Appliance Standards Awareness Project
Natural Resources Defense Council
Northwest Energy Efficiency Alliance
Northwest Power and Conservation Council

June 6, 2011

Ms. Brenda Edwards
U.S. Department of Energy
Building Technologies Program
Mailstop EE-2J
1000 Independence Avenue, SW
Washington, DC 20585-0121

RE: Docket Number EERE-2011-BT-STD-0029: Notice of Data Availability for Commercial Heating, Air-Conditioning, and Water-Heating Equipment

Dear Ms. Edwards:

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP), Natural Resources Defense Council (NRDC), Northwest Energy Efficiency Alliance (NEEA), and Northwest Power and Conservation Council (NPCC) in response to the Department of Energy (DOE) request for comments on the notice of data availability (NODA) for commercial heating, air-conditioning, and water-heating equipment.[1] We appreciate the opportunity to provide input to the Department. Below we provide both our technical recommendations for commercial warm-air furnaces, air conditioners and heat pumps, and water heaters and also the legal requirements that compel review of certain of these products.

Under Recently Announced Department Policy and Legal Requirements, DOE Must Review All Products Whose Efficiency Standards Are More Than Five Years Old.

The Federal energy efficiency standards for most of the products covered by ASHRAE 90.1 were finalized in 2005 or earlier.[2] This means that review of these products is due under the recently announced Strategic Plan for the Department of Energy and is also legally required under the six-year review provision, 42 U.S.C. § 6313(a)(6)(C).

In its May 2011 Strategic Plan, the Department committed to "Review minimum appliance efficiency standards at least every 5 years."[3] We applaud this commitment, which is essential to ensure that energy efficiency standards keep up with technological advances. As discussed below, the Federal standards for many of the products covered by ASHRAE 90.1 are already five

[1] 76 Fed. Reg. 25,622 (May 5, 2011).
[2] The exceptions are commercial packaged boilers and water- and evaporatively-cooled commercial packaged air conditioners and heat pumps with cooling capacities ≥240,000 and <760,000 Btu/h (74 Fed. Reg. 36,312 (July 22, 2009)) and packaged terminal air conditioners and heat pumps (73 Fed. Reg. 58,772 (October 7, 2008)).
[3] http://www.energy.gov/news/documents/DOE_StrategicPlan.pdf .

or ten years old. We urge the Department to apply this Strategic Plan commitment to these standards.

The Department is also legally required to review standards for commercial products every six years. 42 U.S.C. § 6313(a)(6)(C). As described in the attached March 31, 2011 Memorandum to Acting General Counsel Sean Lev (attached as Exhibit A), the six-year review provision requires that within six years of a rule setting efficiency standards the Department must either publish a notice indicating that new standards are not required or commence a proposed rulemaking including new proposed standards. *Id.* For commercial products also subject to an ASHRAE review trigger, the six year review provides an independent and additional review trigger.

As discussed in the attached Memorandum, the plain language of the six year review provision applies to all final rules setting efficiency standards, including those set prior to enactment of the six year review provision. Even if the plain language did not govern, it would be unreasonable to read the provision to exclude the most out-of-date standards given the fact that the very purpose behind the provision is to ensure that DOE keep the efficiency standards up to date. Accordingly, in order to satisfy the six-year review requirement, DOE is obligated to review the standards for many of the products covered by ASHRAE 90.1. Each of the subsequent sections describes ASHRAE product categories and our specific recommendations.

Commercial Warm-Air Furnaces

The current Federal energy conservation standards for gas- and oil-fired warm-air furnaces are identical to the respective thermal efficiency standards in ASHRAE 90.1-2010. However, ASHRAE 90.1-2010 contains additional requirements for warm-air furnaces that are not included in the Federal standards, so the Department has incorrectly determined that no further action is required for these products.[4] In addition to the thermal efficiency requirements, ASHRAE 90.1-2010 also requires that units include an interrupted or intermittent ignition device (IID), have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. **We urge DOE to adopt all the requirements for gas- and oil-fired warm-air furnaces included in ASHRAE 90.1-2010 as the Federal standards.** The ASHRAE 90.1-2010 requirements for warm-air furnaces are included as part of the Implementation of National Consensus Appliance Agreements Act (INCAAA, S. 398), and the American Council for an Energy-Efficient Economy (ACEEE) estimates that adopting these standards would achieve annual energy savings of 2.3 trillion Btu by 2030.[5]

