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Paper 41
Entered: September 15, 2016

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

STELLAR ENERGY AMERICAS, INC.,
Petitioner,

v.

TAS ENERGY INC.,
Patent Owner.

Cases[1] IPR2015-00882 and IPR2015-00886
Patent RE44,815

Before PHILLIP J. KAUFFMAN, WILLIAM V. SAINDON, and DONNA M. PRAISS, *Administrative Patent Judges.*

PRAISS, *Administrative Patent Judge.*

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

[1] This Final Decision addresses issues that are common to each of the above-referenced cases. We, therefore, issue a single Final Decision for entry in each case.

I. BACKGROUND

Stellar Energy Americas, Inc. ("Petitioner"), filed a Petition in IPR2015-00882 requesting an *inter partes* review of claims 8–20 and 53–56 of U.S. Patent No. RE44,815 ("the '815 patent") pursuant to 35 U.S.C. §§ 311–319. IPR2015-00882 (Paper 2, "882 Pet."). Petitioner also requested an *inter partes* review of claims 21–33, 66, and 71–75 of the '815 patent in IPR2015-00886 (Paper 2, "886 Pet."). TAS Energy Inc. ("Patent Owner") filed a preliminary response in each proceeding. IPR2015-00882 (Paper 9); IPR2015-00886 (Paper 9). We instituted trials on all of the challenged claims. IPR2015-00882 (Paper 10, "882 Dec. on Inst."); IPR2015-00886 (Paper 11, "886 Dec. on Inst.").

Although Petitioner proposed eleven grounds of unpatentability in the 882 Petition and five grounds in the 886 Petition, we instituted trials only on the following grounds:

Claim(s)	References	Basis
8, 9, 14–20, and 53–56	Andrepont[2] and Clark[3]	§ 103(a)
10 and 12	Andrepont, Clark, and Mornhed[4]	§ 103(a)

[2] John S. Andrepont and Sandra L. Steinmann, "Summer Peaking Capacity Via Chilled Water Storage Cooling of Combustion Turbine Inlet Air," Proceedings of the American Power Conference: 56th Annual Meeting Chicago, 1345–1350 (1994) ("Andrepont") (Ex. 1014).
[3] Clark et al., "The Application of Thermal Energy Storage for District Cooling and Combustion Turbine Inlet Air Cooling," Official Proceedings Eighty-Ninth Annual Conference of the International District Energy Association, 85–97 (1998) ("Clark") (Ex. 1019).
[4] Goran Mornhed and Thomas R. Casten, "Innovations in District Heating and Cooling 1984–1994 and their Economic Impact," preprinted for

Claim(s)	References	Basis
11	Andrepont, Clark, and ASHRAE[5]	§ 103(a)
13	Andrepont, Clark, and Trane Product Sheet[6]	§ 103(a)
21–23	Andrepont and Mornhed	§ 103(a)
24–26, 28–33, and 66	Andrepont, Mornhed, and Clark	§ 103(a)
27	Andrepont, Mornhed, and Trane Product Sheet	§ 103(a)
71–75	Andrepont and Trane Product Sheet	§ 103(a)

882 Dec. on Inst. 20; 886 Dec. on Inst. 24.

During trial, Patent Owner filed in each proceeding an identical Patent Owner Response (Paper 16,[7] "PO Resp.") relying on the Declaration of Gregor P. Henze (Ex. 2012). Petitioner responded by filing in both proceedings an identical Reply (Paper 21, "Pet. Reply") relying on the Declarations of Douglas Reindl (Ex. 1012; Ex. 1112).[8] A transcript of the

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inclusion in ASHRAE TRANSACTIONS 1995, v. 101, Pt. 1 (1995) ("Mornhed") (Ex. 1016).

[5] ASHRAE, Chap. 12 "Hydronic Heating and Cooling System Design," 1992 ASHRAE Handbook: Heating, Ventilating, and Air-Conditioning Systems and Equipment, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Inch-Pound Ed., 12.1–12.18 (1992) (Ex. 1020).

[6] Trane Product Sheet, "Trane Duplex Centrifugal Water Chillers CDHF (60 Hz):1500–2800 Tons, CDHG (50 Hz): 1200–2500 Tons," Product data sheet CTV-S-49 (1992).

[7] Citations to the record hereon are to IPR2015-00882 unless otherwise indicated.

[8] Petitioner follows the convention of numbering its exhibits in IPR2015-00882 as 1001 *et seq*. and in IPR2015-00886 as 1101 *et seq*.

oral hearing held on May 4, 2014, is included in the record. (Paper 39, "Tr.").

Also during trial, Patent Owner moved to exclude Exhibits 1028/1128, 1029/1129, and 1030/1130. (Paper 24, "PO Motion"). Petitioner opposed the motion (Paper 29) and Patent Owner replied (Paper 33). Petitioner also moved to exclude Exhibits 2007, 2009, and 2011. (Paper 26, "Pet. Motion"). Patent Owner opposed the motion (Paper 31) and Petitioner replied (Paper 32).

We have jurisdiction under 35 U.S.C. § 6(c). This final written decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

For the reasons that follow, we determine that Petitioner has met its burden to prove by a preponderance of the evidence that claims 8–33, 53–56, 66, and 71–75 of the '815 patent are unpatentable.

A. Related Proceedings

The '815 patent was asserted in a complaint filed in the U.S. District Court for the Middle District of Florida in *TAS Energy Inc. v. Stellar Energy Americas, Inc.*, No. 8:14-cv-3145-T-30MAP. 882 Pet. 1, 59; 886 Pet. 52–53; Ex. 1026. It is also the subject of pending instituted *inter partes* review proceedings IPR2016-00294 and IPR2016-00335 commenced by Petitioner.

U.S. Patents 6,318,065, 6,470,686, and RE44079, which are related to the '815 patent through continuation applications, are the subject of pending instituted *inter partes* review proceedings IPR2015-01212, IPR2015-01214, IPR2016-00424, IPR2016-00425, and IPR2016-00426, all commenced by Petitioner.

B. The ’815 patent (Exhibit 1001)

The ’815 patent “relates broadly to cooling inlet air to a gas turbine.” Ex. 1001, 1:27–28. Figure 1 below is a schematic of a turbine inlet air cooling system.

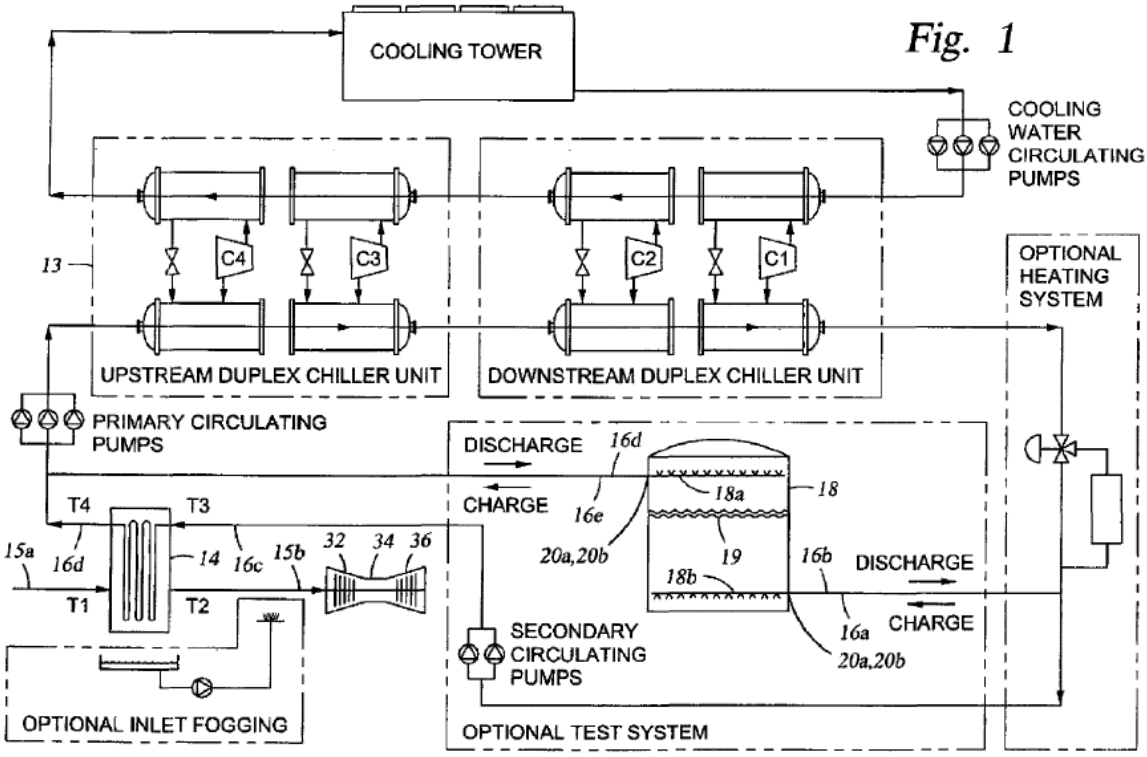


Figure 1 above depicts the system where “chilled compressor feed air **15**b . . . introduced to a conventional gas turbine (GT) compressor **32**, where it is compressed, combined with fuel and burned in a conventional combustor **34** to produce a combustion gas that can be used for driving the power turbine **36**.” *Id.* at 10:36–41. The system has “an air chiller **14**, e.g., a conventional cooling coil, for lowering the temperature of [the] inlet air, shown schematically by arrow **15**a, from ambient temperature . . . to provide compressor feed air, shown schematically by arrow **15**b, having some lower temperature.” *Id.* at 10:9–21.

