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SUGHRUE MION, PLLC
2000 PENNSYLVANIA AVENUE, N.W.
SUITE 900
WASHINGTON, DC 20006

EXAMINER	
KONERU, SUJAY	

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte VINCENT J. CUSHING and GREGOR P. HENZE

Appeal 2019-001268
Application 13/405,153
Technology Center 3600

Before DONALD E. ADAMS, RICHARD M. LEBOVITZ, and MICHAEL A. VALEK, *Administrative Patent Judges*.

LEBOVITZ, *Administrative Patent Judge*.

DECISION ON APPEAL

The Examiner rejected the claims under 35 U.S.C. § 103 as obvious and under 35 U.S.C. § 112 as failing to comply with the written description requirement. Pursuant to 35 U.S.C. § 134(a), Appellant[1] appeals from the Examiner's decision to reject the claims. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

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[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as QCoefficient, Inc. Appeal Br. 2.

STATEMENT OF THE CASE

Claims 21–31 and 37–58 stand finally rejected by the Examiner as follows:

Claims 21–31 and 37–58 under 35 U.S.C. § 103(a) as obvious in view of Drees et al. (US 2011/0047418 A1, published Feb. 24, 2011) ("Drees"), Brickfield et al. (US 2008/0177423 A1, published July 24, 2008) ("Brickfield"), and Crabtree et al. (US 2010/0217550 A1, published Aug. 26, 2010) ("Crabtree"). Final Act. 7.

Claims 21–31 and 37–58 under 35 U.S.C. § 112(a) or 35 U.S.C. § 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. Final Act. 6.

There are three independent claims on appeal, claims 21, 37, and 48. Claim 21 is illustrative and is reproduced below (bracketed numbers have been added for reference to the steps recited in the claim):

> 21. A method of managing energy consumption in a portfolio of facilities, each facility having at least one controllable energy-consuming component and at least one energy response attribute, the method comprising the steps of:
>
> [1] unbundling energy response attributes from each of the facilities;
>
> [2] rebundling the unbundled attributes into aggregations, with at least one said aggregation including attributes from plural facilities and representing a synthetic resource;
>
> [3] predicting energy consumptive behavior of said synthetic resource in response to possible future stimuli and based on said attributes included in said synthetic resource; and
>
> [4] controlling the components of each building, via a processor-based control system, to support deployment of said synthetic resource in at least one market;
>
> [5] wherein at least one of said unbundling and rebundling steps are optimized with respect to at least one objective.

OBVIOUSNESS REJECTION

The Examiner found that Drees describes all five steps of the claimed method, but stated that although Drees shows bundling of attributes into aggregations as recited in steps [1] and [2] of claim 21, it may not be "explicit" that it is energy response attributes that are aggregated in Drees's method. Final Act 7–8. The Examiner found, however, that Brickfield discloses energy response attributes that are rebundled as in claim 21. *Id.* at 8.

The Examiner determined that it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Drees and Brickfield "because using such attributes in energy consumption decisions provides an opportunity to maximize energy curtailment for buildings and optimize resources and efficiency." Final Act. 9. The Examiner also stated it would have been obvious to use Brickfield's "method for automatic energy management and energy consumption reduction, especially in commercial and multi-building systems" in Drees's system for its known and expected advantages. *Id.*

Crabtree was further cited by the Examiner for describing "aggregation including attributes from plural facilities and representing a synthetic resource" as recited in step [2] of claim 21 ("rebundling") and further managing the synthetic resources as in step [3] and [4] of claim 21. Final Act. 9–10. The Examiner determined it would have been obvious to one of ordinary skill in the art at the time of the invention to combine Crabtree's teachings with Drees and Brickfield "because integrating aggregation data from a plural facilities and representing a synthetic resource would enable better allocation of resources and thus lead to optimization of transmission and distribution of the grid system and improve management of such markets." *Id.* at 11.

Energy response attributes

Appellant argues that Drees does not describe "energy response attributes." Appeal Br. 15–17. Appellant also states that there is "no discussion" in Brickfield "of energy response attributes, but in any event applicant herein does not contest that energy response attributes of buildings and of collections of buildings was a known concept in a demand response system." Appeal Br. 24.

We begin with determining the meaning of the term "energy response attribute." The term is not expressly defined in the Specification, but Appellant contends that it means "'an attribute of a facility that affects how the energy consumption of the facility can be made to change in response to a stimuli.'" Appeal Br. 13. Appellant states that the "response that the invention is particularly interested in is the change in energy consumption." *Id.* at 12.

The Specification discloses examples of energy response attributes, such as "the ability of an HVAC system to quickly change its operation and so its electric load," thermal inertia, and cold water. Spec. ¶¶ 53–54; s*ee also* Appeal Br. 7. Appellant states that the latter "impact how the energy consumption of facility can be made to respond" to a stimulus. Appeal Br. 9. As an example, Appellant describes how changing the set point of the HVAC system trigger changes in the energy consumption of the building. *Id.* at 12. Claim 29, which depends from claim 21, recites that at least one of the "energy response attributes" comprises "an electric power response of an

HVAC system or component thereof to a change of at least one of: an HVAC system setpoint, HVAC system controller setting, or electric power supply frequency." Appellant further explains:

> So in a system such as described above, changing the thermostat setting is a stimulus that will provoke a response in the form of a change in the energy consumptive behavior of the building. And the response that is invoked will depend on attributes of the building such as the heat retention properties of the building (building construction), the efficiency of the HVAC system technology, and others. In the context of a single building, this would amount to "predicting energy consumptive behavior of said building in response to possible future stimuli and based on said attributes included in said building."

Appeal Br. 12.

We find that Appellant's definition of "energy response attributes" is the broadest reasonable interpretation of that term, as would be understood in light of the Specification, and we adopt it here.

