

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LIBERTY ENERGY, INC. and LIBERTY OILFIELD SERVICES LLC,
Petitioner,

v.

U.S. WELL SERVICES, LLC,
Patent Owner.

IPR2024-01274
Patent 11,091,992 B2

Before ANNETTE R. REIMERS, GEORGE R. HOSKINS, and
SEAN P. O'HANLON, *Administrative Patent Judges*.

REIMERS, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background

Liberty Energy, Inc. and Liberty Oilfield Services LLC (collectively, “Petitioner”) filed a Petition for *inter partes* review of claims 1–20 (“the challenged claims”) of U.S. Patent No. 11,091,992 B2 (Ex. 1001, “the ’992 patent”). Paper 1 (“Pet.”). U.S. Well Services, LLC (“Patent Owner”) did not file a Preliminary Response.

Institution of an *inter partes* review is authorized by statute only when “the information presented in the petition . . . and any response . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a). A decision to institute may not institute on fewer than all claims challenged in the petition. *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1354, 1359–60 (2018). If the PTAB institutes a trial, the PTAB will institute on all challenges raised in the petition. *See* Patent Trial and Appeal Board Consolidated Trial Practice Guide (“CTPG”) 64 (Nov. 2019) (“The Board will not institute on fewer than all claims or all challenges in a petition.”);¹ *see also AC Techs. S.A. v. Amazon.com, Inc.*, 912 F.3d 1358, 1364 (Fed. Cir. 2019) (“[I]f the Board institutes an IPR, it must . . . address all grounds of unpatentability raised by the petitioner.”).

We have authority, acting on the designation of the Director, to determine whether to institute an *inter partes* review under 35 U.S.C. § 314 and 37 C.F.R. § 42.4(a). For the reasons set forth below, upon considering the Petition and evidence of record, we conclude that the information

¹ Available at <https://www.uspto.gov/TrialPracticeGuideConsolidated>.

presented shows that there is a reasonable likelihood that Petitioner would prevail in establishing the unpatentability of at least one of the challenged claims. Thus, we institute *inter partes* review of all challenged claims based on all asserted grounds.

B. Real Parties in Interest

Petitioner identifies itself and Liberty Advanced Equipment Technologies LLC as the real parties in interest. Pet. 1.

Patent Owner identifies itself, U.S. Well Services Holdings, LLC, ProFrac Manufacturing, LLC, and ProFrac Services, LLC as the real parties in interest. Paper 4, 2.

The parties are reminded of their continuing obligation to update their mandatory notice information “within 21 days of a change of the information.” 37 C.F.R. § 42.8(a)(3).

C. Related Matters

The parties indicate that the ’992 patent is the subject of the following district court proceeding: *U.S. Well Services, LLC v. Liberty Energy, Inc.*, 4:24-cv-00839-KPE (S.D. Tex.). Pet. 1; Paper 4, 2.

The parties also note other petitions for *inter partes* review filed by Petitioner challenging patents owned by Patent Owner, particularly: IPR2021-01035² (U.S. Patent No. 9,970,278 (Ex. 1011, “the ’278 patent”));

² A Final Written Decision was rendered on January 17, 2023, which determined that all challenged claims are unpatentable. IPR2021-01035, Paper 40; Pet. 1. We note that the PTAB’s decision in IPR2021-01035 was appealed to the Federal Circuit. The Federal Circuit recently affirmed the PTAB’s decision, citing Rule 36.

and IPR2021-01032³ (U.S. Patent No. 9,410,410 (Ex. 1010)). Pet. 1; Paper 4, 2. Petitioner notes that the '278 patent is a parent to the '992 patent. Pet. 1.

D. The Challenged Patent

The '992 patent relates to hydraulic fracturing in oil and gas wells, which entails pumping fluid into underground formations at high pressure. Ex. 1001, 1:22–36. Typically, this pumping is performed by large diesel-powered pumps. *Id.* at 1:37–39. The '992 patent purports to improve upon known fracturing systems and methods by using electric generators and motors to drive the pumps. *Id.* at 1:60–2:12. The '992 patent purports that electric motors and generators can be loaded directly on a truck or trailer, increasing efficiency and lowering cost. *Id.* at 6:60–7:25.

Figure 1 shows a plan view of equipment used in the hydraulic fracturing operation and is reproduced below.

³ A Final Written Decision was rendered on January 4, 2023, which granted-in-part and denied-in-part Patent Owner's Revised Non-Contingent Motion to Amend. IPR2021-01032, Paper 79.

