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BEFORE THE
PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of Protocols for the Measurement and Verification of Energy Efficiency and Peak Demand Reduction Measures	))))	Case No. 09-512-GE-UNC

JOINT OBJECTIONS AND COMMENTS TO THE AUGUST 6, 2010 DRAFT TECHNICAL REFERENCE MANUAL FROM OHIO EDISON COMPANY, THE CLEVELAND ELECTRIC ILLUMINATING COMPANY, THE TOLEDO EDISON COMPANY, COLUMBUS SOUTHERN POWER COMPANY, OHIO POWER COMPANY, DUKE ENERGY OHIO, INC., THE DAYTON POWER AND LIGHT COMPANY AND INDUSTRIAL ENERGY USERS-OHIO

Pursuant to the Public Utilities Commission of Ohio's ("Commission") October 4, 2010 Entry, Ohio Edison Company, The Cleveland Electric Illuminating Company, The Toledo Edison Company, Columbus Southern Power Company, Ohio Power Company, Duke Energy Ohio, Inc., The Dayton Power and Light Company (collectively "Electric Distribution Utilities" or " EDUs") and Industrial Energy Users-Ohio ("IEU-Ohio") (hereinafter the EDUs and IEU-Ohio will be referred to collectively as Respondents) hereby submit their Joint Objections and Comments to the August 6, 2010 Draft Technical Reference Manual ("TRM"). As explained in more detail in the attached Memorandum in Support, the TRM is unlawful, unreasonable and incorrect in several respects.

These Joint Objections and Comments to the TRM are separated into three parts. The first section will address the legal objections to the TRM. Second, Respondents will present general policy objections and recommended modifications to the TRM. Lastly, Respondents will present their technical and specific objections to the Residential; Commercial and Industrial; Custom; and Transmission and Distribution sections of the TRM.

Respondents respectfully request that the Commission accept their objections and comments to the TRM and grant the relief requested herein.

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I. INTRODUCTION

Pursuant to Am. Sub. S.B. 221 ("SB 221"), the General Assembly charged the with developing a blueprint for implementation of, among other things, the energy efficiency and peak demand reduction requirements set forth in O.R.C. §4928.66. The process of developing this blueprint has involved not only the drafting of the TRM, but also the rules promulgated through Case No. 08-888, various Commission entries and orders, and a Mercantile Customer Pilot Program created through Case No. 10-834. Energy efficiency is new in Ohio. Thus, in order for all the stakeholders to understand their rights and responsibilities set forth in O.R.C. §4928.66, all of the actions taken to develop this blueprint must be consistent both individually and collectively.

The Commission recognized the need for this consistency when it declared that through the TRM process, it wanted to provide the EDUs and its customers with "***predictability and consistency***" so that the Commission could determine with "**reasonable certainty**" the energy savings and demand reductions attributable to the energy efficiency programs.[1] (emphasis added). As discussed below, the Commission's consultants did not develop a TRM that meets this goal. Rather, by limiting what can be counted for energy efficiency and peak demand response purposes, the TRM conflicts with Ohio law. Furthermore, in violation of the due process clauses of the Ohio and United States Constitutions, the TRM fails to provide clear guidance to the EDUs (and their customers) as to how to comply with SB 221. While recognizing that the Commission has the difficult task to balance a number of interests in implementing the aggressive mandates of SB 221, Respondents urge the Commission to require its consultants or its Staff to: 1) eliminate the conflicts between the TRM and Ohio law and the

[1] Case No. 09-512, June 24, 2009 Entry at 2-3.

Mercantile Customer Pilot Program; 2 eliminate the confusing and vague provisions of the TRM; 3) eliminate some of the unreasonable and unusable aspects of the TRM discussed below; and 4) reissue a law-conforming and transparent TRM that Respondents can utilize in implementing the energy efficiency mandates of SB 221. Therefore, Respondents submit these objections and comments to the TRM and request that the Commission accept these objections and grant the relief requested herein.

II. HISTORY OF THE TRM PROCESS

On June 16, 2009, the Commission opened the above-captioned docket for the purpose of developing protocols for the measurement and verification of energy and peak demand reduction measures. As part of this process, on June 24, 2009, the Commission issued an Entry in which it said:

> The Commission must be in a position to be able to determine, with ***reasonable certainty***, the energy savings and demand reductions attributable to the energy efficiency programs undertaken by gas and electric utilities, including mercantile customers, in order (a) to verify each EDUs achievement of energy and peak-demand reduction requirements, pursuant to Section 4928.66(B), Revised Code...In order to provide guidance regarding how the Commission will determine energy savings and/or peak demand reductions, the Commission intends to establish protocols for the measurement and verification of energy efficiency and peak-demand reduction measures, which will be incorporated into a Technical Reference Manual (TRM). The Commission's intent is that the TRM would provide **predictability and consistency** for the benefit of the electric and gas utilities, customers, and the Commission itself.[2]

In that same Entry, the Commission called for collaboration and asked utilities to work with mercantile customers to advise the Commission on measures that are in current use, measures which the utilities may intend to use in their compliance programs, and measures that mercantile customers may intend to use to seek an exemption from cost recovery mechanisms.

[2] Case No. 09-512, June 24, 2009 Entry at 2-3, ¶5.

Moreover, in Appendix A to the June 24, 2009 Entry, the Commission identified areas in need of policy guidance. Accordingly, Respondents filed comments and reply comments for the Commission's consideration.

On October 15, 2009, the Commission issued a Finding and Order, which introduced new policy questions (contained in Appendix C). The October 15, 2009 Finding and Order also contained proposed provisional policy recommendations for the manner in which those questions should be resolved in the context of the development of the TRM. Moreover, the Finding and Order signaled an interpretation of the SB 221 requirements that is not supported by the statutory language. In particular, the Finding and Order changed the baseline specified by the General Assembly for purposes of measuring the effects of energy efficiency programs and compliance with the portfolio benchmarks established by the General Assembly. The Finding and Order rejected measurements based on actual achieved efficiency relative to the three-year average as required by O.R.C. § 4928.66 (which has become known as the "as-found" method[3]), and, in effect, rewrote the law to establish a higher baseline.

In November 2009, several of the EDUs filed Comments in response to the October 15, 2009 Finding and Order. Likewise, IEU-Ohio, the Office of the Ohio Consumers' Counsel ("OCC"), and Ohio Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison Company (collectively, "FirstEnergy") filed Applications for Rehearing on the October 15, 2009 Finding and Order. On December 11, 2009, the Commission granted these Applications for Rehearing for further consideration. Subsequently, the Commission held the first workshop on the TRM.

[3] "Under the 'as-found' method, savings are calculated by subtracting the energy efficiency of existing equipment from the proposed new, more efficient equipment." Case No. 09-512, October 15, 2009 Finding and Order at 8, fn. 5.

On June 16, 2010, the Commission issued its Entry on Rehearing denying IEU-Ohio, FirstEnergy and the OCC's November, 2009 Applications for Rehearing. For reasons explained previously and below by IEU-Ohio and others in this proceeding, the June 16, 2010 Entry on Rehearing worked to modify the all inclusive provisions of O.R.C. §4928.66 in ways that imposed undue, unjust and unconscionable prejudice on the EDUs and its customers.

On July 2, 2010, IEU-Ohio contested the June 16, 2010 Entry on Rehearing by filing another Application for Rehearing. FirstEnergy also filed an Application for Rehearing on July 16, 2010 protesting the Commission's ongoing violations of O.R.C. §§ 4928.64 and 4928.66.

On July 29, 2010, the Commission granted the July 2, 2010 and July 16, 2010 Applications for Rehearing filed by IEU-Ohio and FirstEnergy to further consider the issues raised therein. On that same date, the Commission issued an Entry establishing a workshop in conjunction with the Staff's release of a draft TRM. To date, the July 2, 2010 and July 16, 2010 Applications for Rehearing remain pending. On August 6, 2010, the draft TRM was filed in this proceeding.

The draft TRM workshop was held on August 10, 2010 at the Commission's offices. Respondents participated in the workshop and, among other things, identified technical and legal issues in the TRM. The legal issues were tied back to: 1) conflicts with O.R.C. §§ 4928.64 and 4928.66; 2) the lack of transparent and clear guidelines in the TRM; and 3) the fact that the Commission had not yet ruled on IEU-Ohio and FirstEnergy's July 2010 Applications for Rehearing.

In the meantime, on September 15, 2010, the Commission issued an Entry in Case No. 10-834-EL-EEC announcing a Mercantile Customer Pilot Program. In that Entry (beginning at page 3), the Commission established a review process that is more consistent with O.R.C. §

4928.66. The Mercantile Customer Pilot Program includes, among other things, authorization to use the "as found" approach for measuring energy efficiency and peak demand reduction capabilities of mercantile customers and to use the "benchmark comparison methodology" as a proper going forward method. The Commission also confirmed that the life expectancy of equipment at the point of replacement and the duration of the payback period are not necessary elements for determining what must be counted for purposes of measuring compliance with O.R.C. §4928.66.[4]

On October 4, 2010, the Commission issued an Entry in this proceeding to establish a formal process to address the draft TRM that has been the subject of prior applications for rehearing, comments and the workshop held on August 10, 2010. It is unlikely that this formal process will be completed before the end of 2010 - the second Ohio portfolio mandate compliance year.

In sum, without clear guidance on how to comply with the energy efficiency requirements of SB 221, Respondents are being asked to venture out into a sea of confusion with no map to guide them home. Consequently, Respondents implore the Commission to promptly amend the TRM so that it lawfully and reasonably reflects the requirements of SB 221 as such requirements relate to compliance with Ohio's portfolio mandates.

III LEGAL OBJECTIONS TO THE DRAFT TRM

A. The TRM Conflicts with the Plain Language of SB 221.

Respondents have previously demonstrated in this proceeding, and in other proceedings such as the Commission's "Green Rules" case (PUCO Case No. 08-888-EL-ORD) that the

[4] It is noteworthy that even the application template issued following the September 15, 2010 Entry in Case No. 10-834 conflicts with the clarifications provided by the Commission in said entry.

Commission's rules and orders placing restrictions on what the EDUs may count towards the energy efficiency mandates violate SB 221 and are unreasonable.[5]

As discussed above, a key event in this proceeding occurred on October 15, 2009 when the Commission entered a Finding and Order regarding issues involving measurement and verification of energy efficiency measures that would appear in the TRM, which were set forth in "Appendix A" of the Commission's June 24, 2009 Entry. In no small way, the problems embedded in the TRM are there because the consultants appear to have tried to force their TRM to conform with their understanding of the policy statements contained in the October 15, 2009 Finding and Order. Consequently, the consultants did not take into account the requirements of Ohio law on the "what counts" question.

Although in developing the Mercantile Customer Pilot Program the Commission has indicated a willingness to follow the clear language of SB 221, the TRM indicates that the Commission's outside consultants have continued to pursue the unreasonable and unwise course of imposing a measurement and verification approach that is unsupportable under the statute. As a result, instead of helping customers to reduce their energy bills, the TRM will likely drive electric bills higher by: (1) prejudicing low and no cost compliance opportunities; (2) making the "what counts" question incapable of being answered at the time when compliance must be planned and pursued; and (3) squandering the opportunity to constructively engage real customers in the compliance process.

[5] Respondents hereby incorporate by reference their previous pleadings regarding these issues in both this Case No. 09-512 and Case No. 08-888.

1. **SB 221 neither limits an EDU's ability to count energy efficiency programs implemented by the EDUs for *all of its* customers nor limits what an EDU may count as energy savings for measures implemented by its mercantile customers.**

SB 221 is broad and allows an EDU to count ***any*** energy efficiency program. In SB 221, the Ohio General Assembly declared as a matter of state public policy that EDUs shall implement, without qualification or limitation, energy efficiency programs to achieve energy savings as well as programs designed to achieve peak demand reductions. O.R.C. § 4928.66(A)

As it relates to both mercantile and non-mercantile customers, the Commission, in promulgating rules under SB 221, stated that the purpose of the rules was "for the implementation of electric utility programs that will ***encourage*** innovation and market access for ***cost-effective*** energy efficiency and peak-demand reduction and to "meet or exceed the statutory benchmark for energy efficiency..." O.A.C. §4901:1-39-02. In its rules implementing the energy efficiency mandates of SB 221, the Commission defined "program," without limitation, as "a single offering of one or more measures provided to consumers." O.A.C. §4901:1-39 (V). The Commission also defined "energy efficiency," without limitation as "reducing the consumption of energy while maintaining or improving the end-use customer's existing level of functionality, or while maintaining or improving the utility system functionality." O.A.C. §4901:1-39 (L). Furthermore, "measure" is broadly defined as "***any*** material, device, technology, operation practice, or educational program that makes it possible to deliver a comparable level and quality of end-use energy service while using less energy or less capacity than would otherwise be required." O.A.C. §4901:1-39 (O).

The Commission encouraged the EDUs to design programs that will "overcome barriers to customer adoption." O.A.C. §4901-1-39-03(A)(3). Although the Commission did indicate

that the staff could publish guidelines for program measurement and verification, these guidelines cannot contradict the law or the rules promulgated thereunder.

As it relates to mercantile customers, in order for EDUs to comply with the aggressive mandates of SB 221, the General Assembly enacted O.R.C. §4928.66(2)(c) which states, without limitation, that EDUs may measure compliance with the energy efficiency mandates "***all*** demand-response programs for mercantile customers of the subject electric distribution utility and ***all*** such mercantile customer-cited energy efficiency and peak demand reduction programs."

Next, compliance with O.R.C. §§ 4928.64 and 4928.66, in any given year, is measured against a baseline that is computed as the average of the three prior years (subject to such baseline adjustments as the Commission may make under the law). O.R.C. § 4928.64 defines the mercantile resources that are eligible to count towards compliance, as those which meet the substantive resource definitions ("advanced" and "renewable") and directs the Commission to count such resources against the compliance requirement when the mercantile customer commits the eligible resource for integration into the EDUs demand response, energy efficiency or peak demand reduction programs as provided under O.R.C. § 4928.66(A)(2)(c).

Lastly, O.R.C. § 4928.66 directs the Commission to measure ***compliance*** [with divisions (A)(1)(a) and (b)] by including the ***effects*** of all demand response programs for mercantile customers of the subject EDU and all such mercantile customer-sited energy efficiency and peak demand reduction programs adjusted upward by appropriate loss factors.

For both mercantile and non-mercantile customers, in O.R.C. §§4928.64 and 4928.66, there is: 1) no limitation in on counting all energy efficiency improvements, programs and measures, including those that are the result of changes in behavior; 2) no authority delegated to the Commission to define "any" as only the increment above some hypothetical "market

practices" standard; 3) no authority for the Commission to preclude EDU compliance by relying on both mercantile and non-mercantile customer energy efficiency programs or demand-side management that may occur as a result of compliance with a building code or a federal or state requirement; 4) nothing that suggests that the compliance count will be diminished if the energy efficiency occurs as part of an equipment replacement program that causes more energy efficient equipment to be installed to replace equipment at the end of its "useful life" (whatever that means); and 5) nothing that allows the exclusion of energy efficiency from the compliance count because the energy efficiency is too cost-effective (has a payback of less than one year). In other words, "any" means "any".

Where an EDU and/or its customers develop and implement, as part of their energy efficiency compliance effort, programs that are designed to harvest energy efficiency measures for its customers, the TRM must include (in the compliance count) the ***effects*** of ***any*** and ***all*** demand response programs for customers of the subject EDU and all such mercantile customer-sited energy efficiency and peak demand reduction programs adjusted upwards by appropriate loss factors. In other words, if an EDU proposes/implements a program focused on achieving energy efficiency through behavior modification (usually low or no cost), the TRM must operate to count the energy efficiency effects of this program in measuring compliance (subject to whatever limitation might be imposed by the applicable cost-effectiveness test). If an EDU implements a program focused on achieving energy efficiency through education about "best practices", the TRM cannot be designed to ignore the energy efficiency ***effects*** of this program in measuring compliance. The Commission cannot, through the TRM or otherwise, threaten to or actually impose its prejudice on an EDU that proposes to achieve compliance through these options. The clear and repeated direction of the General Assembly is that compliance must be

measured relative to a three-year historical baseline and that "any" and "all" the energy efficiency programs and customer-sited capabilities of mercantile customers are eligible to be counted for compliance purposes. However, prior orders and the current version of the TRM violate this clear statutory directive. The TRM must be modified to reflect the clear intent of the General Assembly in enacting SB 221.

