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STATE & LOCAL ENERGY EFFICIENCY ACTION NETWORK

Industrial Energy Efficiency: Designing Effective State Programs for the Industrial Sector

Industrial Energy Efficiency and Combined Heat and Power Working Group

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Acronyms

BPA	Bonneville Power Administration
Btu	British thermal units
CEE	Consortium for Energy Efficiency
CEPS	clean energy portfolio standard(s)
CFA	Consolidated Funding Application
CHP	combined heat and power
C&I	commercial and industrial
DOE	U.S. Department of Energy
DSM	demand-side management
EERS	energy efficiency resource standard(s)
EPA	U.S. Environmental Protection Agency
EPI	energy performance indicator
EnMS	energy management system
ETO	Energy Trust of Oregon
EWEB	Eugene [Oregon] Water and Electric Board
FTE	full-time equivalent employee
GWh	gigawatt-hour
IEE	Industrial energy efficiency
IOF-WV	Industries of the Future West Virginia
IPE	NYSERDA's Industrial Process Efficiency program
IPMVP	International Performance Measurement and Verification Protocol
IRP	integrated resource planning
HVAC	heating, ventilating, and air conditioning
HPEM	High Performance Energy Management (BPA program)
kW	kilowatt
kWh	kilowatt hour
M&V	measurement and verification
MMBtu	million British thermal units
MW	megawatt
MW_{avg}	average megawatts
MWh	megawatt-hour
NAICS	North American Industry Classification System
NEEA	Northwest Energy Efficiency Alliance
NEB	non-energy benefit
NWFPA	Northwest Food Processors' Association
NYSERDA	New York State Energy Research and Development Authority
O&M	operations and maintenance
PAC	program administrator cost test
PDC	program delivery contractor
RMP	Rocky Mountain Power
SEM	strategic energy management
SEO	state energy office
SEP	U.S. Department of Energy Superior Energy Performance program
SME	small- and medium-sized enterprise
SWEEP	Southwest Energy Efficiency Project
Therm	100,000 Btu
TRC	total resource cost
UMP	Uniform Methods Project
WFE	Wisconsin Focus on Energy

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Executive Summary

Industry[1] is a key energy-using sector in the United States and accounted for about one-third of the nation's total primary energy consumption in 2012. In addition, the potential cost-effective energy savings in U.S industry is large—amounting to approximately 6,420 trillion British thermal units of primary energy (including combined heat and power), according to a comprehensive 2009 analysis by McKinsey & Company. In the United States, efforts to capture more of the potential energy savings in industry at the state level have grown in recent years as energy efficiency programs that capture cost-effective savings continue to be created and expand.

This report provides state regulators, utilities, and other program administrators an overview of the spectrum of U.S. industrial energy efficiency (IEE) programs[2] delivered by a variety of entities including utilities and program administrators. The report also assesses some of the key features of programs that have helped lead to success in generating increased energy savings and identifies new emerging directions in programs that might benefit from additional research and cross-discussion to promote adoption.

Why Do States Undertake Industrial Energy Efficiency Programs?

Many states have instituted energy efficiency programs funded by the public or ratepayers to achieve a variety of benefits. A core, compelling reason for this is because energy efficiency represents a least-cost option for supplying energy services compared to other prevailing options, providing both consumers and society with cost savings. Additional benefits can include environmental gains (including carbon or water use reduction), improved security against energy supply disruption or rapid price increases, and enhanced economic competitiveness. Most state governments have determined that it is necessary to include programs that cover all customers as part of their overall energy efficiency efforts, with industrial customers often a critical component. Experience has shown that the industrial sector historically saves more energy per program dollar than other customer classes: at the national level, IEE programs had an average cost of saved energy of $0.030 per kilowatt hour (kWh) in 2012—nearly one cent lower than the aggregate average energy efficiency program cost of $0.038/kWh.[3] Many of the well-established ratepayer-funded IEE programs in North America, such as those of Bonneville Power Authority, BC Hydro, Energy Trust of Oregon, or Wisconsin's Focus on Energy, continue to realize reliable energy savings from industry at or below the average costs they face for their programs overall. To realize these low-cost energy savings, however, requires a concerted effort developed specifically for the industrial sector and long-term, focused efforts addressing specific industrial needs and circumstances.