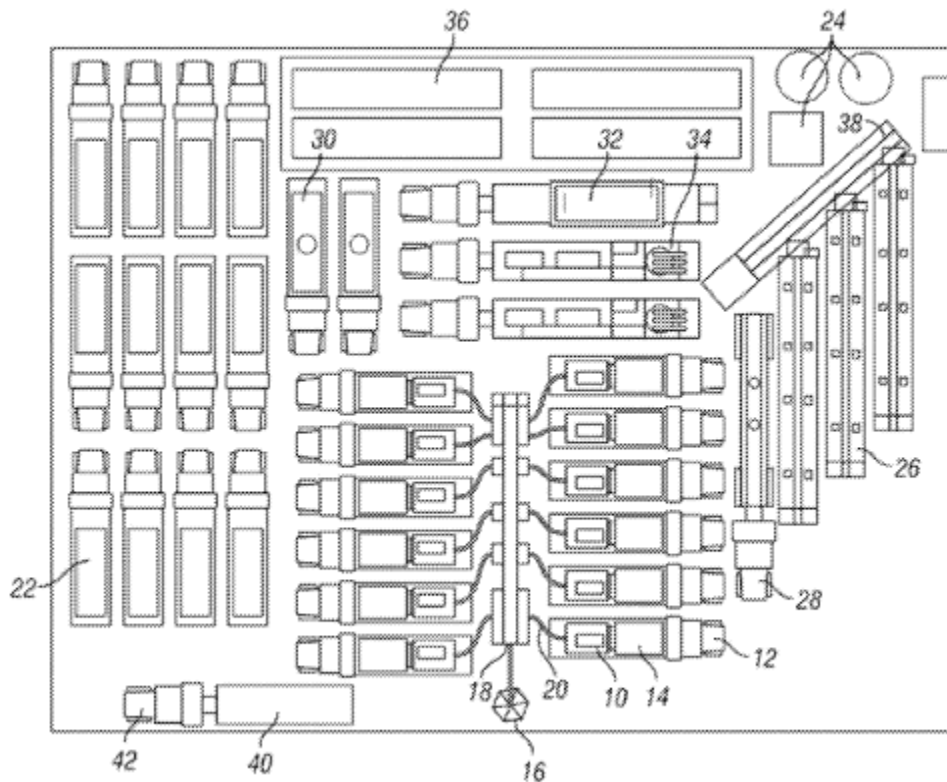


Figure 1 illustrates an overhead view of wellhead 16 fluidly connected to manifold trailer 18. Ex. 1001, 3:11–25, Fig. 1. Multiple pump trailers 12 are illustrated as trucks with attached trailers, located on both sides of manifold trailer 18. *Id.* Pump trailers 12 include pumps 10 and electric motors 14, both mounted on the pump trailers. *Id.* The electric motors can be equipped with a variable frequency drive (VFD) that controls the speed of the electric motor and thus, the speed of the pump. *Id.* at 3:34–37. Electric generators 22, which may be natural gas turbines, provide power to electric motors 14 and are connected to the motors by power lines (not shown). *Id.* at 4:26–31, 4:44–46. Fracturing fluid lines 20 connect the pumps to the manifold trailer such that the manifold trailer is configured to deliver fracturing fluid from the pumps to the wellhead. *Id.* at 3:20–25.

Figure 1 also illustrates monitor/control data van 40 mounted on control vehicle 42. Ex. 1001, 5:14–27. The data van can be connected to

the pumps and electric motors “to provide information to an operator and to allow the operator to control different parameters of the fracturing operation.” *Id.* Monitoring and control of functions can be accomplished using cables, Ethernet, or wireless capability. *Id.* at 5:50–52. The pump can be controlled can be via “a pump VFD fault indicator with a reset.” *Id.* at 5:22–24. The data van “incorporate[s] various functions in a centralized location such that compressors and turbines spread across a plurality of trucks can be monitored by a single operator.” *Id.* at 5:28–31. The data van further includes an emergency power off (“EPO”), which allows for the entire site to be shut off completely. *Id.* at 5:56–57. Switchgear 47 connects the data van to the turbines. *Id.* at 7:33–33, Fig. 3. “Upon activation of the EPO 43, breakers open in the switchgear 47, cutting power to the generator 22. The gas compression will turn off, cutting fuel to the turbine(s) 23.” *Id.* at 7:38–40; *see also id.* at Fig. 3.

The ’992 patent claims priority as a continuation of U.S. Patent Application No. 14/884,363 (Ex. 1001, code (63); Ex. 1002, 414), which issued as the ’278 patent.

E. The Challenged Claims

Petitioner challenges claims 1–20 of the ’992 patent. Pet. 11–12. Claims 1, 8, and 17 are independent. Claim 1 (with Petitioner’s identifiers of claim elements) is illustrative of the challenged claims and is reproduced below.

1. [1p] A system for hydraulically fracturing an underground formation in an oil or gas well to extract oil or gas from the formation, the oil or gas well having a wellbore that permits passage of fluid from the wellbore into the formation, the system comprising:

[1a] an electric pump fluidly connected to the well, and configured to pump fluid into the wellbore; and

[1b] a centralized control unit coupled to the electric pump,

[1c] wherein the centralized control unit is configured to: monitor the electric pump; and

[1d] a variable frequency drive that controls a speed of the electric pump;

[1e] wherein the centralized control unit is coupled to the electric pump via one or more of cabling, Ethernet, or wirelessly; and

[1f] wherein the centralized control unit is further configured to reset a fault occurring in the variable frequency drive.

Ex. 1001, 21:44–61.

F. Asserted Grounds of Unpatentability

The Petition relies on the following prior art references:

Name	Reference	Exhibit
Coli	US 2012/0255734 A1, published October 11, 2012	1004
Birch	US 5,606,853, issued March 4, 1997	1005
Dykstra	US 2008/0236818 A1, published October 2, 2008	1006
Rusnak	US 2008/0288115 A1, published November 20, 2008	1007
Hunt	US 2010/0038907 A1, published February 18, 2010	1008

Petitioner asserts the following grounds of unpatentability:

Claim(s) Challenged	35 U.S.C. §	Reference(s)
1–5, 8–14	103	Coli, Birch, Rusnak
1–5, 8–14	103	Coli, Birch, Rusnak, Dykstra
6, 7, 15–20	103	Coli, Birch, Rusnak, Hunt

Claim(s) Challenged	35 U.S.C. §	Reference(s)
6, 7, 15–20	103	Coli, Birch, Rusnak, Dykstra, Hunt

Pet. 11–12. Petitioner submits a declaration of Robert Durham, Ph.D. (Ex. 1003, “Durham Declaration”) in support of its contentions.

II. ANALYSIS

A. Principles of Law

1. Inter Partes Review

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). Petitioner bears the burden of persuasion to prove unpatentability of each challenged claim by a preponderance of the evidence. 35 U.S.C. § 316(e). This burden never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). The Board may authorize an *inter partes* review if we determine that the information presented in the Petition and Patent Owner’s Preliminary Response shows that there is a reasonable likelihood that Petitioner will prevail with respect to at least one of the claims challenged in the petition. 35 U.S.C. § 314(a).

2. *Obviousness*

A patent claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) when in evidence, any objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). “While the sequence of these questions might be reordered in any particular case” (*KSR*, 550 U.S. at 407), the Federal Circuit has explained that an obviousness determination can be made only after consideration of all of the *Graham* factors. *See, e.g., Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1360 (Fed. Cir. 2012).

B. Level of Ordinary Skill in the Art

The level of ordinary skill in the art is “a prism or lens” through which we view the prior art and the claimed invention. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). The person of ordinary skill in the art is a hypothetical person presumed to have known the relevant art at the time of the invention. *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). In determining the level of ordinary skill in the art, we may consider certain factors, including: “(1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems;

(4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field.” *Best Med. Int’l, Inc. v. Elekta Inc.*, 46 F.4th 1346, 1353 (Fed. Cir. 2022) (citations omitted). “The patent’s purpose can also be informative.” *Id.* (citation omitted).

Petitioner contends that a person having ordinary skill in the art at the time of the invention (“POSITA”) would have either “a Bachelor of Science in Mechanical Engineering, Electrical Engineering, Petroleum Engineering or an equivalent field, as well as at least 2 years of academic or industry experience in the oil and gas industry, including well drilling, completion, or production” or “at least four years of industry experience in the oil and gas industry including well drilling, completion, or production.” Pet. 12 (citing Ex. 1003 ¶¶ 27–28).

