



**Testimony of Steven Nadel,  
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**To the House Energy and Commerce Committee  
Subcommittee on Energy and Power**

**Hearing on: H.R. 906, A Bill To Modify the Efficiency Standards  
For Grid-Enabled Water Heaters**

**March 19, 2015**



## Summary

Water heating is a major use of home energy, second only to space heating. For homes with electric water heating, the water heater is generally the single largest electricity user. In 1987, Congress passed and President Reagan signed legislation establishing minimum efficiency requirements for appliances including water heaters. A recent analysis estimates that these standards are saving American consumers more than \$1 trillion on a cumulative basis. New water heater efficiency standards established in 2010 and taking effect next month will save additional energy and money, with even higher standards and higher savings for very large water heaters that use the most energy. Because of the high power use and inherent storage capacity of water heaters, some utilities operate demand-response or thermal-storage programs that can turn off the electric heating elements during peak demand periods, helping the utilities to manage loads on their system.

After the Department of Energy (DOE) issued final rules for water heaters in 2010 at the culmination of a three-and-a-half-year public rulemaking process, some utilities realized that the very large electric-resistance water heaters they use in demand-response and thermal-storage programs would no longer be manufactured. More efficient heat-pump water heaters would be manufactured, but these have not yet been fully evaluated and field tested for use in demand-response and thermal-storage programs.

To address these concerns, many organizations, including my organization, the American Council for an Energy-Efficient Economy, negotiated the language in H.R. 906 that carefully balances opportunities for saving energy via high-efficiency water heaters with the benefits to utilities of using very large electric water heaters in demand-response and thermal-storage programs. H.R. 906 allows continued manufacture of very large electric-resistance water heaters, but with a variety of provisions to limit their use to homes participating in demand-response and thermal-storage programs. Guidance is

provided so that DOE will carefully consider both energy efficiency and demand-response/thermal-storage needs in future rulemakings. We support this bill.

At the same time, while the new demand-response water heaters will facilitate programs that shift electricity use away from peak periods, they will use more energy than water heaters meeting the 2015 efficiency standards. Therefore they will modestly increase energy use in homes. In order to have an overall package that reduces energy use and does not increase it, we recommend that H.R. 906 be paired with other energy efficiency bills, just as this committee did last year in reporting out H.R. 2126. We also recommend that this subcommittee consider additional energy efficiency bills as part of forthcoming comprehensive energy legislation. We hope that enactment of H.R. 906 will be the beginning of a productive series of bills on energy efficiency in the 114<sup>th</sup> Congress.

## **Introduction**

My name is Steven Nadel and I am the executive director of the American Council for an Energy-Efficient Economy (ACEEE), a nonprofit organization that acts as a catalyst to advance energy efficiency policies, programs, technologies, investments, and behavior. We were formed in 1980 by energy researchers and celebrate our 35<sup>th</sup> anniversary this year. Personally I have been involved in energy efficiency issues since the late 1970s and have testified multiple times before the House Energy and Commerce Committee and its subcommittees, as well as before the Senate Energy and Natural Resources Committee. ACEEE is a nonpartisan organization; sometimes I appear as a Republican witness and sometimes as a Democratic witness. In our view, energy efficiency is a quintessentially nonpartisan issue. As Chairman Whitfield said when I testified at a previous hearing, “no one is in favor of energy waste.”

## **H.R. 906**

H.R. 906 was introduced by Representative Whitfield and several cosponsors and is designed to permit the continued sale of very large electric-resistance water heaters exclusively for application in thermal-storage and demand-response programs. The language of H.R. 906 was negotiated in 2013 among the National Rural Electric Cooperative Association (NRECA), water heater manufacturers, ACEEE, and several other energy efficiency and utility industry groups. It is a carefully negotiated compromise that seeks to improve energy efficiency while also allowing utilities to manage peak and off-peak loads to optimize their systems. We support H.R. 906.

