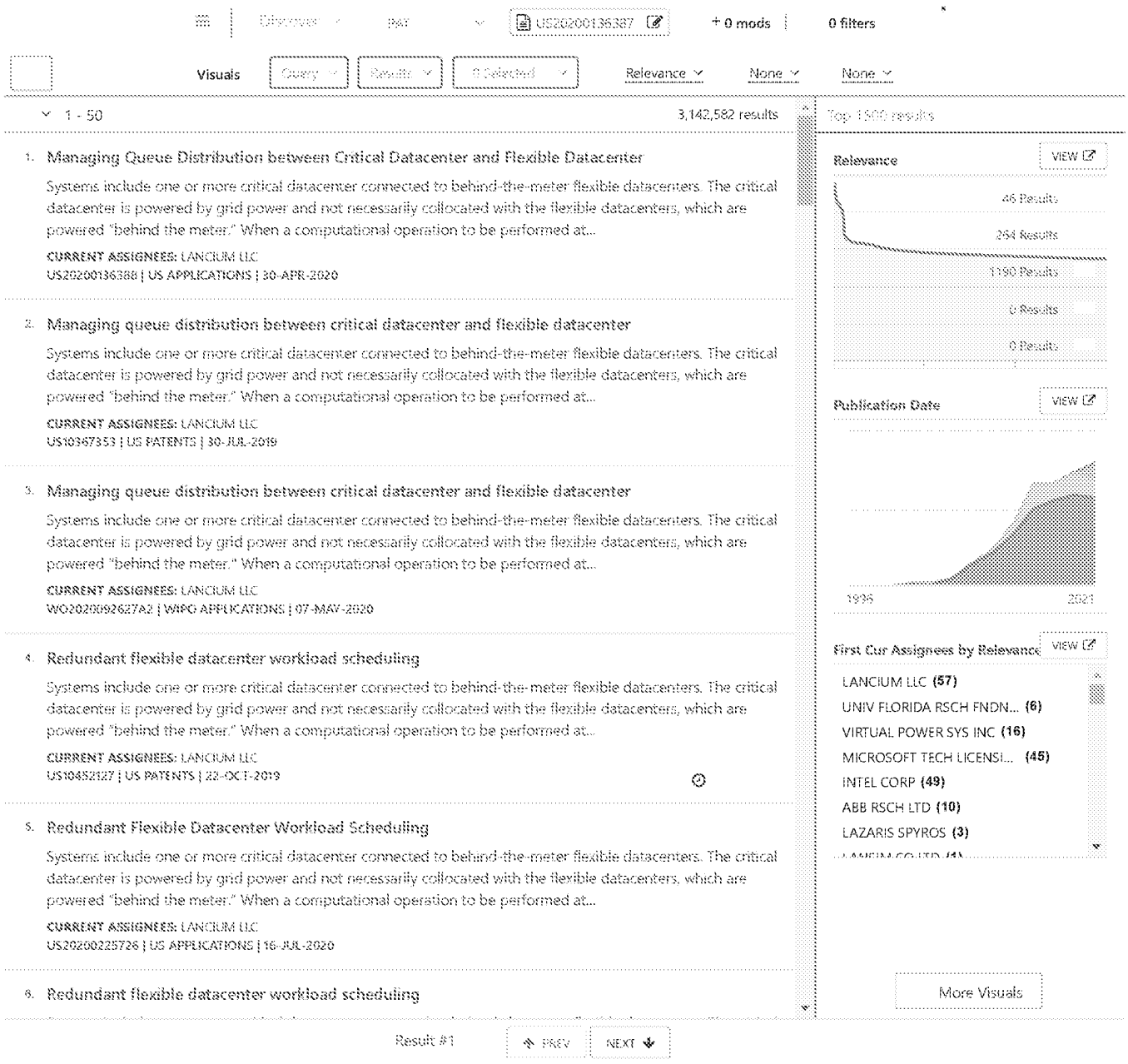
US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
See search history printout included with this form to determine scope of search	02/19/21	RNS
IP.com (attached)	02/19/21	RNS
See search history printout included with this form to determine scope of search	06/30/21	RNS
IP.com (attached)	06/30/21	RNS

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/525,142	McNamara et al.
	Examiner	Art Unit
	RANODHI N SERRAO	2444

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	Interference Searched	02/19/21	RNS
	Interference Searched	06/30/21	RNS


Discover
PAT
US20200136387
+ 0 mods
0 filters
Visuals
Query
Results
0 Selected
Relevance
None
None
1 - 50
3,142,582 results
Top 1500 results
1. Managing Queue Distribution between Critical Datacenter and Flexible Datacenter
Systems include one or more critical datacenter connected to behind-the-meter flexible datacenters. The critical datacenter is powered by grid power and not necessarily collocated with the flexible datacenters, which are powered "behind the meter." When a computational operation to be performed at...
CURRENT ASSIGNEES: LANCIUM LLC
US20200136388 | US APPLICATIONS | 30-APR-2020
2. Managing queue distribution between critical datacenter and flexible datacenter
Systems include one or more critical datacenter connected to behind-the-meter flexible datacenters. The critical datacenter is powered by grid power and not necessarily collocated with the flexible datacenters, which are powered "behind the meter." When a computational operation to be performed at...
CURRENT ASSIGNEES: LANCIUM LLC
US10367353 | US PATENTS | 30-JUL-2019
3. Managing queue distribution between critical datacenter and flexible datacenter
Systems include one or more critical datacenter connected to behind-the-meter flexible datacenters. The critical datacenter is powered by grid power and not necessarily collocated with the flexible datacenters, which are powered "behind the meter." When a computational operation to be performed at...
CURRENT ASSIGNEES: LANCIUM LLC
WO2020092627A2 | WIPO APPLICATIONS | 07-MAY-2020
4. Redundant flexible datacenter workload scheduling
Systems include one or more critical datacenter connected to behind-the-meter flexible datacenters. The critical datacenter is powered by grid power and not necessarily collocated with the flexible datacenters, which are powered "behind the meter." When a computational operation to be performed at...
CURRENT ASSIGNEES: LANCIUM LLC
US10452127 | US PATENTS | 22-OCT-2019
5. Redundant Flexible Datacenter Workload Scheduling
Systems include one or more critical datacenter connected to behind-the-meter flexible datacenters. The critical datacenter is powered by grid power and not necessarily collocated with the flexible datacenters, which are powered "behind the meter." When a computational operation to be performed at...
CURRENT ASSIGNEES: LANCIUM LLC
US20200225726 | US APPLICATIONS | 16-JUL-2020
6. Redundant flexible datacenter workload scheduling
Relevance
VIEW
46 Results
264 Results
1190 Results
0 Results
0 Results
Publication Date
VIEW
1936
2021
First Cur Assignees by Relevance
VIEW
LANCIUM LLC (57)
UNIV FLORIDA RSCH FNDN... (6)
VIRTUAL POWER SYS INC (16)
MICROSOFT TECH LICENSI... (45)
INTEL CORP (49)
ABB RSCH LTD (10)
LAZARIS SPYROS (3)
More Visuals
Result #1
PREV
NEXT

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 3

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	FOLLANSBEE, JOHN A
Attorney Docket Number	84008-321859 (18-1490-CON)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	001	US-9994118	06-12-2018	WILLIAMS; Nate et al.	
	002	US-20020158749	10-31-2002	IKEDA; Masakazu et al.	
	003	US-20100280675	11-04-2010	TATE, Jr.; Edward D. et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
		None				

Examiner Signature	/RANODHI SERRAO/	Date Considered	06/29/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.N.S./

Confirmation No. 7602

Substitute for form 1449/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)	Application Number	16/525142
	Filing Date	07-29-2019
	First Named Inventor	MCNAMARA; Michael T.
	Art Unit	2444
	Examiner Name	FOLLANSBEE, JOHN A
Sheet 2 of 3	Attorney Docket Number	84008-321859 (18-1490-CON)

NON-PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.[1]	Include name of the author(in CAPITAL LETTERS),title of the article(when appropriate), title of the item (book,magazine,journal,serial,symposium,catalog,etc.),date,page(s),volume-issue number(s),publisher, city and/or country where published.	T[2]
	001	Non-Final Office Action mailed 04 February 2021 on for U.S. Patent Application No. 16/284,610, filed on 25 February 2019, 9 pages.	☐
	002	Non-Final Office Action mailed 12 February 2021 on for U.S. Patent Application No.16/528,348, filed on 31 July 2019, 25 pages.	☐
	003	Notice of Allowance mailed 08 February 2021 on for U.S. Patent Application No. 16/132,062, filed on 14 September 2018, 21 pages.	☐
	004	Notice of Allowance mailed 08 February 2021 on for U.S. Patent Application No. 16/803,109, filed on 27 February 2020, 29 pages.	☐
	005	Notice of Allowance mailed 08 February 2021 on for U.S. Patent Application No. 16/834,987, filed on 30 March 2020, 180 pages.	☐
	006	Notice of Allowance mailed 13 January 2021 on for U.S. Patent Application No. 16/175246, filed on 30 October 2018, 5 pages.	☐
	007	Notice of Allowance mailed 25 January 2021 on for U.S. Patent Application No. 16/132,098, filed on 14 September 2018, 5 pages.	☐
	008	Notice of Allowance mailed 25 January 2021 on for U.S. Patent Application No. 16/702,894, filed on 04 December 2019, 24 pages.	☐
	009	Notice of Allowance mailed 27 January 2021 on for U.S. Patent Application No. 16/132,092, filed on 14 September 2018, 8 pages.	☐

Examiner Signature	/RANODHI SERRAO/	Date Considered	06/29/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.N.S./

Confirmation No. 7602

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)				Application Number	16/525142
				Filing Date	07-29-2019
				First Named Inventor	MCNAMARA; Michael T.
				Art Unit	2444
				Examiner Name	FOLLANSBEE, JOHN A
Sheet	3	of	3	Attorney Docket Number	84008-321859 (18-1490-CON)

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ Please charge any required fees or credit any overpayments in connection with this communication to Deposit Account No. 12-0913.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Kurt W. Rohde/	Date (YYYY-MM-DD)	February 23, 2021
Name/Print	Kurt W. Rohde	Registration Number	62923

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 5

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	001	US-5142672	08-25-1992	JOHNSON; William M. et al.	
	002	US-5367669	11-22-1994	HOLLAND; Alexander et al.	
	003	US-5913046	06-15-1999	BARTH; Richard Maurice et al.	
	004	US-7376851	05-20-2008	KIM; Seo Kwang	
	005	US-8260913	09-04-2012	KNAPP; Adam et al.	
	006	US-8639392	01-28-2014	CHASSIN; David P.	
	007	US-8706915	04-22-2014	DUCHESNEAU; David D.	
	008	US-8719223	05-06-2014	KNAPP; Adam et al.	
	009	US-9282022	03-08-2016	MATTHEWS; William Brad et al.	
	010	US-9542231	01-10-2017	KHAN; Rishi L. et al.	
	011	US-9645596	05-09-2017	LEE; Ja-Chin Audrey et al.	
	012	US-10452532	10-22-2019	McVAY; Jeffrey L. et al.	
	013	US-20090216910	08-27-2009	DUCHESNEAU; David D.	
	014	US-20140070756	03-13-2014	KEARNS; Ben et al.	
	015	US-20140180886	06-26-2014	FORBES, Jr.; Joseph W.	
	016	US-20150212122	07-30-2015	SOBOTKA; Peter et al.	
	017	US-20160248631	08-25-2016	DUCHESNEAU; David D.	
	018	US-20170373500	12-28-2017	SHAFI; Sayed Yusef et al.	
	019	US-20180026478	01-25-2018	PELOSO; Matthew	
	020	US-20200040272	02-06-2020	CAVNESS; Charles et al.	
	021	US-20200051184	02-13-2020	BARBOUR; Stephen	
	022	US-20200136388	04-30-2020	McNAMARA; Michael T. et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages	T[6]

Examiner Signature	/RANODHI SERRAO/	Date Considered	06/29/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.N.S./

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 5

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

		Country Code[3]-Number[4]-Kind Code[5] (if known)	MM-DD-YYYY		Or Relevant Figures Appear	
	001	WO-2019116375-A1	06-20-2019	MAIMON ERAN [IL]		☐
	002	WO-2019139633-A1	07-18-2019	LANCIUM LLC [US]		☐

Examiner Signature	/RANODHI SERRAO/	Date Considered	06/29/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.N.S./

Confirmation No. 7602

Substitute for form 1449/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)	Application Number	16/525142
	Filing Date	07-29-2019
	First Named Inventor	MCNAMARA; Michael T.
	Art Unit	2444
	Examiner Name	SERRAO, RANODHI N
Sheet 3 of 5	Attorney Docket Number	84008-321859 (18-1490-CON)

NON-PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.[1]	Include name of the author(in CAPITAL LETTERS),title of the article(when appropriate), title of the item (book,magazine,journal,serial,symposium,catalog,etc.),date,page(s),volume-issue number(s),publisher, city and/or country where published.	T[2]
	001	International Search Report and Written Opinion of PCT Application No. PCT/US2021/019875, mailed on 29 April 2021, 12 pages.	☐
	002	International Search Report and Written Opinion of PCT Application No. PCT/US20/57686, mailed on 22 February 2021, 67 pages.	☐
	003	ISO, "Distributed Energy Resources Roadmap for New York's Wholesale Electricity Markets," Distributed Energy Resource Roadmap, January 2017, pp 1-39. [retrieved on 2020-12-15], Retrieved from the Internet:< url:< a="" href="https://www.nyiso.com/documents/20142/1391862/Distributed_Energy_Resources_Roadmap.pdf/ec0b3b64-4de2-73e0-ffef-49a4b8b1">https://www.nyiso.com/documents/20142/1391862/Distributed_Energy_Resources_Roadmap.pdf/ec0b3b64-4de2-73e0-ffef-49a4b8b1 b3ca.</url:>.	☐
	004	KEWL, "Start-Up From the Heart of Berlin Has Pioneered Decentralized Mobile Mining by Combining Blockchain With Regenerative Energy" November 2017, 3 pages pdf http://www.crypto-news.net/start-up-from-the-heart-of-berlin-has-pioneered-decentralized-mobile-mining-by-combining-blockchain-with-regenerative-energy/ (Year: 2017).	☐
	005	Non-Final Office Action mailed 01 April 2021 on for U.S. Patent Application No. 16/482,495, filed on 31 July 2019, 59 pages.	☐
	006	Non-Final Office Action mailed 25 March 2021 on for U.S. Patent Application No. 16/573,577, filed on 17 September 2019, 65 pages.	☐
	007	Non-Final Office Action mailed on 11 May 2021 for U.S. Patent Application No. 16/529,360, filed on 01 August 2019, 64 pages.	☐
	008	Non-Final Office Action mailed on 28 May 2021 for U.S. Patent Application No. 16/658,983, filed on 21 October 2019, 21 pages.	☐
	009	Notice of Allowance mailed 12 May 2021 on for U.S. Patent Application No. 16/132,062, filed on 14 September 2018, 2 pages.	☐

Examiner Signature	/RANODHI SERRAO/	Date Considered	06/29/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.N.S./

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 4 of 5

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author(in CAPITAL LETTERS),title of the article(when appropriate), title of the item (book,magazine,journal,serial,symposium,catalog,etc.),date,page(s),volume-issue number(s),publisher, city and/or country where published.	T[2]
	010	Notice of Allowance mailed 20 April 2021 on for U.S. Patent Application No. 16/482,495, filed on 31 July 2019, 5 pages.	☐
	011	Notice of Allowance mailed 27 May 2021 on for U.S. Patent Application No. 16/284610, filed on 25 February 2019, 16 pages.	☐
	012	Notice of Allowance mailed 27 May 2021 on for U.S. Patent Application No. 16/284,610, filed on 25 February 2019, 5 pages.	☐

Examiner Signature	/RANODHI SERRAO/	Date Considered	06/29/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.N.S./

Confirmation No. 7602

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)				Application Number	16/525142
				Filing Date	07-29-2019
				First Named Inventor	MCNAMARA; Michael T.
				Art Unit	2444
				Examiner Name	SERRAO, RANODHI N
Sheet	5	of	5	Attorney Docket Number	84008-321859 (18-1490-CON)

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ Please charge any required fees or credit any overpayments in connection with this communication to Deposit Account No. 12-0913.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Mark P. Vrla/	Date (YYYY-MM-DD)	June 8, 2021
Name/Print	Mark P. Vrla	Registration Number	43973

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L7	171	1 and queu$3.clm. and ((data adj center) datacenter data-center)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/06/30 08:54
L6	407	1 and meter and behind	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/06/30 08:54
L5	47	3 and meter and behind	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/06/30 08:53
L3	290	2 and (step-up stepup (step adj up))	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/06/30 08:52
L2	2,644	1 and (power and grid and transform$4)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/06/30 08:52
L1	20,900	((G06F1/3206 OR G06F1/329 OR G06F9/4893 OR G06F9/5088 OR G06F9/5094 OR H02J1/14 OR H02J2300/20 OR H02J2310/16 OR H02J3/12 OR H02J3/14).CPC.)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/06/30 08:51
S74	1	S70 and transform$5	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/06/17 09:38
S73	1	S70 and grid and transform$5	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/06/17 09:37
S72	1	S70 and (step-up stepup (step adj up))	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/06/17 09:37
S71	0	S70 and (step-up stepup (step adj up)) and grid and transform$5	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/06/17 09:37

S70	2	(US-20130304903-$ or US-20150278968-$).did.	US-PGPUB	OR	ON	2021/06/17 09:36
S69	13	(S67 S68) and (step-up stepup (step adj up)).clm.	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/06/17 09:29
S68	69	lancium.AS,AANM.	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/06/17 09:29
S67	248	((("MCNAMARA") near3 ("Michael")) OR (("HENSON") near3 ("David")) OR (("CLINE") near3 ("Raymond"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2021/06/17 09:29
S65	789	S64 and ((data adj center) datacenter data-center) and queu$3	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/19 13:26
S64	18,815	S63 and (power grid utility transformer)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/19 13:16
S63	20,120	((G06F1/3206 OR G06F1/329 OR G06F9/4893 OR G06F9/5088 OR G06F9/5094 OR H02J1/14 OR H02J2300/20 OR H02J2310/16 OR H02J3/12 OR H02J3/14).CPC.)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/19 13:15
S62	1	"20200136387"	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/19 13:14
S61	10	S60 and behind	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/18 13:17
S60	19	(US-20020072868-$ or US-20030023885-$ or US-20150278968-$ or US-20180144414-$ or US-20180367320-$ or US-20180366978-$ or US-20190052094-$ or US-20190168630-$ or US-20130306276-$ or US-20130117621-$ or US-20190005576-$ or US-20180060106-$ or US-20160248631-$ or US-20120324259-$).did. or (US-6633823-$ or US-7143300-$ or US-10444818-$ or US-9143392-$ or US-9027024-$).did.	US-PGPUB; USPAT	OR	ON	2021/02/18 13:17

S59	2	"20130304903" and (power electricity grid utility transformer)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/18 12:53
S58	2	"20130117621" and (power electricity grid utility transformer)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/18 12:53
S57	2	"20130304903" and (power electricity grid utility transformer) and queu$3 and schedul$3 and task and ((data adj center) datacenter) and ((load near2 balanc$3) load$4 load-balanc$4 loadbalanc$4 (load near2 shar$4) load-shar$3 loadshar$3 work-load (work near2 load) workload balance$4)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/18 09:46
S56	2	"20130304903" and (power electricity grid utility transformer) and queu$3 and ((data adj center) datacenter)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/18 09:31
S55	2	"20130304903" and (power electricity grid utility transformer) and queu$3 and datacenter	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/18 09:30
S54	2	"20130304903" and (power electricity grid utility transformer) and queu$3	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/18 09:24
S53	2	"20130117621" and (power electricity grid utility transformer) and queu$3	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/18 09:20
S52	2	"20130306276" and queu$3	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/18 09:08
S51	9	S43 and (power electricity grid utility transformer)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 15:06
S50	9	S43 and (power grid utility transformer)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 15:06
S49	7	S48 and (@ad<"20181030" @rlad<"20181030")	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 14:39

S48	10	S47 and queu$3	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 14:39
S47	52	("20080030078" | "20080094797" | "20090055665" | "20100211810" | "20100328849" | "20110238342" | "20120000121" | "20120072745" | "20120300524" | "20130006401" | "20130063991" | "20130086404" | "20130187464" | "20130306276" | "20140137468" | "20140379156" | "20150155712" | "20150229227" | "20160198656" | "20160212954" | "20160324077" | "20170104336" | "20180144414" | "6288456" | "6633823" | "7143300" | "7647516" | "7702931" | "7779276" | "7861102" | "7921315" | "7970561" | "8001403" | "8006108" | "8214843" | "8374928" | "8447993" | "8571820" | "8627123" | "8789061" | "8799690" | "9003211" | "9003216" | "9026814" | "9207993" | "9218035" | "9552234").PN. OR ("10367353").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2021/02/11 14:39
S46	6	serrao.xp,xa. and queu$3.clm. and ((data adj center) datacenter data-center)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 14:33
S45	27	serrao.xp,xa. and queu$3.clm.	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 14:33
S44	138	serrao.xp,xa. and queu$3	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 14:32
S43	9	S42 and queu$3	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 14:32
S42	19	(US-20020072868-$ or US-20030023885-$ or US-20150278968-$ or US-20180144414-$ or US-20180367320-$ or US-20180366978-$ or US-20190052094-$ or US-20190168630-$ or US-20130306276-$ or US-20130117621-$ or US-20190005576-$ or US-20180060106-$ or US-20160248631-$ or US-20120324259-$).did. or (US-6633823-$	US-PGPUB; USPAT	OR	ON	2021/02/11 14:31

		or US-7143300-$ or US-10444818-$ or US-9143392-$ or US-9027024-$).did.				
S41	49	("20130006401" | "8789061" | "9026814" | "20130187464" | "20140379156" | "9003211" | "9552234" | "20020072868" | "20120072745" | "20160198656" | "8214843" | "8447993" | "8799690" | "9207993" | "20080094797" | "20090055665" | "20110238342" | "20160212954" | "20160324077" | "6633823" | "7647516" | "7970561" | "8571820" | "20080030078" | "20120000121" | "20170104336" | "6288456" | "7143300" | "7861102" | "7921315" | "8001403" | "8374928" | "20130063991" | "20150229227" | "7702931" | "8006108" | "20100211810" | "20100328849" | "20130306276" | "20150155712" | "9003216" | "20120324259" | "20120300524" | "20130086404" | "20140137468" | "20180144414" | "7779276" | "8627123" | "9218035").PN.	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 14:15
S40	24	S38 and (power grid utility transformer)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 14:07
S39	24	S38 and (power grid transformer)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 14:07
S38	24	S37 and (@ad<"20181030" @rlad<"20181030")	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 14:05
S37	24	S36 and ((data adj center) datacenter data-center) and queu$3	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 14:05
S36	28	"20130117621" "20190098081" "20190097933" "20180300964" "20130306276" "20160248631" "20140317315" "20090216910" "20130238785" "20180060106" "20200091727" "20130304903" "20190005576" "20130107872" "20130117426"	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 14:04
S35	4	S33 and ((data adj center) datacenter data-center) and queu$3 and behind	US-PGPUB; USPAT;	OR	ON	2021/02/11 13:52

			USOCR; IBM_TDB			
S34	13	S33 and ((data adj center) datacenter data-center) and queu$3	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 13:44
S33	81	("20130006401" | "8789061" | "9026814" | "10444818" | "20120324259" | "20150121113" | "20180202825" | "20130187464" | "20140379156" | "9003211" | "9552234" | "20060161765" | "20130227139" | "20160170469" | "20180240112" | "20190168630" | "20120072745" | "20160198656" | "8214843" | "8447993" | "8799690" | "9207993" | "20170023969" | "20180366978" | "20190052094" | "20190318327" | "8700929" | "20080094797" | "20090055665" | "20110238342" | "20160212954" | "20160324077" | "6633823" | "7647516" | "7970561" | "8571820" | "20020072868" | "20110072289" | "20080030078" | "20120000121" | "20170104336" | "6288456" | "7143300" | "7861102" | "7921315" | "8001403" | "8374928" | "10497072" | "20150278968" | "20050203761" | "20090089595" | "20130063991" | "20150229227" | "7702931" | "8006108" | "10367535" | "20150277410" | "20160172900" | "20170261949" | "20190324820" | "20090070611" | "20100211810" | "20100328849" | "20130306276" | "20150155712" | "9003216" | "20180367320" | "20190280521" | "20040117330" | "20120300524" | "20130086404" | "20140137468" | "20180144414" | "7779276" | "8627123" | "9218035" | "10367353" | "10452127" | "20030074464" | "20190258307" | "20160187906").PN.	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 13:44
S32	5	S31 and ((data adj center) datacenter data-center) and queu$3	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 13:44
S31	18	S30 and (@ad<"20181030" @rlad<"20181030")	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 13:42

S30	19	"20200091727" "20200136432" "20200091766" "20200089307" "20200091717" "20200379537" "20160109916" "20180052431" "20110282982" "20130212410" "20200359572" "20160187395" "20040027004" "20120324245" "20040030457"	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 13:42
S29	0	S27 and ((data adj center) datacenter data-center) and queu$3	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 09:47
S28	9	S27 and ((data adj center) datacenter data-center)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/11 09:43
S27	11	(US-20020072868-$ or US-20030023885-$ or US-20150278968-$ or US-20180144414-$ or US-20180367320-$ or US-20180366978-$ or US-20190052094-$ or US-20190168630-$).did. or (US-6633823-$ or US-7143300-$ or US-10444818-$).did.	US-PGPUB; USPAT	OR	ON	2021/02/11 09:37
S26	15	S25 and (@ad<"20181030" @rlad<"20181030")	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/10 14:05
S25	17	S24 and behind	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/10 14:04
S24	81	("20130006401" | "8789061" | "9026814" | "10444818" | "20120324259" | "20150121113" | "20180202825" | "20130187464" | "20140379156" | "9003211" | "9552234" | "20060161765" | "20130227139" | "20160170469" | "20180240112" | "20190168630" | "20120072745" | "20160198656" | "8214843" | "8447993" | "8799690" | "9207993" | "20170023969" | "20180366978" | "20190052094" | "20190318327" | "8700929" | "20080094797" | "20090055665" | "20110238342" | "20160212954" | "20160324077" | "6633823" | "7647516" | "7970561" | "8571820" | "20020072868" | "20110072289" | "20080030078" | "20120000121" | "20170104336" | "6288456" | "7143300"	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/10 14:04

		| "7861102" | "7921315" | "8001403" | "8374928" | "10497072" | "20150278968" | "20050203761" | "20090089595" | "20130063991" | "20150229227" | "7702931" | "8006108" | "10367535" | "20150277410" | "20160172900" | "20170261949" | "20190324820" | "20090070611" | "20100211810" | "20100328849" | "20130306276" | "20150155712" | "9003216" | "20180367320" | "20190280521" | "20040117330" | "20120300524" | "20130086404" | "20140137468" | "20180144414" | "7779276" | "8627123" | "9218035" | "10367353" | "10452127" | "20030074464" | "20190258307" | "20160187906").PN.				
S23	3	"20020072868" "20030023885"	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/10 13:29
S21	3	(S19 S20) and (power and queue and datacenter).clm.	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/10 12:58
S20	58	lancium.AS,AANM.	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2021/02/10 12:57
S19	7	((("LANCIUM") near3 ("LLC"))).AS,AANM.	USPAT	OR	ON	2021/02/10 12:57
S17	11	S15 AND ((G06F1/3203 OR G06F1/3209 OR H02J13/0017 OR H02J13/0086 OR H02J3/14 OR H04W24/00 OR H04W52/34 OR Y02B70/3225 OR Y02B70/3266 OR Y02E60/74 OR Y04S10/30 OR Y04S20/222 OR Y04S20/242).CPC.)	USPAT	OR	ON	2019/03/20 09:30
S16	2	(US-6633823-$ or US-7143300-$).did.	USPAT	OR	ON	2019/03/20 09:29
S15	40	("20080030078" | "20080094797" | "20100211810" | "20100328849" | "20110238342" | "20120000121" | "20120300524" | "20130006401" | "20130063991" | "20130187464" | "20130306276" | "20140137468" | "20150155712" | "20150229227" | "20160198656" | "20160212954" | "20160324077" | "20170104336" |	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2019/03/20 09:29

		"6633823" | "7143300" | "7647516" | "7702931" | "7779276" | "7861102" | "7921315" | "7970561" | "8001403" | "8006108" | "8214843" | "8374928" | "8447993" | "8571820" | "8627123" | "8789061" | "8799690" | "9003211" | "9026814" | "9207993" | "9218035" | "9552234").PN.				
S14	5	(S11 S12) and (power).clm.	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2019/03/20 09:28
S13	0	(S11 S12) and (datacenter and power).clm.	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2019/03/20 09:24
S12	35	lancium.as.	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2019/03/20 09:24
S11	191	((("MCNAMARA") near3 ("Michael")) OR (("HENSON") near3 ("David")) OR (("CLINE") near3 ("Raymond"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2019/03/20 09:24
S10	6	S8 and queu$4	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2019/03/08 13:24
S9	9	S8 and meter	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2019/03/08 13:17
S8	35	S6 and ((load near2 balanc$3) load$4 load-balanc$4 loadbalanc$4 (load near2 shar$4) load-shar$3 loadshar$3 work-load (work near2 load) workload balance$4)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2019/03/08 13:12
S7	40	S6 and (energy power)	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2019/03/08 12:21
S6	40	S5 and (@ad<"20181030" @rlad<"20181030")	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2019/03/08 12:18
S5	40	("20080030078" | "20080094797" | "20100211810" | "20100328849" |	US-PGPUB; USPAT;	OR	ON	2019/03/08 12:18