Based on the argument presented and the asserted references, we find Petitioner’s definition of the level of ordinary skill reasonable and, for purposes of this Decision, adopt it as our own.

C. Claim Construction

In an *inter partes* review, claims are construed using the same claim construction standard that would be used to construe the claims in a civil action under 35 U.S.C. § 282(b), including construing the claims in accordance with the ordinary and customary meaning of such claims as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.100(b). “[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the

invention” and “after reading the entire patent.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313, 1321 (Fed. Cir. 2005) (en banc). In addition to the specification and prosecution history, we also consider use of the terms in other claims and extrinsic evidence including expert and inventor testimony, dictionaries, and learned treatises, although extrinsic evidence is less significant than the intrinsic record. *Id.* at 1312–17. Usually, the specification is dispositive, and it is the single best guide to the meaning of a disputed term. *Id.* at 1315.

“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (alteration in original) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

Petitioner does not assert that any claim terms require express construction for purposes of this Decision. Pet. 12.

As we explain below, Petitioner establishes a reasonable likelihood that it would prevail with respect to at least one claim based on the ordinary and customary meaning of the claim terms. Thus, we determine that no claim terms require express construction for purposes of this Decision.

D. Overview of the Asserted Prior Art

1. Coli

Coli relates to hydraulic fracturing in hydrocarbon-bearing wells. Ex. 1004 ¶ 3. Coli recognizes drawbacks of the diesel motors typically used in such drilling. *Id.* ¶¶ 5, 8. Coli purports to improve upon known fracturing systems by using electric motors and generators powered by

natural gas to drive the pumps. *Id.* ¶¶ 9–11, 38. Coli purports that this use of electric components beneficially reduces the amount of infrastructure, provides systems that are safer and easier to control than known diesel systems, facilitates syncing the equipment within the system, and reduces costs. *Id.* ¶¶ 39, 66–71, 73.

Figure 2 is a schematic view of the fracturing site and is reproduced below.

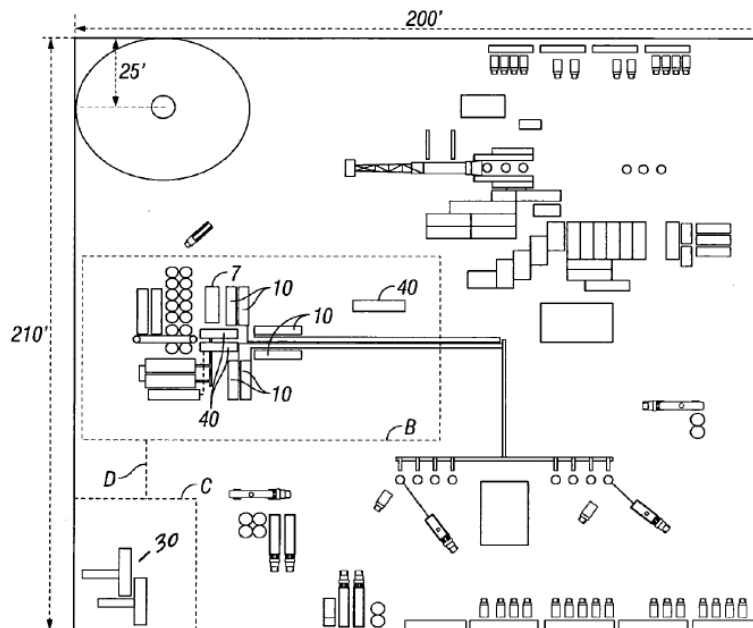


FIG. 2

Figure 2 illustrates a schematic diagram of a fracturing site, including dotted line boxes marking region B and region C, separated by distance D.

Ex. 1004 ¶¶ 23, 38. Trailers 10 housing one or more fracturing modules, each module including an electric motor coupled to one or more pumps, are located in region B. *Id.* ¶¶ 38, 46. One or more natural-gas powered turbine generators 30 are located in region C, separate from the fracturing modules for safety. *Id.* The turbine generators provide a dedicated source of on-site electric power. *Id.*

Figure 2 also illustrates control center 40 located in region B.⁴ Ex. 1004 ¶ 72. The control center may include suitable controls and computer monitoring for the entire fracturing operation. *Id.* The control center may manage various operations through a communications link, including power generation and the delivery of treatment fluid to the pumps for delivery to the wellbore. *Id.* “Because [the] electric motors are controlled by variable frequency drives, absolute control of all equipment on location can be maintained from one central point.” *Id.* ¶ 65. Coli discloses that parameters of electric motors can be monitored via signals that “are typically sent via hardwired cable to an operator console controlled by the pump driver.” *Id.* ¶ 66. Coli discloses that accidental over-pressures are “quite common” in conventional drilling systems and can result in significant damage and shutdown interruptions. *Id.* ¶¶ 67–68. Coli purports that an electrical system “virtually eliminates” these scenarios, as the control system may set a maximum pressure value at the beginning of the operation, which is extrapolated to a maximum amount of power or current value sent to the electric motor. *Id.* ¶ 69. Also, the control system may initiate a “near instantaneous” stop of the electric motors thereby immediately stopping the pumps. *Id.*

2. Birch

Birch discloses a gaseous fuel compression and control system for gas turbine engines. Ex. 1005, 1:9–10. The fuel compression system includes a screw compressor for compressing gaseous fuel supplied to the gas turbine

⁴ Coli refers to “control center 40” and “blender module 40,” and labels two different boxes as “40” in Figure 2, both located in region B.

engine. *Id.* at 1:60–62. An electric motor drives the screw compressor. *Id.* A power sensor senses the output power of the gas turbine engine. *Id.* at 1:62–67. The power sensor sends a control signal to control the speed of the electric motor through modulating means that control the frequency of electrical power supplied to the motor. *Id.*

Figure 1 illustrates a schematic view of the gas fuel compression system and is reproduced below.

