**New Jersey Board of Public Utilities**

**Clean Energy Program**

**Proposed Revisions to the Protocols to Measure Resource Savings**

**Comments of the New Jersey Division of Rate Counsel**

**November 9, 2017**

The Division of Rate Counsel ("Rate Counsel") would like to thank the Board of Public Utilities ("BPU" or "Board") for the opportunity to present the within comments on the proposed revisions ("Draft Protocols") to the Clean Energy Program ("CEP") Protocols to Measure Resource Savings ("Protocols") submitted in red-line form by the BPU's Office of Clean Energy ("OCE") on October 18, 20175 to stakeholders for comment.[1]

## I. Background

The Draft Protocols present proposed revisions to the Protocols to be used for evaluation of CEP and utility Energy Efficiency ("EE") and Demand-Side Management ("DSM") programs. At the same time, consultant Energy Resource Solutions ("ERS"), which produced the Protocols updates, provided a memorandum ("ERS Memo") describing and rationalizing the proposed changes to the Protocols, as well as presenting and explaining updates to Measure Lives. ERS also provided a set of webinar slides describing the process of updating the Protocols and key changes in the protocols themselves. This presentation was used in a webinar presented to stakeholders on Friday November 3, 2017 ("November 3 Webinar").

[1] The Draft Protocols circulated for comment was entitled: "New Jersey Board of Public Utilities, New Jersey Clean Energy Program, Protocols to Measure Resource Savings, Draft Revisions to FY 2016 Protocols, Date: October 18, 2017."

## II. General Comments

### A. Document organization, format, and conventions

Rate Counsel appreciates the time and effort that have gone into this long-overdue thorough review of the Protocols, as well as the efforts to fully inform stakeholders and solicit feedback. The Protocols document has grown organically over many iterations led by different consultants, with input from many parties. Rate Counsel believes that the current review represents an ideal opportunity to significantly improve the document in terms of length, organization, consistency, readability, and usability. Specific ways in which the document could be improved include:

- Eliminate redundancy and opportunities for error and confusion by moving tables that are presented more than once into appropriate appendices. For example, the current document has eight tables labeled "EFLH Table", consisting of five identical tables for residential and three for commercial values.
- Use table numbers and better descriptive table captions throughout to facilitate internal referencing.
- Create a single comprehensive list of external references, including URLs, to be referenced by number throughout the document.
- Apply consistent use of document references and footnotes throughout the document.
- Eliminate the use of constants in algorithms except for the most obvious and standard conversion factors, such as 1000 kWh/MWh.
- Use consistent subscripting and, where possible, variable names throughout the document.
- Avoid variable names that are easily confused for units of measure, such as the use of "$kBtu/hr_q$" as a variable name to represent input capacity for Commercial and Industrial ("C/I") water heaters in the current draft.
- Generally improve consistency in presentation of text, algorithms, parameter definitions, input tables, and sources throughout the document.
- When possible, refer to primary sources rather than secondary sources.

A number of these concerns are reflected in the measure-specific comments provided below. Also noted below are a number of errors that probably could have been avoided were the document better organized and more consistent.

While reorganizing the document at this late stage may seem onerous, Rate Counsel believes that making the improvements recommended here will be well worth the effort as it will render the Protocols easier to use, review, and maintain for years to come. It will also make it far easier and more convenient for utilities and contractors to consistently and accurately project and calculate savings from energy efficiency initiatives in New Jersey.

**B. Equivalent Full Load Hours ("EFLH")**

EFLH, which represents the number of hours a heating or cooling device would have to run at maximum output to deliver an amount of heating or cooling equivalent to its average annual output.[2] As such, EFLH serves as a crucial input to numerous measures in both residential and C/I programs. This parameter should be explained in the Protocols as it is applied in the savings calculation algorithms for several measures. As noted above, the eight EFLH tables scattered throughout the Draft Protocols should be consolidated into an appendix, which should include an explanation of the term and its use.

