

APPLICATION FOR EXCEPTION
UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF HEARINGS AND APPEALS

In the Matter of:)

Vaughn Thermal Corporation)

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26 Old Elm Street)

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Background

Vaughn Thermal Corporation (“Vaughn” or “the Applicant”) respectfully submits this Application for Exception (“Application”) to a Final Rule issued by the United States Department of Energy (“DOE”) on April 16, 2010¹ (“Final Rule”). In that Final Rule, DOE amended existing energy conservation standards for residential water heaters manufactured² on or after April 16, 2015 (the “Compliance Date”), including standards for certain electric storage water heaters that would require an Energy Factor (“EF”) of approximately 2.0. In practical terms, the Final Rule will require the use of an electric heat pump for electric storage water heaters larger than 55 gallons in volume and eliminates the use of like sized electric resistance water heaters.

Heretofore, DOE’s minimum standards for all residential electric storage water heaters, irrespective of size, would have allowed the use of electric resistance elements as the sole means of heating water. As discussed in more detail herein, heat pump water heaters offer consumers the potential for substantial energy savings but, currently, they are not a good fit for use in certain common niche applications like load shifting, renewables integration and demand response.³ These applications frequently involve the use of Electric Thermal Storage (ETS)⁴ water heaters larger than 55 gallons. Under the current rule, a heat pump water heater will be required for these larger tanks after April 16, 2015; however, a heat pump water heater today cannot reliably meet the requirements of the niche applications aforementioned.

¹ Energy Conservation Program: Energy Conservation Standards for Residential Water Heaters, Direct Heating Equipment, and Pool Heaters; Final Rule 75 Fed. Reg. 73, 20112 (April 16, 2010) (codified at 10 C.F.R. Pt. 430.32).

² “It shall be unlawful . . . for any manufacturer or private labeler to distribute in commerce” products that fail to meet or exceed efficiency levels determined by DOE. 42 U.S.C. 6302. The Applicant chooses to use the terms “manufacture” and / or “fabricate” herein as synonymous with “distribute in commerce.”

³ Several studies confirm the potential for future consideration of heat pumps in the provision of ancillary services like frequency regulations but, when examined closely, these same reports also confirm that heat pump water heaters are not ready for use in the mass markets. *See*, for instance, a study by PNNL on a small sample of water heaters in which it states, “. . . significant barriers must be overcome before this technology will reach widespread adoption in the Pacific Northwest region and nationwide. One barrier noted by the Northwest Energy Efficiency Alliance (NEEA) is that HPWH products are not ideal for northern climates, especially when installed in conditioned spaces, as there may be complex interactions with the homes’ space conditioning systems for units installed in conditioned spaces (Kresta 2012)... Another barrier is the impact of HPWHs on demand-response (DR) programs, **since HPWH DR characteristics are currently unknown.**” The report concludes: “. . . the DR performance explored in these experiments represents only an initial indication of the relative response of HPWHs as compared to ERWHs under a given, high hot water use draw profile and with the GE GeoSpring Hybrid HPWH. To validate the extrapolation of these results to other sizes and types of water heaters and the variety of draw profiles experienced in the field, **further research is required.**” (emphasis added) Demand Response Performance of GE Hybrid Heat Pump Water Heater, http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22642.pdf. The referenced study has been recently updated but the limited nature of its results remains the same.

⁴ For the purposes of this Application, Electric Thermal Storage (ETS) Water Heaters for ‘dedicated’ Off-Peak water heating applications are defined as 75-119 gal. electric resistance water heaters equipped with utility control switches which turn the unit off during peak load periods.

This Application requests an exception from the Final Rule to allow Vaughn to continue to fabricate large-capacity storage electric resistance water heaters in certain limited circumstances.

The Applicant, Vaughn Thermal Corporation, is a fifty-three year old U.S. manufacturing company that employs about 45 persons in Massachusetts where all of its products are made. Since 1961, Vaughn has made and supplied to the U.S. electric utility industry a unique line of high-efficiency, long-life water heaters that are used in a variety of applications including ETS, grid-enabled,⁵ and grid-interactive.⁶ Vaughn also manufactures a variety of water heater control products to support the needs of its many utility customers across the United States. At present, these products account for over 30% of Vaughn's annual sales volume, the loss of which will impose significant financial hardship on Vaughn, accompanied by attendant losses of employees and R&D investment resources.

Operationally, Vaughn's innovative controls are designed to cycle electric resistance heating elements on and off according to pre-determined switching schedules or, alternatively, when a utility sends a signal, thereby allowing utilities to manage their respective peak loads. By reducing peak loads, utilities are able to operate their generation, transmission and distribution systems more efficiently and avoid the construction of new, more expensive generation which, in turn, helps to keep rates affordable for consumers. These utility off-peak water heating programs almost always include a financial incentive for the participant, usually in the form of a monthly credit, preferential rate, or as an affordable and low monthly cost rental of the water

⁵ The following definition of grid-enabled water heater was established by multiple, diverse stakeholders (<http://www.regulations.gov/#!documentDetail;D=EERE-2012-BT-STD-0022-0301>) for use in the proposed Shaheen-Portman bill, S. 761 (<http://thomas.loc.gov/cgi-bin/query/F?c113:1:./temp/~c11373ObPU:e96729>) as: an electric resistance water heater that has a rated storage tank volume of more than 75 gallons, manufactured on or after April 16, 2015 with an energy factor of not less than 1.061 minus the product obtained by multiplying) the rated storage volume of the tank, expressed in gallons and 0.00168 (or an equivalent alternative standard prescribed by the Secretary); is equipped at the point of manufacture with an activation lock and bears a permanent label applied by the manufacturer that is made of material not adversely affected by water that is attached by means of non-water-soluble adhesive and which advises purchasers and end-users of the intended and appropriate use of the product with the following notice printed in 16.5 point Arial Narrow Bold font:
"IMPORTANT INFORMATION: This water heater is intended only for use as part of an electric thermal storage or demand response program. It will not provide adequate hot water unless enrolled in such a program and activated by your utility company or another program operator. Confirm the availability of a program in your local area before purchasing or installing this product."

