

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

STELLAR ENERGY AMERICAS, INC.,
Petitioner,

v.

TAS ENERGY, INC.,
Patent Owner.

Case IPR2015-01214
Patent 6,470,686 B2

Before JOSIAH C. COCKS, BARRY L. GROSSMAN, and
MICHAEL L. WOODS, *Administrative Patent Judges*.

GROSSMAN, *Administrative Patent Judge*.

FINAL DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 40.73

I. INTRODUCTION

Stellar Energy Americas, Inc. (“Petitioner”) filed a Petition requesting an *inter partes* review of claims 1–11 of U.S. Patent No. 6,318,686 B1 (“the ’686 patent”). Paper 2 (“Pet.”). Patent owner, TAS Energy, Inc. (“Patent Owner”), filed a Preliminary Response. Paper 8 (“Prelim. Resp.”). We instituted an *inter partes* review of claims 1–11. Paper 13 (“Decision”). Patent Owner filed a response. Paper 17 (“Response”). Petitioner filed a Reply. Paper 23 (“Reply”). Petitioner (Paper 30) and Patent Owner (Paper 26) each filed motions to exclude evidence.

An oral hearing occurred on August 18, 2016. The record includes a transcript of the hearing. Paper 40 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This final written decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 40.73.

Petitioner has the burden of proving a proposition of unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e). For the reasons that follow, we determine Petitioner has shown, by a preponderance of the evidence, that claims 1–11 are unpatentable.

A. Related Proceedings

Petitioner states the ’686 patent was the subject of *inter partes* review No. IPR2014-00162, which was terminated following settlement. Pet. 14–15, 58; *see General Electric Company v. TAS Energy, Inc.*, No. IPR2014-00162, Paper 19 (PTAB Oct. 3, 2014) (generally cited as “the ’162 IPR”).

Petitioner also states the ’686 patent is the subject of a suit against Petitioner and others filed by Patent Owner, *TAS Energy, Inc. v. Direct Energy, Inc.*, No. 4:15-cv-00512 (S.D. Tex. filed Feb. 24, 2015). Pet. 58.

Patent Owner also lists the *TAS Energy v. Direct Energy* case as a related proceeding. Paper 10, 1. Additionally, Patent Owner identifies *TAS Energy, Inc. v. Stellar Energy Americas, Inc.*, No. 8:14-cv-3145 (M.D. Fla. Dec. 17, 2014). *Id.* This case alleges infringement of U.S. Patent No. RE44,815, issued Mar. 25, 2014 (filed Feb. 26, 2013) (“the ’815 patent”). The ’815 patent claims priority to several previous patents, including the ’686 patent and its parent, U.S. Patent No. 6,318,065.

Numerous patents claim priority to the ’686 patent, directly or indirectly. Many of these offspring patents are involved, or have been involved, in *inter partes* reviews. We identify these cases below.

Patent Owner identifies four *inter partes* review proceedings as related matters (Paper 10, 1):

IPR2015-00882 and IPR2015-00886, each case filed by Petitioner herein, seeking review of selected claims in the ’815 patent (Final Decision determining selected claims are unpatentable entered September 15, 2016);

IPR2015-01212, filed by Petitioner herein, seeking review of all the claims of U.S. Patent No. 6,318,065 (Final Decision determining claims 1, 3–6, 8, and 9 are unpatentable entered concurrently with this decision); and

IPR2015-01665, filed by Petitioner herein, seeking review of selected claims in the ’815 patent (petition denied; case terminated).

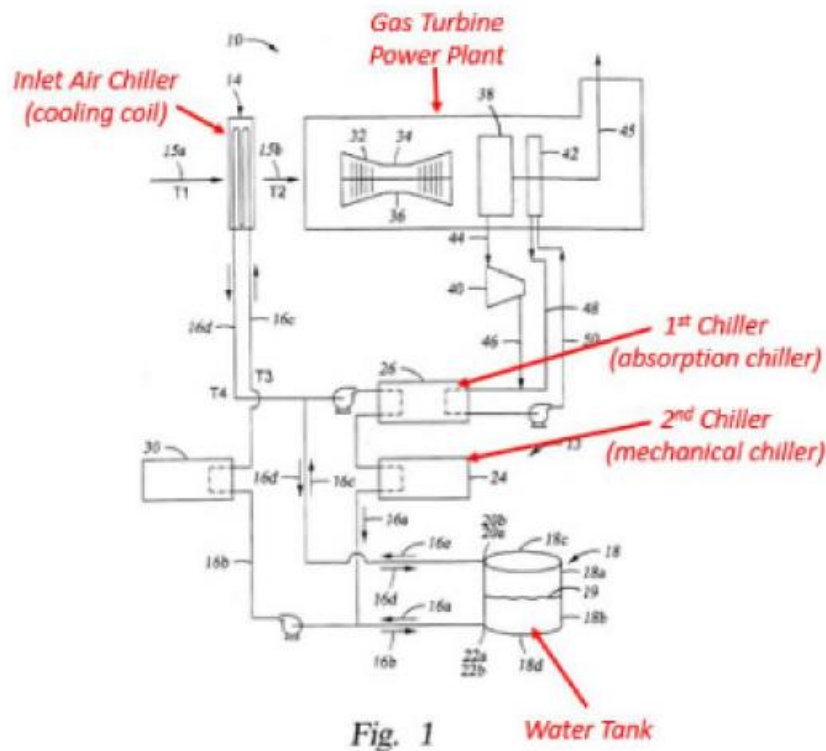
We also identify the following three related *inter partes* reviews: IPR2016-00424, 00425, and 00426. Each case was filed by Petitioner herein. Each case seeks review of selected claims of Patent No. RE44,079. Each case is pending.

Patent Owner lists as a related matter U.S. Patent Application Serial No. 13/777,820. *Id.*

B. The '686 Patent

The invention recited in the challenged claims is a method of cooling inlet air to a gas turbine. Ex. 1001, col. 1, ll. 10–11. The method includes storing chilled water in a thermal storage tank, and using the stored, chilled water to cool the inlet air to a gas turbine. *Id.* at col. 1, ll. 12–14. The method further includes a chilling water system that includes water chillers, arranged in series, which cool the stored water and provide a staged water temperature drop from about 20° F to about 34° F. *Id.* at col. 7, ll. 9–14; col. 13, ll. 62–64.