Appellant's argument with respect to Drees is that Drees describes energy consumption of a building, but not an energy response attribute as required by claim 21. Appeal Br. 21.

We are not persuaded by Appellant's argument.

Drees discloses that, in response to an employee "badging in" at parking garage, the system controllers can "provide new setpoints to an HVAC control algorithm of the HVAC subsystem." Drees ¶ 38. This is the same response attribute recited in claim 29.

Drees also discloses:

> This configuration may advantageously provide much less disruptive demand response behavior than conventional systems. For example, the integrated control layer 116 may be configured to assure that *a demand response-driven upward*

> *adjustment to the setpoint for chilled water temperature* (or another component that directly or indirectly affects temperature) does not result in an increase in fan energy (or other energy used to cool a space) *that would result in greater total building energy use than was saved at the chiller*. The integrated control layer 116 may also be configured to provide feedback to the demand response layer 112 so that the demand response layer 112 may check that constraints (e.g., temperature, lighting levels, etc.) are properly maintained even while demanded load shedding is in progress.

Drees ¶ 40 (emphasis added).

Thus, a set point for "chilled water" temperature is adjusted ("demand response-drive upward adjustment") and then the building response to the adjustment ("increase in fan energy (or other energy used to cool a space") is then determined by the "total building energy use." *Id.* As discussed above, the Specification expressly discloses "cold water" as an energy response attribute. Spec. ¶¶ 54, 55; Appeal Br. 7. Drees teaches adjusting the temperature of cold water and determining how the "total building energy use" is affected by it. Drees ¶ 40 (*see* Final Act. 14 referencing paragraph 40 of Drees). Drees also discloses managing "thermal energy storage" in a collection of buildings (Drees ¶ 92), which is also an energy response attribute recited in the Specification (Appeal Br. 7). Accordingly, we find that Drees discloses "energy response attributes" as recited in claim 21.

Brickfield also discloses energy response attributes. In paragraph 101, Brickfield expressly teaches that its intelligent agents "monitor each piece of equipment, forming a non-parametric model of its behavior, allowing accurate predictions of the impact that specific energy control actions will have on the building environment." Brickfield ¶ 101. The "control action" is therefore a "stimulus" that "affects how the energy consumption of the facility can be made to change," meeting Appellant's definition of an energy response attribute (*see* definition on page 13 of the Appeal Brief; *supra* at p. 4).

More specifically, Brickfield discloses:

> When hundreds of energy-consuming devices such as air handlers, chillers and lighting systems are covered by the system, minor adjustments *to each one can have a significant impact on overall energy consumption*. For example, the system can meet energy reduction goals by raising the temperature in unoccupied rooms from 70 degrees to 75 degrees.

Brickfield ¶ 120 (emphasis added).

Brickfield further explains:

> At any point in the month when peak loads approach the preset threshold, the *intelligent agents in the invention can choose from a wide variety of available strategies to prevent crossing the line, such as raising (or lowering) thermostats throughout a building(s); dimming lights; etc*. However, if executing a certain strategy would violate another parameter or other parameters set by the customer (e.g., that temperature must never go beyond a certain threshold or that lights cannot be dimmed below defined lumens, etc.), then the intelligent agents of the invention will either employ another strategy for reducing peak load demand, or notify the customer that the goal cannot be achieved.

Brickfield ¶ 121 (emphasis added).

Brickfield thus teaches setting a threshold (temperature in an unoccupied room, thermostats, amount a light is dimmed) and then determining how the response affects the "overall energy consumption." Brickfield ¶¶ 120, 121. Brickfield is therefore not only considering "energy consumption" as asserted by Appellant (Appeal Br. 24), but is also determining how the "overall energy consumption" changes in response to regulating the attribute (thermal mass of the room when temperature is raised from 70 degrees to 75 degrees) (Brickfield ¶ 120). Appellant specifically stated that the "response that the invention is particularly interested in is the change in energy consumption." Appeal Br. 12.

Brickfield also discloses that "the building managers can also optionally simulate one or more 'what if' scenarios, using the intelligent agents, to *predict* the effect of control actions on the energy bill and the comfort in the building. Brickfield 109 (emphasis added). Brickfield therefore is not only looking at energy consumption of a specific device, but rather how the facility responds in energy consumption to a control action or stimulus applied to the device. Brickfield is therefore also "predicting energy consumptive behavior of said synthetic resource in response to possible future stimuli" as recited in step [3] of claim 21 (Brickfield ¶ 109: "predicting the effect of control actions").

In sum, both Drees and Brickfield describe "an attribute of a facility" (HVAC, cold water, thermal mass (temperature of a room)) as affecting "the energy consumption of the facility . . . in response" to the "stimuli" of changing a set point of the attribute, meeting the definition of "energy response attribute" articulated by Appellant (Appeal Br. 13) and which we have adopted.

Unbundling and Rebundling Energy Response Attributes

Step [1] of claim 21 recites "unbundling energy response attributes from each of the facilities." In step [2], the attributes are rebundled into "aggregations."

The Specification discloses that a facility can include industrial plants and commercial buildings. Spec. ¶ 31. The term "unbundling" is not expressly defined in the Specification, but Appellant states it is described in Figs 4–5 and paragraph 50 of the Specification. Appeal Br. 7. Figure 4 of the Specification shows a number of facilities which are unbundled by an "Unbundling Algorithm" into attributes. The Specification teaches that each facility has numerous attributes which are unbundled from one another. Spec. ¶ 50, Fig. 5. The Specification describes these attributes as "facility features or capabilities that may affect energy usage over time periods of seconds to weeks." Spec. ¶ 52. The Specification teaches "attributes from each facility may be unbundled and rebundled into synthetic resources for deployment as an aggregation 204 or portfolio of facility parts." Spec. ¶ 33. "The unbundled parts from multiple facilities may be mathematically and optimally rebundled into synthetic resources that match selected markets for optimal deployment to those markets." *Id.* Thus, the "unbundling" is separating the attributes from one or more buildings; the rebundling" is aggregating or grouping the separated attributes into a new aggregate or grouping.