		"20110238342" | "20120000121" | "20120300524" | "20130006401" | "20130063991" | "20130187464" | "20130306276" | "20140137468" | "20150155712" | "20150229227" | "20160198656" | "20160212954" | "20160324077" | "20170104336" | "6633823" | "7143300" | "7647516" | "7702931" | "7779276" | "7861102" | "7921315" | "7970561" | "8001403" | "8006108" | "8214843" | "8374928" | "8447993" | "8571820" | "8627123" | "8789061" | "8799690" | "9003211" | "9026814" | "9207993" | "9218035" | "9552234").PN.	USOCR; IBM_TDB			
S3	0	(S1 S2) and (datacenter and power).clm.	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2019/03/07 15:34
S2	35	lancium.as.	US-PGPUB; USPAT; USOCR; IBM_TDB	OR	ON	2019/03/07 15:34
S1	191	((("MCNAMARA") near3 ("Michael")) OR (("HENSON") near3 ("David")) OR (("CLINE") near3 ("Raymond"))).INV.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2019/03/07 15:33

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L8	1	(behind and meter and power and input and queue and set and grid).clm.	USPAT	OR	ON	2021/06/30 08:55
S66	1	(behind and meter and power and input and queue and set and operation).clm.	USPAT	OR	ON	2021/02/19 13:27
S18	0	(rout$4 and queue and meter and datacenter and power).clm.	USPAT	OR	ON	2019/03/20 09:27

6/30/2021 8:56:10 AM
C:\Users\rserrao\Documents\EAST\Workspaces\16525142.wsp

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 5

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	001	US-5142672	08-25-1992	JOHNSON; William M. et al.	
	002	US-5367669	11-22-1994	HOLLAND; Alexander et al.	
	003	US-5913046	06-15-1999	BARTH; Richard Maurice et al.	
	004	US-7376851	05-20-2008	KIM; Seo Kwang	
	005	US-8260913	09-04-2012	KNAPP; Adam et al.	
	006	US-8639392	01-28-2014	CHASSIN; David P.	
	007	US-8706915	04-22-2014	DUCHESNEAU; David D.	
	008	US-8719223	05-06-2014	KNAPP; Adam et al.	
	009	US-9282022	03-08-2016	MATTHEWS; William Brad et al.	
	010	US-9542231	01-10-2017	KHAN; Rishi L. et al.	
	011	US-9645596	05-09-2017	LEE; Ja-Chin Audrey et al.	
	012	US-10452532	10-22-2019	McVAY; Jeffrey L. et al.	
	013	US-20090216910	08-27-2009	DUCHESNEAU; David D.	
	014	US-20140070756	03-13-2014	KEARNS; Ben et al.	
	015	US-20140180886	06-26-2014	FORBES, Jr.; Joseph W.	
	016	US-20150212122	07-30-2015	SOBOTKA; Peter et al.	
	017	US-20160248631	08-25-2016	DUCHESNEAU; David D.	
	018	US-20170373500	12-28-2017	SHAFI; Sayed Yusef et al.	
	019	US-20180026478	01-25-2018	PELOSO; Matthew	
	020	US-20200040272	02-06-2020	CAVNESS; Charles et al.	
	021	US-20200051184	02-13-2020	BARBOUR; Stephen	
	022	US-20200136388	04-30-2020	McNAMARA; Michael T. et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages	T[6]

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 5

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

		Country Code[3]-Number[4]-Kind Code[5] (if known)	MM-DD-YYYY		Or Relevant Figures Appear	
	001	WO-2019116375-A1	06-20-2019	MAIMON ERAN [IL]		☐
	002	WO-2019139633-A1	07-18-2019	LANCIUM LLC [US]		☐

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 3 of 5

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

NON-PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No.[1]	Include name of the author(in CAPITAL LETTERS),title of the article(when appropriate), title of the item (book,magazine,journal,serial,symposium,catalog,etc.),date,page(s),volume-issue number(s),publisher, city and/or country where published.	T[2]
	001	International Search Report and Written Opinion of PCT Application No. PCT/US2021/019875, mailed on 29 April 2021, 12 pages.	☐
	002	International Search Report and Written Opinion of PCT Application No. PCT/US20/57686, mailed on 22 February 2021, 67 pages.	☐
	003	ISO, "Distributed Energy Resources Roadmap for New York's Wholesale Electricity Markets," Distributed Energy Resource Roadmap, January 2017, pp 1-39. [retrieved on 2020-12-15], Retrieved from the Internet:< url:< a="" href="https://www.nyiso.com/documents/20142/1391862/Distributed_Energy_Resources_Roadmap.pdf/ec0b3b64-4de2-73e0-ffef-49a4b8b1">https://www.nyiso.com/documents/20142/1391862/Distributed_Energy_Resources_Roadmap.pdf/ec0b3b64-4de2-73e0-ffef-49a4b8b1 b3ca.</url:>.	☐
	004	KEWL, "Start-Up From the Heart of Berlin Has Pioneered Decentralized Mobile Mining by Combining Blockchain With Regenerative Energy" November 2017, 3 pages pdf http://www.crypto-news.net/start-up-from-the-heart-of-berlin-has-pioneered-decentralized-mobile-mining-by-combining-blockchain-with-regenerative-energy/ (Year: 2017).	☐
	005	Non-Final Office Action mailed 01 April 2021 on for U.S. Patent Application No. 16/482,495, filed on 31 July 2019, 59 pages.	☐
	006	Non-Final Office Action mailed 25 March 2021 on for U.S. Patent Application No. 16/573,577, filed on 17 September 2019, 65 pages.	☐
	007	Non-Final Office Action mailed on 11 May 2021 for U.S. Patent Application No. 16/529,360, filed on 01 August 2019, 64 pages.	☐
	008	Non-Final Office Action mailed on 28 May 2021 for U.S. Patent Application No. 16/658,983, filed on 21 October 2019, 21 pages.	☐
	009	Notice of Allowance mailed 12 May 2021 on for U.S. Patent Application No. 16/132,062, filed on 14 September 2018, 2 pages.	☐

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

Confirmation No. 7602

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 4 of 5

Complete if Known	
Application Number	16/525142
Filing Date	07-29-2019
First Named Inventor	MCNAMARA; Michael T.
Art Unit	2444
Examiner Name	SERRAO, RANODHI N
Attorney Docket Number	84008-321859 (18-1490-CON)

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author(in CAPITAL LETTERS),title of the article(when appropriate), title of the item (book,magazine,journal,serial,symposium,catalog,etc.),date,page(s),volume-issue number(s),publisher, city and/or country where published.	T[2]
	010	Notice of Allowance mailed 20 April 2021 on for U.S. Patent Application No. 16/482,495, filed on 31 July 2019, 5 pages.	☐
	011	Notice of Allowance mailed 27 May 2021 on for U.S. Patent Application No. 16/284610, filed on 25 February 2019, 16 pages.	☐
	012	Notice of Allowance mailed 27 May 2021 on for U.S. Patent Application No. 16/284,610, filed on 25 February 2019, 5 pages.	☐

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

Confirmation No. 7602

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)				Application Number	16/525142
				Filing Date	07-29-2019
				First Named Inventor	MCNAMARA; Michael T.
				Art Unit	2444
				Examiner Name	SERRAO, RANODHI N
Sheet	5	of	5	Attorney Docket Number	84008-321859 (18-1490-CON)

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ Please charge any required fees or credit any overpayments in connection with this communication to Deposit Account No. 12-0913.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Mark P. Vrla/	Date (YYYY-MM-DD)	June 8, 2021
Name/Print	Mark P. Vrla	Registration Number	43973

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
20 June 2019 (20.06.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/116375 A1

(51) International Patent Classification:
G06Q 30/00 (2012.01) *G06F 15/76* (2006.01)
G06Q 30/06 (2012.01) *G06F 1/26* (2006.01)
G06Q 20/30 (2012.01) *G06F 1/32* (2019.01)
H01G 9/20 (2006.01)

(21) International Application Number:
PCT/IL2018/051362

(22) International Filing Date:
17 December 2018 (17.12.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/599,762 17 December 2017 (17.12.2017) US

(72) Inventor; and
(71) Applicant: **MAIMON, Eran** [IL/IL]; SolarPaint LTD, Kibbutz Nahsholim, M.P Hof Carmel 3081500, 3081500 Kibbutz Nahsholim (IL).

(74) Agent: **RUTMAN, Jeremy**; 34 Zvulun, 6652435 Tel Aviv (IL).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) **Title:** EXCESS ELECTRICAL PRODUCTION CAPACITY CONVERTER

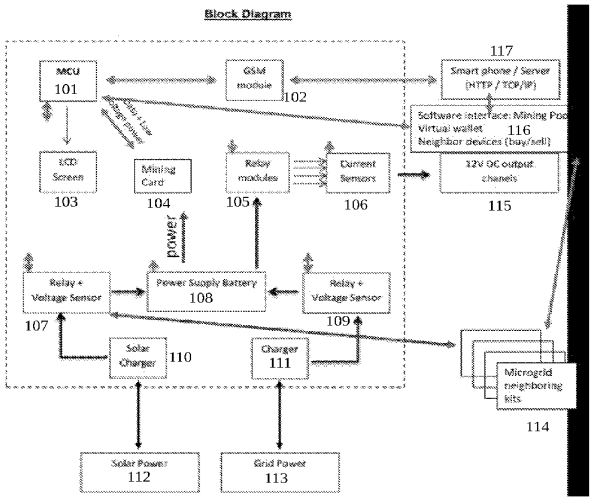


FIG 1

(57) **Abstract:** A novel means and method for utilizing excess solar production capacity requiring neither storage nor transmission is introduced. In one embodiment this takes the form of a solar kit with embedded blockchain mining equipment, whereby an excess electricity generated by the system is used to generate income through mining of virtual currencies. Generally, any computational task having a market value can be considered for use.

[Continued on next page]

WO 2019/116375 A1

Published:
— *with international search report (Art. 21(3))*

SOLAR OFF-GRID KIT WITH EMBEDDED BLOCKCHAIN MINER

Field of the Invention

The present invention relates to a means for utilizing excess energy production capacity.

Background of the Invention

Energy production systems are often sized to deal with peak loads, or alternatively to deal with minima in energy availability. For example, in solar off-grid energy production systems, the sizing may be chosen to deal with the lowest anticipated daily insolation.

The solar insolation varies throughout the year, thus generally off-grid systems are sized to be capable of harvesting a certain minimum amount of energy at the lowest expected lighting conditions expected, to ensure essential functions of the system even in these conditions. As a result, most of the time there is an excess capacity of generation in the system, that will be lost if not used locally, transported elsewhere, or stored. Likewise, electric generation plants, generators, and any electric energy generation system will generally be sized to cover the peak load (e.g. mid-day in summer) , and therefore a large amount of excess capacity is not used during off-peak hours.

Generally speaking the excess energy can either be used locally, transported elsewhere (e.g. by feeding into an electrical grid for remote use), or stored. However as will be appreciated by one skilled in the art, storage involves

capital investment, inevitable conversion loss, and will have a necessarily limited capacity, growing only with increased capital investment. Likewise, transfer to a grid that is physically distant involves inevitable transfer losses including conversion inefficiency and transport inefficiency, and also requires power-transfer infrastructure (namely a grid connection) that may not be available in remote areas. Running high-voltage lines to remove areas can have prohibitive costs, e.g. over $300,000USD per mile for a 10MW line.

There is thus a long-felt need for a different approach to conversion of excess energy from renewable sources that avoids the need for both storage and power transfer.

Summary of the Invention

The present invention is further described in detail with the accompanying drawings and describe a principle view of the invention. The exemplary embodiments and illustrations are not intended to be limiting the scope of the present invention.

An object of the present invention is to provide a system to locally utilize the excess electricity that may be generated by over capacity of any energy-generating system, instead of storing or transporting this energy. Note that by using the energy locally, storage and transmission capital costs and running costs (as well as inefficiencies) are avoided. In a preferred embodiment, the excess capacity is used to solve computational problems,

preferably ones for which there is an online market and therefore a computable market value. A known value per kWh of computation will exist in such markets which assists in operation of the system, as will be detailed in the following.

Instead of transporting or storing excess energy, the current invention simply transfers this extra energy into computation, thereby generating money in a computation market.

Still further objects and advantages will become apparent from a consideration of the ensuing description and drawings.

These and other objectives, features, and advantages of the present invention will become apparent from the following detailed description, the accompanying drawings, and the appended assertions.

The foregoing embodiments of the invention have been described and illustrated in conjunction with systems and methods thereof, which are meant to be merely illustrative, and not limiting. Furthermore just as every particular reference may embody particular methods/systems, yet not require such, ultimately such teaching is meant for all expressions notwithstanding the use of particular embodiments.

Brief Description of the Drawings

Embodiments and features of the present invention are described herein in conjunction with the following drawings:

FIG. 1 is describing a schematic design of the hardware in one embodiment of the invention.

FIG .2 is a graph of profitability variation over time for a cryptocurrency.

Detailed Description of Preferred Embodiments

The present invention will be understood from the following detailed description of preferred embodiments, which are meant to be descriptive and not limiting. For the sake of brevity, some well-known features, methods, systems, procedures, components, circuits, and so on, are not described in detail.

An object of the present invention is to utilize the excess electricity that may be generated by over capacity of any energy-generating system. For example, a solar installation will produce excess energy on days that have higher insolation, which will either be used locally, used remotely (ie fed into a grid), stored, or wasted. Note that by using the energy locally, storage and transmission capital costs, running costs, and inefficiencies are all avoided.

In a preferred embodiment of the invention, the excess energy is used to solve computational problems, preferably ones for which there is an online market and hence a known market value. A value per kWh of computation will exist in such markets, and market forces will tend to drive this towards the value per kWh of energy; as the market reaches greater maturity, more resources will be dedicated to computation when the profitably is higher, thereby driving down the profitability and shifting the system towards an equilibrium.

A familiar example of such a market is the market for blockchain mining, used for producing Bitcoins (BTC) . A computer (ASIC, GPU, or CPU) is used to perform computations that are of value to the network and which yield bitcoins to those doing the calculation (miners). The value of these computations (in BTC) will affect the number of miners willing to mine, with a resulting equilibrium wherein the value of the computation per kWh tends towards the cost of electricity per kWh. Various forces also exist which will tend to drive the system out of equilibrium, often resulting in large swings in the profitability of mining. See for example Fig. 2 for an example of the mining profitability of a cryptocurrency as it varies over time.

Obviously, any computation market where computation is bought and sold on any sort of exchange may be used with the system; blockchain mining is simply one concrete example from a number of possible current and conceivable markets.

Other markets exist, notably in the world of web services, where online servers including CPUs and GPUs may be rented by hour or month, from various entities such as Amazon, Google, and IBM. These are not computation markets per-se, but are in principle the current invention is adapted for service as an online service of this sort, where the price per hour may be adapted by taking into account the local production price of energy.

In any case, the invention simply uses any extra energy production capacity for computation instead of transporting, storing, or not using the excess energy. The system thereby generates income in the computation market instead of (for example) selling the energy to the grid.

In one embodiment, the system is entirely off-grid, and any excess energy not being used locally is used for computation. This embodiment needs no grid connection, thus saving considerable capital expense otherwise needed for solar installations.

In another embodiment of the invention, a grid connection is provided. In this case a rubric of the following sort may be used : when the local electric feed-in tariff (payout rate for feeding electricity to the grid) is higher than the computation profitability per kWh, energy is fed to the grid, while otherwise the energy is used for computation.

All of the above systems may be provided with some degree of storage capacity, for example allowing for computation to continue throughout the night. This will provide a shorter ROI for the GPUs and other computer equipment needed.

A well planned system will take into account the capital cost and compute capacity of computation equipment, cost and energy production capacity of the energy production elements such as solar panels, and capacity and cost of storage if used.

According to one embodiment of the present invention, the foregoing and other objects and advantages are attained by a solar off grid kit , as exemplified by the block diagram of Fig. 1. In this case we have as embedded blockchain miner which comprises

a) solar panels(s) 112;

b) a battery 108;

c) inputs and outputs for electricity;

d) inputs and outputs for data;

e) a charging logic for different inputs and battery types 110;

f) a Pay As You Go module;

g) a user interface, keypad, and screen;

h) a discharging regulator;

I) Nonvolatile memory;

j) communications module (eg USB, BlueTooth, GSM, wifi, etc)

k) an MCU to control all modules;

l) a blockchain mining hardware (e.g. GPU, ASIC, FPGA etc.)

m) Appliances for use with the solar kit

n) An app for smartphone control

o) Visible lights for battery status

p) Icons for speed of discharging with gaming capabilities

q) Connections between such kits to have the ability to form a micro grid.

The kit may include any of the above components or omit any of them and may also include unlisted components.

When so desired, (e.g. when the storage batteries are full and production is greater than load), the blockchain mining hardware equipment is activated and generates income by e.g. mining cryptocurrencies or other blockchain assets.

An exemplary embodiment provides a solar kit with standard connectors, including but not limited to the following elements:

a) 12V car socket outputs
b) USB outputs
c) LED light outputs
d) TV/Radio outputs
e) MC4 solar panel inputs
f) AC/DC charger input
g) 2 to 16 AWG Wire inputs
h) 2 to 16 AWG Wire outputs

The kit may include any of the following:

solar panel of e.g. 100W

battery of e.g. 40Ah 12V deep cycle lead acid

keypad and a PAYG module with code to unlock the system.

memory card and GSM 3G or higher to store the data.

The MCU includes a software that triggers the activation of the mining card when triggered by the user or when the battery is full and the consumption of connected appliances is less than what the solar panel is able to generate.

The mining card is fed from the 12V line that comes from the battery and/ or straight from the input after passing a regulating circuit to prevent noise and wear of the mining card (e.g. GPU, FPGU,and or ASIC). 3.3V and 5V logic comes from the MCU board and/or USB terminals.

The calculated hash is saved in the memory and subsequently transmitted through the communications module to the internet in predefined periods of time, e.g. between 1ms to 10 days depending on the specifics of the mined entity. The software is surveying available mining pools and joins the most profitable at a given moment. In every cycle to software may switch a pool in order to optimize profitability of the mining. For example, Mining of ETH with Nvidia 1060 as the mining card attached to the kit has given 15 to 18Mh with 120W consumption at the time of one exemplified experiment.

In some embodiments of the invention , energy input may derive from sources other than solar such as wind mill, hydropower etc.

In some embodiments of the invention, the system may be provided with a grid connection, e.g. for providing power when there is no alternative energy source, and/or for allowing feed-in to the grid when mining is less profitable than direct energy sale.

In some embodiments of the invention, the system is provided with software adapted to allow for payment of or earning currency from selling electricity to other kits connected to each other in the form of a micro grid.

In some embodiments of the invention, the system is provided with the possibility to pay or earn from selling and buying electricity with other

electricity generation consumption devices with P2P electricity trading ability.

In some embodiments of the invention, a computing architecture enabled card is employed that will reduce signicantly power consumption for these type of calculations.

Storage capacity may be sized such that (for example) the average daily total input available minus the maximum energy consumed by the mining hardware is provided. Alternatively, the storage capacity may be dictated by the total mining capacity and expected troughs in energy production. For example, for a solar system where approx. 5kWh may be forecast for every 1kW of installed capacity, 5/24kW or about 200W of mining equipment may be installed for every kW of solar capacity, with about 4kWh of storage capacity sufficing to keep the system running overnight.

In some embodiments of the invention, the mining software algorithm checks the optimum pools to join managing a virtual wallet and presenting to the user the amount of currency earned and used and the state of power.

Additional advantages and features of the invention will become apparent from the description which follows, and may be realized by means of the instrumentalities and combinations.

CLAIMS

1. A method for use of excess energy production capacity, consisting of the steps:

a. providing a source of electrical energy production;

b. identifying one or more computation markets having a market value per computation cycle or equivalent;

c. providing computing means adapted to perform computations available on said computation markets;

d. using said computing means and said excess energy production capacity , performing computations on said markets;

whereby excess energy is converted to capital in said computation markets, thereby utilizing said energy locally without requiring transport nor storage .

2. The method of claim 1 further providing a grid tie-in allowing for:

a. use of grid electricity to run said computing means when said means for energy production is not available or at low capacity;

b. sale of said excess energy production capacity when the economic value of performing computations on said markets is less than the value of direct sale to the grid.

3. The method of claim 1 further providing energy storage means adapted to allow for excess energy storage, allowing for the use of said computing means when said means for energy production is not available or at low capacity.

4. The system of claim 1 wherein said source of energy production is selected from the group consisting of: solar; wind; thermal; hydropower.

5. A system for use of excess energy production capacity, consisting of:

a. a source of electrical energy production;

b. computing means adapted to perform computations available on said computation markets;

c. communications means adapted to transmit the results of said computations to a network;

whereby excess energy is converted to capital on one or more computation markets, thereby utilizing said energy locally without requiring transport nor storage.

6. The system of claim 4 further having a grid tie-in allowing for:

a. use of grid electricity to run said computing means when said means for energy production is not available or at low capacity;

b. sale of said excess energy production capacity when the economic value of performing computations on said markets is less than the value of direct sale to the grid.

7. The system of claim 4 further having energy storage means adapted to allow for excess energy storage, allowing for the use of said computing means when said means for energy production is not available or at low capacity.

8. The system of claim 4 wherein said source of energy production is selected from the group consisting of: solar; wind; thermal; hydropower.

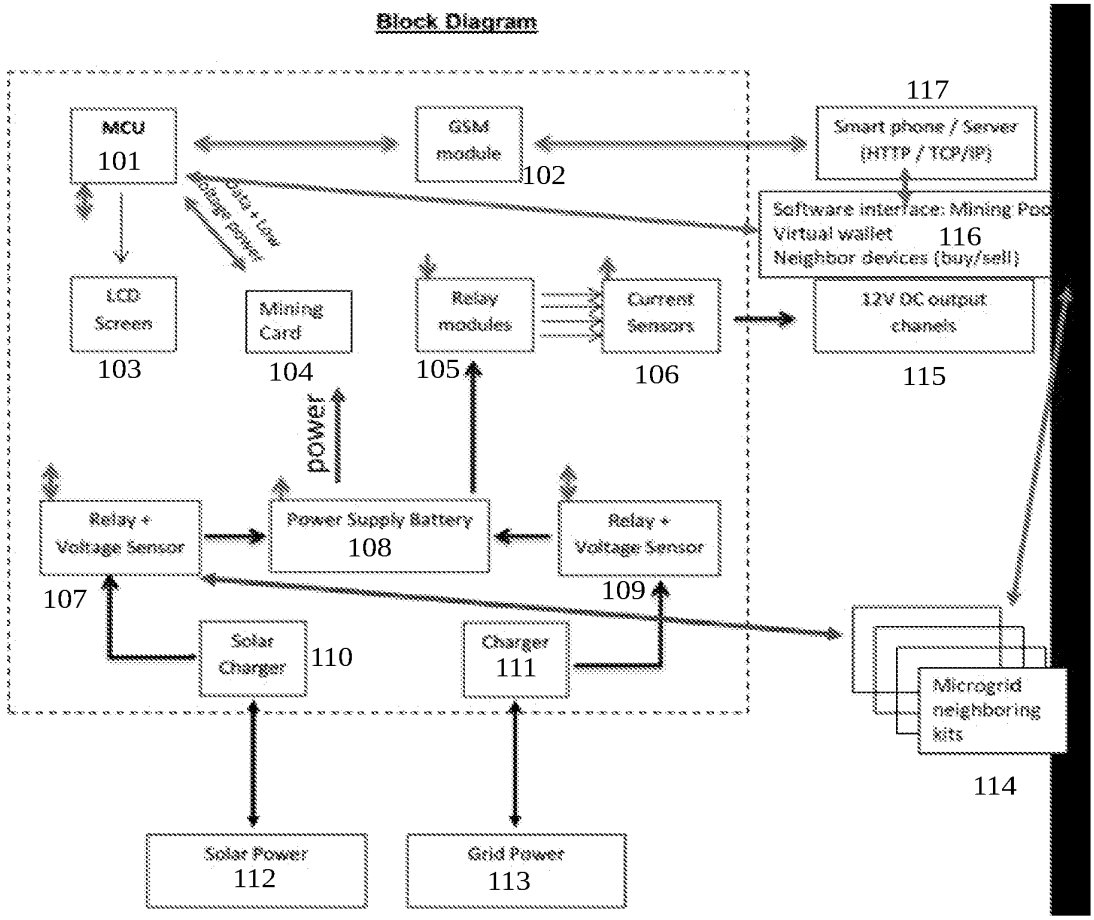

Block Diagram
MCU
101
GSM module
102
117
Smart phone / Server (HTTP / TCP/IP)
Software interface: Mining Pool
Virtual wallet
Neighbor devices (buy/sell)
116
Data + Low voltage power
LCD Screen
103
Mining Card
104
Relay modules
105
Current Sensors
106
12V DC output chanels
115
power
Relay + Voltage Sensor
107
Power Supply Battery
108
Relay + Voltage Sensor
109
Solar Charger
110
Charger
111
Microgrid neighboring kits
114
Solar Power
112
Grid Power
113

FIG 1

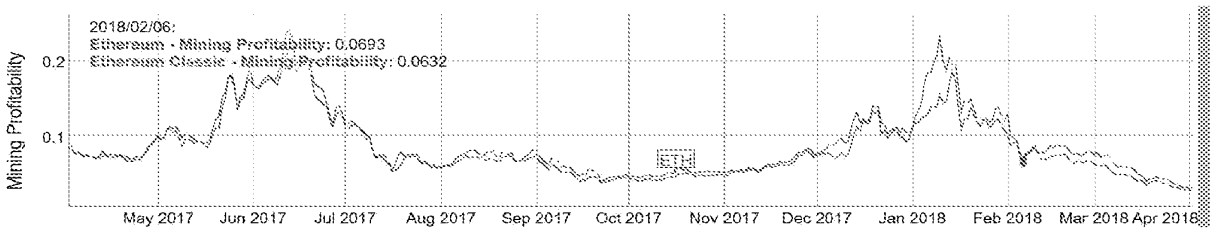

2018/02/06:
Ethereum - Mining Profitability: 0.0693
Ethereum Classic - Mining Profitability: 0.0632
Mining Profitability
0.2
0.1
May 2017
Jun 2017
Jul 2017
Aug 2017
Sep 2017
Oct 2017
Nov 2017
Dec 2017
Jan 2018
Feb 2018
Mar 2018
Apr 2018

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2018/051362

A. CLASSIFICATION OF SUBJECT MATTER
IPC (2019.01) G06Q 30/00, G06Q 30/06, G06Q 20/30, H01G 9/20, G06F 15/76, G06F 1/26, G06F 1/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC (2019.01) G06Q 30/00, G06Q 30/06, G06Q 20/30, H01G 9/20, G06F 15/76, G06F 1/26, G06F 1/32

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Databases consulted: Esp@cenet, Google Patents, Google Scholar, Orbit
Search terms used: excess solar energy electrical production mining profitability micro optimum grid peak

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"Solar Micro-Mining on the Bitcoin Blockchain"; Viral Communications; Retrieved from the Internet: < URL: https://viral.media.mit.edu/pub/solarcoin?version=fc4f427a-0180-4df4-afed-93795aa4f35c> LIPPMAN, Andrew; EKBLAW, Ariel 09 Mar 2016 (2016/03/09) The whole document	1-8
A	"Current trends in sustainability of bitcoins and related blockchain technology"; Sustainability 2017, 9(12), 2214; Retrieved from the Internet: < URL: https://www.mdpi.com/2071-1050/9/12/2214> GIUNGATO, Pasquale, et al. 30 Nov 2017 (2017/11/30) The whole document	1-8
A	"Greenslot: scheduling energy consumption in green datacenters"; SC'11: Proceedings of 2011 International Conference for High Performance Computing, Networking, Storage and Analysis; IEEE; 12-18 November 2011; p. 1-11; Retrieved from the Internet: < URL: https://ieeexplore.ieee.org/abstract/document/6114408> GOIRI, Inigo, et al. 18 Nov 2011 (2011/11/18) The whole document	1-8

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 Feb 2019	21 Feb 2019
Name and mailing address of the ISA: Israel Patent Office Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel Facsimile No. 972-2-5651616	Authorized officer PLACHINTA Ekaterina Telephone No. 972-2-5651740

Form PCT/ISA/210 (second sheet) (January 2015)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 July 2019 (18.07.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/139633 A1

(51) International Patent Classification:
A01G 9/16 (2006.01) *H02S 10/40* (2014.01)
A01G 9/14 (2006.01) *H02S 20/30* (2014.01)

(21) International Application Number:
PCT/US2018/017955

(22) International Filing Date:
13 February 2018 (13.02.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/616,348 11 January 2018 (11.01.2018) US

(71) Applicant: **LANCIUM LLC** [US/US]; c/o Angelo Mikeska PLLC, 21 Waterway Avenue, Suite 300, The Woodlands, TX 77380 (US).