The following annotated Figure 1 from the '686 patent was provided by Petitioner (Pet. 2).



As shown in annotated Figure 1, and as described in the Specification, the claimed method includes water chillers 24, 26 arranged in series, connected to inlet air chiller 14. As explained in the Specification, water chilling system 13 may

include any number of conventional water chillers installed either in parallel or in series, but preferably with at least two chillers piped in series so as to stage the temperature drop of the water into an intermediate and a lower temperature chiller. *Id.* at col. 7, ll. 23–27. Thermal water tank 18 contains chilled water, and thus provides thermal energy storage. During a “charge cycle,” water tank 18 fills with chilled water, thus providing for thermal energy storage. Ex. 1001, col. 11, ll. 8–12. During a “discharge cycle,” chilled water from water tank 18 is delivered to inlet air chiller 14 to cool the air entering the turbine. *Id.* at col. 11, l. 60–col. 12, l. 8.

The parties and their respective experts generally refer to turbine inlet cooling (“TIC”) using thermal energy storage (“TES”) by the combined acronym of TIC/TES systems. *E.g.*, PO Resp. 1 (“gas turbine power plants implement the combination of Turbine Inlet Chilling (TIC) and Thermal Energy Storage (TES)”); “the combination of TIC and TES (‘TIC/TES’)”).

The method recited in claim 1 includes five basic elements and steps (*id.* at 9) (“method of claim 1 consists of five elements”):

1. A gas turbine power plant;
2. A series of mechanical *water* chillers;
3. A staged water temperature drop (ΔT) through the water chillers from about 20°F to about 34°F;
4. An inlet *air* chiller for the gas turbine compressor that provides a chilling water temperature rise from about 20°F to about 34°F; and
5. Thereby chilling the inlet air with the chilling water.

Id. at 9–10. Claim 10 is a method with the same steps, except that claim 10 specifies three chillers in series and states a ΔT of “up to about 34°F.” *Id.* at 11–

13.

In the Summary of the Invention, the '686 patent refers to these five elements and steps, collectively, as “a method for chilling inlet air to a gas turbine power plant.” Ex. 1001, col. 1, l. 64–col. 2, l. 24.

As discussed more fully below, there is no dispute between the parties that the five elements and steps are well known and commonly used in TIC/TES systems. The sole patentability issue before us is whether it would have been obvious to combine these known elements and steps as recited in the challenged claims.

C. Representative Claim

Claims 1–11, all the claims in the '686 patent, are challenged. Claims 1 and 10 are independent claims. Claim 1, reproduced below, is representative of the claimed invention:

1. A method of chilling inlet air to a gas turbine power plant, comprising:

a. providing a gas turbine power plant that includes at least one gas turbine and at least one compressor, and having a gas turbine inlet which receives inlet air;

b. providing a system of circulating liquid chilling water including a chilling system that includes a first mechanical chiller and a second mechanical chiller, the first and second mechanical chillers being arranged in series;

c. passing at least a portion of the liquid chilling water through the first mechanical chiller and the second mechanical chiller, the liquid chilling water passing through the first mechanical chiller being lowered to a first temperature, and the liquid chilling water passing through the second mechanical chiller being lowered to a second temperature that is lower than the first temperature, thus providing a staged liquid chilling water temperature drop, wherein the staged liquid chilling water temperature drop is from about 20° F. to about 34° F.;

d. providing an inlet air chiller, comprising a cooling coil through which liquid chilling water passes, for lowering the temperature of inlet air being fed to the compressor through heat transfer between the liquid chilling water passing through the cooling coil and the inlet air, wherein the inlet air chiller provides a liquid chilling water temperature rise of from about 20° F. to about 34° F.; and

e. chilling the inlet air by directing the liquid chilling water to the inlet air chiller and passing the liquid chilling water through the cooling coil of the inlet air chiller to make heat transfer contact between the liquid chilling water and the inlet air.

D. References Relied Upon

Petitioner relies upon the following prior art references:

Reference	Date	Exhibit Number
Mornhed <i>et al.</i> , “Innovations in District Heating and Cooling 1984-1994 and Their Economic Impact,” ASHRAE Transactions: Symposia, p. 911 (cited as “Mornhed”)	Asserted by Petitioner as dated 1995. Pet. iv, 8.	Ex. 1010
Energy Cogeneration Handbook,” Chapter 3, Polimeros (cited as “Polimeros”)	1981	Ex. 1011
ASHRAE ¹ Handbook - HVAC Systems and Equipment, Chapter 21, “Air-Cooling and Dehumidifying Coils” (cited as ASHRAE Coils”)	1996	Ex. 1013

¹ ASHRAE is the acronym for the American Society of Heating, Refrigerating and Air-Conditioning Engineers.

Andrepoint et al., “Summer Peaking Capacity Via Chilled Water Storage Cooling of Combustion Inlet Air,” Proceedings of the Am. Power Conference, Vol. 56-II (“Andrepoint”)	1994	Ex. 1014
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Petitioner also relies on the Declaration testimony of Douglas Reindl, Ph.D., P.E. (Ex. 1006).

E. The Asserted Grounds

Petitioner asserts the following grounds of unpatentability.

References	Statutory Basis	Claims challenged
Andrepoint and Mornhed	§ 103	1, 2, and 4–7
Andrepoint, Polimeros, and Mornhed	§ 103	1, 3, 10, and 11
Andrepoint, Mornhed, and ASHRAE Coils	§ 103	8 and 9

II. ANALYSIS

A. Claim Construction

Petitioner proposes specific definitions for several claim terms. Pet. 16–19. Patent Owner does not challenge Petitioner’s proposed constructions. PO Resp. 13–14. Patent Owner asserts, however, there is no need for construction of specific claim terms “because the constructions are immaterial to the Board’s institution decisions.” *Id.* at 13.