The Examiner found that "Drees shows bundling attributes into aggregation," but further relied on Brickfield as teaching energy response attributes that are aggregated. Final Act. 8.

As explained above, Brickfield describes energy response attributes. Brickfield teaches unbundling the attributes and then rebundling them. For example, Brickfield considers "buildings 10, 10A, 10B," which serve as the "facilities" of claim 21. Brickfield ¶ 102. Brickfield teaches:

> Discomfort or inconvenience to occupants or users of buildings 10, 10A, 10B is considered and included in the data processing

> or computer system 25 so that a particular energy-using device in the plurality of devices 11, 11A, l1B will not be curtailed in its energy use in a manner that would cause discomfort or negative impact. Thus, certain energy-using devices (such as computer equipment, hospital equipment, etc.) are treated differentially and intelligently so as not to be subjected to energy curtailment in the same manner as other energy-using devices, while other energy-using devices that are otherwise identical but in different buildings may be subjected to different energy curtailment based on time of day and occupancy or the like in the respective buildings. Thus, if building 10 and building 10A are in different time zones but otherwise have a similar set of respective devices 11, 11A, they may be controlled appropriately and in a maximally energy-intelligent manner.

Brickfield ¶ 102.

Further, Brickfield teaches that its intelligent agents "can leverage multiple devices" and that "our agents control devices, such as HVAC or lighting across a whole portfolio of buildings." Brickfield ¶¶ 217, 228. Thus, Brickfield describes "bundling" devices, as that term is used in the claims, from a plurality of buildings and controlling them by an intelligent agent.

While Brickfield doesn't expressly disclose the devices are unbundled, because each device is originally part of one building, it must be unbundled from the facility in order for it to be rebundled into a different aggregation as described by Brickfield. For these reasons, we are not persuaded by Appellant's argument that "Brickfield notably does <u>not</u> suggest is the unbundling of attributes from the buildings themselves" (Appeal Br. 24), i.e., because it would be reasonably understood from Brickfield's teaching that the attributes are unbundled from the buildings in order for them to be rebundled and controlled by an intelligent agent.

Brickfield teaches that the energy response to controlling the aggregated devices (the "stimulus" in Appellant's definition of "energy response attribute") is measured as a goal, e.g., to save a certain amount of energy:

> For example, a building manager may use the system of FIG. 5 to monitor the current state of devices 11, 11A, 11B in the buildings 10, 10A, 10B. . . . The building managers can also optionally simulate one or more "what if" scenarios, using the intelligent agents, *to predict the effect of control actions* on the energy bill and the comfort in the building. Building managers optionally may manipulate the parameters of the intelligent agents, such as by constraining the temperature band used by a "supply air rest" agent. *The building manager no longer needs to control individual devices* (as he would conventionally do) because the intelligent use of energy system of FIG. 5 is "goal based". The manager gives the system a goal (such as to save 40 KW in the next two hours) and the intelligent use of energy system of FIG. 5 determines how to best achieve the goal.

Brickfield ¶ 109 (emphasis added).

While Brickfield does not explicitly state in the paragraph reproduced above that the aggregated devices are monitored and controlled, Brickfield in paragraphs 102, 217, and 228 refer to controlling multiple devices, so it would be recognized by the ordinary skilled worker that the devices can be controlled as in paragraph 109. Furthermore, the table in paragraph 217 expressly states that an advantage of "Control over multiple buildings" is that "Agents can leverage multiple devices and therefore have more degrees of freedom in finding the best compromise between savings and comfort." It is clear from this disclosure that Brickfield is aggregating multiple devices from more than one building, controlling them, and determining the response in terms of energy usage ("savings"). The device itself is not the "energy response attribute," but Brickfield teaches that the change in control of the device "affects how the energy consumption of the facility" is changed (Appeal Br. 13), and therefore the device control and aggregation meets the definition of "energy response attribute" as set forth by Appellant. Thus, while Brickfield unbundles and rebundles devices, the devices have attributes; the Specification refers to cold water and humidity as attributes (Spec., Fig. 7), but how can humidity be unbundled from a building, if not by unbundling a device which produces or contains humidity?

The disclosure that multiple devices are leveraged, in our opinion, coupled with disclosure in Brickfield that decisions are made using artificial intelligence and neural networks (Brickfield ¶ 105) reasonably suggests that different devices and energy response attributes can be leveraged differently, and in different aggregates, depending on the energy demands. Indeed, the teaching that the system intelligently determines how best to achieve a goal of reducing energy consumption by controlling devices (Brickfield ¶ 109), indicates that the intelligent system may bundle and then rebundle different devices to achieve the desired goal.

Consistently, Brickfield distinguishes its system from "traditional" management systems by explaining that "our agents control devices, such as HVAC or lighting across a whole portfolio of buildings" which "prevents the agents from merely finding local maxima but allow them to globally optimize" and "equips the agents with increased degrees of freedom in balancing energy savings requirements with tenant comfort across buildings." Brickfield ¶ 228.

Appellant admits that both Drees and Brickfield "are directed to control of energy-consuming devices in buildings" that implement "control with at least some knowledge of how the energy consumption will respond to the control." Appeal Br. 24. However, Appellant contends that "the only 'aggregation' mentioned in the prior art is aggregation of some category of data (i.e., the frequency of a particular fault) for purposes of display, analysis, monitoring, etc." *Id.* This argument is not persuasive for the reason discussed above that Brickfield describes aggregation of attributes. Brickfield ¶¶ 102, 103, 109, 217, 228.