2. The TRM conflicts with SB 221 in establishing the baseline for calculating savings based on the highest standards of federal and state regulations. or market practices.

In violation of O.R.C. 4928.66, the TRM limits the nature of projects that are eligible to be counted for purposes of compliance with the energy efficiency benchmarks Specifically, in O.A.C. §4901:1-39-05(I), the Commission unreasonably promulgated a rule that disallows any EDU to count in meeting any statutory benchmark the adoption of measures that are required to comply with energy performance standards set by law or regulation. The TRM also utilizes as this baseline for many measures the federal or state standard that is being utilized at that time instead of the equipment as it is found. Examples in the TRM where it utilizes equipment that meets federal standards as the baseline, rather than the as found method include:

- Page 9: "Specific reductions in savings have [been] incorporated for CFL measures that relate to the shift in appropriate baseline[s] due to changes in Federal Standards for lighting products."
- Page 13: Adjusting the baseline for CFLs.
- Page 30: Baseline equipment for Central Air Conditioning must be equipment that meets federal standard efficiency levels.
- Page 33: Baseline equipment for air source heat pumps must be equipment that meets federal standard efficiency levels.
- Page 53: Baseline equipment for refrigerators must be equipment that meets federal standard efficiency levels.
- Page 59: Baseline equipment for Clothes Washers must be equipment that meets federal standard efficiency levels.[6]

[6] There are many other examples in the TRM where the baseline is calculated in this manner rather than the as found method.

The TRM should be amended to eliminate these exclusions for several reasons. First, the TRM cannot be founded on Commission policy statements and promulgated rules that are themselves in conflict with the statutory requirements. Thus, the TRM cannot lawfully prevent utilities from counting any measure required to comply with energy performance standards set by other laws or regulations to meet the statutory benchmarks imposed by O.R.C. § 4928.66(A). Such exclusions are totally at odds with the stated purpose of the law as discussed above. The TRM actually makes it harder for utilities to achieve the desired results by shrinking the pool of available tools an EDU may use to meet the statutory benchmarks. The statute neither states nor suggests that the EDU is limited to using only new measures for energy efficiency and demand reduction purposes. The statute also does not state or suggest that the statutory benchmarks must produce incremental savings in use and/or reductions in demand above those that might be encouraged by other laws and regulations. The TRM arbitrarily and unreasonably precludes the utilities from using certain measures to achieve the statutory benchmarks for energy efficiency and peak demand reduction merely because these measures also comply with energy performance standards required by other laws, standards or building codes. Thus, the TRM irrationally makes it harder for an EDU to achieve the desired goals by favoring some other governmental entity – federal, state or local – or "industry standard/practices" to designate the baseline from which compliance should be measured.

Second, the TRM requires energy savings and peak demand reductions to be calculated by making an artificial and speculative comparison between the actual energy use and peak demand associated with a customer's energy efficiency and designed peak demand reduction activity compared to some increment above a hypothetical amount of energy efficiency and designed peak demand reduction had the customer used "industry standard new equipment or

practices," In effect, the TRM tosses actual energy efficiency and designed peak demand reduction capabilities out of the compliance math that was mandated by the General Assembly. The TRM's artificial, hypothetical and speculative nature is precluded by the statute itself.

The TRM creates an irrational end-result because it ignores actual energy savings and demand reductions, pretending they really did not occur only because some portion of the actual, real savings or reduction *might have occurred* through some other means that was never actually deployed. The TRM also irrationally penalizes the EDU by not allowing actual energy savings and demand reductions to be counted solely because the customer exercised its right to use its own business judgment to decide whether it was in the customer's best interests to install new industry standard equipment or implement new industry standard practices. In turn, the TRM requires customers to be responsible for the excessive compliance costs that result from the TRM failing to utilize actual energy savings and designed for peak demand reductions.

As O.R.C. §§4928.64 and 4928.66 and the rules promulgated thereunder clearly indicate, the effects of ***all*** energy efficiency and peak demand reduction programs are to be included. The General Assembly placed no restrictions on the nature of such programs to be included and, therefore, as a creature of statute, the Commission has no authority to do so through its rules. *Canton Storage and Transfer Co. v. Pub. Util. Comm.* (1995), 72 Ohio St. 3d 1, 5. Any qualifying criteria established by the Commission that limits the inclusion of such projects for purposes of an EDU's compliance with the statutory benchmarks are unlawful as being contrary to the statute and beyond the authority delegated to the Commission. The TRM should be modified accordingly.

B. THE TRM VIOLATES THE DUE PROCESS CLAUSES OF THE UNITED STATES AND OHIO CONSTITUTIONS.

The contradiction between the statute and the TRM, and the lack of clear guidance that articulates what an EDU must do to comply with the energy efficiency mandates of SB 221 causes the EDUs and customers affected by the portfolio requirements to be unable to ascertain how they might comply with such requirements at the time they are obliged to comply. The law calls this type of government regulation a "standardless" trap, a form of regulation that violates the United States and Ohio Constitutions.

The Due Process Clauses of the Fifth and Fourteenth Amendment give rise to the void-for-vagueness doctrine. The doctrine has two primary goals. The first goal is to ensure "fair notice" to the subject of the law as to what the law requires; the second is to provide standards to guide the discretion of those charged with enforcing the law. *Columbia, Natural Resources, Inc. v. Tatum*, 58 F.3d 1101, 1104 (6th Cir. 1995). The second goal "relates to notice to those who must enforce the law . . . [t]he standards of enforcement must be precise enough to avoid 'involving so many factors of varying effect that neither the person to decide in advance nor the jury after the fact can safely and certainly judge the result.'" *Id.* (citing *Cline v. Frink Dairy Co.*, 274 U.S. 445, 465, 47 S.Ct. 681, 71 L.Ed. 1146 (1927)).

Although the vagueness doctrine arises most often in the context of criminal laws that implicate First Amendment values, "vague laws *in any area* suffer a constitutional infirmity." *Ashton v. Kentucky*, 384 U.S. 195, 200, 86 S.Ct. 1407, 16 L.Ed.2d 469 (1966) (collecting cases at n. 1) (emphasis added). *See also, Cline*, 274 U.S. at 463 ("The principle of due process of law requiring reasonable certainty of description in fixing a standard for exacting obedience from a person in advance has application as well in civil as in criminal legislation.") Laws that impose criminal penalties or sanctions or reach a substantial amount of constitutionally protected

conduct, however, must satisfy a "higher level of definiteness." *Belle Maer Harbor v. Charter Township of Harrison*, 170 F.3d 553, 557 (6th Cir. 1999).

The Ohio Supreme Court re-affirmed and clarified the void-for-vagueness doctrine in its recent decision in *Norwood v. Horney*, 110 Ohio St.3d 353, 2006-Ohio-3799. The court struck down a municipal ordinance that allowed private property in a "deteriorating area" to be taken by eminent domain, even though the municipal code set forth "a fairly comprehensive array of conditions that purport to describe a 'deteriorating area,' including . . . incompatible land uses, nonconforming uses, lack of adequate parking facilities, faulty street arrangement, obsolete platting, and diversity of ownership." *Id.* at ¶ 93. The Court held:

> In the cases before us, we cannot say that the appellants had fair notice of what conditions constitute a deteriorating area, even in light of the evidence adduced against them at trial. The evidence is a morass of conflicting opinions on the condition of the neighborhood. Though the Norwood Code's definition of 'deteriorating area' provides a litany of conditions, it offers so little guidance in application that it is almost barren of any practical meaning.
>
> In essence, deteriorating area is a standardless standard. Rather than affording fair notice to the property owner, the Norwood Code merely recites a host of subjective factors that invite ad hoc and selective enforcement – a danger made more real by the malleable nature of the public-benefit requirement.

Id. at ¶¶ 97-98.

O.R.C. § 4928.66(C) imposes a forfeiture, payable to the state, on an EDU that fails to comply with the requirements of R.C. 4928.66(A). The statute is a penal statute and as such, it, and any rules promulgated to carry it into effect, must provide a "high level of definiteness." *See Cleveland Mobile Radio Sales, Inc. v. Verizon Wireless*, 113 Ohio St. 3d 394, 2007-Ohio-2203; *Belle Maer Harbor*, 170 F.3d at 557; *Norwood v. Horney*, at ¶¶ 84-85. The Commission's

pronouncements in the TRM, however, do not even cross the threshold for satisfying a minimal level of definiteness.

The void-for-vagueness doctrine, as illustrated by the foregoing cases, is clearly violated by the Commission's policy statements and TRM in which it sets standards based on the highest standard provided by federal regulations, state regulations, or market practices, as reflected on the Department of Energy's Energy Information Administrator website, and precludes activities derived from business as usual practices. Although the Commission promised that "[t]hrough the development of the TRM in this docket, we continue to provide guidance on the application of current market practices,"[7] the TRM does very little to provide the much-needed guidance. Ironically, while the statute itself is relatively clear and precise in articulating that the effects of *all* energy efficiency programs should be included for purposes of complying with statutory energy efficiency benchmarks, the Commission's entries, rules and TRM so muddles the requirements that it drives the regulatory scheme over the constitutional brink.

First, O.R.C. § 4928.66, and the rules promulgated thereunder, allow an EDU to employ any and all measures or programs in order to meet its duty to achieve energy savings and reduce peak demand. By not categorizing or limiting the types of programs that may be implemented, the statute gives the EDUs clear comfort that any program that helps to achieve the statutory benchmarks will be counted and measured relative to the statutory baseline. But, the TRM destroys that clarity by prohibiting an EDU from counting any measure that is otherwise required to comply with energy performance standards set by law or regulation. Furthermore, given the number of different standards that may be set now, or at various times in the future, by different

[7] October 15, 2009 Entry at p. 5, fn.1.

governmental entities, some of which may have jurisdiction only with a particular city or county, EDUs will face a daunting array of potentially ever-changing and inconsistent baselines.

The TRM further compounds the confusion it sows by calculating a customer's energy savings and designed for peak demand reduction capability by comparing the customer's post-program use and demand to the estimated energy use and peak demand that would have occurred if the customer had hypothetically used industry standard new equipment or practices to perform the same functions in the industry in which the customer operates.

Next, in some cases, the TRM prescribes standards that are circular and incapable of implementation or execution. For example, in the section relating to process equipment replacement measures, the TRM defines (differently than the applicable statute) how the baseline will be calculated as:

> Baseline for Equipment Replacement projects is the equipment meeting the level of efficiency required by State Code, applicable Federal product efficiency standard or standard practices, whichever is most stringent, in place at the time of installation. If there is no applicable State Code or Federal Standard then the methodology for establishing standard practice shall be documented in the M&V plan as described in PJM Manual 18B Section 8. The baseline description shall detail information regarding the baseline technology(ies) including make, model number, nameplate data and rated capacity of the equipment, operating schedule, and controls and how the baseline was determined.[8]

Thus, the TRM sends persons eager to understand the compliance requirement off to consult, among other things, the Ohio Building Code. But, the Ohio Building Code postpones the ability to obtain the guidance that the TRM assumes comes from the Code because the Code points to ASHRAE 90.1 to fill in the blanks that are left open by the TRM. ASHRAE 90.1 by reference states:

[8] TRM at 301 (footnotes omitted).

2.3 The provisions of this standard **DO NOT APPLY TO**

a. single family homes, multi-family structures of three stories or fewer above grade, manufactured houses (mobile homes) and manufactured houses (modular),

b. buildings that do not use electricity or fossil fuel, or equipment and portions of buildings system that use energy primarily to provide for industrial, manufacturing or commercial processes (emphasis added).

So, after following the TRM's directional signs, persons charged with compliance are ultimately directed to ASRAE 90.1 which, on its face, is likely inapplicable to the majority of industrial customer projects. Thus, the EDU is required to fall back to the PJM Manual cited in the TRM, which refers back to "applicable standards" or state or federal building codes.

Moreover, there are other layers of compliance obfuscation in the TRM. For example, the TRM indicates that in the absence of an applicable federal or state standard, the methodology for establishing standard practice shall be documented in the measurement and verification plan as provided for in PJM Manual 18B.[9] PJM Manual 18B defines how energy efficiency improvements can be counted towards PJM's Reliability Pricing Model ("RPM") requirements. PJM also limits the counting of energy efficiency or peak demand improvements to those that exceed an applicable standard, which is defined as a baseline against which customer-sited capabilities may be counted for RPM purposes. If there is no applicable standard, PJM says that "standard practice" becomes the baseline:

> "Standard" Baseline: For projects in which equipment (whether failed or not) is replaced by a more efficient equivalent or by an alternative strategy for delivering comparable output, the Baseline Condition shall be the nameplate rating of the equipment meeting the level of efficiency required by applicable State code, Federal product efficiency standard, or standard practice, whichever is most stringent, in place at the time of installation, as known at the time of commitment. If there is no applicable State code or federal standard,

[9] PJM Manual 18B: Energy Efficiency Measurement and Verification, Rev. 0, Section 11, Effective Date April 23, 2009. This manual is published by PJM Interconnect LLC ("PJM").

then standard practice shall be used as the basis for establishing Baseline Conditions and shall be documented in the M&V Plan.[10]

Thus, the layered references in the TRM instruct EDU's and their customers to embark on a continuous-loop journey that is incapable of producing any information that can be relied upon to identify what the Commission will count against the Ohio portfolio obligations.

Next, the TRM indicates that standard industry practice can be defined by consulting the Department of Energy's (DOE) Energy Information Agency's Manufacturing Energy Consumption Survey ("MECS").[11] The MECS is a lengthy survey in which manufacturers report energy use across all forms of energy (electricity, natural gas...etc.). DOE instructs a survey respondent to break down total energy use by energy form into percentage of total use by type of use (process heat, motors, etc). MECS neither collects any data on the level of manufacturing (sales or tons of manufactured product for example) nor collects energy usage at the equipment level. Therefore, the published MECS cannot be used in raw form for any type of benchmarking or establishment of standard practice by customers.

Because the standard practice is not defined by the TRM, and the TRM's uninformative references do not allow standard practice to be defined, the so-called standard practice and related measurement parameters must be removed from the TRM because of the Constitutional requirements discussed herein. The as-found measurement approach should instead be adopted in the TRM to conform the TRM to Ohio statutory requirements.

Lastly, the timing of the TRM and the formal comment period has further muddied up the EDUs efforts to comply with the energy efficiency mandates of SB 221. On October 15, 2009,

[10] PJM Manual 18B: Energy Efficiency Measurement and Verification, Rev. 0, Section 11, Effective date: April 23, 2009 at 26.

[11] TRM at 316.

the Commission issued a Finding and Order containing certain policy statements related to (among other things) issues involving measurement and verification and the TRM -- which were set forth in "Appendix A." of the Commission's June 24, 2009 Entry. In no small way, the problems embedded in the TRM are there because the consultants selected by the Commission relied on policy statements contained in the October 15, 2009 Finding and Order that neglected to consider important statutory provisions. Rather, without ruling on the above-referenced Applications for Rehearing, the Commission issued a draft TRM for final comment, which is riddled with inaccuracies, inconsistencies and unlawful and unreasonable provisions. The Commission must rule on Appendices A and C prior to issuing a final TRM since the TRM is based in part on these appendices. Consequently, the consultants did not take into account the requirements of Ohio law on the "what counts" question.

The EDUs have a statutory duty to implement energy efficiency and demand reduction programs beginning in 2009. Yet by not giving the utilities timely or effective guidance as to how their compliance will be judged, the Commission denies the utilities their fundamental due process right to fair notice of what is expected of them and it exposes them to the unconstitutional enforcement of a penal statute. The Commission can cure this constitutional defect by amending the TRM to comport with the mandates already clearly expressed in O.R.C. § 4928.66, and by stripping the Commission-imposed exclusions, additions and confusing administrative gloss from the TRM.

IV. GENERAL OBJECTIONS TO THE TRM

In addition to the legal objections to the TRM discussed above, Respondents hereby submit the following general policy objections and recommendations and comments to the TRM.

A. <u>The TRM Should Be Used for Compliance Counting Only</u>.

In its September 15 Order regarding the Mercantile Pilot Program (Case No.10-834), the Commission differentiates between what programs qualify for an incentive and how program savings are calculated for purposes of measuring compliance with S.B. 221. In keeping with this differentiation, the TRM should be narrowly focused on achieving the purpose of measuring the compliance as such measurement is mandated by SB 221. Portions of the TRM that do not contribute to that purpose should be removed from the TRM and discussed, if at all, in another forum.