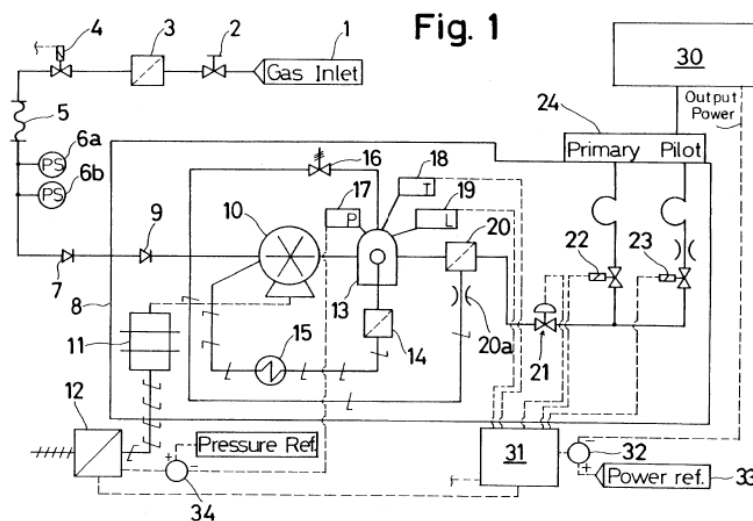


Figure 1 is a schematic view illustrating the gaseous fuel compression and control system. Ex. 1005, 2:4–6. Natural gas enters the system from mains supply 1 and travels through a series of valves (4, 7, 9) to compressor 10. *Id.* at 2:31–42. The compressor is driven by electric motor 11 and inverter device 12. *Id.* at 2:42–44. The compressor is connected to combustion chamber 24 of gas turbine 30 through separator tank 13, filter 20, control valve 21 and cut-off valves 23, 24. *Id.* at 2:59–3:22. The system includes controller 31, which sends a control signal to the control valve in response to an output signal of comparator 32. *Id.* at 3:23–28. The comparator compares the output power of the gas turbine engine with power reference 33 and sends the output signal to the controller. *Id.*

The gas fuel control system can operate continuously in a pressure feedback mode. Ex. 1005, 4:46–47. The controller “generates two signals in response to output power. One is the required gas flow rate and therefore positions the control valve accordingly and the other is the required gas pressure which therefore is the gas compression system set point pressure.” *Id.* at 4:48–53. If the output power is higher than the power reference, the controller closes the control valve, causing a slight increase in gas pressure, in turn causing the compressor to slow down. *Id.* at 4:54–60. If the output power is lower than the power reference, the controller opens the control valve, causing a slight decrease in gas pressure, in turn causing the compressor to accelerate. *Id.* at 4:61–67. In both scenarios, inverter device 12 slows or accelerates the compressor until a new equilibrium is reached. *Id.* at 4:59–60, 4:65–67.

3. Dykstra

Dykstra discloses a system for controlling the manufacturing of well treatment fluid in an oil or gas well. Ex. 1006 ¶¶ 2, 5. The system includes a central control system that controls, coordinates, and monitors the operations of various subsystems, including a pumping grid and a power unit. *Id.* ¶ 21. Each subsystem has its own controller. *Id.* ¶ 26. Dykstra refers to the combined subsystems as a “well treatment operations factory.” *See id.* ¶ 14. The pumping grid includes one or more pumps that can be electric, gas, diesel, or natural gas powered. *Id.* ¶ 20. The power unit provides electrical power to all of the subunits within the well operations factory and “may comprise a single trailer with subunits, each subunit with the ability to operate independently.” *Id.* ¶ 15. The power unit “can be

powered by liquid fuel, natural gas, or other equivalent fuel and may optionally be a cogeneration power unit.” *Id.*

The central control system receives analog or digital signals from sensors associated with the various components in the operations factory. Ex. 1006 ¶ 21. “The central control system may use all of the sensor data from all units and the drive signals from their individual subcontrollers to determine subsystem trajectories.” *Id.* A desired property, such as well treatment fluid flow rate, is provided and the control system drives the output rate of the fracturing operations factory to the desired rate. *Id.* ¶ 22. “The central control system can also be used to monitor equipment health and status.” *Id.* ¶ 21.

4. *Rusnak*

Rusnak discloses a VFD-based controller for controlling a pump using intelligent pump system monitors. Ex. 1007 ¶¶ 1, 20, 21. The controller operates the VFD to control flow, speed, or pressure of the pumping system and to identify and report pump system problems. *Id.* ¶ 20. The controller can be run in either a speed mode or a process mode. *Id.* ¶ 25. In speed mode, the controller maintains a specific motor speed entered by the user (the setpoint). *Id.* In process mode, the controller uses input from an external process sensor(s) as feedback and will continuously adjust speed to maintain the process variable setpoint(s). *Id.* ¶ 26. The user enters the maximum and minimum speeds for the pump. *Id.* ¶¶ 30–31. If the required setpoint cannot be attained within the maximum and minimum speed limits, the controller initiates a response action. *Id.* ¶ 37. Such actions include shutting down the pump or overriding the setpoint. *Id.* at Table 1. After a

preset time delay, the controller will attempt to reestablish normal operation. *Id.* ¶ 80. If the controller is unable to reestablish normal operation after a preset number of attempts, an auto reset fault occurs. *Id.* The controller will automatically reset the faulted condition after a preset amount of time has elapsed. *Id.*

5. *Hunt*

Hunt discloses a power generation system for producing electrical energy from gas captured at a wellhead. Ex. 1008 ¶ 2. Hunt purports that “[c]apturing the gas at the wellhead and using it to generate power not only reduces the greenhouse gas emissions related to oil and natural gas production, but also prevents the waste of a natural resource by converting it into something useful.” *Id.* ¶ 24. The system uses natural gas to fuel a generator, such as a gas turbine(s). *Id.* ¶ 25. Hunt discloses that “a gas turbine generator is less susceptible to damage resulting from brief instances of reverse power flow, i.e., such as when an insufficient amount of gas is available to maintain a positive torque on the generator.” *Id.* The generated power can be used to power a local load, such as a pump for extracting oil from a wellhead, or supplied to a utility grid. *Id.* ¶¶ 27, 31, 37.

The system includes a multifunction control module (“MCM”) that monitors the gas flow and generates control signals to produce the desired response. Ex. 1008 ¶ 33. The MCM monitors, adjusts, and controls the power generation system over a communications network. *Id.* ¶ 34. The MCM controls a switchgear, which is coupled to the generator power bus and the grid power bus. *Id.* ¶ 46. A switchgear control relay is connected to

engage or disengage the switchgear, thus coupling or decoupling the power buses. *Id.*

Hunt also discloses that “[p]ower not consumed by the local loads may be stored, and/or supplied to utility grid 265, for example, by paralleling power generation system 200 with utility grid 265” and that “[p]rior to connecting generator 215 to utility power bus 265, however, it is important to synchronize the output voltage waveforms in order to minimize the risk of power surges and potential damage to generator 215.” *Id.* ¶ 31.