Does Crabtree teach or suggest bundling energy consuming components of facilities?

The Examiner further cited Crabtree as describing a "synthetic resource" as recited in claim 21. Final Act. 9–10. A "synthetic resource" is described in the Specification as an aggregation of attributes (Spec. ¶ 33: "in Figure 2 the system's 200 various attributes from each facility may be unbundled and rebundled into synthetic resources for deployment as an aggregation 204 or portfolio of facility parts."). As explained above, Brickfield teaches aggregation of attributes and therefore alone meets the claimed limited.

The Examiner cited paragraphs 27, 63, 73, 78, 88, 91, 94, 108, 117 of Crabtree as disclosing aggregating attributes into a synthetic resource and predicting energy consumption of the resource. Final Act. 9–10.

Crabtree describes response profiles which "reflects an amount of load likely to be actually reduced (or generated) by a user, when requested." Crabtree ¶ 61. For example, a user could agree to turn off a device. Crabtree ¶ 62. This constitutes an attribute because the "amount of load" that is reduced is a response to a control action or stimulus (e.g., turning the device off). The energy response profiles are aggregated in Crabtree: "For example, a response package made up of the collected response profiles of 10,000 consumers might be expected to yield 1.5 MWh (megawatt hours) of load reduction during a particular 15-minute peak load period." Crabtree ¶ 63. Crabtree also describes "neighborhood energy management system" that "coordinate among the participating neighborhood residents' premise iNodes 710 to, for example, coordinate the starting of heat pumps and air conditioning compressors during periods of high heat load (which are usually also periods of high electricity demand)." Crabtree ¶ 78. Crabtree further teaches that the energy consumption from all the facilities (i.e., houses in a neighborhood) is "coordinate[d] to ensure that the overall energy usage of a particular neighborhood does not exceed some specified limit." *Id.*

Paragraph 88 of Crabtree (emphasis added) also discloses bundling of attributes from users and predicting responses: "For example, statistics server 1030 can calculate the expected load reduction to be delivered by a single end user or *a collection of end users* on receipt of a request for a reduction in load."

Therefore, the evidence supports the Examiner's finding that Crabtree describes bundling and rebundling as in steps [1] and [2] of claim 21.

Appellant argues that "the aggregations discussed by Crabtree are aggregations of complete buildings, not attributes that have been unbundled from the buildings." Appeal Br. 25. We do not agree with this statement because Crabtree teaches aggregation of heat pumps and air conditioners (Crabtree ¶ 78) which are not "buildings" as stated by Appellant, but attributes of the buildings that have been aggregated together, e.g., as part of a response package (Crabtree ¶ 63) and then "coordinate[d] to ensure that the overall energy usage of a particular neighborhood does not exceed some specified limit" (Crabtree ¶ 78).

Crabtree is also cited at paragraphs 88 and 91 by the Examiner for teaching step [3] of the claim of "predicting energy consumptive behavior." Final Act. 10. Appellant argues that the Examiner did not give "proper accord" to this limitation. Appeal Br. 26. However, the Examiner expressly cited Crabtree for this limitation and Appellant did not identify a defect in Crabtree's disclosure nor the Examiner's reasoning.

Step [4] of claim 21: "controlling the components of each building, via a processor-based control system"

Appellant contends that Drees does not teach step [4] of claim 21 of "controlling the components of each building, via a processor-based control system, to support deployment of said synthetic resource in at least one market." Appeal Br. 19.

We do not agree.

Paragraph 66 of Drees discloses:

> In one embodiment business rules engine 312 is configured to respond to a DR [demand response] event by adjusting a control algorithm or selecting a different control algorithm to use (e.g., for a lighting system, for an HVAC system, for a combination of multiple building subsystems, etc.).

The paragraph therefore teaches using a "business rules engine" and "control algorithm," which correspond to the claimed step of "controlling" and a "processor-based control system," to control multiple components ("subsystems") of buildings, such as lighting or an HVAC systems. Drees also teaches that the smart building manager deploys selected equipment to the energy market:

> For example, in the event of a brownout, the smart building manager 106 may prioritize branches of a building's internal power grid-tightly regulating and ensuring voltage to high priority equipment (e.g., communications equipment, data center equipment, cooling equipment for a clean room or chemical factory, etc.) while allowing voltage to lower priority equipment to dip or be cut off by the smart grid (e.g., the power provider).

Drees ¶ 69.

Thus, the energy response attributes are "deployed" to a synthetic resource because they are aggregated together and deployed to an electric "smart grid" market. As explained in the Appeal Brief, deployment to a synthetic resource includes having the aggregated attributes participate in a desired electric grid market (Appeal Br. 6), i.e., a provider of electricity.

Drees further discloses that that energy units from this selective regulation "may offer units of energy during that period for sale back to the smart grid (e.g., directly to the utility, to another purchaser, in exchange for carbon credits, etc.)" (Dreed 69), which corresponds to deployment to at least one market as required by step [4] of the claim. In the context of paragraph 69 of paragraph (cited by the Examiner in the Final Action at 8), Drees does not describe deployment of a synthetic resource from aggregated energy response attributes from multiple facilities as required by the claim. However, paragraph 91 discloses deployment from "a collection of building subsystems for multiple buildings in a campus." Therefore, one of ordinary skill in the art would understand that the teachings in paragraph 69 could be applied to rebundled subsystems from multiple facilities.

Step [5] of claim 21: "unbundling and rebundling steps are optimized with respect to at least one objective"

Appellant argues that Drees does not disclose step [5] of the claim "wherein at least one of said unbundling and rebundling steps are optimized with respect to at least one objective." Appeal Br. 25.

We do not agree with Appellant that the Examiner erred in finding this limitation met by the cited prior art.