Thermal water storage tank 18 has a thermocline 19, shown in Figure 1 as a thin band. *Id.* at 14:1–2. "The thermocline **19** separates the cold water in the bottom portion **18**b of the tank **18** from the warmer water in the top portion **18**a. The bottom portion **18**b of the tank **18** is that part of the tank **18** that is below the thermocline **19**, and the top portion **18**a of the tank **18** is that portion of the tank **18** that is above the thermocline **19**." *Id.* at 14:2–7. "[T]he thermocline will move up and down during the charge and discharge cycles respectively." *Id.* at 14:7–9. The charge and discharge cycles are described as follows:

> During the water chilling or "charge" cycle, the average temperature of the water in the tank is lowered by introducing lower temperature chilling water **16**a to the bottom of the tank **18**b from the water chilling system **13**. In an advantageous aspect of this invention, this charge cycle will typically be during the night-time or "off-peak" hours. . . . Generally, the charge cycle should be performed when the need for useful power from the gas turbine system is at a minimum, i.e. off-peak periods, while the discharge cycle should be performed when the need for useful power is at a maximum, i.e. on-peak periods. . . . During the charge cycle, warm water **16**e is pulled from the top **18**a of the tank **18** and pumped through the water chilling system **13**. Chilled water **16**a is introduced back to the bottom portion **18**b of the tank. The water level in the tank **18** does not change, only the proportion of warm water **16**e to chilled water **16**a changes as the tank becomes progressively chilled.

Id. at 15:6–48.

> Water chilling by 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.

> This saves power on the upstream chiller and makes the system more efficient.

Id. at 11:18–25. Sequential chilling of the circulating water may be accomplished by two different water chillers or a single duplex chiller with sequentially positioned compressors. *Id*. at 18:60–64. "[A] 'duplex chiller' is a mechanical device with at least one inlet and at least one outlet where the temperature of water passing through the device is reduced two times via two different refrigerant temperatures and two separate compressions." *Id.* at 18:62–19:1.

C. Illustrative Claims

Claims 8–82 were added by reissue to the '815 patent. Independent claims 8 and 53 are illustrative of the claims at issue in the 882 Petition; each claim recites a "water circulation system" and "a first chiller." Claims 21 and 71 are illustrative of the claims at issue in the 886 Petition and recite "first and second chillers are arranged in series" and "a duplex chiller," respectively.

> 8. A system for chilling inlet air to a gas turbine plant, comprising:
>
> a. a gas turbine that includes a gas turbine air inlet;
>
> b. an air cooler disposed adjacent the gas turbine air inlet, the air cooler having an air inlet, an air outlet, a liquid water inlet and a liquid water outlet;
>
> c. a thermal energy storage tank having a warm water port and a cool water port and a water reservoir defined within the tank, the reservoir having an upper first portion and a lower second portion, wherein the warm water port is in fluid communication with the first portion of the reservoir and the

cool water port is in fluid communication with the second portion of reservoir;

d. *a first water circulation system* comprising *a first chiller* and a first pump system, the first chiller having a first chiller inlet and outlet, wherein the outlet of the first chiller is in fluid communication with the cool water port, and the inlet of the first chiller is in fluid communication with the warm water port of the thermal energy storage tank, the first pump system having a first pump inlet and first pump outlet, wherein the first pump system is in fluid communication with the first chiller;

e. wherein the first pump inlet is in fluid communication with the second portion of the reservoir and the liquid water outlet of the air cooler is in fluid communication with the first portion of the reservoir, and

f. a second water circulation system comprising a variable speed pump system having a variable speed pump, wherein variable speed pump system is in fluid communication with the second portion of the reservoir and the liquid water inlet of the air cooler.

21. A system for chilling inlet air to a gas turbine plant, comprising:

a. a gas turbine that includes a gas turbine air inlet;

b. an air cooler disposed adjacent the gas turbine air inlet, the air cooler having an air inlet, an air outlet, a liquid water inlet and a liquid water outlet;

c. a thermal energy storage tank having a warm water port and a cool water port and a water reservoir defined within the tank, the reservoir having an upper first portion and a lower second portion, wherein the warm water port is in fluid communication with the first portion of the reservoir and the cool water port is in fluid communication with the second portion of [the] reservoir; and

d. *a first water circulation system comprising a first chiller having a first chiller inlet and outlet and a second chiller*

having a second chiller inlet and outlet, wherein the outlet of the first chiller is in fluid communication [with] the inlet of the second chiller *such that the first and second chillers are arranged in series*, the outlet of the second chiller is in fluid communication with the cool water port, and the inlet of the first chiller is in fluid communication with the warm water port of the thermal energy storage tank,

e. wherein the liquid water inlet of the air cooler is in fluid communication with the second portion of the reservoir and the liquid water outlet of the air cooler is in fluid communication with the first portion of the reservoir.

53. A system for chilling inlet air to a gas turbine plant, comprising:

a. a gas turbine that includes a gas turbine air inlet;

b. an air cooler disposed adjacent the gas turbine air inlet, the air cooler having an air inlet, an air outlet, a liquid water inlet and a liquid water outlet;

c. a thermal energy storage tank having a warm water port and a cool water port and a water reservoir defined within the tank, the reservoir having an upper first portion and a lower second portion, wherein the warm water port is in fluid communication with the first portion of the reservoir and the cool water port is in fluid communication with the second portion of reservoir;

d. *a water circulation system*, the water circulation system comprising *a first chiller*, the first chiller having a first chiller inlet and outlet, wherein the outlet of the first chiller is in fluid communication with the cool water port, and the inlet of the first chiller is in fluid communication with the warm water port of the thermal energy storage tank;

e. a sensor system having at least one sensor adjacent the air outlet of the air cooler; and

f. a control system disposed to alter a characteristic of the water in the water circulation system based on the sensor system and a first predetermined set point,

g. a pump system having a pump inlet, wherein the pump inlet is in fluid communication with the second portion of the reservoir and the liquid water outlet of the air cooler is in fluid communication with the first portion of the reservoir.

71. A system for chilling inlet air to a gas turbine plant, comprising:

a. a gas turbine that includes a gas turbine air inlet;

b. an air cooler disposed adjacent the gas turbine air inlet, the air cooler having an air inlet, an air outlet, a liquid water inlet and a liquid water outlet;

c. a thermal energy storage tank having a warm water port and a cool water port;

d. *a first water circulation system comprising a duplex chiller* with a duplex chiller outlet in fluid communication with the cool water port of the thermal energy storage tank, and a duplex chiller inlet in fluid communication with the warm water port of the thermal energy storage tank;

e. wherein the liquid water inlet of the air cooler is in fluid communication with the cool water port of the thermal energy storage tank and the liquid water outlet of the air cooler is in fluid communication with the warm water port of the thermal energy storage tank.

Id. at 30:24–54, 31:27–54, 34:1–30, 36:25–44 (italics added).

II. ANALYSIS

A. Claim Interpretation

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. § 42.100(b); *see also Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) ("We conclude that [37 C.F.R. § 42.100(b)] represents a reasonable exercise of the rulemaking authority that Congress delegated to the Patent Office.").

Under that standard, claim terms generally are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art[9] in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Only those terms in controversy need to be construed, and only to the extent necessary to resolve the controversy. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

In the Decision on Institution, we determined that it was not necessary to construe the terms "gas turbine plant," "air cooler," "chiller," "duplex chiller," "fluid communication," and "a characteristic of the water" as proposed by Petitioner. 882 Dec. on Instit. 8; 886 Dec. on Instit. 7. In its Response, Patent Owner asserts that Petitioner's proposed constructions "are immaterial to the issues before the Board." PO Resp. 13. After consideration of the complete trial record, we maintain our determination that no express construction for these terms is required.

[9] It is undisputed that a person of ordinary skill in the art "would have had at least two years of practical experience relating to the design and operation of chilled water systems including thermal energy storage" in addition to having either (1) a Bachelor's degree in mechanical engineering or a related discipline with 4–7 years of industry experience or (2) an Associate's degree with HVAC&R or related training with 6–10 years of industry experience. Pet. 14 (citing Ex. 1012 ¶¶ 15–17); PO Resp. 15–16. Patent Owner applies Petitioner's level of skill in the art in its Response, but asserts that the proposed level of skill is too low because it does not require experience with gas turbines. *See* PO Resp. 15 (citing Ex. 2002, 23:4–24:14) (noting that the field of "the invention 'relates broadly to cooling inlet air to a gas turbine'" (quoting Ex. 1001, 1:27–28)). Patent Owner, however, does not adequately explain how experience with a gas turbine would impact designing a chilled water system to cool the inlet air to a gas turbine.

B. Patentability of Claims

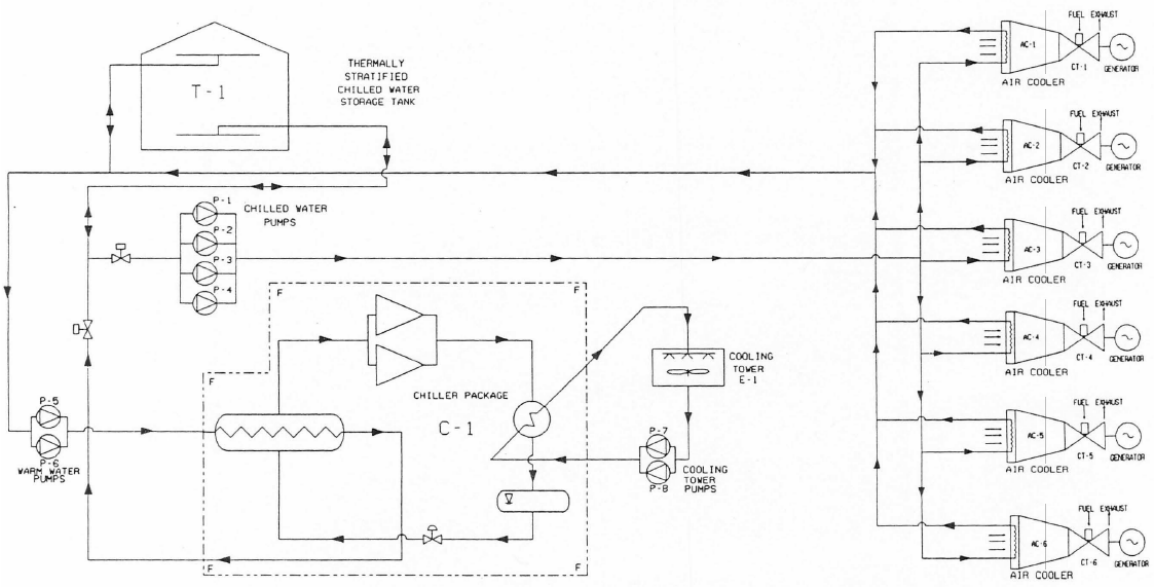
To prevail in its challenges to the patentability of claims, the Petitioner must establish facts supporting its challenges by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). A claim is obvious, and, thus, unpatentable under 35 U.S.C. § 103(a), if the differences between the 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. *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) objective evidence of nonobviousness, i.e., secondary considerations. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). It must also be based on "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness" but "the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR*, 550 U.S. at 418 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Also, care is taken not to read a particular embodiment appearing in the written description into the claim if the claim language is broader than the embodiment. *See In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993) ("limitations are not to be read into the claims from the specification").