In the remainder of this testimony I will:

- Provide context for H.R. 906
- Discuss some important aspects of the legislation and its implementation
- Make a few other recommendations

## **Context: Water Heating Energy Use, Appliance Standards, and Demand Response/Thermal Storage**

Water heating is one of the largest uses of energy in American homes. The Department of Energy's (DOE) Energy Information Administration (EIA) estimates that water heating accounts for about 18 percent of home energy use, second only to space heating. For a home with an electric water heater, water heating is on average its single largest electricity user. In 2009 (the last year with detailed data), the average electric water heater used nearly 2,700 kWh, which is more electricity than was used by the average home with electric heat (2,062 kWh) or air conditioning (1,980 kWh). (Homes with both electric water heaters and electric space heat are more likely to be in warm climates where space heating needs are lower.) In 2009, the average home with electric water heat spent about \$300 on water heating.<sup>1</sup>

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<sup>1</sup> Residential Energy Consumption Survey. <http://www.eia.gov/consumption/residential/data/2009/index.cfm?view=consumption#end-use>.

Due to the high energy use of water heaters, they were included as part of federal energy efficiency standards passed by Congress in 1987 and signed by President Reagan. Congress set the initial standards, and DOE periodically revises them based on criteria established by Congress. Congress has established standards for more than 50 products. A 2012 analysis estimates that standards already enacted are saving consumers and businesses more than \$1 trillion on a cumulative basis, considering both the higher cost of the efficient products and their lower operating costs.<sup>2</sup> In 2013, a pair of studies found that these standards often spurred manufacturers to find new ways to improve consumer utility and decrease product cost.<sup>3</sup>

After a prescribed multistep rule-making process with opportunities for public input by all interested parties over a three-and-a-half year period, in 2010 DOE established new efficiency standards for water heaters. They take effect a few weeks from now, on April 16, 2015. The standards apply at the point of manufacture and do not affect water heaters already in houses or in the sales distribution system. The new standards require moderate efficiency improvements in water heaters with a storage capacity of 55 gallons or less, but much larger efficiency improvements in both electric and gas water heaters over 55 gallons. Fifty gallons is the most common size for electric storage water heaters sold in the United States. Households with very large water heaters use more hot water on average, making higher efficiency levels more cost effective for households with these heaters. When DOE established the standards, it estimated the average household with a very large electric water heater would save \$626 over the lifecycle of the new high-efficiency unit.<sup>4</sup> These water heaters use a heat pump to heat water, making them roughly twice as efficient as an electric-resistance water heater.<sup>5</sup>

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<sup>2</sup> Lowenberger et al. *Efficiency Boom* (ACEEE, 2012). <http://aceee.org/research-report/a123>.

<sup>3</sup> Mauer et al. *Better Appliances* (ACEEE, 2013). <http://aceee.org/research-report/a132>. Nadel and deLaski. *Appliance Standards: Comparing Predicted and Observed Prices* (ACEEE, 2013). <http://aceee.org/research-report/e13d>.

<sup>4</sup> *Federal Register* 2010, p. 20114. <http://www.gpo.gov/fdsys/pkg/FR-2001-01-17/pdf/01-1081.pdf>.

<sup>5</sup> There were also comparable efficiency improvements for gas water heaters including stronger standards for large gas water heaters.

Many electric cooperatives, as well as some other utilities, have long sponsored programs to use very large water heaters to heat and store hot water during off-peak periods (e.g., overnight), permitting lower use during peak periods. These programs can help utilities manage their systems by reducing peak loads. A timer, radio control, or other type of communication device controls the water heaters to generally stop them from operating during peak periods.

A search of the *Federal Register* notice finalizing the 2015 standards yields no mention of concerns about demand response, load management, or thermal storage. After the final rule was published, NRECA and others became concerned that the very large electric water heaters they use for demand-response and thermal-storage programs would no longer be manufactured. At the time, and even today, the heat-pump water heaters on the market have not been fully evaluated and field tested in demand-response mode, and therefore their performance in demand-response programs cannot be ensured.<sup>6</sup>

## **Important Aspects of H.R. 906 and Its Implementation**

H.R. 906 will permit the continued sale of very large electric-resistance water heaters for use in thermal-storage and demand-response programs. While we believe that heat-pump water heaters can meet the needs of demand-response and thermal-storage programs in the longer term, they have not yet been fully evaluated and demonstrated in these programs. Therefore, at least for the time being, there is a need for the continued availability of large electric-resistance water heaters for use in these programs.