(72) Inventors: **HENSON, David**; Lancium LLC, c/o Angelo Mikeska PLLC, 21 Waterway Avenue, Suite 300, The Woodlands, TX 77380 (US). **MCNAMARA, Michael**; Lancium LLC, c/o Angelo Mikeska PLLC, 21 Waterway Avenue, Suite 300, The Woodlands, TX 77380 (US). **CLINE, Raymond**; Lancium LLC, c/o Angelo Mikeska PLLC, 21 Waterway Avenue, Suite 300, The Woodlands, TX 77380 (US).

(74) Agent: **KORENCHAN, James, L.**; McDonnell Boehnen Hulbert & Berghoff LLP, 300 South Wacker Drive, Suite 3200, Chicago, IL 60606 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME,

(54) Title: METHOD AND SYSTEM FOR DYNAMIC POWER DELIVERY TO A FLEXIBLE GROWCENTER USING UNUTILIZED ENERGY SOURCES

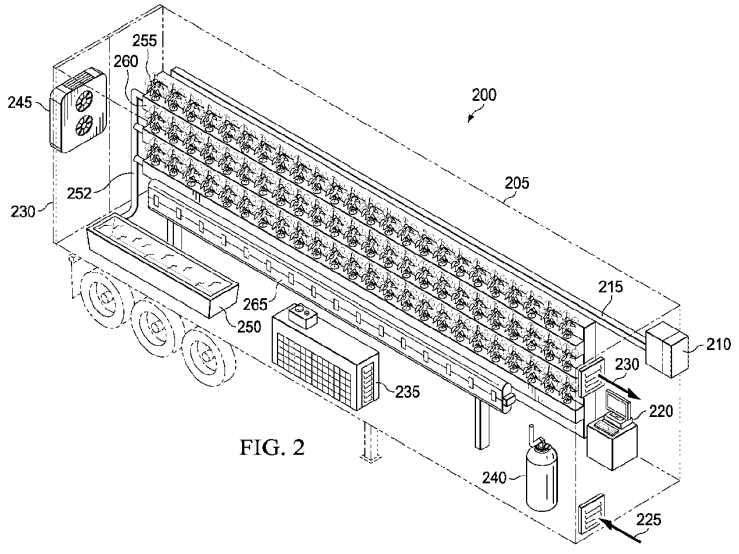


FIG. 2

(57) **Abstract:** A flexible growcenter includes a mobile container, a behind-the-meter power input system, a power distribution system, a growcenter control system, a climate control system, a lighting system, and an irrigation system. The growcenter control system modulates power delivery to one or more components of the climate control system, the lighting system, and the irrigation system based on unutilized behind-the-meter power availability or an operational directive. A method of dynamic power delivery to a flexible growcenter using unutilized behind-the-meter power includes monitoring unutilized behind-the-meter power availability, determining when a growcenter ramp-up condition is met, and enabling behind-the-meter power delivery to one or more computing systems when the growcenter ramp-up condition is met.

[Continued on next page]

WO 2019/139633 A1

MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

METHOD AND SYSTEM FOR DYNAMIC POWER DELIVERY TO A FLEXIBLE GROWCENTER USING UNUTILIZED ENERGY SOURCES

BACKGROUND OF THE INVENTION

[0001] Rapid population growth threatens to outpace food production, storage, and distribution capabilities. While modern agricultural practices have thus far allowed production to keep pace with population growth, the population is expected to swell to more than nine (9) billion by the year 2050. It is predicted that, by the year 2025, supply will no longer be able to meet demand. This anticipated food shortage is further complicated by the fact that large scale production farms produce the vast majority of food. As such, many regions rely completely on food produced in one location, stored in another, and distributed for local consumption. Storage and distribution logistics further complicate the delivery of fresh food and add additional cost. Thus, new agricultural practices are needed to address these issues as demand starts to outpace supply.

[0002] Shipping containers have been adapted for use in farming in non-traditional locations. Containers have successfully been used in traditional agriculture, hydroponics, aquaculture, and aquaponics applications growing food, cash, plantation, and horticulture crops. A single 40-foot container can potentially yield the annual equivalent of three to five acres of farm land. The use of containers offers a number of unique advantages over conventional farming. Container farms are self-contained and modular, thereby allowing them to be built, transported, and situated where local demand exists. In addition, container farms allow farming to take place in locations and climates where farming otherwise wouldn't be viable due to climate, soil conditions, or water availability. Perhaps most importantly, because of their modularity, container farms allow production to scale. Containers may be stacked vertically on top of one another to minimize the footprint and maximize yield.

BRIEF SUMMARY OF THE INVENTION

[0003] According to one aspect of one or more embodiments of the present invention, a flexible growcenter includes a mobile container, a behind-the-meter power input system, a power distribution system, a growcenter control system, a climate control system, a lighting system, and an irrigation system. The growcenter control system

modulates power delivery to one or more components of the climate control system, the lighting system, and the irrigation system based on unutilized behind-the-meter power availability or an operational directive.

[0004] According to one aspect of one or more embodiments of the present invention, a method of dynamic power delivery to a flexible growcenter using unutilized behind-the-meter power includes monitoring unutilized behind-the-meter power availability, determining when a growcenter ramp-up condition is met, and enabling behind-the-meter power delivery to one or more computing systems when the growcenter ramp-up condition is met.

[0005] Other aspects of the present invention will be apparent from the following description and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] Figure **1** shows a computing system in accordance with one or more embodiments of the present invention.

[0007] Figure **2** shows a flexible growcenter in accordance with one or more embodiments of the present invention.

[0008] Figure **3** shows a three-phase power distribution of a flexible growcenter in accordance with one or more embodiments of the present invention.

[0009] Figure **4** shows a control distribution scheme of a flexible growcenter in accordance with one or more embodiments of the present invention.

[0010] Figure **5** shows a control distribution scheme of a fleet of flexible growcenters in accordance with one or more embodiments of the present invention.

[0011] Figure **6** shows a flexible growcenter powered by one or more wind turbines in accordance with one or more embodiments of the present invention.

[0012] Figure **7** shows a flexible growcenter powered by one or more solar panels in accordance with one or more embodiments of the present invention.

[0013] Figure **8** shows a flexible growcenter powered by flare gas in accordance with one or more embodiments of the present invention.

[0014] Figure **9** shows a method of dynamic power delivery to a flexible growcenter using unutilized behind-the-meter power in accordance with one or more embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0015] One or more embodiments of the present invention are described in detail with reference to the accompanying figures. For consistency, like elements in the various figures are denoted by like reference numerals. In the following detailed description of the present invention, specific details are set forth in order to provide a thorough understanding of the present invention. In other instances, well-known features to one having ordinary skill in the art are not described to avoid obscuring the description of the present invention.

[0016] The modular and scalable nature of container farms provides significant advantage in that they may be located on site near consumption and production may be scaled based on demand. The largest operational cost of a container farm is power. As container farms scale, the power consumption of each container becomes increasingly important. Each container typically includes a climate control system, an irrigation system, and a lighting system, as well as others systems that may be critical to its function, each of which consume power. While advancements have been made to reduce the power consumption of these systems, perhaps most notably, the use of light emitting diode ("LED") lighting systems, the power consumption remains significant and more so as the container farm scales up in size. As such, one of the greatest impediments to the widespread adoption of container farms is the cost prohibitive nature of providing power.

[0017] Accordingly, in one or more embodiments of the present invention, a method and system for dynamic power delivery to a flexible growcenter uses unutilized behind-the-meter power sources without transmission and distribution costs. The flexible growcenter may be configured to modulate power delivery to one or more components of the climate control system, an irrigation system, or a lighting system based on the availability of unutilized behind-the-meter power or an operational directive. For example, the flexible growcenter may ramp-up to a fully online status, ramp-down to a fully offline status, or dynamically adjust power consumption, act a load balancer, or adjust the power factor based on which systems, or subsystems thereof, receive power. Advantageously, the flexible growcenter may allow localized farm operations to be performed with little to no energy costs, using clean and renewable energy that would otherwise be wasted.

[0018] Figure **1** shows a computing system **100** in accordance with one or more embodiments of the present invention. Computing system **100** may include one or more central processing units (singular "CPU" or plural "CPUs") **105**, host bridge **110**, input/output ("IO") bridge **115**, graphics processing units (singular "GPU" or plural "GPUs") **125**, and/or application-specific integrated circuits (singular "ASIC or plural "ASICs") (not shown) disposed on one or more printed circuit boards (not shown) that are configured to perform computational operations. Each of the one or more CPUs **105**, GPUs **125**, or ASICs (not shown) may be a single-core (not independently illustrated) device or a multi-core (not independently illustrated) device. Multi-core devices typically include a plurality of cores (not shown) disposed on the same physical die (not shown) or a plurality of cores (not shown) disposed on multiple die (not shown) that are collectively disposed within the same mechanical package (not shown).

[0019] CPU **105** may be a general purpose computational device typically configured to execute software instructions. CPU **105** may include an interface **108** to host bridge **110**, an interface **118** to system memory **120**, and an interface **123** to one or more IO devices, such as, for example, one or more GPUs **125**. GPU **125** may serve as a specialized computational device typically configured to perform graphics functions related to frame buffer manipulation. However, one of ordinary skill in the art will recognize that GPU **125** may be used to perform non-graphics related functions that are computationally intensive. In certain embodiments, GPU **125** may interface **123** directly with CPU **125** (and interface **118** with system memory **120** through CPU **105**). In other embodiments, GPU **125** may interface **121** with host bridge **110** (and interface **116** or **118** with system memory **120** through host bridge **110** or CPU **105** depending on the application or design). In still other embodiments, GPU **125** may interface **133** with IO bridge **115** (and interface **116** or **118** with system memory **120** through host bridge **110** or CPU **105** depending on the application or design). The functionality of GPU **125** may be integrated, in whole or in part, with CPU **105**.

[0020] Host bridge **110** may be an interface device configured to interface between the one or more computational devices and IO bridge **115** and, in some embodiments, system memory **120**. Host bridge **110** may include an interface **108** to CPU **105**, an interface **113** to IO bridge **115**, for embodiments where CPU **105** does not include an interface **118** to system memory **120**, an interface **116** to system

memory **120**, and for embodiments where CPU **105** does not include an integrated GPU **125** or an interface **123** to GPU **125**, an interface **121** to GPU **125**. The functionality of host bridge **110** may be integrated, in whole or in part, with CPU **105**. IO bridge **115** may be an interface device configured to interface between the one or more computational devices and various IO devices (*e.g.*, **140**, **145**) and IO expansion, or add-on, devices (not independently illustrated). IO bridge **115** may include an interface **113** to host bridge **110**, one or more interfaces **133** to one or more IO expansion devices **135**, an interface **138** to keyboard **140**, an interface **143** to mouse **145**, an interface **148** to one or more local storage devices **150**, and an interface **153** to one or more network interface devices **155**. The functionality of IO bridge **115** may be integrated, in whole or in part, with CPU **105** or host bridge **110**. Each local storage device **150**, if any, may be a solid-state memory device, a solid-state memory device array, a hard disk drive, a hard disk drive array, or any other non-transitory computer readable medium. Network interface device **155** may provide one or more network interfaces including any network protocol suitable to facilitate networked communications.

[0021] Computing system **100** may include one or more network-attached storage devices **160** in addition to, or instead of, one or more local storage devices **150**. Each network-attached storage device **160**, if any, may be a solid-state memory device, a solid-state memory device array, a hard disk drive, a hard disk drive array, or any other non-transitory computer readable medium. Network-attached storage device **160** may or may not be collocated with computing system **100** and may be accessible to computing system **100** via one or more network interfaces provided by one or more network interface devices **155**.

[0022] One of ordinary skill in the art will recognize that computing system **100** may be a conventional computing system or an application-specific computing system. In certain embodiments, an application-specific computing system may include one or more ASICs (not shown) that are configured to perform one or more functions in a more efficient manner. The one or more ASICs (not shown) may interface directly with CPU **105**, host bridge **110**, or GPU **125** or interface through IO bridge **115**. Alternatively, in other embodiments, an application-specific computing system may be reduced to only those components necessary to perform a desired function in an effort to reduce one or more of chip count, printed circuit board footprint, thermal design power, and power consumption. The one or more ASICs (not shown) may be

used instead of one or more of CPU **105**, host bridge **110**, IO bridge **115**, or GPU **125**. In such systems, the one or more ASICs may incorporate sufficient functionality to perform certain network and computational functions in a minimal footprint with substantially fewer component devices.

[0023] As such, one of ordinary skill in the art will recognize that CPU **105**, host bridge **110**, IO bridge **115**, GPU **125**, or ASIC (not shown) or a subset, superset, or combination of functions or features thereof, may be integrated, distributed, or excluded, in whole or in part, based on an application, design, or form factor in accordance with one or more embodiments of the present invention. Thus, the description of computing system **100** is merely exemplary and not intended to limit the type, kind, or configuration of component devices that constitute a computing system **100** suitable for performing computing operations in accordance with one or more embodiments of the present invention.

[0024] One of ordinary skill in the art will recognize that computing system **100** may be a stand alone, laptop, desktop, server, blade, or rack mountable system and may vary based on an application or design.

[0025] Figure **2** shows a flexible growcenter **200** in accordance with one or more embodiments of the present invention. Flexible growcenter **200** may include a mobile container **205**, a behind-the-meter power input system **210**, a power distribution system **215**, a growcenter control system **220**, a climate control system (*e.g.*, **225**, **230**, **235**, **240**, and/or **245**), an irrigation system (*e.g.*, **250** and **252**), a plurality of plants **255** disposed in a plurality of grow containers **260**, and a lighting system **265**.

[0026] Growcenter control system **220** may be a computing system (*e.g.*, **100** of Figure **1**) configured to dynamically modulate power delivery to one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lighting system **265** disposed within flexible growcenter **200** based on unutilized behind-the-meter power availability or an operational directive from a local station control system (not shown), a remote master control system (not shown), or a grid operator (not shown).

[0027] In certain embodiments, mobile container **205** may be a storage trailer disposed on wheels and configured for rapid deployment. In other embodiments, mobile container **205** may be a storage container (not shown) configured for placement on the ground and potentially stacked in a vertical manner (not shown).

In still other embodiments, mobile container **205** may be an inflatable container, a floating container, or any other type or kind of container suitable for housing a mobile growcenter **200**.

[0028] Flexible growcenter **200** may be rapidly deployed on site near a source of unutilized behind-the-meter power generation. Behind-the-meter power input system **210** may be configured to input power to flexible growcenter **200**. Behind-the-meter power input system **210** may include a first input (not independently illustrated) configured to receive three-phase behind-the-meter alternating current ("AC") voltage. In certain embodiments, behind-the-meter power input system **210** may include a supervisory AC-to-AC step-down transformer (not shown) configured to step down three-phase behind-the-meter AC voltage to single-phase supervisory nominal AC voltage or a second input (not independently illustrated) configured to receive single-phase supervisory nominal AC voltage from the local station (not shown) or a metered source (not shown). Behind-the-meter power input system **210** may provide single-phase supervisory nominal AC voltage to growcenter control system **220**, which may remain powered at almost all times to control the operation of flexible growcenter **200**. The first input (not independently illustrated) or a third input (not independently illustrated) of behind-the-meter power input system **210** may direct three-phase behind-the-meter AC voltage to an operational AC-to-AC step-down transformer (not shown) configured to controllably step down three-phase behind-the-meter AC voltage to three-phase nominal AC voltage. Growcenter control system **220** may controllably enable or disable generation or provision of three-phase nominal AC voltage by the operational AC-to-AC step-down transformer (not shown).

[0029] Behind-the-meter power input system **210** may provide three phases of three-phase nominal AC voltage to power distribution system **215**. Power distribution system **215** may controllably provide a single phase of three-phase nominal AC voltage to components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and subsets of lights (not independently illustrated) of lighting system **265** disposed within flexible growcenter **200**. Growcenter control system **220** may controllably select which phase of three-phase nominal AC voltage that power distribution system **215** provides to components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and one or more lights (not independently illustrated) of lighting system **265**. In this way,

growcenter control system **220** may modulate power delivery by either ramping-up flexible growcenter **200** to fully operational status, ramping-down flexible growcenter **200** to offline status (where only growcenter control system **220** remains powered), reducing power consumption by withdrawing power delivery from, or reducing power to, one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lights (not independently illustrated) of lighting system **265**, or modulating a power factor correction factor for the local station by controllably adjusting which phases of three-phase nominal AC voltage are used by one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lights (not independently illustrated) of lighting system **265**.

[0030] Flexible growcenter **200** may include a climate control system (*e.g.*, **225**, **230**, **235**, **240**, and/or **245**) configured to maintain the climate within container **205**. In certain embodiments, the climate control system may include an air intake **225**, an air outtake **230**, a humidity control system **235**, a gas system **240**, and an air conditioner/heater **245**, each of which may be independently powered, with a single phase of three-phase nominal AC voltage for maximum flexibility. Humidity control system **235** may, under the direction of growcenter computing system **220** or based on one or more sensors (not independently illustrated), regulate the relative humidity within container **205** to control the transpiration of the plants **255**. Gas system **240** may, under the direction of growcenter computing system **220** or based on one or more sensors (not independently illustrated), regulate the release of one or more gases, such as, for example, carbon dioxide, CO_2, that, with light and nutrients, aid the plants **255** in photosynthesis. Air conditioner/heater **245** may be used to control the temperature within container **205**. The enclosure of container **205**, as well as the use of heat generating lights **265**, tends to increase the ambient temperature within container **205**, which damages plants **255**. In warm climates, air conditioner **245** may be configured to lower the temperature within container **205** to a temperature suitable for growth of the plants **255**. In cold climates, heater **245** may be configured to raise the temperature within container **205** to a temperature suitable for growth of the plants **255**.

[0031] The irrigation system may include a water tank **250**, a pump system (not independently illustrated), and a plurality of irrigation lines **252** that provide water to plants **255**. The pump system (not independently illustrated) may be powered by

a single phase of three-phase nominal AC voltage. Lighting system **265** may include a plurality of lights (not independently illustrated) that provide light for photosynthesis. Each light (not independently illustrated) or group of lights (not independently illustrated) of lighting system **265** may be powered by a single phase of three-phase nominal AC voltage. Lighting system **265** may, under direction of growcenter computing system **220**, control the on or off state of one or more lights (not independently illustrated) or groups of lights (not independently illustrated) of lighting system **265**. The lights (not independently illustrated) may be fluorescent, high intensity discharge ("HID"), or LED lights. Because the lighting system **265** tends to work antagonistically with the climate control system (*e.g.*, **225**, **230**, **235**, **240**, and/or **245**), the modern trend is to use LED lights. However, one of ordinary skill in the art will recognize that the type of lights used may vary based on an application or design.

[0032] Flexible growcenter **200** may include a battery system (not shown) configured to convert three-phase nominal AC voltage to nominal DC voltage and store power in a plurality of storage cells. The battery system (not shown) may include a DC-to-AC inverter configured to convert nominal DC voltage to three-phase nominal AC voltage for flexible growcenter **200** use. Alternatively, the battery system (not shown) may include a DC-to-AC inverter configured to convert nominal DC voltage to single-phase nominal AC voltage to power growcenter control system **220**.

[0033] One of ordinary skill in the art will recognize that a voltage level of three-phase behind-the-meter AC voltage may vary based on an application or design and the type or kind of local power generation. As such, a type, kind, or configuration of the operational AC-to-AC step down transformer (not shown) may vary based on the application or design. In addition, the frequency and voltage level of three-phase nominal AC voltage, single-phase nominal AC voltage, and nominal DC voltage may vary based on the application or design in accordance with one or more embodiments of the present invention.

[0034] Figure **3** shows a three-phase power distribution of a flexible growcenter **200** in accordance with one or more embodiments of the present invention. Flexible growcenter **200** may include a plurality of plants **255** disposed within a plurality of containers **260**. As discussed above, the behind-the-meter power input system (**210** of Figure **2**) may provide three phases of three-phase nominal AC voltage to the power distribution system (**215** of Figure **2**). The power distribution system (**215** of

Figure **2**) may controllably provide a single phase of three-phase nominal AC voltage to one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the pump system (*e.g.*, pump for **252**) that drives water through the irrigation lines **252** of the irrigation system to one or more plants **255**, and one or more lights (not independently illustrated) of the lighting system **265** disposed within flexible growcenter **200**. For example, for purposes of illustration only, a flexible growcenter **200** may include three groups (*e.g.*, **310**, **320**, and **330**) of plants **255**, each of which may have one or more independently controlled lights (not independently illustrated) of the lighting system **265** and the pump system (not independently illustrated) that drives one or more irrigation lines **252**. The power distribution system (**215** of Figure **2**) may control which phase of three-phase nominal AC voltage is provided to the one or more lights (not independently illustrated) of the lighting system **265** and the pump system (not independently illustrated) that drives one or more irrigation lines **252**.

[0035] In the figure, for purposes of illustration only, the plurality of plants **255** disposed in the plurality of containers **260** may be divided into a first group **310**, a second group **320**, and a third group **330**, where each group includes a subset of lights (not independently illustrated) of lighting system **265**, and potentially other components such as, for example, the pumping system (not independently illustrated) that drives one or more irrigation lines **252**. The power distribution system (**215** of Figure **2**) may, for example, provide a first phase of three-phase nominal AC voltage to the first group **310**, a second phase of three-phase nominal AC voltage to the second group **320**, and a third phase of three-phase nominal AC voltage to the third group **330**. If the flexible growcenter (**200** of Figure **2**) receives an operational directive from the local station (not shown) to provide power factor correction, the growcenter control system (**220** of Figure **2**) may direct the power distribution system (**215** of Figure **2**) to adjust which phase or phases of three-phase nominal AC voltage are used to provide the power factor correction required by the local station (not shown) or grid operator (not shown). One of ordinary skill in the art will recognize that, in addition to the power distribution, the load may be varied by adjusting the number of groups operatively powered. As such, the flexible growcenter (**200** of Figure **2**) may be configured to act as a capacitive or inductive load to provide the appropriate reactance necessary to achieve the power factor correction required by the local station (not shown).

[0036] Figure **4** shows a control distribution scheme of a flexible growcenter **200** in accordance with one or more embodiments of the present invention. Growcenter control system **220** may independently, or cooperatively with one or more of local station control system **410**, remote master control system **420**, and grid operator **440**, modulate power delivery to flexible growcenter **200**. Specifically, power delivery may be dynamically adjusted based on conditions or operational directives.

[0037] Local station control system **410** may be a computing system (*e.g.*, **100** of Figure **1**) that is configured to control various aspects of the local station (not independently illustrated) that generates power and sometimes generates unutilized behind-the-meter power. Local station control system **410** may communicate with remote master control system **420** over a networked connection **430** and with growcenter control system **220** over a networked or hardwired connection **415**. Remote master control system **420** may be a computing system (*e.g.*, **100** of Figure **1**) that is located offsite, but connected via a network connection **425** to growcenter control system **220**, that is configured to provide supervisory or override control of flexible growcenter **200** or a fleet (not shown) of flexible growcenters **200**. Grid operator **440** may be a computing system (*e.g.*, **100** of Figure **1**) that is configured to control various aspects of the grid (not independently illustrated) that receives power from the local station (not independently illustrated). Grid operator **440** may communicate with local station control system **440** over a networked or hardwired connection **445**.

[0038] Growcenter control system **220** may monitor unutilized behind-the-meter power availability at the local station (not independently illustrated) and determine when a growcenter ramp-up condition is met. Unutilized behind-the-meter power availability may include one or more of excess local power generation, excess local power generation that the grid cannot accept, local power generation that is subject to economic curtailment, local power generation that is subject to reliability curtailment, local power generation that is subject to power factor correction, situations where local power generation is prohibitively low, start up situations, transient situations, or testing situations where there is an economic advantage to using locally generated behind-the-meter power generation, specifically power available at little to no cost and with no associated transmission or distribution costs.

[0039] The growcenter ramp-up condition may be met if there is sufficient behind-the-meter power availability and there is no operational directive from local station control system **410**, remote master control system **420**, or grid operator **440** to go offline or reduce power. As such, growcenter control system **220** may enable **435** behind-the-meter power input system **210** to provide three-phase nominal AC voltage to the power distribution system (**215** of Figure **2**) to power one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lighting system **265** or a subset thereof.

[0040] Remote master control system **420** may specify to growcenter control system **220** what sufficient behind-the-meter power availability constitutes, or growcenter control system **220** may be programmed with a predetermined preference or criteria on which to make the determination independently. For example, in certain circumstances, sufficient behind-the-meter power availability may be less than that required to fully power the entire flexible growcenter **200**. In such circumstances, growcenter control system **220** may provide power to only a subset of one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lighting system **265**, that is within the sufficient, but less than full, range of power that is available.

[0041] While flexible growcenter **200** is online and operational, a growcenter ramp-down condition may be met when there is insufficient, or anticipated to be insufficient, behind-the-meter power availability or there is an operational directive from local station control system **410**, remote master control system **420**, or grid operator **440**. Growcenter control system **220** may monitor and determine when there is insufficient, or anticipated to be insufficient, behind-the-meter power availability. As noted above, sufficiency may be specified by remote master control system **420** or growcenter control system **220** may be programmed with a predetermined preference or criteria on which to make the determination independently. An operational directive may be based on current dispatchability, forward looking forecasts for when unutilized behind-the-meter power is, or is expected to be, available, economic considerations, reliability considerations, operational considerations, or the discretion of the local station **410**, remote master control **420**, or grid operator **440**. For example, local station control system **410**, remote master control system **420**, or grid operator **440** may issue an operational directive to flexible growcenter **200** to go offline and power down. When the

growcenter ramp-down condition is met, growcenter control system **220** may disable power delivery to one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lighting system **265**. Growcenter control system **220** may disable **435** behind-the-meter power input system **210** from providing three-phase nominal AC voltage to the power distribution system (**215** of Figure **2**) to power down the one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lighting system **265**, while growcenter control system **220** remains powered and is capable of rebooting flexible growcenter **200** when unutilized behind-the-meter power becomes available again.

[0042] While flexible growcenter **200** is online and operational, changed conditions or an operational directive may cause growcenter control system **220** to modulate power consumption by flexible growcenter **200**. Growcenter control system **220** may determine, or local station control system **410**, remote master control system **420**, or grid operator **440** may communicate, that a change in local conditions may result in less power generation, availability, or economic feasibility, than would be necessary to fully power flexible growcenter **200**. In such situations, growcenter control system **220** may take steps to reduce or stop power consumption by flexible growcenter **200** (other than that required to maintain operation of growcenter control system **220**). Alternatively, local station control system **410**, remote master control system **420**, or grid operator **440**, may issue an operational directive to reduce power consumption for any reason, the cause of which may be unknown. In response, growcenter control system **220** may dynamically reduce or withdraw power delivery to one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lighting system **265** to meet the dictate. Growcenter control system **220** may controllably provide three-phase nominal AC voltage to a smaller subset of one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lighting system **265** to reduce power consumption.

[0043] Figure **5** shows a control distribution of a fleet **500** of flexible growcenters **200** in accordance with one or more embodiments of the present invention. The control distribution of a flexible growcenter **200** shown and described with respect to Figure **4** may be extended to a fleet **500** of flexible growcenters **200**. For example, a first local station (not independently illustrated), such as, for example, a wind farm (not

shown), may include a first plurality **510** of flexible growcenters **200*a*** through **200*d***, which may be collocated or distributed across the local station (not shown). A second local station (not independently illustrated), such as, for example, another wind farm or a solar farm (not shown), may include a second plurality **520** of flexible growcenters **200*e*** through **200*h***, which may be collocated or distributed across the local station (not shown). One of ordinary skill in the art will recognize that the number of flexible growcenters **200** deployed at a given station and the number of stations within the fleet **500** may vary based on an application or design in accordance with one or more embodiments of the present invention.

[0044] Remote master control system **420** may provide supervisory control over fleet **500** of flexible growcenters **200** in a similar manner to that shown and described with respect to Figure **4**, with the added flexibility to make high level decisions with respect to fleet **500** that may be counterintuitive to a given station. Remote master control system **420** may make decisions regarding the issuance of operational directives to a given local station based on, for example, the status of each local station where flexible growcenters **200** are deployed.

