IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLORADO
Chief Judge Philip A. Brimmer

Civil Action No. 21-cv-02235-PAB-SBP

ENERGY ENVIRONMENTAL CORPORATION, a Colorado corporation,

Plaintiff,

v.

THE CITY AND COUNTY OF DENVER, ACTING BY AND THROUGH ITS BOARD OF WATER COMMISSIONERS a/k/a DENVER WATER,

Defendant.

ORDER

The matter before the Court is the parties' Joint Motion for Determination of Claim Construction [Docket No. 67], wherein the parties ask the Court to construe eight terms[1] in two patents.[2] On January 18, 2023, the Court held a claim construction hearing pursuant to *Markman v. Westview Instruments, Inc.*, 517 U.S. 370 (1996). Docket No. 98.

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[1] The parties Joint Agreed and Disputed Claim Terms Chart identifies nine disputed terms. *See* Docket No. 55. However, Energy Environmental Corporation's response to City and County of Denver, acting by and through its Board of Water Commissioners' motion lists "a . . . dew point . . . in a fresh intake air moving into a dehumidifying device" as a stipulated term, Docket No. 65 at 6, accordingly the Court will address it as such.

[2] The patents at issue are U.S. Patent No. 10,072,863 (the "'863 Patent"), issued September 11, 2018, and U.S. Patent No. 10,907,848 (the "'848 Patent"), issued February 2, 2021. Docket Nos. 20-2, 20-4. The patents share a common specification. Docket No. 55 at 5 n.1. The Court will cite only the '863 Patent unless a citation to the '848 Patent is necessary.

I. BACKGROUND

Energy Environmental Corporation ("Energy Environmental") filed this action on August 17, 2021. Docket No. 1. On January 19, 2023, Energy Environmental filed a second amended complaint, alleging that defendant City and County of Denver, acting by and through its Board of Water Commissioners ("Denver Water"), infringed the '863 and '848 Patents. Docket No. 99 at 30-31, ¶¶ 60-69.

The Court will construe the claim terms consistently across each patent and each claim. *See Boss Indus., Inc. v. Yamaha Motor Corp., U.S.A., Inc.*, 333 F. App'x 531, 536-37 (Fed. Cir. 2009) (unpublished) (finding that the district court did not err in construing a term consistently for multiple patents where the patents' specifications were "nearly identical" and where the patents "share[d] many common terms with [their] sister patents").

Both patents are "directed to methods and systems for heating and cooling a building" using a fluid circulating in a thermally conductive structure. Docket No. 99 at 7, ¶ 13; Docket No. 62 at 5. Independent claim 1 of the '863 Patent describes:

> 1. A method for controlling heating and cooling in a conditioned space, the method comprising the steps of:
>
> (a) receiving in a microprocessor controller a desired set point temperature;
>
> (b) receiving in the microprocessor controller a plurality of sensor inputs from a plurality of sensors, wherein the plurality of sensors sense at least one temperature and at least one relative humidity;
>
> (c) processing by the microprocessor controller the plurality of sensor inputs from the plurality of sensors in light of the desired set point temperature;
>
> (d) **calculating and tracking by the microprocessor controller a dew point in** at least one of:
>
> (i) a fresh intake air moving into a dehumidifying device;
>
> (ii) **a thermally conductive structure in the conditioned space**; or

(iii) the conditioned space;

(e) sending a plurality of digital signals from the microprocessor controller to a device controller; and

(f) sending a plurality of control signals from the device controller to a plurality of devices, wherein the plurality of devices upon receiving the plurality of control signals achieve the desired set point temperature in the conditioned space by:

(i) circulating a fluid within the **thermally conductive structure**;

(ii) keeping the temperature of the fluid greater than the dew point at the **thermally conductive structure**.

’863 Patent col. 27–28 ll. 61–65, 1–23 (emphasis added) (claim terms at issue in this order appear in bold).

Independent claim 1 of the ’848 Patent describes:

1. An apparatus comprising:

a conditioned space;

a **thermally conductive structure oriented below and thermally connected with the conditioned space**;

at least one source process heat exchanger fluidly connected to at least one first **thermal storage** and at least one second **thermal storage**;

at least one first process heat circulator fluidly connected to the at least one source process heat exchanger and configured to circulate a first source fluid through the at least one first **thermal storage**;

at least one second process heat circulator fluidly connected to the at least one source process heat exchanger and configured to circulate a second source fluid through the at least one second **thermal storage**;

at least one hydronic-to-air circulator fluidly connected to the at least one first **thermal storage**;

at least one energy transfer and ventilation device comprising a dedicated outdoor air system (DOAS) and at least one hydronic coil-to-air heat exchanger, wherein the at least one hydronic coil-to-air heat exchanger is fluidly connected to the at least one hydronic-to-air circulator;

the at least one hydronic-to-air circulator is configured to circulate at least one hydronic coil supply fluid in the at least one hydronic coil-to-air heat exchanger;

the at least one energy transfer and ventilation device is configured with at least one fresh air fan fluidly connected to a fresh air supply;
wherein the at least one energy transfer and ventilation device receives the fresh air supply, and outputs into the conditioned space at least one of:
a fresh air; and
a conditioned air;

at least one fan coil unit comprising: a fan and at least one fan coil unit hydronic coil-to-air heat exchanger in fluid communication with an air in the conditioned space, wherein the at least one fan coil unit returns the air from the conditioned space and supplies the conditioned air into the conditioned space;

a radiant mixing device in fluid communication with the at least one first **thermal storage**, the **thermally conductive structure,** and the at least one fan coil unit hydronic coil-to-air heat exchanger;

at least one first hydronic load circulator fluidly connected to the at least one first **thermal storage** and fluidly connected to the radiant mixing device, wherein the at least one first hydronic load circulator circulates a first hydronic supply fluid to the at least one first **thermal storage** and the radiant mixing device;

the at least one first hydronic load circulator is fluidly connected to:
the **thermally conductive structure**; and
the at least one fan coil unit hydronic coil-to-air heat exchanger;

the at least one first hydronic load circulator circulates a mixed radiant supply fluid from the radiant mixing device through:
the **thermally conductive structure**; and
the at least one fan coil unit hydronic coil-to-air heat exchanger;

wherein a temperature of the mixed radiant supply fluid is modulated by the operation of at least one of:
the radiant mixing device; and
the at least one first hydronic load circulator that modulates a mixed flow of fluid comprised of a portion of at least one of:
the first hydronic supply fluid; and
a first hydronic return fluid;

at least one second hydronic load circulator fluidly connected to:
the at least one second **thermal storage** that is fluidly connected to:
the **thermally conductive structure** that is fluidly connected to:

the at least one fan coil unit hydronic coil-to-air heat exchanger that is fluidly connected to:
at least one DOAS hydronic coil-to-air heat exchanger;

wherein the at least one second hydronic load circulator circulates a second hydronic supply fluid in:
the at least one second **thermal storage**; and
at least one of:
the **thermally conductive structure**;
the at least one fan coil unit hydronic coil-to-air heat exchanger; and
the at least one DOAS hydronic coil-to-air heat exchanger;

at least one temperature sensor in at least two of:
the conditioned space;
the **thermally conductive structure**; and
the at least one energy transfer and ventilation device;

at least one humidity sensor in at least two of:
the conditioned space;
the at least one energy transfer and ventilation device; and
the fresh air supply;

a plurality of sensors that send a plurality of sensor inputs to a microprocessor controller, the plurality of sensors selected from the group consisting of at least two of:
the at least one temperature sensor;
a pressure sensor;
an atmospheric pressure sensor;
the at least one humidity sensor;
a relative humidity sensor;
an air velocity sensor;
a fluid velocity sensor;
a power sensor; and
a real time energy use sensor;

a building automation system configured to achieve at least one of:
at least one energy efficiency;
at least one health benefit;
at least one safety benefit; and
at least one comfort benefit;

the building automation system comprising:
a client/server architecture; and
the microprocessor controller;

a memory coupled to and readable by the microprocessor controller and storing therein a plurality of instructions that, when executed by the microprocessor controller, causes the microprocessor controller to:

receive at least one of:

a cooling set point temperature for the conditioned space;

a heating set point temperature for the conditioned space;

a temperature from the at least one temperature sensor; and

a humidity level from the at least one humidity sensor;

calculate a dew point temperature for at least one of:

a fresh air intake;

the conditioned air into the conditioned space;

a surface of the **thermally conductive structure**; and

the conditioned space;

in response to processing at least one of:

the cooling set point temperature for the conditioned space; and

the heating set point temperature for the conditioned space;

process:

the temperature from the at least one temperature sensor;

the humidity level from the at least one humidity sensor; and

the dew point temperature;

to achieve at least one of:

the at least one energy efficiency;

the at least one health benefit;

the at least one safety benefit; and

the at least one comfort benefit;

execute at least two of the following:

send a **thermal storage** temperature control signal to the at least one source process heat exchanger causing the at least one source process heat exchanger to maintain at least one of:

a set point temperature in the at least one first **thermal storage**; and

a set point temperature in the at least one second **thermal storage**;

send a hydronic-to-air circulator control signal to the at least one hydronic-to-air circulator causing the at least one hydronic-to-air circulator to circulate the at least one hydronic coil supply fluid;

send a first hydronic load circulator control signal to the at least one first hydronic load circulator causing the at least one first hydronic load circulator to circulate the mixed radiant supply fluid;

send a second hydronic load circulator control signal to the at least one second hydronic load circulator causing the at least one second

hydronic load circulator to circulate the second hydronic supply fluid;
send a hydronic supply mixing control signal to at least one of the radiant mixing device and the at least one first hydronic load circulator that modulates at least one of the temperature of the mixed radiant supply fluid and the flow rate of the mixed radiant supply fluid and maintain a temperature of the surface of the **thermally conductive structure** above the dew point temperature;
send a DOAS temperature control signal to the at least one energy transfer and ventilation device that modulates a temperature of the conditioned air from the at least one energy transfer and ventilation device into the conditioned space;
send a DOAS humidity control signal to the at least one energy transfer and ventilation device that modulates a humidity of the conditioned air from the at least one energy transfer and ventilation device into the conditioned space; and
send a ventilation air fan control signal to at least one of:
the at least one energy transfer and ventilation device; and
the at least one fresh air fan to modulate a fan speed.

'848 Patent col. 27–30 ll. 36–67, 1–67, 1–67, 1–35.

II. LEGAL STANDARDS FOR PATENT CLAIM CONSTRUCTION

Claim construction is a question of law for the court, *Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 574 U.S. 318, 325 (2015), guided by Federal Circuit precedent. *See SunTiger, Inc. v. Scientific Research Funding Group*, 189 F.3d 1327, 1333 (Fed. Cir. 1999). The Federal Circuit has made clear that "there is no magic formula or catechism for conducting claim construction." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1324 (Fed. Cir. 2005) (en banc). Nevertheless, there are several key sources and doctrines that should be consulted and applied, but "[t]he sequence of steps used by the judge in consulting various sources is not important; what matters is for the court to attach the appropriate weight to be assigned to those sources in light of the statutes and policies that inform patent law." *Id.*

The starting point is the "bedrock principle" that "'the claims of a patent define the invention to which the patentee is entitled the right to exclude.'" *Id.* at 1312 (quoting

Innova/Pure Water, Inc. v. Safari Water Filtration Systems, Inc., 381 F.3d 1111, 1115 (Fed. Cir. 2004)). The words of the claims "'are generally given their ordinary and customary meaning,'" *id.* (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)), which is "the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention." *Id.* at 1313; *see CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002) ("Generally speaking, [courts] indulge a 'heavy presumption' that a claim term carries its ordinary and customary meaning."). In those instances when the claim language "involves little more than the application of the widely accepted meaning of commonly understood words," construction is relatively straightforward and "the ordinary meaning . . . may be readily apparent even to lay judges." *Phillips*, 415 F.3d at 1314. When the claim terms have a particular meaning in the field, however, courts "look[ ] to 'those sources available to the public that show what a person of skill in the art would have understood disputed claim language to mean.'" *Id.* (quoting *Innova*, 381 F.3d at 1116). "These sources include the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art." *Innova*, 381 F.3d at 1116.

The context in which a term is used, both in the asserted claim as well as in other claims of the patent, can be valuable and instructive. *Phillips*, 415 F.3d at 1314. In addition, the patent specification – the text and figures of the patent that precede the claims – "is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term." *Id.* at 1315 (quoting *Vitronics*, 90 F.3d at 1582). With that said, "the claim requirement

presupposes that a patent applicant defines his invention in the claims, not in the specification." *Johnson & Johnston Associates Inc. v. R.E. Service Co., Inc.*, 285 F.3d 1046, 1052 (Fed. Cir. 2002); *see PSC Computer Products, Inc. v. Foxconn Int'l, Inc.*, 355 F.3d 1353, 1359 (Fed. Cir. 2004) ("the claims of a patent limit the invention, and specifications cannot be utilized to expand the patent monopoly") (quoting *United States v. Adams*, 383 U.S. 39, 48-49 (1966)).

If necessary, courts may also consider the patent's prosecution history – the official record of the patent application and subsequent process before the U.S. Patent and Trademark Office, which "provides evidence of how the PTO and the inventor understood the patent." *Phillips*, 415 F.3d at 1317. Nevertheless, "because the prosecution history represents an ongoing negotiation between the PTO and the applicant, . . . it often lacks the clarity of the specification and thus is less useful for claim construction purposes." *Id.* And, although courts may consult extrinsic evidence such as "expert and inventor testimony, dictionaries, and learned treatises," such evidence is "less significant than the intrinsic record," i.e., the specification and prosecution history, and courts must be wary not to use extrinsic evidence to override the meaning of the claim terms demonstrated by the intrinsic evidence. *Id.* at 1317-19 (quoting *C.R. Bard, Inc. v. U.S. Surgical Corp.*, 388 F.3d 858, 862 (Fed. Cir. 2004)). That is, "extrinsic evidence may be useful to the court, but it is unlikely to result in a reliable interpretation of patent claim scope unless considered in the context of the intrinsic evidence." *Id.* at 1319.

In short, a court must construe the claim terms as they would be viewed by "the ordinary artisan after reading the entire patent." *Id.* at 1321. This is important in order

to respect the public notice function of patents:

> The patent system is based on the proposition that claims cover only the invented subject matter. As the Supreme Court has stated, "[i]t seems to us that nothing can be more just and fair, both to the patentee and the public, than that the former should understand, and correctly describe, just what he has invented, and for what he claims a patent."

Id. (quoting *Merrill v. Yeomans*, 94 U.S. 568, 573-74 (1876)).

III. ANALYSIS[3]

A. POSITA

Patent claims are to be construed through the eyes of a person of ordinary skill in the art in question at the time of the invention ("POSITA"). Energy Environmental offers the following definition of a POSITA:

> a person with a Bachelor's degree in Mechanical Engineering and 2-3 years of experience designing and installing commercial and residential radiant systems or a person without a Mechanical Engineering degree having 8 to 10 years of experience designing and installing radiant systems, where their educational and practical knowledge is consistent with the content of the ASHRAE Handbooks available at that time.

Docket No. 65-1 at 7-8, ¶ 20. Denver Water proposes that a POSITA be defined as:

> someone with a degree in mechanical engineering and at least five years of experience designing commercial and residential radiant systems and control systems. In the absence of an engineering degree, a person may have had significantly more practical and professional experience in designing, building and operating such control systems. These designers have typically been involved with designing commercial and residential radiant heating and cooling, ventilation and control systems for at least seven to ten years and have developed a good understanding of how they function.

Docket No. 62-3 at 5–6, ¶ 16.

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[3] The Court addresses the terms in the order the parties addressed them at the Markman hearing.

