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June 24, 2014

Ms. Debra A. Howland
Executive Director
New Hampshire Public Utilities Commission
21 South Fruit Street, Suite 10
Concord, New Hampshire 03301-2429

Re: Docket 14-095, Initial Proposal of Amendments to Chapter Puc 2500, dated 4/10/2014

Dear Ms. Howland,

The New England Geothermal Professional Association (NEGPA) commends the efforts made by the NH Public Utilities Commission (PUC) in updating Chapter Puc 2500, to include useful thermal energy as part of the NH Renewable Portfolio Standard. NEGPA is pleased to have the opportunity to work with the PUC throughout the Rulemaking process and we are very pleased to see the process continue to move forward.

The following comments are offered to help clarify the Initial Proposal distributed on April 10, 2014. Because of the detailed nature of the comments, we felt that it would be preferable to submit them in writing prior to the Public Hearing scheduled for June 27, 2014. Depending on the testimony and discussion during the Public Hearing, NEGPA may submit additional and/or revised comments.

Comments:

1. Clarification of Metering Technologies for Large Thermal Sources

There are two comments related to the section on metering technologies (Puc 2506.04 Metering of Sources that Produce Useful Thermal Energy):

a. The reliance upon the "manufacturer's guaranteed accuracy of the meters" [2506.04(e)(2) and 2506.04(f)(2)] is potentially ambiguous. First, it appears that "meters" should be specified as "heat meters" to avoid potential confusion with flow meters. Second, accuracy of a heat meter depends on both the accuracy of the equipment (temperature sensors, flow meter, and calculator) and the actual operating conditions. When manufacturers provide accuracy ratings of the meters,

it is often based on either the accuracy of the individual components[1] or the accuracy of the heat meter under what the manufacturer may consider to be 'typcial' operating conditions. The operating conditions on which the meter is rated may deviate significantly from actual operating condition, resulting in a much larger meter error.

Recommendation: modify to require that the meters are installed according to manufacturer's specifications and that the operating conditions are typically within the range over which the temperature and flow accuracies are guaranteed.

b. Several paragraphs [2506.04(e)(3), 2506.04(f)(1), and 2506.04(f)(3)] call for the accuracy of measurement to be certified by a Professional Engineer. However, there is no specification of the methods to be used for such certification. As noted in the *ANTARES* report, the complexity of a biomass system may require different combinations of meters from which the accuracy can be derived through an analysis of uncertainty[2].

Recommendation: Paragraphs 2506.04(e)(3), 2506.04(f)(1), and 2506.04(f)(3), should specify the ANSI Standard[3] as the method by which the Professional Engineer will certify accuracy.

2. Definition of "Useful Thermal Energy" and Discounting for Thermal Energy Losses

The rules provide the following definition for useful thermal energy [Puc 2502.37] (emphasis added):

> "Useful thermal energy" means "useful thermal energy" as defined in RSA 362-F:2, XV-a, namely "renewable energy delivered from Class I sources that can be metered ***and*** that

[1] For example, the Badger 380 reports a flow meter accuracy of 2% but also specifies temperature sensors are IEC Class B (+/- 0.3C) which would result in a 10% error for most geothermal applications.

[2] "Given that BECD [biomass energy conversion device] systems have the potential to require different combinations of meters and instrumentation with different capabilities; it seems more appropriate to focus on this end point rather than the individual measurements. To accomplish this, it is recommended that facilities be given the freedom to choose the meters and instruments needed to fulfill their requirements. Using this as built instrumentation data, an uncertainty analysis can be constructed which can be used as a correction factor against the useful thermal heat output of the system to ensure that this calculation does not overstate REC generation." (p. 54)

[3] American National Standard for Expressing Uncertainty -- U.S. Guide to the Expression of Uncertainty in Measurement (ANSI/NCSL Z540-2-1997). This method standardizes the root-sum-of-squares methodology for a wide array of applications.

> is delivered in New Hampshire to an end user in the form of direct heat, steam, hot water, or other thermal form that is used for heating, cooling, humidity control, process use, or other valid thermal end use energy requirements and for which fuel or electricity would otherwise be consumed."