[0045] Figure **6** shows a flexible growcenter **200** powered by one or more wind turbines **610** in accordance with one or more embodiments of the present invention. A wind farm **600** typically includes a plurality of wind turbines **610**, each of which intermittently generates a wind-generated AC voltage. The wind-generated AC voltage may vary based on a type, kind, or configuration of farm **600**, turbine **610**, and incident wind speed. The wind-generated AC voltage is typically input into a turbine AC-to-AC step-up transformer (not shown) that is disposed within the nacelle (not independently illustrated) or at the base of the mast (not independently illustrated) of turbine **610**. The turbine AC-to-AC step up transformer (not shown) outputs three-phase wind-generated AC voltage **620**. Three-phase wind-generated AC voltage **620** produced by the plurality of wind turbines **610** is collected **625** and provided **630** to another AC-to-AC step-up transformer **640** that steps up three-phase wind-generated AC voltage **620** to three-phase grid AC voltage **650** suitable for delivery to grid **660**. Three-phase grid AC voltage **650** may be stepped down with an AC-to-AC step-down transformer **670** configured to produce three-phase local station AC voltage **680** provided to local station **690**. One of ordinary skill in the art will recognize that the actual voltage levels may vary based on the type, kind,

or number of wind turbines **610**, the configuration or design of wind farm **600**, and grid **660** that it feeds into.

[0046] The output side of AC-to-AC step-up transformer **640** that connects to grid **660** may be metered and is typically subject to transmission and distribution costs. In contrast, power consumed on the input side of AC-to-AC step-up transformer **640** may be considered behind-the-meter and is typically not subject to transmission and distribution costs. As such, one or more flexible growcenters **200** may be powered by three-phase wind-generated AC voltage **620**. Specifically, in wind farm **600** applications, the three-phase behind-the-meter AC voltage used to power flexible growcenter **200** may be three-phase wind-generated AC voltage **620**. As such, flexible growcenter **200** may reside behind-the-meter, avoid transmission and distribution costs, and may be dynamically powered when unutilized behind-the-meter power is available.

[0047] Unutilized behind-the-meter power availability may occur when there is excess local power generation. In high wind conditions, wind farm **600** may generate more power than, for example, AC-to-AC step-up transformer **640** is rated for. In such situations, wind farm **600** may have to take steps to protect its equipment from damage, which may include taking one or more turbines **610** offline or shunting their voltage to dummy loads or ground. Advantageously, one or more flexible growcenters **200** may be used to consume power on the input side of AC-to-AC step-up transformer **640**, thereby allowing wind farm **600** to operate equipment within operating ranges while flexible growcenter **200** receives behind-the-meter power without transmission or distribution costs. The local station control system (not independently illustrated) of local station **690** may issue an operational directive to the one or more flexible growcenters **200** or to the remote master control system (**420** of Figure **4**) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible growcenters **200**, the remote mater control system (**420** of Figure **4**) may determine how to power each individual flexible growcenter **200** in accordance with the operational directive or provide an override to each flexible growcenter **200**.

[0048] Another example of unutilized behind-the-meter power availability is when grid **660** cannot, for whatever reason, take the power being produced by wind farm **600**. In such situations, wind farm **600** may have to take one or more turbines **610** offline or shunt their voltage to dummy loads or ground. Advantageously, one or

more flexible growcenters **200** may be used to consume power on the input side of AC-to-AC step-up transformer **640**, thereby allowing wind farm **600** to either produce power to grid **660** at a lower level or shut down transformer **640** entirely while flexible growcenter **200** receives behind-the-meter power without transmission or distribution costs. The local station control system (not independently illustrated) of local station **690** or the grid operator (not independently illustrated) of grid **660** may issue an operational directive to the one or more flexible growcenters **200** or to the remote master control system (**420** of Figure **4**) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible growcenters **200**, the remote master control system (**420** of Figure **4**) may determine how to power each individual flexible growcenter **200** in accordance with the operational directive or provide an override to each flexible growcenter **200**.

[0049] Another example of unutilized behind-the-meter power availability is when wind farm **600** is selling power to grid **660** at a negative price that is offset by a production tax credit. In certain circumstances, the value of the production tax credit may exceed the price wind farm **600** would have to pay to grid **660** to offload their generated power. Advantageously, one or more flexible growcenters **200** may be used to consume power behind-the-meter, thereby allowing wind farm **600** to produce and obtain the production tax credit, but sell less power to grid **660** at the negative price. The local station control system (not independently illustrated) of local station **690** may issue an operational directive to the one or more flexible growcenters **200** or to the remote master control system (**420** of Figure **4**) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible growcenter **200**, the remote master control system (**420** of Figure **4**) may determine how to power each individual flexible growcenter **200** in accordance with the operational directive or provide an override to each flexible growcenter **200**.

[0050] Another example of unutilized behind-the-meter power availability is when wind farm **600** is selling power to grid **660** at a negative price because grid **660** is oversupplied or is instructed to stand down and stop producing altogether. The grid operator (not independently illustrated) may select certain power generation stations to go offline and stop producing power to grid **660**. Advantageously, one or more flexible growcenters **200** may be used to consume power behind-the-meter, thereby

allowing wind farm **600** to stop producing power to grid **660**, but making productive use of the power generated behind-the-meter without transmission or distribution costs. The local station control system (not independently illustrated) of the local station **690** or the grid operator (not independently illustrated) of grid **660** may issue an operational directive to the one or more flexible growcenters **200** or to the remote master control system (**420** of Figure **4**) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible growcenters **200**, the remote master control system (**420** of Figure **4**) may determine how to power each individual flexible growcenter **200** in accordance with the operational directive or provide an override to each flexible growcenter **200**.

[0051] Another example of unutilized behind-the-meter power availability is when wind farm **600** is producing power to grid **660** that is unstable, out of phase, or at the wrong frequency, or grid **660** is already unstable, out of phase, or at the wrong frequency for whatever reason. The grid operator (not independently illustrated) may select certain power generation stations to go offline and stop producing power to grid **660**. Advantageously, one or more flexible growcenters **200** may be used to consume power behind-the-meter, thereby allowing wind farm **600** to stop producing power to grid **660**, but make productive use of the power generated behind-the-meter without transmission or distribution costs. The local station control system (not independently illustrated) of local station **690** may issue an operational directive to the one or more flexible growcenters **200** or to the remote master control system (**420** of Figure **4**) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible growcenters **200**, the remote master control system (**420** of Figure **4**) may determine how to power each individual flexible growcenter **200** in accordance with the operational directive or provide an override to each flexible growcenter **200**.

[0052] Further examples of unutilized behind-the-meter power availability is when wind farm **600** experiences low wind conditions that make it not economically feasible to power up certain components, such as, for example, the local station (not independently illustrated), but there may be sufficient behind-the-meter power availability to power one or more flexible growcenters **200**. Similarly, unutilized behind-the-meter power availability may occur when wind farm **600** is starting up,

or testing, one or more turbines **610**. Turbines **610** are frequently offline for installation, maintenance, and service and must be tested prior to coming online as part of the array. One or more flexible growcenters **200** may be powered by one or more turbines **610** that are offline from farm **600**. The above-noted examples of when unutilized behind-the-meter power is available are merely exemplary and are not intended to limit the scope of what one of ordinary skill in the art would recognize as unutilized behind-the-meter power availability. Unutilized behind-the-meter power availability may occur anytime there is power available and accessible behind-the-meter that is not subject to transmission and distribution costs and there is an economic advantage to using it.

[0053] One of ordinary skill in the art will recognize that wind farm **600** and wind turbine **610** may vary based on an application or design in accordance with one or more embodiments of the present invention.

[0054] Figure 7 shows a flexible growcenter **200** powered by one or more solar panels **710** in accordance with one or more embodiments of the present invention. A solar farm **700** typically includes a plurality of solar panels **710**, each of which intermittently generates a solar-generated DC voltage **720**. Solar-generated DC voltage **720** may vary based on a type, kind, or configuration of farm **700**, panel **710**, and incident sunlight. Solar-generated DC voltage **720** produced by the plurality of solar panels **710** is collected **725** and provided **730** to a DC-to-AC inverter that converts solar-generated DC voltage into three-phase solar-generated AC voltage **750**. Three-phase solar-generated AC voltage **750** is provided to an AC-to-AC step-up transformer **760** that steps up three-phase solar-generated AC voltage to three-phase grid AC voltage **790**. Three-phase grid AC voltage **790** may be stepped down with an AC-to-AC step-down transformer **785** configured to produce three-phase local station AC voltage **777** provided to local station **775**. One of ordinary skill in the art will recognize that the actual voltage levels may vary based on the type, kind, or number of solar panels **710**, the configuration or design of solar farm **700**, and grid **790** that it feeds into.

[0055] The output side of AC-to-AC step-up transformer **760** that connects to grid **790** may be metered and is typically subject to transmission and distribution costs. In contrast, power consumed on the input side of AC-to-AC step-up transformer **760** may be considered behind-the-meter and is typically not subject to transmission and distribution costs. As such, one or more flexible growcenters **200** may be powered

by three-phase solar-generated AC voltage **750**. Specifically, in solar farm **700** applications, the three-phase behind-the-meter AC voltage used to power flexible growcenter **200** may be three-phase solar-generated AC voltage **750**. As such, flexible growcenter **200** may reside behind-the-meter, avoid transmission and distribution costs, and may be dynamically powered when unutilized behind-the-meter power is available.

[0056] Unutilized behind-the-meter power availability may occur when there is excess local power generation. In high incident sunlight situations, solar farm **700** may generate more power than, for example, AC-to-AC step-up transformer **760** is rated for. In such situations, solar farm **700** may have to take steps to protect its equipment from damage, which may include taking one or more panels **710** offline or shunting their voltage to dummy loads or ground. Advantageously, one or more flexible growcenters **200** may be used to consume power on the input side of AC-to-AC step-up transformer **760**, thereby allowing solar farm **700** to operate equipment within operating ranges while flexible growcenter **200** receives behind-the-meter power without transmission or distribution costs. The local station control system (not independently illustrated) of local station **775** may issue an operational directive to the one or more flexible growcenters **200** or to the remote master control system (**420** of Figure **4**) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible growcenters **200**, the remote mater control system (**420** of Figure **4**) may determine how to power each individual flexible growcenter **200** in accordance with the operational directive or provide an override to each flexible growcenter **200**.

[0057] Another example of unutilized behind-the-meter power availability is when grid **790** cannot, for whatever reason, take the power being produced by solar farm **700**. In such situations, solar farm **700** may have to take one or more panels **710** offline or shunt their voltage to dummy loads or ground. Advantageously, one or more flexible growcenters **200** may be used to consume power on the input side of AC-to-AC step-up transformer **760**, thereby allowing solar farm **700** to either produce power to grid **790** at a lower level or shut down transformer **760** entirely while flexible growcenter **200** receives behind-the-meter power without transmission or distribution costs. The local station control system (not independently illustrated) of local station **775** or the grid operator (not independently illustrated) of grid **790** may issue an operational directive to the one

or more flexible growcenters **200** or to the remote master control system (**420** of Figure **4**) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible growcenters **200**, the remote master control system (**420** of Figure **4**) may determine how to power each individual flexible growcenter **200** in accordance with the operational directive or provide an override to each flexible growcenter **200**.

[0058] Another example of unutilized behind-the-meter power availability is when solar farm **700** is selling power to grid **790** at a negative price that is offset by a production tax credit. In certain circumstances, the value of the production tax credit may exceed the price solar farm **700** would have to pay to grid **790** to offload their generated power. Advantageously, one or more flexible growcenters **200** may be used to consume power behind-the-meter, thereby allowing solar farm **700** to produce and obtain the production tax credit, but sell less power to grid **790** at the negative price. The local station control system (not independently illustrated) of local station **775** may issue an operational directive to the one or more flexible growcenters **200** or to the remote master control system (**420** of Figure **4**) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible growcenter **200**, the remote master control system (**420** of Figure **4**) may determine how to power each individual flexible growcenter **200** in accordance with the operational directive or provide an override to each flexible growcenter **200**.

[0059] Another example of unutilized behind-the-meter power availability is when solar farm **700** is selling power to grid **790** at a negative price because grid **790** is oversupplied or is instructed to stand down and stop producing altogether. The grid operator (not independently illustrated) may select certain power generation stations to go offline and stop producing power to grid **790**. Advantageously, one or more flexible growcenters **200** may be used to consume power behind-the-meter, thereby allowing solar farm **700** to stop producing power to grid **790**, but making productive use of the power generated behind-the-meter without transmission or distribution costs. The local station control system (not independently illustrated) of the local station **775** or the grid operator (not independently illustrated) of grid **790** may issue an operational directive to the one or more flexible growcenters **200** or to the remote master control system (**420** of Figure **4**) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of

multiple flexible growcenters **200**, the remote master control system (**420** of Figure **4**) may determine how to power each individual flexible growcenter **200** in accordance with the operational directive or provide an override to each flexible growcenter **200**.

[0060] Another example of unutilized behind-the-meter power availability is when solar farm **700** is producing power to grid **790** that is unstable, out of phase, or at the wrong frequency, or grid **790** is already unstable, out of phase, or at the wrong frequency for whatever reason. The grid operator (not independently illustrated) may select certain power generation stations to go offline and stop producing power to grid **790**. Advantageously, one or more flexible growcenters **200** may be used to consume power behind-the-meter, thereby allowing solar farm **700** to stop producing power to grid **790**, but make productive use of the power generated behind-the-meter without transmission or distribution costs. The local station control system (not independently illustrated) of local station **775** may issue an operational directive to the one or more flexible growcenters **200** or to the remote master control system (**420** of Figure **4**) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible growcenters **200**, the remote master control system (**420** of Figure **4**) may determine how to power each individual flexible growcenter **200** in accordance with the operational directive or provide an override to each flexible growcenter **200**.

[0061] Further examples of unutilized behind-the-meter power availability is when solar farm **700** experiences intermittent cloud cover such that it is not economically feasible to power up certain components, such as, for example local station 775, but there may be sufficient behind-the-meter power availability to power one or more flexible growcenters **200**. Similarly, unutilized behind-the-meter power availability may occur when solar farm **700** is starting up, or testing, one or more panels **710**. Panels **710** are frequently offline for installation, maintenance, and service and must be tested prior to coming online as part of the array. One or more flexible growcenters **200** may be powered by one or more panels **710** that are offline from farm **700**. The above-noted examples of when unutilized behind-the-meter power is available are merely exemplary and are not intended to limit the scope of what one of ordinary skill in the art would recognize as unutilized behind-the-meter power availability. Behind-the-meter power availability may occur anytime there is power

available and accessible behind-the-meter that is not subject to transmission and distribution costs and there is an economic advantage to using it.

[0062] One of ordinary skill in the art will recognize that solar farm **700** and solar panel **710** may vary based on an application or design in accordance with one or more embodiments of the present invention.

[0063] Figure **8** shows a flexible growcenter **200** powered by flare gas **800** in accordance with one or more embodiments of the present invention. Flare gas **800** is combustible gas produced as a product or by-product of petroleum refineries, chemical plants, natural gas processing plants, oil and gas drilling rigs, and oil and gas production facilities. Flare gas **800** is typically burned off through a flare stack (not shown) or vented into the air. In one or more embodiments of the present invention, flare gas **800** may be diverted **812** to a gas-powered generator that produces three-phase gas-generated AC voltage **822**. This power may be considered behind-the-meter and is not subject to transmission and distribution costs. As such, one or more flexible growcenters **200** may be powered by three-phase gas-generated AC voltage. Specifically, the three-phase behind-the-meter AC voltage used to power flexible growcenter **200** may be three-phase gas-generated AC voltage **822**. Accordingly, flexible growcenter **200** may reside behind-the-meter, avoid transmission and distribution costs, and may be dynamically powered when unutilized behind-the-meter power is available.

[0064] Figure **9** shows a method of dynamic power delivery to a flexible growcenter (**200** of Figure **2**) using unutilized behind-the-meter power **900** in accordance with one or more embodiments of the present invention. In step **910**, the growcenter control system (**220** of Figure **4**), or the remote master control system (**420** of Figure **4**), may monitor unutilized behind-the-meter power availability. In certain embodiments, monitoring may include receiving information or an operational directive from the local station control system (**410** of Figure **4**) or the grid operator (**440** of Figure **4**) corresponding to unutilized behind-the-meter power availability.

[0065] In step **920**, the growcenter control system (**220** of Figure **4**), or the remote master control system (**420** of Figure **4**), may determine when a growcenter ramp-up condition is met. In certain embodiments, the growcenter ramp-up condition may be met when there is sufficient behind-the-meter power availability and there is no operational directive from the local station to go offline or reduce power. In step **930**, the growcenter control system (**220** of Figure **4**) may enable behind-the-meter

power delivery to one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lighting system **265**.

[0066] While operational, the growcenter control system (**220** of Figure **4**), or the remote master control system (**420** of Figure **4**), may receive an operational directive to modulate power consumption. In certain embodiments, the operational directive may be a directive to reduce power consumption. In such embodiments, the growcenter control system (**220** of Figure **4**) or the remote master control system (**420** of Figure **4**) may dynamically withdraw power delivery to one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lighting system **265** or subsets thereof or dynamically reduce power consumption of one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lighting system **265** or subsets thereof. In other embodiments, the operational directive may be a directive to provide a power factor correction factor. In such embodiments, the growcenter control system (**220** of Figure **4**) or the remote master control system (**420** of Figure **4**) may dynamically adjust power delivery to one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lighting system **265** to achieve a desired power factor correction factor. In still other embodiments, the operational directive may be a directive to go offline or power down. In such embodiments, the growcenter control system (**220** of Figure **4**) may disable power delivery to one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lighting system **265**.

[0067] The growcenter control system (**220** of Figure **4**), or the remote master control system (**420** of Figure **4**), may determine when a growcenter ramp-down condition is met. In certain embodiments, the growcenter ramp-down condition may be met if there is insufficient or anticipated to be insufficient behind-the-meter power availability or there is an operational directive from the local station to go offline or reduce power. The growcenter control system (**220** of Figure **4**) may disable behind-the-meter power delivery to one or more components of the climate control system (*e.g.*, **235**, **240**, and/or **245**), the irrigation system (*e.g.*, **252**), and lighting system **265**. Once ramped-down, the growcenter control system (**220** of Figure **4**) remains powered and in communication with the remote master control system (**420** of

Figure **4**) so that it may dynamically power the flexible growcenter (**200** of Figure **2**) when conditions change.

[0068] One of ordinary skill in the art will recognize that a growcenter control system (**220** of Figure **4**) may dynamically modulate power delivery to one or more computing systems (**100** of Figure **2**) of a flexible growcenter (**200** of Figure **2**) based on unutilized behind-the-meter power availability or an operational directive. The flexible growcenter (**200** of Figure **2**) may transition between a fully powered down state (while the growcenter control system remains powered), a fully powered up state, and various intermediate states in between. In addition, flexible growcenter (**200** of Figure **2**) may have a blackout state, where all power consumption, including that of the growcenter control system (**220** of Figure **4**) is halted. However, once the flexible growcenter (**200** of Figure **2**) enters the blackout state, it will have to be manually rebooted to restore power to growcenter control system (**220** of Figure **4**). Local station conditions or operational directives may cause flexible growcenter (**200** of Figure **2**) to ramp-up, reduce power consumption, change power factor, or ramp-down.

[0069] Advantages of one or more embodiments of the present invention may include one or more of the following:

[0070] In one or more embodiments of the present invention, a method and system for dynamic power delivery to a flexible growcenter using unutilized energy sources provides a green solution to the problem of scalable container farming.

[0071] In one or more embodiments of the present invention, a method and system for dynamic power delivery to a flexible growcenter using unutilized energy sources allows for the rapid deployment of mobile growcenters to local stations. The mobile growcenters may be deployed on site, near the source of power generation, and receive unutilized behind-the-meter power when it is available.

[0072] In one or more embodiments of the present invention, a method and system for dynamic power delivery to a flexible growcenter using unutilized energy sources allows for the power delivery to the growcenter to be modulated based on conditions or an operational directive received from the local station or the grid operator.

[0073] In one or more embodiments of the present invention, a method and system for dynamic power delivery to a flexible growcenter using unutilized energy sources may dynamically adjust power consumption by ramping-up, ramping-down, or

adjusting the power consumption of one or more computing systems within the flexible growcenter.

[0074] In one or more embodiments of the present invention, a method and system for dynamic power delivery to a flexible growcenter using unutilized energy sources may be powered by unutilized behind-the-meter power that is free from transmission and distribution costs. As such, the flexible growcenter may perform computational operations, such as hashing function operations, with little to no energy cost.

[0075] In one or more embodiments of the present invention, a method and system for dynamic power delivery to a flexible growcenter using unutilized energy sources provides a number of benefits to the hosting local station. The local station may use the flexible growcenter to adjust a load, provide a power factor correction, to offload power, or operate in a manner that invokes a production tax credit.

[0076] While the present invention has been described with respect to the above-noted embodiments, those skilled in the art, having the benefit of this disclosure, will recognize that other embodiments may be devised that are within the scope of the invention as disclosed herein. Accordingly, the scope of the invention should be limited only by the appended claims.

CLAIMS

What is claimed is:

1. A flexible growcenter comprising:
   a mobile container;
   a behind-the-meter power input system;
   a power distribution system;
   a growcenter control system;
   a climate control system,
   a lighting system; and
   an irrigation system;
   wherein the growcenter control system modulates power delivery to one or more components of the climate control system, the lighting system, and the irrigation system based on unutilized behind-the-meter power availability or an operational directive.

2. The flexible growcenter of claim 1, further comprising:
   a remote master control system.

3. The flexible growcenter of claim 1, wherein the behind-the-meter power input system comprises an input configured to receive three-phase behind-the-meter AC voltage and a supervisory AC-to-AC step-down transformer configured to step down the three-phase behind-the-meter AC voltage to a single-phase supervisory nominal AC voltage or an input configured to receive single-phase supervisory nominal AC voltage from a local station or metered source.

4. The flexible growcenter of claim 3, wherein the behind-the-meter power input system provides the single-phase supervisory nominal AC voltage to the growcenter control system.

5. The flexible growcenter of claim 1, wherein the behind-the-meter power input system comprises an input configured to receive three-phase behind-the-meter AC voltage and an

operational AC-to-AC step-down transformer configured to controllably step down the three-phase behind-the-meter AC voltage to three-phase nominal AC voltage.

6. The flexible growcenter of claim 5, wherein the growcenter control system controllably enables or disables generation of the three-phase nominal AC voltage by the operational AC-to-AC step-down transformer.

7. The flexible growcenter of claim 1, wherein the behind-the-meter power input system provides three-phases of the three-phase nominal AC voltage to the power distribution system.

8. The flexible growcenter of claim 7, wherein the power distribution system controllably provides a single phase of the three-phase nominal AC voltage to one or more components of the climate control system, the irrigation system, and the lighting system.

9. The flexible data center of claim 7, wherein the growcenter control system controllably selects which phase of the three-phase nominal AC voltage the power distribution system provides to each components of the climate control system, the irrigation system, and the lighting system.

10. The flexible growcenter of claim 7, wherein the growcenter control system modulates a power factor correction factor by controllably adjusting which phase of the three-phase nominal AC voltage each component of the climate control system, the irrigation system, and the lighting system receive.

11. The flexible growcenter of claim 5, wherein the three-phase behind-the-meter AC voltage comprises a three-phase wind-generated AC voltage output by one or more wind turbines prior to an AC-to-AC step-up transformer that steps up the three-phase wind-generated AC voltage to a three-phase grid AC voltage.

12. The flexible growcenter of claim 5, wherein the three-phase behind-the-meter AC voltage comprises a three-phase solar-generated AC voltage output by a DC-to-AC inverter that inputs solar-generated DC voltage from one or more solar panels and prior to an AC-to-

AC step-up transformer that steps up the three-phase solar-generated AC voltage to a three-phase grid AC voltage.

13. The flexible growcenter of claim 5, wherein the three-phase behind-the-meter AC voltage comprises a three-phase gas-generated AC voltage output by a generator that inputs combustible gas diverted from a flare or venting system.

14. The flexible growcenter of claim 5, wherein the three-phase behind-the-meter AC voltage is a three-phase metered AC voltage.

15. The flexible growcenter of claim 1, wherein unutilized behind-the-meter power availability comprises one or more of excess local power generation at a local station level, excess local power generation that a grid cannot receive, local power generation subject to economic curtailment, local power generation subject to reliability curtailment, local power generation subject to power factor correction, low local power generation, start up local power generation situations, transient local power generation situations, or testing local power generation situations where there is an economic advantage to using local behind-the-meter power generation to power the flexible growcenter.

16. The flexible growcenter of claim 1, wherein an operational directive comprises one or more of a local station directive, a remote master control directive, or a grid directive.

17. The flexible growcenter of claim 1, wherein an operational directive comprises one or more of a dispatchability directive or a forecast directive.

18. The flexible growcenter of claim 1, wherein an operational directive comprises a workload directive based on actual behind-the-meter power availability or projected behind-the-meter power availability.

19. The flexible growcenter of claim 2, wherein the remote master control system dynamically adjusts power delivery to the flexible growcenter based on a remote master control directive.

20. The flexible growcenter of claim 1, wherein the climate control system comprises a humidity control system, a gas system, and an air conditioner/heater.

21. The flexible growcenter of claim 1, wherein the irrigation system comprises a water tank, a pump system, and a plurality of irrigation lines.

22. The flexible growcenter of claim 1, wherein the lighting system comprises a plurality of lights.

23. The flexible growcenter of claim 1, wherein the mobile container comprises a storage container configured for placement on a ground surface.

24. The flexible growcenter of claim 1, wherein the mobile container comprises a storage trailer on wheels.

25. The flexible growcenter of claim 5, further comprising a battery system configured to convert the three-phase nominal AC voltage to DC nominal voltage and store power in a plurality of storage cells.

26. The flexible growcenter of claim 23, wherein the DC nominal voltage from the plurality of storage cells are converted via a DC-to-AC inverter to three-phase nominal AC voltage for flexible growcenter use.

27. A method of dynamic power delivery to a flexible growcenter using unutilized behind-the-meter power comprising:

monitoring unutilized behind-the-meter power availability;

determining when a growcenter ramp-up condition is met; and

enabling behind-the-meter power delivery to one or more components of a climate control system, a lighting system, and an irrigation system when the growcenter ramp-up condition is met.

28. The method of claim 27, further comprising:

determining when a growcenter ramp-down condition is met; and

disabling power delivery to one or more components of the climate control system, the irrigation system, and the lighting system when the growcenter ramp-down condition is met.

29. The method of claim 27, further comprising:

receiving an operational directive to go offline; and

disabling power delivery to the climate control system, the irrigation system, and the lighting system.

30. The method of claim 27, further comprising:

receiving an operational directive to reduce power consumption; and

dynamically reducing power delivery to a subset of the one or more components of the climate control system, the irrigation system, and the lighting system.

31. The method of claim 27, further comprising:

receiving an operational directive to reduce power consumption, and

dynamically reducing power consumption to one or more components of the climate control system, the irrigation system, and the lighting system.

32. The method of claim 27, further comprising:

receiving an operational directive to provide power factor correction; and

dynamically adjusting power delivery to a subset of the one or more components of the climate control system, the irrigation system, and the lighting system.

33. The method of claim 27, wherein unutilized behind-the-meter power availability comprises one or more of excess local power generation at a local station level, excess local power generation that a grid cannot receive, local power generation subject to economic curtailment, local power generation subject to reliability curtailment, local power generation subject to power factor correction, low local power generation, start up local power generation situations, transient local power generation situations, or testing local power generation situations where there is an economic advantage to using local behind-the-meter power generation.

34. The method of claim 27, wherein the growcenter ramp-up condition is met if there is sufficient behind-the-meter power availability and there is no operational directive from a local station to go offline.

35. The method of claim 27, wherein the growcenter ramp-down condition is met if there is insufficient behind-the-meter power availability or there is an operational directive from a local station to go offline.