Rate Counsel further notes that the data for this parameter is based on DOE2.2 model[3] runs analyzing conditions in New York City. On the residential side, values are provided for "Single Family Detached" homes that are "Old", "Average", and "New". No values are given for other types of structures, nor is any definition provided for these age categories, which may themselves take on different meaning in New York City as compared to New Jersey. Rate Counsel believes that more New Jersey-specific model runs should be performed, and age ranges should be defined so that users can consistently and accurately apply this important parameter.

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[2] For a discussion of this parameter specifically as applied to cooling, see https://aceee.org/files/proceedings/2016/data/papers/1_1168.pdf.

[3] DOE2.2 is the most current version of a standard model for estimating energy use in buildings, developed and distributed on behalf of the US Department of Energy. Information and downloads available at http://www.doe2.com/.

### C. References

Rate Counsel further notes that some of the references appear to be inconsistent in the versions used of various documents. For example, the Draft Protocols cite three different versions of the Mid-Atlantic Technical Reference Manual ("TRM")[4]: v. 2.0 (2011, referenced indirectly, on page 68), v.5 (2015), and v.6 (2016). Whenever possible, the most recent version of the TRM (as of May 2017, Version 7) should be used. In other cases, multiple references apparently to the same document use different formats or wording, making it difficult for the reader to be sure if the same document is intended. In many cases references to materials available on the internet do not include URLs – notably the multiple references to Residential Energy Consumption Survey ("RECS") data, and in at least one case (page 130) a reference to an unpublished ERS presentation.

### D. Inactive Measures

Rate Counsel appreciates the identification of measures that were not reviewed or updated in the Draft Protocols update. However, it would be helpful for ERS to differentiate between EE and DSM measures that are truly obsolete for technical reasons, as distinguished from those that are not currently offered for some other reason but could reasonably be offered in the future. In the latter case, updated information and inputs for measuring savings could be helpful for planning future EE and DSM programs, and should be provided.

### E. Measure Life

Measure Life, or the expected period over which an individual EE measure can be expected to persist for savings projection purposes, is a crucial input to any calculation of resource savings. Estimating Measure Life can involve subtle and complex considerations involving assumptions about consumer behavior in both the presence and absence of the EE measure. As technologies and consumer habits have changed in many areas, it is essential to review Measure Life assumptions and update them accordingly.

However, Rate Counsel is concerned that ERS's approach to updating Measure Life appears to rest solely on reconciling New Jersey's Measure Life assumptions with those in "similar

[4] In the context of EE planning, regulation, and evaluation, "Technical Reference Manual", or "TRM", is a general term used to describe a guide to estimating resource savings, whether or not the term appears in the title of a specific document. For example, the New Jersey Protocols to Measure Resource Savings is a TRM for New Jersey.

regional [TRMs] from Massachusetts, New York, Pennsylvania, and NEEP Mid-Atlantic." (ERS Memo, page 1.) It does not appear that ERS evaluated the basis of any of these measure life assumptions, or determined if the assumptions in any of the referenced TRMs (or in New Jersey's existing Protocols) were reasonable. Rate Counsel recommends that each Measure Life should be updated, and all Measure Lives for the 30 measures "reviewed in-depth" as described in the November 3 Webinar, be given individual consideration based on engineering principles. Rate Counsel further recommends that a rational basis and/or technical reference for each Measure Life should be included in the Protocols wherever possible.

## III. Specific Comments

The portion of the Draft Protocols document addressed by each of the comments below is identified by section and page numbers. **NOTE: The page numbers below refer to the Draft Protocols (dated October 18, 2017), with red-lined changes accepted.**

### A. Introduction

- Net-to-Gross: Through numerous iterations of the Protocols, Rate Counsel has noted that programs and measures have been evaluated without a rigorous analysis of the effects of free-ridership and spillover effects, which together comprise the "Net-to-Gross" adjustment to determine the portion of savings directly attributable to EE measures. Utilities and the CEP have generally relied upon the assumption that these two effects cancel each other out in all cases, yielding a Net-to-Gross ratio of 1.0. According to the November 3 Webinar slides, page 21, "ERS reviewed memo submitted by [Rutgers] CEEEP" on this issue. Unfortunately, this issue has once again been relegated to a "future" revision of the Protocols. Rate Counsel submits that the significance of this issue is well-recognized, as evidenced by a 2008 Board Order[5] and as recently as the CEEEP memo on this topic cited by ERS.[6] Like many inputs into evaluation of DSM measures, the estimation of Net-to-Gross requires technical judgement and experience. Rate