B. The TRM Is Inconsistent with the Mercantile Pilot Program.

On September 15, 2010 and September 29, 2010, the Commission issued an Order and template application, respectively, that announced the establishment of a Mercantile Customer Pilot Program. As discussed above, the September 15, 2010 Order provided guidance on how compliance with SB 221 is to be measured. As also discussed above, the compliance math in the TRM conflicts with the compliance math in the September 15, 2010 Order. The approach for counting savings between the TRM and the mercantile pilot program should be consistent. Indeed, an energy efficiency project should count the same – whether it is implemented through a mercantile program or through any other utility incentive program.

Specific examples of inconsistencies between the TRM and the September 15, 2010 Order regarding the Mercantile Pilot Program are listed below. This is not an exhaustive list:

- The compliance math identified by the Commission for purposes of the Mercantile Customer Pilot Program confirms that the "as found" method is appropriate for measuring compliance. The TRM contains compliance math that precludes use of the "as found" method. The same "as found" approach should be incorporated throughout the TRM for calculating compliance savings on all measures when appropriate data is available.

- The compliance math identified by the Commission for purposes of the Mercantile Customer Pilot Program permits compliance to be achieved by reliance on behavioral

changes. The TRM does not. The TRM should recognize that SB 221 allows energy efficiency achieved through behavior modification to be counted towards compliance.

Other differences between the compliance math identified by the Commission for purposes of the Mercantile Customer Pilot Program and the compliance math contained in the TRM are outlined below in comments regarding specific sections and measures of the TRM.

C. The TRM Lacks an Effective Date.

The TRM itself, as well as the information the Commission has issued in this proceeding, do not identify when the final TRM will become effective. Given that the Commission has set up a three-year planning cycle in its rules, the TRM should become effective no sooner than the first year following the submission and approval of the EDUs next portfolio plan. All of the EDUs developed their initial portfolio plan based on various assumptions related to measure savings. These assumptions were necessary in order to propose and implement a plan that would result in compliance with the energy efficiency benchmarks set forth in S.B. 221. It is impossible at this point to go back and incorporate provisions in a final TRM into the compliance initiatives that were designed or undertaken prior to the issuance of a final TRM. Once the Commission issues a final TRM, utilities and customers alike must have adequate time to incorporate the applicable provisions in the TRM and into their related design and implementation activities.

D. To the Extent that the TRM Provides Deemed Values for Specific Measures, These Should be Considered Minimum Values.

SB 211 places a compliance burden on the EDUs and the EDUs must design and implement plans to achieve compliance while being permitted to recover the cost of such compliance. For compliance purposes, the EDUs must be assured that they will be credited with at least a deemed level of measure-by-measure savings prior to implementing programs. For

example, should an EDU or its customers be able to outperform the deemed minimum savings standard, and can provide evidence or M&V studies to support the performance above the deemed value for a specific measure, the Commission should accept the higher value, given that the higher level of performance is returning more energy savings than originally estimated. Making the deemed level of efficiency or designed for peak demand reduction the floor for purposes of measuring compliance will provide the confidence that EDUs and customers must have to pursue outcomes that exceed the deemed level of performance particularly in the initial years following the TRM. This approach will also yield data that will allow a prospective modification, if warranted, of the deemed values.

Additionally, if an EDU places good faith reliance upon deemed values for purposes of designing and implementing compliance plans, the EDU should not be subjected to penalties or a non-compliance finding.

Lastly, and as indicated above, when new data shows the deemed values to be incorrect (too high or too low), the TRM should be adjusted for prospective application to the planning, reporting and compliance routines in the following cycle.

E. <u>The TRM Lacks a Definition Section.</u>

Some terms in the TRM are unclear and should be defined therein so that they can be understood and applied consistently. The short timeframe for TRM objections did not allow time to create a comprehensive list of terms, but examples are below:

- Direct Install
- Retrofit
- Time of Sale
- Early Retirement
- Early Replacement
- Retrofit – New Equipment

- Retrofit – Early Replacement
- New Construction
- Time of Use
- Low Income

It is not clear what the intended definitions are for those various measure types in the draft TRM. As discussed above, the context in which some of those words appear, seem to conflict with the plain language of SB 221.

Respondents recommend reducing the number of terms being used, and providing clear definitions for those that remain. It is difficult to suggest definitions for all the terms currently being used since the TRM does not indicate the intended meaning of the terms. It also appears that some of the terms are utilizied in the TRM becuase the TRM has adopted compliance math that is inconsistent with SB 221.

It also seems that the TRM causes some measures to have the incorrect project type (New Construction, Retrofit, etc,) associated with the measure, or an inappropriate baseline for the type. For example, "Lighting Systems (Non-Controls)" combines *Time of Sale/New Construction* in one measure; and *Early Replacement/Retrofit* in another measure.[12] Dissimilarly, "LED Case Lighting with/without Motion Sensors" combines *New Construction/Retrofit – Early Replacement.*[13] "Chilled Water Reset Controls" is listed for *Retrofit – New Equipment.* These examples represent three different uses of *"Retrofit"* including cases in which it is combined with *"New Construction."*[14]

Consequently, Respondents request that they work with the Commission and its consultants in developing definitions that comport with the plain language of SB 221.

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[12] TRM at 153.
[13] TRM at 180
[14] TRM at 204.

F. The TRM Improperly Introduces a Degradation Factor.

The TRM assumes that the degradation of savings is being tracked in each EDU's tracking and reporting system. In fact, this is not the case. The TRM's net degradation of any measure and the baseline should be zero. Both technologies degrade at the same rate; therefore the net impact on savings is zero. As a result, savings should be calculated assuming a net degradation impact of zero.

If the TRM is going to consider degradation of new technology, the degradation of the "as found" equipment (or technology) must also be considered. Additionally, tracking the degradation would make the M&V and tracking and reporting costs overly burdensome, which could impact the cost-effectiveness of programs.

Lastly, if the TRM is properly conformed to the compliance math contained in SB 221, the rolling three year base line and the escalating compliance percentages in SB 221 will work to reflect any actual degradation in the compliance required by SB 221. Therefore it is entirely unnecessary to introduce a separate degradation factor.

G. The TRM's Discount Rate is Not Appropriate.

The TRM assumes a 5% discount factor for all net present value calculations. The TRM does not identify why 5% was selected as the discount factor. A net present value calculation using 5% as the discount factor may or may not be appropriate depending on the nature of the compliance initiative. Thus, the TRM's adoption of 5% is arbitrary.

Appendix C, entered into Case No. 09512-GE-UNC, recommended the use of after-tax weighted average cost of capital ("WACC"). Given the lack of clarity as to the selection of 5%, each EDU should be able to propose its own discount factor as part of its compliance plan, and once approved, rely upon such discount factor or factors for purposes of achieving compliance.

H. The TRM Update Process Needs to be Clarified.

While the TRM discusses the update procedures for new measures and states, "Data from reliable impact evaluations would be necessary to support savings claims until the measure has been incorporated into the TRM or update,"[15] a process needs to be established to determine which impact evaluations are deemed reliable by the Commission. To date, the Commission has not provided any direction to the parties on how the evaluation identified in the TRM should be conducted.

Respondents agree that the TRM should be applied prospectively. However, the TRM should be updated periodically based on new information and available data and the updated TRM should be applied prospectively for future program years. Updates should not alter the level of S.B. 221 achievement, once recognized by the Commission, nor should it alter any energy savings or designed for demand reductions already in service. In other words, updates to the TRM should be applied only on a prospective basis.

Specifically, the TRM proposes two update periods, one in September and one at the end of December.[16] Respondents believe that an annual cycle of updating the TRM would be excessive and unnecessarily costly. Developing this first draft has proven to be a significant undertaking and is still not complete as we approach the end of 2010. Subjecting the TRM to an annual review process would introduce an added and unnecessary level of uncertainty and cost. A more appropriate cycle would match the three-year planning cycle that EDUs have been directed to use by the Commission for program planning purposes. An exception to this would be to create a mechanism that enables a new measure to be added to the TRM in any given year.

[15] TRM at 8.
[16] TRM at Appendix D.

Any proposed new measure should be finalized by September for use the following program year.

Lastly, if there are conflicts between the TRM and an approved compliance plan, the approved compliance plan should control at least for purposes of determining if an EDU should be subjected to a non-compliance finding.

I. Online Access Is Needed for Referenced Reports and other Sources of Data.

Many algorithms in the TRM contain an energy savings factor (ESF) that is an empirical number based on other studies, some of which are difficult to obtain. The Commission or its consultants should provide an online site at which EDUs, consultants and other stakeholders can obtain any of the scores of reports referenced in the draft TRM document.

J. The TRM Needs to Map EFLH Values to Zip Codes.

The TRM fails to include a zip code mapping table which maps all Ohio zip codes to the appropriate reference city listed in the TRM measures. Without this mapping table it is difficult to know which city has the appropriate EFLH for a project in some zip codes.

K. Commercial & Industrial Market Sector General Objections

1. Collection of Baseline Data

The collection data related to the type of equipment removed when a new measure is installed should not be required for all measures. In some instances, often in prescriptive programs, savings are simply "deemed" and collecting data on the removed equipment would be overly burdensome. There may, however, be other cases where the cost and effort are justified to establish an "as found" baseline. In short, collecting data regarding removed equipment should be optional.

In general, whenever Ohio program specific data is available, it should be used rather than relying on information from a different part of the country, for different programs, operated in different time periods by different program providers.

2. Building Types

Several measures in the TRM include EFLH and coincidence factor ("CF") tables which list distinct hours and CF values according to various building types. However, certain locations at which energy efficiency or peak demand reduction measures are installed will not fit neatly into the listed building types. Further, Respondents recommend using site-specific values if known. Lastly, given that the building types currently included in the draft TRM tables do not cover many applications, Respondents recommend that those tables should be expanded:

- The Hotel/Motel should be split to include Hotel/Motel-Common Areas and Hotel/Motel-Guest Rooms as the building hours for these vary greatly. Lighting measures in particular are often geared toward the higher use common areas which are typically 8760 hours.

- Health Care should be split into Medical-Hospital and Medical-Clinic to differentiate the higher hours associated with hospitals.

- If the Food Sales portion of the TRM is intended to cover grocery stores and fast food restaurants, differentiating these categories is recommended, e.g., Grocery versus Restaurant-Sit Down and Restaurant-Fast Food.

- Retail covers a broad category of businesses from big box stores to small retail strip malls to full malls. This category should be split between Retail-Large and Retail-Small.

- Warehouse's description should be broadened. It is unclear whether this category covers storage warehouses or distribution warehouses. These are often multiple shift operations. This category should be split into one-, two- and three-shift categories similar to Industrial.

- Additional categories should be added for: a) Police/Fire Stations; b) Parking Garages; c) Daycare; and d) Light Manufacturing.

V. TECHNICAL OBJECTIONS AND COMMENTS TO THE TRM

A. Residential Measures

The EDUs hereby present their specific and technical objections and comments to the Residential Measures contained in the TRM.

1. Residential Energy Star CFL (Time of Sale)

- Page 11 – If the Delta Watts Multiplier is kept, it should include a calculation for Delta Watts Multiplier.
- Page 12 – The calculation for adjusted lifetime in Footnote 3 appears to be incorrect. The term (0.2/0.77) should be (0.2*0.77), which would adjust the lifetime to 8.7 yrs, not 9.18.
- Page 13 – In Service Rate: This should be higher based on the California Final Upstream Lighting Evaluation Report Volume 1, table 72 for CFLs installed over the life of the bulb. The table below provides the appropriate percents and proportions from the CA evaluation report. The table below uses CA findings (from table 72) and applies them to the proposed Ohio TRM installation rate. The table below is linked to Excel with formulas (Note slight rounding differences).

Data from CA Report, Table 72

CA Post-Program Installations			
Total Yr 1 and 2 Post	28%		
1 Yr Post	16%	Yr 1 Proportion	57%
2 Yr Post	12%	Yr 2 Proportion	43%
Expected to never be installed total=		2%	

OHIO TRM Percent Installed Assumption

Percent installed year 1=	77%
% of Savings that can be Claimed Post program Year	
% that can be claimed 1 Yr after program	12%
% that can be claimed 2 Yr after program	9%
Total to be installed:	98%

- Page 14 – The WHFd should be calculated by multiplying by 35% similar to the WHFe to account for the decrease in lighting heat load. This resulting equation should be "WHFd = (1+(0.64*(0.35/3.1)) = 1.07.

- Page 14 – We request the coincidence factor be revised from 0.11 to 0.16 based on Duke CFL savings load shape data[17] normalized to the full population of CFLs.

- Page 15 – "Deemed O&M Cost Adjustment Calculation" – The "Efficient Incandescent" heading in table should read "Halogen" to maintain consistency with spreadsheet on page 16.

2. Residential Direct Install – Energy Star CFL (Early Replacement

- Page 17 – If the Delta Watts Multiplier is kept, please include calculation for Delta Watts Multiplier.

- Page 17 – "Description" – include expected hours of use for calculation of this measure.

- Pages 17 and 19 – The deemed Lifetime calculation is based on 1,011 annual hours and energy savings are based on 1,040 annual hours (2.85 hours per day). The value of 1,040 hours should be listed in the TRM, although the lifetime will stay 8 years (rounded up from 7.7 years).

- Page 18 – In Service Rate (ISR) of 0.81 is lower than the ISR deemed in the Time of Sale section. This is counter-intuitive. The ISR for a direct install program should be higher, since the lamps are installed by a contractor in an appropriate socket. If the circumstances around the data are similar to direct install of auditors, Duke Energy Ohio recommends an ISR rate of 0.89.

- Page 19 – Please provide the following data (report): Megdal & Associates, 2003; "2002/2003 Impact Evaluation of LIPA's Clean Energy Initiative REAP Program."

- Page 20 – Citation for "HF" (footnote 29) does not provide enough information to gauge accuracy. Can VEIC clarify how this citation is used?

- Page 21 – "Deemed O&M Cost Adjustment Calculation" – The "Efficient Incandescent" heading in table should read "Halogen" to maintain consistency with spreadsheet on page 22.

3. Residential HVAC Maintenance/Tune-UP (Retrofit)

- Page 26 - In footnote 42, the calculation of the Summer Peak Coincidence Factor (CF) is incorrect. The referenced report – Energy Center of Wisconsin, May 2008 metering study; "Central Air Conditioning in Wisconsin, A Compilation of Recent Field Research", p32 – indicates that of the 58 air conditioning systems in the study, during the peak operating period 17 were "running flat out" while 11 were not running and 30 were

[17] Ohio Residential Smart Saver CFL Program. Results of a Process and Impact Evaluation. Prepared for Duke Energy by Tecmarket Works and BuildingMetrics. June, 2010.

cycling. The average duty cycle was 44 minutes per hour for the 47 systems that operated during the peak period. Thus the Summer Peak Coincidence Factor is the weighted average equal to:

[(47 units * 44 min/hr) + (11 units * 0 min/hr)] / (58 units * 60 min/hr) = 0.594

However, based on the analysis described in the ADM White Paper pertaining to this measure, the CF for Central Air Conditioning (CAC) measures should stay at 0.50, the CF for CAC tune-up measures should be 0.44, and the Maintenance Demand Savings Factor (MFd) for this measure should be equal to the Maintenance Energy Savings Factor (MFe).

- Page 26 - We agree the total measure cost is roughly in agreement with the $175 figure currently used in the TRM. A recent survey by CSG of twelve of the larger Dayton area residential HVAC contractors suggests an average Dayton total measure cost for inspection and tune-up of $160 which is in synch with the $175 national average estimate, particularly since southwestern Ohio is a somewhat lower cost region than the national average. The average cost for an inspection alone based on the same Dayton area survey is $96. This would suggest an estimated incremental measure cost of $64 ($160 - $96) for the additional diagnostic and repair work the Real Cool Analyzer system entails. Another way to look at it is to realize that in a significant number of cases the contractor does the work only for the program incentive of $90. This would suggest that in these cases, the incentive cost closely approximates the incremental measure cost. The EDUs would therefore propose that the program should use an average of these estimates, approximately $75 - $80.