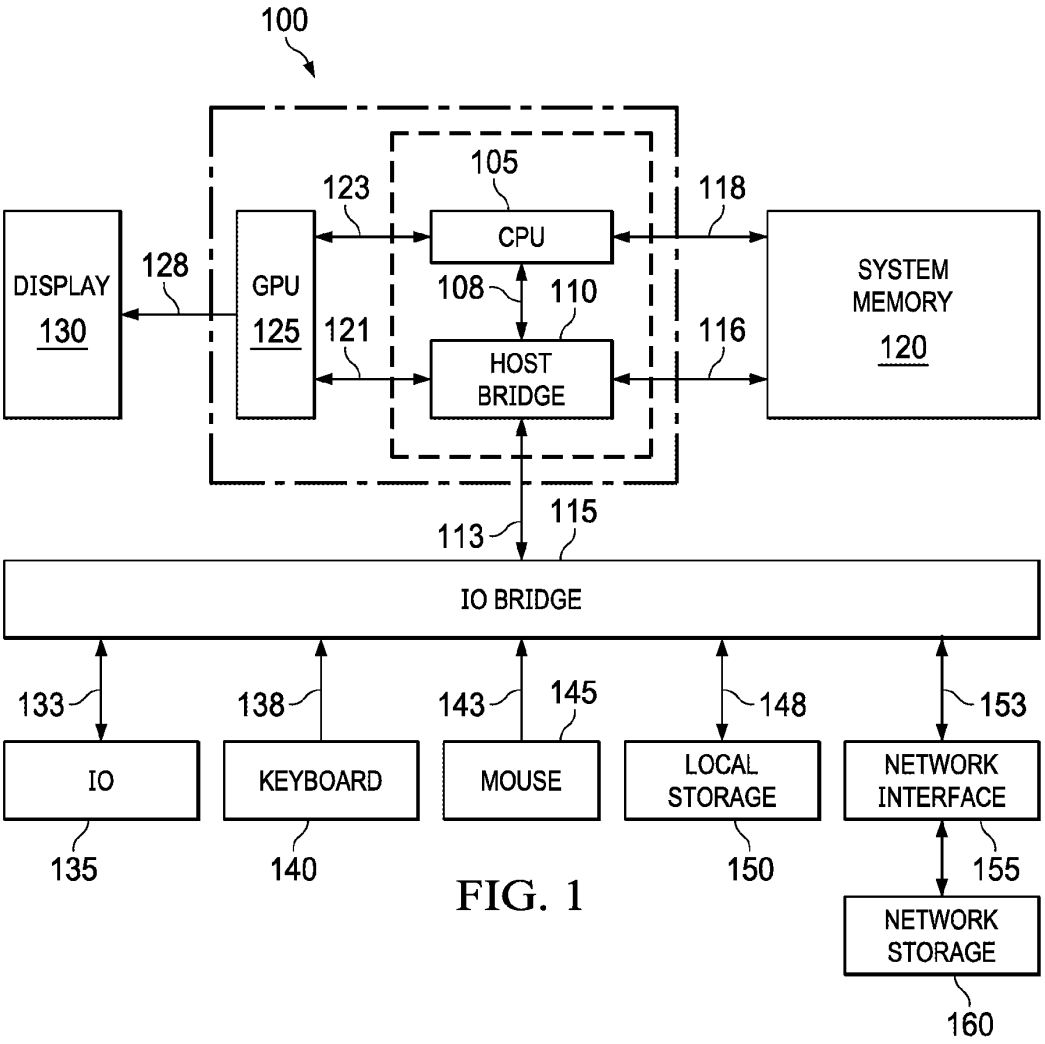

100
105
123
118
CPU
DISPLAY
130
128
GPU
125
121
108
110
HOST
BRIDGE
116
SYSTEM
MEMORY
120
113
115
IO BRIDGE
133
138
143
145
148
153
IO
KEYBOARD
MOUSE
LOCAL
STORAGE
NETWORK
INTERFACE
135
140
150
155
NETWORK
STORAGE
160

FIG. 1

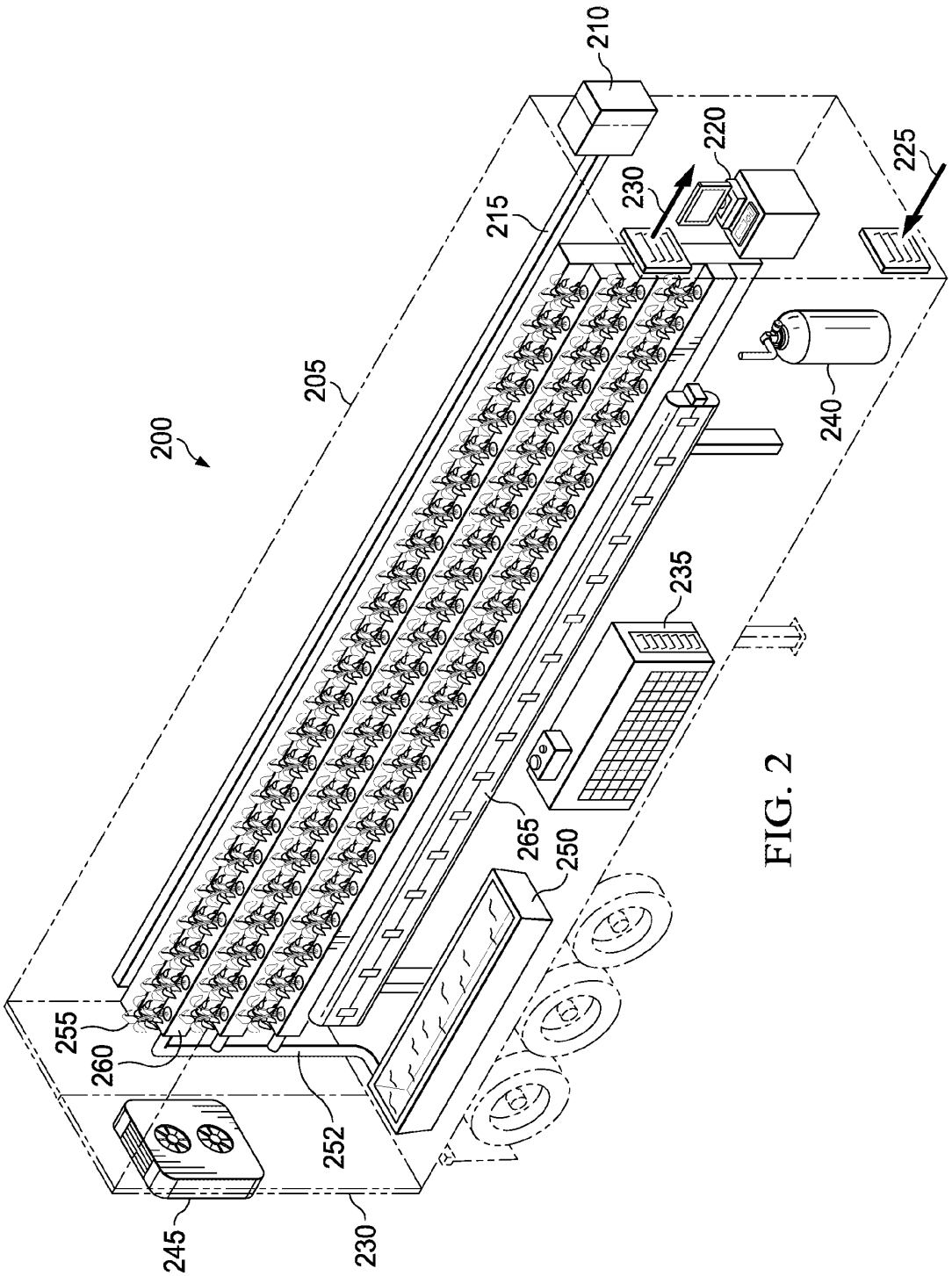


FIG. 2

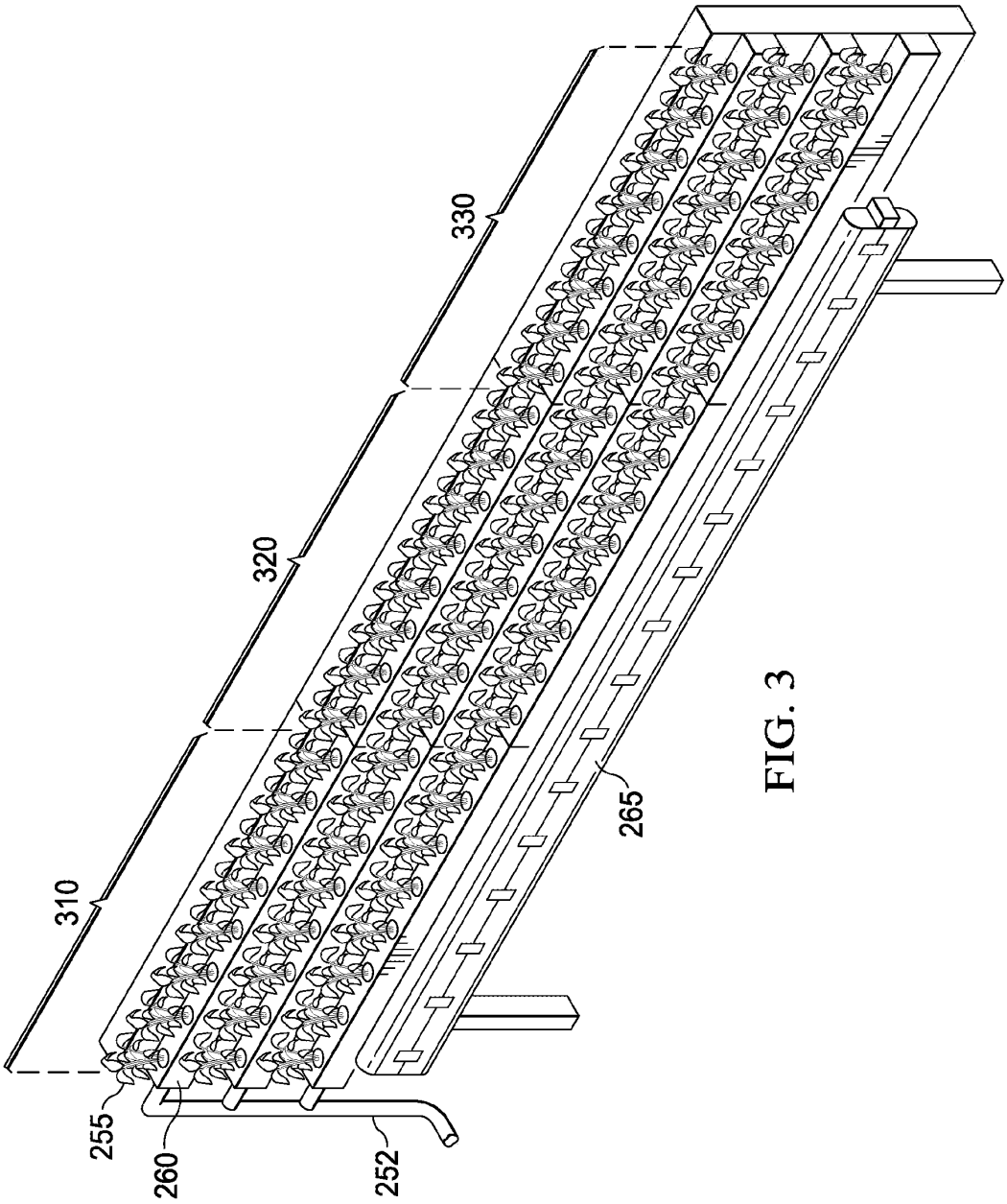


FIG. 3

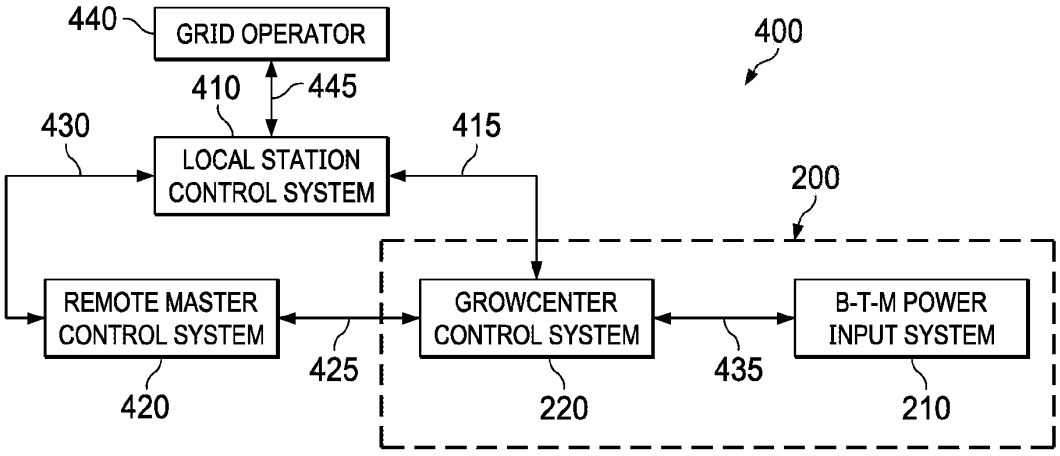

440
GRID OPERATOR
400
410
445
430
415
LOCAL STATION CONTROL SYSTEM
200
REMOTE MASTER CONTROL SYSTEM
GROWCENTER CONTROL SYSTEM
B-T-M POWER INPUT SYSTEM
425
435
420
220
210

FIG. 4

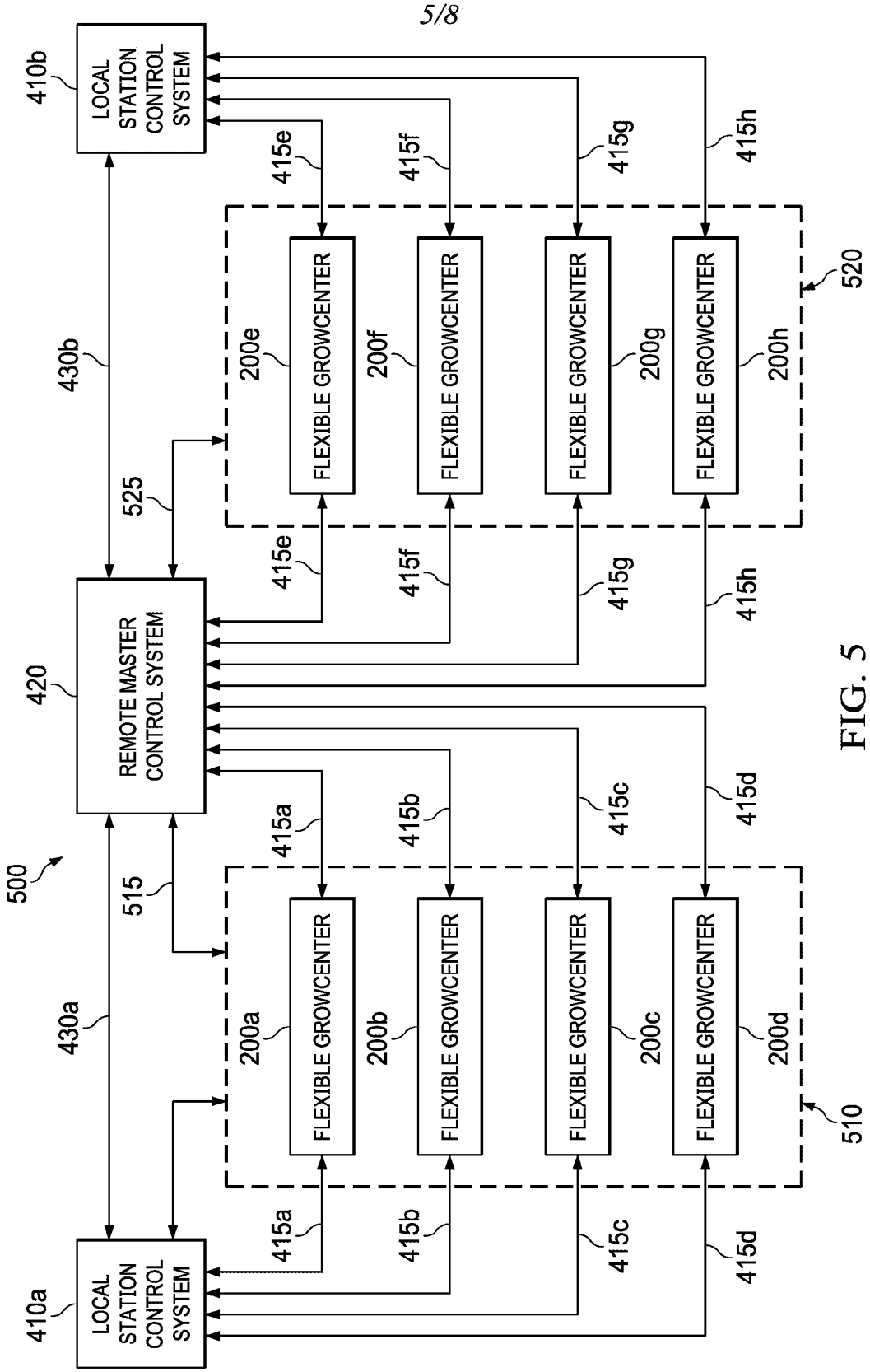

410b
LOCAL STATION CONTROL SYSTEM
415e
415f
415g
415h
520
200e
FLEXIBLE GROWCENTER
200f
FLEXIBLE GROWCENTER
200g
FLEXIBLE GROWCENTER
200h
FLEXIBLE GROWCENTER
430b
525
420
REMOTE MASTER CONTROL SYSTEM
500
515
415a
415b
415c
415d
200a
FLEXIBLE GROWCENTER
200b
FLEXIBLE GROWCENTER
200c
FLEXIBLE GROWCENTER
200d
FLEXIBLE GROWCENTER
510
430a
410a
LOCAL STATION CONTROL SYSTEM

FIG. 5

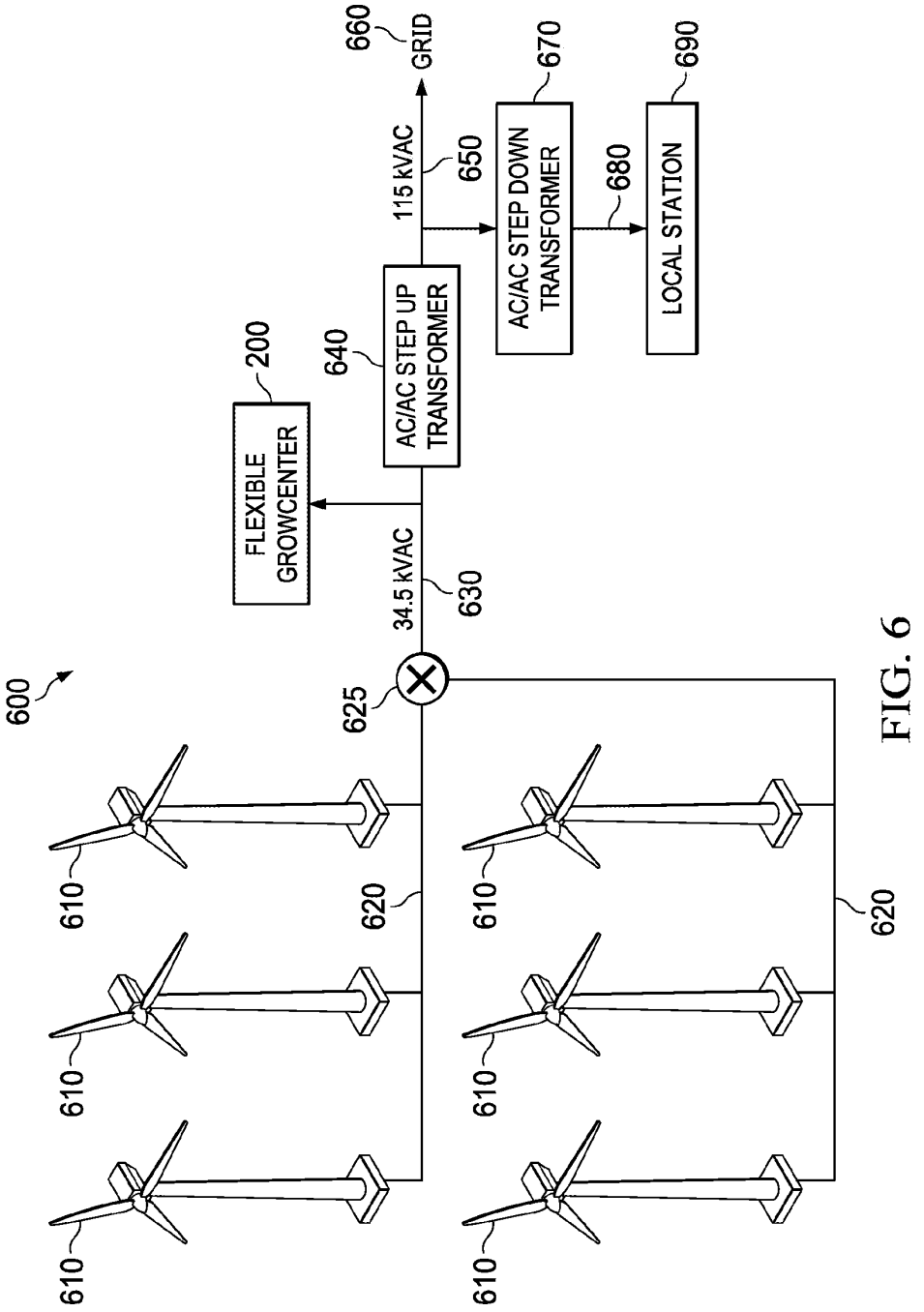

600
610
610
610
620
625
630
34.5 kVAC
640
AC/AC STEP UP TRANSFORMER
650
115 kVAC
660
GRID
670
AC/AC STEP DOWN TRANSFORMER
680
690
LOCAL STATION
200
FLEXIBLE GROWCENTER
610
610
610
620

FIG. 6

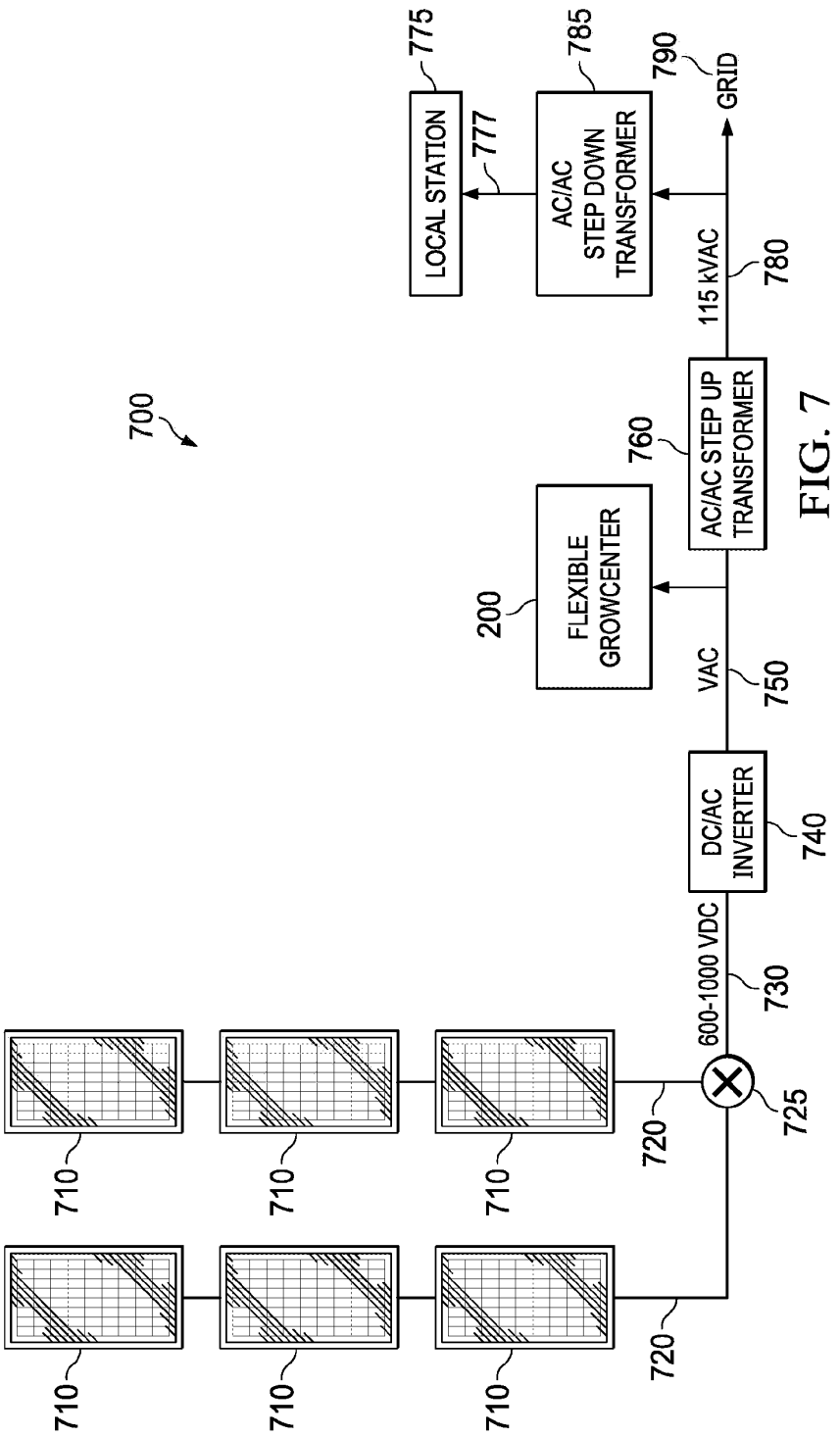

700
710
710
710
710
710
710
720
720
725
600-1000 VDC
730
DC/AC INVERTER
740
VAC
750
FLEXIBLE GROWCENTER
200
AC/AC STEP UP TRANSFORMER
760
115 kVAC
780
AC/AC STEP DOWN TRANSFORMER
785
790
GRID
LOCAL STATION
775
777

FIG. 7

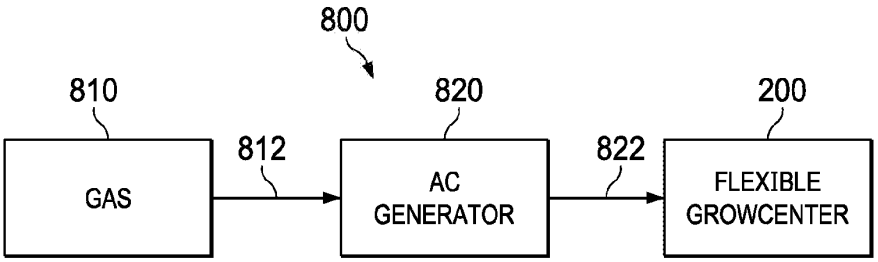

800
810
820
200
812
822
GAS
AC GENERATOR
FLEXIBLE GROWCENTER

FIG. 8

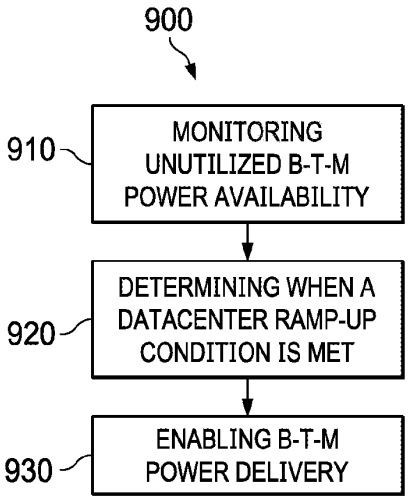

900
910
MONITORING UNUTILIZED B-T-M POWER AVAILABILITY
920
DETERMINING WHEN A DATACENTER RAMP-UP CONDITION IS MET
930
ENABLING B-T-M POWER DELIVERY

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/017955

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A01G 9/16; A01G 9/14; A01G 9/24; H02S 10/40; H02S 20/30 (2018.01)
CPC - A01G 9/16; A01G 9/14; A01G 9/24; H02S 10/40; H02S 20/30 (2018.02)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 47/17; 47/66.7; 47/66.6 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2016/0198656 A1 (FREIGHT FARMS, INC.) 14 July 2016 (14.07.2016) entire document	1, 2, 15-23, 26
---		---
Y		3-14, 24, 25
Y	US 2013/0187464 A1 (SELDON ENERGY PARTNERS, LLC et al) 25 July 2013 (25.07.2013) entire document	3-14, 25
Y	US 2015/0229227 A1 (ABB TECHNOLOGY AG) 13 August 2015 (13.08.2015) entire document	10, 32
Y	US 2016/0324077 A1 (HELICAL HOLDINGS, LLC) 10 November 2016 (10.11.2016) entire document	24
Y	US 2012/0000121 A1 (SWANN) 05 January 2012 (05.01.2012) entire document	27-35
Y	US 2017/0104336 A1 (JOHNSON CONTROLS TECHNOLOGY COMPANY) 13 April 2017 (13.04.2017) entire document	27-35
A	US 2016/0212954 A1 (ARGENTO) 28 July 2016 (28.07.2016) entire document	1-35
A	US 2014/0137468 A1 (CHING) 22 May 2014 (22.05.2014) entire document	1-35
A	WO 2015/199629 A1 (DOKUZ EYLÜL ÜNIVERSITESI REKTÖRLÜGÜ) 30 December 2015 (30.12.2015) entire document	1-35
A	US 2013/0006401 A1 (SHAN) 03 January 2013 (03.01.2013) entire document	1-35

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 April 2018	30 APR 2018
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/017955

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 103163904 A (ZHEJIANG INDUSTRY UNIVERSITY) 19 June 2013 (19.06.2013) entire document	1-35

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To:
Rohde, Kurt W.
BARNES & THORNBURG LLP
P.O. Box 2786
Chicago, Illinois 60690-2786
ETATS-UNIS D'AMERIQUE

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference 84008-335053	Date of mailing *(day/month/year)* 29 April 2021 (29-04-2021)
	FOR FURTHER ACTION See paragraphs 1 and 4 below
International application No. PCT/US2021/019875	International filing date *(day/month/year)* 26 February 2021 (26-02-2021)
Applicant LANCIUM LLC	

1. [X] The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

   How? Directly to the International Bureau preferably through ePCT, or on paper to:
   The International Bureau of WIPO, 34 chemin des Colombettes, 1211 Geneva 20, Switzerland

   For more detailed instructions, see the *PCT Applicant's Guide,* International Phase, paragraphs 9.004 - 9.011.

2. [ ] The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. [ ] **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

   [ ] the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.