In an *inter partes* review, claim terms in an unexpired patent are interpreted according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 40.100(b); *Cuozzo Speed Techs., LLC*

v. Lee, 136 S. Ct. 2131, 2144–46 (2016). Under that standard, and absent any special definitions, we give claim terms their ordinary and customary meaning, as would be understood by one of ordinary skill in the art at the time of the invention. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Any special definitions for claim terms must be set forth with reasonable clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Only terms that are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

In our Decision to institute this proceeding, we construed several claim terms. Decision 5–8. In general, we agree with Patent Owner that the meaning of specific terms in the claim is not in dispute. PO Resp. 13 (Patent Owner “does not believe that [claim constructions] impact the outcome of this IPR”). It is helpful to our analysis, however, to adopt for purposes of this decision the construction of the phrase “gas turbine power plant,” which we repeat below, from our Decision to institute this proceeding. This phrase is relevant to Patent Owner’s arguments concerning the motivation to combine Andrepont and Mornhed. We give all other claim terms their ordinary and customary meaning, as one of ordinary skill in the art would have understood them at the time of the invention.

1. “*Gas turbine power plant*”

The Specification does not provide any special definition for the term “gas turbine power plant.” The Specification describes a conventional “gas turbine system” as one including a power turbine that is driven by “combustion gas, thereby producing an exhaust gas and useful power.” Ex. 1001, col. 1, ll. 16–21. Accordingly, we determine that the broadest reasonable construction in light of the Specification of the claim term “gas turbine power plant” is a “gas turbine power

source driven by combustion gas, thereby producing an exhaust gas and useful power.”

B. Asserted Grounds of Unpatentability

A claim is unpatentable under section 103(a) if “the differences between the subject matter sought to be patented 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 said subject matter pertains.”

35 U.S.C. § 103(a). In *Graham v. John Deere Co.*, 383 U.S. 1 (1966), the Court set out a framework for applying the statutory language of § 103:

Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.

Id. at 17–18. “While the sequence of these questions might be reordered in any particular case, the factors continue to define the inquiry that controls.” *KSR Int’l v. Teleflex Inc.*, 550 U.S. 398, 407 (2007). When present, evidence of secondary considerations must be considered in a determination of obviousness. *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1328 (Fed. Cir. 2016).

The Supreme Court made clear that we apply “an expansive and flexible approach” to the question of obviousness. *KSR*, 550 U.S. at 415. Whether a patent claiming the combination of prior art elements would have been obvious is determined by whether the improvement is more than the predictable use of prior art elements according to their established functions. *Id.* at 417. To reach this conclusion, however, it is not enough to show merely that the prior art includes

separate references covering each separate limitation in a challenged claim.

Unigene Labs., Inc. v. Apotex, Inc., 655 F.3d 1352, 1360 (Fed. Cir. 2011). Rather, obviousness additionally requires that a person of ordinary skill at the time of the invention would have selected and combined those prior art elements in the normal course of research and development to yield the claimed invention. *Id.*

As a factfinder, we also must be aware “of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning.”

KSR, 550 U.S. at 421. This does not deny us, however, “recourse to common sense” or to that which the prior art teaches. *Id.*

Against this general background, we consider the references, other evidence, and arguments on which the parties rely.

1. Scope and Content of the Prior Art

Petitioner asserts Andrepont discloses all of the elements of claim 1 except the series mechanical chillers and recited temperature ranges, which Petitioner asserts are disclosed in Mornhed. Pet. 24–33; Tr. 9:15–16² (“Andrepont has everything that’s needed to invalidate except series chilling.”).

In general, Patent Owner asserts this is “not a simple case about just series chilling. . . . [I]t is not just about swapping out a single chiller for series chilling.” Tr. 26:12–13, 16–17. According to Patent Owner, this case “involves a complex thermomechanical system with numerous interrelated components.” *Id.* at 26:14–16. Patent Owner asserts the case is “about whether someone would have been motivated to combine” the references. *Id.* at 26:17–18; PO Resp. 21 (“failure to establish a motivation to combine”). Patent Owner also asserts that “objective indicia . . . strongly support upholding” patentability. PO Resp. 21.

² Transcript citations are to “page:line.”

Before addressing these arguments of the parties, we discuss the references and related evidence.

a. Andrepont

Andrepont is a journal article that discusses various turbine inlet air cooling technologies, including several commercially available cool storage technologies. Ex. 1014, 4.³ The pros and cons of each cooling option are summarized to illustrate the types of design conditions likely to justify the economic application of each technology. *Id.*

Andrepont discloses the use of chilled water storage for combustion turbine (“CT”) inlet air cooling, including potential applications for “*utility and non-utility* CTs, for new and existing CTs, and for combined cycle as well as simple cycle CTs.” *Id.* (emphasis added). Andrepont notes that various approaches can be employed for the cooling CT inlet air, including evaporative, absorption, mechanical compression, and cool storage cooling. *Id.* Each technology has its pros and cons, which Andrepont summarizes. *Id.*

“Cool storage” cooling, also known as thermal energy storage (“TES”) (*id.*), uses a storage tank to store chilled water. *Id.* at 5 (“[C]old water is pumped from the bottom of the thermally stratified chilled water storage tank to the air coolers.”).

In the context of discussing a design for a new cool storage installation applied to existing utility simple cycle CTs, Andrepont states that “[t]he technology is of course readily applied to cogeneration or independent power producer (IPP) CTs, as well as to electric power utility CTs.” *Id.* at 5. Andrepont also states that the disclosed CT system has broad applicability and provides

³ We cite to the page number applied by Petitioner to the 9-page exhibit. Exhibit page 4 corresponds to Journal page 1345.

benefits “[w]herever there is a value to electricity which varies with the time of day (i.e. *in virtually all situations*).” *Id.* (emphasis added). Andrepont explains: “an inherent flexibility of chilled water storage is that *any water chilling technology*, including absorption chilling, *could be used* to accomplish the recharge [of the storage tank].” *Id.* at 5 (emphases added). Andrepont concludes by stating: “Cool Storage CT Inlet Air Cooling is an economical and technically proven option for CT capacity enhancement. It should not be overlooked by utilities when procuring or planning for summer peaking capacity additions.” *Id.* at 9.