E. Asserted Obviousness Based on Coli, Birch, and Rusnak

Petitioner argues that claims 1–5 and 8–14 would have been obvious over Coli, Birch, and Rusnak. Pet. 19–43. In support of its showing, Petitioner relies upon the Durham Declaration. *Id.* (citing Ex. 1003). We have reviewed Petitioner’s brief and the evidence of record and determine that, for the reasons explained below, Petitioner has shown, by a preponderance of the evidence, that the limitations of claims 1–5 and 8–14 are disclosed by the combination of Coli, Birch, and Rusnak and that Petitioner has set forth reasoning with rational underpinning why it would have been obvious to a skilled artisan to combine the teachings of these references to arrive at the claimed subject matter.

1. Independent Claim 1

a. The Preamble 1p

Claim 1 recites “[a] system for hydraulically fracturing an underground formation in an oil or gas well to extract oil or gas from the formation, the oil or gas well having a wellbore that permits passage of fluid

from the wellbore into the formation.” Ex. 1001, 21:44–47. Petitioner argues that Coli discloses such a system. Pet. 26–27 (citing Ex. 1004 ¶¶ 6, 9, 13; Ex. 1003 ¶ 147).

Coli discloses “a system and method for hydraulic stimulation of underground hydrocarbon-bearing formations” by “delivering fracturing fluid to a wellbore.” Ex. 1004 ¶ 9.

Accordingly, for the foregoing reasons and on this preliminary record, to the extent the preamble is limiting, Coli supports Petitioner’s contentions.

b. The Pump Recitation 1a

Claim 1 recites “an electric pump fluidly connected to the well, and configured to pump fluid into the wellbore.” Ex. 1001, 21:49–50. Petitioner maps this recitation to Coli’s fracturing modules 20. Pet. 27–28 (citing Ex. 1004 ¶¶ 5, 40, 77, Fig. 2; Ex. 1003 ¶ 150, 152).

Coli discloses that its system includes “trailer 10 for housing one or more fracturing modules 20.” Ex. 1004 ¶ 40, Fig. 3. Coli discloses “[e]ach fracturing module 20 can include an electric motor 21 and a fluid pump 22 coupled thereto” and that “[f]racturing modules 20 utilize electric power from turbine generator 30 to pump the fracturing fluid directly to the wellbore.” *Id.* ¶ 40.

Accordingly, for the foregoing reasons and on this preliminary record, Coli supports Petitioner’s contentions.

c. The Centralized Control Unit Recitation 1b

Claim 1 recites “a centralized control unit coupled to the electric pump.” Ex. 1001, 21:51. Petitioner maps Coli’s control system to the

recited centralized control unit. Pet. 28–30 (citing Ex. 1004 ¶¶ 65, 71, 72, Fig. 2; Ex. 1003 ¶¶ 155, 156).

Coli discloses that its system includes a “control system . . . for regulating various equipment and systems within the electric powered fractioning operation.” Ex. 1004 ¶ 65. Coli discloses that “the control system can regulate fracturing module 20 in delivery of treatment fluid from blender module 30 to pumps 22 for delivery to the wellbore” and its “electric motors are controlled by variable frequency drives,” allowing for “absolute control of all equipment on location . . . from one central point.” *Id.*⁵

Coli further discloses that, “[w]hen the system operator sets a maximum pressure for the treatment, the control software and variable frequency drives calculate a maximum current available to the motors.” Ex. 1004 ¶ 65. Coli discloses that “controls and computer monitoring for the entire fracturing operation can take place at a single central location,” namely control center 40, further indicating that the electric pumps are controlled via the control center. *Id.* ¶ 72.

Accordingly, for the foregoing reasons and on this preliminary record, Coli supports Petitioner’s contentions.

d. The Configured To Monitor Recitation 1c

Claim 1 recites “wherein the centralized control unit is configured to: monitor the electric pump.” Ex. 1001, 21:52–53. Petitioner argues that a person of ordinary skill in the art would have understood Coli’s “‘regulating’ fracturing module 20 (which includes the electric pump) and monitoring

⁵ We note that Coli also refers item 30 as a turbine generator. *See e.g.*, Coli Fig. 2.

‘delivery of treatment fluid from blender module 40 to pumps 22 for delivery to the wellbore’ discloses ‘monitor[ing] the electric pump,’” as required. Pet. 30–31 (citing Ex. 1004 ¶¶ 65, 72; Ex. 1003 ¶ 158). Petitioner also argues that a person of ordinary skill in the art would have understood “that it would be advantageous to monitor and control the pressure at the pumps to avoid exceeding the maximum pressure.” *Id.* at 31–32 (citing Ex. 1004 ¶¶ 67–69; Ex. 1003 ¶¶ 159–160).

Coli discloses “the control system can regulate fracturing module 20 in delivery of treatment fluid from blender module 30 to pumps 22 for delivery to the wellbore.” Ex. 1004 ¶ 65. Coli discloses “[e]xamples of operations that can be controlled and monitored remotely from control center 40 via communications link 41 can be . . . the delivery of treatment fluid from blender module 40 to pumps 22 for delivery to the wellbore.” *Id.* ¶ 72.

Coli also discloses that, to prevent accidental over-pressures that are “quite common,” “[a] maximum pressure value [can be] set at the beginning of the operation.” Ex. 1004 ¶¶ 67, 69. Coli discloses that the maximum pressure value “is the maximum amount of power that can be sent to electric motor 21 for pump 22.” *Id.* ¶ 69.

Accordingly, for the foregoing reasons and on this preliminary record, Coli supports Petitioner’s contentions.

e. The Variable Frequency Drive Recitation 1d

Claim 1 recites “a variable frequency drive that controls a speed of the electric pump.” Ex. 1001, 21:54–55. Petitioner contends that this recitation

is disclosed by Coli. Pet. 32–33 (citing Ex. 1004 ¶¶ 11, 52, 65, 69; Ex. 1003 ¶¶ 95–99, 162–163).

Coli discloses “the electric motor can be an AC permanent magnet motor and/or a variable speed motor.” Ex. 1004 ¶ 11. Coli discloses “electric motors are controlled by variable frequency drives” in which the variable frequency drives essentially “‘tell’ the motors what they are allowed to do.” *Id.* ¶ 65. Coli discloses that its electric motor can receive electric power from a turbine generator and is coupled directly to a pump. *Id.* ¶ 52. We credit the testimony of Petitioner’s declarant that a person of ordinary skill in the art would have understood the above description to disclose “at least one variable frequency drive connected to the electric motors to control the speed of the motors.” Ex. 1003 ¶¶ 162–163.