States have found that a larger amount of energy savings potential in industry can be gained from energy efficiency programs than can likely be achieved if industrial energy users pursue energy efficiency individually, with limited program assistance. Industrial companies are often aware of energy savings projects in their facilities and many companies have a solid record of developing these projects to save money; however, energy efficiency often cannot compete with other capital demands, even with similar or better paybacks. Moreover, industrial staff members often report that it is difficult to effectively navigate corporate project decision-making systems to get management endorsement for even quick payback energy efficiency projects. In addition, small- or medium-sized energy savings projects often do not compete well with other projects in garnering management attention and

[1] As defined by the Energy Information Administration (EIA), industry consists of the following types of activity: manufacturing (NAICS codes 31-33); agriculture, forestry, fishing, and hunting (NAICS code 11); mining, including oil and gas extraction (NAICS code 21); and construction (NAICS code 23). This report principally focuses on the manufacturing subsector.

[2] The best practices information presented in this report is based on a review of publically available literature on state energy efficiency programs and materials and presentations from related workshops and discussions with industrial energy efficiency experts and program administrators, including: the ACEEE Summer Study on Industry (July 2013, Niagara Falls), the ACEEE Resource Acquisition Conference (September 2013, Nashville), the Industrial Energy Efficiency and CHP Regional Dialogue Meetings (held in 2011, 2012 and 2013), the Midwestern Governor's Association Industrial Energy Productivity Meeting (November 2013, Chicago).

[3] Source: Aden et al. 2013 based on EIA 2012 demand-side management, energy efficiency, and load management programs data for more than 1,000 utilities. Note: To ensure consistency and comparability, these values only include the 182 organizations that reported residential, commercial, and industrial savings and expenditure data; transport sector energy efficiency program data are not included except as a component of the aggregate average.

enthusiasm. Finally, limitations on staff resources and knowhow can further hinder implementation of cost-effective energy efficiency measures.[4]

In states where ratepayer-funded energy efficiency programs are in place, industrial programs can make a significant difference, not only by fostering higher implementation of quick payback projects, but also by providing financial incentives that improve the economics of what would have been longer-term payback projects (3–6 years) that are well outside the typical interest scope of industrial managers. Program incentives to help industrial customers capture the potential for large, additional energy savings can strengthen the alignment of company incentives with the broader interests of energy users statewide in developing low-cost resources for energy service supply. In addition, other intensive but highly cost-effective initiatives of key medium-term interest can be fostered through multi-year programming, such as development of new strategic energy management (SEM) systems in industrial companies.

Even relatively simple programs providing technical assistance, fostering peer exchange, and disseminating practical information can make a difference by supporting facility or company energy management staff in their work and drawing company management attention to energy cost saving possibilities. Increasing awareness of the non-energy benefits (NEBs) that often accompany energy saving projects can help tip the scale in favor of project implementation.

The Wide Spectrum of Ongoing and Useful State Programs

There is wide variation in the types of IEE programs pursued by states, utilities, and energy efficiency program administrators. The dynamics of local economies, existing regulatory frameworks, political interest, and characteristics of local industrial sectors help define what different states feel are the most appropriate approaches for IEE programs. Within this wide spectrum of successful—if diverse—experience, all states can certainly launch new programs, or adapt existing programs, providing cost-saving benefits to industry and the state at large. Moreover, because of the diversity of programs and experience, each state can learn from others about new ideas and lessons learned in program design and implementation.

This report defines a state IEE program in broad terms as a program that provides information, services, and/or financial support to interested industrial facilities within the state for energy efficiency activities. Broadly speaking, there are two main types of IEE programs in the United States:

- Ratepayer-funded energy efficiency programs which are funded through electric and gas customer rates
- Non-ratepayer-funded programs, which are funded by other means (e.g., federal resources, state operating budgets) and are often run by out-of-state energy offices and universities.

This report principally focuses on ratepayer-funded programs, although non-ratepayer-funded programs are also touched upon. Many states also mix a variety of different offerings and funding streams. The National Association of State Energy Officials (NASEO) reports that at least 35 state energy offices operate some type of IEE program separate from, or in support of, ratepayer-funded programs. Forty-one states have ratepayer-funded energy efficiency programs, and just over one-half of states operate ratepayer-funded programs with clean energy portfolio standards/energy efficiency resource standards or utility energy efficiency targets. Some states have chosen to include a self-direct or opt-out option to industrial programs. Self-direct programs are defined in this report as programs that allow qualifying industrial customers to “self-direct” fees that would normally be charged for a ratepayer-funded program directly into energy efficiency investments in their own facilities instead of into a broader aggregated pool of funds collected through a public benefits charge for energy efficiency programs. Not to be confused with “opting out,” where the industrial company does not have to participate in the program, self-directed industrial customers are still obligated to spend money and deliver energy savings, either on a project-by-project basis, or over a certain amount of time.