   [ ] no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may **submit comments on an informal basis on the written opinion of the International Searching Authority** to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

   Shortly after the expiration of **18 months from the priority date, the international application will be published** by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for **entry into the national phase** before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

   Within **22 months from the priority date, the applicant may request that a supplementary international search be carried out** by a different International Searching Authority that offers this service (Rule 45*bis*.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the International Searching Authority	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040 Fax: (+31-70) 340-3016	KELLNER, Alexandra Tel: +49 (0)89 2399-8772

Form PCT/ISA/220 (revised January 2020)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
84008-335053		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US2021/019875	26 February 2021 (26-02-2021)	27 February 2020 (27-02-2020)
Applicant		
LANCIUM LLC		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language,** the international search was carried out on the basis of:
      [X] the international application in the language in which it was filed
      [ ] a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
   b. [ ] This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. [ ] With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. [ ] **Certain claims were found unsearchable** (See Box No. II)

3. [ ] **Unity of invention is lacking** (see Box No III)

4. With regard to the **title,**
   [X] the text is approved as submitted by the applicant
   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**
   [X] the text is approved as submitted by the applicant
   [ ] the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings,**
   a. the figure of the **drawings** to be published with the abstract is Figure No. 2
      [ ] as suggested by the applicant
      [X] as selected by this Authority, because the applicant failed to suggest a figure
      [ ] as selected by this Authority, because this figure better characterizes the invention
   b. [ ] none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2021/019875

A. CLASSIFICATION OF SUBJECT MATTER
INV. H02J3/14 H02J3/38
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H02J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 10 452 127 B1 (MCNAMARA MICHAEL T [US] ET AL) 22 October 2019 (2019-10-22) the whole document figures 1-13	1-30

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 April 2021	29/04/2021

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Bourdon, Jérémy

2

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2021/019875

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 10452127 B1	22-10-2019	US 10452127 B1	22-10-2019
		US 2020225726 A1	16-07-2020
		WO 2020146875 A1	16-07-2020

Form PCT/ISA/210 (patent family annex) (April 2005)

Information on Search Strategy - Pilot phase (see OJ 2015, A86)
The type of information contained in this sheet may change during the pilot for improving the usefulness of this new service.

Application Number
PCT/US2021/019875

TITLE: COMPUTING SYSTEM ARRANGEMENT BASED ON RAMPING CAPABILITIES

APPLICANT: LANCIUM LLC

IPC CLASSIFICATION: H02J3/14, H02J3/38

EXAMINER: Bourdon, Jérémy

CONSULTED DATABASES:

CLASSIFICATION SYMBOLS DEFINING EXTENT OF THE SEARCH:

IPC:

CPC: H02J3/14, H02J3/381, H02J2310/16, H02J2310/60

FI/F-TERMS:

KEYWORDS OR OTHER ELEMENTS FEATURING THE INVENTION:

EPO FORM P04A42

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2021/019875	26.02.2021	27.02.2020

International Patent Classification (IPC) or both national classification and IPC
INV. H02J3/14 H02J3/38

Applicant
LANCIUM LLC

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA:	Date of completion of this opinion	Authorized Officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Fax: +49 89 2399 - 4465	see form PCT/ISA/210	Bourdon, Jérémy Telephone No. +49 89 2399-0

Form PCT/ISA/237 (Cover Sheet) (January 2015)

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	11-14, 22-29
	No:	Claims	1-10, 15-21, 30
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-30
Industrial applicability (IA)	Yes:	Claims	1-30
	No:	Claims	

2. Citations and explanations

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

1 **Item V**

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.1 Reference is made to the following documents:

D1 US 10 452 127 B1 (MCNAMARA MICHAEL T [US] ET AL) 22 October 2019 (2019-10-22)

1.2 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1, 19 and 30 is not new in the sense of Article 33(2) PCT. D1 discloses about claim 1 (the same argumentation holds mutatis mutandis for the subject matter of corresponding method/computer-readable medium claims 19/20):

"A system **(e.g. fig.6)** *comprising:*

- *a first set of computing components* **(implicit, at least to control/regulate the wind farm ; can also be seen as one of the flexible data center 200 or fixed or critical data centers all along D1)** *located in a first region* **(fig.6, relative area)**, *wherein the first region is positioned proximate to a generation station control system associated with a generation station* **(610)**;
- *a second set of computing components* **(200, the flexible data center ; or 775, the local station or critical data center. See e.g. in the description**
- ***"Flexible datacenter 200 may be rapidly deployed on site near a source of unutilized behind-the-meter power generation. Behind-the-meter power input system 210 may be configured to input power to flexible datacenter 200. Behind-the-meter power input system 210 may include a first input (not independently illustrated) configured to receive three-phase behind-the-meter alternating current ("AC")"***
- ***"The embodiments provided herein relate to providing an electrical load "behind the meter" at local stations" [...]***
- ***"Preferably, controlled computing systems that consume electrical power through computational operations can provide a behind-the-meter electrical load that can be granularly ramped up and down quickly under the supervision of control systems that monitor power system conditions and direct the power state and/or computational activity of the computing systems")*** *located in a second region* **(fig.6, relative area)**, *wherein the second region is positioned remotely from the generation station control system* **(see figs.**

6-7), *wherein the second set of computing components is configured to receive behind-the-meter, BTM, power from the generation station* **(implicit since they are disclosed as BTM loads)**; *and*

- *a control system* **("datacenter control system" 220 or "remote master control system" 420 in fig.4)** *configured to:*
  - *monitor a set of parameters, wherein the set of parameters include BTM power availability at the second set of computing components; and*
  - *adjust power consumption at one or more computing components of the second set of computing components based, at least in part, on the set of parameters".*

(e.g. FIG. 9A shows a method of dynamic power delivery to a flexible datacenter (200 of FIG. 2) using behind-the-meter power 900 in accordance with one or more embodiments of the present invention. In step 910, the datacenter control system (220 of FIG. 4), or the remote master control system (420 of FIG. 4), may monitor behind-the-meter power availability).

1.3 The additional features of the dependent claims can either readily be found in cited documents or concern obvious modifications of the prior art which come within the scope of the customary practice followed by persons skilled in the art, especially as the advantages thus achieved are evident in advance. Consequently, the subject-matter of those claims also appears to lack novelty or at least an inventive step. See more details in the table below:

2	D1, fig.6-7, 610 or 710
3	D1, fig.6-7, 660 or 790
4	e.g. D1, fig.11, implicit that 420 is at least able to provide control instructions to ensure a minimum and constant power in order to power supply the different data centers
5-6	D1, *"In some examples, power received at the flexible datacenter 200 may* ***actively switch between different behind-the-meter sources****. For example, the flexible datacenter 200 may actively switch* ***from receiving power from either or both the wind farm 600 and the solar farm 700 (or other types of sources)****. A control system associated with the flexible data center 200 (e.g., the data center control system 220) or associated with the system 1000 (e.g., remote master control system 420) generally may monitor various input signals, such as, but not limited to,* ***the price for***

	power, *availability of power, computing analysis, and order from an operator, etc., to determine which sources to receive power from at a given time. In some situations, the control system may determine that no source is currently a viable option for supplying power to the flexible data center 200. Other sources of behind-the-meter power or grid power can also be used to power the flexible data center 200 within examples. For example, the flexible data center 200* ***may receive grid power from the local station where it is cited****".*
7	implicit or at least obvious alternative in regards to the embodiments of D1
8-9	D1, fig.6, see the connection point between 640, 660 and 670
10	D1, fig.6-7
11-14	e.g. in D1 *"For instance, the datacenter* ***that bids to perform a computational operation at the lowest cost*** *may win and receive the right to enter into a contract to perform the computational for the priced bid or subsequently agreed upon. As such, flexible datacenters may compete and receive* ***the right to perform computational operations by bidding prices based on using low cost power, such as behind-the-meter power.*** *A datacenter control system of a flexible datacenter may monitor available computational operations in multiple auctions simultaneously to determine when to bid for computational operations based on the cost of power available and competing bids"*
15	D1, see climate control systems (e.g., 250, 260, 270, 280, and/or 290) configured to maintain the plurality of computing systems within their operational temperature range.
16	in D1, see the flexible datacenters 200
17-18	this threshold is relative and can be easily seen in D1, fig.6-7
20-29	the same argumentation holds mutatis mutandis

2 **Item VII**

Certain defects in the international application (form or content)

Further defects:

- The independent claims are not cast in two part form, contrary to Rule 6.3(b) PCT.
- The claims do not contain reference signs, contrary to Rule 6.2(b) PCT.
- The relevant prior art (D1) is not acknowledged in the description, contrary to Rule 5.1(a)(ii).

3 **Item VIII**

3.1 The application does not meet the requirements of Article 6 PCT, because claim 1 is not clear (same objections for independent claims 19 and 30).

3.1.1 The system of claim 1 contains three elements:

- i) *a first set of computing components*
- ii) *a second set of computing components* and
- iii) *a control system.*

In claim 1, it not not followed in which way the i) "*first set of computing components*" is useful for the iii) "*control system*" or for the whole system of claim 1.

3.1.2 Then, it is not understood where is located the iii) "*control system*", since it seems that the location is a key feature in the subject-matter of claim 1. Is it in the first or second region ? or in another area ?

3.1.3 In addition, the terms *"proximate"* and *"remotely"* are relative features, which are not necessary in opposition.

3.1.4 Terms such as "BTM" have to be written between comas, since they are not reference signs.

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: MARK P. VRLA
BARNES & THORNBURG LLP
P.O. BOX 2786
CHICAGO, IL 60690-2786

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Date of mailing *(day/month/year)*	22 FEB 2021
Applicant's or agent's file reference: 84008-328630	**FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No.: PCT/US2020/057686	International filing date *(day/month/year)*: 28 October 2020
Applicant: LANCIUM LLC	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

   How? Directly to the International Bureau preferably through ePCT, or on paper to:
   The International Bureau of WIPO, 34, chemin des Colombettes, 1211 Geneva 20, Switzerland
   (Facsimile No.: +41 22 338 82 70)

   For more detailed instructions, see the *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
   ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.
   ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may **submit comments on an informal basis on the written opinion of the International Searching Authority** to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

   Shortly after the expiration of **18 months from the priority date, the international application will be published** by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for **entry into the national phase** before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

   Within **22 months from the priority date, the applicant may request that a supplementary international search be carried out** by a different International Searching Authority that offers this service (Rule 45*bis*.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Authorized officer Blaine R. Copenheaver Telephone No. PCT Helpdesk: 571-272-4300

Form PCT/ISA/220 (revised January 2019)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference		FOR FURTHER ACTION
84008-328630		see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US2020/057686	28 October 2020	28 October 2019
Applicant		
LANCIUM LLC		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

☒ the international application in the language in which it was filed.

☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

a. the figure of the **drawings** to be published with the abstract is Figure No. 2

☐ as suggested by the applicant.

☒ as selected by this Authority, because the applicant failed to suggest a figure.

☐ as selected by this Authority, because this figure better characterizes the invention.

b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2020/057686

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G05D 5/00; G05D 17/00; H02J 3/28 (2020.01)
CPC - G05B 13/027; G05B 15/02; G05F 1/66; G06Q 30/04; G06Q 50/06; H02J 11/00 (2020.08)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
see Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
see Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
see Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Iso, "Distributed Energy Resources Roadmap for New York's Wholesale Electricity Markets," Distributed Energy Resource Roadmap, [retrieved on 2020-12-15]. Retrieved from the Internet: <URL: https://www.nyiso.com/documents/20142/1391862/Distributed_Energy_Resources_Roadmap.pdf/ec0b3b64-4de2-73e0-ffef-49a4b8b1b3ca> pp 1-39	1-4, 7-9, 14, 15, 19-23, 29, 31, 33, 35, 37, 40-44, 49, 51, 53, 55, 57, 60
---		---
Y		10, 11, 30, 32, 38, 50, 52, 58
---		---
A		5, 6, 12, 13, 16-18, 24-28, 34, 36, 39, 45-48, 54, 56, 59
Y	US 2014/0180886 A1 (CAUSAM ENERGY, INC.) 26 June 2014 (26.06.2014) entire document	10, 11, 30, 32, 50, 52
Y	US 9,645,596 B1 (ADVANCED MICROGRID SOLUTIONS, INC.) 09 May 2017 (09.05.2017) entire document	38, 58
A	US 8,639,392 B2 (CHASSIN) 28 January 2014 (28.01.2014) entire document	1-60
A	US 2015/0212122 A1 (CORINEX COMMUNICATIONS CORP.) 30 July 2015 (30.07.2015) entire document	1-60
A	WO 2019/139633 A1 (LANCIUM LLC) 18 July 2019 (18.07.2019) entire document	1-60
A	US 2017/0373500 A1 (ROBERT BOSCH GMBH) 28 December 2017 (28.12.2017) entire document	1-60

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 December 2020	22 FEB 2021
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Authorized officer Blaine R. Copenheaver Telephone No. PCT Helpdesk: 571-272-4300

Form PCT/ISA/210 (second sheet) (July 2019)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2020/057686

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2014/0070756 A1 (STEM, INC) 13 March 2014 (13.03.2014) entire document	1-60
A	US 2018/0026478 A1 (SUN ELECTRIC PTE. LTD.) 25 January 2018 (25.01.2018) entire document	1-60

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: MARK P. VRLA
BARNES & THORNBURG LLP
P.O. BOX 2786
CHICAGO, IL 60690-2786

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	22 FEB 2021

Applicant's or agent's file reference	FOR FURTHER ACTION
84008-328630	See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2020/057686	28 October 2020	28 October 2019

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - G05D 5/00; G05D 17/00; H02J 3/28 (2020.01)
CPC - G05B 13/027; G05B 15/02; G05F 1/66; G06Q 30/04; G06Q 50/06; H02J 11/00 (2020.08)

Applicant LANCIUM LLC

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	17 December 2020	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 Telephone No. 571-272-4300

Form PCT/ISA/237 (cover sheet) (revised January 2019)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2020/057686

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(b)).

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2020/057686

Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	see claims below	YES
	Claims	see claims below	NO
Inventive step (IS)	Claims	see claims below	YES
	Claims	see claims below	NO
Industrial applicability (IA)	Claims	see claims below	YES
	Claims	see claims below	NO

2. Citations and explanations:

Novelty (N):
5, 6, 10-13, 16-18, 24-28, 30, 32, 34, 36, 38, 39, 45-48, 50, 52, 54, 56, 58, 59 (YES)

1-4, 7-9, 14, 15, 19-23, 29, 31, 33, 35, 37, 40-44, 49, 51, 53, 55, 57, 60 (NO)

Inventive Step (IS):
5, 6, 12, 13, 16-18, 24-28, 34, 36, 39, 45-48, 54, 56, 59 (YES)

1-4, 7-11, 14, 15, 19-23, 29-33, 35, 37, 38, 40-44, 49-53, 55, 57, 58, 60 (NO)

Industrial Applicability (IA):
1-60 (YES)

None (NO)

Claims 1-4, 7-9, 14, 15, 19-23, 29, 31, 33, 35, 37, 40-44, 49, 51, 53, 55, 57, and 60 lack novelty under PCT Article 33(2) as being anticipated by Iso.

Regarding Claim 1, Iso discloses a system comprising: a set of computing systems (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER),

wherein the set of computing systems is configured to perform computational operations using power from a power grid (page 30, second paragraph for Behind-the-meter generators and storage devices further complicate these calculations because operation of such generation or storage for local needs alters the baseline demand making it more difficult to assess DER performance [using a power grid]. A policy for meter data and metering requirements will be critical to ensuring the integrity of the market. The ability for the NYISO to measure gross generation and gross native load at DER sites participating in NYISO markets will be necessary to ensure that the market is properly compensating DER for their contribution to system needs);

and a control system configured to: monitor a set of conditions (page 21 second paragraph for required to have 6-second real-time telemetry. The NYISO's current meter data infrastructure supports PTID-level data, primarily collected through real-time telemetry for real-time operations and monitoring functions [means for monitoring and control], and after-the-fact uploads to support settlement. The integration of dispatchable DER into Capacity, Energy, and Ancillary Service markets is expected to follow a comparable model. DCEAs will be required to provide PTID-level i.e., aggregation level real-time telemetry data for operations and monitoring functions);

while monitoring the set of conditions, receive first power option data based, at least in part, on a power option agreement (page 23, Section IX second paragraph for The NYISO recognizes that some DER will be unable to deliver capacity in all 24 hours due to its physical characteristics e.g., DER aggregations consisting of load curtailment assets that have a typical "9 to 5" load profile [load power options based on time periods] These DER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service tiers that dispatchable DER can provide to help the NYISO meet its daily load with page 28, last two paragraphs for reliability-based Demand Response programs SCR and EDRP are expected to continue, with some changes to better align these programs with the DER market rules. Any changes to the SCR program, including eligibility, obligations [agreements to provide power], or payments, will be addressed after the development of the dispatchable DER program concepts. If NYISO determines future changes to the SCR program are warranted, NYISO will work with stakeholders to develop an appropriate transition plan from the current rules),

wherein the first power option data specify a first minimum power usage threshold associated with a first time interval (page 24, and Figure 11 for having first minimum power threshold associated with the first time interval of hours 7-13 of the day that is known as peak demand with the minimum and maximum thresholds shown with the tan box approximately 17000-23000 MW respectively [first power option of a peak load] with page 25, second paragraph for evaluation of DER-specific thresholds of existing offer parameters, such as

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

minimum down time, minimum run-time, response rate, and to introduce a new DER offer parameter, maximum commitments per day. The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software [using software to determine thresholds and minimize power down time intervals]);

responsive to receiving the first power option data (page 24, and Figure 11, for having first minimum power threshold associated with the first time interval of hours 7-13 of the day the first power condition being an off peak option peak power [changing power option from off peak to peak power]),

provide first control instructions for the set of computing systems based on a combination of at least a portion of the first power option data and at least one condition of the set of conditions (page 25, first and second paragraph for he purpose of NYISO's DAM is to procure enough supply to meet the load bid in the NYISO's DAM. All 10-minute-capable traditional generators east of Central East have an obligation to offer into the real-time market. The NYISO intends to apply the same obligation to dispatchable DER to offer in the real-time market. If more supply resources are required due to system condition changes in real-time [power condition of off peak power with control instructions to provide power in real time] and The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software [using computing systems to determine power demands] Response rate is the speed with which a resource can reach its upper operating limit within the minimum run-time),

wherein the first control instructions comprises a first power consumption target for the set of computing systems for the first time interval (page 24, and figure 11 for having first minimum power threshold associated with the first time interval of hours 7-13 of the day with a first power consumption target of peak [first power option of peak power]),

and wherein the first power consumption target is equal to or greater than the first minimum power usage threshold associated with the first time interval (page 24, and figure 11 for the first minimum power usage of low from 0-6 hours as the first minimum value of 16000 MW and transitioning to the first time interval of 7-13 hours and a peak hours minimum values or 17000 MW);

while monitoring the set of conditions, receive second power option data based, at least in part, on the power option agreement (page 24, and top figure for having second power threshold of peak power window associated with the second time interval of hours 14-20 of the day that is greater than the peak threshold value with page 25 last paragraph for In another scenario, if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation [power option agreements] by discharging storage devices for two hours and by load curtailment for the remaining two hours. Importantly, the NYISO intends to establish performance obligations at the aggregation level, and not at individual resource level),

wherein the second power option data specify a second minimum power usage threshold associated with a second time interval (page 24, and figure 11 for having a second power usage threshold of daytime peak from hours 14-20 as the second time interval showing a second minimum and maximum values shown by the orange box from 21000-23000 MW for the second time interval of 14-20 hours);

and responsive to receiving the second power option data (page 25 first paragraph for intends to apply the same obligation to dispatchable DER to offer in the real-time market. If more supply resources are required due to system condition changes in real-time [receiving a need for a different power option], NYISO operations can initiate its Supplemental Resource Evaluation (SRE) process. All NYISO capacity resources are eligible for selection and are required to respond to a SRE request in real-time regardless of whether they received an award/schedule in the DAM),

provide second control instructions for the set of computing systems based on a combination of at least a portion of the second power data and at least one condition of the set of conditions (page 23, Section A, second paragraph for ER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service tiers that dispatchable [adjust for conditions based on load tiers] DER can provide to help the NYISO meet its daily load. The NYISO currently proposes three such tiers - full day service, on-peak service and daytime peak service with page 25, last paragraph for if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation by discharging storage devices for two hours and by load curtailment for the remaining two hours. Importantly, the NYISO intends to establish performance obligations at the aggregation level, and not at individual resource level),

wherein the second control instructions comprises a second power consumption target for the set of computing systems for the second time interval (page 23 bottom section for Daytime peak service is the provision of wholesale service to help the NYISO manage its daily peak hours. Consistent with the key principle of aligning payments with system requirements, the NYISO believes that Capacity market compensation commensurate with a DER's capabilities and performance is appropriate, and, therefore, the NYISO expects to develop market rules through the stakeholder process to prorate capacity and associated capacity payments),

and wherein the second power consumption target is equal to or greater than the second minimum power usage threshold associated with the second time interval (page 24, and figure 11 for having a second power consumption of daytime peak that is greater than the regular peak power interval threshold, and page 12, second paragraph for while activating DER to displace wholesale energy purchases during periods of high market prices [higher power usage threshold resulting in a time interval of higher prices] New York's LSEs submit approximately 3-5% of their day-ahead Load bids as price responsive, some of which is used for other purposes such as price hedging).

Regarding Claim 2, Iso discloses the control system is configured to: receive the second power option data subsequent to receiving the first power option data (page 28, fourth bullet for valuate how load served by DER operating at the time of the system peak will be incorporated into load forecasts and LSE capacity obligations with page 12, second paragraph for LSEs would rely more heavily on wholesale energy purchases during periods of low prices while activating DER to displace wholesale energy purchases during periods of high market prices [knowing power option data to know when to go to second power level for peaks] New York's LSEs submit approximately 3-5% of their day-ahead Load bids as price responsive, some of which is used for other purposes such as price hedging).

Regarding Claim 3, Iso discloses the first time interval corresponds to a first hour and the second time interval corresponds to a second

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

hour, and wherein the second hour is subsequent to the first hour (page 24, figure 11 for having a first hour 15 at the first peak power level, and a second hour element 16 at the daytime peak power hour that is subsequent to the first hour 15).

Regarding Claim 4, Iso discloses the control system is configured to monitor the set of conditions comprising: a price of power from the power grid (page 12, second paragraph for Under existing market rules a LSE may choose to submit price-sensitive Day-Ahead load bids for some, or all, of the load it must procure. That is, a LSE may choose the Day-Ahead Market price [threshold price] at which it will serve its Load. If the Day-Ahead price exceeds the LSE's Price-Capped Load bid [making sure the power for the day is below the price capped load threshold] the LSE will then either reduce its Load or procure energy through another source. DER may participate in wholesale markets as a tool LSEs use to modulate load in response to wholesale price signals);

and a plurality of parameters associated with one or more computational operations to be performed at the set of computing systems (page 12 third paragraph for Another economic-based mechanism for DER that can inject at least 1 MW into the grid is to participate as a Behind-the-Meter Net Generation BTM:NG Resource. This initiative is designed for large facilities that have on-site generation capability routinely serving a local, on-site Load the facility's Host Load, and that have excess generation capability after serving that Host Load [using computations such as host load values]).

Regarding Claim 7, Iso discloses the first power consumption target is greater than the first minimum power threshold when a cost of power from the power grid is below a threshold price during the first time interval (page 12, second paragraph for Under existing market rules a LSE may choose to submit price-sensitive Day-Ahead load bids for some, or all, of the load it must procure. That is, a LSE may choose the Day-Ahead Market price [threshold price] at which it will serve its Load. If the Day-Ahead price exceeds the LSE's Price-Capped Load bid [making sure the power for the day is below the price capped load threshold] the LSE will then either reduce its Load or procure energy through another source. DER may participate in wholesale markets as a tool LSEs use to modulate load in response to wholesale price signals).

Regarding Claim 8, Iso discloses the first power consumption target is equal to the first minimum power threshold when a cost of power from the power grid is above a threshold price during the first time interval (page 12, second paragraph for LSEs can submit load bid curves to the NYISO reflecting a "willingness to buy" energy by modifying load bids in response to the NYISO's clearing price. In a typical scenario, LSEs would rely more heavily on wholesale energy purchases during periods of low prices while activating DER to displace wholesale energy purchases during periods of high market prices [modifying power pricing based on time interval thresholds] New York's LSEs submit approximately 3-5% of their day-ahead Load bids as price responsive, some of which is used for other purposes such as price hedging).

Regarding Claim 9, Iso disclose the control system is a remote master control system positioned remotely from the set of computing systems (page 4, second paragraph for his DER Roadmap is only the first step in building that grid of the future. We are committed to seamlessly transitioning from a primarily central station-based grid [remote master control]).

Regarding Claim 14, Iso discloses a method comprising: monitoring, at a computing system, a set of conditions (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER);

while monitoring the set of conditions and a control system configured to: monitor a set of conditions (page 21 second paragraph for required to have 6-second real-time telemetry. The NYISO's current meter data infrastructure supports PTID-level data, primarily collected through real-time telemetry for real-time operations and monitoring functions [means for monitoring and control], and after-the-fact uploads to support settlement. The integration of dispatchable DER into Capacity, Energy, and Ancillary Service markets is expected to follow a comparable model. DCEAs will be required to provide PTID-level i.e., aggregation level real-time telemetry data for operations and monitoring functions),

receiving first power option data based, at least in part, on a power option agreement (page 23, Section IX second paragraph for The NYISO recognizes that some DER will be unable to deliver capacity in all 24 hours due to its physical characteristics e.g., DER aggregations consisting of load curtailment assets that have a typical "9 to 5" load profile [load conditions based on time periods] These DER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service tiers that dispatchable DER can provide to help the NYISO meet its daily load with page 28, last two paragraphs for reliability-based Demand Response programs SCR and EDRP are expected to continue, with some changes to better align these programs with the DER market rules. Any changes to the SCR program, including eligibility, obligations [agreements to provide power], or payments, will be addressed after the development of the dispatchable DER program concepts. If NYISO determines future changes to the SCR program are warranted, NYISO will work with stakeholders to develop an appropriate transition plan from the current rules),

wherein the first power option data specify a first minimum power usage threshold associated with a first time interval (page 24, and Figure 11 for having first minimum power threshold associated with the first time interval of hours 7-13 of the day that is known as peak demand);

responsive to receiving the first power option data (page 24, and Figure 11, for having first minimum power threshold associated with the first time interval of hours 7-13 of the day the first power condition being an off peak option peak power [changing power option from off peak to peak power]),

providing first control instructions for a set of computing systems based on a combination of at least a portion of the first power option data and at least one condition of the set of conditions (page 25, first and second paragraph for he purpose of NYISO's DAM is to procure enough supply to meet the load bid in the NYISO's DAM. All 10-minute-capable traditional generators east of Central East have an

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

obligation to offer into the real-time market. The NYISO intends to apply the same obligation to dispatchable DER to offer in the real-time market. If more supply resources are required due to system condition changes in real-time [power condition of off peak power with control instructions to provide power in real time] and The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software [using computing systems to determine power demands] Response rate is the speed with which a resource can reach its upper operating limit within the minimum run-time),

wherein the first control instructions comprises a first power consumption target for the set of computing systems for the first time interval (page 25, first and second paragraph for he purpose of NYISO's DAM is to procure enough supply to meet the load bid in the NYISO's DAM. All 10-minute-capable traditional generators east of Central East have an obligation to offer into the real-time market. The NYISO intends to apply the same obligation to dispatchable DER to offer in the real-time market. If more supply resources are required due to system condition changes in real-time [power condition of off peak power with control instructions to provide power in real time] and The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software [using computing systems to determine power demands] Response rate is the speed with which a resource can reach its upper operating limit within the minimum run-time),

and wherein the first power consumption target is equal to or greater than the first minimum power usage threshold associated with the first time interval (page 24, and figure 11 for having first minimum power threshold associated with the first time interval of hours 7-13 of the day with a first power consumption target of peak);

while monitoring the set of conditions, receiving second power option data based (page 24, and figure 11 for the first minimum power usage of low from 0-6 hours as the first minimum value of 16000 MW and transitioning to the first time interval of 7-13 hours),

at least in part, on the power option agreement (page 24, and top figure for having second power threshold of peak power window associated with the second time interval of hours 14-20 of the day that is greater than the peak threshold value with page 25 last paragraph for In another scenario, if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation [power option agreements] by discharging storage devices for two hours and by load curtailment for the remaining two hours. Importantly, the NYISO intends to establish performance obligations at the aggregation level, and not at individual resource level),

wherein the second power option data specify a second minimum usage power threshold associated with a second time interval (page 24, and figure 11 for having a second power usage threshold of daytime peak from hours 14-20 as the second time interval);

and responsive to receiving the second power option data (page 25 first paragraph for intends to apply the same obligation to dispatchable DER to offer in the real-time market. If more supply resources are required due to system condition changes in real-time [receiving a need for a different power option], NYISO operations can initiate its Supplemental Resource Evaluation (SRE) process. All NYISO capacity resources are eligible for selection and are required to respond to a SRE request in real-time regardless of whether they received an award/schedule in the DAM),

providing second control instructions for the set of computing systems based on a combination of at least a portion of the second power data and at least one condition of the set of conditions (page 23, Section A, second paragraph for ER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service tiers that dispatchable [adjust for conditions based on load tiers] DER can provide to help the NYISO meet its daily load. The NYISO currently proposes three such tiers - full day service, on-peak service and daytime peak service with page 25, last paragraph for if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation by discharging storage devices for two hours and by load curtailment for the remaining two hours. Importantly, the NYISO intends to establish performance obligations at the aggregation level, and not at individual resource level),

wherein the second control instructions comprises a second power consumption target for the set of computing systems for the second time interval (page 23 bottom section for Daytime peak service is the provision of wholesale service to help the NYISO manage its daily peak hours. Consistent with the key principle of aligning payments with system requirements, the NYISO believes that Capacity market compensation commensurate with a DER's capabilities and performance is appropriate, and, therefore, the NYISO expects to develop market rules through the stakeholder process to prorate capacity and associated capacity payments),

and wherein the second power consumption target is equal to or greater than the second minimum power usage threshold associated with the second time interval (page 24, and figure 11 for having a second power usage threshold of daytime peak from hours 14-20 as the second time interval showing a second minimum and maximum values shown by the orange box from 21000-23000 MW for the second time interval of 14-20 hours and also for having a second power consumption of daytime peak that is greater than the regular peak power interval threshold, and page 12, second paragraph for while activating DER to displace wholesale energy purchases during periods of high market prices [higher power usage threshold resulting in a time interval of higher prices] New York's LSEs submit approximately 3-5% of their day-ahead Load bids as price responsive, some of which is used for other purposes such as price hedging).