We analyze the instituted grounds of unpatentability in accordance with the above-stated principles.

1. Overview of Andrepont

We begin with a description of Andrepont, which is asserted in each of the instituted grounds.

Andrepont discloses "chilled water storage cooling of combustion turbine inlet air" shown in Figure 2 below (Ex. 1014, 4, 6).



The system shown in Figure 2 has six combustion turbines (combustion turbine CT-1 through -6), six air coolers (air coolers AC-1 through -6) adjacent the inlet air to each CT, and a water chiller (chiller package C-1). *Id*. at 6. The system has a thermally stratified chilled water storage tank (T-1) that operates as follows:

> During the on-peak operation of the CTs, cold water is pumped from the bottom of the thermally stratified chilled water storage tank to the air coolers. The cold water cools the hot, humid air approaching the CT; warm water is returned to the top of the tank while cool air enters the CT, increasing CT output and performance. During off-peak periods, warm water is removed from the top of the tank, pumped to and chilled by the refrigeration system, and returned to the bottom of the tank for use during the next on-peak period.

Id. at 5.

While chiller package C1 shows a single chiller (connected to warm water pumps P-5, P-6), Andrepont teaches that other configurations are possible. *Id*. ("an inherent flexibility of chilled water storage is that any water chilling technology, including absorption chilling, could be used to accomplish the recharge.").

2. Claims 8–11, 14–20, and 53–56

Once trial was instituted, and after a specified period of discovery, Patent Owner was afforded the opportunity to file a Patent Owner Response to address "any ground for unpatentability not already denied" by our Decisions on Institution. 37 C.F.R. § 42.120. In its Patent Owner Response, Patent Owner only addresses the instituted grounds set forth in the 882 Petition with respect to claims 12 and 13, and chooses to be silent on the grounds in the 882 Petition as instituted against claims 8–11, 14–20, and 53–56. PO Resp. 3.

Our Scheduling Order in IPR2015-00882 cautioned Patent Owner "that any arguments for patentability not raised in the [Patent Owner Response] will be deemed waived." Paper 11, 3. The Board's Trial Practice Guide also states that the Patent Owner Response "should identify all the involved claims that are believed to be patentable and state the basis for that belief." Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012).

Here, Patent Owner "leaves [Petitioner] to its burden of proving that the challenged claims are obvious." PO Resp. 3.

By instituting trial, we determined that Petitioner presented credible evidence pointing towards the unpatentability of claims 8–11, 14–20, and 53–56. Dec. on Inst. 10–19. Thus, we are left to consider only the evidence

of record as presented in the Petition. *See* 882 Pet. 14–41. After considering Petitioner's evidence with respect to claims 8–11, 14–20, and 53–56, we find that Petitioner has shown, by a preponderance of the evidence, that these claims are unpatentable for the reasons provided in the Petition and below. *Id*.

Regarding claim 8, Petitioner asserts that Andrepont explicitly discloses all of the required elements of the cooling system of claim 8, except for the specific type of pumps that are used, and provides an explanation of how claim 8 otherwise reads on the Andrepont system. Pet. 14–24. Claim 8 recites "a variable speed pump" to pump the cool water from the water reservoir of the storage tank to the water inlet of the air cooler. Petitioner asserts that the use of variable speed pumps was known to pump chilled water from water storage to turbine inlet air cooling, as taught by Clark, which describes a facility serving Walt Disney World. *Id*. at 23–24 (citing Ex. 1019, 2, 11–13). According to Petitioner, the pumps in Clark are variable speed pumps because they "adjust their flow" in order to maintain pressure "using variable frequency drive speed controllers on the pumps." *Id*. (quoting Ex. 1019, 9, 11) (citing Ex. 1012 ¶ 64). Petitioner argues that it would have been obvious to replace the pumps of Andrepont with the variable speed pumps of Clark "in order to maintain and adjust the chilled water supply and system pressure, as explained by Clark." *Id*. at 24 (citing Ex. 1012 ¶¶ 64–65). According to Dr. Reindl, "[t]he use of variable speed drive pumps to increase or decrease the flow of chilled water to cooling loads as they [are] increased or decreased was a common design approach within the grasp of one with ordinary skill in the art." Ex. 1012 ¶ 65. Dr. Reindl also provides reasons why one of ordinary skill in the art

would have considered it obvious to use such pumps in the system of Andrepont, including (1) to reduce the pumping power, (2) to increase the net power produced by the turbine, and (3) to avoid returning cooler fluid from the air coolers to the storage tank during partial cooling load conditions. *Id*. Another reason provided by Dr. Reindl for selecting variable speed pumps is to increase mechanical reliability of the pumps. *Id*.

Petitioner has presented sufficient evidence showing that Andrepont teaches a system for cooling the air inlet to a gas turbine using an air cooler adjacent the air inlet that has a first water circulation system and a second water circulation system as required by claim 8. The first water circulation system of Andrepont includes a chiller that receives warm water from and delivers cool water to a thermal energy storage tank. The second water circulation system of Andrepont pumps cool water from the thermal energy storage tank to the inlet of the air cooler. 882 Pet. 14–16. Petitioner also presents sufficient evidence that one of ordinary skill in the art would have considered it obvious to combine the variable speed pumps taught by Clark in the second water circulation system of Andrepont for the reasons described in Clark. *Id*. at 16, 22–24. We are persuaded that one of ordinary skill in the art (1) would have been knowledgeable about systems for cooling turbine inlet air in both Andrepont's powerplant context and Clark's district cooling environment and (2) would have recognized that the variable speed pumps used in Clark's system would similarly be employable in Andrepont's system. Ex. 1012 ¶¶ 23–24, 64–65; *see KSR*, 550 U.S. 417 ("[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual

application is beyond his or her skill."). Based on the complete record, we determine that Petitioner has shown, by a preponderance of the evidence, that claim 8 would have been obvious over the combination of Andrepont and Clark for the reasons stated in the 882 Petition. *See id*. at 14–24.

We also have reviewed Petitioner's arguments and evidence for dependent claims 9 and 14–20, which depend directly or indirectly from claim 8, and are persuaded that Petitioner has met its burden of demonstrating obviousness over the combination of Andrepont and Clark as well. Regarding claim 9, which depends from claim 8 and requires that the water temperature at the outlet of the chiller is cooler than the water temperature at the inlet temperature, this feature is present in Andrepont. Andrepont discloses that the outlet temperature of the air chiller is cooler than the inlet temperature of the air chiller as required by claim 9. Ex. 1014, 5, 6; Ex. 1012 ¶ 72.

Regarding claim 14, which depends from claim 8 and requires that the variable speed pumps are at least two in parallel, Andrepont discloses a second water circulation system having water pumps arranged in parallel while Clark discloses variable speed pumps arranged in parallel as required by claim 14. Ex. 1014, 6, Fig. 2; Ex. 1019, 8–9, 12, Fig. 3. Clark further describes pump speed and flow as the benefits of variable frequency drive speed controllers on the pumps. Ex. 1019, 8–9. Clark also teaches that an extra third pump also serves as a standby pump for emergency use and allowing quick recharge of the storage tank. *Id*. Therefore, the substitution or modification of Andrepont's pumps in parallel with Clark's at least two variable speed pumps in parallel as required by claim 14 would have been obvious. Ex. 1012 ¶ 97. Because Clark demonstrates that variable speed

pumps were used in the art for turbine inlet air cooling with thermal energy storage, we are persuaded by Petitioner that the combination of Clark with Andrepont would have yielded the "predictable results of variable flow and redundancy with a reasonable expectation of success." Pet. 25–26; *see id*. at 24 (describing the disclosure of Clark with respect to the limitations of claim 8(f) from which claim 14 depends).

Regarding claim 15, which depends from claim 8 and requires a sensor system, Andrepont generally discloses the use of "controls and instrumentation" in its turbine inlet air cooling system while Clark specifically discloses a sensor system and control valves that control the flow of water through the combustion turbine cooling coil banks "to control the air cooling temperature . . . down to the design cooled temperature." Ex. 1014, 7; Ex. 1019, 12, 13, Fig. 3; Ex. 1012 ¶¶ 103–104. Therefore, the sensor system required by claim 15 would have been obvious over the combination of Andrepont's turbine inlet cooling system with Clark's sensor system to control the air cooling temperature down to a design cooled temperature. *See* 882 Pet. 26–29; Ex. 1012 ¶¶ 104–105.

Regarding claims 16–18, which each depend from claim 15 and require a temperature sensor, a relative humidity sensor, and both types of sensors, respectively, Petitioner demonstrates that Clark's sensor system includes these claimed features. 882 Pet. 29–30. Clark's sensor system includes temperature transmitters located at each cooling coil bank as required by claim 16, humidity sensors as required by claim 17, and both temperature and humidity sensors as required by claim 18. Ex. 1019, 12, Fig. 3; Ex. 1012 ¶¶ 101, 114.

Regarding claims 19 and 20, which each depend from claim 15 and require that either the temperature or the flow rate of the water in the water circulation system, respectively, is altered based on the sensor system, Petitioner demonstrates that Clark's turbine inlet cooling system includes these claimed features. 882 Pet. 30–31. Because the sensor and control system of the combination alters the temperature of water in the second water circulation system as required by claim 19 and alters the flow rate of water within the second water circulation system as required by claim 20, claims 19 and 20 also would have been obvious over the combination of Andrepont and Clark. Ex. 1012 ¶¶ 118–119, 122.

Based on all of the evidence of record, we determine that Petitioner has shown, by a preponderance of the evidence, that dependent claims 9 and 14–20 also would have been obvious over the combination of Andrepont and Clark under 35 U.S.C. § 103 (a) for the reasons provided in the 882 Petition. *See* Pet. 24–31.