As we discussed in the August 15, 2008 comments attached as Exhibit B[6] and the June 3, 2009 comments attached as Exhibit C,[7] the additional ASHRAE 90.1-2010 requirements qualify as an

[4] *Id*. at 25,630.
[5] ACEEE. Benefits from Consensus Efficiency Standards in S.398. http://www.aceee.org/files/pdf/fact-sheet/INCAAA_042111.pdf.
[6] NRDC and ASAP submitted the August 15, 2008 comments with the American Council for an Energy-Efficient Economy, Alliance to Save Energy, California Energy Commission, Northeast Energy Efficiency Partnerships, and Northwest Power and Conservation Council.
[7] NRDC and ASAP submitted the June 3, 2009 comments with the American Council for an Energy-Efficient Economy, Alliance to Save Energy, Northeast Energy Efficiency Partnerships, and Northwest Power and Conservation Council.

"amendment" that triggers DOE's obligation to review the potential energy savings of amended energy efficiency standards under the Energy Policy and Conservation Act ("EPCA"). 42 U.S.C. § 6313(a)(6)(A)(i). In addition, DOE is authorized to adopt a multi-metric standard under EPCA. DOE has asserted that Congress generally intended 42 U.S.C. § 6313 to result in DOE "maintain[ing] uniform national standards consistent with those set in ASHRAE/IESNA Standard 90.1."[8] Because ASHRAE has adopted a performance standard and multiple design requirements, DOE must read the statute as permitting the Department sufficient authority to harmonize federal and ASHRAE requirements. Moreover, Congress intended for multi-metric standards as many products are already subject to a standard with more than one efficiency requirement (e.g. commercial storage and instantaneous water heaters, commercial clothes washers, commercial heat pumps, ceiling fans, unit heaters, and others). Some of these multi-part standards (e.g. those for commercial storage and instantaneous water heaters and commercial heat pumps) are based on equivalent multi-part requirements in ASHRAE 90.1.

Even if review were not compelled by the ASHRAE changes, reviewing the efficiency standards for warm air furnaces, which were set in 2001, is also compelled by the six year review provision and consistent with the Department's policy of reviewing standards every five years.

Commercial Package Air Conditioners and Heat Pumps

ASHRAE 90.1 contains minimum efficiency levels for various types of commercial package air conditioners and heat pumps. We encourage DOE to conduct rulemakings for specific types of commercial package air conditioners and heat pumps where there may be potential for significant national energy savings from amended standards, regardless of whether the minimum efficiency levels in ASHRAE 90.1-2010 were raised. In the following sections, we provide our recommendations for specific types of commercial package air conditioners and heat pumps.

Unitary Air-Cooled Air Conditioners and Heat Pumps, Including VRF Equipment

ASHRAE 90.1-2010 did not raise the minimum efficiency levels for unitary air-cooled air conditioners and heat pumps. ENERGY STAR has specifications for commercial air-cooled air conditioners and heat pumps with capacities ≥65,000 Btu/h and <240,000 Btu/h, and CEE has specifications for capacities ≥65,000 Btu/h and <760,000 Btu/h. Table 1 shows the current Federal standards, the ENERGY STAR and CEE specifications, and the efficiency levels of the most-efficient commercially-available units for small, large, and very large air-cooled air conditioners. For each capacity range, the CEE Tier 2 level is at least 1 EER point higher than the Federal standard while the EER of the most-efficient unit in each category significantly exceeds the CEE Tier 2 specification.

[8] 72 Fed. Reg. at 10,042 (March 7, 2007).

Table 1. Federal standards, CEE and ENERGY STAR specifications, and efficiency levels of the most-efficient commercially-available units for commercial air-cooled air conditioners.