⁶ "Grid-interactive water heater" is defined in the Peak Load Management Alliance GIWH Interest Groups' mission statement as the consensus term describing high-speed, two-way communication between the electric water heating appliance and the electric utility, balancing authority, independent system operator or aggregation entity. When equipped with a grid-interactive control device, a large-capacity electric thermal storage (ETS) water heater becomes a 'thermal battery' for storing electric energy, having the ability to follow locational marginal pricing, providing fast regulation service and better integrating renewable energy".
<http://www.peakload.org/group/GIWH>.

heater itself. The loss of such incentives will be particularly hard-felt by low-income households which may see their water heating costs increase significantly should they no longer have access to these programs. While such peak-shaving activities are well demonstrated geographically throughout the United States, peak load management programs employing water heaters are disproportionately used by electric cooperatives serving rural customers.⁷

Utility load shifting programs typically turn-off customer water heaters either intermittently or continuously during periods of peak electrical consumption which frequently occurs between 7am and 11pm. Because customer water heaters may be turned-off for as long as 16 hours, large volume water heaters are necessary to ensure an adequate supply of heated water when required. From Vaughn's experience, these programs typically only succeed when customers have water heaters that are 80 gallons or larger. Using a load control device on a water heater smaller than 80 gallons may result in insufficient hot water, creating an inconvenience whereby customers discontinue their participation in the utility's program.

Over the last decade, Grid-Interactive Water Heating (GIWH) control technologies have been developed that can provide all of the benefits of off-peak water heating discussed above *plus* additional benefits in many circumstances. In particular, this new GIWH control technology is capable of increasing or decreasing its charging rate (input) in small, discrete increments (kW) instead of simply operating in an "all-on/all-off" manner like the earlier generation products did, and can vary the target state of charge (kWh). In addition, GIWH's can report to a utility or interested aggregator its state of charge (kWh) and power (kW) to verify that each water heater or group of water heaters is responding exactly as requested to serve the real-time needs of the electric grid. Independent System Operators (ISO's), including PJM⁸, are especially interested in grid-interactive appliances as they are seen as an efficient way to help operators balance system supply and demand – a more challenging exercise than ever before with the introduction of larger and larger quantities of intermittent, renewable energy like that provided by wind and solar. In addition, ISO's and Regional Transmission Organizations (RTO's) view grid-interactive water heaters as an emerging, cost-effective means to provide frequency regulation services for grid stabilization.⁹

⁷ As the result of the Federal Energy Regulatory Commission's interest in demand response, investor owned electric utilities and municipal electric utilities are increasingly offering customers the opportunity to participate in water heater load shedding programs like electric cooperatives have for many years. For an interesting discussion on the FERC's demand response activities, see <https://www.ferc.gov/industries/electric/indus-act/demand-response/dr-potential.asp>.

⁸ PJM is an acronym for the PJM Interconnection, a regional transmission operator that coordinates the buying, selling and delivery of wholesale electricity in the mid-Atlantic and other areas of the United States.

⁹ Interest in grid-interactive devices is wide-spread. For example, *ASHRAE Standard 189.1, Standard for Design of High-Performance Green Buildings*, recognizes grid-interactive devices as a technology that can be used to satisfy the standard's demand response requirements. Likewise, in October 2014, the *International Green Construction*

In the near-term, however, Grid-Enabled Water Heaters (GEWH) supply a bridge technology that will assist in the transition from current ETS (where a water heater may be controlled by something as simple as a time clock) to full integration of GIWH with its panoply of functions including the provision of ancillary services. Vaughn's innovative grid-enabled controls, when coupled with a Vaughn manufactured electric resistance water heater, are an example of such bridge products. Importantly, Vaughn electric resistance water heaters can be used in all three applications; ETS, grid-enabled, and grid-interactive water heating applications.

As additional background, DOE has commenced Docket Number EERE-2012-BT-STD-0022, RIN 1904-AC78 entitled *Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Water Heaters*.¹⁰ In this docket, DOE proposed a limited, generic waiver from DOE's April 16, 2010 Final Rule establishing new minimum efficiency levels for residential water heaters. Under the proposed rule outlined in DOE's Notice of Proposed Rulemaking ("NOPR") published last year, successful waiver applicants could manufacture large-capacity residential electric resistance water heaters under limited circumstances where, without the waiver, an electric heat pump would be required.

For clarity, Vaughn supported (and continues to support) the DOE generic waiver process. Further, Vaughn notes that a diverse group of stakeholders supported a legislative solution that would allow continued production of large capacity electric thermal storage water heaters under certain conditions.¹¹ However, in the absence of perceived progress in either the generic waiver docket or with legislation, Vaughn files this Application out of business necessity. The compliance date, April 16, 2015 is less than five months away, after which it will become unlawful for Vaughn (and others) to manufacture electric resistance storage water heaters needed by its customers for their various ETS programs including load-management, Demand Response (DR) and Demand Side Management (DSM) programs.¹²

Finally, as noted above, the Final Rule to which Vaughn seeks exception will require an electric heat pump for all electric storage heaters larger than 55 gallons. Electric heat pump water heaters are an extremely efficient means of heating water and they offer promise for energy

Code voted to approve the inclusion of grid-interactive provisions for water and space heating in the 2015 version of the IGCC.