[5] The Board's Order promulgating the Minimum Filing Requirements for utility EE programs directed utilities to "quantify and deduct from the energy and capacity savings any free rider effects and the business as usual benefits from homeowners and businesses installing Energy Efficiency or Renewable Energy without the N.J.S.A. 48:3-98.1 benefits or incentives." (BPU Docket No. EO08030164; Order dated May, 8, 2008, paragraph V(g)).

[6] The October 6, 2017 CEEEP memo cited in the ERS Memo, page 4, entitled "Estimation of Freeridership and Spillovers (Free Drivers) in NJCEP Protocols," has not provided to stakeholders.

Counsel urges ERS and CEP to address the Net-to-Gross issue and provide guidance for all program administrators.

- On-peak vs. Off-Peak Hours: As discussed during the November 3 Webinar, the Draft Protocols use a definition of on-peak and off-peak hours that is incompatible with the definition used by [PJM Interconnection ("PJM"), the electricity market operator for New Jersey and the surrounding region. On page 12 of the Draft Protocols, the on-peak period for electric energy savings is defined as Monday through Friday, 8 am to 8 pm. PJM defines on-peak as Monday through Friday, 7 am through 11 pm.[7] Adopting PJM's definition would not only include high-use evening hours in the definition of on-peak, it would also facilitate monetary savings calculations using on-peak and off-peak pricing information typically used by PJM and PJM market participants. This correction should be reconciled with each of the savings algorithms, as needed.

- Calculation of Emission Factors: A specific reference and date should be provided for the "statewide conversion factors" for air emissions reductions factors supplied by the New Jersey Department of Environmental Protection ("NJ DEP") referenced on page 14. Consistent and well-defined units in the savings values for each time period and pollutant should also be used.

**B. Residential Electric HVAC**

- Pages 17, 20: The terms $KWh_p$ and $kW_p$ are not inputs and should not be used or defined.

- Page 21: The use of reference #12 for Energy and Demand Savings Factors ("ESF" and "DSF", respectively) appears to be inaccurate. A corrected reference should be provided.

**C. Residential Gas HVAC**

- Page 25: EFLH should have the subscript *p* in the algorithm.

- Pages 29, 33: On both pages, referring to a parameter called the Uniform Energy Factor ("UEF") for water heaters, the Draft Protocols state that:

[7] http://www.pjm.com/en/Glossary#index_O.

> A weighted average baseline UEF was calculated with a medium draw pattern from the referenced federal standards and water heating equipment market data from the Energy Information Association 2009 residential energy consumption survey for NJ assuming tank sizes of 30 gallons for small units, 40 gallons for medium units, and 55 gallons for large units.

It is unclear from this repeated description what calculation is being described, what "weighting" was used, or if this calculation was performed by the referenced source or specifically for the New Jersey Protocols. In the first instance, on page 29, the Protocols should provide more specific data and an explicit description of example of how the final values were derived. The second instance, on page 33, should refer to the first.

- Pages 32-33: The Draft Protocols provide two baselines for instantaneous water heaters, stating that "This measure assumes that the baseline water heater is either a new storage water heater, or instantaneous water heater." Guidance should be provided on which baseline to use under specific circumstances. The average baseline for New Jersey, weighted by current installations, should be provided for cases in which the appropriate baseline cannot be determined,

**D. Residential Low-Income**

- Page 37: It appears that the "Demand Factor" for low-flow showerheads has been re-used for faucet aerators. The correct value for faucets aerators is .000134.

- Page 44: URL for Apprise report has an extra "t" at the end.

**E. Residential New Construction**

- Page 45: Energy savings should be in kWh/yr and therms/yr.