The only apparent substantive difference between the two definitions is Energy Environmental's suggestion that a POSITA have experience working with handbooks from The American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. ("ASHRAE"). Energy Environmental's brief states that "[t]he content of the ASHRAE Handbooks available in 2012 are consistent with the knowledge of a PHOSITA in the field," Docket No. 65 at 15 n.3, and Energy Environmental repeatedly referred to ASHRAE standards at the Markman hearing. Denver Water's definition of a POSITA requires additional years of experience, which presumably would make it more likely for the POSITA to have knowledge of an ASHRAE handbook. Furthermore, Energy Environmental's understanding of a POSITA requires only that the POSITA have knowledge consistent with the ASHRAE handbook, not actual knowledge of its contents. The Court finds Energy Environmental's definition the most helpful and will adopt it.

B. Thermally Conductive Structure

"Thermally conductive structure" appears in claims 1 and 36 of the '863 Patent and in claim 1 of the '848 Patent. Docket No. 62 at 15. Denver Water argues that this term should be interpreted under 35 U.S.C. § 112(f) as a means-plus-function term and construed as "a radiant floor, wall, or ceiling." *Id*. Energy Environmental responds that the term should not be interpreted under § 112(f) and that no construction is necessary because the term should be interpreted based on its plain and ordinary meaning. Docket No. 65 at 16.

When a claim term is drafted as a means-plus-function term it invokes 35 U.S.C. § 112(f), which states:

> An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

"[T]he use of the word 'means' in a claim element creates a rebuttable presumption that § 112, para. 6[4] applies." *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1348 (Fed. Cir. 2015) (en banc) (footnote added) (citing *Personalized Media Communications, LLC v. International Trade Commission*, 161 F.3d 696, 703-04 (Fed. Cir. 1998)). "In making the assessment of whether the limitation in question is a means-plus-function term subject to the strictures of § 112, para. 6, [the Federal Circuit has] emphasized that the essential inquiry is not merely the presence or absence of the word 'means' but whether the words of the claim are understood by persons of ordinary skill in the art to have a sufficiently definite meaning as the name for structure." *Id*. (citing *Greenberg v. Ethicon Endo-Surgery, Inc.*, 91 F.3d 1580, 1583 (Fed. Cir. 1996)).

Construction of a claim that has been established as a means-plus-function limitation is a two-step process. "First, the court must determine the claimed function. Second, the court must identify the corresponding structure in the written description of the patent that performs the function." *Noah Sys., Inc. v. Intuit Inc.*, 675 F.3d 1302, 1311 (Fed. Cir. 2012) (quoting *Applied Med. Res. Corp. v. U.S. Surgical Corp.*, 448 F.3d 1324, 1332 (Fed. Cir. 2006)); *see also ABT Sys., LLC v. Robertshaw Controls Co.*, 2013 WL 1498997, at *4 (N.D. Ill. Apr. 11, 2013) (language in a patent specification may support an argument that a limitation denotes structure). A means-plus-function

[4] Paragraph 6 has been restyled as 35 U.S.C. § 112(f) without material changes.

limitation covers only "the corresponding structure . . . described in the specification and equivalents thereof." 35 U.S.C. § 112(f). To determine whether a means-plus-function term discloses sufficient structure, the relevant inquiry is "to look at the disclosure of the patent and determine if one of skill in the art would have understood that disclosure to encompass" the technology at issue. *Blackboard, Inc. v. Desire2Learn Inc.*, 574 F.3d 1371, 1385 (Fed. Cir. 2009) (quoting *Med. Instrumentation & Diagnostics Corp. v. Elekta AB*, 344 F.3d 1205, 1212 (Fed. Cir. 2003)). "It is not proper to look to the knowledge of one skilled in the art apart from and unconnected to the disclosure of the patent." *Id.*; *Williamson*, 792 F.3d at 1351 ("the fact that one of skill in the art could program a computer to perform the recited functions cannot create structure where none otherwise is disclosed") (citation omitted).

Denver Water argues that § 112(f) applies because "thermally conductive" is a functional term and "structure" is a generic and abstract nonce term that does not actually identify any structure. Docket No. 62 at 15. Energy Environmental responds that, because "thermally conductive structure" does not include the word "means," Denver Water cannot overcome the presumption that it is not a mean-plus-function term. Docket No. 65 at 16. Energy Environmental also argues that the specification identifies walls, floors, ceilings, and chilled beams, which is a sufficient identification of structure to establish that § 112(f) does not apply. *Id.* at 17. Examples in the specification, however, cannot support a finding that a claim term refers to a specific structure. *Team Worldwide Corp. v. Intex Recreation Corp.*, 2021 WL 4130634, at *6 (Fed. Cir. 2021) (unpublished). Energy Environmental also cites the patent that "[t]ypical structures utilize low or high mass mediums in which tubing is mounted or

embedded," '863 Patent col. 13 ll. 9–13, which Energy Environmental says is an indication that "thermally conductive structure" is "any building structure. . . through which a thermally conductive fluid is designed to circulate." Docket No. 65 at 17. However, once again, Energy Environmental cites language from the specification, not the claim, which fails to address Denver Water's § 112(f) argument. *See Williamson*, 792 F.3d at 1348.

At the hearing, Energy Environmental identified several uses of "thermally conductive structure" in the claims at issue, noting that the structure is described as having mixed radiant supply fluid circulating through it, as being in fluid connection with the radiant mixing device, and as having a surface, but each of these uses of the term fails to "describe any structure for performing" thermal conduction. *Team Worldwide*, 2021 WL 4130634, at *5. The interactions between a thermally conductive structure and other aspects of the invention do not "inform the structural character of the limitation-in-question." *Williamson*, 792 F.3d at 1351. The Court finds that Denver Water has met its burden of overcoming the presumption that the term "thermally conductive structure" is not "purely functional," *Team Worldwide*, 2021 WL 4130634, at *5, and the Court will analyze the term under § 112(f).

The first step of § 112(f) analysis requires determining the "claimed function" of a term. *Noah Sys., Inc.*, 675 F.3d at 1311. Denver Water proposes that the function of thermally conductive structures is to conduct thermal energy. Docket No. 62 at 16. Energy Environmental does not dispute this description of the function and states that, if construction is necessary, the structure should be construed as "for [the] purposes of heating and cooling." Docket No. 65 at 18. The Court finds that, for the first step of

§ 112(f) analysis, the function of thermally conductive structures is conducting thermal energy.

Next, the Court "must identify the corresponding structure in the written description of the patent that performs the function." *Noah Sys., Inc.*, 675 F.3d at 1311. The parties agree that the structures identified in the specification include radiant walls, floors, ceilings, and chilled beams. Docket No. 62 at 16 n.5; Docket No. 65 at 13; '863 col. 9 ll. 28–30. Accordingly, the Court will construe the term "thermally conductive structure" pursuant to § 112(f) as "a radiant floor, wall, ceiling, or chilled beam."

C. Thermal Storage

The term "thermal storage" appears in claim 39 of the '863 Patent and claim 1, among others, of the '848 Patent. '863 col. 33 ll. 17–20; '848 Patent col. 27 ll. 40–43. Energy Environmental argues that no construction is necessary for the term "thermal storage." Docket No. 65 at 10. Denver Water claims that "thermal storage" denotes a function, namely, "the act or state of storing energy," and does not identify any associated structures. Docket No. 62 at 11. As a result, Denver Water argues that the term should be construed under § 112(f) as "a chilled fluid storage tank or a heated fluid storage tank." *Id*. at 10.

In order to determine whether § 112(f) applies, the Court considers the context in which the term "thermal storage" is used. In claim 1 of the '848 Patent, "thermal storage" is used several times, an example of which states:

> at least one source process heat exchanger fluidly connected to at least one first **thermal storage** and at least one second **thermal storage;** at least one first process heat circulator fluidly connected to the at least one source process heat exchanger and configured to circulate a first source fluid through the at least one first **thermal storage**; at least one second

> process heat circulator fluidly connected to the at least one source process heat exchanger and configured to circulate a second source fluid through the at least one second **thermal storage**; at least one hydronic-to-air circulator fluidly connected to the at least one first **thermal storage.**

'848 Patent col. 27 ll. 40–52.