b. Mornhed

Mornhed also is a journal article. Mornhed summarizes innovations in “district heating and cooling” from 1984–1994. Ex. 1010, 1. “District” cooling technology distributes cooling to multiple buildings in a defined district or geographic area rather than using individual building cooling systems. *Id.* In looking at technical innovations during the period studied, Mornhed notes “in many cases technology developed for other fields has been successfully applied” to district cooling. *Id.*

One of the innovations in district cooling summarized by Mornhed is “series chilling,” wherein two chillers “operate in series.” *Id.* at 4. “Series chilling” simply is connecting two chillers in a chain, so the chilled water has only one path to take, from one chiller to the next. Regarding series chilling, Mornhed states series chilling “will almost double the capacity of existing distribution piping” or, alternatively, “reduce pumping power to a fraction.” *Id.* Mornhed also discloses, “[t]he economic benefits of series chilling can be significantly enhanced by the installation of low-temperature chilled-water storage,” i.e., TES. *Id.*

Patent Owner's expert, Gregor P. Henze, Ph.D., P.E., testifies that the problem addressed in Mornhed "was to increase capacity without increasing the number or size of the existing pipes." Ex. 2009 ¶ 59. Dr. Henze also testifies that "Mornhed resolves this dilemma by adding a low temperature chiller in series with the existing chiller." *Id.* There is no evidence to which we have been directed, however, that this problem, to increase system capacity, and solution, to use series chilling, discussed by Dr. Henze, is dependent on the specific number, size, or length of pipes, or to the specific temperatures involved in the system. The quantum of benefits of using series chillers may depend on the details of a specific system, but these details are not recited in the challenged claims.

c. Polimeros

Polimeros discloses design criteria for central plants that facilitate energy conversion, utilization, and conservation. Ex. 1011, 1. It provides an evaluation of project alternatives and an examination of systems and their functions to achieve optimum overall design in the generation of heating, cooling, and electricity. *Id.* Polimeros discusses specifically the factors that influence chiller selection and arrangement, such as in series or parallel. *Id.* at 3. In discussing the "basic arrangement" of chillers in an air conditioning systems for buildings, Polimeros discloses specifically that "[t]wo or more chillers may be employed, either in series or in parallel." *Id.* In the context of discussing one specific embodiment, Polimeros discloses that "[o]ne chiller is used for low loads, two chillers for normal loads and three chillers for high loads." *Id.* at 10.

d. ASHRAE Coils

ASHRAE Coils is a seventeen page summary of uses, construction, selection, and performance of coils for cooling an airstream. *See, e.g.*, Ex. 1013, 2. As stated in the reference, the majority of the equipment used for cooling and

dehumidifying an airstream under forced convection incorporates one or more cooling coils assembled in a coil bank arrangement. *Id.* The reference explains that individual tubes in a coil usually are interconnected by return bends (or hairpin bend tubes) to form the serpentine arrangement of multipass tube circuits. *Id.* Coils are available with different circuit arrangements and combinations offering varying numbers of parallel water flow passes. *Id.*

2. Level of Skill

Petitioner asserts the level of ordinary skill in the art of “chilled water-based turbine inlet air cooling systems” at the relevant time “was high.” Pet. 20 (citing Ex. 1006 ¶ 12). According to Petitioner, a person of ordinary skill in this art, or relevant technology, would have been a person having: (1) a Bachelor’s degree in Mechanical Engineering or a related discipline along with 4-7 years of related industry experience, or (2) an Associate’s degree focusing on HVAC&R or equivalent training with 6 to 10 years of related industry experience. In addition, this person would have had at least two years of practical experience relating to the design and operation of chilled water systems including thermal energy storage. *Id.*

Patent Owner notes that “conspicuously absent” from Petitioner’s proposed level of skill “is any mention of the field of the invention, *i.e.*, turbine inlet cooling.” PO Resp. 15. Patent Owner overlooks Petitioner’s specific reference to “the art of *chilled water-based turbine inlet air cooling systems*” as defining the relevant technology. Pet. 20 (emphasis added). Patent Owner also notes that Petitioner’s proposed level of skill could theoretically cover a person without “*any experience*” with gas turbines. PO Resp. 15. Patent Owner does not state what significance, if any, there is to this fact. Moreover, we note that experience with the more specific technology of “gas turbine” inlet cooling is subsumed within the

broader technology of “turbine” inlet air cooling. Notwithstanding Patent Owner’s comments, Patent Owner accepts Petitioner’s proposed level of skill for this proceeding. *Id.* at 16.

The level of 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). Based on the evidence and arguments, we adopt Petitioner’s proposed level of skill.

C. Obviousness Based on Andrepont and Mornhed

Petitioner asserts that claims 1, 2, and 4–7 would have been obvious under 35 USC § 103 based on Andrepont and Mornhed. Pet. 16, 24.

1. Claim 1

Petitioner asserts Andrepont discloses all of the elements of claim 1 except the series mechanical chillers and recited temperature ranges, which Petitioner asserts are disclosed in Mornhed. Pet. 24–33. Petitioner asserts that Mornhed discusses the benefits of series mechanical chillers, which include the ability to “almost double the capacity of existing distribution piping or, alternatively, reduce pumping power.” *Id.* at 28 (*citing* Ex. 1014, 4). Petitioner concludes it would have been obvious to modify Andrepont to use two mechanical chillers in series to obtain the advantages of series chillers described in Mornhed. *Id.* at 29 (*citing* Ex. 1006 ¶¶ 44–45).

Petitioner also concludes that the claimed temperature range “are obvious as a mere design choice” based on the disclosure in Mornhed. *Id.* at 30.

Based on the evidence and arguments of the parties, we agree with Petitioner that Andrepont discloses all the elements of claim 1 except series chillers and the specific temperature range recited. We also agree that Mornhed discloses series chillers.