Cooling Capacity (Btu/h)	Heating Section Type	Efficiency Level (EER)				
		Federal Standard	ENERGY STAR[9]	CEE Tier 1[10]	CEE Tier 2[11]	Max Available[12]
≥65,000 and <135,000	Electric Resistance (or none)	11.2	11.7	11.7	12.2	13.9
	All other	11.0	11.5	11.5	12.0	13.8
≥135,000 and <240,000	Electric Resistance (or none)	11.0	11.7	11.7	12.2	12.8
	All other	10.8	11.5	11.5	12.0	12.6
≥240,000 and <760,000	Electric Resistance (or none)	10.0	--	10.7	11.0	12.0
	All other	9.8	--	10.5	10.8	11.9

Table 2 shows the number of active models of single-package air-cooled air conditioners in the AHRI directory that meet CEE Tier 1 and Tier 2 specifications. There are more than 60 models for each sub-category of equipment that meet CEE Tier 2 levels, and for each sub-category, at least four out of the five major manufacturers have models that meet CEE Tier 2 levels.[13] The wide commercial availability of air-cooled air conditioners that significantly exceed the minimum Federal standards indicates that higher efficiency levels are technologically feasible.

Table 2. Number of active models of single-package air-cooled air conditioners in the AHRI directory that meet CEE Tier 1 and Tier 2 levels.

Cooling Capacity (Btu/h)	Heating Section Type	Number of Models	
		CEE Tier 1	CEE Tier 2
≥65,000 and <135,000	Electric Resistance (or none)	269	198
	All other	282	202
≥135,000 and <240,000	Electric Resistance (or none)	173	95
	All other	249	167
≥240,000 and <760,000	Electric Resistance (or none)	84	63
	All other	195	112

DOE conducted analysis in 2004 to evaluate higher efficiency levels for commercial unitary air-cooled air conditioners with capacities ≥65,000 Btu/h and <240,000 Btu/h.[14] Table 3 shows the incremental national energy savings relative to a baseline efficiency level of 11.0 EER for small and large air-cooled air conditioners from the 2004 DOE analysis. The baseline level and the higher efficiency levels are similar but not identical to the current Federal standards and the CEE specifications, respectively. The DOE analysis showed incremental savings of about 0.5 quads over 30 years for an efficiency level of 11.5 EER and 0.7 quads for a standard level of 12.0 EER relative to a baseline of 11.0 EER. We note that these savings estimates do not include potential savings from very large equipment (≥240,000 Btu/h and <760,000 Btu/h).

[9] http://www.energystar.gov/index.cfm?c=lchvac.pr_crit_lchvac.
[10] http://www.cee1.org/com/hecac/hecac-tiers.pdf.
[11] *Ibid*.
[12] Based on active models of single-package air-cooled air conditioners (SP-A) and year-round single-package air-cooled air conditioners (SPY-A) in the AHRI directory.
[13] The five major manufacturers are AAON, Carrier, Lennox, Trane, and York.
[14] Commercial Unitary Air Conditioners and Heat Pumps. Technical Support Document. July 2004. p. 10-23.

Table 3. Incremental potential national energy savings from higher efficiency levels for air-cooled air conditioners relative to a baseline of 11.0 EER.

Efficiency Level	National Energy Savings (quads)		
	Cooling Capacity (Btu/h)		Total
	≥65,000 and <135,000	≥135,000 and <240,000	
11.0 EER	--	--	--
11.5 EER	0.28	0.23	0.51
12.0 EER	0.38	0.30	0.68

We encourage DOE to conduct a rulemaking to consider amended standards for unitary air-cooled air conditioners and heat pumps since higher efficiency levels are technologically feasible and the potential national energy savings are significant. In addition, higher efficiency levels for air conditioners and heat pumps can provide significant reductions in peak electricity demand.