We also are persuaded that Petitioner has shown by a preponderance of the evidence that it would have been obvious to further modify the combination of Andrepont and Clark with the freezing point depressant additive disclosed by Mornhed and required by claim 10 for the purpose of increasing the thermal capacity of the storage tank, decreasing the required storage tank volume, and enabling lower chilled fluid supply temperatures to the air coolers. Ex. 1016, 3; 1012 ¶¶ 76–77. Similarly, Petitioner has shown by a preponderance of the evidence that it would have been obvious to further modify the combination of Andrepont and Clark with the parallel chiller arrangement disclosed by ASHRAE and required by claim 11 in view of Andrepont's disclosure of flexibility in the selection of chiller technology

and for the purpose of achieving "redundancy, improved operating reliability, and efficiency" as argued by Petitioner and supported by Dr. Reindl. Pet. 41; Ex. 1012 ¶¶ 81–82; Ex. 1014, 5; Ex. 1020, 14, Fig. 24.

Regarding claim 53, Petitioner asserts that the combination of Andrepont's cooling system, which contemplates controls and instrumentation, and Clark's disclosure of a control system to control the air cooling temperature by varying the chilled water supply flow based on a sensor system that includes a sensor adjacent to the outlet of the air cooler, renders the claim unpatentable as obvious under 35 U.S.C. § 103(a). Pet. 31–36 (citing Ex. 1012 ¶¶ 100–105, 126–128); *see id*. at 26–29 (discussing the combination of Andrepont and Clark in connection with the sensor and control system claimed in claim 15). Petitioner argues that the combination of Clark's programmable logic controller and sensors with Andrepont's cooling system would have been obvious to control the air cooling temperature to a design cooled temperature or to maintain a system pressure. *Id*. at 35 (citing Ex. 1012 ¶ 129); *see also* Ex. 1012 ¶¶ 104–105 (discussing the control configuration of Clark in connection with claim 15).

Petitioner has presented convincing evidence showing that Andrepont's system for cooling the air inlet to a gas turbine using an air cooler and a water circulation system that includes a chiller and thermal energy storage tank also teaches using a control system and instrumentation. Petitioner also presents convincing evidence that one of ordinary skill in the art would have combined the control system taught by Clark in the water circulation system of Andrepont for the reasons described in Clark. Based on the complete record, we determine that Petitioner has shown, by a preponderance of the evidence, that claim 53 would have been obvious over

the combination of Andrepont and Clark for the reasons stated in the 882 Petition. *See* 882 Pet. 26–29, 31–36. We also have reviewed Petitioner's arguments and evidence for dependent claims 54–56, which depend from claim 53 (and correspond with dependent claims 16–18 discussed above), and are persuaded that Petitioner has met its burden of demonstrating obviousness over the combination of Andrepont and Clark as well.

3. Andrepont, Clark, and Mornhed: Claim 12

Claim 12 depends from claim 8 and recites "a second chiller arranged in series with the first chiller." Ex. 1001, 31:2–3. Petitioner combines with the turbine inlet air cooling system of Andrepont, as modified by Clark, the disclosure in Mornhed to arrange two chillers in series for the reasons taught in Mornhed, namely, doubling the capacity of existing distribution piping, or, alternatively, reducing pumping power. 882 Pet. 38–39. Petitioner also supports the combination with Andrepont's teaching that the selection of chillers for its turbine inlet air cooling system is "an inherent flexibility." *Id*. at 38 (quoting Ex. 1014, 5), 39. Petitioner asserts that the selection of series chillers would have been a predictable variation in the turbine inlet air cooling system of Andrepont because Mornhed provides benefits for series chilling and the combination of Andrepont, Clark, and Mornhed "merely combines prior art elements to yield predictable results of reducing pumping power with a reasonable expectation of success." *Id*. at 38–39.

Patent Owner contends that the combination is not a substitution of Mornhed's chiller for Andrepont's chiller, but, rather, "adding a new component to Andrepont, a low temperature chiller." PO Resp. 22 (emphasis omitted). Patent Owner asserts that there are "negative consequences" from "adding a low temperature chiller from Mornhed in

series with Andrepont's existing chiller." *Id*. (citing Ex. 2012 ¶ 46). These negative consequences include unpredictability in the thermal energy storage tank because Andrepont teaches 39 °F as the lower temperature limit while Mornhed teaches chilling the water down to 34 °F. *Id*. at 23. They also include an increase in the amount of chilling power (*id*. at 24 (citing Ex. 2012 ¶ 48)) and pumping power (*id*. at 25 (citing Ex. 2012 ¶ 49)) required by the system as well as additional expense and complexity (*id*. (citing Ex. 2012 ¶ 50)). According to Patent Owner, these costs would outweigh any of the benefits described by Mornhed because Mornhed's benefits "are specific to the problem Mornhed was trying to solve, namely 'how to get more chilling capacity out of a very large and expensive existing district cooling piping network.'" *Id*. at 26 (unattributed quote) (citing Ex. 2012 ¶¶ 53–56).

Patent Owner describes the difference between district cooling and turbine inlet cooling (TIC) as "[w]hereas TIC is designed specifically for cooling gas turbine inlet air—which represents a load in a single location—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." PO Resp. 18. Thus, the second chiller added to the first chiller in series "allows Mornhed to get more chilling capacity out of the existing piping network without excavation by using the extra cold supply water to achieve a higher supply-to-return water temperature differential." *Id*. at 28 (citing Ex. 2012 ¶¶ 57–58). For Andrepont and TIC, on the other hand, Patent Owner argues that "excavation is not an issue since the pipes typically run aboveground and are much shorter as they are limited to the power station facility and do not need to reach many different

buildings across a city or college campus." *Id*. at 29 (citing Ex. 2012 ¶¶ 56, 60; Ex. 2007 ¶¶ 22–36).

Patent Owner concludes that claim 12 has not been proved to be unpatentable because an ordinarily skilled artisan would not have been motivated to combine Andrepont and Mornhed and because the combination would have been unpredictable. *Id*. at 30 ("Because Mornhed's motivations for modifying an existing chilling system do not exist in Andrepont, [Petitioner's] motivation to combine argument is improper."); 34–35 ("[I]f one were to remove the pumping/piping considerations, the motivation for installing the expensive second chiller disappears as well."); 54 ("[The alleged] benefits apply uniquely in the context of district cooling systems and would have had zero to negligible benefit to the Andrepont system."); 55 ("[Petitioner's] *own expert* does not know whether his proposed combination would have been desirable.") (citing Ex. 2002, 137:17–138:18, 142:17–143:9, 163:14–19); 33 ("[I]t is altogether unclear what would happen to the thermocline if a TES tank were used with water that is below the temperature of maximum water density, or even what temperature the water entering the cooling coil would be."); 36 ("The expense of the second chiller alone suggests that the negative aspects of [Petitioner's combination] are likely to far outweigh the positive ones (if any).").

Patent Owner further argues that the reason provided in the '815 patent for using series chilling with TIC is neither argued by Petitioner nor disclosed in Mornhed, which "demonstrate[s] the nonobviousness of the invention." *Id*. at 40. According to Patent Owner, the reason provided in the '815 patent is "to save electric power in the chilled water system and specifically in the upstream chiller[,]" however this chiller efficiency is "true

only if the return water temperature is driven much higher than the supply water temperature." *Id*. at 41 (citing Ex. 1001, 11:4–16, Fig. 1; Ex. 2012 ¶ 68). Patent Owner argues that Mornhed's disclosure of supplementing an existing chiller with a low temperature chiller does not achieve a gain in efficiency because "the existing chiller continued to work the same way" and the "added chiller [] would use much more power per ton of chilling than [the] existing chiller." *Id*. at 42 (citing Ex. 2012 ¶ 70).

Patent Owner also asserts that the exclusive use of water in TIC systems built for power plants since 1999 is objective evidence of non-obviousness. *Id*. at 48 (citing Ex. 2012 ¶ 78). Additional objective evidence of non-obviousness submitted by Patent Owner is Dr. Reindl's 1995 paper examining chilled water storage systems that used a single chiller rather than series chillers and only drove the temperature down 13 °F. *Id*. at 49–50 (citing Ex. 2005, 1). Lastly, Patent Owner asserts that the authors of Mornhed both worked for a company called Trigen, which built several TIC systems in the 1990's, but "in three of these systems, Trigen did not use chilled water (let alone series water chillers) to cool the turbine even though they had vast amounts of chilled water nearby." *Id*. at 51 (citing Ex. 2012 ¶ 77). According to Patent Owner, "the implementations of Mornhed's own company tend to show that the use of series chilling with TIC was not obvious." *Id*.

We are not persuaded that the 882 Petition lacks a sufficient reason to combine the series chiller of Mornhed in the system of Andrepont. Petitioner explains that Mornhed offers reasons why one of ordinary skill in the art would have substituted two chillers in series for one chiller. Those reasons are distribution piping capacity, reduced pumping power, and

economic benefits. 882 Pet. 38–39 (citing Ex. 1012 ¶¶ 88, 90; Ex. 1016, 4). Another reason provided for modifying the chiller of Andrepont with another chilling technology is the express teaching in Andrepont that the selection of chillers is "an inherent flexibility." *Id*. at 38 (quoting Ex. 1014, 5).

We also are not persuaded that Mornhed is nonanalogous art because it concerns district cooling applications. Mornhed itself indicates that the district heating and cooling industry and the power generation industry look to each other for ideas on how to chill inlet air to a gas turbine. Specifically, Mornhed states:

> The district heating and cooling industry is small in comparison to other technology-related industries, such as power generation. Although there certainly have been developments made by the district heating and cooling industry, in many cases technology developed for other fields has been successfully applied. Innovations such as large-scale chilled water storage and low-cost distribution piping are examples of the former, while efficient cogeneration technology and process automation are examples of the latter.

Ex. 1016, 1.

Mornhed's above statement is borne out by the two industries sharing a database kept by the Turbine Inlet Cooling Association (TICA). Ex. 2004. In addition, both Mornhed and Andrepont describe the same objective of improving the performance of a combustion turbine during a peak period, also referred to as a derating problem. Mornhed describes "combustion air cooling" as an improvement in gas turbine technology generally, explaining that "[c]ombustion air cooling, which can be provided for through a chilled-water or refrigerant coil in the combustion air intake, will alleviate the problem of gas turbine derating at high ambient temperatures when the gas

turbine electric power is most valuable." Ex. 1016, 2. The derating problem is precisely the same problem that Andrepont addresses. Ex. 1014, Fig. 1, 4 ("[I]t is a characteristic of CTs that their rated power output decreases significantly with increasing ambient air temperature. . . . The result is that when peaking capacity is most in demand is precisely when CT capacity is most severely derated."). It is also a stated objective of the '815 patent. Ex. 1001, 2:2–7 ("[A] continuing need exists for a turbine inlet air cooling system which: would efficiently cool turbine inlet air; would take advantage of surplus power available during times of low consumer power demand; and would not drain the system of power during times of high consumer power demand.").