Petitioner’s proposed combination of the references is that it would have been obvious to one of ordinary skill in the art “to combine *or replace* the chiller package of Andrepont with the series arrangement of the chillers of Mornhed, in order to achieve the capacity, reduced pumping power, and/or economic benefits explained by Mornhed.” Pet. 29 (citing Ex. 1006 ¶¶ 44–45); Reply 4 (“[T]he Petition expressly asserts that a person of ordinary skill could ‘combine *or replace*’ the large, field-erected chiller in Andrepont with conventional chillers arranged in series.”). Petitioner made clear that the proposed modification of Andrepont is to “swap out the C-1 chiller package of Andrepont, take it out, and substitute in series chilling as described in Mornhed, and it is a simple substitution.” Tr. 18:9–13.

Patent Owner asserts that Mornhed focuses on “district” cooling, which, according to Patent Owner, “is a different field of technology from turbine inlet cooling,” which is the technological field of the claimed invention. PO Resp. 18.

Patent Owner asserts that turbine inlet cooling (“TIC”) is designed specifically for cooling gas turbine inlet air “which represents a known load in a single location.” PO Resp. 18 (citing Ex. 2009 ¶ 36). Patent Owner asserts that “district” cooling is intended to cool “a large number of buildings over a large geographic area, with each building having a number of different (and varying) cooling loads.” *Id.* Patent Owner does not cite, however, any limitation in the challenged claims that limits the claims to a known load in a single location. Moreover, Patent Owner acknowledged that the challenged claims “cover district cooling.” Tr. 28:22–24 (“I think the claims, in fairness, as construed by the Board in this case would cover district cooling.”). At the hearing, Patent Owner also stated:

we may take issues in other proceedings with the scope of the claims, but we didn't take issue with the definition of gas turbine that was

proposed.^[4] So, I do think, as constituting and construing these IPRs^[5], that they fairly would encompass district cooling.

Tr. 28:24–29:3. Thus, we are not persuaded that a person of ordinary skill would ignore Mornhed’s disclosure of series chilling in considering improvements to capacity and pumping power of a TIC/TES system, as disclosed in Andrepont.

Additionally, Patent Owner made clear at the hearing that it was *not* arguing that Mornhed was “nonanalogous art.” *Id.* at 31:16–32:2 (“[I]t’s not a nonanalogous art argument.”). Patent Owner also acknowledged that “there’s a lot of same/similar technology being used in these fields.” *Id.* at 31:22–24. Indeed, Mornhed states that the district or distributed cooling systems discussed in his article rely on gas turbine power sources. Mornhed discloses that improvements in gas turbine technology have greatly enhanced their mechanical efficiency and, where natural gas fuel is available, gas turbines are today increasingly replacing steam turbines in cogeneration applications. Ex. 1010, 2.

Patent Owner’s primary argument against the proposed combination of references is that Petitioner has “failed to provide a valid motivation to combine the references.” PO Resp. 30. Patent Owner also asserts that “objective indicia” “strongly support” patentability of the claims. *Id.* at 21. We discuss these two issues below.

a. Rationale

Petitioner’s rationale for the proposed modification of Andrepont is that “Mornhed makes clear [the] benefits of series chilling.” Pet. 29. These benefits

⁴ The definition of “gas turbine power plant” that was proposed in our Decision to institute this trial has been adopted in this Final Decision. See Section II(A)(1) above.

⁵ The hearing was a consolidated hearing for IPR2015-01212 and IPR2015-01214, which is a related case.

are an increase in the capacity of existing distribution piping or, alternatively, reduce pumping power. Ex. 1010, 4. Dr. Reindl testifies that the specific benefits of higher operating temperature differentials disclosed in Mornhed for series chilling also can be achieved by using the series chillers of Mornhed for the chiller package C-1 in Figure 2 of Andrepont. Ex. 1006 ¶ 44. Dr. Reindl opines that:

Because of the known advantages of series mechanical chillers . . . , as specifically disclosed in Mornhed, it would be obvious to one of ordinary skill in the art to modify Andrepont's chiller package C-1, shown in Figure 2, to use at least two mechanical chillers in series. This is particularly the case when Andrepont notes: "an inherent flexibility of chilled water storage is that any water chilling technology, including absorption chilling, could be used to accomplish the recharge."

Id.

Regarding the specific temperature differential recited in claim 1, Mornhed discloses a staged 20°F temperature drop across the chiller system shown in Figure 4, from 54°F to 34°F (Ex. 1010, Figure 4), which is within the range recited in claim 1 (20–34°F).

Dr. Reindl testifies that "[t]he design of any chilled water system involves selecting appropriate equipment to achieve a desired operating condition." Ex. 1006 ¶ 32. According to Dr. Reindl, "[t]o achieve a high temperature drop across a chiller system (*i.e.*, 20°F or greater), one of ordinary skill in the art would know to select an appropriate commercially available chiller system (*i.e.*, series mechanical chillers) and an appropriate commercially available air chiller system (*i.e.*, cooling coils)," such as disclosed in Andrepont and Mornhed. *Id.*

Petitioner's expert, Dr. Reindl, and Patent Owner's expert, Dr. Henze, agree that a person of ordinary skill, in the relevant period, would have known that series water chillers were a design option for turbine inlet cooling using thermal energy storage. *E.g.*, Ex. 1006 ¶ 31 ("(1) series mechanical chillers, (2) a drop of 20-34°F

across the series chillers, and (3) a respective rise of 20-34°F across the inlet air chiller (air cooling coil) . . . were well-known”); Ex. 1017, 73:16–19 (in a TIC/TES system, series chillers would be “an option that a designer in 1998 could consider”).

Dr. Henze, however, testifies that, in his opinion, the impacts of adding a second or third chiller to Andrepont’s system would far outweigh whatever minor benefit, if any, that would be achieved.” Ex. 2009 ¶ 66. According to Dr. Henze, “adding additional chillers would cost millions of dollars in upfront capital costs.” *Id.* Dr. Henze does not state any facts or data to support these costs. 37 C.F.R. § 42.65(a) (“Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.”).

Patent Owner asserts that series chilling as disclosed in Mornhed is used to provide more cooling capacity using “existing piping network.” PO Resp. 39. Patent Owner does not direct us to any claim limitation that relates to the “piping network” of the system. Moreover, as admitted by Patent Owner, the claims cover “district cooling,” which is the specific context of the Mornhed disclosure.

