Testimony of **HotZero LLC** on the revised 225 CMR 16.00: Alternative Energy Portfolio Standard (APS) – submitted by D. Dickinson Henry, Jr. Founding Director; Michael Jesanis, Managing Director; and Douglas Foy Chairman.

HotZero LLC, a developer of district heating and cooling systems would like to commend the Department of Energy Resources (DOER) for its revised Alternative Energy Portfolio Standard (APS). We would start our comments with some general observations and then move into specific suggestions.

Overview

Overall, we view the revised APS as inadvertently aimed at suburban and rural communities where many of the supported renewable technologies can more easily be implemented. But we would suggest that a substantial proportion of the Commonwealth's greenhouse gases are being emitted from the Commonwealth's cities where it is more difficult to implement renewable energy sources for a variety of reasons including limited space and air quality challenges. It is common for the heating, cooling, and electrical requirements of buildings in cities to make up more than 60% of a city's carbon footprint and therefore is an important target for the APS program.

Cities have many sources of waste heat and cooling that if captured could serve the city building's heating and cooling requirements and use much less electricity than fossil fuels to do so. These waste thermal sources have essentially a low carbon footprint as the carbon has been accounted for in the primary use of the energy that generates this waste heat and cold and the only additional carbon needed is to capture the thermal energy and move it around. Much of this energy can be captured, stored and transferred through a water medium. This means that water to

water heat exchangers and water source heat pumps should be encouraged so that cities can take maximum advantage of this low carbon source of thermal energy. The process of utilizing waste thermal energy can often reduce electric use as well.

DOER clearly understands these benefits through its promotion of new combined heat and power generation and associated micro-grids but there are many other existing thermal sources that could be used effectively if the standard embraced water to water heat exchangers and water source heat pumps.

Flexibility

We would encourage the department to also include a mechanism where by other or future technologies which meet a DOER defined performance standard, can also earn APS credits, in addition to the already well described specific technologies. Both the legislation and the definition sections of the APS make it very clear that useful thermal energy includes "***heating, cooling, humidity control, process use, or other valid thermal end use energy requirements, for which fuel or electricity would otherwise be consumed."*** The implication here being the active displacement of carbon-based fuels to help the Commonwealth reach its stringent carbon reduction targets.

One viable way to add such a performance standard requirement would be to define a total building's energy usage on a kwh/sf/yr. basis. You already reward something similar in your added APS multiplier for net zero buildings but this is still limited to the defined technologies. By setting a performance standard per square foot, this would allow building owners to use a combination of technologies to reach the stated goal. Then as new technologies or novel uses of existing technologies emerge they would not have to be defined or anticipated as long as

they delivered the performance standard. **We think adding this concept to the regulation would significantly broaden its effectiveness.**

Water Source Heat Pumps

We are concerned that in section ***1605 6 a ii*** the term ***water source heat pump*** has been removed from the latest version of the definition in part but included in the last sentence. We strongly urge the department to restore the term ***water source heat pump*** throughout ***1605 6 a ii*** as written in the earlier draft. We also encourage the department to permit any water source as long as it meets the requirement of serving a "***valid thermal end use energy requirement(s), for which fuel or electricity would otherwise be consumed***."

We suggest that the definition of ***water source*** should be any water source below or above ground either natural or man-made. Capturing waste heat for instance from commercial or industrial processes particularly in city settings could go a long way to reducing a city's carbon footprint. This practice is common in many European nations but has yet to be used widely in North America. It would be unfortunate if this revised APS regulation did not encourage the use of waste thermal energy in the Commonwealth's cities.

Cities in Europe that currently capture waste heat

A wide variety of cities in Europe currently use extensive hot and cold-water district energy systems.

- The city of Helsingborg just outside of Stockholm, has such a system and has been using waste heat from a chemical processing plant for over 50 years.
- The City of Copenhagen's district heating and cooling system serves 98% of the city's buildings.

- The city of Kristianstad in Sweden has a system with over 160 KM of pipe serving not only the central city but the neighboring city of Ahus 15 KM away.
- In each of these cities waste heat and cooling is captured from a multitude of sources.

In North America, Honolulu and Toronto both take cooling water from the ocean and the great lakes to provide chilled water to their cities. As a result, these cities have replaced a significant amount of fossil fuel driven electric generation which had previously been used for cooling.

In each of these cases a combination of water to water heat exchangers combined with water source heat pumps has allowed for a dramatic reduction in the use of fossil fuels.

In short, these cities have done an inventory of their sources of waste energy and put them to use. We feel that the APS, by specifically supporting water source heat pumps, has an opportunity to encourage similar innovation in the state of Massachusetts.

Cooling Prohibition

We would like to draw your attention to ***1605 6 a ii*** that specifically permits the use of ground or water source heat pumps ***in heating mode only***. This seems to directly contradict the intent of the original legislation and the definition of ***Useful Thermal Energy*** in section 16.02. where cooling and humidity control are specifically called out.

We surmise that this prohibition of water source heat pump cooling is based on a statement by Bram Clays in DOER's December 16, 2014 presentation on renewable thermal technologies in the alternative portfolio standard, slide 11 in

which he stated under **Consideration of Cooling**, that "*cooling from heat pumps will not be credited because heat pumps in cooling mode deliver heating energy from the conditioned space to the environment, rather than bring energy in from the environment*." We respectfully disagree with this interpretation because the goal of the regulation is to serve a "*valid end use thermal energy requirement (s), for which fuel or electricity would otherwise be consumed."*

A water source heat pump which can use a thermal source with a low carbon content to displace cooling energy will have a disproportionate benefit to carbon reduction and ground-level ozone generation during the summer months.

Currently most central cooling in large buildings use standard or centrifugal chillers with some type of cooling tower on the roof to displace heat to the atmosphere. These towers rely on a variety of dry and evaporative cooling technologies. But all of these cooling technologies become less and less efficient as ambient temperature and relative humidity rise and as a result they use more and more electricity at a time of peak demand. This fossil fuel driven summer peak electric use has a particularly high carbon footprint and contributes precursors to ground level ozone.

Water source heat pumps, can provide cooling, at efficiencies 3 to 4 times that of conventional centrifugal chillers or absorption chillers and eliminate water to air cooling towers. This reduces electric demand dramatically. If solar or wind energy could also be used to drive these heat pumps the carbon footprint of such a system would be very low. We therefore suggest that in section 1605 6 a ii you delete "***only when operating in a heating mode; that is,***" from the last sentence.

In addition, in the technology table after ***1605 6 b i*** on page 14 we would suggest you add water source heat pump, as in earlier drafts, so that the fifth definition would read "***Ground and Water source heat pump***"

APS Funding Prohibition

Section 16.05 of the Proposed Regulations provides that certain recipients of funding from the Massachusetts Clean Energy Center would not be eligible to participate in the Alternative Portfolio Standard. While there is certainly good reason to control the use of multiple sources of public funds to support renewable generation, the APS regulations are not the best place to exert such control. Instead, HotZero proposes that the Clean Energy Center utilize its authority to place terms on its funding to provide the desired degree of control. For example, the CEC could require recipients of funding to use a portion of the proceeds from participation in the APS to repay the Commonwealth for funding provided by the CEC.

Conclusion

Cities present a unique opportunity in the Commonwealth to harvest sources of wasted thermal energy and help achieve the Commonwealth's aggressive carbon reduction goals in a timely manner. Water to water heat exchangers and water source heat pumps are an efficient way to do this. We encourage the department to make the above modifications so that existing and evolving technologies can benefit from the new APS standard and play a significant role in allowing the Commonwealth's cities to benefit from this program and reduce their carbon footprint.

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