¹⁰ Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Water Heaters, Notice of Proposed Rulemaking 78 Fed. Reg. 38, 12969 (proposed Feb. 26, 2013) (to be codified at 10 C.F.R. Pt. 430).

¹¹ Fred Sissine, Cong. Research Serv., R43524., S. 2262, Shaheen-Portman Bill 2014: Energy Savings and Industrial Competitiveness Act (2014)., http://www.eenews.net/assets/2014/05/07/document_daily_03.pdf. See also footnote 22.

¹² Vaughn currently produces electric thermal storage water heaters larger than 55 gallons. See Vaughn at www.regulations.doe.gov/certification-data/CCMS-79222842113.html.

savings. To that end, Vaughn is very supportive of DOE's efforts to improve water heating efficiency in the United States.

Unfortunately, electric Heat Pump Water Heaters (HPWH) have a number of significant marketplace challenges to their use in either ETS programs or, importantly, in the transition to full GIWH application. For instance, HPWH's require more space than is normally available in homes that traditionally have used utility ETS programs. In addition, the ability of HPWH's to heat water to high temperatures when using only the compressor is not well established.¹³

Likewise, in GIWH applications, HPWH compressors are operationally unable to cycle on and off rapidly in small, discrete increments like electric resistance heating elements can, making the vapor-compression component of the heat pump water heater unable to provide frequency regulation services utilizing GIWH control technology. This severely limits a heat pump water heater's ability to perform as a substitute for fossil fuel generation for grid services.

In the context of opposing the Steffes Corporation's Application for Exception, EXC-14-0002, the General Electric Company cited several studies that purportedly confirm the potential for future consideration of heat pumps in the provision of ETS, GEWH and GIWH but, when examined closely, these same reports also confirm that heat pump water heaters are not ready for use in utility ETS and demand response programs. For instance, the Pacific Northwest National Laboratory ("PNNL") performed a study on a small sample of water heaters in which it stated, ". . . significant barriers must be overcome before this technology will reach widespread adoption in the Pacific Northwest region and nationwide. One barrier noted by the Northwest Energy Efficiency Alliance (NEEA) is that HPWH products are not ideal for northern climates, especially when installed in conditioned spaces, as there may be complex interactions with the homes' space conditioning systems for units installed in conditioned spaces (Kresta 2012)... Another barrier is the impact of HPWHs on demand-response (DR) programs, **since HPWH DR characteristics are currently unknown.**" The report concludes: ". . . the DR performance explored in these experiments represents only an initial indication of the relative response of HPWHs as compared to ERWHs under a given, high hot water use draw profile and with the GE GeoSpring Hybrid HPWH. To validate the extrapolation of these results to other sizes and types of water heaters and the variety of draw profiles experienced in the field, **further research is required.**" (emphasis added.)¹⁴

¹³ See comments of numerous electric cooperatives in response to RFI issued by DOE at <http://www.regulations.gov/#!docketBrowser;rpp=25;po=0;dct=PS;D=EERE-2012-BT-STD-0022> wherein they provide details of potential problems with the use of HPWH's in ETS applications including space and temperature limitations.

¹⁴ Demand Response Performance of GE Hybrid Heat Pump Water Heater, http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22642.pdf. The referenced study has been recently updated but the limited nature of its results remains the same.

Thus, the Final Rule's *de facto* ban on the manufacture of residential electric resistance water heaters larger than 55 gallons not only imposes hardship on Vaughn as a manufacturer of large-capacity electric resistance water heaters for ETS, grid-enabled, and grid-interactive water heating applications; it also negatively impacts electric utilities, grid operators, renewable energy developers, and, of course, most importantly, consumers.

It is this current incompatibility of heat pump water heaters with ETS, grid-enabled and grid-interactive water heater applications that drives the necessity for this Application for Exception.

The Applicant and the Product

Vaughn Thermal Corporation is a small business located in Salisbury, Massachusetts. For over 50 years, Vaughn has invested in the research, development, and manufacture of electric storage water heaters and electronic water heater control technologies.¹⁵ Over time, Vaughn's product designs have evolved to become more sophisticated.

Initially, Vaughn produced electric storage water heaters that were capable of being equipped with timers or radio-control switches that would temporarily disable the storage heater at times when the local electric utility needed to trim its peak system loads. This design was relatively simple – onboard schedule control or one-way communication from the utility to the switch. Further, the control was not incremental – the heater was either on or off. Despite its relatively simple design, the concept became very popular with utilities, especially electric cooperatives that generally serve rural areas, as they recruited hundreds of thousands of customers to participate in their respective electric thermal storage programs. Today, more than 600,000 utility customers are enrolled in ETS programs. According to the National Rural Electric Cooperative Association, these ETS programs have resulted in peak load reductions of approximately 700 MW's and annual consumer cost savings in excess of \$300 million.¹⁶

Vaughn electric resistance storage water heaters have played an important role in the development of utility ETS programs. Significantly, these same Vaughn water heaters have the potential to assist in the evolution of the residential water heater market from ETS to even more valuable grid-enabled and grid-interactive applications if Vaughn's Application for Exception is granted.

¹⁵ While Vaughn manufactures both residential and commercial water heating products, this Application only addresses domestic hot water products subject to the National Appliance Efficiency and Conservation Act.

¹⁶ See comments at <http://www.regulations.gov/#!documentDetail;D=EERE-2012-BT-STD-0022-0246> at 19.

Problematic Aspects of the Final Rule Which Result in Serious Hardship, Gross Inequity or Unfair Distribution of Burdens for Vaughn and Others

As stated above, the Final Rule issued by DOE in April 2010 requires the use of a heat pump water heater for electric storage water heaters larger than 55 gallons after April 15, 2015. Vaughn is supportive of DOE's efforts to increase national energy efficiency through the development of technologically feasible, cost effective energy standards, including DOE's decision to require the use of heat pump water heaters for residential electric storage water heaters larger than 55 gallons.