Patent Owner also argues that using series chilling in the Andrepont system results in: an impractical and unpredictable thermal energy storage tank; an increase in required chilling power; an increase in required pumping power; and significantly increased cost and complexity of the overall system. *Id.* at 34–35 (citing Ex. 2009 ¶ 46). Again, however, Patent Owner does not direct us to persuasive evidence why a person of ordinary skill seeking to enhance system capacity of a TIC/TES turbine power plant, as disclosed in Andrepont, would ignore Mornhed’s disclosure of series chilling.

We note that claim 1 does *not* recite any specific type of chillers arranged in series, or details of the storage tank. There is no persuasive evidence that merely

using series chillers in the Andrepont system makes the Andrepont storage tank “impractical and unpredictable.” Moreover, Patent Owner’s argument that adding series chilling to the Andrepont system would result in increased pumping power is directly contrary to the disclosure in Mornhed that series chilling can “reduce pumping power” (Ex. 1010, 4).

Patent Owner’s arguments of increased cost and complexity appear to be based on the assumption that the low temperature chiller in Mornhed will be physically added to the existing Andrepont system. PO Resp. 58 (“[I]f the low temperature chiller from Mornhed were placed in series with the chiller of Andrepont, it would lead to an impractical thermal energy storage tank.”) (citing Ex. 2009 ¶ 49). The obviousness inquiry, however, does not ask “whether the references could be physically combined but whether the claimed inventions are rendered obvious by the teachings of the prior art as a whole.” *In re Etter*, 756 F.2d 852, 859 (Fed. Cir. 1985) (en banc); *see also In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (“The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art.”). Furthermore, “[a] reference must be considered for everything it teaches by way of technology and is not limited to the particular invention it is describing and attempting to protect.” *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985). Here, we conclude that Mornhed’s detailed disclosure of the known uses and benefits of serial chilling in district cooling would have suggested to a skilled artisan that those uses and benefits would have been applicable in the TIC/TES system disclosed in Andrepont. Thus, we are persuaded that the evidence establishes a motivation to combine the references.

b. Objective Indicia

The objective indicia of non-obviousness play an important role as a guard against the statutorily proscribed hindsight reasoning in the obviousness analysis. *WBIP*, 829 F.3d at 1328. “[E]vidence of secondary considerations may often be the most probative and cogent evidence in the record.” *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538 (Fed. Cir. 1983). “[E]vidence rising out of the so-called ‘secondary considerations’ must always when present be considered en route to a determination of obviousness.” *Id.* “For objective evidence . . . to be accorded substantial weight, its proponent must establish a nexus between the evidence and the merits of the claimed invention.” *In re Kao*, 639 F.3d 1057, 1068 (Fed. Cir. 2011) (quoting *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed. Cir. 2010)) (emphasis omitted) (internal quotation marks omitted).

Patent Owner generally argues that “objective indicia” establishes that the claimed invention “would not have been obvious.” PO Resp. 21–29. According to Patent Owner, a database of the Turbine Inlet Cooling Association (“TICA”) (Ex. 2007) establishes patentability of the claimed invention. PO Resp. 25 (“This objective evidence - unaffected by hindsight bias - establishes that the claimed system was not obvious.”).

The version of the TICA database that is reflected in Exhibit 2007 is a “members only” version that contains information that is not available to the general public. Ex. 2008 ¶ 6.⁶ A public version of the TICA database is in the record as Ex. 2014. *Id.* at ¶ 7. According to Patent Owner, the TICA database establishes that “the evidence clearly shows that Mr. Pierson’s chilled-water TIC/TES caused an absolute shift in the TIC/TES market in *standalone* utility gas

⁶ Mr. Pierson refers in error to the TICA database as “Ex. 2004.” Ex. 2008 ¶ 2. The TICA database is Ex. 2007.

turbine power plants from a very strong preference for ice storage and ammonia refrigeration to the [Patent Owner's] patented system.” PO Resp. 25 (citing Ex. 2009, Henze ¶ 84) (emphasis added). We disagree.

There is no persuasive evidence or argument that claim 1 is limited to a “standalone” gas power plant. Also, Patent Owner admitted that there is no nexus between the TICA database and the challenged claims. Tr. 50:3–7 (“I agree that the TICA database doesn't teach it. It doesn't speak to series chilling. So, the TICA database, standing alone, doesn't address the nexus. It addresses part of it because it has chilled water, but it doesn't address the series chilling.”). Based on this admission and the evidence discussed above, there is no persuasive nexus between the TICA database and the claimed invention, and thus no persuasive objective indicia of patentability.

c. Conclusion for Claim 1

Andrepoint discloses all the elements of claim 1, except series chilling and the recited ΔT . Mornhed discloses series chilling and the ΔT . Mornhed also suggests the motivation for using series chilling—series chillers will almost double the capacity of existing distribution piping or, alternatively, reduce pumping power to a fraction. Ex. 1010, 4. Mornhed also discloses that low-temperature chilled-water storage enhances the economic benefits of series chilling. *Id.*

We determine that a preponderance of the evidence supports a determination that one of ordinary skill in the art would have been motivated to modify Andrepoint to use water chillers in series rather than a single water chiller given Mornhed's disclosure of the benefits of series chillers.

As the Supreme Court made clear, in considering whether an invention would have been obvious, often it will be necessary for a court to look to interrelated teachings of multiple patents and the effects of demands known to the

design community or present in the marketplace. *KSR*, 550 U.S. at 418. When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one.

KSR does not require that a combination only unite old elements without changing their respective functions. *KSR*, 550 U.S. at 416. Instead, *KSR* teaches that “[a] person of ordinary skill is also a person of ordinary creativity, not an automaton.” *Id.* at 421. We are persuaded that a person of ordinary creativity would have considered it obvious to select the appropriate equipment to achieve a desired operating condition. *KSR* explains that in many cases a person of ordinary skill “will be able to fit the teachings of multiple patents together like pieces of a puzzle.” *Id.* at 420. The rationale of *KSR* does not support a theory that a person of ordinary skill can only perform combinations of a puzzle element A with a perfectly fitting puzzle element B. *ClassCo, Inc. v. Apple, Inc.*, 838 F.3d 1214, 1219 (Fed. Cir. 2016). Regardless of Mornhed’s primary purpose, the assertion that a person of ordinary skill in turbine inlet cooling technology would ignore the benefits of series chillers disclosed in Mornhed because Mornhed may use this technology differently than the claimed invention is not persuasive.