Energy Environmental states that the term "thermal storage" does not include the word "means" and that Denver Water cannot overcome the presumption that § 112(f) does not apply. Docket No. 65 at 10. Energy Environmental claims that both parties' experts conclude a POSITA would understand the term to mean a definite structure. *Id.* The parties' experts, however, rely on the specification of the '863 Patent as opposed to the language of the claim to describe the structure of thermal storage. Mr. Wallace, Energy Environmental's expert, cites examples from the specification to describe thermal storage as a heated or chilled fluid tank or circulating fluid. *See* Docket No. 65-1 at 9-10, ¶¶ 24–25 (citing '863 Patent col. 12–13 ll. 65–67, 1–3, 9–11, col. 19 ll. 11–19, col. 24 ll. 48–56). Mr. Simmonds, Denver Water's expert, states that a "POSITA, reading the patent specification, would identify the devices for storing heat energy to be 'a chilled fluid storage tank or a heated fluid storage tank.'" Docket No. 62-3 at 6, ¶ 19. Neither expert supports Energy Environmental's contention that a POSITA would be able to discern specific structures from the language of the claim without looking at examples in the specification. The Court agrees that the claims using the term "thermal storage" are functional and do not identify any specific structure. The Court also finds that Denver Water has overcome the presumption. The Court will therefore construe the term "thermal storage" under § 112(f).

Denver Water argues the function of thermal storage is the act or state of storing heat energy. Docket No. 62 at 11. Energy Environmental does not dispute this

function, but argues the term should be construed to include removing heat with circulating fluid and that, if § 112(f) applies, "thermal storage" should be interpreted as any apparatus that holds fluid in a hydronic system. Docket No. 65 at 11-12. The Court finds the function of "thermal storage" is the act or state of storing heat energy.

Denver Water asserts that a chilled fluid tank and a heated fluid tank are the only examples of thermal storage in the specification. Docket No. 62 at 11-12. Energy Environmental argues this is too narrow because tanks are provided as "examples of thermal storage." Docket No. 65 at 11 (emphasis omitted). Energy Environmental believes that a POSITA would understand circulating fluid in the hydronic system as a type of storage and that removing heat would be included in the definition. *Id*. at 12. Energy Environmental, however, does not point to an example in the specification of thermal storage referring to circulating fluid. Instead, the specification of the '863 Patent refers to fluid in the "thermal storage" being used to transfer energy to a second "thermal storage," '863 Patent col. 13 ll. 8–11, thus distinguishing between the "fluid" and "thermal storage." Under § 112(f), the concept of storing heat in the fluid cannot be included in the construction of the term "thermal storage." Additionally, the '848 Patent states that a heat exchanger is "configured to circulate a first source fluid through the at least one first thermal storage." '848 Patent col. 27 ll. 43–46. Thus, like the specification of the '863 Patent, claim 1 of the '848 Patent makes a distinction between fluid and "thermal storage." The Court will decline to include circulating fluid in its definition of thermal storage. The Court will construe the term "thermal storage"

pursuant to § 112(f) as "a tank where thermal energy is stored."[5]

D. Oriented Below and Thermally Connected with the Conditioned Space

The term "thermally conductive structure oriented below and thermally connected with the conditioned space" appears in claim 1 of the '848 Patent. '848 Patent col. 27 ll. 38–39. Energy Environmental argues that the term "oriented below and thermally connected with the conditioned space" does not require construction. Docket No. 65 at 22. Denver Water believes that the term should be construed as "radiant flooring beneath the space(s) to be heated or cooled with no thermal disconnect between the fluid and those spaces(s)." Docket No. 62 at 21. The term does not include the word "means," and Denver Water does not argue that § 112(f) applies to this term. Accordingly, the Court will not construe this term pursuant to § 112(f).

As noted above, the Court has construed the term "thermally conductive structure" as floors, ceilings, walls, or chilled beams. Given that the Court will construe terms consistently across usages, *see Phillips*, 415 F.3d at 1314 ("claim terms are normally used consistently throughout the patent"), the Court will construe a "thermally conductive structure" in this term to be a radiant floor, wall, ceiling, or chilled beam. Denver Water argues that, because the words "oriented below" are included, this claim term must be limited to floors.[6] Docket No. 62 at 21. By contrast, Energy

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[5] Denver Water proposes that the definition of "thermal storage" differentiates between a "chilled fluid storage tank" and a "heated fluid storage tank," Docket No. 62 at 10, but the specification describes Thermal Storage One and Thermal Storage Two as "typically" either hot or cold, not always one or the other. *See* '863 Patent col. 12–13 ll. 66–67, 1–2.

[6] The specification, however, notes that the "application of [hydronic building systems control] is not limited to radiant floor applications." '848 Patent col. 20 ll. 1–2.

Environmental argues that a radiant ceiling could heat or cool the space above the ceiling in addition to the space below it. Docket No. 65 at 22. The Court agrees with Energy Environmental that, despite the use of the words "oriented below," the term is not limited to just a radiant floor, and also includes a wall, ceiling, or chilled beam.

Next, Denver Water argues that the words "thermally connected to the conditioned space" require that there be no thermal disconnect between the floor and the conditioned space. Docket No. 62 at 22. Denver Water argues that a thermally conductive structure separated by insulation or air from a conditioned space would not be thermally connected. *Id.* Energy Environmental responds that Denver Water's definition is vague and proposes that the plain and ordinary meaning of thermally connected should be used. Docket No. 65 at 23. The Court agrees with Energy Environmental that the term thermally connected describes the ability of heat to transfer between the thermally conductive structure and the conditioned space as opposed to providing additional constraints on the positioning of the thermally conductive structure. *See id.* The Court will construe the term "a thermally conductive structure oriented below and thermally connected with the conditioned space" as "a radiant floor, wall, ceiling, or chilled beam located below a conditioned space enabling the transfer of heat to the space."

E. <u>Calculating and Tracking by the Microprocessor Controller a Dew Point</u>

The term "calculating and tracking by the microprocessor controller a dew point" appears in claim 1 of the '863 Patent. Docket No. 62 at 13. Denver Water argues the term "calculating and tracking by the microprocessor controller" should be construed as "periodically calculating a dew point using received inputs and subsequently storing

historically determined dew points for subsequent use." *Id.* Energy Environmental argues that no construction is necessary and that Denver Water's proposed construction is too narrow. Docket No. 65 at 13.

As noted in the '863 Patent, "[t]he dew point is the temperature below which the water vapor in a volume of humid air . . . will condense into liquid water at the same rate at which it evaporates." '863 Patent col. 4 ll. 23–26. The parties agree that there are commonly accepted methods for calculating a dew point that a POSITA would be aware of. Docket No. 62 at 13; Docket No. 65 at 13. Denver Water's proposed construction includes calculating a dew point "using received inputs," Docket No. 62 at 13, but Denver Water does not explain why this modifier is necessary when a POSITA would understand how a dew point is calculated. The Court will not construe the term to include that dew points are calculated using received inputs.

Denver Water argues that "tracking" a dew point should be construed as storing historic dew point calculations for subsequent analysis. *Id.* at 14. Denver Water points to several instances in the '863 Patent where the term calculating a dew point is used without any reference to tracking, *see, e.g.*, "methods known in the art used to calculate dew point," '863 Patent col. 8 ll. 7–8; "calculate dew point in real-time" *id.* at col. 16 ll. 59–60, arguing that this means that calculating and tracking a dew point is different from simply calculating a dew point. Docket No. 62 at 13. Energy Environmental responds that Denver Water's definition is overly restrictive and that the specification does not indicate that tracking requires storing historical data. Docket No. 65 at 14. Energy Environmental states that, if the term is construed, "tracking" should be defined as "following dew point measurements over time to enable the hydronic system to

adjust dynamically and actively respond to and control humidity." *Id.* at 15. Energy Environmental, however, does not explain how dew points could be followed over time without storing the previously calculated dew points. In order to follow or track a dew point over time, new calculations must be compared to previous calculations. Energy Environmental has not shown how "tracking" differs from "calculating" in a way that would not involve data storage. Energy Environmental's proposed construction would make the term "tracking" superfluous because, without a comparison to previous dew point calculations, the term is synonymous with "calculating." Such a construction is disfavored. *See Wasica Fin. GmbH v. Cont'l Auto. Sys., Inc.*, 853 F.3d 1272, 1288 n.10 (Fed. Cir. 2017) ("It is highly disfavored to construe terms in a way that renders them void, meaningless, or superfluous"); *Power Mosfet Techs., L.L.C. v. Siemens AG*, 378 F.3d 1396, 1410 (Fed. Cir. 2004) ("interpretations that render some portion of the claim language superfluous are disfavored"). The Court will construe the term "calculating and tracking by the microprocessor controller a dew point" as "calculating a dew point and storing previously determined dew points."