- Page 27— The EDUs could not confirm MFe in source cited in footnote 45. It is not clear that this factor would equally apply to Heat Pump cooling and heating seasons. The Wisconsin study in the footnote is more focused on AC units, not heat pumps. The EDUs recommend the value be subjected to further review by VEIC.

- Page 29—The EDUs could not confirm MFd in source cited in footnote 45. It is not clear that this factor would equally apply to Heat Pump cooling and heating seasons. The Wisconsin study in the footnote is more focused on AC units, not heat pumps. We recommend the value be subjected to further review by VEIC.

4. Air Source Heat Pump (Time of Sale)

- Page 33 - The Definition of Baseline Equipment should include the minimum HSPF required by code (7.7) similar to the Definition of Efficient Equipment.

5. Attic/Roof/Ceiling Insulation (Retrofit)

- Page 36 - Duke Energy Ohio suggests that the simulation approach from the Joint IOU TRM be used in lieu of the cooling degree hours calculation. Consultants can provide

more combinations of initial and final R values for this measure to make the algorithm more general.

The degree hour approach is a simple steady-state approach that misses much of the important dynamics of building energy use, including thermostat setback, time-varying internal loads, solar heat gains, and building thermal mass effects. The ASHRAE Handbook[18] states "When the indoor temperature is allowed to fluctuate or when interior gains vary, simple steady-state models must not be used."

In one typical case investigated, the DOE-2 simulations provided energy savings three times larger the calculated kWh and kW savings, and eight times more than the therm savings predicted by the degree hour approach in the TRM.

For example, using the algorithms in the TRM for attic/roof/ceiling insulation:

Parameter	Value
Rexist	17.5
Rnew	30
CDH	7711
Area	1000
SEER	13
HDD	3992
nHeat	0.7
FLHcool	664
CF	0.5
kWh/1000 SF	10.6
kW / 1000SF	0.008
Therm / 1000 SF	3.3

DOE-2 simulations using comparable inputs on the DEER prototypes returned 36.5 kWh/kSF, 0.026 kW/kSF and 27.9 therms/kSF.

The algorithms require a site-specific estimate of heating system efficiency, which includes an estimate of the distribution system efficiency. Estimates of distribution system efficiency come from either a duct leakage test or visual inspection combined with the BPI lookup tables on distribution efficiency. Furnace efficiency is estimated from the nameplate AFUE or from a combustion test. This level of data collection is too onerous for a prescriptive rebate measure. There is no guidance provided on cooling system efficiency, for either the air conditioner (or heat pump) or the duct system.

[18] 2009 ASHRAE Handbook of Fundamentals, Chapter 19 – Energy Estimating and Modeling Methods, pg 19-17. The opening paragraph in the section on System Modeling/Degree-day and Bin Methods describes this limitation.

- Page 38—"Space Heating Savings Calculation" – If the modeling approach is not approved, the link in footnote 77 should be corrected to verify HDDs. The current link does not work.

6. ENERGY STAR Torchiere (Time of Sale)

- Page 40 – ENERGY STAR uses a measure life of seven years versus the eight used here. The EDUs recommend using the ENERGY STAR value of seven years.

- Page 42 – the average heating system efficiency nHeat is given as 0.72. However, the calculation in footnote 89 needs an additional set of parenthesis to specify correct order of operations. It could be calculated as 0.78 depending on the order. This should be fixed in all measures containing this factor.

7. Dedicated Pin Based CFL Table Lamp (Time of Sale)

- Page 44—If the Delta Watts Multiplier is kept, please include calculation for Delta Watts Multiplier.

- Page 44—"HOURS" – Based on citation and page number given, average hours came to 901.2 instead of 869. We recommend using the value of 901 hours.

- Page 46—"Deemed O&M Cost Adjustment Calculation" – The "Efficient Incandescent" heading in table should read "Halogen" to maintain consistency with spreadsheet on page 47.

8. Ceiling Fam with ENERGY STAR Light Fixture (Time of Sale)

- Page 48— Navigant recommends increasing the CF to 0.16 to account for fan use during peak hours. The CF of 0.11 from the cited study applies to the lighting savings only, and it cannot be assumed that ceiling fan use will coincide exactly with lighting use. The 0.05 increase is based on a conservative assumption that 10% of HVAC CF can be applied by customers choosing to use their fan instead of A/C during peak hours. If this recommendation is not accepted, the savings table for this measure should be amended to state that demand reductions are due only to lighting.

- Page 49 – "HOURSfan" – The value of 2.8 hrs/day for 365 days seems high for fan use. The EDUs would like to see the source referenced in footnote 110.

- Page 49 – The assumption of three 60 Watt incandescent lamps in the baseline was expected; however, we would not expect to replace these with three 20 Watt CFLs. This would be equivalent to three 75 Watt incandescent bulbs. The "CFLWatt" value should be adjusted to three 14 Watt CFLs instead.

- Page 50 – The WHFd should be calculated by multiplying by 35% similar to the WHFe to account for the decrease in lighting heat load? This should be WHFd = (1+(0.64*(0.35/3.1)) = 1.07.

- Page 51—"Deemed O&M Cost Adjustment Calculation" – The "Efficient Incandescent"

9. Efficient Refrigerator – ENERGY STAR and CEE TIER 2 (Time of Sale)

- Page 53 – "Deemed Lifetime of Efficient Equipment" – The DEER Database has reduced the lifetime to 14 years. This value should be considered.

10. Refrigerator Replacement (Low Income, Early Replacement)

- Page 56 – "Deemed Lifetime of Efficient Equipment" – The DEER Database has reduced the lifetime to 14 years. This value should be considered.

- Page 57— "UECexisting" – The part-use factor cited in footnote 126 is based on a study that provides incentives to recycle spare or secondary refrigerators. For low income applications, it is appropriate to assume that the refrigerators being replaced are not spare or secondary, but in fact primary units. For this reason, we recommend using the "full-use" value of 1,995 kWh to calculate UECexisting, for a result of 1,995*0.85=1,696 kWh.

- Page 57— "UECES" – our calculated average for ENERGY STAR refrigerators was 445kWh based on the ENERGY STAR calculator.

- Page 57— "UECbase" – our calculated average for ENERGY STAR refrigerators was 557kWh based on the ENERGY STAR calculator.

11. Clothes Washer – ENERGY STAR and CEE TIER 3 (Time of Sale)

- Page 59 - The draft TRM assumes that the ENERGY STAR measure will be governed by the 2011 ENERGY STAR specification rather than the current, 2010 ENERGY STAR specification. The EDUs recommend the 2010 ENERGY STAR specifications continue to apply to all units which were manufactured in 2010, because manufacturers and retailers are likely to need 6-12 months to cycle through the inventory of ENERGY STAR 2010 qualified units.

- Page 60—The EDUs could not verify coincidence factor or washer volume.

- Page 60—Water Savings per load should be stated as "Average water savings per load." In addition the value used by ENERGY STAR (16.69) should be used— the EDUs were unable to follow the logic used in the calculation in footnote 140.

12. ENERGY STAR Dehumidifier (Time of Sale)

- Page 65—"Deemed Measure Cost" – The source given is a great tool; however, we are unable to change the inputs and it has defaulted to 2012 prices. In addition there are very

distinct pricing differences for the various models. This could either be addressed by making a table or the EDUs suggest using the ENERGY STAR calculator for 2010 and 2011 prices to make it more current. ENERGY STAR shows no price difference.

- Page 65—VEIC should include "Av Capacity" in the description of algorithm variables.

- Page 65—"Annual kWh table" – For ">25 to ≤ 35" under Federal Standard, the value should be 798 not 802, and the Savings should be 114 not 117.

13. ENERGY STAR Room Air Conditioner (RAC((Time of Sale)

- Page 67—Deemed lifetime is stated as 12 years, which is correct according to document cited, but this is an ENERGY STAR measure and ENERGY STAR states 9 years. The EDUs recommend using the ENERGY STAR lifetime.
- Page 68 - While the EDUs do agree that in any given locality, annual usage of room air conditioners (RAC) is lower than annual usage of central air conditioners (CAC), an Ohio study or a study from a similar climate zone should be used rather than assuming that the New England ratio of 0.31 for $Hours_{RAC}/Hours_{CAC}$ is appropriate for Ohio. Further, when one applies the draft TRM algorithm to the ENERGY STAR database for Room Air Conditioners, the RAC units with capacities ranging from 8000 Btu/Hr to 13,999 Btu/Hr and $EER_{base} \geq 9.8$ have average savings of:

    - 22.1 kWh/yr (rather than 18.7 kWh in draft TRM) for the 315 ENERGY STAR-qualified models.

    - 40.3 kWh/yr (rather than 26.8 kWh in draft TRM) for the five CEE-qualified models.

- Page 68 – Hours should be broken out by city. This would not be expected to be uniform across the state.

- Page 68 – The average size of replaced units (8,500 BtuH) appears low. ENERGY STAR uses 10,000 BtuH. In looking at the referenced study in footnote 155, we found BtuH per square foot, but did not see average size at the unit level. The EDUs recommend using the ENERGY STAR value of 10,000 BtuH.

14. ENERGY STAR RAC Replacement (Low Income, Early Replacement)

- Page 71 - While the EDUs do agree that in any given locality, annual usage of room air conditioners (RAC) is lower than annual usage of central air conditioners (CAC), an Ohio study or a study from a similar climate zone should be used rather than assuming that the New England ratio of 0.31 for $Hours_{RAC}/Hours_{CAC}$ is appropriate for Ohio. Further, when one applies the draft TRM algorithm to the ENERGY STAR database for Room Air Conditioners, the RAC units with capacities ranging from 8000 Btu/Hr to 13,999 Btu/Hr and $EER_{base} \geq 9.8$ have average savings of:

- 22.4 kWh/yr (rather than 18.7 kWh in draft TRM) for the 315 ENERGY STAR-qualified models.

- 86.9 kWh/yr (rather than 73.8 kWh in draft TRM) for the first three years of savings for those same 315 ENERGY STAR-qualified models.

- Page 71 – The average size of replaced units (8,500 BtuH) appears low. ENERGY STAR uses 10,000 BtuH. In looking at the referenced study in footnote 166, we found BtuH per square foot, but did not see average size at the unit level. The EDUs recommend using the ENERGY STAR value of 10,000 BtuH.

- Page 72—Deemed O&M cost is lacking justification for the 69% multiplier. For a low income program we disagree with this calculation method because the cost difference is $50 and this reduction is incongruent with barriers that face participants.

- Page 72— Hours should be broken out by city. This would not be expected to be uniform across the state.

15. ENERGY STAR Room Air Conditioner Recycling (Early Retirement)

- Page 74 - While the EDUs agree that in any given locality, annual usage of room air conditioners (RAC) is lower than annual usage of central air conditioners (CAC), an Ohio study or a study from a similar climate zone rather should be used rather than assuming that the New England ratio of 0.31 for $Hours_{RAC}/Hours_{CAC}$ is appropriate for Ohio. Further, when one applies the draft TRM algorithm to the ENERGY STAR database for Room Air Conditioners, the RAC units with capacities ranging from 8000 Btu/Hr to 13,999 Btu/Hr and $EER_{base} \geq 9.8$ have average savings of:

    - 138.7 kWh/yr (rather than 103.6 kWh in draft TRM) for the 315 ENERGY STAR models.

- Page 73—Deemed O&M Costs: This should be calculated as the measure cost plus incentive for the customer. The customer is not seeing these charges and therefore these figures do not apply. See also Vermont TRM, Mid-Atlantic TRM.

- Page 74—Hours should be broken out by city. This would not be expected to be uniform across the state.

- Page 74— The average size of replaced units (8,500 BtuH) appears low. ENERGY STAR uses 10,000 BtuH. In looking at the referenced study in footnote 177, we found BtuH per square foot, but did not see average size at the unit level. The EDUs recommend using the ENERGY STAR value of 10,000 BtuH.

16. Smart Strip Power Strip (Time of Sale)

- Page 76—The coincidence factor of 0.8 is unexpectedly high. The 0.8 seems to be reflecting the appliances plugged into the strip, not the savings associated with the strip itself. Northwest Council uses CF = 0.2 (www.nwcouncil.org/rtf/measures/com/PowerStripsFY10v1_0.xls). We recommend using the value of CF = 0.2.

- Page 76 – The four year lifetime is not consistent with the Commercial Smart Strip measures with a lifetime of eight years. If anything, it would be expected that the residential strip would get less use and therefore last longer. The EDUs recommend using the eight year lifetime.

- Page 77—Hours - This would be for home entertainment, but a different figure for a home office should be used, especially if someone works from home. This number coincides with the fact that the average household watches 4 hours of TV a day. The EDUs recommend VEIC develop a weighted average to account for home office use.

17. Central Air Conditioning (Early Replacement)

- Page 78 - More information should be given in this section regarding the types of heating and cooling systems that dictate the energy and demand savings values encountered in the reference tables. Not all of this information is available in Appendix A.

- Page 78 - Please include an early replacement calculation for heat pumps.

- Page 78 – It is extremely difficult to identify the HSPF value for older heat pumps. The EDUs propose a set ratio for HSPF based on the SEER values. Most small residential units should be rated in SEER rather than EER (although the ratio should still be the same because of the EER/SEER ratio).

18. Ground Source Heat Pumps (Time of Sale)

- Page 83 – The annual energy savings algorithm is missing "/1,000" in the first half of the algorithm.

19. Heat Pump Water Heaters (Time of Sale)

- Page 87 – n footnote 218, the phrase "Discretionary Usage Adjustment of 0.75%" appears to be incorrect, as it appears that VEIC meant to instead provide the value of 0.75 or 75%.

20. Low Flow Faucet Aerator (Time of Sale or Early Replacement)

- Page 89 – "Deemed Lifetime of Efficient Equipment" – As stated, five years is quite conservative. DEER Database suggests ten years, Vermont TRM (2008) suggests nine years. The EDUs suggest using the DEER value of ten years.

- Page 90 – the 50% value provided for "DR" or "percentage of water flowing down drain" should be replaced by a more appropriate value. The source report referenced in footnote 230 provides two values – 50% for kitchen faucets and 70% for bathroom faucets. The deemed savings algorithm on page 90 should include a weighted average of those values, such as 63% (assuming two bathroom faucets and one kitchen faucet).

21. Low Flow Showerhead (Time of Sale or Early Replacement)

- Page 93 – "Deemed Lifetime of Efficient Equipment" – As stated, five years is quite conservative. DEER Database suggests ten years, Vermont TRM (2008) suggests nine years. The EDUs suggest using the DEER value of ten years.

- Page 94 - Savings are based on a gas utility study of showerhead replacements, with the savings adjusted for the actual gpm savings relative to the gpm savings associated with the utility study. The TRM deems energy savings at 149 kWh/gpm reduction. An engineering calculation shows higher savings per gpm reduction (244 kWh) when using comparable inputs:

$$KWh = (GPD_{base}\text{-}GPD_{ee}) \times \text{delta T} \times 8.33 \times 365 / 3413 / \text{showers per home}$$

$$GPD_{base} = gpm_{base} \times \text{minutes/ shower} \times \text{showers per wk} / 7$$

$$GPD_{ee} = gpm_{ee} \times \text{minutes/ shower} \times \text{showers per wk} / 7$$

showers /wk	min/shower	Gpm base	Gpm ee	GPD base	GPD ee	delta T	showers per home	kWh
17.5	5	3	2	37.5	25	46	2.1	244

22. Domestic Hot Water Pipe Insulation (Retrofit)

- Page 98—TRM is inconsistent with Btu/kWh conversion. Here 3,413 is being used but previously 3,412 was. The conversion value of 3,412 Btu/kWh should be used consistently.
- Page 98—VEIC should resolve formatting issues at the bottom of the page.
- Page 98—The average recovery efficiency of a gas hot water heater should be 78.5% not 75% according to footnote 253 calculation.

23. Wall Insulation (Retrofit)

- Page 100 - The measure description notes that the auditor should collect heating system efficiency. VEIC may also want to note the auditor should also collect cooling system efficiency, as it is used in the cooling savings equations.

- Page 100 - Duke Energy Ohio suggests that the simulation approach from the Joint IOU TRM be used in lieu of the cooling degree hours calculation. Consultants can provide more combinations of initial and final R values for this measure to make the algorithm more general.

