Attachment A:

Review of Self-Direct Demand Side Management (DSM) Programs

Presentation by Merrian Borgeson, Lawrence Berkeley National Laboratory

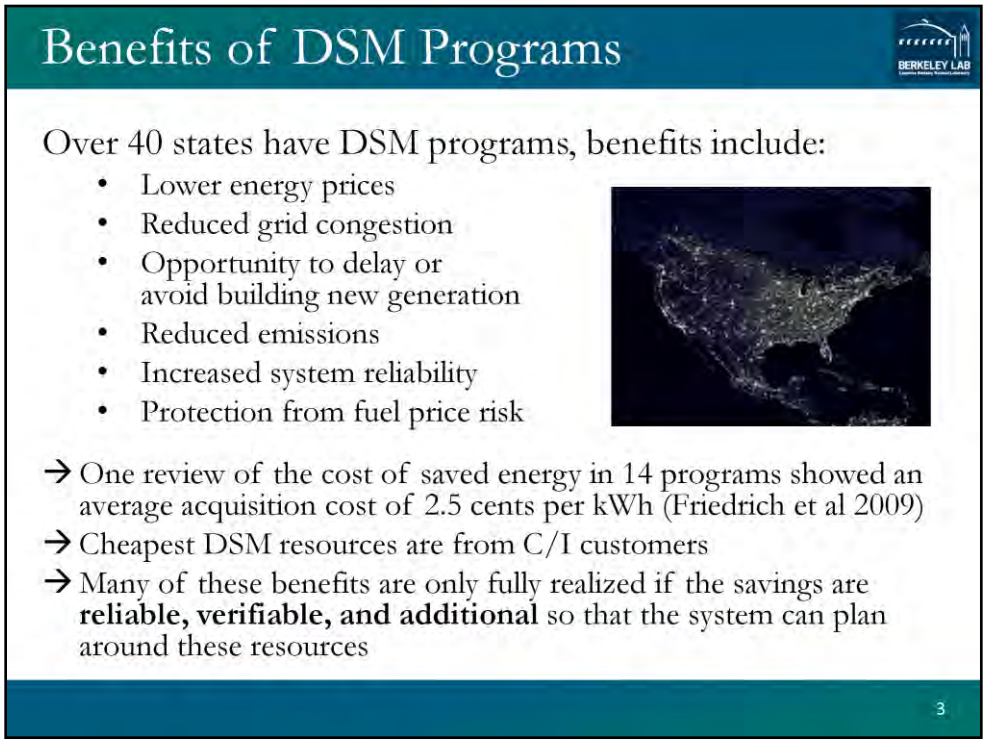
Thanks for having me here today. I'm a researcher at Lawrence Berkeley National Laboratory, and I spend much of my time examining energy efficiency polices and program design around the country.

I was asked to inform the discussion in Ohio regarding the design of self-direct programs by reviewing practices in other states.

Presentation Outline

1. Background
2. Case Studies
3. Comparison of Self-direct Program Design Elements

A note on language: I use the term “DSM charge” to encompass the many names for the funds collected to procure energy efficiency and demand response for the system – in Ohio it is the Energy Efficiency / Peak Demand Reduction (EE/PDR) Rider. In other places it might be called system benefits charges, public benefits fees, or other names for the DSM cost-recovery mechanism.



Let's dive into why we have these programs in the first place, as a foundation for the discussion about what makes an effective self-direct program…

Bulleted list

Plus additional non-energy benefits including job creation & economic development, more comfortable homes, more cost-efficient businesses, the ability to reduce energy costs for low income customers, etc…

A 2009 review of the cost of saved (COS) energy in 14 programs showed an average cost to the utility of 2.5 cents per kWh (Friedrich et al 2009) – much cheaper than both renewable and fossil fuel generation.

LBNL is currently undertaking a study of the COS over time by program type, due out early next year. We know that the cheapest DSM resources come from C/I customers.

To be able to realize many of the benefits of EE, savings need to be **reliable, predictable, and additional** so that the system can plan around these resources.

Levelized Cost of Energy Comparison

Certain Alternative Energy generation technologies are already cost-competitive with conventional generation technologies under some scenarios, even before factoring in environmental and other externalities (e.g., RECs, potential carbon emission costs, transmission costs) as well as the fast-increasing construction and fuel costs affecting conventional generation technologies

Source: Lazard estimates.

Note: Reflects production tax credit, investment tax credit, and accelerated asset depreciation as applicable. Assumes 2007 dollars, 60% debt at 7% interest rate, 40% equity at 12% cost, 20-year economic life, 40% tax rate, and 5-20 year tax life. Assumes coal price of $2.50 per MMBtu and natural gas price of $8.00 per MMBtu.

(a) Low end based on total system cost per watt of $3.99 per First Solar investor presentation dated December 3, 2007. High end based on utility-scale crystalline facility.

(b) Represents First Solar's targeted implied levelized cost of energy in 2010, assuming a total system cost of $2.75 per watt. First Solar 2012 guidance for total system cost of $2.00 per watt would imply a levelized cost of energy of $75 per MWh.

(c) High end incorporates 90% carbon capture and compression.

(d) Low end represents solar tower. High end represents solar trough.

(e) Does not reflect potential economic impact of federal loan guarantees or other subsidies.

(f) Based on advanced supercritical pulverized coal. High end incorporates 90% carbon capture and compression.

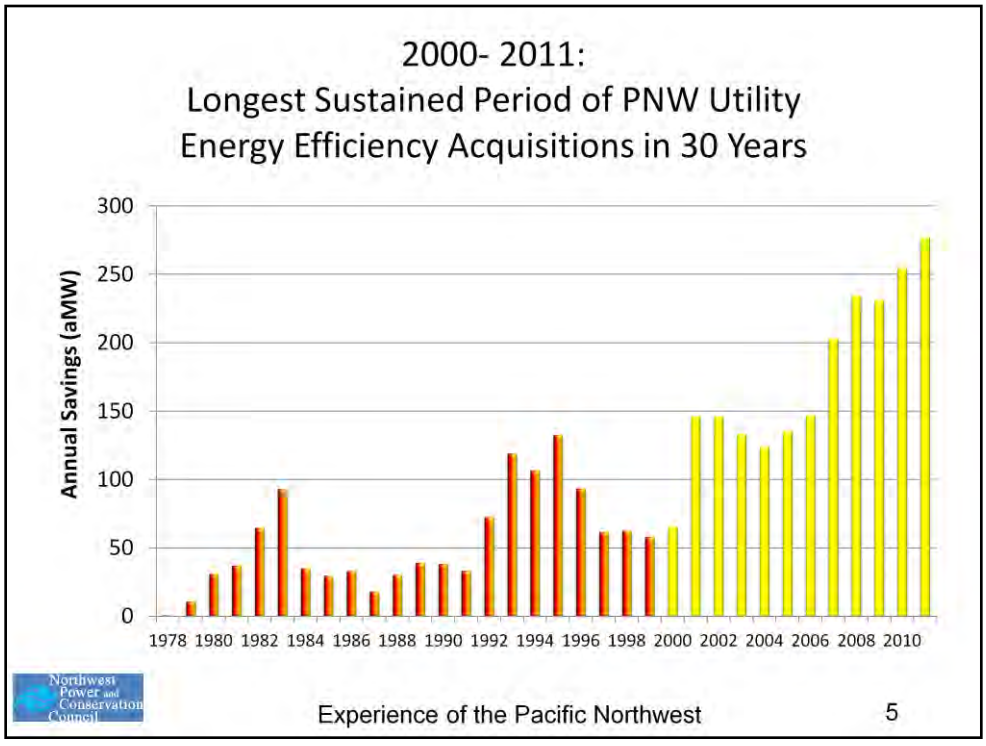
(g) Represents retrofit cost of coal plant.

(h) Estimates per National Action Plan for Energy Efficiency; actual cost for various initiatives varies widely.

Source: Lazard

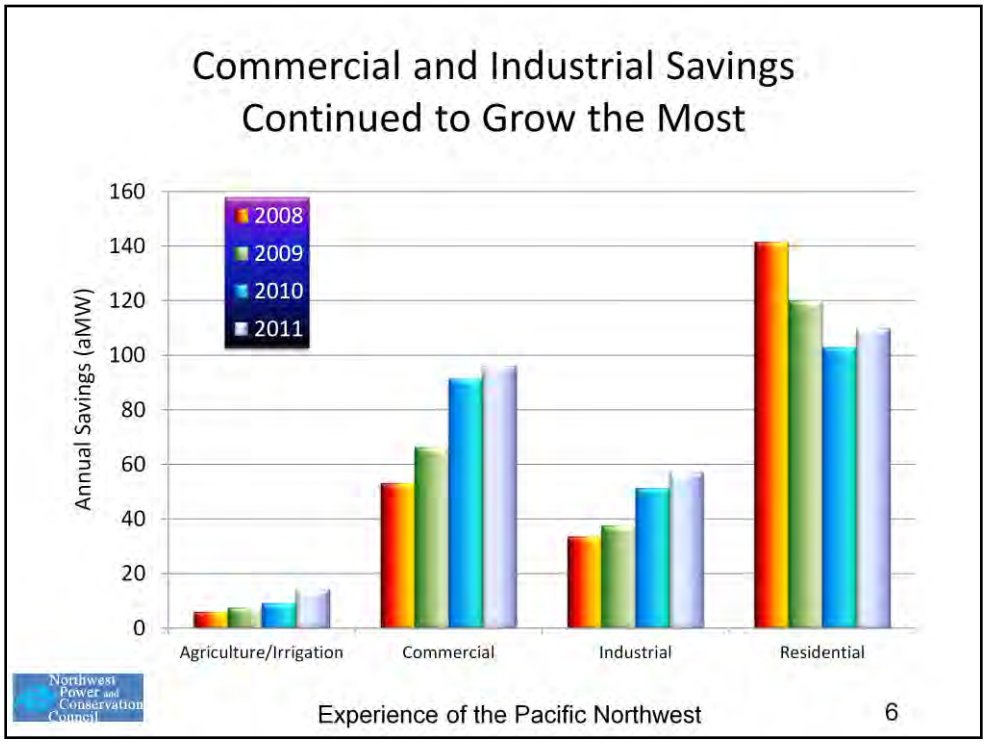
This is the levelized cost of NEW generation.

This chart is from 2008, but trends are the same today. This version has the energy sources in order of cost which is more useful for this discussion, but the more recent version is available here and has the same trends: http://votesolar.org/wp-content/uploads/2012/07/Lazard-June-11-Levelized-Cost-of-Energy-and-proj-to-2020-copy.pdf



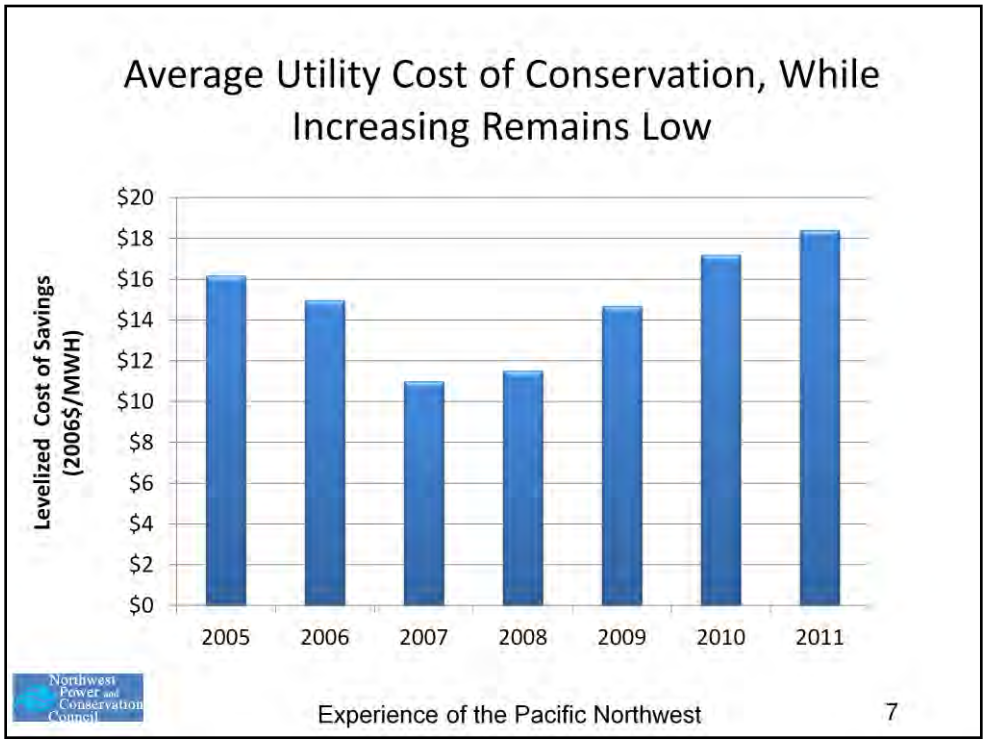
Recent results from the Northwest Power and Conservation Council, slides created by Tom Eckman.

Sustained DSM programs over time have continued to yield results – an especially good case study given the very low cost of energy in the Pac NW due to abundant hydropower. If you can make cost effective EE work in the Pac NW, you can make it work anywhere.



Continued savings over time with especially strong growth in the C/I sectors.

C/I customers often don't have the in-house expertise to identify all cost-effective EE – business customers benefit from this specialized input about new technologies, processes, and services that reduce their costs.



Well under 2 cents / kWh (=$20/MWh) → far less than new generation resources.

C/I Program Types

Four main types of programs are offered to commercial / industrial customers:

- Technical assistance / energy auditing services
- Prescriptive incentive programs
- Custom incentive programs
- Self-direct programs

Self-direct Programs

- Usually targeted at large industrial customers with specialized needs or strong in-house energy engineering capacity
- Self-direct programs are found in at least 24 states
- Many variants on how these programs are structured
- Least-used program in most jurisdictions due to eligibility limits and attractiveness of other program offerings

9

Usually targeted at LARGE customers with specialized needs or strong in-house energy engineering capacity.

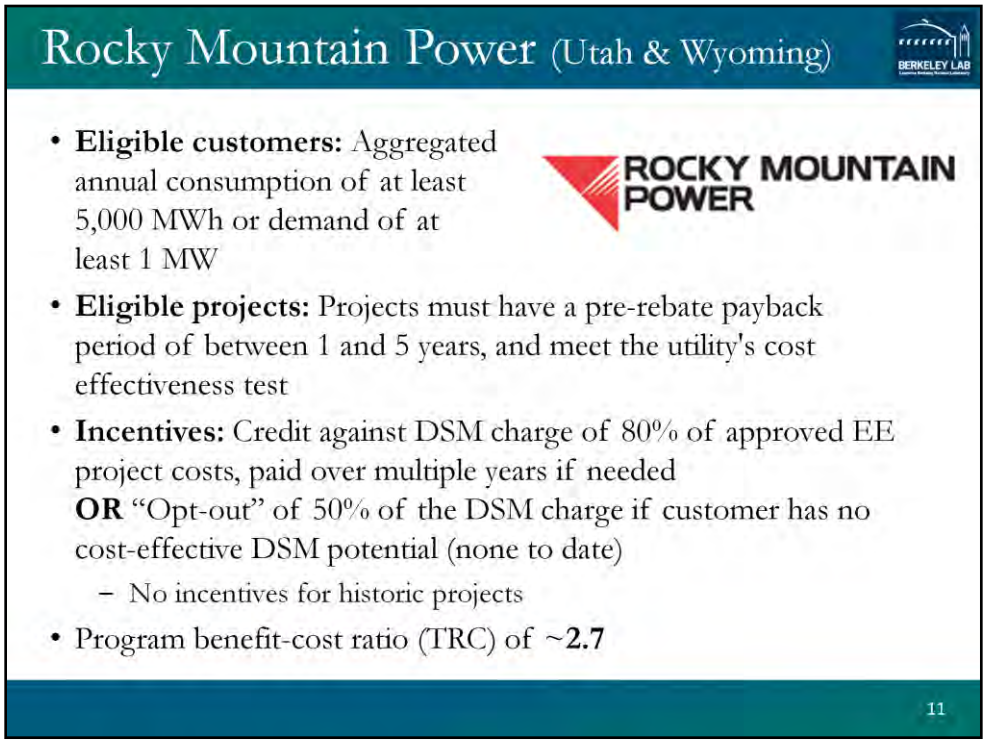
The best self-direct programs are creative ways to tailor programs to the needs of large customers.

Self-direct programs are found in at least 24 states.

Many variants on how these programs are structured.

The least-used program in most jurisdictions due to eligibility limits and the benefits of other program offerings – many customers need/want support from the EE program administrator.

Three case studies of particularly strong self-direct programs that highlight a number of possible features of effective self-direct programs.



RMP has programs in Utah, Wyoming, and Idaho, including a self-direct program for large customers with a benefit-cost ratio of 2.7.

RMP's self-direct program has two paths. In the first path, customers receive credits against their DSM charge up to 80% of approved EE project costs. The DSM charge credits can be taken over multiple years until 80% of the approved costs are reimbursed.

Like in Ohio, when replacing equipment that is in use the baseline for savings and costs is "as found". For new construction or replacement of equipment at the end of its useful life, code or industry common practice is used as the baseline.

The program does not give incentives to historic projects, only new projects that exceed code or industry common practice. Projects must have a pre-rebate payback period of between 1 and 5 years, and meet the utility's cost effectiveness test.

Customers must pay a $500+ admin fee per project that they submit (large admin costs for more meters).

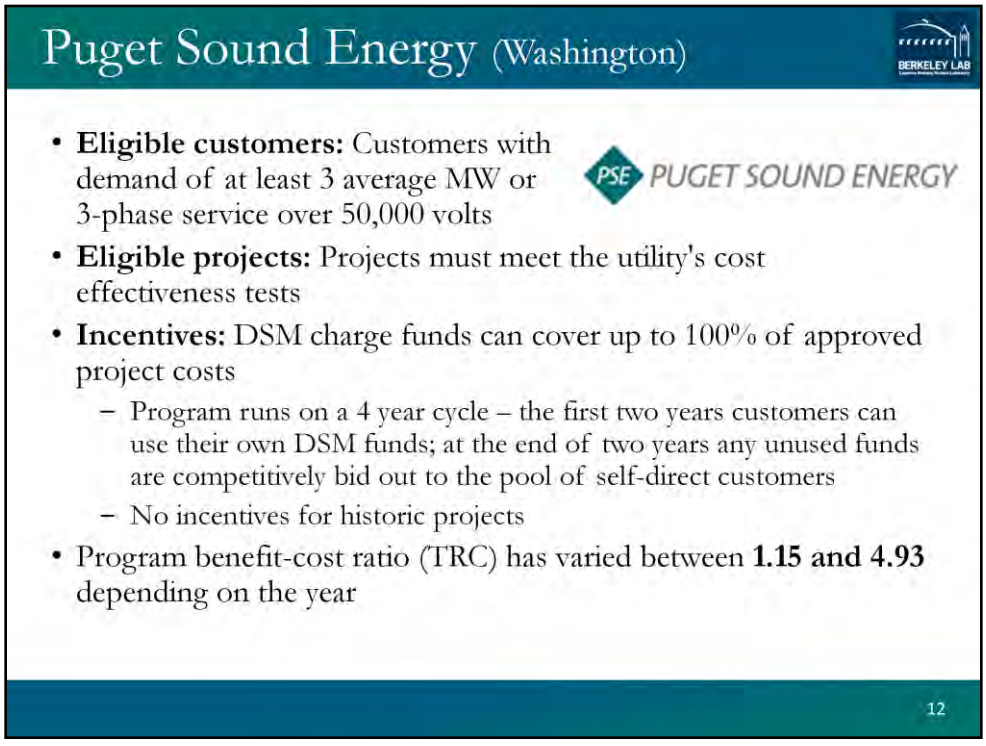
The second path is for customers that have no remaining DSM opportunities. To demonstrate this, the customer hires an auditor retained by the program administrator that performs an energy audit of all the customers' facilities. If the audit demonstrates that there are no remaining DSM projects with a payback period of 8 years or less, the customer is eligible for the 50 percent credit of the DSM charge for 2 years (at which point they have to reapply). To date, no customer has applied for this opt-out.

RMP allows industrial customers the option to choose between the self-direct program and the custom rebate program for each project – which means that a customer can receive more in incentives than they pay in DSM fees, if they have enough cost effective efficiency projects. The advantage of the self-direct program is that the amount of the rebate is larger (80% of project cost compared to only 50% under the custom program). But with the custom rebate program, RMP will provide assistance in identifying the project, estimating the initial costs and energy savings, and verifying the savings after the project is implemented.

More info: Chris Helmers, Rocky Mountain Power / Pacificorp, chris.helmers@pacificorp.com, 801_220_4439

http://www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/About_Us/Rates_and_Regulation/Wyoming/Approved_Tariffs/Rate_Schedules/Self_Direction.pdf

http://www.rockymountainpower.net/bus/se/epi/utah/ilc/sdc.html



Puget Sound Energy's self-direct program is set up to get significant savings from its large customers by giving them incentives to act quickly.

The program runs on 4 year cycles. In the first two years, customers are able to use up to 82.5% of their DSM funds for projects that meet both the total resource cost test and the utility cost test.

These funds can cover 100% of approved project costs, versus only 70% for non-self-direct programs. Program staff review the project proposal and M&V plan, and they inspect the project after installation - but they don't do the engineering and project analysis as they would for other programs. All projects must be new, not historic.

After the first 2 years of the program, any unused self-direct funds are put into a common pool and competitively bid out to customers who submit additional projects. They receive a large volume of applications in the competitive phase - in 2009 they received applications for over 4 times the amount of funds available. This reveals the significant amount of savings still to be had, that arise when customers are given the right incentives.

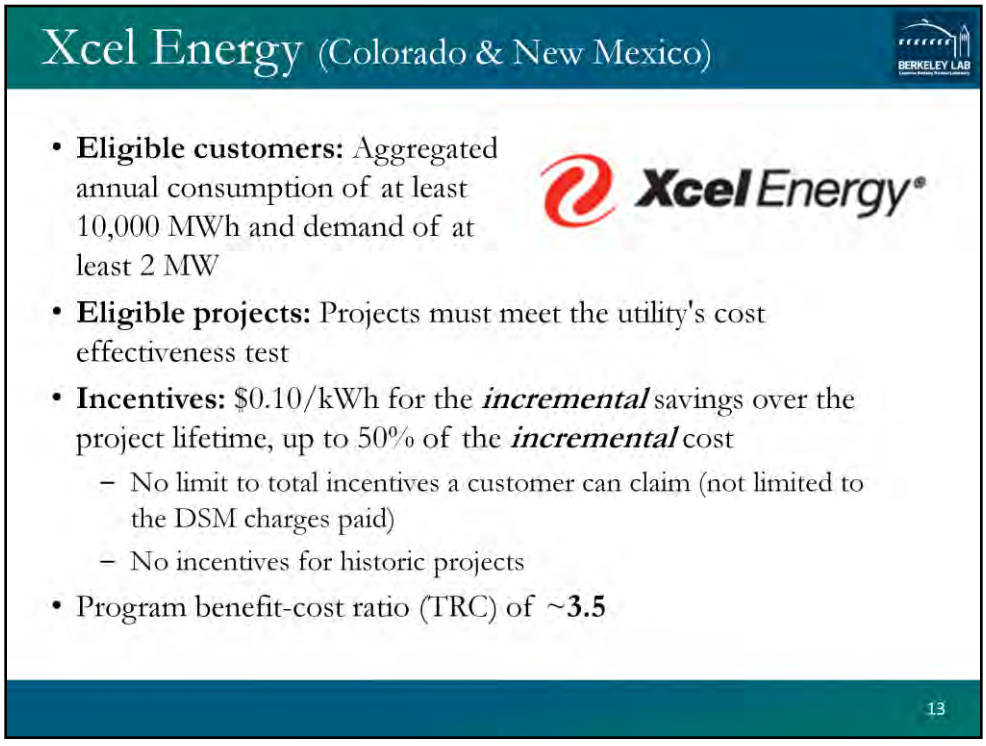
This program has both higher participation (as a percent of the eligible customers) and higher savings than other programs due to the structure. The program benefit-cost ratio (TRC) has varied between **1.15 and 4.93** depending on the year – the higher TRCs are in the “competitive” years of the program.

More info: Gus Takala, Puget Sound Energy, 425-462-3656, gus.takala@pse.com

http://www.efficiencyconnectionsnw.com/uploads/06_EE-Programs-for-Industrial-Customers_1Dec2010.pdf

http://www.pse.com/aboutpse/Rates/Documents/elec_sch_258.pdf

The RFP along with the tariff that governs the program can be found at, http://www.pse.com/aboutpse/Rates/Pages/Electric-Rate-Schedules.aspx?Schedule_x0020_Type=Conservation, under Electric Schedule 258.



Xcel has one of the more rigorous self-direct programs in the country, and has achieved savings they are confident in while achieving a benefit-cost ratio (TRC) of ~3.5.

Their self-direct program has similar requirements to their prescriptive and custom programs, including needing to pass the cost test, providing incentives for only the costs of incremental improvements, and rigorous M&V done on each project. The incentives are $0.10/kWh for the incremental savings over the lifetime of the project or $525/kW demand reduction (which ever is greater) up to 50% of **incremental** project costs.

For some improvements, like new energy mgt control systems they simply estimate savings from the use of this new system – all the savings are incremental. But for equipment that the customer will need to replace anyway, like a furnace, the incremental cost is the difference in cost between the current code or standard industry practice and the high-efficiency equipment the customer is encouraged to choose due to the program. They also only get paid for the incremental savings - which is the difference between the energy use of the std equipment currently available and the energy use of the high-efficiency equipment.

The program does not give incentives to historic projects, only new projects that are shown to be incremental EE improvements.

For every project, an Xcel customer can choose between the self-direct, custom, and prescriptive programs offer by Xcel. The self-direct programs offer rebates that are about 30% higher, but require more investment of time & resources on the part of the customer - so customers decide which program will give them the biggest benefit based on the project scope and their own in-house capabilities.

But there is no upper bound to the total incentives a customer can get (it is not limited to the DSM charges paid). Xcel is looking to purchase EE as a resource wherever they can - and customers' interest in and capacity for energy savings vary. Xcel seeks the lowest cost resource wherever they can find it.

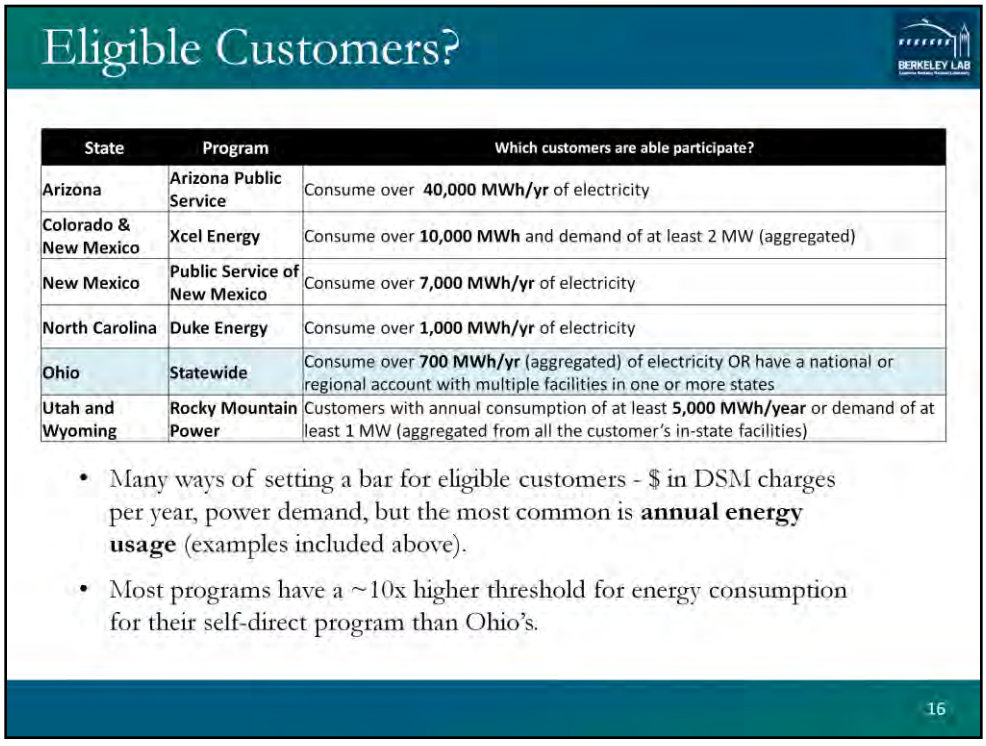
Xcel has rigorous M&V requirements. They require pre-project energy use monitoring to establish a baseline. Xcel staff also pre-approve projects and provide an estimate of the incentive available. Xcel's most senior engineers review all of the plans and the monitoring reports. Most self-direct customers hire consultants to help with the measurement and verification (M&V) requirements.

More info: Kenny Romero, 303-294-2466, kenny.romero@xcelenergy.com
http://www.xcelenergy.com/Save_Money_&_Energy/Find_a_Rebate/Self_Direct_-_CO


BERKELEY LAB
Environmental Energy Technologies Division
Lawrence Berkeley National Laboratory
Elements of Self-direct
Program Design
(comparison of programs)

Elements of Program Design

- Eligible Customers
- Eligible Projects
- Incentives
- Level of Exemption
- Length of Exemption
- Measuring Savings



Many ways of setting a bar for eligible customers - $ in DSM charges per year, demand, but the most common is **annual energy usage**.

Most programs have a ~10x higher threshold for energy consumption for their self-direct program than Ohio's, which increases administrative complexity and regulatory oversight burden compared to other states.

As a result, other programs are drawing from a much smaller pool of customers that have been deemed to have special needs, or more in-house capacity for identifying DSM opportunities. Almost all of the 20 programs I reviewed had 50 or fewer self-direct participants annually – versus 1,400 self-direct projects in Ohio since 2009.

Eligible Projects?

- Like Ohio, most programs allow projects with a benefit-cost ratio of greater than 1
- Some have simple payback thresholds, e.g. 1 to 7 year simple payback.

Xcel Energy C/I Programs

Program	Benefit/Cost Ratio
Self-Direct	3.59
Process Efficiency	2.53
Standard Offer	2.36
Custom Project	1.80

Source: Chittum 2012

PSE Self-Direct Program

Cost Effectiveness Reporting from Annual Reports

	UC B/C	TRC B/C
2007	1.34	1.15
2008	2.93	1.98
2009	4.60	3.30
2010	2.21	1.84
2011	6.20	4.93

Source: Takala 2012

17

Puget Sound Energy's program cycles → 2006-2009 and 2010-2014

Eligible Projects?

State	Program	What EE projects are eligible?
Arizona	Arizona Public Service	Projects must meet the societal cost test
Colorado & New Mexico	Xcel Energy	Projects must meet the total resource cost test
New Jersey	New Jersey Clean Energy Program	Projects must have a payback period of less than 8 years
New Mexico	Public Service of New Mexico	Projects must meet the total resource cost test with a payback period of between 1 and 7 years
Ohio	Statewide	Projects must meet the total resource cost test or the utility cost test
Oregon	Oregon Dept of Energy	Projects must have a payback period of less than 10 years
Utah and Wyoming	Rocky Mountain Power	Projects must have a pre-rebate payback period of between 1 and 5 years, and meet the utility's cost effectiveness test
Vermont	Statewide	Projects must meet the same cost effectiveness tests as other EE programs
Washington	Puget Sound Energy	Projects must meet both the total resource cost test and the utility cost test
Wisconsin	Statewide	Projects must meet the same cost effectiveness tests as other EE programs

Incentives?

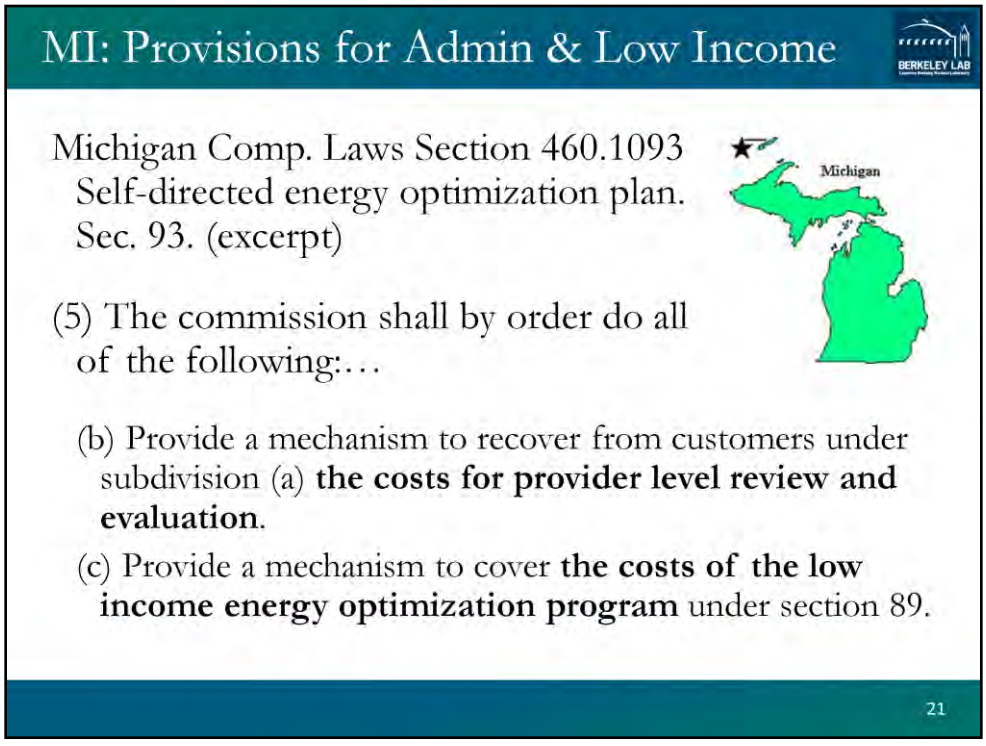
- Many programs reimburse up to 50-100% of project costs
- A few programs provide incentives based on savings
- A few programs create a customized plan with the customer

State	Program	How are EE exemptions / incentives structured?
Arizona	Arizona Public Service	Incentives can cover 100% of EE project costs
Colorado & New Mexico	Xcel Energy	$0.10/kWh incremental energy savings over the project lifetime or $525/kW demand reduction (which ever is greater); up to 50% of incremental project cost
Idaho	Idaho Power	Incentives can cover 100% of EE project costs
Michigan	Statewide	If customers meet the goals in their plan, they are exempted from a portion of the DSM charge
New Mexico	Public Service of New Mexico	Incentives can cover 100% of EE project costs
Ohio	Statewide	Either 1) an exemption from the DSM charge for an amount of time based on the projected savings, or 2) a rebate capped at 50% of project costs
Oregon	Eugene Water and Electric Board	EWEB staff works closely with customers to design 5-year energy savings goals; the customers' DSM charges are reduced if these goals are met
Oregon	Oregon Dept of Energy	Incentives can cover 100% of EE project costs
Utah and Wyoming	Rocky Mountain Power	Incentives cover up to 80% of approved EE project costs
Washington	Puget Sound Energy	Incentives can cover 100% of EE project costs
Wisconsin	Statewide	Customer creates a self-direct energy efficiency plan with detailed M&V plans and submits it to the PSC

Level of Exemption?

- Many programs require customers to pay a portion of shared costs, such as program admin and M&V
- If self-direct customers aren't paying for the full cost of their programs, this burden fall to other customer classes

State	Program	How much of the EE fees are customers exempt from paying?
Arizona	Arizona Public Service	Incentives given up to 85% of the annual DSM charge
Colorado & New Mexico	Xcel Energy	No cap on the amount of incentive relative to the annual DSM charge (incentives can be greater than the DSM charge)
Idaho	Idaho Power	Incentives given up to 100% of the annual DSM charge
Michigan	Statewide	Incentives given up to 100% of the annual DSM charge, minus administrative and low income program costs
New Mexico	Public Service of New Mexico	Incentives given up to 70% of the annual DSM charge.
Ohio	Statewide	Up to 100% of the DSM charge can be waived over multiple years based on the Benchmark Comparison Method
Oregon	Eugene Water and Electric Board	The full DSM charge, minus utility M&V costs, can be returned to the customer - level of reimbursement is based on meeting the savings goals, not on $ spent
Oregon	Oregon Dept of Energy	Incentives for projects given up to 68% of the annual DSM charge
Utah and Wyoming	Rocky Mountain Power	Incentives given up to 100% of the annual DSM charge, can be taken over multiple years. Customers must pay a $500 admin fee per project that they submit.
Washington	Puget Sound Energy	Incentives given up to 82.5% of the annual DSM charge
Wisconsin	Statewide	Incentives given up to 100% of the annual DSM charge, minus administrative and renewable energy charges



Michigan's self-direct legislation provides for funds to support overall program administration and low income programs (whose costs are shared across customer classes)

Contact: Dave Walker, Michigan PSC

PSC program info: http://www.michigan.gov/mpsc/0,4639,7-159-52495_54478---,00.html

The law: http://law.onecle.com/michigan/460-public-utilities/mcl-460-1093.html

PSE: Provisions for Admin & Market Trans.

Puget Sound Energy customers receive credits for 82.5% of their DSM charge when they invest in approved DSM projects, with carve outs for:

- Program administration – 7.5%
- Market transformation programs – 10%

neea

Commercial Real Estate (CRE)

Encouraging energy-efficient building management practices among commercial portfolio property owners.

Existing Building Renewal (EBR)

Creating a market-attractive pathway and market capabilities to energy-efficient renewal of existing buildings.

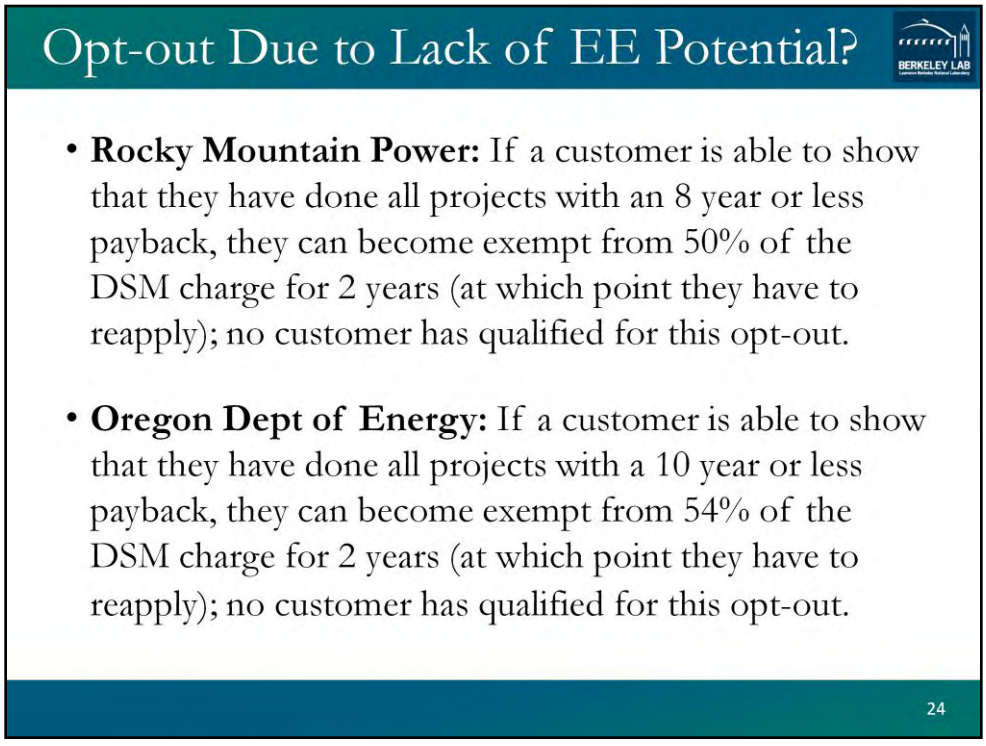
Commercial Lighting

Creating tools and market capabilities to support continued advances in new lighting standards.

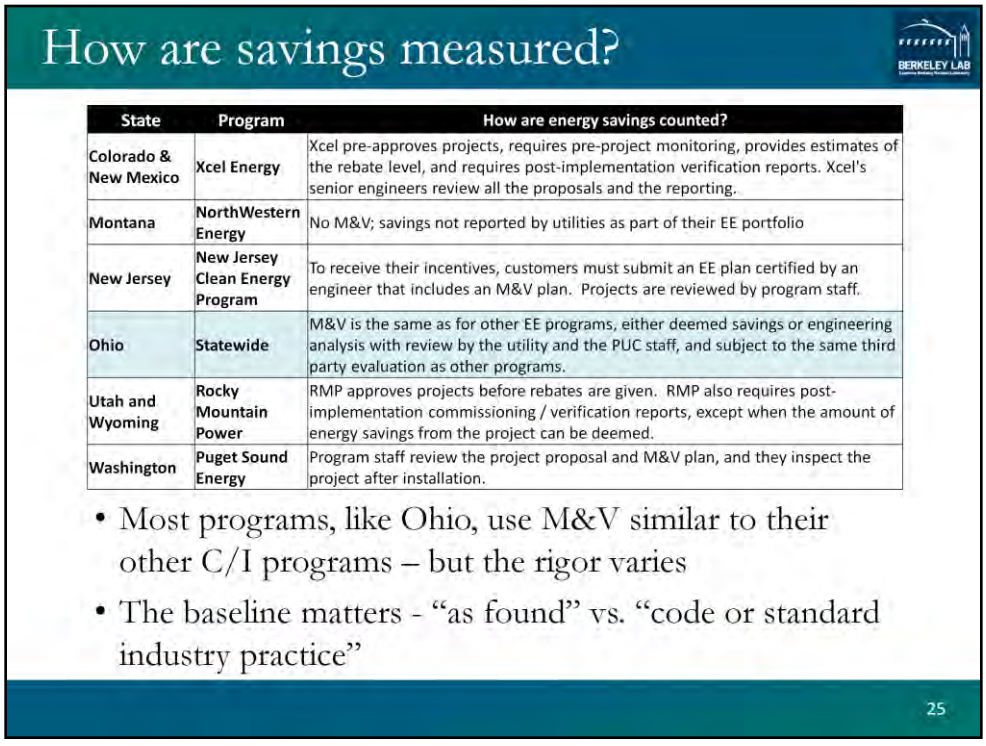
Length of Exemption?

- Most programs allow multi-year exemptions
- Multi-year exemptions are important for encouraging larger projects with deeper savings

State	Program	How long / under what conditions are customers exempt from all or part of the DSM charge?
Arizona	Arizona Public Service	Multi-year exemption, based on project costs
Idaho	Idaho Power	Up to 3-year exemption, based on project costs
Montana	NorthWestern Energy	Up to 2-year exemption, based on project costs
Ohio	Statewide	Multi-year exemption, based on savings
Oregon	Eugene Water and Electric Board	Multi-year exemption, based on meeting savings goals
Utah and Wyoming	Rocky Mountain Power	Multi-year exemption, based on project costs
Washington	Puget Sound Energy	Up to 4-year exemption, based on project costs



No programs have identified customers who have found all cost-effective EE.



In Ohio and several other states savings are largely measured from the "as found" baseline (not code or standard industry practice), unless the equipment has failed or is obsolete (e.g. T12 fixtures).

Whereas others, such as Xcel Energy, count and reward only the "incremental" saving, i.e. savings beyond code or standard industry practice.

Summary of How Ohio Compares

- **Eligible Customers** – Significantly more customers qualify for self-direct in Ohio than programs in other states
- **Eligible Projects** – Unlike most programs, Ohio credits historic projects; Ohio's cost effectiveness criteria is similar to many other programs
- **Incentives / Level of Exemption** – Ohio's Benchmark Comparison Method is not used in other states; more than half of programs reviewed also have some carve out for costs such as admin
- **Length of Exemption** – Unlike most programs, in Ohio the length of exemption is based on savings rather than project costs
- **Measuring Savings** – Several states have practices similar to Ohio; may want to consider changing the baseline to code and/or industry standard practice (like Xcel) to increase likelihood that project savings are "additional" (and not free riders)

Questions for Consideration

1. More than half (10 of 19) of the programs reviewed provide some portion of the DSM charge to support costs such as program administration and EM&V – **Should Ohio's self-direct customers pay for some of these costs, and if so to what extent?**

2. Few self-direct programs reward credit for historic projects – **Should Ohio re-direct resources to new and additional projects, and if so how?**

3. Most programs provide credit for projects based on project cost (or incremental project cost), and a few programs reward customers for aggressive savings with competitively granted funds or by allowing customers to receive incentives beyond their DSM charge – **Should Ohio consider alternatives to the Benchmark Comparison Method?**

4. To achieve many of the system benefits from DSM, savings need to be reliable, verifiable, and *additional* – **Should Ohio adopt the baseline of current code or industry standard instead of "as found"?**


BERKELEY LAB
Environmental Energy Technologies Division
Lawrence Berkeley National Laboratory
Additional Slides &
Resources

References

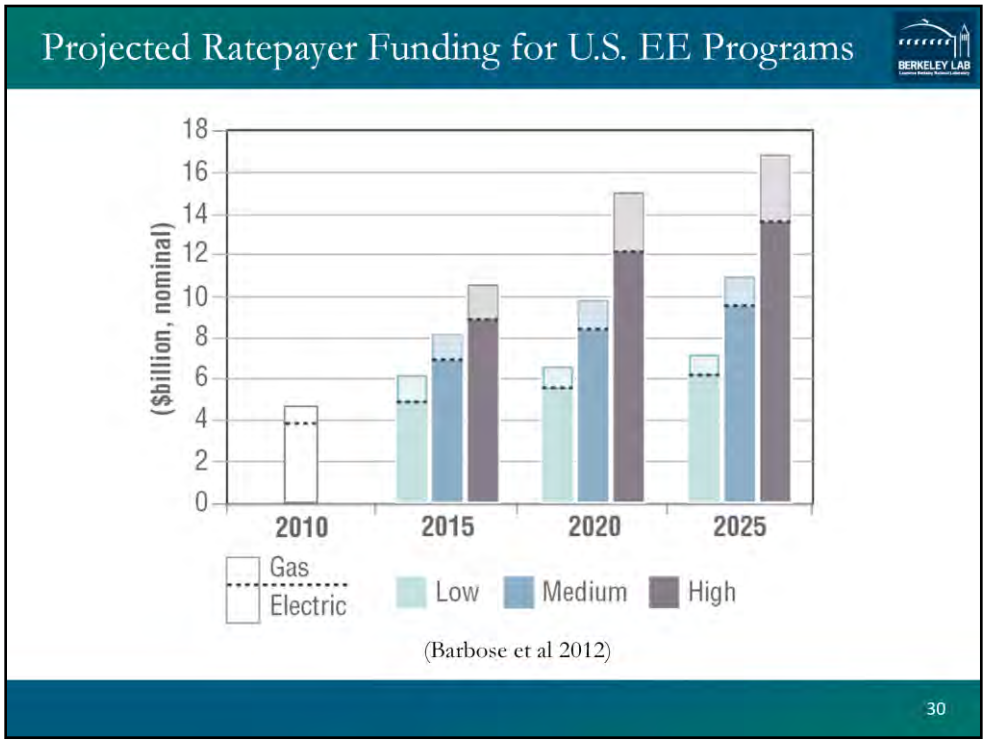
Chittum, Anna, Today's Self-Direct Energy Efficiency Programs: Cost-Effectiveness, Structure, and Lessons Learned: An ACEEE Memorandum, American Council for an Energy-Efficient Economy. Washington, DC: July 2012.

Utility Financing Programs for Industrial Customers (PDF)
September 2012 - SWEEP Report

Chittum, Anna, Follow the Leaders: Improving Large Customer Self-Direct Programs. American Council for an Energy-Efficient Economy. Washington, DC: October 25, 2011. http://aceee.org/research-report/ie112

G. L. Barbose, C. A. Goldman, and J. Schlegel, The Shifting Landscape of Ratepayer-Funded Energy Efficiency in the U.S. Berkeley: , 2009, p. 41. Download: Report PDF (446.46 KB); Presentation PDF (79.49 KB)

Friedrich, Katherine, Maggie Eldridge, Dan York, Patti Witte and Marty Kushler. 2009. *Saving Energy Cost-Effectively: A National Review of the Cost of Energy Saved Through Utility-Sector Energy Efficiency Programs.* Report U092. Washington, DC: American Council for an Energy-Efficient Economy. http://www.aceee.org/sites/default/files/publications/researchreports/U092.pdf



Electric EE funding projected to more than double from around $4B to $9.5B annually in the Medium Case by 2025

Gas EE funding projected to stay relatively flat at $1.3B annually in the Medium Case by 2025

From ACEEE: Approaches & Best Practices

Key features of well-designed self-direct programs:

1. Run as resource-acquisition efforts, with expectations the programs will yield energy savings like any other energy efficiency program;
2. Offer customers "carrots" for investing in energy efficiency projects;
3. Are flexible, allowing customers to use EE fees to fund long-term (multi-year) projects that might not be well-suited to traditional energy efficiency program offerings;
4. Employ the same cost-effectiveness criteria as other energy efficiency programs;
5. Conduct the same levels of evaluation, measurement, and verification as other energy efficiency programs;
6. Collect enough of an EE fee to cover administrative expenses;
7. Require customers to pay back retained EE fees or forfeit other benefits if they do not meet program requirements; and
8. Regularly collect meaningful data and use it to determine if the self-direct program is indeed acquiring cost-effective energy efficiency.

From ACEEE Memo: Chittum, Anna, Today's Self-Direct Energy Efficiency Programs: Cost-Effectiveness, Structure, and Lessons Learned: An ACEEE Memorandum, American Council for an Energy-Efficient Economy. Washington, DC: July 2011.

Ohio's Benchmark Comparison Method

- When customers "commit" their EE/PDR resources they can be exempted from the EE/PDR rider
- Their expected savings are compared to the utilities' "benchmark" energy savings requirements from SB 221, see table →
- Customers receive an exemption for the time period comparable to the utilities' level of required savings; exemptions for more than 2 years require the customer to submit a report every two years to confirm continued savings
  - *Example:* A project installed in 2009 with an estimated **3.2%** savings with a lifetime of at least 5 years could exempt a customer from the EE/PDR rider from 2009 to 2013

Annual and Cumulative Energy Savings Benchmarks as Defined by SB 221

Year	Additional Reduction	Cumulative Reduction
2009	0.30%	0.30%
2010	0.50%	0.80%
2011	0.70%	1.50%
2012	0.80%	2.30%
2013	0.90%	**3.20%**
2014	1.00%	4.20%
2015	1.00%	5.20%
2016	1.00%	6.20%
2017	1.00%	7.20%
2018	1.00%	8.20%
2019	2.00%	10.20%
2020	2.00%	12.20%
2021	2.00%	14.20%
2022	2.00%	16.20%
2023	2.00%	18.20%
2024	2.00%	20.20%
2025	2.00%	22.20%

Specific provision: R.C. 4928.66(A)(1)(a)
Link: http://codes.ohio.gov/orc/4928.66

Attachment B:

State of Ohio Energy Efficiency Technical Reference Manual
August 6, 2010

Pages 9, 297, 301

VERMONT ENERGY
INVESTMENT CORPORATION

State of Ohio Energy Efficiency Technical Reference Manual

Including
Predetermined Savings Values
and Protocols for Determining Energy and Demand Savings

Prepared for the Public Utilities Commission of Ohio
by Vermont Energy Investment Corporation
August 6, 2010

how reductions in waste heat from many efficiency measures impacts space conditioning, are not universally captured in this version of the TRM. Such interactive factors are included in calculations for lighting measures, and full protocols for their inclusion are given in the custom project protocols.

- Many C&I measures in the Joint Utility TRM were based on building energy simulations. This was typically done for complex, highly interactive measures, such as envelope improvements or chilled water resets. We agree that this is the best approach; it is prohibitively difficult to estimate energy savings from these types of measures with simplified algorithms. We conducted a review of the building prototype assumptions, which are primarily based on California's Database of Energy-Efficient Resources (DEER) prototypes with adjustments based on data published by the U.S. Energy Information Administration's (EIA) Commercial Building Energy Consumption Survey (CBECS) and a review by an engineering consulting company under contract to Duke Energy, and did not have any major concerns. The parameters used for the efficient case were also reviewed, and no issues significant enough to justify additional modeling work were identified. Two major changes were made in the presentation of the modeled measures in this TRM. First, we added the change in natural gas usage due to heating impacts for all relevant measures. Second, we disaggregated savings estimates by building type as well as climate zone. Many modeled measures show savings varying by up to a factor of four from one building type to another, and envelope measures often have significant heating impacts. These changes should increase the accuracy of the savings estimates and provide a more complete portrait of the measure's impacts. Finally, other values, such as incremental measures costs, that do not affect the modeling results were updated based on the latest available data.
- For early replacement measures across all sectors, we have provided two levels of savings:
  - An initial period during which the existing inefficient unit would have continued to be used had it not been replaced (and savings claimed between the existing unit and the efficient replacement),
  - The remainder of the measure life, where we assume that the existing unit would have been replaced with a standard baseline unit (and so savings are claimed between the standard baseline and the efficient replacement).

  We assume that accounting for this step-down adjustment in annual savings is possible in the utilities' tracking systems. We have also provided the impact of the deferred replacement payment that would have occurred at the end of the useful life of the existing equipment.
- For this and other net present value calculations, we have assumed a 5% discount factor for all calculations.
- In general, the baselines included in the TRM are intended to represent average conditions in Ohio. Some are based on data from the state, such as household consumption characteristics provided by the Energy Information Administration. Some are extrapolated from other areas, when Ohio data are not available. When weather adjustments were needed in extrapolations, weather conditions in all major Ohio cities were generally used as representative for their regions.
- The TRM anticipates the effects of changes in efficiency standards for some measures, specifically CFLs and motors. Specific reductions in savings have incorporated for CFL measures that relate to the shift in appropriate baseline due to changes in Federal Standards for lighting products. In 2012, Federal legislation (stemming from the Energy Independence and Security Act of 2007) will require all general-purpose light bulbs between 40 and 100W to be approximately 30% more energy efficient than current incandescent bulbs, in essence beginning the phase-out of the current style, or "standard", incandescent bulbs. In 2012, standard 100W incandescent bulbs will no longer be manufactured, followed by restrictions on standard 75W bulbs in 2013 and 60W bulbs in 2014. The baseline for the CFL measure in those years will therefore become bulbs (improved, or "efficient", incandescent, or halogen) that meet the new standard but are still less efficient than a CFL. The industry has indicated that new products that meet the federal standards but are less efficient than CFLs will be on the market. Those products can take several different forms we can envision now and perhaps others we do not yet know about; halogens are one of those possibilities and have been chosen to represent a baseline at that time. CFL fixtures will also have savings reduced by approximately 50% after the first year. Other lighting measures will also have baseline shifts that could result in significant impacts to estimated savings. While not reflected in the current proposed characterization, as of July 14, 2012, Federal

IV. Protocols for Custom Commercial & Industrial Projects

C&I Equipment Replacement – Custom Measure Analysis Protocol

This protocol defines the requirements for analyzing and documenting commercial and industrial energy efficiency measures. It applies to custom measures filed under Utility Programs and those prepared for Mercantile Customers. This protocol addresses equipment replacement measures that are not covered by other analysis methodologies in the TRM. An equipment replacement project is defined as equipment replaced at the end of its rated service life, or when it is replaced due to failure, obsolescence or a need for increased capacity. If the project is replacing equipment prior to the end of its rated service life for the purpose of achieving energy savings, it is classified as Retrofit and the "C&I Retrofit – Custom Measure Analysis Protocol" should be used to guide analysis.

This protocol is intended to address the energy impacts of the incremental energy efficiency improvements over what would have been installed as per applicable federal/state/local codes or standard industry practice. Projects that include duplex, redundant and/or spare equipment shall calculate the energy savings based only on the operating equipment and systems.

This analysis protocol is supplemented by a glossary and an Analysis Template (Appendix B). Words used herein that are defined in the glossary are in italics. The Analysis Template is a tool that can guide applicants in preparing and presenting the documentation to support custom equipment replacement energy efficiency measure savings estimates.

The Analysis Protocol is divided into four sections:
Section 1: Project Information
Section 2: Project Savings
Section 3: Project Variables
Section 4: Documentation and Metering

Section 1: Project Information

Project Title
Provide a unique title for the project so that it is easily distinguishable from other projects prepared by the same customer and from projects with similar scope. Example: Company XYZ Building A - Compressed Air System Replacement.

Customer Name
Provide the name of the company undertaking the energy efficiency improvements.

Customer Contact
Provide the contact information including name, title, mailing address, phone, and email for the primary customer contact on this project.

Site (Location)
Provide the full address of the site at which the project is being implemented. If the customer has an additional business location that is involved with the project, include additional customer site information as needed.

Sector/Industry Description and NAICS Code
Describe the sector and industry in which the custom measure is being applied. Sectors include: Industrial, Commercial, Institutional, and Multi-family. Industry should specify the end use for commercial and institutional projects (e.g. office, restaurant, dormitory) and the specific industry for manufacturing projects[725].

[725] 2007 NAICS; North American Industry Classification System; http://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2007

The analysis shall include documentation of how the load varies during the *Performance Hours*. For constant load equipment, the analysis shall be based on the equipment load and operating schedule during the performance hours. For variable load equipment, the analysis shall address variations in equipment load and operating schedule during the performance hours.

Additional analysis will typically be prepared to address the impact of the energy efficiency measure on customer peak demand. Such analysis is critical to calculating customer cost savings but should not be confused with the required calculation of the coincident demand during the performance hours.

Baseline Case

Baseline Technology Methodology and Description

Baseline for Equipment Replacement projects is the equipment meeting the level of efficiency required by State Code[726], applicable Federal product efficiency standard[727] 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[728] 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.

Baseline Case Annual Energy Use

Calculate the annual energy use for the baseline equipment and systems using the methodologies outlined in this protocol and all referenced and applicable standards.

The total baseline energy use shall be calculated separately for each *energy source* (e.g. electric and gas) according to the following equations.

For loads calculated from a regression analysis (e.g. kW vs. Temperature as described in Section 4) the following equation shall be used:

$$ENERGY_{base} = \sum_{j=1}^{m} (E\ LOAD_{j,base} \times HOURS_{j,base})$$

Where

$ENERGY_{base} \equiv$ Annual Baseline Energy Use - Annual Energy Use for baseline equipment calculated separately for each measure and each energy source (electric, gas).

$E\ LOAD_{j,base} \equiv$ Baseline Load (electric kW, gas therms) - Baseline Load for each system and subsystem with operating condition *j* (as defined below). For example, Baseline Load will need to be calculated differently for staged condenser fans that have different operating hours or multiple pumps that operate at varying speeds.

$HOURS_{j,base} \equiv$ Total Annual Operating Hours – Total Annual Operating Hours for each system and subsystem with operating condition *j* (as defined below).

For loads calculated based on equipment specifications and metering of baseline operating conditions including load factor and operating hours:

[726] International Code Council, 2007 Ohio Building Code; http://publicecodes.citation.com/st/oh/st/b2v07/index.htm?bu2=undefined

[727] ANSI/ASHRAE/IESNA Standard 90.1-2004, ISSN 1041-2336; www.ashrae.org

[728] PJM Manual 18B: Energy Efficiency Measurement and Verification, Rev. 0, Effective date: April 23, 2009; PJM M&V Manual approved 4_09.pdf

Attachment C:

Report of the Ohio Independent Evaluator: 2009 and 2010 Ohio Efficiency Programs
Evergreen Economics
August 29, 2012

Pages 8-10

EVERGREEN ECONOMICS

Report of the Ohio Independent Evaluator

2009 and 2010 Ohio Efficiency Programs

Volume I: Main Report

August 29, 2012

Prepared for the Public Utilities Commission of Ohio

FINAL REPORT

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As shown in the Table 2 comparison, in 2010 both FirstEnergy and Duke Energy used billing regression models to estimate impacts that were significantly higher than the now out-of-date TRM-recommended savings value and the values found in other studies such as the California HEES evaluation. (Note that the Duke Energy audit program, Home Energy House Call, also included the distribution of some measures such as CFLs and faucet aerators.) Based on our review of the Ohio evaluation reports, the evaluations did not adequately address the issue of participating in other programs or clearly link the reduction in savings to specific actions as a result of the audit. Given the high savings estimates, it also appears that the models were picking up other outside factors influencing lower energy use and attributing it to the audit program.

Table 2: Comparison of 2010 Home Energy Audit Calculations

Measure	TRM	Duke Energy	DP&L	AEP Ohio	FirstEnergy
Home Energy Audit	240 kWh*	856 kWh	N/A	N/A	300 kWh (2010 evaluation average = 416 kWh, with range of 233 to 1,032)
Total 2010 Savings from Home Energy Audits (kWh)		8,948,236	N/A	N/A	13,072,500
Share of 2010 Portfolio Savings		3%	N/A	N/A	13%

***Note:** Value from July 2010 draft Ohio TRM.

3. Mercantile customers – retrofit versus replacement baseline. The draft Ohio TRM specifies how savings are to be calculated for large non-residential custom projects and allows for either a retrofit or replacement baseline depending on the type of project:

impact estimates ranged from 188 to 276 kWh annually (*Memo on HEES 2004-05 Savings Analysis.* John Peterson, Athens Research, September 7, 2007).

> Energy efficiency retrofit projects involve the replacement of existing equipment prior to the end of its useful life in order to achieve energy savings. Therefore, the existing equipment may be used to establish the project baseline. The analysis must account for the remaining life of the existing equipment, and if the analysis period extends beyond the remaining life of the existing equipment, the analysis shall account for increases in efficiency that would have occurred through autonomous efficiency improvements or equipment replacement that would have occurred at the end of the existing equipment life in the absence of early retirement. The baseline description shall detail the baseline technology(ies) affected by the measure; including make, model number, nameplate information, and equipment rated capacity, condition, age, lifetime, usage, operating schedule, and controls. The baseline shall also account for upgrades to the equipment that would have occurred during the analysis period absent the early retirement of the equipment. (p. 316)

All projects that do not meet the requirements as a retrofit project must be defined as a replacement project and must, instead, follow the commercial and industrial (C&I) Equipment Replacement – Custom Measure Analysis Protocol described in the draft Ohio TRM, which states:

> An equipment replacement project is defined as equipment replaced at the end of its rated service life, or when it is replaced due to failure, obsolescence or a need for increased capacity (p. 297).
>
> 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. (p. 301)

In practice, there is sometimes disagreement among evaluators on what the appropriate baseline should be – either replacement or retrofit – and the effect on savings can be significant, depending on which baseline is assumed. This issue arose with one mercantile project for AEP Ohio. In this case, the AEP Ohio evaluator assumed the existing equipment baseline, while the Independent Evaluator believes that a new equipment baseline is appropriate. In this instance, the different baseline assumptions resulted in a 74 percent decrease is savings estimated for this one very large project when the new equipment baseline was used.

In anticipation of future differences in interpretation for these types of projects, we propose that part of the Independent Evaluator role involve helping utilities and PUCO staff review the application savings calculations as they are being submitted for approval for those projects where there may be disagreement on determining the appropriate baseline. This would include mercantile customers and could also be extended to other large custom projects.

Finally, as a separate issue, it should be noted that many of the mercantile projects reviewed were completed before the program was being offered and therefore could not possibly have been influenced by the program. While we understand that this is the law in the State of Ohio and was

being correctly followed by the utilities, we would be remiss as independent evaluators if we did not note that claiming savings for actions taken before a program is offered is inconsistent with standard industry practice.

4. Impact information sources. Our expectation at the start of this project was that the electric utility impact estimates would be a combination of *ex ante* values from the original program filings with the PUCO, savings values from the draft Ohio TRM, and *ex post* impact values derived from the utility evaluation research in the prior year. Instead we found a host of additional impact sources, as illustrated in Table 3. This multitude of sources has made the savings claim review for each utility more challenging, as there are many more sources that needed to be vetted than originally anticipated.

Attachment D:

Pennsylvania Technical Reference Manual
June 2013

Page 5

Technical Reference Manual

June 2013 (DRAFT)

State of Pennsylvania

Act 129

Energy Efficiency and Conservation Program

&

Act 213

Alternative Energy Portfolio Standards

were based on a review of literature from various industry organizations, equipment manufacturers and suppliers.

1.6 Baseline Estimates

For all new construction and replacement of non-working equipment, the ΔkW and ΔkWh values are based on standard efficiency equipment versus new high-efficiency equipment. For early replacement measures, the ΔkW and ΔkWh values are based on existing equipment versus new high-efficiency equipment. This approach encourages residential and business consumers to replace working inefficient equipment and appliances with new high-efficiency products rather than taking no action to upgrade or only replacing them with new standard-efficiency products. The baseline estimates used in the TRM are documented in baseline studies or other market information. Baselines will be updated to reflect changing codes, practices and market transformation effects.

1.7 Resource Savings in Current and Future Program Years

AECs and energy efficiency and demand response reduction savings will apply in equal annual amounts corresponding to either PJM planning years or calendar years beginning with the year deemed appropriate by the Administrator, and lasting for the approved life of the measure for AEPS Credits. Energy efficiency and demand response savings associated with Act 129 can claim savings for up to fifteen years. For Act 129 requirements, annual savings may be claimed starting in the month of the in-service date for the measure.

1.8 Prospective Application of the TRM

The TRM will be applied prospectively. The input values are from the AEPS application forms, EDC program application forms, EDC data gathering and standard input values (based on measured data including metered data and evaluation results). The TRM will be updated annually based on new information and available data and then applied prospectively for future program years. Updates will not alter the number of AEPS Credits, once awarded, by the Administrator, nor will it alter any energy savings or demand reductions already in service and within measure life. Any newly approved measure, whether in the TRM or approved as an interim protocol, may be applied retrospectively consistent with the EDC's approved plan. If any errors are discovered in the TRM or clarifications are required, those corrections or clarifications should be applied to the associated measure calculations for the current program year, if applicable.

1.9 Electric Resource Savings

Algorithms have been developed to determine the annual electric energy and electric coincident peak demand savings.

Annual electric energy savings are calculated and then allocated separately by season (summer and winter) and time of day (on-peak and off-peak). Summer coincident peak demand savings are calculated using a demand savings algorithm for each measure that includes a coincidence factor. Application of this coincidence factor converts the demand savings of the measure, which may not occur at time of system peak window, to demand savings that is expected to occur during the top 100 hours. This coincidence factor applies to the top 100 hours as defined in the

Attachment E:

State of Illinois Energy Efficiency Technical Reference Manual
September 14, 2012

Pages 23-25

State of Illinois

Energy Efficiency

Technical Reference Manual

Final

As of September 14th, 2012

Effective:

June 1st, 2012

Measure Number	Measure Title	Adjustable Variable	Adjustable Variable Description	Documentation	Notes
4.5.4	T5 Lighting	$Watts_{base}$	Base Wattage	Customer input or measured value	This will allow for reduced wattage applications
		$Watts_{EE}$	Efficiency Wattage	Customer input or measured value	This will allow for reduced wattage applications
		Hours	Average use hours	Customer input or documented value based on study or report	
4.5.5	Lighting Controls	$KW_{connected}$	Total Connected kW load	Customer input or measured value	
		Hours	Hours of use	Customer input or documented value based on study or report	
		ESF	Energy Savings Factor	Customer input or documented value based on study or report	
4.5.6	Lighting Power Density Reduction	WSF_{effic}	The actual installed lighting watts per square foot or linear foot	Customer input	
		SF	Square footage of the building area applicable to the lighting design	Customer input	
		Hours	Hours of use	Customer input	

2.5 Program Delivery & Baseline Definitions

The measure characterizations in this TRM are not grouped by program delivery type. As a result, the measure characterizations provided include information and assumptions to support savings calculations for the range of program delivery options commonly used for the measure. The organizational significance of this approach is that multiple baselines, incremental costs, O&M costs, measure lives and in-service rates are included in the measure characterization(s) that are delivered under two or more different program designs. Values appropriate for each given program delivery type are clearly specified in the algorithms or in look-up tables within the characterization.

Care has been taken to clearly define in the measure's description the types of program delivery that the measure characterization is designed to support. However, there are no universally accepted definitions for a particular program type, and the description of the program type(s) may differ by measure. Nevertheless, program delivery types can be generally defined according to the following table. These are the definitions used in the measure descriptions, and, when necessary, individual measure descriptions may further refine and clarify these definitions of program delivery type.

Table 2.5.1: Program Delivery Types

Program	Attributes
Time of Sale (TOS)	Definition: A program in which the customer is incented to purchase or install higher efficiency equipment than if the program had not existed. This may include retail rebate (coupon) programs, upstream buydown programs, online store programs, contractor based programs, or CFL giveaways as examples. Baseline = New equipment. Efficient Case = New, premium efficiency equipment above federal and state codes and standard industry practice. Example: CFL rebate
New Construction (NC)	Definition: A program that intervenes during building design to support the use of more-efficient equipment and construction practices. Baseline = Building code or federal standards. Efficient Case = The program's level of building specification Example: Building shell and mechanical measures
Retrofit (RF)	Definition: A program that *upgrades* existing equipment before the end of its useful life. Baseline = Existing equipment or the existing condition of the building or equipment. A single baseline applies over the measure's life. Efficient Case = New, premium efficiency equipment above federal and state codes and standard industry practice. Example: Air sealing and insulation
Early Replacement (EREP)	Definition: A program that *replaces* existing equipment before the end of its expected life. Baseline = Dual; it begins as the existing equipment and shifts to new baseline equipment after the expected life of the existing equipment is over. Efficient Case = New, premium efficiency equipment above federal and state codes and standard industry practice. Example: Refrigerators, freezers
Early Retirement (ERET)	Definition: A program that *retires* duplicative equipment before its expected life is over. Baseline = The existing equipment, which is retired and not replaced. Efficient Case = Zero because the unit is retired. Example: Appliance recycling
Direct Install (DI)	Definition: A program where measures are installed during a site visit. Baseline = Existing equipment. Efficient Case = New, premium efficiency equipment above federal and state codes and standard industry practice. Example: Lighting and low-flow hot water measures

The concept and definition of the baseline is a key element of every measure characterization and is directly related to the program delivery type. Without a clear definition of the baseline, the savings algorithms cannot be adequately specified and subsequent evaluation efforts would be hampered. As a result, each measure has a detailed description (and in many cases, specification) of the specific baseline that should be used to calculate savings. Baselines in this TRM fall into one of the following five categories, and are organized within each measure characterization by the program delivery type to which it applies.

1. **Building Code:** As defined by the minimum specifications required under state energy code or applicable federal standards.

2. **Existing Equipment**: As determined by the most representative (or average) example of equipment that is in the existing stock. Existing equipment baselines apply over the equipment's remaining useful life.

3. **New Equipment**: As determined by the equipment that represents standard practice in the current market environment. New equipment baselines apply over the effective useful life of the measure.

4. **Dual Baseline**: A baseline that begins as the existing equipment and shifts to new equipment after the expected life of the existing equipment is over.

5. **Zero Baseline**: A baseline that is applicable to early retirement measures where the existing equipment is no longer in service.

2.6 High Impact Measures

Measures that are expected to collectively account for at least 80% of statewide energy savings are considered high impact measures. The following tables list these measures and show the section in which they may be found.

Table 2.6.1: Commercial and Industrial High Impact Measures

Section	End-use	Technology / Measure
4.2.3	Food Service	Commercial Steam Cooker
4.2.11	Food Service	High Efficiency Pre-Rinse Spray Valve
4.4.3	HVAC	Process Boiler Tune-up
4.4.4	HVAC	Boiler Lockout/Reset Controls
4.4.10	HVAC	High Efficiency Boilers
4.4.11	HVAC	High Efficiency Furnace
4.4.15	HVAC	Steam Trap Replacement or Repair
4.4.16	HVAC	Variable Speed Drives for HVAC
4.5.1	Lighting	CFL
4.5.2	Lighting	ILED
4.5.3	Lighting	High Performance T8 Fixtures and Lamps
4.5.4	Lighting	T5
4.5.5	Lighting	Lighting Controls
4.6.6	Lighting	Lighting Power Density Reduction
4.5.7	Lighting	LED Traffic and Pedestrian Signals
4.3.4	Hot Water	Tankless Water Heater

Attachment F:

PJM Manual 18B: Energy Efficiency Measurement & Verification
March 1, 2010

Page 26

Working to Perfect the Flow of Energy

PJM Manual 18B:

Energy Efficiency Measurement & Verification

Revision: 01

Effective Date: March 1, 2010

Prepared by

PJM Forward Market Operations

Section 8: Establishing Baseline Conditions

Welcome to the *Establishing Baseline Conditions* section of the PJM Manual for *Energy Efficiency Measurement and Verification*. In this section, you will find the following information:

- A description of general requirements for all EE Resources on establishing, measuring and reporting baseline (see "Baseline Requirements for All EE Resources").
- A description of requirements for EE Resources involving new construction or major renovations on establishing, measuring and reporting baseline (see "Baseline Requirements for EE Resources involving New Construction or Major Renovations").

The EE Resource Provider shall describe in its M&V Plan the methodology used to determine Baseline Conditions for the equipment or process comprising the EE project. Baseline Conditions are defined as the MW demand of the equipment or process during defined EE Performance Hours, or the demand that would have existed, in the absence of the energy efficiency project.

The EE Resource Provider shall identify in its Measurement and Verification Plan any and all equipment, systems, practices or strategies or type of the aforementioned, whose alteration from its Baseline Condition operation will lead to reduced demand during the Performance Hours.

8.1 Baseline Requirements for All EE Resources

The EE Resource Provider must describe in its Measurement and Verification Plan how it will satisfy each of the applicable requirements listed below.

(1) For projects where the demand reduction results from measures involved variable load equipment or equipment whose operation is time-dependent or weather-dependent, the Baseline Conditions must be calculated for each hour across the Performance Hours.

(2) '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, then standard practice shall be used as the basis for establishing Baseline Conditions and shall be documented in the M&V Plan.

(3) 'Current Load' Baseline: For projects in which replacement, modification or removal of equipment and controls in systems or buildings are not planned independently of the Energy Efficiency initiative that is being offered into the RPM Auction, the Baseline Condition is the kW load of the existing equipment across the Performance Hours under pre-retrofit conditions.

Attachment G:

Meaningful Impact: Challenges and Opportunities in Industrial Energy Efficiency Programs Evaluation
Anna Chittum, ACEEE
September 2012

Page v

Meaningful Impact:

Challenges and Opportunities in Industrial Energy Efficiency Program Evaluation

Anna Chittum

September 2012

Report Number IE122

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Glossary and Suggested Definitions

a. Adjusted gross savings
    i. Gross savings that have been adjusted to reflect the applicable realization rate.
b. Baseline
    i. Energy consumption that would have occurred without implementation of the energy efficiency measure, project, or service. Often referred to as business-as-usual (adapted from NMR 2010).
    ii. Least efficient, non-regressive, code or regulations-compliant option specific to a particular facility and application that the customer technically, functionally, and economically could have alternatively considered to deliver the post-retrofit level of production or service (Maxwell et al. 2011).
c. Deemed savings
    i. Savings estimates for a specific measure based on established and universally accepted fixed measure-specific savings estimates.
d. Evaluator
    i. An individual or organization tasked with the evaluation of an energy efficiency program. Most often not a member of the organization administering the energy efficiency program, although internal evaluators within program-administering entities such as utilities and PBF organizations do exist.
e. Free-rider
    i. A program participant who would have implemented the measures or practices in question absent the program (NAPEE 2007 and NMR 2010).
f. Gross energy savings
    i. The changes in energy consumption and/or energy demand seen in customers that have been exposed to an energy efficiency program, regardless of why they participated. The "physical change in energy use after taking into account factors beyond the customer or sponsor's control (e.g., weather)." (NAPEE 2007 and NMR 2010).
g. Impact evaluation
    i. Evaluation activities that determine the actual savings and benefits of the given energy efficiency program.
h. Net energy savings
    i. The energy savings that would not have occurred absent the energy efficiency program (NMR 2010). Sometimes calculated as gross savings minus free rider savings plus spillover savings.
i. Net to gross ratio
    i. Net program savings divided by gross program savings. This ratio is then typically applied to gross program impacts to derive net program impacts (NMR 2010).

Summary: Exhibit Attachments A through G to Joint Comments of the Environmental Law and Policy Center, Ohio Environmental Council, Natural Resources Defense Council, and Sierra Club electronically filed by Mr. Nicholas A. McDaniel on behalf of Environmental Law and Policy Center and Ohio Environmental Council and Natural Resources Defense Council and Sierra Club