F. <u>Calculating a Dew Point in a Thermally Conductive Structure</u>

"[C]alculating and tracking by the microprocessor controller a dew point **in** . . . a thermally conductive structure in the conditioned space" appears in claim 1 of the '863 Patent. '863 Patent col. 28 ll. 6–11 (emphasis added). The Court will construe "calculating and tracking" and "thermally conductive structure" consistently with the definitions above. The parties' dispute concerning this term revolves around how the word "in" should be understood. Both sides acknowledge that it does not make sense to calculate a dew point inside a thermally conductive structure given that the definition

of dew point involves the point at which humidity in the air will condense. Docket No. 62 at 20; Docket No. 65 at 18-19. Denver Water argues the term "dew point in . . . a thermally conductive structure" should be construed as "a dew point within the limits of the thermally conductive structure using temperature and humidity sensors within the thermally conductive structure. It is separate and different from calculating and tracking a dew point in the conditioned air space." *Id.*

Energy Environmental argues that no construction is necessary. Docket No. 65 at 18. However, if construction is necessary, Energy Environmental believes that the term should be construed to mean sensing a temperature in the thermally conductive structure, sensing a humidity from the conditioned space, and using the date to make the calculation. *Id.* at 21–22. Energy Environmental states that, because it is impossible to measure the humidity inside a thermally conductive structure, it would be clear to a POSITA that only temperature would be measured inside the thermally conductive structure, while humidity would be measured from the conditioned space outside the thermally conductive structure. *Id.* at 18–19. Energy Environmental does not identify any ambiguity in element (d) in Claim 1 of the '863 Patent regarding the word "in": "calculating and tracking by the microprocessor controller a dew point **in** . . . a thermally conductive structure in the conditioned space." '863 Patent col. 28 ll. 6–11. In fact, Energy Environmental admits that the "claim literally says a microprocessor calculates a dew point 'in' a thermally conductive structure. However, a dew point cannot be calculated relative to a solid object." Docket No. 65 at 18-19. Thus, the issue is not ambiguity, but rather impossibility or nonsensicality. If there is no ambiguity, the claim term cannot be ignored. The Court does not have license to construe "in" to mean

"on" or to construe the claim in the manner suggested by Energy Environmental simply because a POSITA would understand that "in" does not make sense in the context of the claim.

It is true that the specification describes, at least in one embodiment, temperature sensors being in the thermally conductive structure, '863 Patent col. 16 ll. 12–16, and humidity sensors being in the conditioned space. *Id.* at ll. 50-51. But shortly thereafter the specification states that "this sensor configuration is sufficient to . . . calculate dew point in real time in Conditioned Space 10 and Thermally-Conductive Structure 16." *Id.* at ll. 57–61. This language does not say calculating a dew point "in air located adjacent [to] the thermally conductive structure," as Energy Environmental suggests a POSITA would understand the specification and claim. Docket No. 65 at 19. Later, when discussing the cooling operation, the specification states "this process will lower the relative humidity and calculated dew point in Conditional Space 10. The lower dew point in Thermally-Conditioned Structure 16 will enable a lower Mixed Radiant Supply Fluid 8 temperature. . . ." '863 Patent col. 18–19 ll. 65–67, 1.[7] Thus, the specification refers to a dew point "in" the thermally conditioned structure, which, contrary to Energy Environmental's argument, would not allow a POSITA to reconcile the use of the word "in" in that portion of Claim 1 that says calculating and tracking a dew point "in at least one of:

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[7] Other language in Claim 1 demonstrates that the drafter distinguished between the words "in" and "at" in relationship to the dew point and the thermally conductive structure, but nevertheless chose to use "in" with regard to the dispute claim term. *See*, *e.g.*, '863 Patent col. 28 ll. 22–23 ("(ii) keeping the temperature of the fluid greater than the dew point at the thermally conductive structure").

. . . A thermally conductive structure in the conditioned space. *Id.* at col. 28 ll. 7–11.[8]

The Court will therefore construe the words "dew point in . . . A thermally conductive structure" to mean "dew point . . . within a thermally conductive structure."[9]

G. <u>A Configuration to Stage Priority of at Least One of: a Cooling; and a Ventilation</u>

"[A] configuration to stage priority of at least one of: a cooling; and a ventilation;" appears in claim 10 of the '848 Patent. '848 Patent col. 31 ll. 40–42. Denver Water argues that the term should be construed as:

> [A] control system in which stage 1 activates an Energy Transfer and Ventilation Device 32 to circulate cool outside air in the Conditioned Space 10. If Stage 1 does not meet the cooling demand as needed, Stage 2 is activated to extract heat using the thermally conductive structure. If Stages 1 and 2 do not meet the cooling demand as needed, Stage 3 is activated. Stage 3 provides cooling by dehumidification of air passing through an Hydronic Coil-to-Air Heat Exchanger.

Id. at ll. 23–24. Energy Environmental argues that the term does not need construction. Docket No. 65 at 24. Denver Water argues § 112(f) applies because "configuration" is a

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[8] As noted by Denver Water, another problem with Energy Environmental's proposed construction of the claim term is that reading "in . . . a thermally conductive structure" to mean measuring the dew point in conditioned space is that it would eliminate the distinction between elements (d)(ii) and (d)(iii) of the patent, which violates the presumption that different claim terms have different meanings. *See SimpleAir, Inc. v. Sony Ericsson Mobile Commc'ns AB*, 820 F.3d 419, 431 (Fed. Cir. 2016); *Bd. Of Regents of the Univ. of Tex. Sys. v. BENQ Am. Corp.*, 533 F.3d 1362, 1371 (Fed. Cir. 2008).

[9] Denver Water claims that the effect of requiring that the dew point be calculated within the thermally conductive structure is to invalidate Claim 1 pursuant to the holdings of *Chef Am., Inc. v. Lamb-Weston, Inc.*, 358 F.3d 1371, 1374 (Fed. Cir. 2004), and *Synchronoss Techs., Inc. v. Dropbox, Inc.*, 987 F.3d 1358, 1366–67 (Fed. Cir. 2021). However, given that subparagraph (d) of Claim 1 states "at least one of" and the other two sub-elements are not affected, the Court is not certain that subparagraph (d), or Claim 1 as a whole, is invalidated as a result.

nonce word and "stage priority" is a functional term with no identified structure. Docket No. 62 at 24. Energy Environmental responds that § 112(f) presumptively does not apply because the word "means" is not used and that the challenged claim term, when considered in light of the claims it references, namely, claims 1 and 8, provides sufficient structure. Docket No. 65 at 25.

Claim 10 states, in part, "[t]he apparatus according to claim 8 wherein the building automation system further comprises: a configuration to stage priority of at least one of: a cooling; and a ventilation; by at least one of: the at least one energy transfer and ventilation device; the at least one fresh air fan; the thermally conductive structure; and the at least one water-to-air heat pump." '848 Patent col. 31 ll. 38–48. Claim 8 states, in part, "the apparatus according to claim 1 further comprising: at least one water-to-air heat pump comprising: a two-stage compressor; a variable speed electronically commutated motor fan; and a dedicated microprocessor controller." *Id.* at ll. 6-15. Claim 1 states the building automation system is comprised of "a client/server architecture" and "the microprocessor controller." *Id.* at col. 29 ll. 20–22.