2. *Dependent claims*

a. *Claim 2*

Claim 2, dependent from claim 1, requires a thermal water storage tank and the step of passing a portion of the liquid chilling water from the second mechanical chiller to the thermal water storage tank. Ex. 1001, col. 14, ll. 12–15.

Petitioner asserts that the cited references disclose the claimed thermal water tank. Pet. 33–34.

Patent Owner does not address separately in its Response the merits of any of the challenged dependent claims.

Mornhed discloses using a thermal water tank and passing a portion of the liquid chilling water from the second mechanical chiller to the thermal water storage tank. *See* Ex. 1010, Fig. 4. This disclosure provides an adequate reason and rationale as to why a person of ordinary skill and creativity would have combined the various elements from the cited references to obviate the invention in claim 2.

Based on the analysis above, we determine that a preponderance of the evidence supports a determination that claim 2 would have been obvious in view of Andrepont and Mornhed.

b. Claims 4 and 5

Claim 4, dependent from claim 1, requires the liquid chilling water passing through the *first mechanical chiller* to be lowered from a high temperature of about 54°F. to about 65°F. to a low temperature of about 40°F. to about 48°F. Ex. 1001, col. 14, ll. 20-23. Claim 5, dependent from claim 1, repeats the same limitation recited in claim 4 regarding the first mechanical chiller and further requires the liquid chilling water passing through the *second mechanical chiller* to be lowered from a high temperature of about 40°F. to about 48°F. to a low temperature of about 34°F. to about 40°F. *Id.* at col. 14, ll. 24-30.

Petitioner asserts that the temperature ranges recited in claims 4 and 5 reflect mere design choices that would have been obvious to a person of ordinary skill in the art. Pet. 39, 40. Petitioner also asserts that Mornhed discloses the claimed temperature ranges. *Id.*

Mornhed discloses mechanical chillers in series to achieve a staged temperature drop. Ex. 1010, p. 4, Fig. 4. The explicit example provided in the reference is a two-stage temperature drop of 20°F. *Id.* The first stage is a temperature drop from 54 to 42°F.; the second stage is a temperature drop from 42

to 34°F. *Id.* This staged temperature drop is within the range claimed. Patent Owner has not directed us to any disclosure in the Specification, or to other evidence that establishes unexpected properties in the range claimed, or that the prior art taught away from the range claimed. *See In re Geisler*, 116 F.3d 1465, 1469 (Fed. Cir. 1997). Thus, the references provide an adequate reason and rationale as to why a person of ordinary skill and creativity would have selected the claimed parameters to meet operational needs and requirements.

Based on the analysis above, we determine that a preponderance of the evidence supports a determination that claims 4 and 5 would have been obvious in view of Andrepont and Mornhed.

c. Claim 6

Claim 6, dependent from claim 1, requires passing the chilling water through a single cooling coil of the air inlet chiller to chill the inlet air temperature to a second inlet air temperature that is lower than the first temperature. Ex. 1001, col. 14, ll. 31-35.

Petitioner asserts that Mornhed discloses single stage coiling coils. Pet. 41–42. Petitioner concludes that, in view of this explicit disclosure, claim 6 would have been obvious. *Id.* at 42.

Mornhed discloses that combustion air cooling can be provided by using a chilled-water or refrigerant coil in the combustion air intake. Ex. 1010, 2, col. 2. Mornhed states that combustion air cooling will alleviate the problem of gas turbine derating, i.e., reduced performance, at high ambient temperatures when the gas turbine electric power is most valuable. This disclosure provides an adequate reason and rationale as to why a person of ordinary skill and creativity would have used combustion air cooling of Mornhed with the system in Andrepont.

Based on the analysis above, we determine that a preponderance of the evidence supports a determination that claim 6 would have been obvious in view of Andrepont and Mornhed.

d. Claim 7

Claim 7, dependent from claim 1, requires the inlet air to be lowered from a high temperature of about 80° F to about 155° F. to a low temperature of about 45°F to about 55°F. Ex. 1001, col. 14, ll. 35–37. These are common ranges of ambient air temperatures and reduced-temperature inlet air for enhancing gas turbine operation. Ex. 1006 ¶ 25. As explained in Andrepont, ambient inlet air, at temperatures of 90 to 100°F. or more, is desirably cooled to the 40 to 50°F. range, cool enough to achieve substantial CT capacity increases, but not so cool as to initiate potentially damaging icing within the CT inlet. Ex. 1014, 4.

Based on the analysis above, we determine that a preponderance of the evidence supports a determination that claim 7 would have been obvious in view of Andrepont and Mornhed.

D. Obviousness Based on Andrepont, Mornhed, and Polimeros

Petitioner asserts that claims 1, 3, 10, and 11 would have been obvious based on Andrepont, Mornhed, and Polimeros. Pet. 16, 39.

Patent Owner does not specifically address this asserted ground of unpatentability. Patent Owner relies on the same analysis discussed above regarding lack of a rationale to support Petitioner's position, and objective indicia of patentability to support Patent Owner's position.

As discussed above, Polimeros discloses different arrangements of mechanical chillers in series. Ex. 1011, 3, 10, 12, Figs. 3–1, 3–8, 3–10. Polimeros discloses three chillers in series (*id.* at 10, 12, Fig. 3-8) and explains that “[o]ne chiller is used for low loads, two chillers for normal loads and three chillers for

high loads.” *Id.* at 10.

Under this ground for claim 1, Petitioner relies on Andrepont for the basic elements of the claimed method; relies on Polimeros for chillers in series; relies on both Polimeros and Mornhed for the claimed range for the drop in water temperature across the chillers; and relies on Mornhed for the claimed range for the rise in water temperature from heat transfer at the inlet air chiller. Pet. 39–46. Similar to the rationale provided for the proposed combination of Andrepont and Mornhed against claim 1 discussed above, Petitioner asserts that the “inherent flexibility” described in the references (*id.* at 42) and finding “optimum workable ranges” for temperatures would have been obvious. Petitioner relies on the testimony of Dr. Reindl for support. *E.g.*, *id.* at 41, 42, 44, and 45.