Given the above, we find that Andrepont and Mornhed are analogous art to the '815 patent because Mornhed is reasonably pertinent to the particular problem with which the '815 patent and Andrepont were concerned, namely, using thermal energy storage to "alleviate the problem of gas turbine derating at high ambient temperatures when the gas turbine electric power is most valuable" as stated by Mornhed. Ex. 1016, 1, 2; Ex. 1014, 4, Fig. 1; Ex. 1001, 2:2–7. *See In re Oetiker*, 977 F.2d 1443, 1447 (Fed. Cir. 1992) (stating that the analogous-art test requires that a reference is either in the same field of endeavor or is reasonably pertinent to the problem with which the inventor was concerned).

We also are not persuaded that the combination would be unpredictable and not a simple substitution of one chiller technology for another. Patent Owner presumes a hypothetical cooling system from the bodily incorporation of elements from Andrepont and Mornhed where (i) there is a second low temperature chiller added in series with Andrepont's

existing chiller, (ii) the thermal energy storage tank is run at a tank temperature lower than 39 °F, where the thermal stratification within the tank is disrupted, and (iii) the flow rate through the chillers is the same as the flow rate through Andrepont's single chiller. PO Resp. 23–26. Based on this construct, Patent Owner argues the following negative effects would result from the combination: "(1) an impractical and unpredictable thermal energy storage tank; (2) an increase in required chilling power; (3) an increase in required pumping power; and (4) significantly increased cost and complexity of the overall system." *Id.* at 22. Patent Owner provides no persuasive reasoning for why one of ordinary skill in the art would choose to design a thermal energy storage tank to be run at a temperature where the thermal stratification within the tank is disrupted. Similarly, Patent Owner provides no persuasive reasoning for why one of ordinary skill in the art would choose to use the same flow rate for two chillers in series as was used for Andrepont's single chiller, particularly where a low temperature chiller is added in series.

The preponderance of the evidence demonstrates that it is simple substitution of one known element for another when the Andrepont single chiller is substituted with two chillers in series as taught by Mornhed in a design for cooling the air inlet to a turbine. *See KSR*, 550 U.S. at 417 ("[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill."). This is because both Andrepont and Mornhed are using their chillers to chill inlet air to a gas turbine plant in order to "alleviate the problem of gas turbine derating at high ambient temperatures

when the gas turbine electric power is most valuable." Ex. 1016, 2; Ex. 1014, 4, Fig. 1. Whether the plant is a facility or a utility company, the district heating and cooling industry of Mornhed and the power generation industry of Andrepont look to each other for ideas on how to chill inlet air to a gas turbine. Ex. 1016, 1. The two industries share membership in the same professional association, the Turbine Inlet Cooling Association (TICA), and the two industries share TICA's database, as discussed above. Ex. 2004.

Even if altering the single chiller of Andrepont with the series chiller taught by Mornhed "sets off a chain of decisions and consequences affecting nearly every component of the system" as Patent Owner contends (PO Resp. 43–44), we are not persuaded such decisions would be beyond the skill of one of ordinary skill in the art. According to both experts, one of ordinary skill in the art would have considered a series chiller package as a design choice and may have recommended that design based on the benefits to the system. Ex. 1027, 55:8–58:15, 104:4–107:22; Ex. 1012 ¶¶ 79–80, 85, 87–90.

We find Patent Owner's arguments about Mornhed's stated benefits being outweighed by the costs unpersuasive because whether Mornhed and Andrepont can be combined does not depend on whether pumping/piping costs dominate chiller costs or vice versa in any given hypothetical project, new or retrofit. As discussed above, Petitioner articulated reasons, with rational underpinning, to support the obviousness of substituting two chillers in series for the one chiller shown in Andrepont. One of Petitioner's articulated reasons for combining the chiller arrangement of Mornhed with Andrepont's system concerns pumping/piping benefits. Specifically,

Petitioner contends that Mornhed teaches providing a second chiller in series with a first chiller will increase the capacity of the existing distribution piping or, alternatively, reduce the pumping power. 882 Pet. 38–39 (citing Ex. 1016, 4; Ex. 1012 ¶¶ 88, 90). This benefit exists, whether it is offset by other effects in the system or not. Ex. 2002, 129:15–137:15 (Dr. Reindl describes the effect of system changes posited by Patent Owner's counsel, including increased capacity and reduced pumping power.). Patent Owner concedes that Mornhed's stated benefits may result from the proposed substitution, albeit small. PO Resp. 26 ("[T]he alleged benefits either would not exist, or they would be vastly outweighed by the costs required to obtain those benefits."); *id*. at 54 ("[The alleged] benefits apply uniquely in the context of district cooling systems and would have had zero to negligible benefit to the Andrepont system."); Tr. 36:8–11 ("[T]he benefits that Mr. Mornhed described are giant in the district cooling field and they are miniscule in the turbine inlet chilling field.").

Patent Owner argues that in order for an ordinary person to be motivated to make the proposed substitution, it must be desirable. PO Resp. 32, 36, 39 (citing *KSR*, 550 U.S. 416; *Hynix Semiconductor Inc. v. Rambus, Inc.*, 645 F.3d 1336, 1353 (Fed. Cir. 2011); *Winner Int'l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 (Fed. Cir. 2000)). According to Patent Owner, the only way to determine if changing from a single chiller to two chillers in series is desirable is to do a cost/performance evaluation of the Andrepont system as modified by the Mornhed low temperature chiller. *Id*. at 31–40. The experts agree that assumptions must be made about the systems in Andrepont, Mornhed, and the proposed combination in order to generate a cost/performance evaluation, including the temperature differential on the

water side, airflow through the turbines, plant owner requirements, and whether an additive is used to depress the freezing point of the liquid in the thermal energy tank. *Id*. at 36–38 (citing Ex. 2002, 137:17–138:17, 142:17–143:9, 163:14–19; Ex. 2012 ¶¶ 72–74).

To the extent that Patent Owner's cost/benefit arguments impose on Petitioner's obviousness showing a teaching, suggestion, or motivation to combine (TSM) test, they are unpersuasive for two reasons. First, the TSM test is not the only test for determining obviousness. *KSR*, 550 U.S. 419. Instead, some articulated reasoning with some rational underpinning can support the legal conclusion of obviousness. *Id.* at 418. It is unnecessary for the cited prior art publications to explicitly direct the use in a power plant setting of known chillers and chiller arrangements for turbine inlet air cooling. *Id*. at 419 ("Granting patent protection to advances that would occur in the ordinary course without real innovation retards progress and may in the case of patents combining previously known elements, deprive prior inventions of their value or utility."). Second, the cost motivation that Patent Owner asserts is fatally missing from the 882 Petition is just one rationale to establish obviousness.[10] In this case, Petitioner asserts two other rationales that are supported by the evidence of record: (1) "Mornhed explains that series chilling 'will almost double the capacity of existing

[10] Further, if a person of ordinary skill in the art would be familiar enough with a design option, such as using two chillers in series rather than a single chiller, to consider implementing it and to perform a cost/benefit analysis of it, we find it hard to believe that such an option is not obvious. In other words, if it is a serious enough option to consider, and is predictable enough to model costs, then that option would appear to be one of a "finite number of identified, predictable solutions" that are "within [a person of ordinary skill in the art's] technical grasp. *KSR*, 550 U.S. at 421.

distribution piping or, alternatively, reduce pumping power to a fraction . . . [t]he economic benefits of series chilling can be significantly enhanced by installation of low-temperature chilled-water storage'" and (2) "Andrepont describes 'an inherent flexibility' in the selection of chillers." 882 Pet. 38–39 (quoting Ex. 1016, 4; quoting Ex. 1014, 5). We agree with Petitioner that it would have been obvious to one of ordinary skill in the art to substitute the one chiller of Andrepont with the two chillers in series taught by Mornhed "in order to achieve the capacity, reduced pumping power, and/or economic benefits explained by Mornhed." 886 Pet. 21–22. We also agree with Petitioner that it would have been obvious to one of ordinary skill in the art to substitute the one chiller of Andrepont with the two chillers in series taught by Mornhed because the combination requires substitution of one known chiller package for another to obtain the predictable result of chilling water. *Id*. at 40 (citing *KSR*, 550 U.S. at 417).

While Patent Owner may be correct that "the ultimate question for motivation to combine is whether a person of skill in the art would have seen a given course of action as desirable[,]" motivation to combine is not the only test for obviousness. *See* PO Resp. 32 (citing *Winner*, 202 F.3d at 1349); *KSR*, 550 U.S. 419. Moreover, the assertion that Petitioner's obviousness challenge is fatally flawed without a full economic analysis evidencing an economic motivation to combine elevates that one reason over other reasons for a skilled artisan to have found obvious the combination of elements independently known in the prior art. *See* PO Resp. 31 (Petitioner "cannot reasonably argue that negligible economic benefits would have motivated a person of skill in the art to modify Andrepont to use series chilling . . . ."). We have considered Patent Owner's post-*KSR* caselaw that

it relies upon for the proposition that "economic disincentives and complexity weigh against a finding of obviousness." Tr. 51:17–19 (citing *Hynix*, 645 F.3d at 1353). We are not persuaded that *Hynix* requires balancing economic disincentives and complexity, even though it can be a relevant consideration in some cases. Just because a particular modification would not have been made by a businessman for economic reasons does not mean that one of ordinary skill would not have found the combination obvious. *In re Farrenkopf*, 713 F.2d 714, 718 (Fed. Cir. 1983). In *Hynix*, "it was unclear whether the combination [of existing pieces of circuitry] would be beneficial or detrimental" as to its ability to work. *Hynix*, 645 F.3d at 1353. The evidence in this case, however, establishes that the benefits of series chilling are clearly stated in Mornhed and the degree to which those benefits translate into lower costs is dependent upon design considerations for a particular turbine cooling system installation. Ex. 1012 ¶¶ 79–80, 85, 87–90; Ex. 1014, 5; Ex. 1016, 4; Ex. 1027, 55:8–58:15, 104:4–107:22. Therefore, Petitioner's obviousness analysis in this case is sufficient without a cost/performance analysis.