Energy Environmental does not explain how these claims describe a configuration to prioritize between cooling and ventilation; rather, Energy Environmental argues that, because claims 1, 8, and 10 recite devices that can perform staged cooling or ventilation, the term "a configuration to stage priority" provides a definite structure. Docket No. 65 at 25. This, however, does not reach the claimed function. Energy Environmental's identification of the structures used to perform the cooling and ventilation does not address the structure used to stage priority between the cooling and ventilation devices. At the hearing, Energy Environmental argued that staging can be

accomplished with multiple devices or within one device, but did not identify what structure prioritizes the operation of each device or of functions within a device. As there is no indication of what structure the "configuration" consists of, the Court will apply § 112(f).

Under § 112(f), the Court must first determine the function of the term. Denver Water argues the function is to "stage priority of cooling or a ventilation." Docket No. 62 at 24. Energy Environmental does not dispute this definition of the function, arguing only that Denver Water's definition improperly limits the term by reading limits from the specification into the claim. Docket No. 65 at 25–26. The Court finds that the function is "staging priority between cooling and ventilation."

Next, the Court must identify the structure in the specification that performs the function. Denver Water argues that the specification identifies one example of a structure that performs staged cooling and ventilation, namely, "a control system in which stage 1 activates an Energy Transfer and Ventilation Device 32 to circulate cool outside air in the Conditioned Space 10. If Stage 1 does not meet the cooling demand as needed, Stage 2 is activated to extract heat using the thermally conductive structure. If Stages 1 and 2 do not meet the cooling demand as needed, Stage 3 is activated. Stage 3 provides cooling by dehumidification of air passing through a Hydronic Coil-to-Air Heat Exchanger." Docket No. 62 at 23–24. Energy Environmental responds that this definition improperly reads limitations into the term based on the specification and argues a POSITA "would understand that a priority staging is not limited to the specific sequence asserted by Denver Water but includes the activation of a first device before another device or varying the operation of a single device to achieve cooling or

ventilation." Docket No. 65 at 26. Energy Environmental does not point to any examples in the specification to support its interpretation. *Id.*

The specification states the hydronic building systems control "is programmed with staged priority cooling and ventilation set to multiple stages, e.g., Stage 1-Energy Transfer and Ventilation Device []; Stage 2-radiant floor cooling through Thermally-Conductive Structure []; and Stage 3-forced air cooling through Hydronic Coil-to-Air Heat Exchanger," '848 Patent col. 17 ll. 16–21, and explains an example of how the three stages are prioritized. *Id.* at col. 17–18 ll. 22–67, 1–61.

The Court agrees with Denver Water that the three-stage configuration to prioritize cooling and ventilation is the only example in the specification. Accordingly, the Court will construe "a configuration to stage priority of at least one of: a cooling; and a ventilation" as "a control system in which stage 1 activates an Energy Transfer and Ventilation Device 32 to circulate cool outside air in the Conditioned Space 10. If Stage 1 does not meet the cooling demand as needed, Stage 2 is activated to extract heat using the thermally conductive structure. If Stages 1 and 2 do not meet the cooling demand as needed, Stage 3 is activated. Stage 3 provides cooling by dehumidification of air passing through an Hydronic Coil-to-Air Heat Exchanger."

H. A building automation system configured to achieve at least one of: at least one energy efficiency; at least one health benefit; at least one safety benefit; and at least one comfort benefit

"[A] building automation system configured to achieve at least one of: at least one energy efficiency; at least one health benefit; at least one safety benefit; and at least one comfort benefit" appears in claims 1 and 10 of the '848 Patent. '848 Patent col. 29 ll. 13–19, col. 31 ll. 38–53. Energy Environmental argues that no construction is

necessary. Docket No. 65 at 26. Denver Water argues, first, that § 112(f) applies and that the term "building automation system" lacks the necessary corresponding structure. Docket No. 62 at 26. Second, it argues that the "benefit" terms should be found invalid because they lack definiteness. *Id.*

The entirety of Denver Water's argument that § 112(f) applies is that "the term 'building automation' is functional and 'system' is a generic nonce word. Similarly, achieving an 'energy efficiency,' 'health benefit,' 'safety benefit' and 'comfort benefit' are all purely functional language. Accordingly, this claim terminology should be analyzed according to §112(f)." *Id.* Energy Environmental responds that § 112(f) does not apply because claim 1 of the '848 Patent states that a building automation system "comprises a client/server architecture and microprocessor controller with a coupled memory." Docket No. 65 at 27.[10] In its reply, Denver Water does not contest this conclusion, but

[10] Energy Environmental also argues that sufficient structure is recited for energy efficiency, health benefit, safety benefit, and comfort benefit ("the efficiency and benefit terms") in claims 1 and 41 and that the relevant structures include "thermally conductive structure, source process heat exchangers, source fluids, process heat circulators, hydronic coil-to-air circulators, hydronic supply fluids, hydronic coil supply fluid, hydronic coil-to-air circulators, DOAS, fan coil units, radiant mixing devices, mixed radiant supply fluid, hydronic load circulators, thermal storage, a variety of sensor including temperature and humidity sensors, fresh air supply, and a building automation system including a client/server architecture and microprocessor controller with memory and stored instructions." Docket No. 65 at 28. However, these other structures are not part of the building automation system, but part of the heating and cooling system generally. As claim 1 indicates, the "system" is the computerized control system comprised of a microprocessor controller and a client/server architecture. The Court will not construe "building automation system" to cover additional structures in the heating and cooling system as corresponding structures for claims 1 and 10.

asserts that, "even accepting EEC's position, the goals of achieving an 'energy efficiency,' 'health benefit,' 'safety benefit' and 'comfort benefit' are purely functional language" that "are each inherently vague and subjective and therefore fail to inform a POSITA of the scope of the invention with reasonable certainty." Docket No. 66 at 12. Denver Water's reply focuses on its contention that these terms are indefinite and provides no support for its argument that § 112(f) should apply. The challenged claim turn does not use the word "means," which creates a rebuttable presumption that § 112(f) does not apply. *Williamson*, 792 F.3d at 1348. Denver Water has not sufficiently rebutted that presumption and the Court will not construe the challenged claim term under § 112(f).

Denver Water argues the efficiency and benefit targets are invalid because they are not definite, being terms of degree, such as being more efficient, more healthy, more safe, and more comfortable than previous heating and cooling systems. Docket No. 62 at 26. "Definiteness problems often arise when words of degree are used in a claim. That some claim language may not be precise, however, does not automatically render a claim invalid. When a word of degree is used the district court must determine whether the patent's specification provides some standard for measuring that degree. The trial court must decide, that is, whether one of ordinary skill in the art would understand what is claimed when the claim is read in light of the specification." *Seattle Box Co., Inc. v. Indus. Crating & Packing, Inc.*, 731 F.2d 818, 826 (Fed. Cir. 1984). Denver Water argues that the functions in this claim term are vague and subjective because they do not provide objective boundaries for the included terms. Docket No. 62 at 27. Energy Environmental responds that the specification demonstrates that

"energy efficiency," "health benefit," "safety benefit," and "comfort benefit" are tangible results and not subjective indefinite objectives. Docket No. 65 at 29.

At the hearing, the parties agreed that "energy efficiency," "health benefit," "safety benefit," and "comfort benefit" are terms of degree and agreed that *Sonix Tech. Co., Ltd. v. Publications Int'l, Ltd.*, 844 F.3d 1370, 1377 (Fed. Cir. 2017), holds that, where a term is stated as a term of degree, it is not inherently subjective and indefinite. *Sonix Tech.* observed that, for a term of degree to be definite, it must "provide[] guidance as to the scope of the claims" with "examples of noninterfering structures and criteria for their selection." *Id.* A claim containing a term of degree must provide "enough certainty to one of skill in the art when read in the context of the invention" to be able to identify what is claimed by the patent. *Id.* Indefiniteness analysis begins with the language of the claims and then looks to the specification for a standard to define the scope of the term. *Id.* at 1377–78.

Denver Water claims that the efficiency and benefit terms are vague objectives without boundaries and parameters, and notes that no baseline is provided to use as a comparator. Docket No. 62 at 23. Energy Environmental responds that the efficiency and benefits terms have tangible results and are compared to the baseline of forced air systems, which were previously state-of-the-art in the United States. Docket No. 65 at 29; Docket No. 65-1 at 24–28.