  The degree hour approach is a simple steady-state approach that misses much of the important dynamics of building energy use, including thermostat setback, time-varying internal loads, solar heat gains, and building thermal mass effects. The ASHRAE Handbook[19] states "When the indoor temperature is allowed to fluctuate or when interior gains vary, simple steady-state models must not be used."

  In one typical case investigated, the DOE-2 simulations provided energy savings > 3 times the kWh and kW savings and > 8 times the therm savings predicted by the degree hour approach in the TRM.

  For example, using the algorithms in the TRM for attic/roof/ceiling insulation:

Parameter	Value
Rexist	17.5
Rnew	30
CDH	7711
Area	1000
SEER	13
HDD	3992
nHeat	0.7
FLHcool	664
CF	0.5
kWh/1000 SF	10.6
kW / 1000SF	0.008
Therm / 1000 SF	3.3

  DOE-2 simulations using comparable inputs on the DEER prototypes returned 36.5 kWh/kSF, 0.026 kW/kSF and 27.9 therms/kSF.

  The algorithms require a site-specific estimate of heating system efficiency, which includes an estimated of the distribution system efficiency. Estimates of distribution system efficiency come from either a duct leakage test or visual inspection combined

[19] 2009 ASHRAE Handbook of Fundamentals, Chapter 19 – Energy Estimating and Modeling Methods, pg 19-17. The opening paragraph in the section on System Modeling/Degree-day and Bin Methods describes this limitation.

with the BPI lookup tables on distribution efficiency. Furnace efficiency is estimated from the nameplate AFUE or from a combustion test. This level of data collection is too onerous for a prescriptive rebate measure. There is no guidance provided on cooling system efficiency, for either the air conditioner (or heat pump) or the duct system.

- Page 102—If the modeling approach is not used, the Average Net Heating value should be clarified. The current description is vague and leaves too much room for interpretation by customers or contractors and may skew data. VEIC should consider creating constants for people to use or calculations for when there are more than one type of heating system.

24. Air Sealing – Reduce Infiltration (Retrofit)

- Page 104 - The energy savings associated with infiltration reduction accounts for sensible heat gains only. Humidity and the impact on latent cooling should also be included to capture the impacts of moisture from infiltration on the cooling loads. The simulation models, with results normalized per cfm reduction, can be used to estimate the savings per cfm accounting for both sensible and latent loads. We recommend the simulation models be used rather than the calculations in the TRM.

- Page 105—The EDUs could not find the LBNL document that shows the N-Factor conversion. Please provide this analysis.
- Page 105—The conversion of 1,000 W to 1 kW should be defined in the calculation of savings.

- Page 105 - The n-factor is defined on page 105 as 29.4 for space cooling, but the space heating calculation uses an n-factor of 17.8 on page 107 without re-defining the value.

25. ENERGY STAR Windows (Time of Sale)

- Page 115 – Savings from the ENERGY STAR windows vary by which direction they are facing, i.e., south-facing windows will save significantly save more than will north-facing windows. The EDUs recommend adding solar radiation factors to VEIC's algorithm, to calculate total solar radiation (direct versus diffused) as a function of window orientation.

- Page 115 – The EDUs could not find the source cited for deemed measure cost in footnote 290.

- Page 115 – No source was listed for the baseline window u-value of 0.49, which doesn't conform to Ohio residential energy code. Baseline u-values should be 0.35 (Ohio code for CZ5) or 0.40 (Ohio code for CZ4)[20].

26. Residential Two Speed / Variable Speed Pool Pumps (Time of Sale)

[20] Table 1102.1 in the Residential Code of Ohio

- Page 118—The EDUs could not find the coincidence factor cited in the Efficiency Vermont document in footnote 302.

- Pages 118 and 119—The EDUs could not locate the document in footnotes 303 and 305 to verify kWh savings figures used.

27. Residential Premium Efficiency Pool Pump Motor (Time of Sale)

- Page 120—We would like a reference for the Deemed Lifetime estimation.

- Page 120—We could not verify CF without the reference cited in footnote 308.

- Page 121 - A typo was noted:

  "ηPumpBase = Efficiency of premium efficiency motor" should instead be:

  "ηPumpBase = Efficiency of baseline motor"

- Page 121—VEIC should provide supporting documentation for assumptions used. For example, where did motor efficiencies come from? These are not the efficiencies for an EPACT standard 1.5HP motor, nor a NEMA Premium 1.5HP motor. It appears this may be the combined motor and pump efficiency, but there is no mention of this or derivation of the results.

28. Water Heaters (Time of Sale)

- Page 123 - It is not clear why this measure provides savings and assumptions for gas water heaters only. This measure should show savings for the option of efficient electric water heaters as well.

- Page 124—VEIC should provide the document cited in footnote 319 for BtuHWusage.

- Page 124 - The minimum efficiency of a federal standard gas water heater should be 0.594, not 0.58.

29. Programmable Thermostats (Time of Sale, Direct Install)

- Page 125 - The TRM assigns zero savings for air conditioners controlled by programmable thermostats. Although we realize there is a lack of data on programmable thermostats in cooling applications, the savings are likely not zero. Recent simulations conducted for Duke Energy provided a value of 53 kWh/ton for a 3°F setback from 11 p.m. to 6 a.m. in Cincinnati. The Pennsylvania PUC will issue a TRM update soon which will include a programmable thermostat measure. This measure includes a 2% ESF for cooling savings based on a DEER 2005 report (2004 SCE report "Programmable Thermostats Installed into Residential Buildings: Predicting Energy Saving Using

Occupant Behavior & Simulation"). This value is based on combining usage from a RASS analysis with DOE2 simulation results. The cooling savings for climate zone 16 (most comparable to OH) was around 2%.

Until such time as an OH simulation model is developed to predict energy savings for cooling, we recommend including a conservative 2% cooling energy savings for programmable thermostats based on this report.

- Page 126—VEIC should include definitions for the algorithm used.

30. Condensing Furnaces – Residential (Time of Sale)

- Page 127 - High efficiency furnaces are assigned an electricity savings when an EC motor is included in the commercial section. Electricity savings for condensing furnaces with EC motors in residential applications should also be included.

31. Water Heater Wrap (Direct Install)

- Page 131 – The TRM lists the base EF at 0.86. Federal efficiency standards for electric water heaters were 0.864 in 1990 but were increased to 0.904 in 2004. Ohio's water heater EF standard is (0.97-0.00132*volume), which would be 0.917 for a 40 gallon tank and 0.904 for a 50 gallon tank. The value of 0.86 would be appropriate for 80-gallon tanks, but these are not representative of the average population. A baseline EF value of 0.904 would be more appropriate.

- Page 132 – The annual energy use of 3,460 kWh by electric water heaters seems low, and most likely applies to a small tank on the order of 40 gallon capacity. The California Energy Commission puts the average value closer to 4,900 kWh (http://www.consumerenergycenter.org/home/appliances/waterheaters.html), which is also closer to the value used for solar hot water heaters in the next section of the Ohio TRM. This is again confirmed by other sources for an average water heater (~60 gal capacity) (http://www.wapa.gov/es/pubs/fctsheet/WaterHeating.pdf). The EDUs recommend adjusting the annual energy usage to at least the 4,395 kWh used for the solar water heater section. The deemed savings for this measure would have to be adjusted to account for this.

32. Solar Water Heater with Electric Backup (Retrofit)

- Page 133 - A solar water heater cannot provide 100% of hot water needs in most households, unless it is an atypical, oversized solar thermal system with a very large, well insulated storage tank. It is not clear whether the energy-savings algorithm has accounted for the annual hours that the Solar Water Heater is not able to meet the hot water demand. Therefore the energy-savings algorithm should be clarified and/or expanded to ensure it accounts for the hours per year that a Solar Water Heater does not keep up with the residential hot water demand.

33. Residential New Construction

- Page 136 - Accredited software may not have all requisite features needed for the Ohio market such as climate zones, weather data for sizing and peak demand calculations and/or construction practices. ADM recommends expanding the definition of qualified software to include enhancements to currently approved software that have demonstrated compliance with the BESTEST evaluation.

  For multifamily residences, REM/Rate does not appropriately address the baseline reference home. Either a user-defined multifamily baseline must be developed, or a custom version of the software must be developed specifically for the multifamily market. The EDUs recommend developing a user-defined reference home for immediate use, then over the longer term incorporate the user-defined reference home into a custom version of the software.

- Page 137 – Under "Energy Savings" – it is stated that savings for RNC will be "linearly adjusted based on floor area" from savings calculations of the model home. This seems appropriate for lighting and HVAC (including insulation) measures. However, it should not be assumed that savings from appliances and water measures scale linearly based on floor space.

B. Commercial and Industrial

Respondents hereby present their specific and technical objections and comments to the Commercial and Industriall Measures contained in the TRM.

1. Electric Chiller (Time of Sale) – (146)

- Page 147 – The cooling EFLH data on page 147 were developed for a single building type, which is a large office. The EDUs would like to expand the table by providing cooling EFLH data for additional buildings with built-up HVAC systems: Hospital, Hotel, Large Multistory Retail, and University. Data for these additional building types will be developed using existing prototypes customized for Ohio construction practices and run for the seven Ohio cities. The runs could be completed, and data provided to VEIC on request.

2. C&I Lighting Controls (Time of Sale, Retrofit) – (149)

- Page 150 – Coincidence Factors for occupancy sensors appear low. Wisconsin TRM uses CF's between 0.64 and 0.77.

  "HOURS" should be defined as annual operating hours instead of total operating hours. To improve the accuracy of impact estimates, we recommend using site-specific values

for "HOURS" – if known – and also adding several, more specific categories of buildings. Following is the full list of building types for which we recommend providing distinct annual hours of operation.

Building Types (Full List Recommended by Ohio Utilities)

- Daycare
- Education-Primary School
- Education-Secondary School
- Education-Community College
- Education-University
- Exterior
- Food Sales
- Food Service
- Grocery
- Hospitals
- Industrial-1 Shift
- Industrial-2 Shift
- Industrial-3 Shift
- Industrial-8760 hours
- Lodging-Hotel Guest Rooms
- Lodging-Hotel Common Spaces
- Manufacturing-Light Industrial
- Medical-Clinic
- Office-Large
- Office-Small
- Other
- Parking Garage
- Police/Fire Stations
- Public Assembly
- Public Services (nonfood)
- Restaurant-Sit Down
- Restaurant-Fast Food
- Retail-3-story Large
- Retail-Single-story Large
- Retail-Small
- Storage Conditioned
- Storage Unconditioned
- Warehouse

- Page 151 – The ESF table should be reviewed. The Wisconsin TRM uses 41% for Occupancy Sensors and 40% for Daylight controls. Many of these vary greatly by building type. A chart showing savings by building type and sensor type would be more reliable.

- Page 152 – "Fossil Fuel Impact Descriptions and Calculations" – It is unclear whether the IF_{MMBtu} factor includes a conversion from kWh to MMBtu. If not, a conversion factor of 0.003412 MMBtu/kWh should be included to convert from kWh to MMBtu.

3. Lighting Systems, Non-Controls (Time of Sale, New Construction) – (153)

- Page 153 – There does not seem to be any benefit to the use of a single multiplier to calculate savings for CFLs. The tracking of wattage is necessary already to apply the Delta Watts Multiplier for different years. The TRM should deem the baseline wattage for the three CFL wattage categories and use the actual ΔW to derive 3 deemed savings values This eliminates the need to evaluate whether the distribution of CFL wattages in the program was similar to the assumed distribution and apply a realization rate if they were different.

- Page 154 – "Deemed O&M Cost Adjustment Calculation for Compact Fluorescent Lamps" – the link does not lead to appropriate document.

- Page 155 – See page 153 comment above regarding CFL savings multiplier.

- Page 156 – The High Bay Fluorescent Fixtures measure limits the baseline to only a "metal halide system." This should be expanded to allow other baselines that may be in place, but which are less efficient than the replacement fluorescents.

- Page 156 – "Deemed Calculation for High Bay Fluorescent Fixtures" – add "%" character after 88 for ballast efficiency.

- Pages 156-157 – Correct formatting to eliminate excessive white space.

- Page 158 – "Baseline Adjustment" – need to correct formatting error.

- Page 158 – While the rationale for the "Baseline Adjustment" section is appropriate, it should not be applied to this measure. For New Construction the appropriate baseline is Electronic T8s as is listed in Table 5 on page 166. This would result in the full measure life of 15 years as opposed to the reduced 7 year lifetime. This section should be moved to the Lighting Systems (Non-Controls) (Early Replacement, Retrofit) measure and the measure life for "High Efficiency Linear Fluorescent Fixtures – 4ft lamps" should be corrected to read 15 years.

  Current code maximum lighting power densities effectively require the use of electronic ballasts for new construction projects. Therefore Resondents recommend that the baseline for 4' linear fluorescent ballasts be electronic for New Construction and Substantial Renovation measures. For Natural Equipment Replacement and Retrofit measures, the baseline ballast should be magnetic until 2014, at which time a baseline

adjustment should be made which adjusts the baseline to electronic ballasts over a period of 4-5 years.

- Page 159 – Measure life for High Efficiency Linear Fluorescent Fixtures – 4ft lamps should be adjusted to 15 years. See the comment above for page 158 regarding baseline adjustment.

- Page 160 – Coincidence Factor for Hotel/Motel should be separated out for common areas and guest rooms. Common areas should have a CF closer to 1.0.

- Page 161 – "WATTSee" – spelled incorrectly when defined in "Reference Section".

- Page 161 – "HOURS" should be defined as annual operating hours instead of total operating hours.

- Page 161 – See comments above (referencing pages 150-151) in which Respondents recommend expanding the "HOURS" table.

- Page 163 – "Fossil Fuel Impact Descriptions and Calculations" – it is unclear whether the IF_{MMBtu} factor includes a conversion from kWh to MMBtu. If not, a conversion factor of 0.003412 MMBtu/kWh should be included to convert from kWh to MMBtu.

- Page 165 – Some of the baseline wattages for the high bay lighting appear to be more representative of standard metal halide fixtures rather than pulse start fixtures. Verify baseline wattages are correct.

- Page 167 – Tables 6 and 7 have very few baseline configurations. These tables should be expanded to cover more configurations.

- Page 168 – "Referenced Documents" – adjust formatting.

4. Lighting Systems, Non-Controls (Early Replacement, Retrofit) – (169)

- General question for this measure – If a lamp has burnt out, but the lamp/ballast/fixture is replaced, it would qualify as a retrofit or early replacement; whereas if the ballast burned out, the replace-on-burnout protocol is used. Is this a correct interpretation of the intended protocol for this measure?

  The Respondents understand the reasoning for the discounted lifetime, Pulse Start Metal Halide measure, and agree that the code change must be addressed. The Respondents encourage VEIC to take the analysis a bit further:

  Our experience shows that in many cases lighting retrofits cause energy savings in two ways. First, the new fixtures are more efficient than the old; second, the new fixtures often have a lower output than old fixtures. This may be due to lower lumen output per fixture, or due to fewer fixtures than previously installed. In these situations, the

component of the energy savings that is attributable to "delumination" can be expected to persist for the typical 15 years, while the portion of the savings associated with improved luminous efficacy should be discounted to 7.5 years.

- Page 169 – This measure should apply the baseline shift as described on page 158 of the Lighting Systems (Non-Controls) (Time of Sale, New Construction) measure. The measure life for High Efficiency Linear Fluorescent Fixtures should be adjusted to 7 years.

  For Natural Equipment Replacement and Retrofit measures, we recommend a magnetic ballast baseline for "High Efficiency Linear Fluorescent Fixtures – 4ft lamps" initially with a baseline shift to electronic ballast over time as described in the "Lighting Systems (Non-Controls) (Time of Sale, New Construction)" measure. This would be based on assumed remaining life of currently installed magnetic ballasts. Although magnetic ballasts have a fairly long EUL, the Energy Policy Act stops the sale of virtually all 4' T12 lamps as of July 14, 2012.