Drees teaches the "smart building manager described herein is configured to achieve energy consumption and energy demand reductions by integrating the management of the building subsystems." Drees ¶ 29. Appellant distinguishes this disclosure by arguing that, in the claim, it is the "unbundling" and "rebundling" which achieves the objective. Appeal Br. 25.

Drees teaches "Multi-campus/Multi-building Energy Management." Drees ¶ 90. This section describes managing "thermal energy storage" (Drees ¶ 91), one of the energy response attributes expressly disclosed in the Specification. Drees further teaches that "the building subsystems shown, e.g., in FIGS. 1A and 1B may be a collection of building subsystems for multiple buildings in a campus." *Id.* A subsystem can be a "building electrical subsystem 134, an information communication technology (ICT) subsystem 136, a security subsystem 138, a HVAC subsystem 140, a lighting subsystem 142, a lift/escalators subsystem 132, and a fire safety subsystem 130." Drees ¶ 27. Because these subsystems from the buildings in the campus are managed together, they necessarily were unbundled from the building and then rebundled in a different grouping to control their performance. As discussed above, based on paragraph 33 of the

Specification, the "unbundling" can be separating the attributes from one building and the "rebundling" can be aggregating the separated attributes from more than one building. Thus, the disclosure in paragraph 29 of Drees describing managing energy consumption is applicable to the multi-campus/multi-building environment (Drees ¶ 91) where the subsystems are unbundled from the building and rebundled as an aggregation. The claim only requires one bundling and rebundling step. Therefore, one step of rebundling subsystems to optimize energy consumption meets the claim limitation.

Brickfield also teaches "unbundling and rebundling steps are optimized with respect to at least one objective." This is discussed *supra* at p. 9–11 ("Brickfield teaches that the energy response to controlling the aggregated devices (the 'stimulus' in Appellant's definition of 'energy response attribute') is measured as a goal, e.g., to save a certain amount of energy," citing Brickfield ¶¶ 109, 217, 228).

Dependent claims

Claims 22, 38, and 49

Appellant separately argues claims 22, 38 and 49 which recites that "said synthetic resource included multiple different attributes." Appellant contends that Drees does not teach the disputed claim limitation (Appeal Br. 27), but failed to consider the disclosure in Crabtree expressly cited by the Examiner (Final Act. 12).

In paragraph 73 cited by the Examiner, Crabtree describes software that can,

> automatically shed some or most electrical loads under its control (that is, controlled by actuators or control elements in

> turn controlled by one of its child load iNodes 321*a-c*) by sending signals to the appropriate load iNodes instructing them to interrupt current to one or more of their controlled loads.

An iNode, as explained by Crabtree, is a data device that be connected to different electrical devices or electrical loads. Crabtree ¶¶ 58, 68, 78.

There is no teaching in Crabtree that the iNodes are connected to the same type of attribute; indeed, this would make no sense because the iNodes represent all the types of devices in a home. Crabtree further teaches that the system is

> adapted for being a data collection element of a larger system by managing the collection of operating data from all of its child iNodes, processing that data as by aggregating it, and passing the data 'upstream' via data network 301 to other system elements that may for example aggregate data from a large number of gateways 315.

Crabtree ¶ 73. Crabtree also teaches using its system to manage electrical loads in neighborhoods and aggregating loads of homeowners in a range. Crabtree ¶¶ 78, 114, 115. Crabtree thus teaches aggregating or bundling multiple different attributes, namely multiple iNodes associated with different types of electrical loads, and from more than one user facility (e.g., a plurality of homes in a neighborhood) which can be aggregated together in a single resource, meeting the claim limitation.

Claims 23, 39, and 50

Appellant separately argues claims 23, 39 and 50 which recite "at least one market is one of energy, capacity, spinning reserve, frequency regulation, and load balancing." Appellant contends that "the only control taught in Drees is control to support a building or group of buildings to the grid, not control to support deployment of an aggregation of energy consuming attributes from different buildings." Appeal Br. 27–28.

We have already addressed Appellant's argument about the failure of Drees to teach an "energy response attribute" as required by all the rejected claims. First, as already pointed out, Drees, in fact, teaches "thermal energy" (Drees ¶ 91), the same attribute disclosed in the Specification as an energy response attribute (Spec. ¶ 53). Second, as discussed above, Brickfield teaches energy response attributes.

Drees teaches curtailing load based on energy providers (Drees ¶¶ 65, 69), meeting the limitation of "at least one market is one of energy." While these disclosures refer to a single building, Drees also teaches that subsystems from multiple buildings may be managed (Drees ¶ 91), and expressly refers to load shedding decisions and using the previously described control algorithms to do so (*id.*). We further note that Crabtree also describes energy markets (Crabtree, e.g., at ¶ 112). Thus, we are not persuaded by Appellant's argument that the Examiner erred in rejecting claim 23, 39, and 50.

Claim 24

Appellant separately argues claim 24 which recites "wherein the at least one market comprises an internal market among electric system participants." Appellant contends that Drees does not teach this limitation. Appeal Br. 28.

Drees discloses that "the smart building manager may communicate with smart meters associated with an energy utility and directly or indirectly with independent systems operators (ISOs) which may be regional power providers." Drees ¶ 91. The ISO is not limited to being a regional power provider, and therefore it could be an internal market comprising the participating buildings in Drees.

The claimed internal market is expressly described in Crabtree, which discloses "a neighborhood cooperative energy management" system that can comprise:

> distributed battery storage systems, and possibly also in several generating devices, and these may be operated under control of local iNode 720b to manage overall load as viewed by regional iNode 730. Additionally, in such an arrangement, when prices are high due to high demand, local iNode 720b could direct generators and storage systems to deliver power to the members of the local community.

Crabtree ¶ 78. The delivery of power "to the members of the local community" is "internal market among electric system participants" as recited in claim 24.