Denver Water asserts that the patent does not identify forced air systems as a baseline because it also claims improvements compared to hydronic systems. Docket No. 66 at 13. For example, Denver Water highlights that the '848 Patent asserts that other hydronic systems struggle in the marketplace due to system cost, controller

complexity, and retrofitting difficulty. *Id.* However, as noted in Albert Wallace's declaration as Energy Environmental's expert witness, the '848 Patent never claims the advantages in the disputed efficiency and benefit terms relative to hydronic systems. Docket No. 65-1 at 24, ¶ 62. ("According to the Patent specification, the targets of energy efficiency, health benefit, safety benefit and comport benefit are measured against then state of the art forced air heating and cooling and variable air volume (VAV) ventilation systems."). The Court agrees. Thus, while it is true that the claims do not explicitly discuss a comparison to HVAC systems alone to realize these benefits, the Court finds that a POSITA would read the disputed claim terms in light of the specification to understand that the efficiency and other benefits are achieved vis-à-vis forced air heating and cooling systems. *Id.* ("a PHOSITA wou[l]d understand the meaning of these terms in August 2012" to be that "the targets of energy efficiency, health benefit, safety benefit and comfort benefit are measured against then state of the art forced air heating and cooling and variable air volume (VAV) ventilation systems.")

1. At Least One Energy Efficiency

The specification provides a baseline for comparison for the energy efficiency term. The patent states, "[d]ue to a lack of capable and cost effective controls for chilled beams and Radiant Floor Cooling (RFC), building owners typically install two complete distribution systems – high mass radiant hydronic heating and ducted air system for cooling and ventilation. Radiant cooling systems use 42% less energy than comparable VAV systems." '848 Patent col. 8 ll. 7–13. A table purports to show how a radiant cooling system uses 57.7 percent of the energy used by an HVAC system. *Id.*, ll. 15–26. The specification goes on to state that "[b]uilding owners often replace inefficient

boilers with condensing boilers as the first costs of GHPs do not justify an investment for heating only operations. Yet GHP equipment combined with radiant cooling architectures would decrease energy use far more than the 42.3% savings predicted above." *Id.*, ll. 34–40. As such, the baseline for measuring energy efficiency is an over 40% energy use reduction as compared to traditional HVAC systems. The Court finds that this provides both a clear baseline and definite parameters for the claims such that the term "at least one energy efficiency" is not indefinite.

2. At Least One Health Benefit

The specification provides a brief discussion of the negative health outcomes the patent seeks to avoid. "Air-conditioning systems using cooling towers can promote the growth and spread of microorganisms. . . . Air conditioning can have a negative effect by drying out the air causing dry skin and negatively affecting sufferers of allergies and asthma." *Id.* at col. 5 ll. 4–5, 12–14. Furthermore, "Legionnaire's disease can occur from the airborne dispersal of *Legionella* bacteria from improperly maintained cooling towers, humidifiers, and evaporative condensers." *Id.* at ll. 43–46. The specification states that "[m]ost building owners do not acknowledge that forced air HVAC systems are causal agents to poor [Indoor Environmental Quality] resulting in higher absenteeism or poor health." *Id.* at ll. 46–49. The Court finds that a POSITA would understand the term "at least one health benefit" to be a reference to the health benefits derived from eliminating the use of an HVAC system. This benefit would include a reduced risk of the growth and spread of sickness-causing microorganisms. That the use of any system that would eliminate cooling towers could satisfy this benefit term does not make it any less definite. Given that the specification provides a baseline for

the health benefits claimed by the patent, which can be measured against traditional HVAC systems, the Court finds that the term "at least on health benefit" is not indefinite.

3. At Least One Safety Benefit

The specification states that "[c]ommercial building owners are ignorant of the terrorist risk inherent with large forced air systems. Ground-mounted HVAC equipment and the related forced air distribution systems which return air from any one zone to the entire building ventilation system are particularly vulnerable" because "[b]y introducing a chemical, biological, radioactive, or nuclear agent . . . a terrorist could inflict mass human casualties and great psychological damage." *Id.* at ll. 49–55, 61–64. The Court finds that a POSITA would understand the term "at least one safety benefit" to be a reference to the safety benefits of Energy Environmental system as compared to an HVAC system. Energy Environmental's system would reduce the risk of a terrorist attack by reducing the efficacy of an attack and the ease with which it could be initiated by eliminating ground-level, centralized air conditioning units. Given that the specification provides a baseline for the safety benefits claimed by the patent, which can be measured against HVAC systems, the Court finds that the term "at least one safety benefit" is not indefinite.

4. At Least One Comfort Benefit

The specification fails to provide meaning to the term "at least one comfort benefit." The specifications for either patent do not identify any particular comfort benefits as compared to HVAC systems. For example, the '848 Patent specification states that "[p]rior research shows a correlation between employee productivity, IEQ, and thermal comfort." *Id.* at ll. 32–34. Elsewhere, the specification states that "HVAC

systems designers in the U.S. prefer forced air systems over hydronic systems, though most will acknowledge that radiant floor heating systems are more comfortable with improved IEQ to the forced-air alternative." *Id.* at col. 6 ll. 16–19. In the specification's discussion of the "Hydronic Building Systems Control – Functionality and Benefits," the specification states that a radiant floor cooling system "enables personal comfort space zoning." *Id.* at col. 22 ll. 62–63. Other references to comfort presuppose a "comfort set point" without providing any guidance as to what that set point might be. *See*, *e.g.*, *id.* at col. 18 ll. 47–49 ("Using historic data, climate data, or real time weather data, the staging and set points of these options can be adjusted to predict set points for optimal comfort.").

The specification does not identify what the "comfort benefit" consists of. Nor does the claim or specification identify how the "comfort benefit" is to be measured and against what standard. The Court finds the claim a "building automation system is configured to achieve . . . at least one comfort benefit" fails to provide enough certainty to one skilled in the art when read in the context of the invention and is therefore indefinite. *Sonix Tech.*, 844 F.3d at 1377.

The Court will construe the term "a building automation system configured to achieve at least one of: at least one energy efficiency; at least one health benefit; at least one safety benefit; and at least one comfort benefit" as "a building automation system configured to achieve at least one energy efficiency, at least one health benefit, and at least one safety benefit when compared to an HVAC heating and cooling system."

I. [Function] Algorithm

Denver Water identifies the following terms from the '848 patent as "algorithm" claim limitations:

Claim 9 – "at least one heat pump staging algorithm"
Claim 13 – "at least one supply fluid temperature control algorithm"
Claim 15 – "at least one mixed radiant supply fluid flow rate algorithm"
Claim 16 – "at least one hydronic supply fluid flow rate algorithm"
Claim 25 – "at least one thermal mass predictive control algorithm"
Claim 28 – "at least one outdoor reset hydronic cooling limit algorithm"
Claim 30 – "at least one outdoor reset control algorithm"
Claim 38 – "at least one hydronic modulation control algorithm"

Docket No. 62 at 28; '848 Patent col. 31 ll.17–18, col. 32 ll. 35–36, col. 32–33 ll. 66–67, 1–2, col. 33 ll. 27–31, col. 35 ll. 40–45, col. 36 ll. 34–38, col. 37 ll. 28–33, col. 40 ll. 11–15.[11] Denver Water argues that the algorithm terms are functional terms that should be invalidated for lack of enablement and definiteness. Docket No. 62 at 28. Energy Environmental argues that no construction is necessary because, for the purpose of § 112(f), an algorithm may be expressed in any understandable terms that provide structure for a POSITA. Docket No. 65 at 32. Energy Environmental argues that the claim language provides enough structure to determine an algorithm for each algorithm term Denver Water identifies. *Id.* at 33–39.