  Per the draft TRM, "Assuming a typical lamp has a lifetime of 18,000 hours and is operated 3,730 hours per year, new lamps installed shortly before the impending federal standards take effect will need to be replaced in mid-2017, indicating that savings should be claimed for only 7 years for measures installed in 2010." At that time, all T12 lamps and ballasts will be required to be upgraded because replacement lamps will not be available. The EUL would be reduced by 1 year each year. For example, in 2013 the remaining EUL for a magnetic ballast would be four years. The last year a magnetic ballast could be considered for retrofit would be 2017. It is recognized that not all T12 lamps will have been replaced shortly before the July 14, 2012 phase out of T12 lamps. It is likely that a portion of T12 lamps will burn out each year starting 2013 and will need to be upgraded to then currently available lamp and ballast combinations, with all lamps finally burning out in 2017. It may be justified to reduce the baseline wattage by a fractional amount each year from 2013 to 2017 until the T8 baseline wattage is reached in 2017.[21]

- Page 170 – Coincidence factor – Is the CF for Hotel/Motel based on the load shape for guest rooms? There are opportunities for lighting upgrades in hotel common areas that are over 6000 hours/year, i.e., the CF for common-area lights is much higher than 0.37.

- Page 171 – See comments above (referencing pages 150-151) in which we recommend expanding the "HOURS" table.

[21] As discussed herein, Respondents believe that the "as found" method should be used as the benchmark. However, should the TRM maintain this provision, it should be modified as indicated.

The exterior lighting value of 3833 is low. Data from monitored photocell-controlled lighting indicates approximately 4300 hours, which is also used in Pennsylvania TRM.

- Page 172 – "Fossil Fuel Impact Descriptions and Calculations" – it is unclear whether the IF_{MMBtu} factor includes a conversion from kWh to MMBtu. If not, a conversion factor of 0.003412 MMBtu/kWh should be included to convert from kWh to MMBtu.

- Page 173 – For Table 8, page 173 baseline & efficient wattages, Respondents have a general question. Is each line meant to represent a specific scenario of baseline and efficient lights, or is the table to be used to estimate the wattage of a specified fixture? The table is very useful if the latter interpretation is correct. However, the table would be inadequate to handle the variety of rebates expected to come through the prescriptive lighting program. In other words, is it possible to take baseline from line 4 and measure from line 3, if those are the nearest matching baseline and measure fixture types?

  Respondents recommend the following changes for high-bay fixtures:

  - Change the baseline for a 2 lamp HO T-5 from 150 W MH to a 175 W MH
  - Change the baseline for a 3 lamp 4ft T-8 from 150 W MH to a 175 W MH

- Page 174 – Table 8, High Bay, MHT, CMH, Delamp, is missing several common baseline options.

  HEF should include 48" T12 Magnetic – STD ballasts as well for early replacement projects. The measure lifetime would be 7 years and degrade annually.

5. Lighting Power Density Reduction (New Construction) – (176)

- Page 176 – Description includes mention of various control strategies; however, the measure does not include these controls. Mention of controls should be removed from this paragraph.

- Page 178 – "Summer Coincident Peak Demand Savings" equation within the "Reference Section" does not match the deemed savings equation on page 176, which is the correct equation. The equation on page 178 needs to be multiplied by the "AREA" term to determine total savings.

- Page 178 – See comments above (referencing pages 150-151) in which Respondents recommend expanding the "HOURS" table.

6. LED Case Lighting With/Without Motion Sensors (New Construction; Retrofit – Early Replacement) – (180)

- Page 180 – Coincidence factor of 92% – This value is apparently from the lighting coincidence factor table in the referenced report, but for retail case lighting the

appropriate CF value is 100%. In the ETCC study referenced for other assumptions in this measure, the authors noted "The recorded data support that the lighting operates continuously at regularly scheduled intervals, for approximately 17 hours per day." That seems to be making the case for 100%, or CF = 1.

- Page 181 – The fixture wattage table is poorly supported. The fixture wattages appear high in general or at least do not represent an average of expected fluorescent options or LED options. Include detailed calculations and assumptions for how the fixture wattages were determined.

- Page 182 – There is no demand savings factor shown in the ΔkW formula. There should be a savings factor for demand.

7. LED Exit Signs (Retrofit) – (183)

- Page 183 – The measure makes an assumption that all existing exit signs are fluorescent models. This is an unrealistic assumption. There are many incandescent exit signs which still need retrofits. The measure should be updated to include savings for incandescent lamps. The Wisconsin TRM assumes incandescent exit signs are 90% of existing stock. See Wisconsin TRM for assumptions.

- Page 183 – Energy Savings formula for ΔkWh should be adjusted to be consistent with other measures. It should read:

$$\Delta kWh = kWsave \times HOURS \times ISR \times (1 + WHFe)$$

The WHFe factor should be adjusted accordingly.

- Page 184 – Demand Savings formula for ΔkW should be adjusted to be consistent with other measures. It should read:

$$\Delta kW = kWsave \times ISR \times (1 + WHFd)$$

The WHFd factor should be adjusted accordingly.

- Page 184 – Why would the WHFe and WHFd factors not be based on similar assumptions as the other Lighting (non-controls) measures? The WHFe would then be:

$$WHFe = (0.5 * 0.095 \text{ (conditioned)} + 0.5 * 0.0 \text{ (non-conditioned)}) = 0.0475$$

And WHFd would be:

$$WHFd = (0.5 * 0.2 \text{ (conditioned)} + 0.5 * 0.0 \text{ (non-conditioned)}) = 0.1$$

- Page 184 – The kWsave value should be adjusted to account for incandescent fixtures.

8. Traffic Signals (Retrofit) – (185)

- Page 185 – Replace "baseline" with "efficient" when defining W_{eff} for both "Energy Savings" and "Summer Coincident Peak Demand Savings".

- Page 187 – "Traffic Signal Technology Equivalencies" table should be updated to include a demand savings (kW) column.

- Page 187 – Missing Red Arrows fixture type.

  Consider either using actual wattages from the installed models, if available, or default to ENERGY STAR, which has higher wattages for qualifying LED lights and would thus be more conservative (http://www.energystar.gov/ia/partners/product_specs/eligibility/traffic_elig.pdf).

9. Light Tube Commercial Skylight (Time of Sale) – (189)

- Page 189 – "Annual kWh savings" equation needs to be corrected for both the "Deemed Savings for this Measure" section and the "Energy Savings" section. The equation should be multiplied by "NumFixtures" for both cases to obtain:

  $$Annual\ kWh\ Savings = NumFixtures * kW_f * 2400$$

  The term NumFixtures should also be properly defined in the "Reference Section".

  A reference should be provided for the EFLH value of 2400.

10. Energy Star Room Air Conditioner, Commercial Use (Time of Sale) – (191)

- Pages 191-192 – All energy and demand savings equations in this section should be divided by 1000 W/kW. The units of EER are Btu/W*h which would lead to an overall result of W*h for energy and W for demand.

11. Single-Package and Split System Unitary Air Conditioners (Time of Sale, New Construction) – (194)

- Pages 195-196 – Recommend adding a Rated Load Factor (RLF) for all formulas to compensate for oversizing of equipment during design. Typical value is RLF = 0.80. See Engineering Methods for Estimating the Impacts of Demand-Side Management Programs; Volume 2: Fundamental Equations for Residential and Commercial End Uses. Prepared by AEC and Hagler Bailly, Inc.

12. Heat Pump Systems (Time of Sale, New Construction) – (197)

- Pages 197-198 – To appropriately use the savings algorithms and efficiencies based on IECC 2006, the text under the "Deemed Calculation for this Measure" and "Energy Savings" sections should be modified to read:

  "For *air-cooled* units with cooling capacities less than 65 kBtu/h..."

  "For *air-cooled* units with cooling capacities equal to or greater than 65 kBtu/h, *and all other units*..."

- Pages 197-200 – Recommend adding a Rated Load Factor (RLF) for all formulas to compensate for oversizing of equipment during design. A typical value is RLF = 0.80. See Engineering Methods for Estimating the Impacts of Demand-Side Management Programs; Volume2: Fundamental Equations for Residential and Commercial End Uses. Prepared by AEC and Hagler Bailly, Inc.

- Page 199 – $EFLH_{cool}$ and $EFLH_{heat}$ should be studied in Ohio. Respondents would also like to review assumptions and input values pertaining to the "prototypical small commercial building simulation runs" referenced in footnote 504.

13. Outside Air Economizer with Dual Enthalpy Sensors (Time of Sale, Retrofit – New Equipment) – (201)

- Page 201 – $400 incremental cost – In utilities' Ohio TRM, this is $170/ton, which would be consistent with how the savings are calculated (kWh/ton), and are derived from DEER database. Given that measure capacity could vary from three to 20 tons, Respondents would prefer that VEIC describe the rationale for using a flat incremental cost of $400.

- Page 202 – The dual Enthalpy Economizer Savings table should be expanded to include additional building types, or at a minimum to include an "other" category.

14. Chilled Water Reset Controls (Retrofit – New Equipment) – (204)

- Page 204 – This measure is effective for a large commercial facility and the project description states that the measure is for larger commercial facilities. However, footnote 513 on page 206 states that the savings value is based on a series of simulation runs using a small commercial building model; is this a typo, or was the wrong building model used?

- Page 206 – Please clarify that the ΔkW_{ton} defaults in Table 9 are indeed showing an increase in electrical demand.

15. Variable Frequency Drives for HVAC Applications (Time of Sale, Retrofit – New Equipment) – (207)

- Pages 207-208 – Consider modifying all energy and demand equations in this section to be based on HP. This would require a modification to the formulas as follows:

$$Annual\ kWh\ Savings = \frac{HP * 0.746 * RLF}{\eta_{motor}} * HOURS * ESF$$

$$\textbf{Summer Coincident Peak kW Savings} = (HP * 0.746 * RLF)/\eta\_motor * DSF$$

- Page 208 – HOURS table should vary by Building Type in addition to the pump type. The hours for hot water pump run time seem high. They should be related to building type and full load heating hours. Chilled water FLHs should also be relative to the building type. These data are captured in other tables in both the Ohio TRM and VEIC documents. The same comments apply to fan FLHs.

  A note on the example VFD calculations for kWh and kW using a 5 BHP pump with 95% efficiency. The input efficiency for the example is unrealistic, and VEIC may want to consider using a more reasonable value instead. For a 5 HP motor, a PE required motor efficiency for rebates is 89.5%.

  HVAC pump and HVAC fan VFD savings factors – Clarification on how these numbers were derived would be useful. Were they determined from an energy model or data logging experience?

- Pages 207-209 – The algorithms presented in this section provide savings that are significantly below Duke evaluation study results for HVAC fans. For example, using the TRM calculations for a VFD applied to an air handler with a forward-curved inlet guide vane fan gives savings on the order of 385 kWh/hp. Duke evaluated a C&I program in Ohio using short-term monitoring of VFDs in building fan applications, and estimated an average savings of 1250 kWh/hp.[22] The savings for the air foil/ backward curved fan with inlet vanes is very close to the evaluation study estimate (on the order of 1485 kWh/hp). Respondents believe the ESF for the forward-curved inlet guide vane fan is too low.

  The algorithm for VFDs applied to chilled water pumps also predicts savings that appear to be low. The HOURS value in the table on the top of page 208 shows 1852 hours for chilled water pumps. Using the ESF of 0.432 on the top of page 209 results in an energy savings of 842 kWh/hp. Most chilled water plants operate year round, so the 1852 hours appears low. Recent simulations conducted for Duke Energy resulted in energy savings on the order of 3500 kWh/hp; which is similar to the value computed for hot water pumps using the TRM equations (3044 kWh/hp).

16. Cool Roof (Retrofit – New Equipment) – (210)

More information should be given in this section regarding the types of heating and cooling systems that dictate the energy and demand savings values encountered in the reference tables. Not all of this information is available in Appendix A.

[22] An Evaluation of the Commercial and Industrial Incentive Program in Ohio. Results of a Process and Impact Evaluation. Prepared by Tecmarket Works and BuildingMetrics, September, 2008.

- Page 210 – It should be noted in the Description that the measure is for Low-Slope roofs with roof slope $\leq 2/12$.

- Page 210 – The measure should be based on solar reflectance and emittance rather than just solar absorptance. The DOE, ENERGY STAR and Cool Roof Rating Council all use solar reflectance and emittance, or SRI values.

- Page 211 – Definition of ΔkWh_{kSF} in "Reference Section" should be per 1000 square feet, not 100.

- Page 211 – Example of energy savings should result in 184 kWh, not 192.

- Page 211 – The column heading for the 4th column in the Reference Table starting on page 211 should read ΔkW_{kSF}, not ΔkWh_{kSF}.

- Page 211 – VEIC should allow review of assumptions and input values pertaining to its "prototypical small commercial building simulation runs" referenced in footnote 524, to enable Respondents and evaluators to check values used for "unit energy savings per 100 square feet of roof area" (ΔkWh_{100SF}) and "unit demand savings per 100 square feet of roof area" (ΔkW_{100SF}).

- Page 212 – The Cool Roof table should be expanded to include additional building types, or at a minimum to include an "other" category.

17. Commercial Window Film (Retrofit – New Equipment) – (214)

- Page 214 – Please verify whether double-pane clear glass is a valid baseline, i.e., is it representative of Ohio building stock?

- Page 214 – More information should be given in this section regarding the types of heating and cooling systems that dictate the energy and demand savings values encountered in the reference tables. Not all of this information is available in Appendix A.215 – Correct typo in "Fossil Fuel Impact" to refer to table below instead of above.

- Page 215 – Respondents would like to review assumptions and input values pertaining to the VEIC "prototypical small commercial building simulation runs" referenced in footnote 528, to enable evaluators to check values used for "unit energy savings per 100 square feet of window film" (ΔkWh_{kSF}) and "unit demand savings per 100 square feet of window film" (ΔkW_{kSF}).

18. Roof Insulation (Retrofit – New Equipment) – (218)

More information should be given in this section regarding the types of heating and cooling systems that dictate the energy and demand savings values encountered in the reference tables. Not all of this information is available in Appendix A.

- Page 218 – "Definition of Efficient Equipment" – The assumption of R-18 as the efficient condition appears low. This does not even bring the roof assembly up to code. It is not clear whether this value represent assembly R-value or insulation R-value. Provide clarification as to which it is.
- Page 218 – "Definition of Baseline Equipment" - Provide a citation for source of baseline R-values in the table. It is not clear whether these values represent assembly R-values or insulation R-values. Provide clarification as to which it is.
- Page 219 – Respondents would like to review assumptions and input values pertaining to the VEIC "prototypical small commercial building simulation runs" referenced in footnote 532, to enable evaluators to check values used for "unit energy savings per 1,000 square feet of roof area" (ΔkWh_{kSF}) and "unit demand savings per 1,000 square feet of roof area" (ΔkW_{kSF}).
- Page 220 – The Roof Insulation table should be expanded to include additional building types, or at a minimum to include an "other" category.

19. High Performance Glazing (Retrofit – Early Replacement) – (222)

- Page 222 – More information should be given in this section regarding the types of heating and cooling systems that dictate the energy and demand savings values encountered in the reference tables. Not all of this information is available in Appendix A.
- Page 222 – "Definition of Efficient Equipment" – The efficient U-value of 0.57 does not even meet the Ohio code U-Value of 0.55. Verify whether it is the intent of this measure to at a minimum meet code.
- Page 222 – Please verify whether double-pane clear glass is a valid baseline, i.e., is it representative of Ohio building stock?
- Page 223 – Respondents would like to review assumptions and input values pertaining to the VEIC "prototypical small commercial building simulation runs" referenced in footnote 536, to enable evaluators to check values used for "unit energy savings per 100 square feet of window space" (ΔkWh_{kSF}) and "unit demand savings per 100 square feet of window space" (ΔkW_{kSF}).
- Page 224 – The High Performance Windows table should be expanded to include additional building types, or at a minimum to include an "other" category.

20. Engineered Nozzles (Time of Sale, Retrofit – Early Replacement) – (226)

- Page 226 – To enable us to complete our review of this measure, please provide the referenced file entitled "Compressed Air Analysis.xls" (see footnote 540 on page 226 of the draft Ohio TRM).

- Page 226 – The units do not appear to be correct in the energy equations under sections "Deemed Savings for this Measure" and "Reference Section." Clarify whether there the kWscfm units are kW/cf or kW/cfm. If the units are indeed kW/cf, then the equations do not have the proper units. If they are kW/cfm, then the units are ok.

- Page 226 – References for footnotes 539 and 540 could not be found. These are needed to verify assumptions.

- Page 227 – The CF is based on an assumption of peak period 4p-5p. This is a much tighter period than all other measures (3p-6p) and is likely leading to an overly high CF.

- Page 228 – Footnote 541 needs full citation.