**F. ENERGY STAR Energy Efficient Products**

- Important details of the calculations for energy efficient clothes washers and dryers are buried in footnote 2 on page 52, along with several different references. Here and elsewhere the Draft Protocols rely on the US EIA's 2009 RECS data, although the 2015 RECS survey is available. The Protocols should separate calculations and input variables from references, use updated references generally, and clearly indicate what data come from which source.

- Regarding the calculation in the same footnote 2 on page 52, it is not clear why it is appropriate to make a generic assumption regarding the composition of gas versus electric water heating and clothes drying in New Jersey. It would be more useful to provide disaggregated savings calculations for each appliance configuration, which could then be used individually for project-level savings calculations or aggregated based on appropriate assumptions for program planning purposes.

- Pages 54-60: The Draft Protocols provide far too much detail and too little guidance on how to select a baseline for energy efficient lighting. In fact, the referenced Mid-Atlantic TRM (Version 6, page 20) merely states that "[t]he baseline is the installation of an incandescent/halogen light bulb meeting the standards described in the Energy and Independence and Security Act of 2007." These "EISA Phase I Standards" were provided in the previous version of the Protocols, and should be included in the updated Protocols to assist with determining baselines. The detailed tables should be removed and reasonable baseline values for various types of lighting (e.g., interior vs. exterior) should be provided.

- Pages 54-55: HVAC interactive factors taken from the New York TRM are introduced in the Draft Protocols. This raises concerns as the factors used appear erroneous and are inconsistent with other sources. For example, the factors presented in the Draft Protocols suggest that the benefit of low-wattage lighting would be discounted by 58% for single-family homes with air conditioning and electric heat, even though the interactive effect should result in an *increase* in savings during the cooling season.[8] At the same time, houses that only use electric heat only (no air conditioning) have the savings discounted by 40% - still a very large penalty - but paradoxically significantly less than houses with air conditioning.

  The Mid-Atlantic TRM, Version 6 (which is cited in the Draft Protocols for HVAC interaction for commercial lighting) provides very different and more reasonable values for accommodating this effect.[9] For default values, the Mid-Atlantic TRM recommends a

[8] See Draft Protocols, page 55.
[9] See Draft Protocols, page 68.

10% savings reduction for heating (page 23), and a 12% increase for cooling – thus a house with both air conditioning and electric heat would see its calculated savings *increased* by 2% under this formula. The FY2016 version of the New Jersey Protocols[10] specified a fixed 5% *increase* in savings for Commercial and Industrial Lighting to represent this interactive effect. In the case of exterior lighting, there should be no interactive effect.

Because the cited New York TRM source is so out of step with other sources, the interactive factors taken from the New York TRM should be removed from the current version of the Protocols pending further study.

**G. Appliance Recycling**

- Page 62: As Rate Counsel has noted previously, the savings estimates for appliance recycling are based on a regression relationship from the Mid-Atlantic TRM that relies upon heating and cooling degree-days ("HDD" and "CDD," respectively.)
    - Instead of using a value based on the different climate in Maryland, the savings for New Jersey should be calculated using the regression relationship and an appropriate value for HDD and CDD.
    - The reference in the Draft Protocols is to the 2016 Version 6.0 of the Mid Atlantic TRM. However, the values provided on page 62 are from the 2014 Version 4.0 of the Mid-Atlantic TRM, and have not been updated even for consistency with the updated values for Maryland found in the referenced 2016 Mid-Atlantic TRM.
    - The notation in the Algorithm is inconsistent with the notation in the definition of terms and the summary of inputs.

**H. Commercial and Industrial Energy Efficient Construction**

- Pages 65-68: References should be provided under the Summary of Inputs for $LPD_b$ and $LPD_q$, rather than for the intermediate calculation of ΔkW. The URL should be moved

[10] FY2016 Protocols, approved June 29, 2016, p.72. "IF" is defined as: "Interactive Factor – This applies to C&I interior lighting only. This represents the secondary demand and energy savings in reduced HVAC consumption resulting from decreased indoor lighting wattage. This value will be fixed at 5%."

from this table to the specific reference, following the general convention of the Draft Protocols document.