We also are not persuaded by Patent Owner's argument that the real reasons for series chilling is articulated in the '815 patent and not argued by Petitioner, i.e., the water chillers are "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 [to] save[] power on the upstream chiller and make[] the system more efficient." Ex. 1001, 11:21–25; *see* PO Resp. 42. This argument is unpersuasive because Mornhed provides other reasons for placing chillers in series, namely, increasing piping capacity and reducing pumping power. Ex. 1016, 4. The argument is

also unpersuasive because the ’815 patent claims a system and it was known in the art at the time of the invention that placing chillers in series, as Mornhed suggests, improves the efficiency of the upstream chiller because of thermodynamic staging. Ex. 1027, 65:25–67:3, 82:13–83:8. The recognition of another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. *See KSR*, 550 U.S. at 419 (“In determining whether the subject matter of a patent claim is obvious, neither the particular motivation nor the avowed purpose of the patentee controls.”); *Ex parte Obiaya*, 227 USPQ 58, 60 (BPAI 1985), *aff’d mem.*, 795 F.2d 1017 (Fed. Cir. 1986) (holding that the recognition of another advantage flowing naturally from following the suggestion of the prior art cannot be the basis for patentability when the difference would otherwise be obvious)

We find the articulated reasons for combining a feature of Mornhed, namely the series chillers, with the cooling system of Andrepont to have a rational underpinning. Patent Owner’s distinctions based on the applications of the cooling systems in Mornhed and Andrepont are unpersuasive because “it is not necessary that the inventions of the references be physically combinable to render obvious the invention under review.” *In re Sneed*, 710 F.2d 1544, 1550 (Fed. Cir. 1983). We also find the selection of Mornhed’s series chillers, in particular, to be embraced by Andrepont’s general teaching that any chiller system can be used in its cooling system design. Thus, the improvement of using series chillers appears to be no more than the predictable use of prior art elements according to their established functions. *See KSR*, 550 U.S. at 417.

We have considered Patent Owner's objective evidence of secondary considerations and find that it does not outweigh the strong evidence of obviousness. While the exclusive use of water in commercial TIC systems built for power plants since 1999 may evidence the desirability of the claimed system, it also evidences the desirability of the Andrepont system published in 1994 (prior to the invention), which uses water for inlet cooling of turbine inlet air for a power plant. As Petitioner points out, the evidence offered by Patent Owner to support this argument that the invention in 1999 triggered a change in commercial TIC plant design, does not reflect the specific chiller arrangement of such commercial systems to differentiate the commercial system from that taught by Andrepont. Pet. Reply 23–24 (citing Ex. 1027, 122:16–23, 126:23–27:3). Moreover, the time between the publication of Andrepont and the first commercial use of water in a TIC system may be due to practical business considerations, such as financing and approval for a new or existing power plant, rather than the subsequent appearance of the claimed invention. Thus, Patent Owner's evidence simply provides observations without sufficient context or explanation that would allow us to conclude the delay between Andrepont's publication and the widespread commercial implementation of chilled water cooling in power plant settings is meaningful to show nonobviousness.

Similarly, practical commercial reasons for why Mornhed's employer, Trigen, chose not to use series water chillers in some of its TIC systems are not excluded by Patent Owner's evidence. The fact that Trigen did use chilled water evidences that alternative technologies were used, and the selection of chilled water cooling in a TIC system was within the skill of one of ordinary skill in the art. Ex. 2011, 5–6; Ex. 1027, 138:10–139:5. Dr.

Reindl's 1995 paper examining chilled water storage systems that used a single chiller may evidence that a single chiller was considered the optimal design for a chilled water system prior to the time of the invention, but it does not evidence that Mornhed's series chiller arrangement was not considered an obvious variation of the chilled water system of Andrepont as the paper considers "the efficacy and cost-effectiveness of ice storage compared with chilled water storage, hybrid (ice/chilled water) storage, and evaporative cooling" rather than optimization of chilled water storage systems. Ex. 2005, 1 (Abstract).

In sum, the preponderance of the evidence shows that claim 12 would have been obvious in view of the combination of Andrepont, Clark, and Mornhed for the reasons discussed above and in the 882 Petition. 882 Pet. 14–24, 38–40; Pet. Reply 1–25.

4. Andrepont, Clark, and Trane Product Sheet: Claim 13

Claim 13 depends from claim 8 and recites "wherein the first chiller is a duplex chiller." Petitioner argues that the Trane Product Sheet discloses that duplex centrifugal water chillers were readily available to one of ordinary skill in the art at the time of the invention and that it would have been obvious to combine with the cooling system taught by Andrepont in view of Andrepont's description of the inherent flexibility in the selection of the chiller. 882 Pet. 41–42 (citing Ex. 1014, 5; Ex. 1017, 1; Ex. 1012 ¶ 94). Petitioner also provides as a reason to combine the duplex chiller of the Trane Product Sheet, for the chiller in Andrepont's system the benefits of "significant first cost and operating cost advantages compared to field assembled very large chillers," as stated in the Trane Product Sheet. *Id*.

(quoting Ex. 1017, 1). Dr. Reindl elaborates on the benefits of a duplex chiller, stating:

> [c]ompared to the simple single chiller arrangement shown in Andrepont, the use of a Duplex™ chiller configuration offers a number of advantages including (1) high efficiency, (2) two independent refrigerant circuits (Andrepont's chiller shows only a single refrigerant circuit), (3) factory-assembly for increased reliability (Andrepont's chiller appears to be a field-erected unit), (4) smaller footprint, and (5) lower capital cost vs. two chillers.

Ex. 1112 ¶ 62. Petitioner asserts that the simple substitution of a known duplex chiller in Andrepont's system would have produced predictable results with a reasonable expectation of success. 882 Pet. 42.

Patent Owner argues that the statement in the Trane Product Sheet that Petitioner relies on:

> is just marketing puffery, not evidence of what a person of skill in the art would actually believe about pricing. Moreover, the alleged cost advantages mentioned in the Trane Product Sheet do not stem from the fact that it is a Duplex chiller. Instead, a person of skill in the art would recognize that the Trane Product Sheet is reciting advantages of factory-assembled chillers generally.

PO Resp. 56 (citing Ex. 2012 ¶ 81).

Patent Owner also contends that the Petition lacks evidence of a cost/performance benefit for replacing the single chiller of Andrepont with a duplex chiller. *Id*. at 56–59. Specifically, Patent Owner estimates that a duplex chiller incorporated in the Andrepont system would cost twice that of the single unit chiller and have unknown operating costs. *Id*. at 57, 58–59. Patent Owner also asserts that duplex chillers were not available in the size

that Andrepont system utilizes "[a]nd using three duplex chillers as a substitute for Andrepont's C-1 chiller would raise cost considerations that Stellar has not addressed." *Id*. at 57–58 (citing Ex. 2012 ¶¶ 82–83). Patent Owner further contends that there are a number of benefits of a single chiller that make them advantageous over a duplex chiller. *Id.* at 58.

These arguments are unpersuasive because the Trane Product Sheet states "[t]he CDHF and CDHG chillers offer significant first cost and operating cost advantages compared to field assembled very large chillers." Ex. 1017, 1. On its face, the sentence means that duplex chillers offer significant first cost and operating cost advantages compared to field assembled very large chillers, whether they be duplex chillers or single chillers. Petitioner's expert describes the expected advantages of a duplex chiller in the system as decreased operating costs (higher efficiencies) and lower first costs (a duplex chiller has two chillers so Petitioner's expert is comparing capital costs of a duplex chiller to two chillers). Ex. 1012 ¶ 94. Patent Owner does not assert that Dr. Reindl's declaration testimony was controverted in any way during his deposition.

Patent Owner's cost / performance benefit argument is unpersuasive for the same reasons discussed above with respect to the Mornhed reference. First, *KSR* makes clear that a rigid TSM test is unnecessary as long as there is some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. *KSR*, 550 U.S. at 418. Second, in view of the inherent flexibility described by Andrepont, it would have been obvious to one of ordinary skill in the art to combine the teachings of Andrepont with the Duplex chiller described in the Trane Product Sheet, in order to achieve the first cost and operating cost advantages explained by the Trane Product

Sheet. Ex. 1012 ¶ 94. Such a combination substitutes one known type of chiller for another known type of chiller in a cooling system design to obtain the predictable result of chilling water for use in an air cooler. *See KSR*, 550 U.S. at 417; 882 Pet. 47–48. That the stated first cost and operating cost benefits of the Trane Product Sheet's duplex chiller are advantages that "would apply to any type of chiller that does not need to be built in the field" does not negate these reasons for combining the references. PO Resp. 56–57 (citing Ex. 2012 ¶ 81). Similarly, Patent Owner's arguments based on the size of the single chiller disclosed by Andrepont exceeding the size of the largest duplex chiller does not negate the general teachings of the cited references and their combination. Bodily incorporation of the Trane Duplex chiller in the Andrepont system on a one-chiller-unit-for-one-chiller-unit basis is not required to establish obviousness. *See Sneed*, 710 F.2d at 1550. We have considered Patent Owner's objective evidence of secondary considerations and find that they do not outweigh the strong evidence of obviousness for the reasons discussed above in Section II.B.3.

In sum, the preponderance of the evidence shows that claim 13 would have been obvious in view of the combination of Andrepont, Clark, and Trane Product Sheet for the reasons discussed above and in the 882 Petition. 882 Pet. 14–24, 41–42; Pet. Reply 21–25.

5. Andrepont and Mornhed: Claims 21–23

Petitioner asserts that Andrepont discloses a system for chilling inlet air to a gas turbine plant that includes all of the required elements of claim 21 other than the specific chiller arrangement as shown on Petitioner's annotated Figure 2 of Andrepont, below.