Claim 25

Appellant separately argues claim 25 which recites "wherein at least one of the unbundling and rebundling steps utilizes decision analysis."

Appellant cites to paragraph 47 of the Specification which describes "decision analysis" as follows:

> Decision analysis techniques involve a simulation of unbundling, rebundling and/or deployment strategies and comparison of the predicted results of any or all of those strategies to determine an optimal unbundling, rebundling or deployment. Decision analysis techniques may include a wide range of analytical methods, including, for example, real options, general option theory, mean-variance portfolio theory, linear programming, Monte Carlo simulation, sensitivity analysis, regression analysis, linear and non-linear optimization

> models, time series forecasting, arbitrage pricing theory, decision trees, and techniques for quantitatively analyzing decisions under uncertainty, including the use of distributions to model uncertainty.

Based on this disclosure, Appellant contends that "'decision analysis' is an optimizing technique wherein different scenarios are tried and the results compared and a decision made as to what works best." Appeal Br. 28–29. Appellant argues that there "is no discussion anywhere in Drees, including in the cited paragraphs [0038], [0039] or [0091], of the use of decision analysis to unbundle, rebundle or deploy anything, much less energy response attributes." Appeal Br. 28–29.

Appellant's arguments are not persuasive. Drees teaches non-human monitoring of energy consumption (the "load"), in which the "non-human constant monitoring and/or adjustment preferably is by artificial intelligence; and, preferably is to monitor and/or adjust at least one factor that influences energy consumption monitoring and adjustment." Drees ¶ 26. Because the factor "influences energy consumption," the concept described by Drees meets Appellant's definition of an "energy response attribute," i.e., "an attribute of a facility that affects how the energy consumption of the facility can be made to change in response to a stimuli." Appellant has not established that the artificial intelligence described in Drees (at ¶¶ 26, 35, 38) is not "decision analysis" as required by the claim. Drees discloses that the artificial intelligence can be used to learn about the needs of buildings or buildings in a system. Drees ¶¶ 38, 47, 53. The learning is used to make adjustments to energy consumption. Drees ¶ 51. Drees further teaches:

> Where computerized reporting has been mentioned, the aggregation level for the computerized reporting may be at an individual device, at everything in a building, at a set of

> buildings, or everything commonly owned. The optimal energy-saving command decision may comprise a rotation of energy curtailment that minimizes impact over energy users in the system.

Drees ¶ 59.

In our view, Drees's reference to aggregation levels for the computerized reporting (which would invoke the artificial intelligence described in Drees), coupled with the later discussion of managing multiple buildings and the building subsystems within them (Drees ¶ 91), would be reasonably understood by the skilled artisan to mean, or suggest, that the energy response attributes could be differently aggregated (rebundled) depending on the energy demands at a specific time as determined by artificial intelligence. In addition (and as addressed above under step [2]), Brickfield also describes unbundling attributes from a building and rebundling them using rules, logic and artificial intelligence. Brickfield ¶¶ 102, 103, 105.

Accordingly, we are not persuaded by Appellant's argument that the Examiner erred in rejecting claim 25 as obvious.

Claim 26

Appellant separately argues claim 26 which recites "wherein at least one of the unbundling and rebundling steps utilizes computer models of said facilities." Appellant argues that the "[E]xaminer refers to paragraphs [0053], [0057], [0066] and [0074] of Drees, but these paragraphs do not teach or suggest this claimed feature of the invention." Appeal Br. 29.

Paragraph 57 describes using artificial intelligence. Appellant has not distinguished artificial intelligence from the recited computer model. With respect to unbundling and rebundling features of the claim, we have addressed these limitations in the discussions of step [2] of claim 21 and in claim 25. Accordingly, for all the foregoing reasons, we are not persuaded by Appellant's argument that the Examiner erred in rejecting claim 26 as obvious.

Claims 27, 40, and 51

Appellant argues claims 27, 40, and 51 separately, which recite "wherein optimizing at least one of said unbundling and rebundling steps comprises selecting which of the markets in which to deploy said synthetic resource and further selecting when said synthetic resource is deployed."

Appellant states that the Examiner "refers to paragraphs [0061]-[0064] of Drees, but the examiner has not considered all of what is required by these claims." Appeal Br. 29. Appellant states that what is required by the claim "is an optimization wherein the market in which to deploy the aggregation, and when the aggregation is to be deployed in that market, have an impact on how the unbundling or rebundling are done." *Id.* We do not agree with Appellant's interpretation of the claim.

The claim requires optimizing at least one of the "unbundling" or "rebundling" steps. The "optimizing" comprises "selecting which of the markets in which to deploy said synthetic resource." The claim does not require that the market has an "impact" on how "unbundling" or "rebundling" step is done as asserted by Appellant. The only requirement of the claim is that optimizing comprises a step of selecting the market. It does not state that that the market selection must "impact" or otherwise affect the how the unbundling or rebundling is done.

The only deficiency in the rejection argued by Appellant is the Examiner's interpretation of the claim. Because we conclude that the Examiner properly interpreted claims 27, 40, and 51, the rejection is affirmed.

Claims 28, 41, and 52

Appellant argues claims 28, 41, and 52 separately, which recite "wherein at least one of said unbundling and rebundling is optimized over multiple time horizons."

Appellant states that "the [E]xaminer refers to paragraph [0057] of Drees, but no such concept is found there." Appeal Br. 30. Appellant states that paragraph 57

> may describe displaying data over different time horizons, but there is no suggestion of optimizing over different time horizons (in addition to the fact that fault occurrence data is not an energy response attribute, and is not part of any aggregation of attributes deployed to a grid market, for all of the reasons given earlier).

Id.