We understand that there is currently no DOE test procedure for variable refrigerant flow (VRF) equipment and that AHRI recently released AHRI Standard 1230 with Addendum 1 for VRF multi-split air-conditioning and heat pump equipment. AHRI's equipment certification process using AHRI Standard 1230 will make data available on the range of efficiencies of VRF equipment. We encourage DOE to conduct a test procedure rulemaking for VRF equipment to eliminate the need for manufacturers to seek test procedure waivers for this equipment. In addition, DOE notes in the NODA that VRF equipment is currently covered under DOE's standards for commercial air conditioners and heat pumps.[15] Therefore, a rulemaking to consider amended standards for unitary air-cooled air conditioners and heat pumps should include air-cooled VRF equipment.

The existing standards were set in 2005 and the Department must initiate review now in order to meet the six-year review deadline, which will run within the year. In addition, review now is consistent with the Department's policy of reviewing standards every five years. If DOE initiates a rulemaking soon, presumably any amended standards could become effective in the 2017-2020 timeframe, thereby providing 7-10 years between effective dates.

Unitary Water- and Evaporatively-Cooled Air Conditioners

DOE's preliminary analysis of unitary water- and evaporatively-cooled air conditioners shows that per-unit energy consumption could be reduced by up to 6-20 percent, depending on the specific product, by adopting efficiency levels above the levels in ASHRAE 90.1-2010.[16] DOE estimates that the ASHRAE 90.1-2010 standards could achieve per-unit annual energy savings for water-cooled units of about 350-3,600 kWh, depending on capacity, and per-unit annual energy savings of about 2,400 kWh for very large evaporatively-cooled units.[17] However, the potential national energy savings from efficiency levels above the levels in ASHRAE 90.1-2010 are very small due to the low shipment volumes of these products. **We encourage DOE to**

[15] 76 Fed. Reg. 25,631.
[16] 76 Fed. Reg. 25,639, 25,640.
[17] *Ibid.*

adopt the levels for water- and evaporatively-cooled air conditioners in ASHRAE 90.1-2010 as the Federal standards.

In this docket, DOE has determined that the 2010 amendments to ASHRAE 90.1 trigger agency review of the national standards for these products. We also note that the existing standards for these products were set in 2001 and, therefore, review of them now also is compelled by the six year review provision and consistent with the Department's five-year standard review policy.

Unitary Water Source Heat Pumps, Including VRF Equipment

ASHRAE 90.1-2010 did not increase the efficiency levels for unitary water source heat pumps.[18] In the 2007 version of ASHRAE 90.1, the minimum efficiency level in cooling mode for water source heat pumps ≥65,000 Btu/h and <135,000 Btu/h was 12.0 EER, which was higher than the minimum efficiency level for small water- and evaporatively-cooled air conditioners with electric resistance heating or none (11.5 EER). The new ASHRAE 90.1 minimum efficiency level for water- and evaporatively-cooled air conditioners ≥65,000 Btu/h and <135,000 Btu/h is 12.1 EER (for equipment with electric resistance heating or none), which is now higher than the efficiency level for water source heat pumps. While water source heat pumps and water- and evaporatively-cooled air conditioners are different technologies with different rating methods, the switch in relative efficiencies suggests that higher efficiency levels for water source heat pumps may be feasible. CEE has a specification for water source heat pumps with capacities <135,000 Btu/h. Table 4 shows the current Federal standards and the CEE specifications for water source heat pumps for cooling and heating modes. The CEE specifications are significantly higher than the current Federal standards.

Table 4. Federal standards and CEE specifications for water source heat pumps.

Mode	Federal Standard[19]	CEE Tier 1[20]
Cooling	12.0 EER	14.0 EER
Heating	4.2 COP	4.6 COP

We encourage DOE to evaluate whether there is a potential opportunity for significant national energy savings from higher efficiency levels for water source heat pumps. A rulemaking to consider amended standards for water source heat pumps should include water source VRF equipment.

Even though ASHRAE 90.1 has not amended its levels for water source heat pumps, review of the existing federal standards, which date from 2001, is compelled by the six year review provision and consistent with the Department's five-year standard review policy.

[18] ASHRAE 90.1-2010 did create a separate product class for VRF equipment, including water source equipment. ASHRAE 90.1-2010 raises the efficiency levels for VRF water source heat pumps <17,000 Btu/h and >135,000 Btu/h above current Federal standards.
[19] For equipment with capacities ≥17,000 Btu/h and <135,000 Btu/h.
[20] For equipment with capacities <135,000 Btu/h. http://www.cee1.org/com/hecac/hecac-tiers.pdf.

Single-Package Vertical Air Conditioners and Heat Pumps

DOE's preliminary analysis shows that efficiency levels above those in ASHRAE 90.1-2010 could reduce national energy consumption by as much as 0.5 quads over 30 years.[21] **We agree with DOE's conclusion that amendments to EISA 2007 compel review of the existing standards for these products and consideration of levels above those contained in ASHRAE 90.1 -2010.**

Computer Room Air Conditioners

Computer room air conditioners represent a potential opportunity for national energy savings as the direct electricity used by data centers and the associated cooling energy consumption continue to increase. The energy consumption of servers and associated infrastructure represented about 1.2% of total U.S. electricity consumption in 2005, with cooling and auxiliary infrastructure consuming about half of the electricity use.[22] California has standards for computer room air conditioners with capacities up to 240,000 Btu/h. Table 5 shows the California Energy Commission (CEC) standard and the efficiency level of the most-efficient commercially-available unit for each capacity range. There are models in each capacity range with efficiencies that significantly exceed the CEC standards.

Table 5. CEC standards and efficiency levels of the most-efficient commercially-available units for computer room air conditioners.

Cooling Capacity (Btu/h)	CEC Standard[23]	Max Available[24]
<65,000	11.0 EER	12.3 EER
≥65,000 and <135,000	10.4 EER	11.0 EER
≥135,000 and <240,000	10.4 EER	10.7 EER

We support DOE's determination that it has the authority to review the ASHRAE Standard 90.1-2010 efficiency levels for computer room air conditioners and establish energy conservation standards.[25] The potential energy savings may be significant. We recognize the difficulty of comparing EER levels to SCOP levels. However, we urge the Department to attempt to ensure that any standards established for computer room air conditioners are at least as stringent as the current California standards.

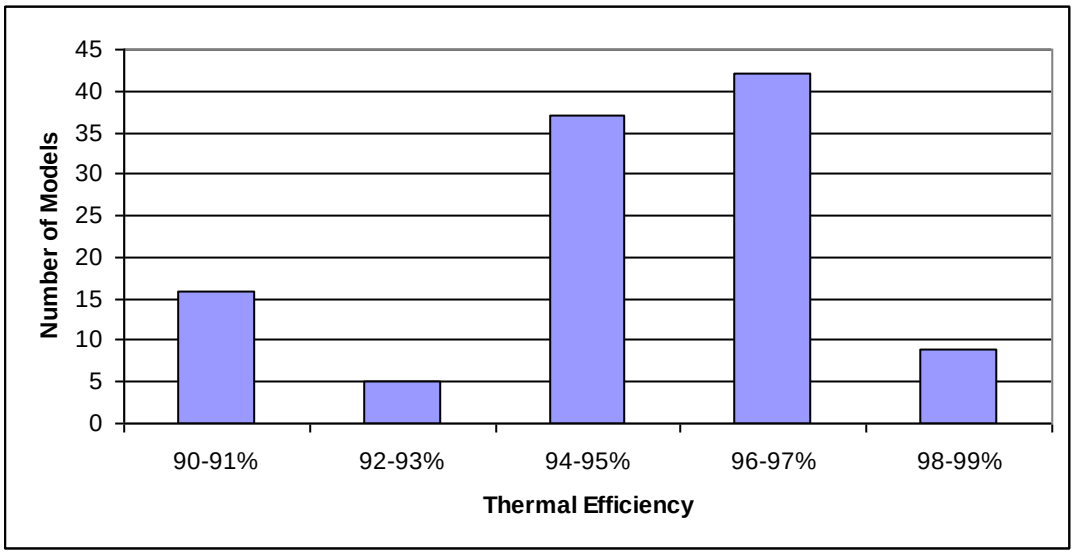
Commercial Water Heaters

The current Federal standards for commercial gas-fired storage water heaters require a minimum thermal efficiency of 80%. There are more than 100 models of commercial gas-fired storage water heaters in the AHRI directory with thermal efficiencies ≥90% including premium units with thermal efficiencies as high as 99%. Figure 1 shows the number of models of gas-fired

[21] 76 Fed. Reg. 25,646, 25,647.
[22] Koomey, J.G. 2007. Estimating Total Power Consumption by Servers in the U.S. and the World. citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.87.5562&rep=rep1&type=pdf.
[23] CEC. 2010 Appliance Efficiency Regulations. http://energy.ca.gov/2010publications/CEC-400-2010-012/CEC-400-2010-012.PDF.
[24] Based on computer room air conditioner models in the CEC appliance efficiency database.
[25] 76 Fed. Reg. 25,634.

storage water heaters in the AHRI directory by thermal efficiency bin. The wide commercial availability of gas-fired storage water heaters with thermal efficiencies ≥90% indicates that efficiency levels significantly higher than the current Federal standards are technologically feasible.

Figure 1. Number of models of commercial gas-fired storage water heaters in AHRI directory by thermal efficiency.



According to CBECS, total natural gas consumption for water heating in commercial buildings in 2003 was about 350 trillion Btu.[26] PG&E's Food Service Technology Center estimates that installing a condensing storage water heater can increase system efficiency from 70% to 90% for a quick-service facility and from 65% to 80% for a full-service restaurant yielding annual gas savings of 340 therms for a typical quick-service facility and 1,760 therms for a typical full-service restaurant.[27] The Food Service Technology Center also estimates that the payback period for a high-efficiency, condensing gas-fired storage water heater is one year or less.[28]

There is also an energy savings opportunity for commercial electric water heaters by shifting the market to heat pump technology. Historically, commercial gas water heaters were much more prevalent than electric water heaters. However, according to AHRI data, electric storage water heaters made up 43 percent of total commercial storage water heater shipments in 2010.[29] In the 2010 Final Rule for residential water heaters, DOE found that a standard level for electric storage water heaters effectively requiring heat pump technology would yield average life-cycle cost

[26] http://www.eia.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set19/2003pdf/e07a.pdf.
[27] PG&E Food Service Technology Center. Presentation at 2011 ACEEE Hot Water Forum. http://www.aceee.org/files/pdf/conferences/hwf/2011/8C%20-%20Don%20Fisher.pdf.
[28] PG&E Food Service Technology Center. Design Guide: Improving Commercial Kitchen Hot Water System Performance: Energy Efficient Heating, Delivery and Use. http://www.fishnick.com/design/waterheating/Water_Heating_Design_Guide_Final_FNi_disclaimer.pdf. p. 23
[29] http://www.ahrinet.org/App_Content/ahri/files/Statistics/Monthly%20Shipments/Dec%2010%20Stat%20Release%20-%20FINAL.pdf.

savings of $112 and that a standard requiring heat pump technology for only large-volume water heaters (>55 gallons) would yield average life-cycle cost savings of $626.[30] It is likely that heat pump water heaters would also be highly cost-effective in commercial applications. In addition, heat pump water heaters provide additional benefits in applications that require spot cooling of work areas in addition to water heating, such as commercial laundries and restaurant/food service kitchens.[31]

We encourage DOE to conduct a rulemaking to consider amended energy conservation standards for commercial water heaters since higher efficiency levels are technologically feasible and the potential national energy savings are likely significant. Moreover, because the existing standards for commercial water heaters were set in 2001, review of the standards is compelled by the six year review provision and consistent with the Department's five-year standard review policy.

Thank you very much for considering these comments.

Sincerely,

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[30] Residential Heating Products Final Rule Technical Support Document. pp. 8-69, 8-76.
[31] ACEEE. 2002. Toward Market Transformation: Commercial Heat Pump Water Heaters for the New York Energy $mart Region. http://www.cee1.org/eval/db_pdf/325.pdf.

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