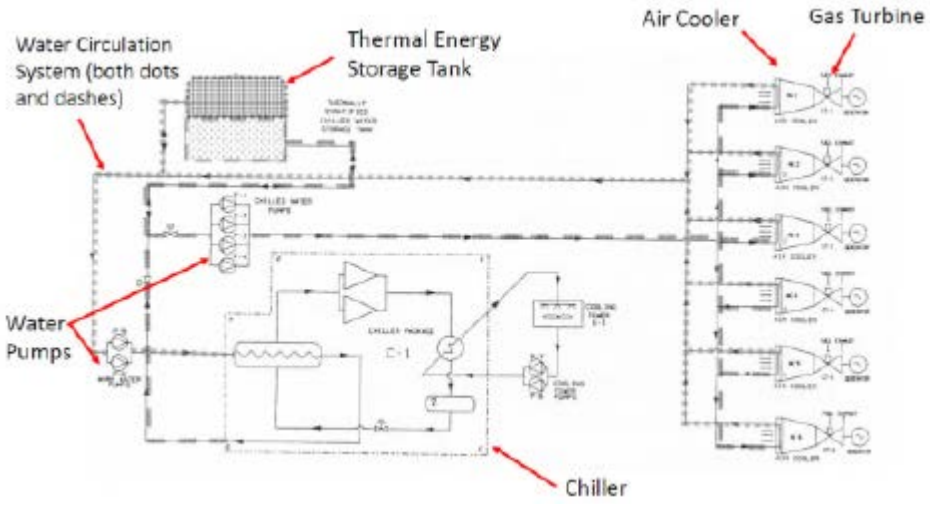


Figure 2 of Andrepont (Ex. 1114), annotated. 886 Pet. 20.

Petitioner asserts that even though Andrepont does not expressly disclose a second chiller arranged in series with the first chiller, it states '"an inherent flexibility of chilled water storage is that ***any water chilling technology***, including absorption chilling, could be used to accomplish the recharge.'" *Id*. at 20–21 (quoting Ex. 1114, 5). Petitioner asserts multiple reasons provided by Mornhed itself why "it would have been obvious to one of ordinary skill in the art to combine or replace the chiller package C-1 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." *Id*. at 22 (citing Ex. 1112 ¶ 60). First, "Mornhed explains that series chilling 'will almost double the capacity of existing distribution piping or, alternatively, reduce pumping power to a fraction . . . [t]he economic benefits of series chilling can be significantly enhanced by the installation of low-temperature chilled-water storage.'" *Id*. at 21 (citing Ex. 1116, 4). Second, "Mornhed describes that '[c]ombustion air cooling, which can be provided for through a chilled-water or refrigerant coil in the combustion air intake, will alleviate the problem of gas turbine derating at

high ambient temperatures when the gas turbine electric power is most valuable.'" *Id*. at 21–22 (citing Ex. 1116, 2). Petitioner contends that it would have been obvious to one of ordinary skill in the art to combine or replace the one chiller of Andrepont with the two chillers in series taught by Mornhed to achieve the benefits described in Mornhed because, "[s]uch a combination requires merely simple substitution of one known element for another to obtain predictable results as explained by Mornhed." *Id*. at 22 (citing *KSR*, 550 U.S. at 417).

Claim 22 depends from claim 21 and further requires that the water temperature at the outlet of the second chiller is cooler than the water temperature at the inlet of the second chiller, which, in turn, is cooler than the water temperature at the inlet of the first chiller. Ex. 1001, 31:55–61. According to Petitioner, Mornhed discloses the staged temperatures recited by claim 22. 886 Pet. 25 (citing Ex. 1116, Fig. 4; Ex. 1112 ¶¶ 68, 70).

Claim 23 depends from claim 22 and further requires an additive to the water circulation system that is "capable of reducing the freezing point of water." Ex. 1001, 31:62–65. Petitioner asserts that claim 23 also would have been obvious over the combination of Andrepont and Mornhed because Mornhed further discloses such an additive (referred to as a "freezing-point depressant") and teaches that low temperature stratified storage offers improvements over traditional stratified tanks including increasing the thermal capacity of the storage tank. 886 Pet. 25–26 (citing Ex. 1116, 3; Ex. 1112 ¶ 73).

Patent Owner challenges the evidence of obviousness of claims 21–23 with the same arguments presented for claim 12 discussed above in Section II.B.3., which arguments focus on turbine inlet air cooling design

considerations, including cost, for a power plant (Andrepont) being different from the design considerations for a district cooling facility (Mornhed). PO Resp. 18, 26–55. As such, Patent Owner does not dispute the teachings of the cited references, but, rather, whether one of ordinary skill in the art would have been have considered it obvious to combine Mornhed's series chillers with Andrepont's turbine inlet air cooling system (*id*. at 30) and whether the combination would have been desirable (*id.* at 32, 55).

We determine that Petitioner's reasons for combining Mornhed's series chillers with Andrepont's turbine inlet air cooling system have a rational underpinning. Both references describe cooling the air inlet to a turbine using chilled water storage which permits water to be chilled during off-peak periods, as taught by Andrepont, and "alleviate the problem of gas turbine derating at high ambient temperatures when the gas turbine electric power is most valuable[,]" as taught by Mornhed. 886 Pet. 19 (citing Ex. 1114, 5, Fig. 2; Ex. 1112 ¶ 51), 21–22 (citing Ex. 1116, 2, 4). Although Andrepont and Mornhed both describe the use of water chillers to chill the water stored in the chilled water storage tank, Mornhed further describes advantages of a series arrangement of chillers. *Id*. at 21 (citing Ex. 1116, 4). These stated advantages are increasing the capacity of existing distribution piping or reducing pumping power. *Id*. While Patent Owner presents evidence to show the benefits described by Mornhed are more significant in a district cooling setting because it has more piping and distance to cover than a power plant, the parties' experts agree that there is no one-size-fits-all design as every case has its own requirements and it is conceivable that chillers in series would be recommended in the design of a TIC/TES configuration under the appropriate circumstances at the time of the

invention. Ex. 2002, 137:2–15; Ex. 1027, 57:10–17, 104:4–10. For the same reasons discussed above in Section II.B.3., we find unpersuasive Patent Owner's arguments regarding the rationale for combining Andrepont and Mornhed. Patent Owner's evidence of secondary considerations is outweighed by the strong evidence of obviousness for the reasons discussed above in Section II.B.3.

Based on the foregoing and the reasons provided by Petitioner, we determine that Petitioner has proved by a preponderance of the evidence that claims 21–23 would have been obvious over the combination of Andrepont and Mornhed. 886 Pet. 16–26; Pet. Reply 1–25.

6. Andrepont, Mornhed, and Clark: Claims 24–26, 28–33, and 66

a. Claims 24–26 and 66 (Variable Speed Pump System)

Claim 24 requires a second water circulation system comprising a variable flow pump system that is in fluid communication with the liquid water inlet of the air cooler. Petitioner asserts that the use of variable speed pumps was known to pump chilled water from water storage to turbine inlet air cooling as taught by Clark, which describes a facility serving Walt Disney World. 886 Pet. 28–29. According to Petitioner, the pumps in Clark are variable speed pumps because they "***adjust their flow***" in order to maintain pressure "using variable frequency drive speed controllers on the pumps." *Id*. (quoting Ex. 1119, 94–96, 9; citing Ex. 1012 ¶ 64). Petitioner argues that it would have been obvious to replace the pumps of Andrepont with the variable speed pumps of Clark "in order to maintain and adjust the chilled water supply and system pressure, as explained by Clark." *Id*. at 29–30 (citing Ex. 1112 ¶ 78). According to Dr. Reindl, "[t]he use of variable speed drive pumps to increase or decrease the flow of chilled water to

cooling loads as they are increased or decreased was a common design approach within the grasp of one with ordinary skill in the art." Ex. 1112 ¶ 78. Dr. Reindl also provides reasons why one of ordinary skill in the art would have been motivated to use such pumps in the system of Andrepont, including (1) to reduce the pumping power, (2) to increase the net power produced by the turbine, and (3) to avoid returning cooler fluid from the air coolers to the storage tank during partial cooling load conditions. *Id*. Another reason provided by Dr. Reindl for selecting variable speed pumps is to increase mechanical reliability of the pumps. *Id*.

Regarding claim 25, which depends from claim 24 and recites "wherein the variable flow pump system comprises a variable speed pump," Petitioner asserts the claim would have been obvious over the combination of Andrepont, Mornhed, and Clark as discussed in connection with claim 24. 886 Pet. 30 (citing Ex. 1112 ¶ 77).

Regarding claim 26, which depends from claim 24 and requires that the variable flow pump system comprise "at least two variable speed pumps in parallel," Petitioner asserts it would have been obvious in view of Clark's disclosure of variable speed pumps arranged in parallel for the purpose of emergency use and quick storage tank recharge. *Id*. at 30–31 (citing Ex. 1112 ¶ 82; Ex. 1114, 6; Ex. 1119, 12).

Regarding claim 66, which depends from claim 24 and requires that the variable flow pump system comprise a flow control valve, Petitioner contends that Clark's Figure 3 further discloses a flow control valve to control the flow of chilled water to the combustion turbine cooling coil banks. *Id.* at 39 (citing Ex. 1119, 95). Petitioner argues that it would have been obvious to combine the air cooling system of Andrepont with the

control valve and sensor system disclosed by Clark to control the air cooling temperature to a design cooled temperature with variable flow. *Id*. at 40 (citing Ex. 1112 ¶¶ 113–114).

Patent Owner does not make separate arguments concerning claims 24–26 and 66 nor does Patent Owner present arguments regarding the further combination of Clark with Andrepont and Mornhed. PO Resp. 21.

Based on the complete record after trial and for the reasons provided in the 886 Petition and above, we are persuaded that Petitioner has shown, by a preponderance of the evidence, that claims 24–26 and 66 would have been obvious in view of the combination of Andrepont, Mornhed, and Clark and that the strong evidence of obviousness outweighs Patent Owner's evidence of secondary considerations, as explained above. 886 Pet. 26–31, 38–40; Pet. Reply 1–25.

b. Claims 28–33 (Sensor and Control Systems)

Claim 28 depends from claim 21 and requires a sensor system "having at least one sensor adjacent the air outlet of the air cooler" and a control system "to alter a characteristic of the water in the water circulation system based on the sensor system." Petitioner asserts that claim 28 would have been obvious over the combination of Andrepont's cooling system, which contemplates controls and instrumentation, and Clark's disclosure of a control system to control the air cooling temperature by varying the chilled water supply flow based on a sensor system that includes temperature transmitters at the turbine cooling coil bank. 886 Pet. 31–35 (citing Ex. 1114, 7; Ex. 1119, 95; Ex. 1112 ¶¶ 88, 90–92). Petitioner argues that the combination of Clark's programmable logic controller and sensors with Andrepont's cooling system would have been obvious to control the air

cooling temperature to a design cooled temperature. *Id*. at 34 (citing Ex. 1112 ¶ 92).