That said, Vaughn recognizes that heat pump water heaters have certain limitations that would prevent their usage in the context of ETS, grid-enabled and/or grid interactive water heating applications, both currently and for at least the next several years.

DOE came to the same conclusion when evaluating heat pump water heaters in the context of the generic waiver rulemaking discussed earlier in this application where DOE stated “. . . DOE concludes that products (heat pump water heaters) that are currently available on the market that meet the April 2010 standard levels may not be practical to fulfill the needs of utility ETS programs.”(parenthetical added).¹⁷

Without relief, Vaughn will be precluded from manufacturing a significant percentage of one of its core products, utilities will be precluded from enjoying the benefits of traditional ETS programs in addition to facilitating renewable energy integration and fast regulation services from grid-enabled products (equipped with GIWH control technology) like those produced by Vaughn, consumers will be denied the opportunity to participate in programs that help keep electric water heating costs affordable, and society will be denied the opportunity to reduce carbon emissions by substituting generation sources such as wind and solar for more traditional fossil fuel sources. These hardships are discussed in more detail below.

Benefits of Electric Thermal Storage, Grid-Enabled and Grid-Interactive Water Heating

There are three primary benefits associated with the use of large capacity, electric resistance storage water heaters like those produced by Vaughn, namely:

1. ETS - Utility load management,
2. Renewable energy integration and storage, and
3. Frequency regulation.

¹⁷ See 78 Fed. Reg 65, 12978.

Each of these primary benefits is discussed briefly below.¹⁸

Electric Thermal Storage - Utility Load Management

Traditional ETS water heating programs, using large-capacity (80 gal. and larger) electric resistance water heaters, shift loads from peak to non-peak times. In the process, utilities are able to avoid generation from more expensive sources and can improve the efficiency of existing generation, transmission and distribution systems, thereby helping to keep rates affordable for customers.

In testimony filed in DOE Docket Number EERE-2012-BT-STD-0022, RIN 1904-AC78 entitled *Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Water Heaters*, (78 FR 12969), electric utilities from around the country told of the value of load shifting due to their respective ETS programs – with annual savings easily reaching into the hundreds of millions of dollars.¹⁹ Clearly, the use of ETS water heating for utility load management is an important benefit to consumers and utilities alike.

Conversely, denying utilities the benefit of ETS programs imposes a severe and real hardship on many parties beyond the utility including consumers and manufacturers like Vaughn.

Renewable Energy Integration and Storage

With the growing deployment of renewable energy sources like wind and solar, the concept of energy storage has become more important. In some instances where supply of renewable energy has exceeded demand, the renewable resources were unfortunately curtailed.²⁰ In recognition of this problem, the U.S. Department of Energy is investing millions of dollars in research towards cost effective storage of grid-scale renewable energy.²¹

Among the technologies being considered by DOE is grid-interactive electric thermal storage. In fact, in a Sandia Laboratory report, electric thermal storage was found to be the most cost

¹⁸ On the issue of benefits, Terry Boston, CEO of PJM, has stated, “[e]lectric water heater storage is the most cost-effective form of energy storage available and has enormous potential to help PJM integrate the projected 33,000 MW of wind and 9,200 MW of solar energy that the state RPS requirements call for by 2029 in our footprint.”

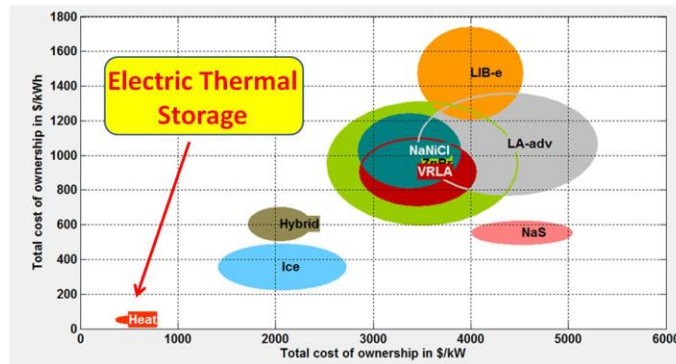
<http://www.regulations.gov/#!documentDetail;D=EERE-2012-BT-STD-0022-0302>. He has also stated, “[e]nergy storage has the potential to become a key contributor to reliability in future power grids . . . You can take technology as old as electric water heaters, add data communications and real-time rates and pricing and turn it into a grid storage device that can provide regulation service or level demand by heating water at off-peak times.” http://www.ensec.org/index.php?option=com_content&view=article&id=456:reliable-and-sustainable-power-grids-interview-with-mr-terry-boston&catid=137:issue-content&Itemid=422.

¹⁹ These same utilities also stated that heat pump water heaters would not be an adequate substitute for electric resistance storage water heaters that they currently employ in their ETS programs. See, generally, comments filed by electric cooperatives at <http://www.regulations.gov/#!docketBrowser;rpp=25;po=0;dct=PS;D=EERE-2012-BT-STD-0022>.

²⁰ Jennifer Rogers, Sari Fink, & Kevin Porter, [Examples of Wind Energy Curtailment Practice NREL/SR 550-38737](#) (Exeter Associates Inc., July 2010).

²¹ See <http://energy.gov/oe/services/technology-development/energy-storage>.

effective means of renewable energy storage when compared to other technologies like chemical batteries, flywheels, eutectics, and others.²²



Cost of Ownership Comparison – Storage Technologies
(DNV KEMA, “ES-Select™Tool,” <http://www.sandia.gov/ess/esselect.html>)

Though in its infancy, grid-enabled and grid-interactive water heating (GIWH) offer great promise for the cost effective storage of renewable energy generated at grid-scale.