The "Fuel Savings" algorithm on page 65 uses undefined and unreferenced variables. It appears that this calculation could be simplified, and this problem solved, by employing the ΔkW value calculated above instead of recalculating the savings in kW. Rate Counsel notes that the HVAC interactive effects as represented here and based on the Mid-Atlantic TRM are more reasonable than those presented for residential lighting.

- Page 66: Summary of inputs generally and incorrectly refers to "Lighting Table by Building Type" in referencing three different tables. As noted above, using table numbers would be preferable here and throughout the document.
- Pages 68, 73, and 74: The referenced Pennsylvania TRM is used here as a secondary reference in that relies on numerous other studies, many of which are out of date and/or inapplicable. Updated and relevant primary references should be used.
- Page 72: The references to "$OCompe_{ff}$" appear to be a typographical error. Further, specific references should be moved from the Summary of Inputs table to the references section.
- Page 72: The "Typical Applications" table is inconsistent with the algorithm shown above because it does not account for the impact on cooling load. This table should be revised accordingly or removed.
- Page 83: Regarding Dual Enthalpy Economizers, the Draft Protocols note that "The input values are based on data provided on the application form and stipulated savings values derived from DOE 2.2 simulations of a series of prototypical small commercial buildings." It is unclear how this statement is to be interpreted; in any case, it seems this information would be more appropriately provided in the Summary of Inputs and the references section, with a clearer indication of how the DOE 2.2 simulations were used.
- Page 92: For Variable Speed Air Compressors, the factor of 0.746 is defined, though not a symbol, and not shown in the algorithm. It is also defined as a "kW to HP conversion factor" when it is in fact the opposite.

- Page 94: For Kitchen Hoods with VFDs, the reference style in the Summary of Inputs is inconsistent with that used in the rest of the Draft Protocols document.

- Page 95: It is not clear how five different sources were used to yield a single value each for ESF and HSF.

- Pages 96-115: Throughout this section, the conventions for presenting inputs and references used in the rest of the Draft Protocols is neglected, numerical constants are used inappropriately in formulas, and referencing in general is ambiguous or absent. This section of the Draft Protocols should be re-written, consistently applying its own conventions or, preferably, conventions modified as recommended in the introductory section of these notes.

- Page 119: The variable "EF" is defined, which presumably should be "EFF"

- Pages 120-122: The formula for %SL relies on a variable names "kBtu/hr$_q$" to represent rated input capacity. This is a confusing variable name and should be replaced with a name that relates to the function of the parameter rather than its units, such as $IC_r$

  Further, the variable "%SL" is not actually a percent but a decimal as presented in both the calculation on page 120 and the example on page 122. This inconsistency should be rectified.

- Page 123: See issue noted above regarding the inconsistent definition of %SL.

- Page 129: The reference for "deemed savings" is provided as the Massachusetts TRM in the Draft Protocols, but as the New York TRM on page 9 of the ERS Memo. This should be clarified.

- Page 130: A URL should be provided for the ERS presentation referenced for the Savings Factor for Fuel Use Economizers.

## I. Combined Heat and Power

- Page 132: It is not clear why emissions factors are provided for Combined Heat and Power ('CHP") applications and not for any other measures in the Draft Protocols. Electric and gas emission factors were provided on pages 13-14 that can be applied to all

fuel- and electricity-saving measures. The specific emissions factors for CHP should be removed.

**J. Direct Install**

- Pages 148: "60" is defined as the conversion factor from hours to minutes but not included in the formula.

- Pages 149-151: The test description for pipe insulation states that "The savings factors are based on a fluid temperature of 180°F, and an ambient temperature of 50°F, resulting in a temperature differential of 130°F. If the actual temperature differential varies significantly from this value, the reported savings should be scaled proportionally." This information, and the formula for scaling savings factors, should be included in the algorithm formulas.

  The table on page 151 is titled "Deemed Savings Values". If these values are intended to represent Savings Factors, the title of the table should be revised accordingly.