Accordingly, for the foregoing reasons and on this preliminary record, Coli supports Petitioner’s contentions.

f. The Cabling Recitation 1e

Claim 1 recites “wherein the centralized control unit is coupled to the electric pump via one or more of cabling, Ethernet, or wirelessly.” Ex. 1001, 21:56–58. Petitioner contends that this recitation is disclosed by Coli. Pet. 33–34 (citing Ex. 1004 ¶¶ 66, 72; Ex. 1003 ¶¶ 165–167).

Coli discloses that operations “can be controlled and monitored remotely from control center 40.” Ex. 1004 ¶ 72. Coli discloses that “[e]lectric motors controlled via variable frequency drive are far safer and easier to control” in which “signals are typically sent via hardwired cable to an operator console controlled by the pump driver.” *Id.* ¶ 66.

Accordingly, for the foregoing reasons and on this preliminary record, Coli supports Petitioner's contentions.

g. The Reset Recitation 1f

Claim 1 recites "wherein the centralized control unit is further configured to reset a fault occurring in the variable frequency drive." Ex. 1001, 21:59–61. Petitioner contends that this recitation is disclosed by Rusnak. Pet. 34–35 (citing Ex. 1007 ¶¶ 20–21, 80; Ex. 1003 ¶¶ 169, 187). Petitioner contends that it would have been obvious to combine the teachings of Coli and Rusnak "in order to provide for the further controlling and monitoring of the VFD/drive unit of *Coli*" and that it would have been "reasonably expected such control and monitoring to succeed." *Id.* at 23–25 (citing Ex. 1007 ¶¶ 1, 20, 21, 80; Ex. 1003 ¶¶ 141–144).

Rusnak discloses "a variable frequency drive based controller for controlling a centrifugal pump within safety parameters by using intelligent pump system monitors." Ex. 1007 ¶ 1. Rusnak discloses that "[w]hen auto restart is enabled by the user . . . and an auto reset fault occurs, the controller 30 will stop and remain in the fault condition" and after the number of seconds in the user defined delay of the auto retry, "the controller 30 will automatically reset the faulted condition." Ex. 1007 ¶ 80.

Accordingly, for the foregoing reasons and on this preliminary record, Coli and Rusnak support Petitioner's contentions. We further determine that on this preliminary record, Petitioner has set forth reasoning with rational underpinning explaining why it would have been obvious to a skilled artisan to combine the teachings of Coli and Rusnak to arrive at the claimed subject matter.

We note that for this asserted ground, Petitioner contends that Birch “discloses a gaseous fuel compression control system for gas turbine engines, similar to the gas turbine engines coupled to generators disclosed in *Coli*.” Pet. 21 (citing Ex. 1005, 1:60–67; Ex. 1004 ¶ 10). Petitioner argues that a person of ordinary skill in the art “would have been motivated to combine the system taught by *Coli* with the gas compression control and monitoring techniques taught by *Birch* to further *Coli*’s goal of providing ‘control and computer monitoring for the entire fracturing operation . . . at a single central location.’” *Id.* (citing Ex 1004 ¶ 72; Ex. 1003 ¶ 131). We note, however, that claim 1 does not require a gaseous fuel compression control system for gas turbine engines and that Petitioner does not rely on Birch for any of the above recitations of claim 1. Petitioner, however, relies on Birch for recitations of dependent claims as discussed below.

h. Conclusion

For the foregoing reasons, based on our findings at this stage of the proceeding, we determine that Petitioner has established a reasonable likelihood of prevailing on its assertion that claim 1 would have been obvious over the combination of *Coli*, *Birch*, and *Rusnak*.

2. *Dependent Claims 2–5*

Claim 2 depends directly from claim 1 and further recites “a generator electrically connected to the electric pump to provide power to the electric pump, wherein the generator is powered by natural gas, and wherein the centralized control unit is further configured to monitor and control compression of the natural gas.” Ex. 1001, 21:62–67. Claim 3 depends directly from claim 2 and further recites “wherein the generator is a turbine

generator, and wherein the centralized control unit is further configured to monitor and control the turbine generator.” *Id.* at 22:1–4. Claim 4 depends directly from claim 1 and further recites “wherein the electric pump is a plurality of electric pumps.” Ex. 1001, 22:5–6. Claim 5 depends directly from claim 4 and further recites “a variable frequency drive that controls the plurality of electric pumps.” *Id.* at 22:7–8.

Petitioner relies on Coli to teach natural gas-powered turbine generators and a variable frequency drive that controls a plurality of electric pumps and relies on Birch to teach monitoring and controlling the pressure of a turbine generator in the manner as recited in claims 2–5. Pet. 35–39 (citing Ex. 1004 ¶¶ 38, 40, 72, Fig. 2; Ex. 1005, 1:60–67, 4:46–67, 5:38–40, Fig. 1; Ex. 1003 ¶¶ 172, 176–178, 183–186;).

Coli discloses “[o]ne or more natural gas-powered turbine generators 30.” Ex. 1004 ¶ 38. Coli discloses “[e]ach fracturing module 20 can include an electric motor 21 and a fluid pump 22 coupled thereto” in which “fracturing module 20 is operatively associated with turbine generator 30 to receive electric power therefrom.” *Id.* ¶ 40. Coli discloses that “controls and computer monitoring for the entire fracturing operation can take place at a single central location,” namely control center 40, further indicating that the turbine generators are controlled via the control center. *Id.* ¶ 72.

Birch discloses “a gaseous fuel compression and control system for a gas turbine engine” comprising

a screw compressor driven by an electric motor for compressing gaseous fuel for supply to the gas turbine engine, a power sensor for sensing the output power of the gas turbine engine, and modulating means for controlling the frequency of

electrical power supplied to the electric motor, so as to control speed of the motor, in response to a control signal derived directly or indirectly from the power sensor.

Ex. 1005, 1:58–67.

We find that Coli and Birch support Petitioner’s contentions, as summarized in § II.E.1 above.

For the foregoing reasons, based on our findings at this stage of the proceeding, we determine that Petitioner has established a reasonable likelihood of prevailing on its assertion that claims 2–5 would have been obvious over the combination of Coli, Birch, and Rusnak.

3. Independent Claim 8

Claim 8 recites a method comprising pumping fracturing fluid including a liquid component and a solid proppant into a well with an electrically powered pump, monitoring at a centralized control unit the electrically powered pump, and controlling the speed of the pump with a variable frequency drive, among other things. Ex. 1001, 22:21–35. In large part, Petitioner refers to its contentions regarding claim 1 in arguing that claim 8 would have been obvious over the combination of Coli, Birch, and Rusnak. *See* Pet. 40–41. Petitioner argues that Coli discloses using a fracturing fluid having a liquid component and a solid proppant such as sand. *Id.* (citing Ex. 1004 ¶¶ 5, 9, 35; Ex. 1003 ¶ 190).