Frequency Regulation

Again related to the growing deployment of larger amounts of grid-scale renewable energy, system operators like PJM, MISO, ERCOT²³ and others are finding it increasingly difficult to regulate frequency on the electrical grids. In the United States, grid operators seek to maintain a frequency of 60 Hz on the grid. As demand and supply diverge, frequency begins to drift away from 60 Hz. When supply exceeds demand, frequency tends to drift upward and when demand exceeds supply, frequency tends to drift downward. Unfortunately, as an example, wind energy generation is often at its maximum at night time when demand on the grid is at its minimum causing an imbalance that results in frequency drift away from 60 Hz.

To regulate frequency when it falls below 60 Hz, grid operators deploy generators (generally fossil fueled) to supply additional voltage. To regulate frequency when it exceeds 60 Hz, grid operators will curtail some generation. This is a costly and energy consuming process. PJM believes that grid-interactive water heating (GIWH) is a less expensive option for a number of reasons, including the fact that GIWH responds nearly in real time versus traditional fossil-fueled regulation assets that often require minutes instead of seconds to respond.

²² Rounds, Robert and Georgianne Peek, Design and Development of a 20-MW Flywheel-based Frequency Regulation Power Plant. SAND2008-8229, Sandia National Laboratories, Albuquerque, New Mexico (2009).

²³ MISO is an acronym for the Midcontinent Independent System Operator. ERCOT is the Electric Reliability Council of Texas.

Moreover, the 2009 Sandia report referenced in footnote 22 concluded that carbon emissions from frequency regulation services could be reduced by more than 50% in many instances when nontraditional (non-fossil fueled) regulation services were used. Thus, in addition to saving money, grid operators also see benefits from grid-interactive water heating because of its potential to reduce carbon emissions.

Relief Requested

Vaughn Thermal Corporation respectfully requests exception from the Department of Energy's April 16, 2010 Final Rule pursuant to the conditions noted below. These conditions are generally consistent with proposed legislation that would allow the continued production of electric resistance storage water heaters under certain conditions. The proposed legislation enjoys a diverse array of supporters including manufacturers (Vaughn, Rheem, A.O. Smith, General Electric Co.), environmental advocacy groups (NRDC, ACEEE), trade associations representing electric utilities (NRECA, EEI, APPA), grid operators like PJM, and others.²⁴

The exception applies only to electric storage water heaters larger than 75 gallons that are manufactured and sold specifically for participation in electric utility ETS, load management, DR, DSM and/or grid-interactive programs. Electric storage water heaters with a capacity of 55 to 75 gallons would remain subject to the Final Rule with a Compliance Date of April 16, 2015. The following conditions would apply:²⁵

1. Electric storage water heaters subject to this exception must have an efficiency that meets the following formula: $EF = 1.061 - (0.00168 \times \text{Rated Storage Volume in gallons})$.²⁶
2. Electric storage water heaters subject to this exception must be shipped with an activation lock that would effectively restrict the full use of the product to consumers enrolled in grid-interactive water heating programs, demand response programs or traditional load management programs. In the absence of activation, the first hour rating of the storage water heater would be less than that of a 55 gallon electric resistance storage water heater pursuant to DOE's test procedures for such products.
3. Electric storage water heaters subject to this exception must have a label permanently affixed that states the unit is intended only for use in GIWH, DR, DSM or Load Management programs.

²⁴See [Shaheen-Portman, S. 761](#). See also [Letter to Senators Shaheen and Portman](#) for a list of organizations that support the bill.

²⁵These conditions are also generally consistent with the conditions agreed to by many parties in the Department of Energy's generic waiver docket. Vaughn believes such conditions were reasonable in that docket as relief for traditional ETS water heaters and, further, Vaughn would support this same relief if another party were to apply to OHA for exception relief for other ETS water heaters.

²⁶The formula is the same as was proposed by DOE for TSL 3 in its last water heater rulemaking.

4. Vaughn agrees to report to the U.S. Department of Energy the number of units shipped on an annual basis during the pendency of this Exception.
5. Vaughn agrees to confidentially share with the U.S. Department of Energy economic and environmental data it collects on the performance of grid-interactive electric resistance water heaters on an annual basis.
6. This exception would be valid through April 16, 2020 at which time, if not renewed by way of OHA's approval of a new Application by Vaughn, the exception would expire. The burden would lie with Vaughn to make a new, timely and persuasive application.

Serious Hardship, Gross Inequity or Unfair Distribution of Burdens

Prior Decisions

It is a canon of statutory construction that remedial statutes are to be construed liberally.²⁷ A review of the Office of Hearings and Appeals' ("OHA") previous decisions reveals that it has consistently ruled according to this canon in finding justification for relief where appropriate, but also denying relief where an applicant fails to meet its burden. Among the many factors OHA balances in its decision-making are:

1. the impact on competition,²⁸
2. the impact on national goals of energy conservation as expressed in Energy Policy and Conservation Act (EPCA),²⁹
3. the size of the market,³⁰
4. the potential for leakage,³¹
5. whether or not denial of relief would tend to foreclose innovation,³²

²⁷ See for instance, Ohio statute that mentions the common law tradition at <http://codes.ohio.gov/orc/gp1.11>. See also, *Exxon Corp. v. Dep't of Energy*, 802 F.2d 1400 Temp. Emer. Ct. App., (1986) ("The Court has been sensitive to the need for an expansive reading of DOE's exception power.") and *Electrolux Home Products, Inc., O.H.A., TEE-0012* (July 19, 2004) citing *Exxon* ("great deference' accorded to agency in appliance standards for exception relief").