Regarding claim 29, which depends from claim 28 and requires a temperature sensor, Petitioner cites Clark's disclosure of a temperature transmitter at each of the combustion turbine cooling coil banks and argues that claim 29 would have been obvious over the combination of Clark's temperature sensor in combination with Andrepont and Mornhed. *Id*. at 35.

Regarding claim 30, which depends from claim 28 and requires a relative humidity sensor, Petitioner cites Clark's disclosure of a coil discharge humidity sensor and argues that the exact type of humidity sensor required by claim 30 would have been within the grasp of one of ordinary skill in the art. *Id*. at 35 (citing Ex. 1112 ¶ 101). Because humidity sensors are known to determine or anticipate risks of icing at the bellmouth of the turbine, Petitioner argues it would have been obvious to combine Clark's humidity sensor and control systems to monitor Andrepont's turbine inlet air cooling system with a reasonable expectation of success. *Id*. at 35–37.

Regarding claims 31, 32, and 33, which each depend from claim 28 and require (1) a sensor system with both a relative humidity sensor and a temperature sensor, (2) a control system disposed to alter the temperature of the water, and (3) a control system disposed to alter the flow rate of the water, respectively, Petitioner argues these claims would have been obvious over the combination of Andrepont, Mornhed, and Clark based on the disclosures in Clark of such components in a control system discussed above. *Id*. at 37–38.

As noted earlier, Patent Owner does not separately argue these claims which depend from claim 21. Based on the complete record and for the

reasons provided in the 886 Petition, we find the Petitioner sufficiently shows that claims 28–33 would have been obvious over the combination of Andrepont, Mornhed, and Clark. *Id.* at 26–40. Patent Owner's evidence of secondary considerations does not outweigh the strong evidence of obviousness, as addressed above.

In sum, Petitioner shows, by a preponderance of the evidence, that claims 24–26, 28–33, and 66 would have been obvious in view of the combination of Andrepont, Mornhed, and Clark.

7. Andrepont, Mornhed, and Trane Product Sheet: Claim 27

Claim 27 also depends from independent claim 21 and recites "wherein the first and second chillers together comprise a single duplex chiller." Ex. 1001, 32:10–11. Petitioner argues that the Trane Product Sheet discloses duplex centrifugal water chillers were readily available to one of ordinary skill in the art at the time of the invention and would have been obvious to combine with the cooling system taught by Andrepont in view of Andrepont's description of the inherent flexibility in the selection of the chiller. 886 Pet. 44–45 (citing Ex. 1114, 5; Ex. 1117, 1; Ex. 1112 ¶ 84).

Patent Owner does not separately argue the patentability of claim 27.

Based on the complete record, we are persuaded that the combination of Andrepont and Trane Product Sheet is supported by the evidence for the reasons discussed in connection with claim 13. We also are persuaded that, based on the complete record and for the reasons provided in the 886 Petition, Petitioner demonstrates, by the preponderance of the evidence, that claim 27 would have been obvious in view of the combination of Andrepont, Mornhed, and the Trane Product Sheet. 886 Pet. 44–45. Patent Owner's

evidence of secondary considerations does not outweigh the strong evidence of obviousness for the reasons discussed above.

8. Andrepont and Trane Product Sheet: Claims 71–75

Independent claim 71, quoted in its entirety in Section I.C. above, requires a duplex chiller with an inlet and an outlet in fluid communication with the warm water and cool water ports, respectively, of a thermal energy storage tank. Ex. 1001, 36:33–38. Petitioner asserts that claim 71 would have been obvious over the combination of Andrepont's cooling system, which explicitly states "any water chilling technology" can be used, together with the duplex chiller of the Trane Product Sheet, which claims such chillers "offer significant first cost and operating cost advantages compared to field assembled very large chillers." 886 Pet. 45–49 (quoting Ex. 1114, 5, Ex. 1117, 1). As discussed above in connection with claim 13, we are persuaded that Petitioner's reasons for combining Trane Product Sheet's duplex chiller with Andrepont's turbine inlet air cooling system have a rational underpinning. *C.f.* PO Resp. 55–59.

Regarding claim 72, which depends from claim 71 and further requires that the duplex chiller comprise a centrifugal water chiller, Petitioner argues that the "Trane Product Sheet specifically discloses 'Trane Duplex Centrifugal Water Chillers.'" 886 Pet. 49 (citing Ex. 1117, 1).

Regarding claim 73, which depends from claim 72 and further requires that the centrifugal water chiller is a Trane duplex centrifugal CDHF water chiller, Petitioner argues that the "Trane Product Sheet specifically discloses the 'Trane Duplex Centrifugal Water Chillers *CDHF*.'" *Id*.

Regarding claim 74, which depends from 71 and recites the first condenser "duplex chiller has a first condenser that is joined directly to a second condenser such that both the first and second condensers share the same condenser tubes," Petitioner argues that the Trane Manual shows that the limitations of claim 74 are inherently included in the Trane Duplex Centrifugal Water Chillers CDHF. *Id*. at 50 (citing Ex. 1123, 1, 9, 10). According to Petitioner, the Trane Manual (Ex. 1123) illustrates that the shell-and-tube condenser of the Refrigerant circuit "A" is joined directly to the shell-and-tube condenser of the Refrigerant circuit "B" and therefore they share the same condenser tubes. Figure 1, below, from the Trane Manual is annotated by Petitioner with labels for the condenser, compressor, and evaporator components of the refrigerant circuits.

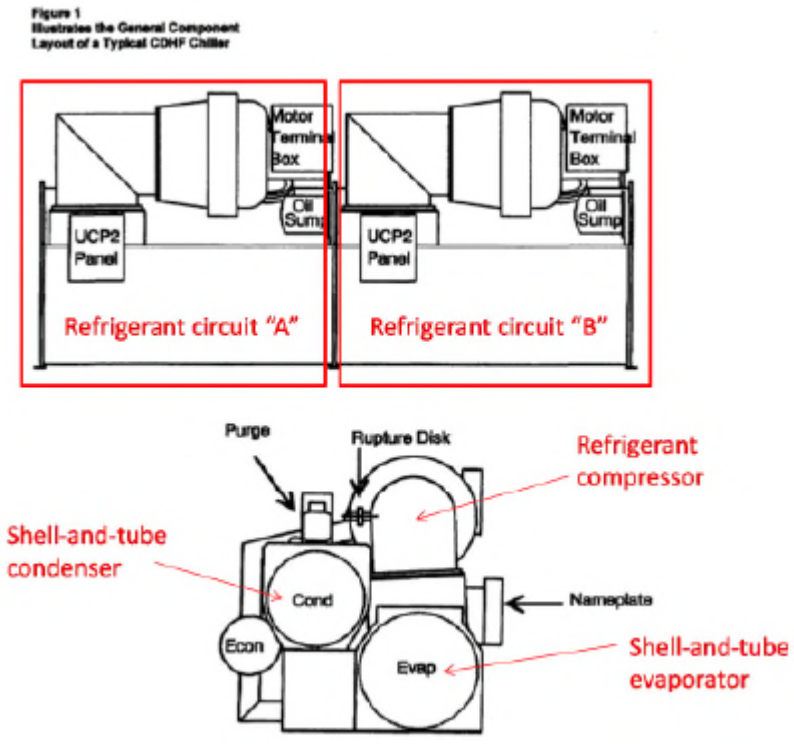


Figure 1 of the Trane Manual (Ex. 1123), annotated. 886 Pet. 50. Petitioner also quotes the Trane Product Sheet describing the chiller as having "[a]

'single pass evaporator and condenser for low pressure drops.'" *Id*. at 51 (quoting Ex. 1117, 1).

Regarding claim 75, which depends from claim 71 and recites "wherein the duplex chiller has a first evaporator that is joined directly to a second evaporator such that both the first and second evaporators share the same evaporator tubes," Petitioner argues that the Trane Manual also shows that the limitations of claim 75 are inherently included in the Trane Duplex Centrifugal Water Chillers CDHF. 886 Pet. 51 (citing annotated Figure 1 above; Ex. 1112 ¶¶ 122–123). According to Petitioner, the Trane Manual illustrates that the shell-and-tube evaporator of the Refrigerant circuit "A" is joined directly to the shell-and-tube evaporator of the Refrigerant circuit "B" and therefore they share the same evaporator tubes. Petitioner also quotes the Trane Product Sheet because it describes the chiller as having "[a] 'single pass evaporator and condenser for low pressure drops.'" *Id.* at 52 (quoting Ex. 1117, 1).

Patent Owner does not include separate arguments for claims 72 through 75.

Based on the foregoing and for the reasons provided in the Petition, we find that Petitioner has proved, by a preponderance of the evidence, that claims 71–75 would have been obvious over the combination of Andrepont and the Trane Product Sheet. 886 Pet. 45–52. Patent Owner's evidence of secondary considerations does not outweigh the strong evidence of obviousness, as explained above.

C. *Motions to Exclude*

Patent Owner moves to exclude Exhibits 1028/1128, 1029/1129, and 1030/1130, which were submitted by Petitioner with its Reply, on the basis

of relevance, timeliness, and authenticity. PO Motion 1–2. Petitioner moves to exclude Exhibits 2007, 2009, and 2011 on the basis of hearsay and relevance. Pet. Motion 1–7. Because we do not rely upon the objected to evidence in rendering this decision, we *dismiss* the parties' motions to exclude.

III. CONCLUSION

Petitioner has demonstrated by a preponderance of the evidence that claims 8–33, 53–56, 66, and 71–75 would have been obvious under 35 U.S.C. § 103(a).

IV. ORDER

Accordingly, it is hereby:

ORDERED that claims 8–33, 53–56, 66, and 71–75 of the '815 patent are held unpatentable;

FURTHER ORDERED that the parties' respective motions to exclude evidence are *dismissed*; and

FURTHER ORDERED that the parties to the proceeding seeking judicial review of this Final Written Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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