H.R. 906 contains a number of important features to balance energy efficiency and demand-response/thermal-storage needs:

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<sup>6</sup> However there have been several studies and pilot projects on the use of heat-pump water heaters in demand-response mode with encouraging findings. These include reports by Pacific Northwest National Laboratory ([http://www.pnnl.gov/main/publications/external/technical\\_reports/PNNL-22642.pdf](http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22642.pdf)), Pacific Gas & Electric ([http://www.etcc-ca.com/sites/default/files/OLD/images/ge\\_hpwh\\_dr\\_test\\_report.pdf](http://www.etcc-ca.com/sites/default/files/OLD/images/ge_hpwh_dr_test_report.pdf)), the Northwest Energy Efficiency Alliance (<http://neea.org/docs/default-source/reports/final-hpwh-dr-report-and-summary.pdf?sfvrsn=6>), and the Electric Power Research Institute (<http://www.epri.com/search/Pages/results.aspx?k=Residential%20Heat%20Pump%20Water%20Heaters>).

- The bill permits the sale of more efficient very large electric-resistance water heaters for use in demand-response and thermal-storage programs. As part of the negotiations, manufacturers agreed to improve the efficiency of these water heaters relative to the efficiency of smaller units.
- The bill limits the use of new very large electric-resistance water heaters to participants in demand-response and thermal-storage programs. To operate fully, these water heaters will need an electronic or physical key, and these keys will be given only to demand-response and thermal-storage program operators. A prominent permanent label on the water heater will alert contractors as well as consumers to this requirement. A contractor or program could be subject to penalties if they knowingly and improperly activate a grid-enabled water heater that is not enrolled in a demand-response or thermal-storage program.
- The bill provides for monitoring the sales of grid-enabled water heaters and tracking participation in demand-response and thermal-storage programs using existing surveys and tracking mechanisms. This will enable DOE to assess whether a substantial number of very large electric-resistance water heaters are being diverted for use outside of demand-response and thermal-storage programs.
- The bill includes a process for the consideration of the future role of very large electric-resistance water heaters in demand-response and thermal-storage programs in future DOE rulemakings. It asks DOE to consider a range of impacts including “the impact on thermal-storage and demand-response programs, including any impact on energy savings, electric bills, peak load reduction, electric reliability, integration of renewable resources, and the environment.” The bill also asks DOE to consider whether future demand-response water heaters should have a standard communication interface to enhance their utility in demand-response programs. This provision unlocks the potential of electric water heaters to support the smart grid of the future.

## **Additional Recommendations**

Demand-response and thermal-storage water heaters can benefit utilities by allowing them to shift a large load away from periods of peak demand. However, for individual consumers to benefit, they will need to receive rate discounts or other incentives. As noted above, DOE estimates that a very large electric-resistance water heater will cost about \$600 more to purchase and operate over its lifetime than a heat pump water heater. For consumers to be made whole, they will need to save this much through lower off-peak electric prices and/or incentives to participate in demand-response programs. For consumers to break even on average, these discounts or incentives will need to average about \$50 per customer per year, based on a 13-year average water heater life. Higher discounts and incentives will be needed if the average consumer is to see benefits as opposed to simply breaking even. We hope that utilities taking advantage of H.R. 906 will offer these discounts or incentives to compensate consumers for the higher energy use of electric-resistance water heaters.

Using data from the DOE rulemaking, we estimate that on average an 80-gallon electric-resistance water heater authorized under H.R. 906 will use about 1,400 kWh per year more than a heat-pump water heater. To make up these lost savings, we recommend that this committee combine H.R. 906 with other energy-saving provisions, as it did last year in reporting out H.R. 2126.

We also recommend that the committee consider a variety of other energy efficiency provisions as it develops a comprehensive “all of the above” energy bill, building on legislative proposals from Representatives McKinley and Welch, Senators Portman, Shaheen, Murkowski and Cantwell, and proposals from many other representatives and senators.

## **Conclusion**

Water heating is a major use of home energy. Water heaters should be efficient and able to participate in demand-response and thermal-storage programs. H.R. 906 carefully balances these considerations and should be enacted into law, ideally in combination with other energy efficiency bills.

We hope that the enactment of H.R. 906 will mark the beginning of a productive series of bills to advance energy efficiency in the 114<sup>th</sup> Congress.

This concludes my testimony. Thank you for the opportunity to present these views.