²⁸ *Nordyne, Inc., O.H.A., TEE-0013* (August 27, 2004), ("We conclude that granting exception relief for split systems in manufactured homes will not have significant adverse impact on competition within the air conditioner industry ...").

²⁹ Energy Policy and Conservation Act, §§321 - 339, 42 U.S.C. 6201 (2000). In particular, OHA has stated that the same factors considered by DOE in promulgating energy conservation standards are useful in evaluating claims for exception relief. See *Viking Range Corp.*, 28 DOE ¶81,002 at 82,506 (2000).

³⁰ *Nordyne, O.H.A., TEE-0013* (August 27, 2004) ("The manufactured housing market constitutes only 8% of the total housing market... Thus, we do not believe that the approval of exception relief will severely impede the energy conservation goals of EPCA.").

³¹ *ECR International, TEE-0034* (February 14, 2006), ("ECR has also not addressed the 'leakage' issue, i.e. the possibility that the units designed ... will somehow make their way into other buildings.").

³² *BSH Home Appliances Corp., TEE - 0070* (March 30, 2010), ("in establishing the Refrigerator Efficiency Standards, the DOE did not intend to stifle innovation and the development and introduction into the marketplace of new technology.").

6. the financial burden on producers and consumers if relief is not granted,³³
7. whether or not the applicant is supplying products to a niche market,³⁴
8. whether or not the hardship alleged by the applicant is the result of its own business decisions,³⁵
9. limited duration of the request for relief,³⁶ and
10. the potential for unintended consequences of DOE's Final Rule .

With this backdrop, without relief, enforcement of the Department of Energy's Final Rule on April 16, 2015 will result in serious hardship, gross inequity or unfair distribution of burdens to Vaughn and others (GIWH control technology providers).

Vaughn Thermal Corporation

With respect to Vaughn Thermal Corporation, Vaughn is a small business concern. It employs about 45 persons in its manufacturing facility located in Massachusetts. Vaughn products are manufactured exclusively in the United States. With the projected loss of its most popular sizes (55+ gallon capacities) of residential electric storage water heaters, combined with associated load management controls, Vaughn anticipates a reduction in sales volume of over 30%. In addition, a comparable percentage of Vaughn employees working directly in water heater and electronic control production will likely lose their jobs.

Vaughn has invested in excess of one million dollars of its research and development resources in ETS and grid-enabled water heaters and GIWH interface technologies. These potential losses of sales volume, personnel and invested capital are arriving simultaneously, driven by the April 2010 rulemaking and the lack of follow-up to the NOPR that proposed one-year waivers for electric utilities with DR, DSM and load-management water heating programs and/or the manufacturers supplying these programs. It is readily apparent that our country needs all of the energy efficiency, carbon reduction, renewable integration and grid-interactive resources it can get. ETS, grid-enabled and grid-interactive water heating technologies afford us the opportunity to transform the electric water heating market in ways that will benefit electric utilities and water heater manufacturers as well as the families they jointly serve.

³³*Nordyne, O.H.A.*, TEE-0013 (August 27, 2004) ("We find that such an increase in the cost of each unit would not only reduce Nordyne's product sales but impose an inequitable financial burden on producers and consumers of manufactured homes.").

³⁴*Energy Savings Products, LTD.*, TEE – 0026 (September 28, 2005), ("The SDHV manufacturing is a niche industry comprising less than 1 percent of the residential cooling market.").

³⁵*Tailored Lighting, Inc.*, EXC – 12 – 0007 (October 23, 2012), ("... we find that the company knowingly chose to develop and market a product that would not meet the impending 2012 deficiency standards...").

³⁶*Id.*, ("Furthermore, the relief requested by NCP is not limited in duration.").

Other Disaffected Parties

In addition to Vaughn, other parties stand to be negatively affected. OHA has recognized the impact on parties other than the applicant on numerous occasions in earlier decisions.³⁷ Such recognition is consistent with the canon of statutory interpretation noted earlier, namely, that remedial statutes are to be construed liberally.

Firstly, utilities, grid operators and renewable energy developers will be denied the use of a product that has been found to be extremely cost effective in the storage of grid-scale generated renewable energy and power management. Grid operators like PJM will also be denied the use of grid-interactive water heaters to solve the increasingly challenging issue of frequency regulation.³⁸ Management of power supply and demand will be at a higher cost and with a less efficient, slower response than could be if operators had grid-enabled and grid-interactive resources available to them. Without affordable energy storage and power management resources like grid-enabled and grid-interactive water heaters, utilities are faced with costly upgrades to their generation, transmission and distribution systems.

Secondly, GIWH control technology providers will be adversely impacted should they no longer have access to the large-capacity (75+ gallons) electric resistance water heaters in order to determine the suitability and to demonstrate the functionality of high-speed, two-way communications to the appliance and the grid-interactive attributes that are accordingly enabled.

Thirdly, electricity consumers (particularly low-income households) will be significantly impacted if electricity prices rise because utilities are unable to deploy low-cost ETS, grid-enabled and grid interactive water heaters. Current participants in utility DR, DSM and load-management electric water heating programs may see their water heating costs increase substantially if utilities are forced to discontinue off-peak rates and incentives. As discussed previously, the cost of using alternative methods for power management, and the cost of building new power generation to handle system peaks is significant. These costs ultimately are passed along to consumers through electric rate increases.