Coli discloses that hydraulic fracturing involves pumping fluids mixed with proppants, such as sand, into a wellbore under pressure such that the sand remains in created fractures, thus propping them open and providing a path through which hydrocarbon fluids can be recovered. Ex. 1004 ¶¶ 5, 35. Thus, Coli supports Petitioner’s contentions.

For the foregoing reasons and the reasons set forth in § II.E.1 above, and based on our findings at this stage of the proceeding, we determine that Petitioner has established a reasonable likelihood of prevailing on its assertion that claim 8 would have been obvious over the combination of Coli, Birch, and Rusnak.

4. Dependent Claims 9–14

Each of claims 9–14 depends directly or indirectly from claim 8 and contains recitations substantially similar to those of claims 2–5, and part of claim 1. Ex. 1001, 22:36–54. Petitioner relies on Coli, Birch, and Rusnak as set forth in § II.E.2 above. Pet. 42–43.

For the foregoing reasons and the reasons set forth in § II.E.2 above, and based on our findings at this stage of the proceeding, we determine that Petitioner has established a reasonable likelihood of prevailing on its assertion that claims 9–14 would have been obvious over the combination of Coli, Birch, and Rusnak.

F. Asserted Obviousness Based on Coli, Birch, Rusnak, and Dykstra

Alternatively, Petitioner argues that claims 1–5 and 8–14 would have been obvious over Coli, Birch, Rusnak, and Dykstra. Pet. 44–53. In support of its showing, Petitioner relies upon the Durham Declaration. *Id.* (citing Ex. 1003). For the reasons explained below, we determine that Petitioner has established a reasonable likelihood of prevailing on its assertion that claims 1–5 and 8–14 would have been obvious over the combination of Coli, Birch, Rusnak, and Dykstra.

1. Independent Claims 1 and 8

Regarding independent claims 1 and 8, Petitioner relies on Coli, Birch, and Rusnak as set forth in § II.E above and relies on Dykstra for additional teaching of monitoring pumps and generators. Pet. 44–52. Petitioner maps Dykstra’s central control system to the recited centralized control unit. *Id.* at 44–45 (citing Ex. 1006 ¶¶ 15, 20–21, 33; Ex. 1003 ¶ 214, 48–51).⁶

Dykstra discloses a central control system for a fracturing operation that controls, coordinates, and monitors the operations of various subsystems, including a pumping grid and a power unit. Ex. 1006 ¶ 21. The pumping grid includes one or more pumps that can be powered by electricity generated in the centralized power unit using natural gas. *Id.* ¶¶ 15, 20. The power unit can include multiple, independently operated subunits that are powered by natural gas. *Id.* ¶ 15. Petitioner’s declarant testifies that an ordinarily skilled artisan would understand that each power unit may be a natural gas generator. Ex. 1003 ¶ 214. We credit this uncontested testimony of Dr. Durham. Thus, Dykstra supports Petitioner’s contentions. We further determine that Petitioner has set forth reasoning with rational underpinning explaining why it would have been obvious to a skilled artisan to include the functionality of Dykstra’s central control system in Coli’s control system. *See, e.g.*, Pet. 46 (arguing that the modification would be the “use of a known technique (*i.e.*, the monitoring and control of pumps and generators

⁶ We note that independent claim 1 does not recite a generator but that dependent claim 2, for example, recites a generator and dependent claim 3 recites the centralized control unit is configured to monitor and control a turbine generator. Ex. 1001, 21:44–22:4.

by a central control system taught by *Dykstra*) to predictably improve a known system (*i.e.*, the control center and hydraulic fracturing system taught by *Coli*) ready for improvement.”).

For the foregoing reasons and the reasons set forth in § II.E above, and based on our findings at this stage of the proceeding, we determine that Petitioner has established a reasonable likelihood of prevailing on its assertion that claims 1 and 8 would have been obvious over the combination of *Coli*, *Birch*, *Rusnak*, and *Dykstra*.

2. Dependent Claims 2–5 and 9–14

Regarding dependent claims 2–5 and 9–14, Petitioner relies on *Coli*, *Birch*, and *Rusnak* as set forth in § II.E above. Pet. 51–53.

For the reasons set forth in § II.E.2 above and based on our findings at this stage of the proceeding, we determine that Petitioner has established a reasonable likelihood of prevailing on its assertion that claims 2–5 and 9–14 would have been obvious over the combination of *Coli*, *Birch*, *Rusnak*, and *Dykstra*.

G. Asserted Obviousness Based on *Coli*, *Birch*, *Rusnak*, and *Hunt*

Petitioner argues that claims 6, 7, and 15–20 would have been obvious over *Coli*, *Birch*, *Rusnak*, and *Hunt*. Pet. 53–70. In support of its showing, Petitioner relies upon the Durham Declaration. *Id.* (citing Ex. 1003). For the reasons explained below, we determine that Petitioner has established a reasonable likelihood of prevailing on its assertion that claims 6, 7, and 15–20 would have been obvious over the combination of *Coli*, *Birch*, *Rusnak*, *Dykstra*, and *Hunt*.

1. Dependent Claims 6, 7, 15, and 16

Claim 6 depends directly from claim 2 and further recites “an emergency power off unit coupled to the centralized control unit, the electric pump, and the generator, wherein the emergency power off unit is configured to substantially immediately cut power from the generator when activated.” Ex. 1001, 22:10–14. Claim 7 depends from claim 6 and further recites “the emergency power off unit comprising an auxiliary power and a switchgear, each coupled to the generator and the centralized control unit, wherein the switchgear is responsive to a signal from the centralized control unit to open a breaker to substantially immediately cut power to the generator.” *Id.* at 22:15–20. Claims 15 and 16 depend directly from claim 9 and 15, respectively, and contain substantially the same recitations as claims 6 and 7. *Id.* at 22:55–67. Petitioner relies on the functionality of Hunt’s multifunction control module and switchgear to teach these recitations. Pet. 58–65 (citing Ex. 1008 ¶¶ 25–29, 31, 33, 34, 39, 45, 46, 49, 50, 52–54, 57–70, 73, 85, Figs. 2, 3, 11, 12, 13; Ex. 1009, 1135; Ex. 1003 ¶¶ 278, 281, 287–293, 296, 301–308, 310). Petitioner maps Hunt’s “utility grid” and “power utility power bus” for “parallel power generation” to the recited “auxiliary power” of claim 7. *Id.* at 60–61 (citing Ex. 1008 ¶ 31, Fig. 2).