An algorithm can be embodied in a patent through prose. *Williamson*, 792 F.3d at 1352 (An "algorithm may be expressed as a mathematical formula, in prose, or as a

[11] The joint term sheet also include algorithms from claims 11, 29, 33, 34, and 35, Docket No. 55 at 17, but because neither party discusses these algorithms in their briefing, *see* Docket No. 62 at 28–31; Docket No. 65 at 31–39; Docket No. 66 at 14–15, the Court will not address these algorithms.

flow chart, or in any other manner that provides sufficient structure."). The prosaic description "must disclose, at least to the satisfaction of one of ordinary skill in the art, enough of an algorithm to provide the necessary structure." *Finisar Corp. v. DirecTV Grp.*, Inc., 523 F.3d 1323, 1340 (Fed. Cir. 2008). An algorithm cannot be a "black box" that represents only a functional description "without any mention of a corresponding structure." *ePlus, Inc. v. Lawson Software, Inc.*, 700 F.3d 509, 518 (Fed. Cir. 2012). It must do more than simply identify input and outputs but must include an algorithm for how the two are connected. *See Augme Techs., Inc. v. Yahoo! Inc.*, 755 F.3d 1326, 1338 (Fed. Cir. 2014). However, "[f]or computer-implemented procedures, the computer code is not required to be included in the patent specification." *Typhoon Touch Techs., Inc. v. Dell, Inc.*, 659 F.3d 1376, 1385 (Fed. Cir. 2011); *Aristocrat Techs. Australia Pty Ltd. v. Int'l Game Tech.*, 521 F.3d 1328, 1338 (Fed. Cir. 2008) (A patent is "not required to produce a listing of source code or a highly detailed description of the algorithm to be used to achieve the claimed functions in order to satisfy 35 U.S.C. § 112 ¶ 6."). In *Typhoon*, the Federal Circuit found the following to be a sufficient algorithm to provide the necessary structure under § 112(f): "data entry, then storage of data in memory, then the search in a library of responses, then the determination if a match exists, and then reporting action if a match is found." *Typhoon*, 659 F.3d at 1386.

The burden is on Denver Water to prove by clear and convincing evidence that a person of ordinary skill in the field of the invention would be unable to recognize supporting structure and acts in the written description and associate it with the corresponding function in the claim. *TecSec*, 731 F.3d at 1349 ("The party alleging that the specification fails to disclose sufficient corresponding structure must make that

showing by clear and convincing evidence.").

Energy Environmental describes the steps in the claims for each of the algorithms, observing what the microprocessor controller is to do to execute each algorithm. Docket No. 65 at 33–39. Denver Water does not address each algorithm, and in response, argues that Energy Environmental impermissibly only identifies inputs and outputs as opposed to the processing steps each algorithm requires. Docket No. 66 at 14–15.

Claim 9 identifies a "plurality of instructions [that] comprises at least one heat pump staging algorithm" which is "executed by the microprocessor." '848 Patent col. 31 ll. 16–19. The algorithm is as follows: (1) the microprocessor controller "reciev[es] and "process[es]" at least two sets of data (e.g., "the cooling set point temperature for the conditioned space" and "the temperature from the at least one temperature sensor"); then (2) "in response" to receiving and processing this data, the microprocessor controller sends "at least one heat pump staging control signal to the at least one water-to-air heat pump to modulate" one of several variables (e.g. "fan speed"); this signal is sent (3) to achieve "at least one of: a dehumidification; the at least one energy efficiency; and the at least one comfort benefit." *Id.* at ll. 16–37. This algorithm identifies the inputs (the temperature data), the outputs (a signal to a machine to change a system variable), and a goal (e.g., dehumidification). However, the algorithm fails to discuss how the algorithm operates. It does not identify specific software products that can be used to accomplish this task. It does not discuss how the data is processed. It does not discuss how the result of this processed data causes the microprocessor to select which signal to send to the water-to-air heat pump. Finally, it

does not identify how the variables that the microprocessor controller modulates correspond to achieving dehumidification, energy efficiency, or comfort. As such, the Court finds that the claim fails to provide a person of ordinary skill in the art enough of an algorithm to provide the necessary structure under § 112(f).

Claim 13 provides the following algorithm, to be executed by the microprocessor controller: (1) the microprocessor controller receives and processes a cooling demand; (2) the microprocessor controller sends one of two signals: (a) a control signal to attain a first temperature set point to enable the radiant supply fluid to maintain the temperature of the thermally conductive structure above the dew point to prevent condensation on the structure or (b) a control signal to attain a second temperature set point to enable the hydronic coil supply fluid to maintain a surface of the hydronic coil-to-air heat exchanger below the dew point temperature to enable dehumidification. *Id.* at col. 32 ll. 34–52. Although this algorithm is simpler than the one in claim 9, it provides no more structure. The algorithm does not indicate how the microprocessor controller processes the data or how it selects which temperature control signal to send. "It is important to determine whether one of skill in the art would understand the specification itself to disclose the structure, not simply whether that person would be capable of implementing that structure." *Med. Instrumentation & Diagnostics Corp. v. Elekta AB*, 344 F.3d 1205, 1212 (Fed. Cir. 2003). Here, a person of ordinary skill in the art may be able to read inputs and outputs identified in claim 13 and invent a structure that would implement the algorithm's goals, but that does not mean that claim 13 provides sufficient structure by its own terms. The Court finds that claim 13 fails to indicate to a person of ordinary skill in the art an algorithm that provides the necessary

structure under § 112(f).

The algorithms in claims 25, 28, 30, and 38 have the same flaw. Each uses the same general structure: (1) the microprocessor controller receives and processes some set of data, which (2) causes the microprocessor controller to send at least one of several signals to other parts of the heating and cooling system, in order to (3) achieve some sort of goal. *See* '848 Patent at col. 35 ll. 40–61, col. 36 ll. 34–59, col. 37 ll. 28–49, col. 40 ll. 5–26. However, each algorithm fails to indicate how the data is processed, how the processed data causes the microprocessor to select which signal to send, and how the effects of sending that signal achieve the goal of the algorithm. The Court finds that claims 25, 28, 30, and 38 fail to provide a person of ordinary skill in the art enough of an algorithm to provide the necessary structure under § 112(f).

The algorithms presented in claims 15 and 16 do provide sufficient structure. The algorithm in claim 15 follows the three-part structure discussed above. However, claim 15 further explains that receiving the identified data set (e.g., "the cooling set point temperature for the conditioned space" and "the temperature from the . . . temperature sensor") "causes the microprocessor controller to: calculate a mixed radiant supply fluid flow rate to meet in the conditioned space . . . a cooling demand." *Id.* at col. 33 ll. 2–12. The result of this calculation causes the microprocessor controller to send a signal to either the first or second hydronic load circulator, which in turn causes "the mixed radiant supply fluid to circulate at the mixed radiant supply fluid flow rate to meet in the conditioned space . . . the cooling demand." *Id.* at ll. 12–23. As such, the algorithm supplies both a means of processing the data, by calculating a mixed radiant supply fluid flow rate, and the connection to how the signal achieves the algorithm's goal, by

causing a hydronic load circulator to circulate the mixed radiant supply fluid at the appropriate flow rate. The Court finds claim 15 provides a person of ordinary skill in the art enough of an algorithm to provide the necessary structure under § 112(f). Claim 16 similarly indicates how the microprocessor controller calculates the data – by "calculat[ing] a hydronic supply fluid flow rate" of either the first or second hydronic supply fluid. *Id.* at ll. 36–41. It also indicates how the goal of the algorithm, such as meeting the cooling demand, is accomplished – by circulating one of the hydronic supply fluids at the appropriate rate. *Id.* at ll. 47–59. The Court finds claim 16 provides a person of ordinary skill in the art enough of an algorithm to provide the necessary structure under § 112(f). Because Energy Environmental points to language in the claim that explains how the algorithm in claims 15 and 16 work, the Court finds no construction is necessary and will not construe these algorithm terms.

IV. CONCLUSION

It is

ORDERED that the parties' Joint Motion for Determination of Claim Construction [Docket No. 67] is **GRANTED**. It is further

ORDERED that the disputed claim terms will be construed as indicated above.

DATED March 26, 2024.

BY THE COURT:

Philip A. Brimmer
Chief United States District Judge