To begin, we note that the Specification as filed does not use the term "multiple time horizons" and the Appeal Brief did not indicate where the term is supported by the original Specification. Appellant also did not explain what is meant by "multiple time horizons." Absent such guidance, we interpret the claim to mean that that the optimization of the bundling and subsequent rebundling into aggregate from different facilities is done over different time periods, e.g., analyzing the data over multiple times.

Appellant admits that paragraph 57 of Drees performs this function: "Paragraph [0057] may describe displaying data over different time horizons." However, Appellant argues that response energy attributes are not being studied, instead "faults."

While paragraph 57 indeed describes faults, the paragraph is more general in describing a user interface that "may summarize relative energy use and intensity across different buildings (real or modeled), different campuses, or the like." The same paragraph also describes that the "GUI elements may include charts or histograms that allow the user to visually analyze the magnitude of occurrence of specific faults or *equipment for a building*, *time frame*, or other grouping." Drees ¶ 57. Thus, although it describes analyzing faults, it also describes equipment for buildings. Appellant has read the paragraph too narrowly and ignored the explicit mention of analyzing energy use across buildings and for equipment in buildings over a time horizon. Drees also describes controlling set points of HVAC, cold water temperature, "thermal energy" (Drees ¶¶ 38, 40, 92), each which is an energy response attribute. We have already addressed under claim 21 the step of rebundling as disclosed in Brickfield, Crabtree, and Drees. Thus, we find these references describe a the "rebundling" step that is optimized over multiple time horizons, as claimed.

Claims 29, 42, and 43

Appellant separately argues claims 29, 42, and 43, which recite "wherein at least one of said attributes comprises an electric power response of an HVAC system or component thereof to a change of at least one of: an HVAC system setpoint, HVAC system controller setting, or electric power supply frequency."

Appellant states that the Examiner "refers to paragraphs [0030]-[0040], [0091] and [0097] of Drees, but no teaching of the claimed feature is found there or anywhere else in Drees." Appeal Br. 30. Appellant acknowledges "that these attributes were known per se. *Id*. However, Appellant argues that "No one prior to the present inventors has unbundled these attributes from the buildings themselves and then rebundled the attributes into aggregations of attributes for deployment to the grid." *Id.*

This argument does not persuade us that the Examiner erred. Appellant does not contest that Drees teaches providing a new setpoint to an HVAC subsystem. Drees ¶ 38. Drees further teaches that the "control algorithms of the smart building manager (e.g., control algorithms of the integrated control layer) may be configured to use weather forecast information to make setpoint or load shedding decisions (e.g., so that comfort of buildings in the campus is not compromised)." Drees ¶ 92. This same paragraph describes the smart building manager as configured to manage the building and refers to "a collection of building subsystems for multiple buildings on campus." *Id.* This disclosure would be understood to mean that a collection of subsystems, such as HVAC (see Fig. 1B listing HVAC a subsystem) could be managed as a group by the smart manager, thus representing attributes that have been unbundled from the building and then rebundled together. Brickfield also discloses unbundling devices from multiple buildings, including HVAC system, and leveraging them to achieve energy benefits. Brickfield ¶¶ 217, 228. Crabtree also describes aggregating air conditioners from a neighborhood. Crabtree ¶ 78.

For the foregoing reasons, the evidence does not support Appellant's argument and we therefore affirm the rejection of claims 29, 42, and 43.

Claims 30, 43, and 54

Appellant separately argues claims 30, 34, and 54 which recites "wherein said HVAC system setpoint is one of zone temperature, chilled water supply, supply air temperature, duct static pressure, or hot water supply."

Appellant acknowledges that "Drees does suggest zone temperature control." Appeal Br. 30. Appellant argues limitations that appear in claims 21 and 29 which already been addressed. We therefore affirm the rejection of claims 30, 43, and 54 for reasons discussed above.

Claims 31, 44 and 45

Appellant separately argues claims 31, 44, and 45 which recite,

> wherein said unbundling and rebundling steps comprise determining optimal aggregations for a set of advocate facilities, wherein the set of advocate facilities is a subset of said portfolio, and said controlling step comprises controlling components in all of the facilities of said portfolio in accordance with a control plan determined for said subset.

Appellant argues that the "first flaw" in the Examiner's rejection of these claims is the "assertion . . . that building subsystems can be considered a subset of a campus." Appeal Br. 31. Appellant states that the claims "refers to a subset of the portfolio, and the portfolio is a set of buildings. So the claim refers to a subset of buildings, and subsystems in Drees are not a subset of buildings." *Id.* Appellant further argues "there is simply no suggestion in Drees, including the paragraphs cited by the examiner, of creating a control plan for a subset of anything and then controlling components in all of the facilities based on the control plan that was developed for the subset." *Id.*

Drees discloses controlling buildings. Drees ¶¶ 90, 91. For example, Drees discloses:

> where the smart building manager 106 is controlling an entire campus or set of campuses, one or more smart building managers may be layered to effect hierarchical control activities. For example, an enterprise level smart building manager may provide overall DR [demand response] strategy decisions to a plurality of lower level smart building managers that process the strategy decisions (e.g., using the framework shown in FIG. 3) to effect change at an individual campus or building. . . . Such a DR layer can execute a campus-wide DR strategy by passing appropriate DR events to the separate lower level smart building mangers having integrated control layers and building system integration layers.

Drees ¶ 92. In other words, the building manager can manage individual buildings separately or multiple buildings on a campus or set of campuses.

Brickfield specifically discloses managing "portfolios of buildings" (Brickfield ¶ 95), the same language in the claim. Brickfield also discloses distinguishing a subset of the buildings: "if building 10 and building 10A are in different time zones but otherwise have a similar set of respective devices 11, 11A they may be controlled appropriately and in a maximally energy-intelligent manner." Brickfield ¶ 102. Therefore, Brickfield teaches controlling all the components of the buildings in accordance with a control plan determined for the subset as recited in the claim.