[4] These IEE program challenges were identified through SEE Action Industrial Energy Efficiency and Combined Heat and Power Regional Dialogue Meetings held across the country in 2011, 2012, and 2013 (www1.eere.energy.gov/seeaction/ieechp_dialogues.html).

APPROACH	DESCRIPTION	PROGRAM EXAMPLES
KNOWLEDGE SHARING	• Low-cost or no-cost technical assistance • Workshops and other outreach • Peer exchange opportunities between industrial clusters or groups of companies • Success story dissemination	• West Virginia Industries of the Future • Southwest Energy Efficiency Project
PRESCRIPTIVE INCENTIVES	• Explicit incentives or rebates for certain specific eligible technologies (e.g., lighting, motors, drives, compressed air, process heating equipment)	• Rocky Mountain Power • Efficiency Vermont
CUSTOM INCENTIVES	• Specific energy efficiency projects tailored to individual customers or specific industrial facilities • May be a mix of technologies • Incentives or rebates often based on entire electricity or natural gas savings	• Xcel Energy • NYSERDA
MARKET TRANSFORMATION	• Streamlined path for introduction of new energy efficiency products to the market • Address structural barriers to energy efficiency (e.g., outdated building codes or lack of vendors offering an emerging technology)	• Northwest Energy Efficiency Alliance
ENERGY MANAGEMENT	• Operational, organizational, and behavioral changes through strategic energy management • Continuous energy improvement (e.g., embedded energy manager to provide leadership and organizational continuity for implementing change)	• Wisconsin Focus on Energy • Energy Trust of Oregon
SELF-DIRECT	• Customer fees directed into energy efficiency investments in their own facilities instead of a broader aggregated pool of funds • Eligibility for customer participation often based on threshold amount of energy use or energy use capacity • Verified energy savings	• Puget Sound Energy • Michigan Self-Direct Energy Optimization

Source: Categorization adapted from Bradbury et al. (2013)

Figure ES-1. Spectrum of IEE state program approaches with program examples

Financial incentives and technical assistance are often provided to energy users to implement sufficient energy efficiency measures to meet specific statewide energy savings goals or pursue all cost-effective energy efficiency opportunities. The main types of offerings, shown in Figure ES-1, are the following:

- **Technical Assistance and Knowledge-Sharing Programs.** These programs typically offer no-cost or low-cost expertise and advice to industrial companies on new technologies and practices, share analytical tools, disseminate success stories and case studies, and offer networking opportunities.
- **Prescriptive Programs.** Standardized prescriptive program offerings provide explicit incentives for adoption of specified higher-efficiency technologies in applications that are common among a variety of commercial and industrial energy users.
- **Custom Programs.** These program offerings provide financial and technical support, usually for customized, often process-specific, project implementation designed to meet the explicit needs of specific industrial customers. They can unlock substantial energy savings beyond what is possible when targeting only individual pieces of equipment and are usually quite cost-effective.

- **Market Transformation Programs.** These programs aim to streamline the path from market introduction of new energy efficiency products or practices to their promotion and consumer acceptance. Adoption of the new products can be supported through increasingly stringent energy efficiency codes and standards, technical assistance, and/or financial incentives.
- **Strategic Energy Management and Energy Manager Support Programs.** Rather than focusing on technology and equipment, these programs seek to promote operational, organizational, and behavioral changes resulting in energy efficiency gains on a continuing basis. SEM involves the operation of internal cross-organization management systems for companies that need to identify and implement many energy efficiency measures year after year.

Experience from Designing and Delivering Programs

A central finding of this report is that achieving success in IEE programs requires significant upfront investment and steady commitment over a number of years. In practice, the experience of strong IEE programs shows that the dedicated effort required is worth it in terms of generating robust and low-cost energy savings. This is especially true in the industrial sector where energy improvement decisions may be linked to operational or capital cycles.

The industrial sector is heterogeneous; different plants have different needs, all of which takes time and skill to grasp. Industrial plant staff members are generally more sophisticated concerning energy matters compared to residential and many commercial energy users. However, internal decision-making processes in industrial companies concerning energy efficiency investments or energy use behavioral change can be complex. Plant operational cycles must be understood and typically define project scheduling. Often, non-energy benefits, including increased productivity, may provide a key tipping point benefit in favor of pursuing a given line of projects, but such benefits may not be immediately obvious. As detailed further in Chapter 4, the barriers and challenges of the industrial sector must be addressed if IEE programs are to create real value for their customers.

To overcome existing barriers and provide high value to industrial customers, programs require quality market assessments, steady and close interaction with customers, a critical mass of knowledgeable staff and strategically engaged consultants, and operational stability. This requires upfront investment and a multi-year focus.