- Page 228 – Footnote 543 is a somewhat unsubstantiated assumption. Additional documentation should be found to support the assumption.

21. Insulated Pellet Dryers (Retrofit) – (228)

- Page 228 – "Definition of Efficient Equipment" should specify the minimum insulation levels that the deemed savings are based on.

- Page 229 – "Energy Savings" – ΔkWh is defined as "non-coincident demand savings", and should be defined as annual energy savings.

- Page 229 – Unable to find reference in footnote 548.

- Page 230 – Provide reference or assumptions used to develop table values

22. Injecting Molding Barrel Wrap (Retrofit – New Equipment) – (231)

- Page 231 – "Deemed Savings for this Measure" – equation for "Summer Coincident Peak kW Savings" needs to be multiplied by the CF.

- Page 231 – Unable to locate reference in footnote 550.

23. Energy Star Hot Food Holding Cabinet (Time of Sale) – (234)

- Page 234 – Unable to locate CF in source given in footnote 555.

"Reference Section" – "Energy Savings" equation should be divided by 1000 instead of multiplied by 1000 to covert from W to kW. This also needs to be changed in demand

equation on p. 235. The calculations for deemed savings were carried out correctly, however the typos appear in the equation.

In general, the method here is inconsistent with the other measures due to the intermediate step of computing kW_{save} for both energy and demand. Consider consolidating these equations by removing the intermediate step and multiplying by "HOURS" for energy and "CF" for demand.

- Page 235 – In the table, the $W_{foot\ base}$ and $W_{foot\ eff}$ values are not consistent with the assumptions stated in the "Definition of baseline equipment" and "Definition of efficient equipment" sections. The ES Calculator uses the following values:

	Full Size	¾ Size	Half Size
$W_{foot\ base}$	125 W/ft^3	125 W/ft^3	125 W/ft^3
$W_{foot\ eff}$	40 W/ft^3	40 W/ft^3	40W/ft^3

Default savings should be adjusted to match any updated assumptions.

- Page 235 – Clean up formatting, realign: (also look throughout the document as this occurs periodially).

HOURS = Annual operating hours

$W_{foot\ base}$ = the electrical demand per cubic foot of the baseline equpiment

24. Steam Cookers (Time of Sale) – (236)

- Page 236 – It seems that the title of this measure should be changed to ENERGY STAR Steam Cookers, as all content pertains to ENERGY STAR devices.

- Page 236 – In Description Section, first sentence, the word "label" should be added after ENERGY STAR.

- Page 236 – Incremental cost does not match the ENERGY STAR database, which states an incremental cost in excess of $5000. Unable to access NYSERDA database to verify $2000 figure.
www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_Commercial_Steam_Cooker.xls - 2009-06-09

- Page 236 – Unable to find reference for footnote 560.

- Page 237 – The value for E_{FOOD} should be 0.0308, not 0.038.

- Page 238 – "Reference Tables" – The Idle Energy Rates for Efficient models in the table do not match the ENERGY STAR website. The Heavy Load Cooking Energy efficiency also does not seem to match ES. Verify all values in the table are correct. Please see for

correct values: http://www.energystar.gov/index.cfm?c=steamcookers.pr_crit_steamcookers.

25. Energy Star Fryers (Time of Sale) – (239)

- Page 239 – Footnote 569 leads to calculator for combination oven, not fryer. Should reference: http://www.fishnick.com/saveenergy/tools/calculators/efryercalc.php.
- Page 239 – Footnote 571 refers to a lighting study for the fryer CF.
- Page 239 – "Reference Section" – "IDLE" should be divided by 1000 W/kW to be compatible with the rest of this equation.
- Page 240 – EFLH is given as 4380, which amounts to 12 hrs/day for 365 days per year. On page 239 HOURS are 16 hrs/day for 365 days per year, which would be 5840.
- Page 240 – Footnote 575 should reference: www.fishnick.com/saveenergy/tools/calculators/efryercalc.php.

26. Combination Oven (Time of Sale) – (241)

- Page 241 – Provide more complete citation for "NYSERDA Deemed Savings Database" in footnote 578.
- Page 241 – The CF is referenced to a lighting study in footnote 579.
- Page 242 – The default values from the FSTC calculator do not appear to be representative of actual default operating conditions. The PRE_{Energy}, IDLE, and EFF values do not match EFF's from various performance reports for combination ovens available on the FSTC website. The LB assumption of 200 pounds does not seem to be appropriate either. These values need more support.

27. Convection Oven (Time of Sale) – (244)

- Page 244 – It seems that the title of this measure should be changed to ENERGY STAR Convection Oven, as all content pertains to ENERGY STAR devices.

28. Energy Star Griddle (Time of Sale) – (247)

- Pages 247-248 – Energy savings per year should be 1,797 kWh (rather than the 6,996 kWh value that results from using the incorrect assumptions provided in the draft TRM).

The 1,797 kWh value was derived by assuming the following values for baseline and efficient equipment, based on the calculation spreadsheet and underlying assumptions provided by Energy Star[23] – see Energy Star calculation spreadsheet, second tab[24].

Specification	Baseline	Efficient
Idle Energy Rate (kW/sqft)	0.4	0.36
Production Capacity (lb/h/sqft)	5.8	6.7
Preheat energy rate (kW/hr/sqft)	2.7	1.3
Heavy Load Cooking Energy Efficiency	65%	70%

The draft TRM for Ohio appears to be using 3ft x 2ft griddle as the standard griddle surface area. If so, the correct table value for OH TRM efficient griddle performance metrics would be the following.

Specification	Baseline	Efficient
Idle Energy Rate (kW)	2.40	2,16
Production Capacity (lb/h)	34.8	40.2
Preheat energy rate (kW)	4.1	2.0
Heavy Load Cooking Energy Efficiency	65%	70%

Based on these corrected values, the savings should be 1,797.3 kWh (i.e., the difference between 17,077.6 kWh for the base case and 15,280.4 kWh for the Energy Star griddle).

29. Spray Nozzles for Food Service (Retrofit) – (250)

- Pages 250-251 – "Annual kWh Savings" equations need to be corrected. They should be divided by 3412 Btu/kWh in order to obtain a savings in kWh rather than multiplied by 10^{-6}. The corrected equation should be:

$$Annual\ kWh\ savings = \Delta Water \times HOT_{\%} \times \frac{8.33}{3412} \times \Delta T \times \frac{1}{EFF}$$

- Page 251 – The "EFF" factor should be based on a baseline Energy Factor, not thermal efficiency. Most water heater calculations are based on the EF. For electric based water heating, an EF = 0.904 should be used. For fossil fuel based water heating, an EF = 0.58 should be used.

- Page 251 – There would be an expected Summer Coincident Peak Demand Savings when using an electric water heater. This savings should be added

30. Refrigerated Case Covers (Time of Sale, New Construction, Retrofit – New Equipment) – (253)

[23] http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=COG

[24] http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_Commercial_Griddle.xls

- Page 253 – In the Reference section, the current energy savings equation is incorrect as written. The formula should be divided by COP, not multiplied. The equation should be corrected as shown:

  $\Delta kWh = (Load/12{,}000) * FEET * (3.216/COP) * ESF * 8760$

  This will yield the correct savings. The Annual kWh Savings equation in the "Deemed Calculation for the Measure" should also be modified to:

  $\text{Annual kWh Savings} = 346.5 * FEET/COP$

31. Door Heater Controls For Cooler or Freezer (Time of Sale) – (255)

- Page 255 – "Annual kWh Savings" calculation is missing an hours of operation term (8760).

32. Energy Star Ice Machine (Time of Sale, New Construction) – (257)

- Page 258 – The duty cycle assumption of 40% seems quite conservative; Respondents think a higher value could be appropriate. Has any monitoring for this measure taken place in jurisdictions in or near Ohio?

33. Commercial Solid Door Refrigerators & Freezers (Time of Sale, New Construction) – (260)

- Page 262 – "Reference Section" – "Summer Coincident Peak Demand Savings" – ΔkW on right side of equation should be changed to ΔkWh.

34. Strip Curtain for Walk-In Coolers and Freezers (New Construction, Retrofit – New Equipment, Retrofit – Early Replacement) – (263)

Deemed values and methodology should be updated in accordance with the r elevant ADM white paper dated September 2010.

- Page 263 – Is the source for footnote 642 published or available anywhere? The results are consistent with the Efficiency Vermont TRM of 2008, which should perhaps be cited instead.

35. Motors (Time of Sale) – (265)

If the measure included IE4 Super Premium motors, then in 2011 the baseline could shift to NEMA IE3 Premium motors rather than EPACT. This would allow the continuation of the measure beyond 2011 assuming Super Premium motors are readily available.

- Page 265 –There are multiple punctuation errors in the second paragraph under the "Definition of Baseline Equipment" heading.

Coincidence Factor (CF) for a motor is dependent on how the motor is being used and the industry type or type of facility in which it is installed. The draft Ohio TRM value of CF 0.38 seems low. For comparison, the California DEER (i.e., the Database for Energy Efficient Resources, which can be downloaded at http://www.energy.ca.gov/deer/) uses CF 0.74 for high efficiency motor measures, as does the Pennsylvania TRM (Act 129). The 0.38 CF in the draft Ohio TRM is referenced to "JCP&L metered data" (footnote 649). We would like to review the source document, study and/or report, none of which are provided.

Further, although it's more accurate to have load factors in the savings algorithm, rated load factor should be 80%, as indicated in the following section on pumps, not the 75% cited in the text.

- Page 265 – It would be useful to provide a table to lookup for EFLH based on building type consistent with building types proposed above (put appropriate reference) if the information is not available.

- Page 266 – The reference in footnote 649 should be cited more thoroughly so that the CF value can be verified. The CF of 0.38 seems low. What applications does the metering study cover and is it appropriate to extrapolate this value to a population as a whole?

- Page 266 – Motor load factor can be defined as:

  Load Factor = (Actual motor BHP)/(Rated motor HP)

  Motor load factor should be the same in the existing and proposed case when comparing same output work energy scenarios and same motor sizes. We are only comparing input work energy, or input kW, in this program. The existing and proposed motors both perform the same output work, or BHP. If the actual needed output BHP is less than their rated HP, then they are partially loaded. However, in both existing and proposed cases the output BHP is the same, and the rated HP is the same for same size motors, so they both should have the same load factor. Only the motor efficiencies (or the factor of output energy/input energy) are different when comparing energy use between existing and proposed motors of the same size.

36. High Efficiency Pumps and Pumping Efficiency Improvements (Retrofit) – (269)

- Page 269 – As currently written, the formula does not appropriately apply the ESF as described in the reference 655. The reference is for "typical pumping efficiency improvements" however the ESF is not being used to adjust the pumping efficiency. All formulas should change the term (ESF/η_pump) to $(1/\eta\_pump - 1/(ESF * \eta\_pump))$. This will properly apply the ESF as an efficiency improvement to the pump efficiency.

- Page 269 – The Coincidence Factor seems low. Consider splitting this into multiple categories and including an HVAC pump category with a CF equal to the chillers.

- Page 270 – The general energy savings factor (ESF) of 15% provided doesn't necessarily apply to all common pumping improvements. Respondents suggest adjusting the ESF by measure type where possible and using 15% as a default.

Measure	% Savings	Source(s)
Reduce overall system requirements	10%	http://www1.eere.energy.gov/industry/bestpractices/pdfs/mtrmkt.pdf
Match Pump Size to Load	20%	http://www1.eere.energy.gov/industry/bestpractices/pdfs/mtrmkt.pdf
Reduce or control pump speed	30%	http://www1.eere.energy.gov/industry/bestpractices/pdfs/mtrmkt.pdf Supporting sources: http://www1.eere.energy.gov/industry/bestpractices/trim_replace_impellers8.pdf http://www.bpma-energy.org.uk/USERIMAGES/GPCS300%20Impeller%20Trimming.pdf
Improve pump components	5%	http://www1.eere.energy.gov/industry/bestpractices/pdfs/mtrmkt.pdf
Operation and Maintenance	2%	http://www1.eere.energy.gov/industry/bestpractices/pdfs/mtrmkt.pdf
Other	15%	

37. Efficient Air Compressors (Time of Sale) – (272)

To enable us to complete our review of this measure, please provide the referenced file entitled "BHP Weighted Compressed Air Load Profiles – OH TRM.xls".

- Page 272 – Footnote 657 states "...it is assumed that the compressed air system with load/no load controls utilize an air receiver with a storage capacity of 5 gallons per cubic foot per minute of compressor capacity." Does the deemed incremental cost for a load/no load compressor type include the cost of the necessary receiver? Without a receiver, the measure might ruin the compressor. Respondents recommend specifically stating that the measure must also include a receiver installation.

38. Vending Machine Occupancy Sensors (Time of Sale, New Construction, Retrofit – New Equipment) – (274)

Draft Ohio TRM algorithms provide annual savings values similar to deemed values in the California DEER database. A default savings table should be provided since all components in the equations are specified.

39. Heat Pump Water Heaters (New Construction, Retrofit) – (276)

- Page 276 – Savings formulas should be based on the water heater Energy Factors, not thermal efficiencies as these do not take into account system losses and overall energy consumption. This is different from the methodology used elsewhere, and should be revised for consistency. "Definition of Baseline Equipment" should be adjusted to use EF = 0.904 rather than using a thermal efficiency = 0.98. (source:

  http://www.standardsasap.org/documents/FACT_SHEET_water_heaters.pdf).

- Page 277 – Energy Savings formula should be modified to use EF_{base} and EF_{HP} for both the baseline and the heat pump rather than $E_{t,base}$ and COP. It is recommended that the EF_{HP} be derated to account for operating conditions rather than testing conditions

- Page 277 – The GPD estimate does not stipulate this is for hot water use only, and that should be clarified. They may also note this value can come from site specific data or ASHRAE estimates, since ASHRAE provides some detail on certain building types.

40. Commercial Clothes Washer (Time of Sale) – (278)

- Page 279 – "Fossil Fuel Impacts Description and Calculation" – refers to a table when defining $\Delta MMBtu_{load}$. This table is the one from the "Reference Section", but needs to be properly labeled.

41. Commercial Plug Load – Smart Strip Plug Outlets (Time of Use, Retrofit – New Equipment) – (280)

It is unclear how $\Delta Wh_{Workday}$ and $\Delta Wh_{Non\text{-}Workday}$ were calculated from the table. Respondents were unable to replicate the values or locate the methodology in the references.

42. Plug Occupancy Sensor (Retrofit) – (282)

- Page 282 – "Reference Section" – is ΔW_{sleep} reported in Wh per day? This would have to be the case for the equation to be correct, and it should be specified.

- Page 283 – The assumptions used to derive the ΔW_{sleep} = 704 Wh are not reasonable. It would not be expected that both a laser printer and laser multi-function device would simultaneously be plugged into the smart strip. This is in no way representative of actual conditions and should be revised to better represent savings estimates. A weighting of electronic devices that occur in office spaces and are likely to be attached to the smart strip could be used as a reasonable method to estimate savings. It could also be noted that the value of ΔW_{sleep} may be adjusted for known applications, as the devices in "Reference Tables" do not cover all circumstances.

43. Energy Efficient Furnace (Time of Sale, Retrofit – Early Replacement) – (284)

- Page 284 – Annual kWh Savings and Annual MMBtu Savings algorithms should be corrected to:

$$Annual\ kWh\ Savings = 5 * CAP * EFLH_h * \left(\frac{1}{\eta_{base}} - \frac{1}{\eta_{ee}}\right)$$

$$Annual\ MMBtu\ Savings = CAP * EFLH_h * \left(\frac{1}{\eta_{base}} - \frac{1}{\eta_{ee}}\right) - MMBtu_{ECM}$$

All other algorithms in the measure should be adjusted accordingly.

- Page 285 – "Reference Section" – unable to find the definition of $MMBtu_{ECM}$ in reference cited by footnote 700.