The claim further requires applying this plan to other facilities/buildings in the portfolio. Brickfield does not require that the determination of how to control building 10 be made independently of building 10A, which has the same devices. In view of the similarities between buildings, one of ordinary skill in the art would have found it obvious to apply the same optimization performed for building 10 to building 10A.

Accordingly, we are not persuaded by Appellant's argument that the Examiner erred in rejecting claims 31, 44, and 45 obvious.

Claim 46

Appellant separately argues claim 46, which recites "wherein said controller simultaneously optimizes deployment of plural aggregations each with respect to a different grid market."

Appellant states that the Examiner "cites to paragraphs [0033], [0038], [0061] and [0063] [of Drees] as allegedly teaching this feature. But these paragraphs do not describe multiple different aggregations of attributes, nor deployment to different markets, much less simultaneously to different markets." Appeal Br. 31. Appellant acknowledges that "Paragraph [0038] describes aggregating subsystems to control the aggregate as a single system,"[2] but argues that "these are all subsystems of a single building." *Id.* Appellant also acknowledges that "Paragraph [0061] talks about responding to grid signaling, but does not talk about simultaneously deployment to different markets." *Id.* Appellant further argues that "what is important to this claim is the simultaneous deployment to different markets of different aggregations of energy response attributes of multiple buildings. There is no way to get to that point simply from the teaching of" Drees. *Id.*

[2] This argument is inconsistent with the argument with the argument made on page 24 of the Appeal Brief that only aggregation of data is disclosed by Drees.

We have already found for claim 22 that Crabtree discloses bundling different aggregates. Crabtree ¶¶ 73, 78, 114, 115. Crabtree also describes participating in different grid markets. For example, Crabtree teaches "the exchange activates additional response packages until the required supply level is achieved, or alternatively the exchange buys power on the open market (presumably at higher prices . . .)." Crabtree ¶ 129. Crabtree also describes using an exchange market and a sub-exchange market, depending on energy demands and consumption. *Id.* *See* also Crabtree ¶¶ 152–154, 158 describing making decisions about energy sources based on demands. Thus, we do not agree that the claimed limitation of optimizing aggregations to different grid markets is new. According the rejection of claim 46 is affirmed.

Claim 47

Appellant separately argues claim 47, which recites "wherein said objective is selected from the group of: increased revenue, reduced capital expense, reduced operating expense, energy efficiency, peak demand reduction, financial risk management, and reliability."

Appellant states

> it is agreed that some of these objectives are known, and with the claim using a Markush group, the objectives themselves as recited in claim 47 are not patentably distinctive, but as applied to the subject matter of parent claim 37 the subject matter of claim 47 is new and non-obvious.

Appeal Br. 31.

This argument is not persuasive. Only one member of a Markush needs to be met to satisfy the claim limitation. The claim only requires one objective from the group to be selected. Appellant admits that the objectives are known. Appellant did not explain how this known objective makes the claim non-obvious. Accordingly, the obviousness rejection of claim 47 is affirmed for the reasons set forth by the Examiner.

WRITTEN DESCRIPTION

The Examiner stated that is no support in the Specification for step [4] of claim 21 of "predicting energy consumptive behavior of said synthetic resource in response to possible future stimuli and based on said attributes included in said synthetic resource." Final Act. 6. Claim 37 and 48 recite a similar limitation.

The inventor must "convey with reasonable clarity to those skilled in the art that, as of the filing date sought, he or she was in possession of the invention." *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563–64 (Fed. Cir. 1991). "One shows that one is 'in possession' of *the invention* by describing *the invention*, with all its claimed limitations." *Lockwood v. Am. Airlines, Inc*., 107 F.3d 1565, 1572 (Fed. Cir. 1997) (citation omitted). In describing the claimed invention, there is no requirement that the wording be identical to that used in the specification as long as there is sufficient disclosure to show one of skill in the art that the inventor "invented what is claimed." *Union Oil Co. v. Atlantic Richfield Co*., 208 F.3d 989, 997 (Fed. Cir. 2000) (citation omitted). The written description "need not recite the claimed invention in *haec verba* but [it] must do more than merely disclose that which would render the claimed invention obvious." *ICU Med., Inc. v. Alaris Med. Sys., Inc*., 558 F.3d 1368, 1377 (Fed. Cir. 2009). Thus, as long as a person "of ordinary skill in the art would have understood the inventor to have been in possession of the claimed invention at the time of filing, even if every nuance of the claims is not explicitly described in the specification, then the adequate written description requirement is met." *In re Alton*, 76 F.3d 1168, 1175 (Fed. Cir. 1996).

Paragraph 69 discloses "Advanced building control and fault detection methods may utilize building energy models to predict or estimate expected building performance." It is further disclosed that "building models may predict cooling loads and energy consumption for optimal control strategy evaluation, as well as online next-day load predictions." Spec. ¶ 69. The Specification describes using models "to improve real-time load estimates using available data." *Id.* Models for predicting loads are further described in paragraphs 70–75 of the Specification. It is evident from this disclosure that Specification expressly describes "predicting energy consumptive behavior." As far as the recited limitation of "predicting the behavior in response to future stimuli," the Specification teaches, for example, determining how to achieve effective energy consumption by regulating set points of HVAC systems (Spec. ¶ 57), which is one of the factors that are optimized by the predictive building control systems described in the Specification. See also Spec. ¶ 76.

Accordingly, one of ordinary skill in the art would have recognized that the inventors were in possession of all the features of step [4] of claim 21, and the corresponding limitation in claims 37 and 48.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
21–31 and 37–58	103	Drees, Brickfield, Crabtree	21–31 and 37–58	
21–31 and 37–58	112	Written description		21–31 and 37–58
Overall Outcome			21–31 and 37–58	

TIME PERIOD

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED