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June 30, 2016

Via email to [Samantha.Meserve@state.ma.us](mailto:Samantha.Meserve@state.ma.us)

Samantha Meserve  
Department of Energy Resources  
100 Cambridge Street  
Suite 1020  
Boston, MA 02114

Re: Comments on Alternative Portfolio Standard Regulations (225 CMR 16.00)

The International District Energy Association appreciates the opportunity to submit the attached comments.

We are pleased to answer any questions or provide further information regarding our comments and recommendations. Please do not hesitate to contact me at [rob.idea@districtenergy.org](mailto:rob.idea@districtenergy.org), or at 508-366-9339, or Mark Spurr, IDEA Legislative Director at [mspurr@fvbenergy.com](mailto:mspurr@fvbenergy.com), or at 612-607-4544.

Yours truly,

A handwritten signature in blue ink, which appears to read "Robert P. Thornton". The signature is fluid and cursive, written in a professional style.

Robert Thornton  
President

# Comments of the International District Energy Association on the Massachusetts Alternative Portfolio Standard Regulations

June 30, 2016

The International District Energy Association (IDEA) applauds the recognition given to thermal energy in the revised Alternative Portfolio Standard (APS) Regulations, including use of biomass and biofuel for generation of useful thermal energy. IDEA respectfully submits the following comments based on our review of proposed 225 CMR 16.00 *Alternative Energy Portfolio Standard* and the following associated documents:

- *Alternative Energy Portfolio Standard Guideline on Metering and Calculating the Useful Thermal Output of Eligible Renewable Thermal Generation Units, Parts 1 and 2;*
- *Alternative Energy Portfolio Standard Guideline on AEC Multipliers for Renewable Thermal Generation Units; and*
- *Alternative Energy Portfolio Standard Guideline on Biomass, Biogas and Biofuels for APS Renewable Thermal Generation Units.*

## Heat Pumps

We have serious concerns regarding crediting of heat pumps in 16.05 (1) 6.

The proposed Regulation states, in 16.05(1) 6. a. i.:

*“An applicant must demonstrate to the satisfaction of the Department that the air-source heat pump is the **primary source** of heating for the residential unit, building, or process it serves, and meets the design criteria, including the ability to operate at or **above a threshold Coefficient of Performance at design conditions, as provided in the Department’s Renewable Thermal Technology Guideline.**”* (emphasis added)

“Primary source” is not defined, and there is no parallel requirement in 16.05(1) 6.a.ii. for Ground and Water-Source Heat Pumps.

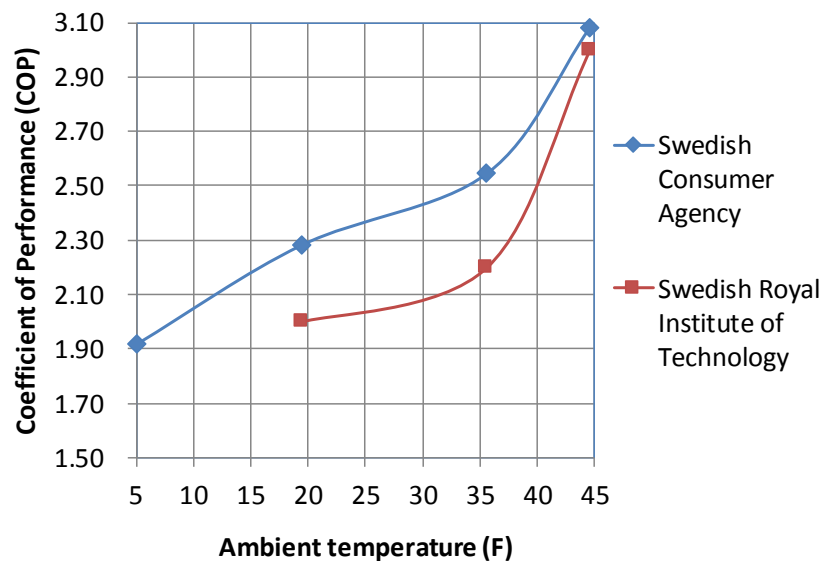
It is our understanding that there is no *Renewable Thermal Technology Guideline*, so the reference to the “threshold Coefficient of Performance at design conditions, as provided in the Department’s *Renewable Thermal Technology Guideline*” is problematic.

## Air-Source Heat Pumps

*Alternative Energy Portfolio Standard Guideline on Metering and Calculating the Useful Thermal Output of Eligible Renewable Thermal Generation Units* does not contain any threshold Coefficients of Performance for air to air heat pumps. Presumably, the crediting formulas on page 8 of that document (under AEC Formula for Small ASHP RTGUs) were developed based on some set of assumptions regarding theoretical COP performance. As discussed below, actual performance of air-source heat pumps is highly dependent on ambient air temperatures and has been shown through field measurements to be significantly poorer than theoretical values based on laboratory tests.

The efficiency of air-source heat pumps varies depending on the outside temperature, with these systems less efficient for heating when the outside air is colder. Figure 1 shows two sets of laboratory

test results with air-source heat pumps under controlled laboratory conditions at a range of air temperatures.

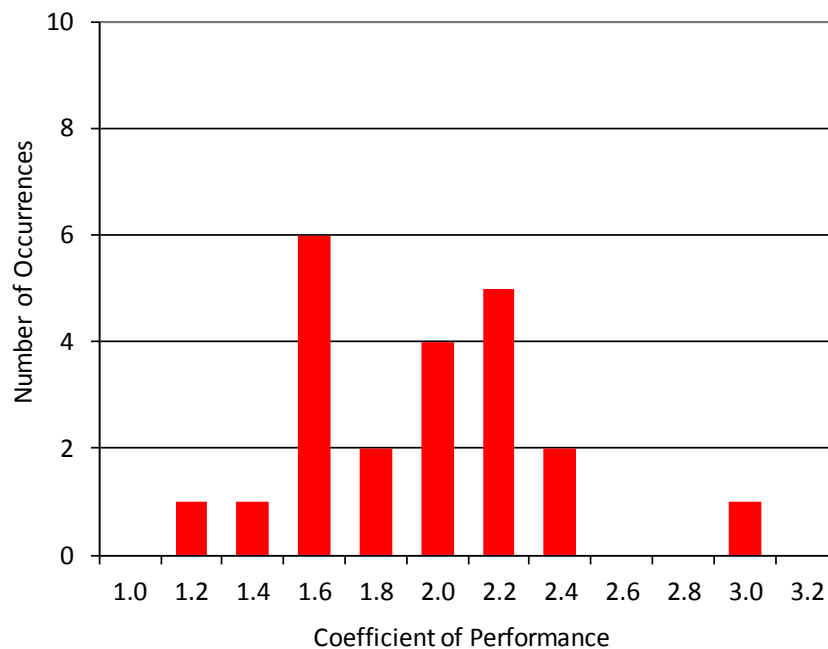


**Figure 1. Air Source Heat Pump Heating Coefficient of Performance Tested at a Range of Ambient Temperatures <sup>1, 2</sup>**

Although heat pumps are often promoted as having heating COPs of 3.0-4.0, actual performance based on field measurements indicate significantly lower efficiencies. Figure 2 shows actual seasonal efficiency performance for 22 air source heat pumps from field measurements in the United Kingdom. The average heating COP for the air source heat pumps was 1.94, far below the theoretical efficiencies.

<sup>1</sup> Swedish Royal Institute of Technology (2007), Single Room Heat Pumps for Cold Climates.

<sup>2</sup> Swedish Consumer Agency, SP Technical Research Institute of Sweden.



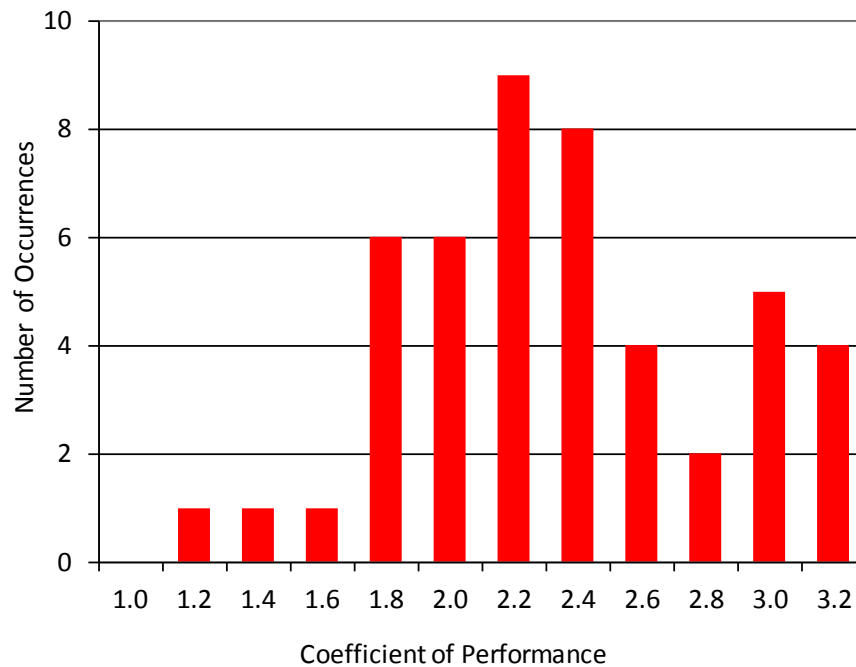
**Figure 2. Actual Air Source Heat Pump Heating Efficiencies Based on Field Measurements in the United Kingdom <sup>3</sup>**

### **Water-Source Heat Pumps**

*Alternative Energy Portfolio Standard Guideline on Metering and Calculating the Useful Thermal Output of Eligible Renewable Thermal Generation Units* indicates threshold COPs for four categories of water-source heat pumps based on AHRI laboratory testing protocols. However, as discussed below, actual field performance of water-source heat pumps is significantly poorer than the theoretical values based on laboratory tests.

Figure 3 shows similar actual seasonal efficiency data collected for ground source heat pumps in the United Kingdom. The average heating COP for the ground source heat pumps was 2.34, or 0.40 higher than the average for air source heat pumps.

<sup>3</sup> Energy Saving Trust (2010), *Getting Warmer: a field trial of heat pumps*.



**Figure 3. Actual Ground Source Heat Pump Heating Efficiencies Based on Field Measurements in the United Kingdom <sup>3</sup>**

### ***Multipliers***

Large credit multipliers for heat pumps (as well as solar and deep geothermal) are provided in *Alternative Energy Portfolio Standard Guideline on AEC Multipliers for Renewable Thermal Generation Units*. No rationale is provided for why the multipliers are provided.

The document notes that “Per the statute, the purpose of applying a multiplier is to stimulate the development of certain emerging renewable thermal technologies with no on-site emissions.” However, heat pumps are not “emerging technologies.” Further, whether carbon dioxide is emitted on site or at a power plant should be immaterial to public policy. Providing heavy credit for electric heat pumps could lead to the perverse result of encouraging power production and the associated emissions.

The document states:

“The Department of Energy Resources (Department) analyzed the costs of the different eligible renewable thermal technologies, and set the base multipliers such that value of the AECs generated by each technology type is similar relative to the costs of implementing the technology and various other factors.”

It appears that the multipliers were intended to be based on the principle of equalizing the cost-competitiveness of the options, providing the most credit to the most expensive approaches and the least credit to the less expensive technologies. The analysis referenced was not provided, so we cannot comment on it. However, we observe that contrast between the high multipliers for heat pumps and the low multiplier for deep geothermal seems inconsistent with this inferred principle.

***We recommend eliminating the multipliers.***

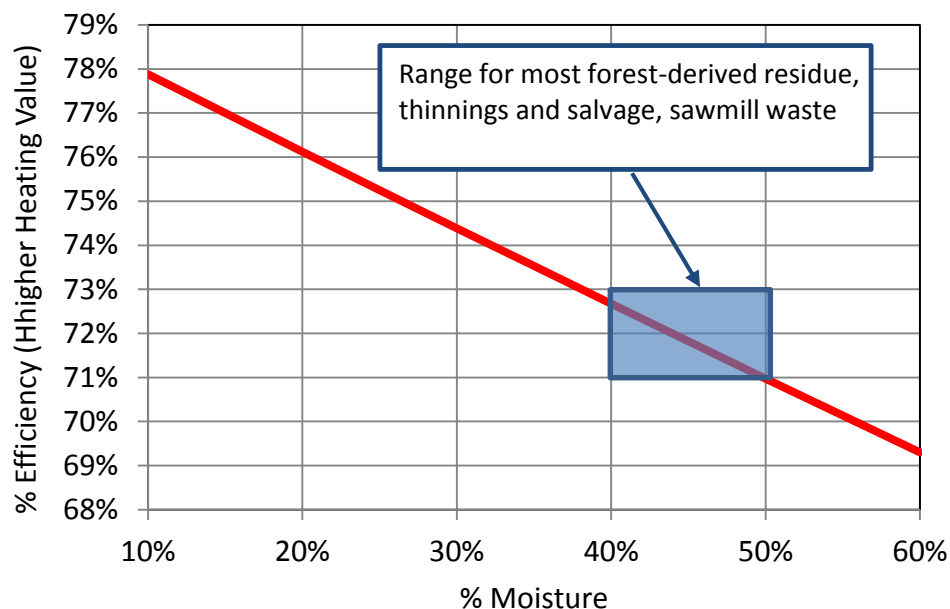
## Biomass

*Alternative Energy Portfolio Standard Guideline on Biomass, Biogas and Biofuels for APS Renewable Thermal Generation Units* includes requirements which will significantly discourage use of biomass. Table 2 of that document requires a minimum thermal efficiency at nominal output (HHV) of 75% for chips. Further, Table 3 requires a moisture level below 30%.

The moisture level criterion will eliminate most of the Eligible Biomass Woody Fuel sources identified in 16.02, in particular Forest-Derived Residues, Forest-Derived Thinning, Forest Salvage, and many sources of Non-Forest-Derived Residues including sawmill residue and land clearing residue. Most of these materials have a moisture content of 40-50%.

Regarding efficiency thresholds, it is important to understand that biomass moisture level has a significant impact on fuel efficiency. Figure 4 shows how HHV efficiency changes based on moisture content for combustion of woody biomass. Efficiencies can be pushed higher if the flue gas is condensed, but this adds expense and may not be feasible depending on the temperature requirements of the thermal load.

***We recommend changing the efficiency threshold for woodchips to 70% and the maximum moisture content to 50%.***



**Figure 4. Impact of Biomass Moisture on Efficiency**

## Efficient Steam Technology

There is no indication of the intention relative to the reservation of a clause 16.05 (1) 5. for “Efficient Steam Technology.” An important opportunity is use of steam turbines or reciprocating engines in place of Pressure Reducing Valves. This technology would produce electricity without additional fuel consumption, and would enhance resiliency in the event of a power outage.

*We recommend that 16.05 (1) a. 6. read as follows:*

*5. Efficient Steam Technology. A steam turbine or steam reciprocating engine, installed to replace or serve the function of a steam pressure reducing valve, may qualify as an APS Alternative Generation Unit, subject to the provisions in 225 CMR 16.05 (4).*

## **Other**

*Alternative Energy Portfolio Standard Guideline on AEC Multipliers for Renewable Thermal Generation Units* refers to “alternative energy credits” but this term is not found in the APS Regulation. We presume that “alternative energy credits” are the same as “APS Alternative Generation Attributes” as defined in the APS Regulation.