The RSA defines "useful thermal energy" as that which is delivered to the end user. While the Proposed Rules suggest the need to account for thermal energy losses[4], the discount factor for thermal energy losses in 2506.05(f) only considers parasitic loads and not thermal energy losses.

Recommendation: Add paragraph 2506.05(g) to the effect, when the energy meter is located at a different location than the end-use of the thermal energy, the calculation of RECs shall include a discounting of thermal energy losses, as certified by a Professional Engineer.

3. Definition and Discounting of Parasitic Loads

In the Calculation of Certificates, paragraph 2506.05(d) specifies that useful thermal energy be discounted for parasitic loads using either a default percentage or metered value. The bases for the default percentages in 2506.04(f)(1)-(3) are unclear and Parasitic Loads are not sufficiently defined in Puc 2500 to allow for actual metering as called for in 2506.04(f)(4).

Because the producer is paying for the electrical energy to deliver the useful thermal energy and the parasitic loads are not included in the useful thermal energy measured[5], the discounting of parasitic load from the parasitic load appears to introduce unnecessary ambiguity.

Recommendation: Either define the parasitic load as "the pumping energy required to deliver the useful thermal energy to the end use" or omit the discounting of parasitic loads in 2506.05(d).

4. Clarifications

a. Application Requirements
   i. 2505.02(d)(11). May not be applicable to small systems using runtime methods. Suggest clarifying, "as applicable" for sites using heat meters.
   ii. 2505.02(d)(24). Listing of COPs should only be necessary for small systems using runtime method and should allow for inclusion of COP for multiple heat pumps.

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[4] Puc 2505.02(d)(15) states "The discount factor for operating energy and thermal energy losses pursuant to Puc 2506.05(f) to be applied for REC calculations, if applicable, or a detailed description of the method for determining a discount factor for operating energy and thermal energy losses, if applicable;"

[5] N.b. Electrical energy used by geothermal heat pumps is not included in the thermal energy measured for either large or small systems. For small systems, the factor (COP-1)/COP discounts the heating capacity (HC) to account for just the renewable geothermal energy produced. Similarly, for large systems, the thermal energy is metered at the ground loop and does not include thermal energy from compressor(s).

EER (as a measure of cooling efficiency) is not particularly relevant. There appears to be some redundancy in items (12) and (24).

iii. 2505.02(d)(27). An affidavit from a Professional Engineer should only be required if site uses one or more methods that requires PE certification. Requiring a PE stamp for small systems will be cost prohibitive.

b. Independent Monitors. 2505.09(g). "No … source producing useful thermal energy shall use an independent monitor who …. sold or installed the equipment used by the source." Suggest clarification of 'equipment' to specify 'thermal equipment'. It seems reasonable that the Independent Monitor have the ability to assemble, sell, install, and commission the metering equipment. Vertical integration encourages proper meter specification, installation, commissioning, and reporting.

   If there are concerns about the veracity of the RECs reported by the Independent Monitors, quality assurance measures could be developed that would help to identify anomalous reporting patterns.

c. Metering of Sources that Produce Useful Thermal Energy. 2506.04

   i. 2506.04(i)(4). Suggest clarifying that "t" is the total operating run time of the "*heat* pump" and specifying operating time in "heating mode" may be more useful than specifying entering and leaving water temperatures.

   ii. 2506.04(i)(5). Clarify this section by inserting words shown in italics. "Small thermal sources using geothermal technologies may calculate Q, the useful thermal energy produced, *for each heat pump* by multiplying the *heat pump* HC by the difference between the *heat pump* COP and 1, multiplying the result by t, and dividing the result by the *heat pump* COP."

   iii. 2506.04(k)(l); 2506.04(l)(4); and 2506.04(m)(6) define "t" as a "frequency at which readings are recorded". We suggest clarification to define "t" as "intervals at which readings are recorded".

Thank you again for your efforts and if you have any questions or need additional information, please contact me at (603) 867-9762.

Sincerely,

J. Matthew Davis, PhD
NEGPA Board of Directors, Member

Cc: Service List via electronic mail