There are 10 IEE program features highlighted by analysts and practitioners that consistently add value to industrial customers and contribute to program success. These program features are:

1. **Clearly demonstrating the value proposition of IEE projects to companies.**
   There are many direct and indirect benefits from IEE projects. A key point in making the value proposition case to industrial company managers is to lay out in simple and concise terms the operating cost savings and other benefits—including profits—that are being left on the table by not addressing cost-effective energy efficiency improvement opportunities.
2. **Developing long-term relationships with industrial customers that include continual joint efforts to identify IEE projects.** Maintaining relationships with key industrial customers is important in pure technical assistance programs as well as energy efficiency resource acquisition programs. It takes time and a steady relationship for program personnel to understand company circumstances and needs, and for company personnel to understand what a program can offer them. Projects tend to be identified over time, as circumstances change and opportunities arise.

   Maintaining quality long-term relationships is people-dependent. Most programs have found that it is necessary to have a consistent and savvy contact person for industrial customers to interact with, such as an account manager. Satisfaction of industrial customers with program delivery and results often hinges on the level of trust established in relationships with program staff or experts.

   Due to the importance of long-term relationships, substantial program investments in staffing or contracted expert capacity are necessary over a number of years to generate the best results. Contracting for program delivery capacity based on only short-term goals, with frequent changes in contractors, is not likely to succeed. Time and effort is needed to set up effective institutional systems.

3. **Ensuring program administrators have industrial sector credibility and offer quality technical expertise.** Effective IEE programs also develop credibility with the industrial customer by employing staff and/or contracted experts that understand the customer's industrial segment and have the technical expertise to provide quality technical advice and support on energy efficiency options and implementation issues specific to that industry and customer. Addressing industrial companies' core needs requires understanding a plant's production processes, operating issues, and the market context that it operates within. Effective IEE programs will adopt the language, engagement strategies, and metrics that are meaningful to the corporate managers who drive capital investment decisions. Understanding customer needs and their investment decision-making processes allows IEE program administrators to generate trust with their industrial customers, boosting IEE implementation rates while making better use of limited resources.
4. **Offering a combination of prescriptive and custom options to best support diverse customer needs.** A combination of both prescriptive offerings for common cross-cutting technologies and customized project offerings for more unique projects can best meet diverse customer needs and provide flexible choices to industries.
5. **Accommodating scheduling concerns.** Program flexibility to meet industry project scheduling requirements is important to meet industrial customer needs. Typically, scheduling of capital project implementation must consider both operational schedules that dictate when production lines may be taken out of operation and capital investment cycles and decision-making processes. Programs with multi-year operational planning can best accommodate company scheduling requirements and the ebb and flow of company project implementation progress.
6. **Streamlining and expediting application processes.** Industrial customers may perceive the application and implementation procedures for IEE programs to be administratively complex and burdensome. Achieving the right balance between meeting key program administration needs for information and keeping program procedures simple and efficient may often require a continual process of evaluation and improvement.
7. **Conducting continual and targeted program outreach.** Even where industrial programs are well established, various industrial customers may remain unaware of the industrial program offerings that may be most applicable or useful for them due to staff turnover and internal demands. Steady and continual outreach and dissemination of information, such as examples of successful past projects, is important to encourage participation. Effective long-term relationships with industrial customers create better information flow and can assist in program outreach efforts.
8. **Leveraging partnerships.** Successful IEE programs often partner with federal, state, and regional agencies and organizations to leverage their expertise, access to customers, and program implementation support capacities. Partnerships can help programs by providing technical expertise, program design and implementation guidance, and expanding program outreach and implementation channels.
9. **Setting medium- to long-term goals as an investment signal for industrial customers.** Most state IEE programs have found that establishing and reporting on energy savings goals in three-year cycles is effective. Medium- and longer-term goals and coordinated funding cycles set a framework for long-term programming and can signal increased certainty to the market and program administrators.
10. **Undertaking proper project measurement and verification and completing program evaluations.** Effective measurement and verification (M&V) of project energy savings is critical to program administrators and regulators to assess the actual results of program activities and measure the contribution of projects and aggregate programs for achieving their goals. Manufacturers also can obtain clear views of the results of investment. Planning for M&V during the program design phase as well as periodic evaluation and adjustment in M&V approaches is important. If NEBs can be included in project assessments, they can further improve understanding of these often important benefits in conveying the value proposition for future energy efficiency projects. Finally, it is useful for programs to undertake periodic process and/or operational strategy evaluations of their full range of activities to assess where program efficiency and results can be further improved.