Hunt discloses a power generation system that uses natural gas to fuel an engine coupled with a generator, such as a turbine. Ex. 1008 ¶ 25. The generated power can be used to power a local load, such as a pump for extracting oil from a wellhead, or supplied to a utility grid. *Id.* ¶¶ 27, 31, 37. The system includes a multifunction control module (MCM) that monitors gas flow and generates control signals to produce the desired generator

output. *Id.* ¶ 33. The MCM controls a switchgear, which is coupled to the generator power bus and the grid power bus. *Id.* ¶ 46. A switchgear control relay is connected to engage or disengage the switchgear, thus coupling or decoupling the power buses. *Id.* Hunt also discloses that “[p]ower not consumed by the local loads may be stored, and/or supplied to utility grid 265, for example, by paralleling power generation system 200 with utility grid 265” and that “[p]rior to connecting generator 215 to utility power bus 265, however, it is important to synchronize the output voltage waveforms in order to minimize the risk of power surges and potential damage to generator 215.” *Id.* ¶ 31. Thus, Hunt supports Petitioner’s contentions.

We further determine that Petitioner has set forth reasoning with rational underpinning explaining why it would have been obvious to a skilled artisan to include the functionality of Hunt’s control system and switchgear in Coli’s control system. *See, e.g.*, Pet. 59–60 (arguing that the modification would be “the application of a known technique (*i.e.*, using a control system (MCM) plus a switchgear with a gas turbine generator at a well site system) to a known system (*i.e.*, the electric hydraulic fracturing system and control system described in *Coli* that provides power using gas turbine generators) ready for improvement (*i.e.*, as described in *Hunt*, to increase protection at the well site, as well as for power supply flexibility)”).

For the foregoing reasons and based on our findings at this stage of the proceeding, we determine that Petitioner has established a reasonable likelihood of prevailing on its assertion that claims 6, 7, 15, and 16 would have been obvious over the combination of Coli, Birch, Rusnak, and Hunt.

2. Independent Claim 17

Claim 17 recites a system for centralized monitoring and control of a hydraulic fracturing operation including an electric powered fracturing fleet. Ex. 1001, 23:1–3. In large part, Petitioner refers to its contentions regarding claims 1, 6, and 15 in arguing that claim 17 would have been obvious over the combination of Coli, Birch, Rusnak, and Hunt. *See* Pet. 66–69. Petitioner argues that Coli discloses an electrically powered fracturing fleet and an operation that uses natural gas to produce electricity to improve upon prior art truck-mounted pumping systems powered by diesel motors. *Id.* at 67 (citing Ex. 1004, code (57), ¶ 7; Ex. 1003 ¶ 314).

Coli discloses “[a] scalable, electrically powered fracturing fleet” that “is provided to pump fluids for the fracturing operation, obviating the need for a constant supply of diesel fuel to the site and reducing the site footprint and infrastructure required for the fracturing operation, when compared with conventional systems.” Ex. 1004, code (57). Thus, Coli supports Petitioner’s contentions.

For the foregoing reasons and the reasons set forth in § II.E.1 above and § II.G.1 above, and based on our findings at this stage of the proceeding, we determine that Petitioner has established a reasonable likelihood of prevailing on its assertion that claim 17 would have been obvious over the combination of Coli, Birch, Rusnak, and Hunt.

3. Dependent Claims 18–20

Each of claims 18–20 depends directly from claim 17 and contains substantially the same recitations as in claims 7, 2, and 3, respectively. Ex. 1001, 21:62–22:4, 22:15–20, 24:6–17. Petitioner relies on Coli, Birch,

Rusnak, and Hunt as described in § II.E.2 above and § II.G.1 above. Pet. 69–70 (citing Ex. 1003 ¶¶ 328–330).

For the foregoing reasons and the reasons set forth in § II.E.2 above and § II.G.1 above, and based on our findings at this stage of the proceeding, we determine that Petitioner has established a reasonable likelihood of prevailing on its assertion that claims 18–20 would have been obvious over the combination of Coli, Birch, Rusnak, and Hunt.

H. Asserted Obviousness Based on Coli, Birch, Rusnak, Dykstra, and Hunt

Petitioner argues that claims 6, 7, and 15–20 would have been obvious over Coli, Birch, Rusnak, Dykstra, and Hunt. Pet. 70–72. In support of its showing, Petitioner relies upon the Durham Declaration. *Id.* (citing Ex. 1003). We have reviewed Petitioner’s brief and the evidence of record and determine that, for the reasons explained below, Petitioner has established a reasonable likelihood of prevailing on its assertion that claims 6, 7, and 15–20 would have been obvious over the combination of Coli, Birch, Rusnak, and Hunt.

Petitioner relies on Coli, Birch, Rusnak and Hunt as set forth in § II.G above and relies on Dykstra as set forth in § II.F above. Pet. 70–72 (citing Ex. 1003 ¶¶ 331–352).

For the reasons set forth in §§ II.G and § II.F above, and based on our findings at this stage of the proceeding, we conclude that Petitioner has established a reasonable likelihood of prevailing on its assertion that claims 6, 7, and 15–20 would have been obvious over the combination of Coli, Birch, Rusnak, and Hunt.

III. CONCLUSION

For the foregoing reasons, we determine that the information presented establishes a reasonable likelihood that Petitioner would prevail in showing that at least one of the challenged claims of the '992 patent is unpatentable. At this preliminary stage, we have not made a final determination with respect to the patentability of the challenged claims or any underlying factual and legal issues. *See TriVascular, Inc. v. Samuels*, 812 F.3d 1056, 1068 (Fed. Cir. 2016) (noting that “there is a significant difference between a petitioner’s burden to establish a ‘reasonable likelihood of success’ at institution, and actually proving invalidity by a preponderance of the evidence at trial”).

Accordingly, *inter partes* review is instituted as to all challenged claims and all proposed grounds of unpatentability. *See SAS*, 138 S. Ct. at 1359–60; *see also PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (interpreting the statute to require “a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”); CTPG 64 (“The Board will not institute on fewer than all claims or all challenges in a petition.”).

IV. ORDER

Accordingly, it is:

ORDERED that pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–20 of the '992 patent is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and

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37 C.F.R. § 42.4, notice is hereby given of the institution of a trial, which commences on the entry date of this decision.

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