Regarding Claim 15, Iso discloses monitoring the set of conditions comprises: monitoring: (i) a price of power from a power grid (page 12, second paragraph for Under existing market rules a LSE may choose to submit price-sensitive Day-Ahead load bids for some, or all, of the load it must procure. That is, a LSE may choose the Day-Ahead Market price [threshold price] at which it will serve its Load. If the Day-Ahead price exceeds the LSE's Price-Capped Load bid [making sure the power for the day is below the price capped load threshold] the LSE will then either reduce its Load or procure energy through another source. DER may participate in wholesale markets as a tool LSEs use to modulate load in response to wholesale price signals),

(ii) a plurality of parameters associated with a set of computational operations to be performed at the set of computing systems (page 12, Section 3 for Load modifiers can consist of many different technologies that LSEs can use to manage its load. Load modifiers are primarily used: (i) to avoid purchasing high-cost power during peak hours, and (ii) to reduce the LSE's seasonal capacity obligations),

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

and (iii) a plurality of parameters associated with the set of computing systems (page 12 third paragraph for Another economic-based mechanism for DER that can inject at least 1 MW into the grid is to participate as a Behind-the-Meter Net Generation BTM:NG Resource. This initiative is designed for large facilities that have on-site generation capability routinely serving a local, on-site Load the facility's Host Load, and that have excess generation capability after serving that Host Load [using computations such as host load values]).

Regarding Claim 19, Iso discloses receiving second power option data based, at least in part, on the power option agreement comprises (page 28, last two paragraphs for reliability-based Demand Response programs SCR and EDRP are expected to continue, with some changes to better align these programs with the DER market rules. Any changes to the SCR program, including eligibility, obligations [agreements to provide power], or payments, will be addressed after the development of the dispatchable DER program concepts. If NYISO determines future changes to the SCR program are warranted, NYISO will work with stakeholders to develop an appropriate transition plan from the current rules):

receiving the second power option data during the first time interval (page 23 bottom section for Daytime peak service is the provision of wholesale service to help the NYISO manage its daily peak hours. Consistent with the key principle of aligning payments with system requirements, the NYISO believes that Capacity market compensation commensurate with a DER's capabilities and performance is appropriate, and, therefore, the NYISO expects to develop market rules through the stakeholder process to prorate capacity and associated capacity payments);

and wherein providing second control instructions for the set of computing systems comprises: providing the second control instructions for the set of computing systems prior to an end of the first time interval (page 24, figure 11 for having a first hour 15 at the first peak power level, and a second hour element 16 at the daytime peak power hour that is subsequent to the first hour 15).

Regarding Claim 20, Iso discloses a non-transitory computer readable medium having stored therein instructions executable by one or more processors to cause a computing system to perform functions comprising (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER):

monitoring a set of conditions; while monitoring the set of conditions (page 21 second paragraph for required to have 6-second real-time telemetry. The NYISO's current meter data infrastructure supports PTID-level data, primarily collected through real-time telemetry for real-time operations and monitoring functions [means for monitoring and control], and after-the-fact uploads to support settlement. The integration of dispatchable DER into Capacity, Energy, and Ancillary Service markets is expected to follow a comparable model. DCEAs will be required to provide PTID-level i.e., aggregation level real-time telemetry data for operations and monitoring functions),

receiving first power option data based, at least in part, on a power option agreement (page 23, Section IX second paragraph for The NYISO recognizes that some DER will be unable to deliver capacity in all 24 hours due to its physical characteristics e.g., DER aggregations consisting of load curtailment assets that have a typical "9 to 5" load profile [load conditions based on time periods] These DER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service tiers that dispatchable DER can provide to help the NYISO meet its daily load with page 28, last two paragraphs for reliability-based Demand Response programs SCR and EDRP are expected to continue, with some changes to better align these programs with the DER market rules. Any changes to the SCR program, including eligibility, obligations [agreements to provide power], or payments, will be addressed after the development of the dispatchable DER program concepts. If NYISO determines future changes to the SCR program are warranted, NYISO will work with stakeholders to develop an appropriate transition plan from the current rules),

wherein the first power option data specify a first minimum power usage threshold associated with a first time interval (page 24, and Figure 11 for having first minimum power threshold associated with the first time interval of hours 7-13 of the day that is known as peak demand);

responsive to receiving the first power option data (page 24, and Figure 11, for having first minimum power threshold associated with the first time interval of hours 7-13 of the day the first power condition being an off peak option peak power [changing power option from off peak to peak power]),

providing first control instructions for a set of computing systems based on a combination of at least a portion of the first power option data and at least one condition of the set of conditions (page 25, first and second paragraph for he purpose of NYISO's DAM is to procure enough supply to meet the load bid in the NYISO's DAM. All 10-minute-capable traditional generators east of Central East have an obligation to offer into the real-time market. The NYISO intends to apply the same obligation to dispatchable DER to offer in the real-time market. If more supply resources are required due to system condition changes in real-time [power condition of off peak power with control instructions to provide power in real time] and The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software [using computing systems to determine power demands] Response rate is the speed with which a resource can reach its upper operating limit within the minimum run-time),

wherein the first control instructions comprises a first power consumption target for the set of computing systems for the first time interval (page 24, and figure 11 for having first minimum power threshold associated with the first time interval of hours 7-13 of the day with a first power consumption target of peak),

and wherein the first power consumption target is equal to or greater than the first minimum power usage threshold associated with the first time interval (page 24, and figure 11 for the first minimum power usage of low from 0-6 hours as the first minimum value of 16000 MW and transitioning to the first time interval of 7-13 hours);

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

while monitoring the set of conditions, receiving second power option data based, at least in part, on the power option agreement (page 24, and top figure for having second power threshold of peak power window associated with the second time interval of hours 14-20 of the day that is greater than the peak threshold value with page 25 last paragraph for In another scenario, if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation [power option agreements] by discharging storage devices for two hours and by load curtailment for the remaining two hours. Importantly, the NYISO intends to establish performance obligations at the aggregation level, and not at individual resource level),

wherein the second power option data specify a second minimum power usage threshold associated with a second time interval (page 24, and figure 11 for having a second power usage threshold of daytime peak from hours 14-20 as the second time interval showing a second minimum and maximum values shown by the orange box from 21000-23000 MW for the second time interval of 14-20 hours);

and responsive to receiving the second power option data (page 25 first paragraph for intends to apply the same obligation to dispatchable DER to offer in the real-time market. If more supply resources are required due to system condition changes in real-time [receiving a need for a different power option], NYISO operations can initiate its Supplemental Resource Evaluation (SRE) process. All NYISO capacity resources are eligible for selection and are required to respond to a SRE request in real-time regardless of whether they received an award/schedule in the DAM),

providing second control instructions for the set of computing systems based on a combination of at least a portion of the second power data and at least one condition of the set of conditions (page 23, Section A, second paragraph for ER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service tiers that dispatchable [adjust for conditions based on load tiers] DER can provide to help the NYISO meet its daily load. The NYISO currently proposes three such tiers - full day service, on-peak service and daytime peak service with page 25, last paragraph for if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation by discharging storage devices for two hours and by load curtailment for the remaining two hours. Importantly, the NYISO intends to establish performance obligations at the aggregation level, and not at individual resource level),

wherein the second control instructions comprises a second power consumption target for the set of computing systems for the second time interval (page 23 bottom section for Daytime peak service is the provision of wholesale service to help the NYISO manage its daily peak hours. Consistent with the key principle of aligning payments with system requirements, the NYISO believes that Capacity market compensation commensurate with a DER's capabilities and performance is appropriate, and, therefore, the NYISO expects to develop market rules through the stakeholder process to prorate capacity and associated capacity payments),

and wherein the second power consumption target is equal to or greater than the second minimum power usage threshold associated with the second time interval (page 24, and figure 11 for having a second power consumption of daytime peak that is greater than the regular peak power interval threshold, and page 12, second paragraph for while activating DER to displace wholesale energy purchases during periods of high market prices [higher power usage threshold resulting in a time interval of higher prices] New York's LSEs submit approximately 3-5% of their day-ahead Load bids as price responsive, some of which is used for other purposes such as price hedging).

Regarding Claim 21, Iso discloses a system comprising (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER):

a set of computing systems coupled to a behind-the-meter (BTM) power generation source (page 30, second paragraph for Behind-the-meter generators and storage devices further complicate these calculations because operation of such generation or storage for local needs alters the baseline demand making it more difficult to assess DER performance [using a power grid]. A policy for meter data and metering requirements will be critical to ensuring the integrity of the market. The ability for the NYISO to measure gross generation and gross native load at DER sites participating in NYISO markets will be necessary to ensure that the market is properly compensating DER for their contribution to system needs),

wherein the set of computing systems is configured to perform computational operations (page 27 first paragraph for Currently, resources participating in NYISO SCR program and EDRP have the option to participate in utility level demand response programs. The NYISO intends to continue allowing DER participating in utility level Demand Response programs to participate in the NYISO SCR program and EDRP. The NYISO is also in ongoing conversations with utilities to explore the possibility of additional dual participation opportunities);

a control system configured to: monitor a set of conditions (page 21 second paragraph for required to have 6-second real-time telemetry. The NYISO's current meter data infrastructure supports PTID-level data, primarily collected through real-time telemetry for real-time operations and monitoring functions [means for monitoring and control], and after-the-fact uploads to support settlement. The integration of dispatchable DER into Capacity, Energy, and Ancillary Service markets is expected to follow a comparable model. DCEAs will be required to provide PTID-level i.e., aggregation level real-time telemetry data for operations and monitoring functions);

receive power option data based that specifies: (i) a set of minimum power thresholds (page 23, Section IX second paragraph for The NYISO recognizes that some DER will be unable to deliver capacity in all 24 hours due to its physical characteristics e.g., DER aggregations consisting of load curtailment assets that have a typical "9 to 5" load profile [load conditions based on time periods] These DER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service tiers that dispatchable DER can provide to help the NYISO meet its daily load),

and (ii) a set of time intervals, wherein each minimum power threshold in the set of minimum power thresholds is associated with a time

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

interval in the set of time intervals (page 24, and Figure 11 for having first minimum power threshold associated with the first time interval of hours 7-13 of the day that is known as peak demand);

responsive to receiving the power option data (page 24, and Figure 11, for having first minimum power threshold associated with the first time interval of hours 7-13 of the day the first power condition being an off peak option peak power [changing power option from off peak to peak power]),

determine a performance strategy for the set of computing systems based on a combination of at least a portion of the power option data and at least one condition from the set of conditions (page 25, first and second paragraph for he purpose of NYISO's DAM is to procure enough supply to meet the load bid in the NYISO's DAM. All 10-minute-capable traditional generators east of Central East have an obligation to offer into the real-time market. The NYISO intends to apply the same obligation to dispatchable DER to offer in the real-time market. If more supply resources are required due to system condition changes in real-time [power condition of off peak power with control instructions to provide power in real time] and The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software [using computing systems to determine power demands] Response rate is the speed with which a resource can reach its upper operating limit within the minimum run-time),

wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals (page 24, and figure 11 for having first minimum power threshold associated with the first time interval of hours 7-13 of the day with a first power consumption target of peak),

wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval (page 24, and figure 11 for the first minimum power usage of low from 0-6 hours as the first minimum value of 16000 MW and transitioning to the first time interval of 7-13 hours);

and provide instructions to the set of computing systems to perform one or more computational operations based on the performance strategy (page 24, and top figure for having second power threshold of peak power window associated with the second time interval of hours 14-20 of the day that is greater than the peak threshold value with page 25 last paragraph for In another scenario, if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation [power option agreements] by discharging storage devices for two hours and by load curtailment for the remaining two hours. Importantly, the NYISO intends to establish performance obligations at the aggregation level, and not at individual resource level).

Regarding Claim 22, Iso discloses the control system is configured to monitor the set of conditions comprising: a price of power from a power grid (page 12, second paragraph for Under existing market rules a LSE may choose to submit price-sensitive Day-Ahead load bids for some, or all, of the load it must procure. That is, a LSE may choose the Day-Ahead Market price [threshold price] at which it will serve its Load. If the Day-Ahead price exceeds the LSE's Price-Capped Load bid [making sure the power for the day is below the price capped load threshold] the LSE will then either reduce its Load or procure energy through another source. DER may participate in wholesale markets as a tool LSEs use to modulate load in response to wholesale price signals);

and a plurality of parameters associated with one or more computational operations to be performed at the set of computing systems (page 12 third paragraph for Another economic-based mechanism for DER that can inject at least 1 MW into the grid is to participate as a Behind-the-Meter Net Generation BTM:NG Resource. This initiative is designed for large facilities that have on-site generation capability routinely serving a local, on-site Load the facility's Host Load, and that have excess generation capability after serving that Host Load [using computations such as host load values]).

Regarding Claim 23, Iso discloses the control system is configured to: determine the performance strategy for the set of computing systems based on a combination of at least the portion option data (page 25, last paragraph for For example, an aggregation with a 24-hour capacity obligation might rely on load curtailment assets to provide performance during the day and generation assets when sufficient load curtailment capability is not available to meet the aggregation's obligation. In another scenario, If an aggregation is scheduled for four hours, the DCE may choose to meet its obligation by discharging storage devices for two hours and by load curtailment for the remaining two hours),

the price of power from the power grid (page 12, second paragraph for Under existing market rules a LSE may choose to submit price-sensitive Day-Ahead load bids for some, or all, of the load it must procure. That is, a LSE may choose the Day-Ahead Market price [threshold price] at which it will serve its Load. If the Day-Ahead price exceeds the LSE's Price-Capped Load bid [making sure the power for the day is below the price capped load threshold] the LSE will then either reduce its Load or procure energy through another source. DER may participate in wholesale markets as a tool LSEs use to modulate load in response to wholesale price signals),

and the plurality of parameters associated with the one or more computational operations (page 12 third paragraph for Another economic-based mechanism for DER that can inject at least 1 MW into the grid is to participate as a Behind-the-Meter Net Generation BTM:NG Resource. This initiative is designed for large facilities that have on-site generation capability routinely serving a local, on-site Load the facility's Host Load, and that have excess generation capability after serving that Host Load [using computations such as host load values]).

Regarding Claim 29, Iso discloses the control system is a remote master control system positioned remotely from the set of computing systems (page 4, second paragraph for his DER Roadmap is only the first step in building that grid of the future. We are committed to seamlessly transitioning from a primarily central station-based grid [remote master control]).

Regarding Claim 31, Iso discloses the control system is configured to receive the power option data while monitoring the set of conditions (page 19, second paragraph for granular monitoring and control of DER aggregations at the transmission substation load bus level is needed to effectively and efficiently manage transmission system congestion and reliability. Therefore, the NYISO proposes that dispatchable DER aggregation boundaries to be limited to all DER interconnected to, and having direct impact on, the same transmission

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

substation load bus).

Regarding Claim 33, Iso discloses the power option data specify: (i) a first minimum power threshold associated with a first time interval in the set of time intervals (page 24, and figure 11 for the first minimum power usage of low from 0-6 hours as the first minimum value of 16000 MW and transitioning to the first time interval of 7-13 hours and a peak hours minimum values or 17000 MW),

and (ii) a second minimum power threshold associated with a second time interval in the set of time intervals (page 24, and figure 11 for having a second power usage threshold of daytime peak from hours 14-20 as the second time interval showing a second minimum and maximum values shown by the orange box from 21000-23000 MW for the second time interval of 14-20 hours),

wherein the second time interval is subsequent to the first time interval (page 28, fourth bullet for valuate how load served by DER operating at the time of the system peak will be incorporated into load forecasts and LSE capacity obligations with page 12, second paragraph for LSEs would rely more heavily on wholesale energy purchases during periods of low prices while activating DER to displace wholesale energy purchases during periods of high market prices [knowing power option data to know when to go to second power level for peaks] New York's LSEs submit approximately 3-5% of their day-ahead Load bids as price responsive, some of which is used for other purposes such as price hedging).

Regarding Claim 35, Iso discloses a total duration of the set of time intervals corresponds to a twenty-four hour period (page 24, and figure 11 for showing three sets of time intervals in a 24 hour time period for minimum, peak, and daytime peak loads).

Regarding Claim 37, Iso discloses a method comprising: monitoring, by a computing system, a set of conditions (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER);

receiving, at the computing system, power option data, wherein the power option data specify (page 23, Section IX second paragraph for The NYISO recognizes that some DER will be unable to deliver capacity in all 24 hours due to its physical characteristics e.g., DER aggregations consisting of load curtailment assets that have a typical "9 to 5" load profile [load conditions based on time periods] These DER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service [having power option tiers] tiers that dispatchable DER can provide to help the NYISO meet its daily load with page 28, last two paragraphs for reliability-based Demand Response programs SCR and EDRP are expected to continue, with some changes to better align these programs with the DER market rules. Any changes to the SCR program, including eligibility, obligations [agreements to provide power], or payments, will be addressed after the development of the dispatchable DER program concepts. If NYISO determines future changes to the SCR program are warranted, NYISO will work with stakeholders to develop an appropriate transition plan from the current rules):

(i) a set of minimum power thresholds, and (ii) a set of time intervals (page 24, and Figure 11 for having first minimum power threshold associated with the first time interval of hours 7-13 of the day that is known as peak demand with the minimum and maximum thresholds shown with the tan box approximately 17000-23000 MW respectively, with page 25, second paragraph for evaluation of DER-specific thresholds of existing offer parameters, such as minimum down time, minimum run-time, response rate, and to introduce a new DER offer parameter, maximum commitments per day. The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software [using software to determine thresholds and minimize power down time intervals]),

wherein each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals (page 24, and figure 11 for having a second power usage threshold of daytime peak from hours 14-20 as the second time interval [multiple intervals] showing a second minimum and maximum values shown by the orange box from 21000-23000 MW for the second time interval of 14-20 hours);

responsive to receiving the power option data (page 25 first paragraph for intends to apply the same obligation to dispatchable DER to offer in the real-time market. If more supply resources are required due to system condition changes in real-time [receiving a need for a different power option], NYISO operations can initiate its Supplemental Resource Evaluation (SRE) process. All NYISO capacity resources are eligible for selection and are required to respond to a SRE request in real-time regardless of whether they received an award/schedule in the DAM),

determining a performance strategy for a set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions (page 22, third paragraph for measure resource performance in the Energy market. The NYISO plans to draw on conclusions of that study for dispatchable DER relying on a baseline methodology to measure performance. DER participating in the Ancillary Services market will be measured by the current DSASP baseline to evaluate performance [determining performance strategies] for the ancillary product with page 25, last paragraph for an aggregation with a 24-hour capacity obligation might rely on load curtailment assets to provide performance during the day and generation assets when sufficient load curtailment capability is not available to meet the aggregation's obligation. In another scenario [using different power conditions], if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation by discharging storage devices for two hours and by load curtailment for the remaining two hours),

wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals (page 25, second paragraph for could potentially involve evaluation of DER-specific thresholds of existing offer parameters, such as minimum down time,22minimum run-time, response rate, and to introduce a new DER offer parameter, maximum commitments per day. The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software. Response rate is the speed with which a resource can reach its upper operating limit within the

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

minimum run-time),

wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval (page 24, and figure 11 for having a second power consumption of daytime peak that is greater than the regular peak power interval threshold, and page 12, second paragraph for while activating DER to displace wholesale energy purchases during periods of high market prices [higher power usage threshold resulting in a time interval of higher prices] New York's LSEs submit approximately 3-5% of their day-ahead Load bids as price responsive, some of which is used for other purposes such as price hedging),

and wherein the set of computing systems is coupled to a behind-the-meter (BTM) power generation source (page 30, second paragraph for Behind-the-meter generators [BTM] and storage devices further complicate these calculations because operation of such generation or storage for local needs alters the baseline demand making it more difficult to assess DER performance. A policy for meter data and metering requirements will be critical to ensuring the integrity of the market. The ability for the NYISO to measure gross generation and gross native load at DER sites participating in NYISO markets will be necessary to ensure that the market is properly compensating DER for their contribution to system needs);

and providing instructions to the set of computing systems to perform one or more computational operations based on the performance strategy (page 23, Section A, second paragraph for ER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service tiers that dispatchable [adjust for conditions based on load tiers] DER can provide to help the NYISO meet its daily load. The NYISO currently proposes three such tiers - full day service, on-peak service and daytime peak service with page 25, last paragraph for if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation by discharging storage devices for two hours and by load curtailment for the remaining two hours. Importantly, the NYISO intends to establish performance obligations at the aggregation level, and not at individual resource level).

Regarding Claim 40, Iso discloses a non-transitory computer readable medium having stored therein instructions executable by one or more processors to cause a computing system to perform functions comprising (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER):

monitoring a set of conditions (page 21 second paragraph for required to have 6-second real-time telemetry. The NYISO's current meter data infrastructure supports PTID-level data, primarily collected through real-time telemetry for real-time operations and monitoring functions [means for monitoring and control], and after-the-fact uploads to support settlement. The integration of dispatchable DER into Capacity, Energy, and Ancillary Service markets is expected to follow a comparable model. DCEAs will be required to provide PTID-level i.e., aggregation level real-time telemetry data for operations and monitoring functions);

receiving power option data that specify: (i) a set of minimum power thresholds, and (ii) a set of time intervals (page 24, and Figure 11 for having first minimum power threshold associated with the first time interval of hours 7-13 of the day that is known as peak demand with the minimum and maximum thresholds shown with the tan box approximately 17000-23000 MW respectively, with page 25, second paragraph for evaluation of DER-specific thresholds of existing offer parameters, such as minimum down time, minimum run-time, response rate, and to introduce a new DER offer parameter, maximum commitments per day. The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software [using software to determine thresholds and minimize power down time intervals]),

wherein each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals (page 24, and figure 11 for having a second power usage threshold of daytime peak from hours 14-20 as the second time interval [multiple intervals] showing a second minimum and maximum values shown by the orange box from 21000-23000 MW for the second time interval of 14-20 hours);

responsive to receiving the power option data (page 25 first paragraph for intends to apply the same obligation to dispatchable DER to offer in the real-time market. If more supply resources are required due to system condition changes in real-time [receiving a need for a different power option], NYISO operations can initiate its Supplemental Resource Evaluation (SRE) process. All NYISO capacity resources are eligible for selection and are required to respond to a SRE request in real-time regardless of whether they received an award/schedule in the DAM),

determining a performance strategy for a set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions (page 22, third paragraph for measure resource performance in the Energy market. The NYISO plans to draw on conclusions of that study for dispatchable DER relying on a baseline methodology to measure performance. DER participating in the Ancillary Services market will be measured by the current DSASP baseline to evaluate performance [determining performance strategies] for the ancillary product with page 25, last paragraph for an aggregation with a 24-hour capacity obligation might rely on load curtailment assets to provide performance during the day and generation assets when sufficient load curtailment capability is not available to meet the aggregation's obligation. In another scenario [using different power conditions], if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation by discharging storage devices for two hours and by load curtailment for the remaining two hours),

wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals (page 25, second paragraph for could potentially involve evaluation of DER-specific thresholds of existing offer parameters, such as minimum down time,22minimum run-time, response rate, and to introduce a new DER offer parameter, maximum commitments per day. The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

Real-Time Commitment software. Response rate is the speed with which a resource can reach its upper operating limit within the minimum run-time),

wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval (page 24, and figure 11 for having a second power consumption of daytime peak that is greater than the regular peak power interval threshold, and page 12, second paragraph for while activating DER to displace wholesale energy purchases during periods of high market prices [higher power usage threshold resulting in a time interval of higher prices] New York's LSEs submit approximately 3-5% of their day-ahead Load bids as price responsive, some of which is used for other purposes such as price hedging);

and providing instructions to the set of computing systems to perform one or more computational operations based on the performance strategy (page 23, Section A, second paragraph for ER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service tiers that dispatchable [adjust for conditions based on load tiers] DER can provide to help the NYISO meet its daily load. The NYISO currently proposes three such tiers - full day service, on-peak service and daytime peak service with page 25, last paragraph for if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation by discharging storage devices for two hours and by load curtailment for the remaining two hours. Importantly, the NYISO intends to establish performance obligations at the aggregation level, and not at individual resource level).

Regarding Claim 41, Iso discloses a system comprising: a set of computing systems (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER),

wherein the set of computing systems is configured to perform computational operations using power from a power grid (page 12, third paragraph for economic-based mechanism for DER that can inject at least 1 MW into the grid is to participate as a Behind-the-Meter Net Generation BTM:NG Resource.14This initiative is designed for large facilities that have on-site generation capability routinely serving a local, on-site Load the facility's Host Load, and that have excess generation capability after serving that Host Load);

a control system configured to: monitor a set of conditions (page 30, second paragraph for Behind-the-meter generators [BTM] and storage devices further complicate these calculations because operation of such generation or storage for local needs alters the baseline demand making it more difficult to assess DER performance. A policy for meter data and metering requirements will be critical to ensuring the integrity of the market. The ability for the NYISO to measure gross generation and gross native load at DER sites participating in NYISO markets will be necessary to ensure that the market is properly compensating DER for their contribution to system needs);

receive power option data based, at least in part, on a power option agreement, wherein the power option data specify (page 23, Section IX second paragraph for The NYISO recognizes that some DER will be unable to deliver capacity in all 24 hours due to its physical characteristics e.g., DER aggregations consisting of load curtailment assets that have a typical "9 to 5" load profile [load conditions based on time periods] These DER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service [having power option tiers] tiers that dispatchable DER can provide to help the NYISO meet its daily load with page 28, last two paragraphs for reliability-based Demand Response programs SCR and EDRP are expected to continue, with some changes to better align these programs with the DER market rules. Any changes to the SCR program, including eligibility, obligations [agreements to provide power], or payments, will be addressed after the development of the dispatchable DER program concepts. If NYISO determines future changes to the SCR program are warranted, NYISO will work with stakeholders to develop an appropriate transition plan from the current rules):

(i) a set of minimum power thresholds, and (ii) a set of time intervals (page 24, and Figure 11 for having first minimum power threshold associated with the first time interval of hours 7-13 of the day that is known as peak demand with the minimum and maximum thresholds shown with the tan box approximately 17000-23000 MW respectively, with page 25, second paragraph for evaluation of DER-specific thresholds of existing offer parameters, such as minimum down time, minimum run-time, response rate, and to introduce a new DER offer parameter, maximum commitments per day. The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software [using software to determine thresholds and minimize power down time intervals]),

wherein each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals (page 24, and figure 11 for having a second power usage threshold of daytime peak from hours 14-20 as the second time interval [multiple intervals] showing a second minimum and maximum values shown by the orange box from 21000-23000 MW for the second time interval of 14-20 hours);

responsive to receiving the power option data (page 25 first paragraph for intends to apply the same obligation to dispatchable DER to offer in the real-time market. If more supply resources are required due to system condition changes in real-time [receiving a need for a different power option], NYISO operations can initiate its Supplemental Resource Evaluation (SRE) process. All NYISO capacity resources are eligible for selection and are required to respond to a SRE request in real-time regardless of whether they received an award/schedule in the DAM),

determine a performance strategy for the set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions (page 22, third paragraph for measure resource performance in the Energy market. The NYISO plans to draw on conclusions of that study for dispatchable DER relying on a baseline methodology to measure performance. DER participating in the Ancillary Services market will be measured by the current DSASP baseline to evaluate performance [determining performance strategies] for the ancillary product with page 25, last paragraph for an aggregation with a 24-hour capacity obligation might rely on load curtailment assets to provide performance during the day and generation assets when sufficient load curtailment capability is

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

not available to meet the aggregation's obligation. In another scenario [using different power conditions], if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation by discharging storage devices for two hours and by load curtailment for the remaining two hours),

wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals (page 25, second paragraph for could potentially involve evaluation of DER-specific thresholds of existing offer parameters, such as minimum down time,22minimum run-time, response rate, and to introduce a new DER offer parameter, maximum commitments per day. The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software. Response rate is the speed with which a resource can reach its upper operating limit within the minimum run-time),

wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval (page 24, and figure 11 for having a second power consumption of daytime peak that is greater than the regular peak power interval threshold, and page 12, second paragraph for while activating DER to displace wholesale energy purchases during periods of high market prices [higher power usage threshold resulting in a time interval of higher prices] New York's LSEs submit approximately 3-5% of their day-ahead Load bids as price responsive, some of which is used for other purposes such as price hedging);

and provide instructions to the set of computing systems to perform one or more computational operations based on the performance strategy (page 23, Section A, second paragraph for ER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service tiers that dispatchable [adjust for conditions based on load tiers] DER can provide to help the NYISO meet its daily load. The NYISO currently proposes three such tiers - full day service, on-peak service and daytime peak service with page 25, last paragraph for if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation by discharging storage devices for two hours and by load curtailment for the remaining two hours. Importantly, the NYISO intends to establish performance obligations at the aggregation level, and not at individual resource level).