Claim 3, dependent from claim 1, adds a third mechanical chiller and requires the step of passing chilling water through the third mechanical chiller after passing the liquid chilling water through the first and second mechanical chillers, and prior to passing the chilling water through the cooling coil of the air chiller.

Independent claim 10 is similar to claim 1 but adds a third mechanical chiller arranged in series with the first and second chillers, and provides a three-stage temperature drop “up to about 34°F.” As noted above, Polimeros discloses the use of three chillers in series.

Claim 11, dependent from claim 10, requires passing chilling water through the first and second mechanical chillers, thereafter passing chilling water through the cooling coil of the inlet air chiller, and “recycling” the chilling water to the first mechanical chiller.

Petitioner asserts Andrepont discloses that chilling water “is ultimately ‘recycled’ to the chiller package C-1 after passing through the air coolers.” Pet. 54 (citing Ex. 1014, Fig. 2). Figure 2 in Andrepont is a flow schematic of a

combustion turbine inlet air cooling system, with water processed by the chiller on each cycle. Polimeros and Mornhed also disclose that water is processed through the first chiller on each cycle of the disclosed system. Neither Petitioner nor Patent Owner asserts that claim 11 requires that the third chiller is skipped or bypassed. For purposes of this Decision, we do not interpret claim 11 as requiring skipping or bypassing the third mechanical chiller. We agree with Petitioner's position.

Patent Owner's arguments concerning lack of rationale and objective indicia have been discussed above in the context of the ground of unpatentability based on Andrepont and Mornhed.

Based on the analysis above, including our analysis of the asserted ground of unpatentability relying on Andrepont and Mornhed, we determine that a preponderance of the evidence supports a determination that claims 1, 3, 10, and 11 would have been obvious in view of Andrepont, Mornhed, and Polimeros.

E. Obviousness Based on Andrepont, Mornhed, and ASHRAE Coils

Petitioner asserts claims 8 and 9 are unpatentable under 35 U.S.C. § 103(a) over the combination of Andrepont and Mornhed, as explained above, in view of ASHRAE Coils. Pet. 54.

Patent Owner does not specifically address this asserted ground of unpatentability. Patent Owner relies on the same analysis discussed above regarding lack of a rationale to support Petitioner's position, and objective indicia of patentability to support Patent Owner's position.

Claim 8, dependent from claim 1, requires passing liquid chilling water through a multi-pass cooling coil of the inlet air chiller to chill the inlet air. Claim 9, also dependent from claim 1, repeats all the method steps and limitations of claim 8 and further adds the limitation that the multi-pass cooling coil has four passes.

According to Petitioner, “multi-pass cooling coils” were “conventional equipment.” Pet. 55 (citing Ex. 1013, 2). Regarding claim 8, Petitioner asserts “it would have been obvious to one of ordinary skill in the art to use the multipass tube circuit of ASHRAE Coils with the air cooler disclosed by Andrepont, in order to use a conventional and available air cooler.” *Id.* at 55–56 (citing Ex. 1006 at ¶¶ 77–84). Regarding claim 9, Petitioner asserts “Figure 1 of ASHRAE Coils discloses a ‘double serpentine 8 row’ cooling coil with four passes.” *Id.* at 57 (citing Ex. 1013 at 2). Petitioner states that the rationale for the proposed combination of references is that it requires merely simple substitution of one known element (Andrepont’s air cooler) for another (ASHRAE Coil’s multipass tube circuit) to obtain predictable results as explained by ASHRAE Coils. *Id.* at 56, 57. We agree with Petitioner’s position.

Patent Owner’s arguments concerning lack of rationale and objective indicia have been discussed above in the context of the ground of unpatentability based on Andrepont and Mornhed.

Based on the analysis above, including our analysis of the asserted ground of unpatentability relying on Andrepont and Mornhed, we determine that a preponderance of the evidence supports a determination that claims 8 and 9 would have been obvious in view of Andrepont, Mornhed, and ASHRAE Coils.

F. Motions to Exclude

Petitioner moves to exclude Exhibit 2013, which is a summary of the TICA Database Summary (Ex. 2007). Paper 30. We do not rely on Ex. 2007. Accordingly, we dismiss Petitioner’s motion to exclude as moot.

Patent Owner moves to exclude Exhibit 1019, which is an ASHRAE Design Guide. Paper 26. We do not rely on Ex. 1019. Accordingly, we dismiss Patent Owner’s motion to exclude as moot.

Petitioner (Paper 38) and Patent Owner (Paper 39) each move to exclude certain demonstrative slides used at the hearing. As set out in our Order regarding oral argument in this case: “[d]emonstratives are aids in support of oral argument; they are not evidence in the review. They will not become part of the official record of this review other than via the transcript of oral argument.” Paper 35, 3. Because the demonstrative slides are not evidence in this case, and because we do not rely on any of the slides in reaching our decision in this case, the objections and motions to exclude the demonstrative slides are moot. The panel acts as both a gatekeeper of evidence and as an evaluator of evidence. Rather than excluding demonstratives that are allegedly confusing, misleading, and/or irrelevant, we simply do not rely on them or give them no probative weight in our analysis, as we do here.

III. CONCLUSION

Based on the evidence and arguments in this proceeding, Petitioner has demonstrated, by a preponderance of the evidence, that claims 1–11 are unpatentable under 35 U.S.C. § 103(a) based on the references asserted and discussed in this decision.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, based on Petitioner’s showing by a preponderance of the evidence, claims 1–11 of Patent No. 6,470,686 B2 are unpatentable.

This is a final decision. Parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

Case IPR2015-01214
Patent 6,470,686 B2

FOR PETITIONER:

Steven J. Schwarz
Tamatane J. Aga
VENABLE LLP
sjschwarz@venable.com
tjaga@venable.com

FOR PATENT OWNER:

Jonathan M. Pierce
Derek V. Forinash
PORTER HEDGES LLP
jpierce@porterhedges.com
dforinash@porterhedges.com