- Page 285 – EFLH is stipulated at 2408. This appears high. Simulations provided building type weighted EFLH for heating ranging from 713 EFLH in Cincinnati to 1056 EFLH in Mansfield. Simulated EFLH by building type and city are shown below:

	Columbus	Cincinnati	Cleveland	Dayton	Akron	Mansfield	Toledo
Fast food	1,157	1,033	1,316	1,174	1,319	1,153	1,337
Assembly	958	530	1,030	489	1,070	1,157	1,329
Big Box	598	516	662	611	663	608	701
Full Service	1,157	1,020	1,301	1,262	1,292	1,251	1,335
Small retail	837	763	1,028	872	1,026	896	1,071
Small office	496	455	645	564	642	677	647
Light industrial	1,049	996	1,262	1,129	1,205	1,104	1,232
Primary school	1,201	1,087	1,382	1,184	1,352	1,153	1,396

44. Tank-less Water Heaters (Time of Sale, Retrofit – Early Replacement) – (288)

- Page 288 – Annual MMBtu Savings algorithm should be corrected to add standby losses, not multiply by them.

$$Annual\ MMBtu\ Savings = \frac{W * 8.33 * (T_{out} - T_{in}) * \left(\frac{1}{\eta_{base}} - \frac{1}{\eta_{ee}}\right) + (STBY_{base} * 8760)}{1000000}$$

- Page 289 – Formula on page 289 should also be changed.

45. Stack Damper (Retrofit – New Equipment) – (291)

- Page 291 – Provide a more thorough citation for sources referred to in footnote 714.

46. Energy Efficient Boiler (Time of Sale) – (295)

- Page 295 – Annual MMBtu Savings algorithm should be corrected to:

$$Annual\ MMBtu\ Savings = Cap * EFLH_h * \left(\frac{1}{\eta_{base}} - \frac{1}{\eta_{ee}}\right)$$

- Page 296 – Formula on page 296 should also be changed.

- Page 296 – EFLH is defaulted to 2408, which appears high, with direction to use site-specific data if available. Please provide additional direction on how to obtain site-specific EFLH. Simulated values for a large office are shown below:

Large Office	Columbus	Cincinnati	Cleveland	Dayton	Akron	Mansfield	Toledo
CV reheat, no economizer	1,313	1,528	1,683	1,615	1,696	1,805	1,606
CV reheat, economizer	1,363	1,565	1,723	1,658	1,745	1,854	1,660
VAV reheat, economizer	318	333	400	376	409	347	452

Values for heating EFLH can be provided for other buildings with built-up systems as mentioned in the electric chiller section above.[25]

[25] Respondents would like to expand the table by providing cooling EFLH data for additional buildings with built-up HVAC systems: Hospital, Hotel, Large Multistory Retail, and University. Data for these additional building types will be developed using existing prototypes customized for Ohio construction practices and run for the seven Ohio cities. The runs could be completed, and data provided to VEIC on request.

C. Custom

Respondents hereby present their specific and technical objections and comments to the Custom Measures contained in the TRM.

1. As an initial matter, it is unclear whether the custom protocols included in the TRM are meant to be guidelines or if the utilities are required to use them. For example, the TRM requires meter data to be submitted with an application.[26] However, in instances in which the measurement and verification of a project relies upon alternative approaches such as a calibrated simulation, there will not be meter data to submit. In addition, if the provisions within the TRM are intended to be requirements, some are vague and incapable of implementation.

2. Additionally, Respondents consider TRM Section IV to be usable for situations that are not covered by any other measure included in the TRM.

3. As discussed above, the TRM should be consistent with the requirements of the Mercantile Customer Pilot Program. To the extent that the TRM is not consistent with the Mercantile Customer Pilot Program, the Pilot Program should override the requirements of the TRM. For example, in the TRM no provision is made in the custom protocols for calculating savings for incentives versus savings for compliance of SB 221. At a minimum, once the Mercantile Customer Pilot Program is completed, the TRM - as a basis for mercantile savings calculations - should be re-evaluated by the Commission and stakeholders.

[26] TRM at 308.

4. Lastly, the custom protocols require significantly more documentation, including, but not limited to, non-energy related impacts, interactive effects, operating conditions, load characterization, and their impacts on such things as lifecycle savings. The TRM seems to imply that annual calculations of these effects would be tracked. Respondents believe that only the first year calculation of savings should be done. The additional cost of tracking and measuring marginal changes is costly and does not yield significantly different results.

5. The TRM does not recognize that O.A.C. § 4901:1-39-05(G)(5), permits mercantile customers to submit, with explanation, projects with methodologies, protocols, and practices used in measuring and verifying program results that deviate from any program measurement and verification guidelines that may be published by the Commission. Rather than specifying measurement and verification of energy and peak demand savings associated with mercantile customer projects, the Commission should (either by order or through incorporation into the TRM) simply require measurement and verification protocols to comply with the International Performance Measurement and Verification Protocol ("IPMVP").

6. Custom programs are also available to non-mercantile customers. Custom projects can vary greatly in size both in terms of rebate value and projected energy savings. The custom program protocol in the TRM appears to assume that all custom projects are of a significant size and warrant extensive documentation, including a required metering plan. Applying the same level of analysis to all project sizes will hinder program participation and drastically increase the cost of analysis with little benefit added to program results. According to the TRM, metering needs to be performed

on all custom measures and the collected data will be used to develop reliable energy savings estimates. Respondents agree that the additional details are beneficial for larger projects and can tighten the savings values, but this may prove to be not cost effective for smaller projects.

To correct this situation, Respondents recommend implementing a tiered approach to custom documentation/protocol requirements as follows:

Protocol, Documentation Required	For Projects with Expected Annual Energy Savings of:
TRM Custom Protocol	> 700,000 kWh
Pre- and post-install third party metering	100,000 kWh to 700,000 kWh
Engineering Calculations (no data logging required)	<100,000 kWh

Further, a simplified custom application should be developed for projects with expected energy savings of less than 100,000 kWh per year. Specifically, Sections C and D of the protocol would be financially and administratively burdensome for small projects in the less than 100,000 kWh category.

7. The TRM recommends maximum metering on variable loads to be carried out for a period of one week with an interval of 5 minutes and the metering equipment must meet PJM manual's metering specification requirements.[27] This requirement limits participation unless a tiered approach, as suggested in item 3 above, is implemented.

8. The TRM also states that the DDC/PLC trend data is acceptable if the sensors are calibrated using calibrated test equipment. The sensors in newer DDC/PLC

[27] TRM at 309.

systems often recalibrate themselves automatically and there may not be a need for calibration for up to 5 years.[28]

D. Transmission and Distribution

Respondents hereby present their specific and technical objections and comments to the Transmission and Distribution Measures contained in the TRM.

1. While Respondents believe that utilizing the TRM may provide for consistent reporting of energy savings, there should be provisions that allow the utilities to develop project and program specific M&V plans that are consistent with the protocols outlined in the IPMVP or those supported by typical engineering practice.

2. Given the often unique nature of T&D infrastructure projects, the EDU should be permitted to provide its own method of calculated losses for review. While having hourly real time data along the line may provide better accuracy in some cases, such data does not exist in many applications. In other cases, such as some transmission projects, it is more appropriate to measure load at the system level.

3. The load on a power system is so dynamic based on customer use patterns, temperature variations from year to year, the addition of distributed generation, bulk power transfers between regions, scheduled and unscheduled transmission and generation outages, etc. that real time historical data does not necessarily provide accurate projections of future flows, even if the real time data exists. Traditional estimating methods, which use peak load estimates, load factors, and load loss factors, have been successfully utilized in the past to determine the reduction in losses and should be used for these types of projects.

[28] *Id.*

4. For some projects 8766 is not available. As stated above, EDU shave traditionally used load loss factors to determine energy losses over a period of time based on losses on peak. The attempt to fine tune that method by using hourly actual data, while it theoretically may add another degree of accuracy, it cannot be completed because the load data required for the analysis per this protocol are often not available. In this case, the EDUs should be able to use other methods consistent with the IPMVP or those supported by typical engineering practice.

5. Measure life should be included exclusively for the purpose of calculating the TRC test associated with the projects.

6. In several of the measures the TRM states that "For each installation, specify the customer classes (residential, small general service, etc.) served by the equipment, and for non-residential customers, the sector (Industrial, Commercial, Institutional, Multi-family) and type of use (e.g., office, restaurant, dormitory, gas station). This information is not always available at this level of detail.

7. Respondents disagree with the statement that "Discount savings with respect to existing equipment over time, to the extent that the EDU would make this (or a similar) change in configuration in the foreseeable future to meet peak load or reliability requirements."[29] Because a project is completed to meet load or reliability requirements does not mean that it cannot count toward energy efficiency benchmarks. The EDUs intentions regarding the installation of efficient equipment are not relevant information for the quantification of energy savings.

[29] TRM at 343.

8. Pages 340-343–T&D Loss Reductions – Mass Plant Replacement and Expansion Analysis Protocol

- It is unclear why the TRM includes two Analysis Protocol sections for Mass Plant changes.

- The equipment listed does not include primary lines; such equipment would be expected to appear on this list.

- Respondents object to the limit of 500 kVA loads. Such loads are not that uncommon, and with the push to move towards AMI, where all loads will in essence be interval metered, the exclusion of projects from this category would become common. A limit of in excess of 2000 kVA is more realistic.

- In the $loss_{base}$, $peakloss_{base}$, $loss_{efficient}$, and $peakloss_{efficient}$ equations the term kVA_t is not defined. Assuming kVA_t is the per-hour load being served by the equipment it is unclear how the multiple individual loads are to be combined for this study.

9. Pages 344-347--T&D Loss Reductions – Mass Plant Retrofit Analysis Protocol (pp. 344-347)

- This protocol covers the installation of lower loss equipment prior to failure or equipment end of life, and in the absence of any need for increased capacity.

Equipment includes:
- Distribution transformers
- Secondary lines
- Service drops
- Meters

This does not apply to equipment serving interval metered loads in excess of 500 kVA.

- 500 kVA loads are not that uncommon. Respondents would recommend a limit of in excess of 1000 kVA as being more realistic.

10. Page 345--Base and Efficient Cases

- This section details the calculation of energy losses.

In the $loss_{base}$, $peakloss_{base}$, $loss_{efficient}$, and $peakloss_{efficient}$ equations the term kVA_t is not defined. Assuming kVA_t is the per-hour load being served by the equipment it unclear how the multiple individual loads are to be combined for this study.

The term ULF and UPLF are not well defined. It appears there is an assumption that ULF would be a straight percentage loss reduction savings.

Additional piece-by-piece equipment documentation, i.e., relative to the equipment having been functioning properly, adequate to meet existing loads, and disposition of removed equipment would be burdensome. Similar documentation is not required for equipment being removed for upgrade as part of the prior section (p. 340).

11. Pages 348-351–T&D Loss Reductions – Large Customer Connection Analysis Protocol

- This protocol defines the requirements for analyzing and documenting loss reductions due to installation of distribution equipment to serve interval-metered load in excess of 500 kVA, where the installed equipment has lower losses than
  - standard equipment, in the case of incremental improvements over equipment required due to failure, need for increased capacity, or connection of new loads, or
  - existing equipment, in the case of retrofit of equipment solely for the energy savings.

  Each project may include equipment serving one or a few customers, each with interval metering, at a single location.

  The 500 kVA load limit is too small, and reporting would include too many small installations. This limit should be increased to 1000 kVA.

12. Page 349–Equipment Loading

- This section requires that we *"Provide the hourly customer loads at this location in the report year."*

  Such an hourly load report would generally be specific to one customer, one site. Providing such detailed information about that customer may be in violation of expected customer confidentiality. Any requirement to provide annual billed sales to a customer would also be such a violation.

13. Pages 349-350: Base and Efficient Cases

- This section details the calculation of energy losses.

  In the $loss_{base}$, $peakloss_{base}$, $loss_{base}$, and $peakloss_{base}$ equations the term kVA_t is not defined. Assuming kVA_t is the per-hour load being served by the equipment it us unclear how the multiple individual loads are to be combined for this study.

  The term ULFE and UPLF are not well defined. It appears there is an assumption that ULF would be a straight percentage loss reduction savings (which would not make engineering sense). In prior sections, the term ULF was used for what ULFE appears to stand for in this equation.

14. Page 353--Equipment Loading

This section requires that the EDUs ""Provide the hourly load the transformer or substation in the current year and identify:

(1) the maximum load on the equipment
(2) the average load on the equipment on weekdays between 3:00 p.m. and 6:00 p.m., June through August (the coincident peak period)"

Such an hourly load report exceeds the current level of load data gathered by the Companies. For many of these sites, the Companies would only have an allocation of a peak load (allocation based on some upstream metering location).

In the $loss_{base}$, $peakloss_{base}$, $loss_{base}$, and $peakloss_{base}$ equations the term kVA_t is not defined. Assuming kVA_t is the per-hour load being served by the equipment it is unclear how the multiple individual loads are to be combined for this study.

15. Pages 356-39--T&D Loss Reductions – System Reconfiguration Analysis Protocol

This section requires that the EDUs *"Provide the hourly loads on each of the major affected network elements for the last full year prior to the installation of the first element of the project."*

Such an hourly load report exceeds the current level of load data gathered by the EDUs For many of these sites, the EDUs would only have an allocation of a peak load (allocation based on some upstream metering location).

The section also requires "For capacitors, provide: (1) the hourly loads in the current year on the substation or other equipment to which the capacitors are attached; and (2) the hours in the current year for which the capacitors were activated at each kVAR level."

Again, such hourly load detail exceeds the current level of load data gathered by the EDUs.

In the $loss_{base}$, $peakloss_{base}$, $loss_{base}$, and $peakloss_{base}$ equations the term kVA_t is not defined. Assuming kVA_t is the per-hour load being served by the equipment it us unclear how the multiple individual loads are to be combined for this study.

16. Pages 360-363--T&D Loss Reductions – Voltage Conversion Analysis Protocol

This protocol as written is designed for transmission and distribution projects of limited scope, from a designated point A to point B and where load data could theoretically be available. Voltage conversion projects can also be of a much larger scope than assumed in this protocol, where actual load data may not exist and assumptions are required to estimate losses.

- **Page 360–Project Information**

Location: This is set up for a project that involves converting a line from one substation to another. It does not provide a method for identifying more complex conversions that might consist of pockets of areas that span multiple miles.

Technology Description: This description does not account for the complexities that may be involved in a project consisting of several hundred miles. For instance, a project may involve hundreds of transformers. Some of the transformers being replaced could be 40-50 years old and original manufacturer specifications do not exist. In some cases, the facilities could have been purchased through the acquisition of municipal systems years ago. In addition, the replacement of poles, insulators, sectionalizers, and other equipment do not have any impact on the loss calculations and should not be required.

- **Pages 360-361--Equipment Loading**

Request for Direction of Flow: Direction does not affect losses and should not be required.

Interval-Metered Location Along the Line: This data is often not available.

Hourly Loads in the Report Year: This data is often not available.

Average Load on the Line Weekdays Between 3:00 PM and 6:00 PM – The definition of average load on the line is not clear.

Total Energy Delivered to the Line: Data is often not available for a partial section of the line, and for total circuit, energy delivered is not measured.

Hourly Loads for Large Loads Among the Line: These values are integrated into the total circuit load data. The definition of large load is not clear.

Distribution of Annual Deliveries Along the Line: Data is often not available.

Line Segments Within Each Segment – Current is Constant Within the Segment: Often not possible to determine with existing metering capabilities.

Line Segments Within Each Segment – Change in Current per Mile is Constant: Often not possible to determine with existing metering capabilities.

Demonstrate that Power Flows on the Segments are Consistent with One Another and the Power Delivered to the Line Input: It is not clear what information is required.

Take Hourly Average Directly from Data Logs or Compute from Power Flow Data: This information may be available on distribution at substations only.

- **Pages 361-362--Pre-Project and Post-Project Cases**

The following data required for the equations are often not available:

Amperage flowing into the segment.

Amperage flowing out of the segment.

The following variables are defined but not included in the equations: A_0 and H.

Pre and Post Loss Savings Calculations: The Post-Loss savings are not necessary to calculate by the proposed equation since the losses will be reduced by the square of the ratio of the voltages. Once the Pre-Losses are calculated, the post-losses can be determined by dividing the pre-losses by $(V_{new}/V_{old})^2$. For example, the conversion of 4kV to 12kV will result in losses one-ninth of the pre-loss value.

VI. CONCLUSION

For all of the foregoing reasons, Respondents respectfully request that the Commission modify and amend the TRM in accordance with the objections and comments discussed herein.

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CERTIFICATE OF SERVICE

I hereby certify that a copy of the foregoing was served upon the following parties of record this 3rd day of November 2010, via electronic transmission or first class U.S. mail, postage prepaid.

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