Regarding Claim 42, Iso discloses the control system is configured to monitor the set of conditions comprising: a price of power from the power grid (page 12, second paragraph for Under existing market rules a LSE may choose to submit price-sensitive Day-Ahead load bids for some, or all, of the load it must procure. That is, a LSE may choose the Day-Ahead Market price [threshold price] at which it will serve its Load. If the Day-Ahead price exceeds the LSE's Price-Capped Load bid [making sure the power for the day is below the price capped load threshold] the LSE will then either reduce its Load or procure energy through another source. DER may participate in wholesale markets as a tool LSEs use to modulate load in response to wholesale price signals);

and a plurality of parameters associated with one or more computational operations to be performed at the set of computing systems (page 12 third paragraph for Another economic-based mechanism for DER that can inject at least 1 MW into the grid is to participate as a Behind-the-Meter Net Generation BTM:NG Resource. This initiative is designed for large facilities that have on-site generation capability routinely serving a local, on-site Load the facility's Host Load, and that have excess generation capability after serving that Host Load [using computations such as host load values]).

Regarding Claim 43, Iso discloses the control system is configured to: determine the performance strategy for the set of computing systems based on a combination of at least the portion option data (page 24, and top figure for having second power threshold of peak power window associated with the second time interval of hours 14-20 of the day that is greater than the peak threshold value with page 25 last paragraph for In another scenario, if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation [power option agreements] by discharging storage devices for two hours and by load curtailment for the remaining two hours. Importantly, the NYISO intends to establish performance obligations [performance strategy] at the aggregation level, and not at individual resource level),

the price of power from the power grid, and the plurality of parameters associated with the one or more computational operations (page 15, last paragraph for DER operating in response to economic signals can work to shift grid-based electricity consumption to off-peak hours, creating the potential for greater stability in prices throughout the day by flattening the load. In this sense, the NYISO's vision for dispatchable DER integration aligns well with REV in that it offers the potential to engage or animate certain consumers).

Regarding Claim 44, Iso discloses the performance strategy further comprises: an order for the set of computing systems to follow when performing the one or more computational operations (page 25, second paragraph for the NYISO also plans to evaluate the feasibility of market software and NYISO system operators making commitment decisions for DCEAs. This could potentially involve evaluation of DER-specific thresholds of existing offer parameters, such as minimum down time,22minimum run-time, response rate, and to introduce a new DER offer parameter),

wherein the order is based on respective priorities associated with the one or more computational operations (page 25, second paragraph for threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software. Response rate is the speed with which a resource can reach its upper operating limit within the minimum run-time).

Regarding Claim 49, Iso discloses the control system is a remote master control system positioned remotely from the set of computing systems (page 4, second paragraph for his DER Roadmap is only the first step in building that grid of the future. We are committed to seamlessly transitioning from a primarily central station-based grid [remote master control]).

Regarding Claim 51, Iso discloses the control system is configured to receive the power option data while monitoring the set of conditions (page 21 second paragraph for required to have 6-second real-time telemetry. The NYISO's current meter data infrastructure supports PTID-level data, primarily collected through real-time telemetry for real-time operations and monitoring functions [means for monitoring and control], and after-the-fact uploads to support settlement. The integration of dispatchable DER into Capacity, Energy, and Ancillary Service markets is expected to follow a comparable model. DCEAs will be required to provide PTID-level i.e., aggregation level real-time telemetry data for operations and monitoring functions).

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

Regarding Claim 53, Iso discloses the power option data specify: (i) a first minimum power threshold associated with a first time interval in the set of time intervals (page 24, and figure 11 for the first minimum power usage of low from 0-6 hours as the first minimum value of 16000 MW and transitioning to the first time interval of 7-13 hours and a peak hours minimum values or 17000 MW),

and (ii) a second minimum power threshold associated with a second time interval in the set of time intervals (page 24, and figure 11 for having a second power usage threshold of daytime peak from hours 14-20 as the second time interval showing a second minimum and maximum values shown by the orange box from 21000-23000 MW for the second time interval of 14-20 hours),

wherein the second time interval is subsequent to the first time interval (page 28, fourth bullet for valuate how load served by DER operating at the time of the system peak will be incorporated into load forecasts and LSE capacity obligations with page 12, second paragraph for LSEs would rely more heavily on wholesale energy purchases during periods of low prices while activating DER to displace wholesale energy purchases during periods of high market prices [knowing power option data to know when to go to second power level for peaks] New York's LSEs submit approximately 3-5% of their day-ahead Load bids as price responsive, some of which is used for other purposes such as price hedging).

Regarding Claim 55, Iso discloses a total duration of the set of time intervals corresponds to a twenty-four hour period (page 24, and figure 11 for showing three sets of time intervals in a 24 hour time period for minimum, peak, and daytime peak loads).

Regarding Claim 57, Iso discloses a method comprising: monitoring, by a computing system, a set of conditions (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER);

receiving, at the computing system (page 21 second paragraph for required to have 6-second real-time telemetry. The NYISO's current meter data infrastructure supports PTID-level data, primarily collected through real-time telemetry for real-time operations and monitoring functions [means for monitoring and control], and after-the-fact uploads to support settlement. The integration of dispatchable DER into Capacity, Energy, and Ancillary Service markets is expected to follow a comparable model. DCEAs will be required to provide PTID-level i.e., aggregation level real-time telemetry data for operations and monitoring functions),

power option data based, at least in part, on a power option agreement, wherein the power option data specify (page 25 first paragraph for intends to apply the same obligation to dispatchable DER to offer in the real-time market. If more supply resources are required due to system condition changes in real-time [receiving a need for a different power option], NYISO operations can initiate its Supplemental Resource Evaluation (SRE) process. All NYISO capacity resources are eligible for selection and are required to respond to a SRE request in real-time regardless of whether they received an award/schedule in the DAM):

(i) a set of minimum power thresholds, and (ii) a set of time intervals (page 24, and Figure 11 for having first minimum power threshold associated with the first time interval of hours 7-13 of the day that is known as peak demand with the minimum and maximum thresholds shown with the tan box approximately 17000-23000 MW respectively, with page 25, second paragraph for evaluation of DER-specific thresholds of existing offer parameters, such as minimum down time, minimum run-time, response rate, and to introduce a new DER offer parameter, maximum commitments per day. The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software [using software to determine thresholds and minimize power down time intervals]),

wherein each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals (page 24, and figure 11 for having a second power usage threshold of daytime peak from hours 14-20 as the second time interval [multiple intervals] showing a second minimum and maximum values shown by the orange box from 21000-23000 MW for the second time interval of 14-20 hours);

responsive to receiving the power option data, determining a performance strategy for a set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions (page 22, third paragraph for measure resource performance in the Energy market. The NYISO plans to draw on conclusions of that study for dispatchable DER relying on a baseline methodology to measure performance. DER participating in the Ancillary Services market will be measured by the current DSASP baseline to evaluate performance [determining performance strategies] for the ancillary product with page 25, last paragraph for an aggregation with a 24-hour capacity obligation might rely on load curtailment assets to provide performance during the day and generation assets when sufficient load curtailment capability is not available to meet the aggregation's obligation. In another scenario [using different power conditions], if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation by discharging storage devices for two hours and by load curtailment for the remaining two hours),

wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals (page 25, second paragraph for could potentially involve evaluation of DER-specific thresholds of existing offer parameters, such as minimum down time,22minimum run-time, response rate, and to introduce a new DER offer parameter, maximum commitments per day. The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software. Response rate is the speed with which a resource can reach its upper operating limit within the minimum run-time),

wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval (page 24, and figure 11 for having a second power consumption of daytime peak that is greater than the regular peak power interval threshold, and page 12, second paragraph for while activating DER to displace wholesale energy purchases during periods of high market prices [higher power usage threshold resulting in a time interval of higher prices] New York's LSEs submit approximately 3-5% of their day-ahead Load bids as price responsive, some of which is used for other purposes such as price hedging);

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

and providing instructions to the set of computing systems to perform one or more computational operations based on the performance strategy (page 23, Section A, second paragraph for ER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service tiers that dispatchable [adjust for conditions based on load tiers] DER can provide to help the NYISO meet its daily load. The NYISO currently proposes three such tiers - full day service, on-peak service and daytime peak service with page 25, last paragraph for if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation by discharging storage devices for two hours and by load curtailment for the remaining two hours. Importantly, the NYISO intends to establish performance obligations at the aggregation level, and not at individual resource level).

Regarding Claim 60, Iso discloses a non-transitory computer readable medium having stored therein instructions executable by one or more processors to cause a computing system to perform functions comprising (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER):

monitoring a set of conditions (page 21 second paragraph for required to have 6-second real-time telemetry. The NYISO's current meter data infrastructure supports PTID-level data, primarily collected through real-time telemetry for real-time operations and monitoring functions [means for monitoring and control], and after-the-fact uploads to support settlement. The integration of dispatchable DER into Capacity, Energy, and Ancillary Service markets is expected to follow a comparable model. DCEAs will be required to provide PTID-level i.e., aggregation level real-time telemetry data for operations and monitoring functions);

receiving power option data based, at least in part, on a power option agreement, wherein the power option data specify (page 23, Section IX second paragraph for The NYISO recognizes that some DER will be unable to deliver capacity in all 24 hours due to its physical characteristics e.g., DER aggregations consisting of load curtailment assets that have a typical "9 to 5" load profile [load conditions based on time periods] These DER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service [having power option tiers] tiers that dispatchable DER can provide to help the NYISO meet its daily load with page 28, last two paragraphs for reliability-based Demand Response programs SCR and EDRP are expected to continue, with some changes to better align these programs with the DER market rules. Any changes to the SCR program, including eligibility, obligations [agreements to provide power], or payments, will be addressed after the development of the dispatchable DER program concepts. If NYISO determines future changes to the SCR program are warranted, NYISO will work with stakeholders to develop an appropriate transition plan from the current rules):

(i) a set of minimum power thresholds, and (ii) a set of time intervals (page 24, and Figure 11 for having first minimum power threshold associated with the first time interval of hours 7-13 of the day that is known as peak demand with the minimum and maximum thresholds shown with the tan box approximately 17000-23000 MW respectively, with page 25, second paragraph for evaluation of DER-specific thresholds of existing offer parameters, such as minimum down time, minimum run-time, response rate, and to introduce a new DER offer parameter, maximum commitments per day. The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software [using software to determine thresholds and minimize power down time intervals]),

wherein each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals (page 24, and figure 11 for having a second power usage threshold of daytime peak from hours 14-20 as the second time interval [multiple intervals] showing a second minimum and maximum values shown by the orange box from 21000-23000 MW for the second time interval of 14-20 hours);

responsive to receiving the power option data (page 25 first paragraph for intends to apply the same obligation to dispatchable DER to offer in the real-time market. If more supply resources are required due to system condition changes in real-time [receiving a need for a different power option], NYISO operations can initiate its Supplemental Resource Evaluation (SRE) process. All NYISO capacity resources are eligible for selection and are required to respond to a SRE request in real-time regardless of whether they received an award/schedule in the DAM),

determining a performance strategy for a set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions (page 22, third paragraph for measure resource performance in the Energy market. The NYISO plans to draw on conclusions of that study for dispatchable DER relying on a baseline methodology to measure performance. DER participating in the Ancillary Services market will be measured by the current DSASP baseline to evaluate performance [determining performance strategies] for the ancillary product with page 25, last paragraph for an aggregation with a 24-hour capacity obligation might rely on load curtailment assets to provide performance during the day and generation assets when sufficient load curtailment capability is not available to meet the aggregation's obligation. In another scenario [using different power conditions], if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation by discharging storage devices for two hours and by load curtailment for the remaining two hours),

wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals (page 25, second paragraph for could potentially involve evaluation of DER-specific thresholds of existing offer parameters, such as minimum down time,22minimum run-time, response rate, and to introduce a new DER offer parameter, maximum commitments per day. The threshold for the minimum run-time for DER is the minimum time a resource will be committed by the Real-Time Commitment software. Response rate is the speed with which a resource can reach its upper operating limit within the minimum run-time),

wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval (page 24, and figure 11 for having a second power consumption of daytime peak that is greater than the regular peak power interval threshold,

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

and page 12, second paragraph for while activating DER to displace wholesale energy purchases during periods of high market prices [higher power usage threshold resulting in a time interval of higher prices] New York's LSEs submit approximately 3-5% of their day-ahead Load bids as price responsive, some of which is used for other purposes such as price hedging);

and providing instructions to the set of computing systems to perform one or more computational operations based on the performance strategy (page 23, Section A, second paragraph for ER are still valuable to the system, but perhaps less than a full 24 hour DER. In order to determine the varying degree of operational benefit that different DER can provide to the grid, the NYISO intends to develop options for service tiers that dispatchable [adjust for conditions based on load tiers] DER can provide to help the NYISO meet its daily load. The NYISO currently proposes three such tiers - full day service, on-peak service and daytime peak service with page 25, last paragraph for if an aggregation is scheduled for four hours, the DCE may choose to meet its obligation by discharging storage devices for two hours and by load curtailment for the remaining two hours. Importantly, the NYISO intends to establish performance obligations at the aggregation level, and not at individual resource level).

Claims 10, 11, 30, 32, 50, and 52 lack an inventive step under PCT Article 33(3) as being obvious over Iso in view of Causam Energy, Inc. (hereinafter Causam).

Regarding Claim 10, Iso discloses the power system as shown above. Iso fails to explicitly disclose the control system is a mobile computing device.

Causam has management of physical and financial settlement for participation of active grid elements in Supply and/or curtailment of power (abstract) and teaches the control system is a mobile computing device (paragraph 91 for messaging to mobile device and/or remote computer devices or processors relating to activation or deactivation of any grid elements registered and associated with communications through that mobile device, and for settlement information to be including with the messaging of grid element participation within the electric power grid).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Iso with the teaching of Causam for the purpose of messaging of grid element participation within the electric power grid (Causam, paragraph 91).

Regarding Claim 11, Iso discloses the power system as shown above. Iso fails to explicitly disclose the control system is further configured to: provide a request to a qualified scheduling entity (QSE) to determine the power option agreement; and receive first power option data in response to providing the request to the QSE.

Causam has management of physical and financial settlement for participation of active grid elements in Supply and/or curtailment of power (abstract) and teaches the control system is further configured to: provide a request to a qualified scheduling entity (QSE) to determine the power option agreement (paragraph 84 for he grid element Supplying power (generating power for Supply to the electric power grid) provides its output through a TDSP smart meter, collecting near-real-time information, telemetry, and metrology through the reading of ANSI or other approved C12.19 tables, communicated to qualified scheduling entity (QSE) and/or energy registration or trader that presents the aggregated generation);

and receive first power option data in response to providing the request to the QSE (paragraph 84 for to call immediately or in near-real-time to generate Supply at market prices and to introduce it to the feeder associated with an electrical bus or substation of an electric power grid. The coordinator communicates with the market for obtaining market price at the time of Supply, and with the market participant(s) or utility, NERC/FERC, preferably with bi-directional communication. The market is always providing transmission information, price per kilowatt packet, modeling, forecasting, clearing, schedules, and combinations in real-time or near-real-time).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Iso with the teaching of Causam for the purpose of collecting near-real-time information (Causam, paragraph 84).

Regarding Claim 30, Iso discloses the power system as shown above. Iso fails to explicitly disclose the control system is a mobile computing device.

Causam has management of physical and financial settlement for participation of active grid elements in Supply and/or curtailment of power (abstract) and teaches the control system is a mobile computing device (paragraph 91 for messaging to mobile device and/or remote computer devices or processors relating to activation or deactivation of any grid elements registered and associated with communications through that mobile device, and for settlement information to be including with the messaging of grid element participation within the electric power grid).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Iso with the teaching of Causam for the purpose of messaging of grid element participation within the electric power grid (Causam, paragraph 91).

Regarding Claim 32, Iso discloses the power system as shown above. Iso fails to explicitly disclose the control system is further configured to: provide a request to a qualified scheduling entity (QSE) to determine a power option agreement having power option data; and receive power option data in response to providing the request to the QSE.

Causam has management of physical and financial settlement for participation of active grid elements in Supply and/or curtailment of power (abstract) and teaches the control system is further configured to: provide a request to a qualified scheduling entity (QSE) to determine the power option agreement (paragraph 84 for he grid element Supplying power (generating power for Supply to the electric power grid) provides its output through a TDSP smart meter, collecting near-real-time information, telemetry, and metrology through the reading of ANSI or other approved C12.19 tables, communicated to qualified scheduling entity (QSE) and/or energy registration or trader that presents the aggregated generation);

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

and receive first power option data in response to providing the request to the QSE (paragraph 84 for to call immediately or in near-real-time to generate Supply at market prices and to introduce it to the feeder associated with an electrical bus or substation of an electric power grid. The coordinator communicates with the market for obtaining market price at the time of Supply, and with the market participant(s) or utility, NERC/FERC, preferably with bi-directional communication. The market is always providing transmission information, price per kilowatt packet, modeling, forecasting, clearing, schedules, and combinations in real-time or near-real-time).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Iso with the teaching of Causam for the purpose of collecting near-real-time information (Causam, paragraph 84).

Regarding Claim 50, Iso discloses the power system as shown above. Iso fails to explicitly disclose the control system is a mobile computing device.

Causam has management of physical and financial settlement for participation of active grid elements in Supply and/or curtailment of power (abstract) and teaches the control system is a mobile computing device (paragraph 91 for messaging to mobile device and/or remote computer devices or processors relating to activation or deactivation of any grid elements registered and associated with communications through that mobile device, and for settlement information to be including with the messaging of grid element participation within the electric power grid).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Iso-with the teaching of Causam for the purpose of messaging of grid element participation within the electric power grid (Causam, paragraph 91).

Regarding Claim 52, Iso discloses the power system as shown above. Iso fails to explicitly disclose the control system is further configured to: provide a request to a qualified scheduling entity (QSE) to determine the power option agreement; and receive power option data in response to providing the request to the QSE.

Causam has management of physical and financial settlement for participation of active grid elements in Supply and/or curtailment of power (abstract) and teaches the control system is further configured to: provide a request to a qualified scheduling entity (QSE) to determine the power option agreement (paragraph 84 for he grid element Supplying power (generating power for Supply to the electric power grid) provides its output through a TDSP smart meter, collecting near-real-time information, telemetry, and metrology through the reading of ANSI or other approved C12.19 tables, communicated to qualified scheduling entity (QSE) and/or energy registration or trader that presents the aggregated generation);

and receive first power option data in response to providing the request to the QSE (paragraph 84 for to call immediately or in near-real-time to generate Supply at market prices and to introduce it to the feeder associated with an electrical bus or substation of an electric power grid. The coordinator communicates with the market for obtaining market price at the time of Supply, and with the market participant(s) or utility, NERC/FERC, preferably with bi-directional communication. The market is always providing transmission information, price per kilowatt packet, modeling, forecasting, clearing, schedules, and combinations in real-time or near-real-time).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Iso with the teaching of Causam for the purpose of collecting near-real-time information (Causam, paragraph 84).

Claims 38 and 58 lack an inventive step under PCT Article 33(3) as being obvious over Iso in view of Advanced Microgrid Solutions, Inc. (hereinafter Advanced).

Regarding Claim 38, Iso discloses the power system as shown above. Iso fails to explicitly disclose determining the performance strategy for the set of computing systems comprises: identifying information about the set of computing systems; and determining the performance strategy to further comprise instructions for at least a subset of the set of computing systems to operate at an increased frequency based on a combination of at least the portion of the power option data and the information about the set of computing systems.

Advanced has control of a fleet of on-site energy assets (abstract) and teaches determining the performance strategy for the set of computing systems comprises: identifying information about the set of computing systems (col 31, lines 5-20 for As shown in block 1020 of FIG. 10, an apparatus, such as apparatus 20 embodied by the operational platform 300 and/or apparatus 400, may be configured to provide the site-level schedules to each of the plurality of affected gateway apparatuses for facilitating control of on-site);

and determining the performance strategy to further comprise instructions for at least a subset of the set of computing systems to operate at an increased frequency based on a combination of at least the portion of the power option data and the information about the set of computing systems (col 31, lines 10-30 for the multi-site portfolio optimization. The system may be configured to perform site-level optimization on each of a plurality of sites. That is, for example, on an hourly or more frequent basis [increasing frequency], a portfolio optimization algorithm may run, generating optimal dispatch instructions and sending DCR schedules to controllable asset systems each time it runs. The algorithm may utilize forecast data for each site, and expected asset availability based on the forecast, site outage data, reflecting most recent status information from gateway components)

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Iso with the teaching of Advanced for the purpose of ensuring the system is prepared to meet the maximum dispatch request from, for example, the utility system/company (Advanced, col 31, lines 25-40).

Regarding Claim 58, Iso discloses the power system as shown above. Iso fails to explicitly disclose determining the performance strategy for the set of computing systems comprises: identifying information about the set of computing systems; and determining the performance strategy to further comprise instructions for at least a subset of the set of computing systems to operate at an increased frequency based on a combination of at least the portion of the power option data and the information about the set of computing systems.

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

Advanced has control of a fleet of on-site energy assets (abstract) and teaches determining the performance strategy for the set of computing systems comprises: identifying information about the set of computing systems (col 31, lines 5-20 for As shown in block 1020 of FIG. 10, an apparatus, such as apparatus 20 embodied by the operational platform 300 and/or apparatus 400, may be configured to provide the site-level schedules to each of the plurality of affected gateway apparatuses for facilitating control of on-site);

and determining the performance strategy to further comprise instructions for at least a subset of the set of computing systems to operate at an increased frequency based on a combination of at least the portion of the power option data and the information about the set of computing systems (col 31, lines 10-30 for the multi-site portfolio optimization. The system may be configured to perform site-level optimization on each of a plurality of sites. That is, for example, on an hourly or more frequent basis [increasing frequency], a portfolio optimization algorithm may run, generating optimal dispatch instructions and sending DCR schedules to controllable asset systems each time it runs. The algorithm may utilize forecast data for each site, and expected asset availability based on the forecast, site outage data, reflecting most recent status information from gateway components).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Iso with the teaching of Advanced for the purpose of ensuring the system is prepared to meet the maximum dispatch request from, for example, the utility system/company (Advanced, col 31, lines 25-40).

Claims 5, 6, 12, 13, 16-18, 24-28, 34, 36, 39, 45-48, 54, 56, and 59 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest:

Regarding claim 5, the prior art of record, individually or in combination, does not teach or fairly suggest the control system is configured to: determine the first control instructions for the set of computing systems based on a combination of at least the portion of the first power option data, the price of power from the power grid, and the plurality of parameters associated with the one or more computational operations.

Claim 6 depends from claim 5, and therefore meets the criteria set out in PCT Article 33(2)-(3) for at least the same reasons as claim 5.

Iso discloses a system comprising: a set of computing systems (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER). However, Iso. fail to disclose said determine the first control instructions for the set of computing systems based on a combination of at least the portion of the first power option data.

Regarding claim 12, the prior art of record, individually or in combination, does not teach or fairly suggest the set of conditions monitored by the control system further comprises: a price of power from the power grid; and a global mining hash rate and a price for a cryptocurrency; and wherein the control system is configured to: determine the second control instructions for the set of computing systems based on a combination of at the portion of the second power option data, the price of power from the power grid, and the global mining hash rate and the price for the cryptocurrency, wherein the second control instructions specify for at least a subset of the set of computing systems to perform mining operations for the cryptocurrency when the price of power from the power grid is equal to or less than a revenue obtained by performing the mining operations for the cryptocurrency.

Iso discloses a system comprising: a set of computing systems (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER). However, Iso. fail to disclose said the second control instructions specify for at least a subset of the set of computing systems to perform mining operations for the cryptocurrency when the price of power from the power grid is equal to or less than a revenue obtained by performing the mining operations for the cryptocurrency.

Regarding claim 13, the prior art of record, individually or in combination, does not teach or fairly suggest the control system is further configured to: receive the second power option data during the first time interval such that the second time interval overlaps the first time interval.

Iso discloses a system comprising: a set of computing systems (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER). However, Iso. fail to disclose said receive the second power option data during the first time interval such that the second time interval overlaps the first time interval.

Regarding claim 16, the prior art of record, individually or in combination, does not teach or fairly suggest providing first control instructions for the set of computing systems based on the combination of at least the portion of the first power option data and at least one condition of the set of conditions comprises: providing first control instructions based on a weighted combination of the first power option data, the price of power from the power grid, the plurality of parameters associated with the set of computational operations, and the plurality of parameters associated with the set of computing systems.

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

Claims 17 and 18 depend from claim 16, and therefore meet the criteria set out in PCT Article 33(2)-(3) for at least the same reasons as claim 16.

Iso discloses a system comprising: a set of computing systems (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER). However, Iso. fail to disclose said the plurality of parameters associated with the set of computational operations, and the plurality of parameters associated with the set of computing systems.

Regarding claim 24, the prior art of record, individually or in combination, does not teach or fairly suggest the performance strategy further comprises: an order for the set of computing systems to follow when performing the one or more computational operations, wherein the order is based on respective priorities associated with the one or more computational operations.

Claim 25 depends from claim 24, and therefore meets the criteria set out in PCT Article 33(2)-(3) for at least the same reasons as claim 24.

Iso discloses a system comprising: a set of computing systems (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER). However, Iso. fail to disclose said an order for the set of computing systems to follow when performing the one or more computational operations, wherein the order is based on respective priorities associated with the one or more computational operations.

Regarding claim 26, the prior art of record, individually or in combination, does not teach or fairly suggest the control system is further configured to: receive subsequent power option data, wherein the subsequent power option data specify to decrease one or more minimum power thresholds of the set of minimum power thresholds.

Claims 27 and 28 depend from claim 26, and therefore meet the criteria set out in PCT Article 33(2)-(3) for at least the same reasons as claim 26.

Iso discloses a system comprising: a set of computing systems (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER). However, Iso. fail to disclose said the control system is further configured to: receive subsequent power option data, wherein the subsequent power option data specify to decrease one or more minimum power thresholds of the set of minimum power thresholds.

Regarding claim 34, the prior art of record, individually or in combination, does not teach or fairly suggest the control system is configured to: determine the performance strategy for the set of computing systems such that the performance strategy comprises: a first power consumption target for the set of computing systems for the first time interval, wherein the first power consumption target is equal to or greater than the first minimum power threshold; and a second power consumption target for the set of computing systems for the second time interval, wherein the second power consumption target is equal to or greater than the second minimum power threshold.

Iso discloses a system comprising: a set of computing systems (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the NYISO expects to modify its outage software to accommodate DER). However, Iso. fail to disclose said second power consumption target for the set of computing systems for the second time interval, wherein the second power consumption target is equal to or greater than the second minimum power threshold.

Regarding claim 36, the prior art of record, individually or in combination, does not teach or fairly suggest the set of conditions monitored by the control system further comprise: a price of power from a power grid; and a global mining hash rate and a price for a cryptocurrency; and wherein the control system is configured to: determine the performance strategy for the set of computing systems based on a combination of at the portion of the power option data, the price of power from the power grid, the global mining hash rate and the price for the cryptocurrency, wherein the performance strategy specifies for at least a subset of the set of computing systems to perform mining operations for the cryptocurrency when the price of power from the power grid is equal to or less than a revenue obtained by performing the mining operations for the cryptocurrency.

Iso discloses a system comprising: a set of computing systems (page 29, last paragraph for DER participating in the NYISO's Energy and Ancillary Services markets will require well-defined metering configurations as well as processes for calculating baseline load levels from which to measure performance. Establishing the baseline will require estimating a participant's load based on data from time periods with page 25, last two paragraphs for DER will be required to be available during all intervals in which they submit offers to provide wholesale service. If DER is derated or unavailable, it must report its unavailability to NYISO. Given the expected size and number of DER, the