³⁷ See, for instance, *BSH Home Appliances Corp.* at 4 where OHA stated “[f]urthermore, if exception relief were denied, consumers would unfairly be deprived of the opportunity to choose among different brands....” Likewise, in *Emerson Motor Technologies, O.H.A., TEE-0003* (October 7, 2002), OHA stated that “... we are persuaded that Entergy and its Arkansas electricity customers would suffer an unfair distribution of burdens if Emerson (the Applicant) were not granted the exception” (Parenthetical added) and *Nordyne, O.H.A., TEE-0013* (August 27, 2004) at 12 where OHA stated that, without exception relief, the “increase in cost ... would ... impose an inequitable financial burden on producers and consumers of manufactured homes.”

³⁸ See PJM comments at <http://www.regulations.gov/#!documentDetail;D=EERE-2012-BT-STD-0022-0302>, <http://www.regulations.gov/#!documentDetail;D=EERE-2012-BT-STD-0022-0246>, and <http://www.regulations.gov/#!documentDetail;D=EERE-2012-BT-STD-0022-0245>.

Lastly, society as a whole can be significantly impacted. With rapidly growing amounts of renewable energy being added onto the grid (wind and solar), it is becoming more and more difficult for utilities to integrate these environmentally friendly, carbon free resources. In a growing number of instances, wind generation is already being curtailed today. Grid-interactive water heaters are tools that help integrate and fully utilize renewable generation which benefits everyone. Without this exception, society is denied this benefit and DOE is missing the opportunity to effectively double the carbon reduction potential in the residential electric water heating market by enabling the market introduction and necessary market development for grid-enabled and grid-interactive water heating.

Consistency with Factors OHA has Found Important in Previous Decisions

Impact on Competition within the Water Heater Industry

While important for reasons stated herein, the market for water heaters that would be subject to this exception is relatively small. In 2013, there were about 4 million electric water heaters shipped.³⁹ Of this amount, less than 200,000 were larger than 55 gallons (about 5%).⁴⁰ Of these larger water heaters, not all would be used in utility ETS programs making them subject to an exception. Thus, the total number of water heaters manufactured subject to this exception would logically be something less than 5% of the total market. OHA has found in the past that, where the total number of units subject to an exception is small, it is unlikely to impact competition.⁴¹ Since the number of water heater potentially shipped pursuant to an exception would be relatively small, it would not have an impact on the water heater industry.

Impact on National Goals of Energy Conservation

One of the stated goals of EPCA is to “conserve energy supplies through energy conservation programs, and, where necessary, the regulation of certain end-uses.”⁴² As discussed herein, ETS, grid-enabled and grid-interactive water heaters provide an efficient means for utilities to manage their load shapes, thereby avoiding the use of less efficient and more costly generation. In turn, this helps to keep rates low for consumers. In addition, grid-enabled water heaters and GIWH functionality are important tools for the successful integration of renewable energy in utility generation portfolios. Finally, GIWH is important to system operators like PJM for its ability to provide low-carbon, fast frequency regulation services. These benefits are consistent with EPCA’s national goals.

³⁹ See <http://www.ari.org/site/495/Resources/Statistics/Historical-Data/Residential-Storage-Water-Heaters-Historical-Data>.

⁴⁰ See Technical Support Document for <http://www.regulations.gov/#!documentDetail;D=EERE-2006-STD-0129-0170>.

⁴¹ *Nordyne*, O.H.A., TEE-0013 (August 27, 2004)

⁴² Energy Policy and Conservation Act, §2(4), 42 U.S.C. §6201 (1975).

The Size of the Market / Niche Market

As noted in the section entitled “Impact on Competition within the Water Heater Industry,” the market for water heaters larger than 55 gallons (and thus subject to this Application for Exception) is relatively small. Moreover, the market for water heaters larger than 55 gallons that also participate in a utility DR and Load Management program is even smaller; in effect, a niche market. OHA has found in the past that whether or not an application for exception is for a niche market is an important factor.⁴³ This Application is for the ability to serve a *niche* market, a factor that should mitigate in Vaughn’s favor.

The Potential for Leakage

The proposed exception will not undermine DOE’s water heater standards by generally allowing the sale of water heaters that do not meet the requisites of DOE’s April 15, 2010 Final Order. As discussed herein, Vaughn supports DOE’s heat pump water heater standard for customers who are not part of a utility demand response program. For those customers, heat pump water heaters will deliver significant lifecycle cost benefits and significant energy savings. Vaughn proposes an exception that will be limited to only those customers who participate in demand-side utility programs. This is achieved through labeling and, even more importantly, the requirement that water heaters subject to the exception must be shipped with an activation lock. This activation lock can only be unlocked by a utility with an ETS, grid-enabled or grid-interactive load management program.

Impact on Innovation

As discussed herein, utilities have successfully used ETS programs for many years to efficiently manage their peak demands. Built on the success of these ETS programs, Vaughn (and others) have invested in the research and development of new and better products, including grid-enabled and grid-interactive electric storage water heaters. However, without relief, all electric utility DSM, DR and Grid-Interactive Water Heating programs will suffer. OHA has recognized the impact on innovation as an important factor and the potential for a deleterious impact on innovation should mitigate in Vaughn’ favor.⁴⁴

Financial Burden on Producers and Consumers

As a manufacturer of electric storage water heaters and grid-enabled control technology, Vaughn will suffer hardship as described above, including loss of sales revenue, loss of its investment in innovative new products and loss of jobs for its employees. In addition, energy consumers (particularly low-income households) will suffer. Current program participants will be faced with higher replacement costs and higher operating costs due to loss of monthly incentives or lower off-peak rates. The National Rural Electric Cooperative Association states that ETS programs administered by rural electric cooperatives save consumers more than \$300

⁴³ *Nordyne, Energy Savings Products, LTD.*

⁴⁴ *BSH Home Appliances Corp., In the Matter of Liebherr Canada LTD.*

million per year. In addition, the ETS programs help to avoid higher rates for consumers by delaying the need to construct new power plants.⁴⁵ OHA has granted relief where standards impose a financial burden on producers and consumers.⁴⁶

Applicant's Business Decisions

Vaughn has supplied innovative electric water heaters and supporting products to the market for over 50 years. Development of its most recent family of products, including V-GRID Grid-Enabled electric water heaters and controllers, was begun about a decade ago. OHA has found that where an applicant has knowledge that it is developing a product that would violate a new standard promulgated by DOE, relief is not in order.⁴⁷ Those are not the facts here.

Duration of Request for Relief

In this Application, Vaughn requests an exception for 5 years. This time period is the same length of time agreed to by many parties in support of the Shaheen-Portman bill referenced in footnote 5 above. OHA has found that failure to request an exception with a limited duration can be fatal to the request.⁴⁸ Vaughn' request is limited to a reasonable time duration.

Unintended Consequence

"Subsequent to the publication of (its April 2010 Final Rule), a number of utility companies brought forth concerns regarding the amended energy conservation standard levels for electric storage water heaters and the impact of these standards on DSM, DR and load management programs that utility companies administer to manage peak load."⁴⁹ Responding to these concerns, DOE published a Request for Information.⁵⁰

After receiving comments from more than one hundred electric utilities during the RFI process, the Department of Energy recognized that its April 15, 2010 Final Rule had the likelihood of creating unintended consequences. Accordingly, DOE issued a Notice of Proposed Rulemaking in February 2013 in which it proposed "to establish a waiver process that will mitigate the concerns of utility companies regarding the implementation of the April 2010 standard levels by allowing for the manufacture of certain large-volume electric storage water heaters provided that they meet a set of conditions..."⁵¹ Ultimately, after thoughtfully deliberating on the many

⁴⁵ See NRECA testimony at <http://www.regulations.gov/#!documentDetail;D=EERE-2012-BT-STD-0022-0246> at 19.

⁴⁶ *Nordyne*. O.H.A., TEE-0013 (August 27, 2004)

⁴⁷ *Tailored Lighting, Inc.*

⁴⁸ *National Comfort Products.*

⁴⁹ Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Water Heaters; Proposed Rule 78 Fed. Reg. 38, 12969. (proposed February 26, 2012) (to be codified at 10 C.F.R. Pt. 430).

⁵⁰ Energy Conservation Program for Consumer Products and Certain Commercial and Industrial Equipment: Energy Conservation Standards for Residential Water Heaters; Proposed Rule 77 Fed. Reg. 114, 35299 (proposed June 13, 2012) (to be codified at 10 C.F.R. Pt. 430).

⁵¹ Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Water Heaters; Proposed Rule 78 Fed. Reg. 38, 12969. (proposed February 26, 2012) (to be codified at 10 C.F.R. Pt. 430).

comments it received, DOE concluded that it “agrees with the majority of commenters that action should be taken to mitigate the impacts of the April 2010 final rule standard levels on utility ETS programs in order to help preserve these benefits.”⁵²

Thus, DOE implicitly acknowledges the potential for deleterious unintended consequences without some form of relief.

Conclusion

Without relief, Vaughn will suffer gross inequity and loss of investment in the development of new and innovative water heating technologies at a time when the market is looking for just such products. In turn, Vaughn’s loss will tend to discourage others from investing in new and innovative technology. Such an outcome is at tension with both EPCA and with previous decisions by the Office of Hearings and Appeals.

To be clear, granting the relief requested by Vaughn would have little impact on competition, is consistent with the national goals of energy conservation as expressed in EPCA, and would tend to spur innovation. The impact of the Final Rule on utility DSM, DR and load management water heating programs is an unintended consequence of DOE’s April 2010 decision to require heat pumps for larger residential electric storage water heaters. Moreover, the market for large capacity electric thermal storage water heaters is a small, niche market. Vaughn’s request for relief is limited in duration and addresses the issue of leakage. The hardship Vaughn would suffer without relief is not the result of its own business decisions.

Accordingly, Vaughn Thermal Corporation respectfully requests that the Office of Hearings and Appeals grant the relief requested herein, in addition to any other relief it finds just and reasonable.

/s/ Ian Bratt, President
Vaughn Thermal Corporation

⁵² DOE also stated that it would look for “practical alternatives” to use of “large volume ERWH’s” but it concluded that “that products that are currently available on the market that meet the April 2010 standard levels may not be practical to fulfill the needs of utility ETS programs.” Id. at 12978.

Statement Regarding Duly Authorized Representative

Subject to the sanctions contained in 18 U.S.C. 1001, the parties identified below certify that we are duly authorized representatives of the Applicant, the Vaughn Corporation.

/s/ Ian Bratt, President

Vaughn Thermal Corporation

/s/ Charles R. Foster, III

Certificate of Service

I, Charles Foster, do hereby certify that on this date I mailed a complete copy of this Application to the parties identified below.

/s/ Charles Foster

Date: November 21, 2014

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Sample Notice to Parties of Opportunity to Comment

November 21, 2014

Dear Recipient:

Attached please find a complete copy of an Application for Exception filed today by the Vaughn Thermal Corporation.

Pursuant to 10 CFR 1003.23, you may submit comments regarding the application within 10 days to:

Office of Hearings and Appeals
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0107

Please reference "Vaughn Application for Exception" when filing comments.

I may be reached at 540-270-5661 if you have any questions.

Thank you,

Chuck Foster

ATTACHMENTS

Vaughn Electronic Controller



EC

Brochure[10-26-12].r

Vaughn V-Grid Series Product Specification Sheet



Vaughn V-Grid Series
[Rev D].pdf