Self-Direct Programs

This report's review of self-directed IEE programs found a wide range in program structures. Some programs leave obligations of self-directed industries only vaguely defined, include little reporting, and little or no monitoring of energy-saving actions. Such programs ultimately may be little different in terms of results from provisions allowing industry to opt out of energy efficiency programs entirely. At the other end of the spectrum, some programs require verified self-directed customer investment and energy savings to be achieved in order for payment into the programs to be waived. Clarity in self-directed customer obligations and M&V of results are necessary if the policy goal is to ensure that self-directed industrial customers contribute to overall efforts to ensure least-cost electricity or gas service at a level on par with the contributions of other customers.

Emerging Industrial Program Directions

Most states with active IEE programs continue to devote much effort to expanding and improving their programs. There are four key areas of particular interest for further program evolution.

- **Expanding and strengthening strategic energy management programs in industry.** Efforts to support implementation of SEM systems in industry (and also commercial and institutional) are gaining momentum in state programs and internationally. Successful implementation of SEM in many industries could have a dramatic impact on capturing more unrealized energy efficiency potential. The benefits of supporting internal company platforms for continual identification and implementation of energy savings measures include more comprehensive identification and prioritization of energy savings investments (including across organizations), high-impact and low-cost behavioral changes, and operational and maintenance improvements, all contributing to the company bottom line. For example, use of greater submetering as part of an SEM initiative may allow previously unclear issues and solutions to come to light, or enable a new energy intensity program to be put in place.

  SEM implementation can be effectively supported through technical assistance and recognition programs or through energy efficiency resource acquisition programs. One key common challenge is how to easily convey options for introducing SEM into different corporate environments and the value proposition of these management systems. Experience has shown that company senior management support for SEM initiatives is necessary for success and strategies are needed to garner such support.
- **Providing energy efficiency incentives for whole-facility performance.** Program expansion to assess energy savings from SEM implementation could provide directions for taking energy efficiency programs that encompass process- or plant-wide opportunities (e.g., providing incentives and assessing savings credits for whole industrial facility performance) as opposed to performance of individual investments or measures. Efforts are underway to determine baselines and performance metrics that can provide sufficiently robust measurements of facility savings so that regulators and the public are confident that funds have produced real and new energy efficiency savings.
- **Valuing and expanding quantification and recognition of project NEBs.** Although there is wide variation between projects, several studies have shown that NEBs from IEE projects, such as broader productivity or quality gains, can be as high as or even higher than the energy cost saving benefits achieved by the projects. Awareness of the importance of quantifying or otherwise highlighting key and large co-benefits is growing. Even so, quantification of these benefits tends to occur mainly after project commissioning as part of project evaluation efforts. Some co-benefits, such as water savings, are relatively easy to quantify, while others, such as safety improvements, are more complex to assess. If programs employed systematic ways to assess some of the NEBs for key projects earlier in the project cycle, the clarity added to both the resulting total returns and shorter project payback could tip the scale on a variety of projects from "wait and see" to implementation.
- **Continuing efforts to expand industrial natural gas efficiency programs.** Although natural gas efficiency programs have been implemented in various states for years, effective coverage of the industrial sector is much less common than for electricity efficiency programs, even though industry accounts for about 26%

of total end-use natural gas consumption in the United States. A key challenge is that most large industrial customers purchase their gas through third-party suppliers, rather than their distribution companies. Another challenge is the recent decrease in natural gas prices (even though many gas saving projects are still cost-effective at current prices). Nevertheless, a number of states and Canadian provinces continue to serve as promising examples in delivery of industrial natural gas efficiency programs, which other states may profit from reviewing. In addition, innovative concepts are under consideration to increase the effectiveness and the reach of gas efficiency programs. One such concept proposes to pool gas and electric efficiency funds to allow participating manufacturers to implement larger and more holistic programs with the flexibility to deliver both electricity and gas savings.

The Importance of Cross Exchange

As this report will show, the experience gained by various states in developing and implementing IEE programs is both diverse and rich. Often, however, valuable details of different programs—and the successes, failures, and lessons learned—are not well known or are poorly understood out-of-state, even though other state practitioners could benefit from these experiences. In addition, early ideas on new programs or improvements to existing ones are common among various practitioners. Opportunities for peer exchange on design and operational specifics could further programs' progress. Finally, there are benefits from greater mutual understanding that can be gained from increased cross-state exchange among different types of stakeholders in the IEE program practice, including regulatory agencies, program administrators, and involved industrial energy users in different states, as well as associated experts.

Various formal and informal networking mechanisms exist for further information exchange. In addition, the State and Local Energy Efficiency Action Network (SEE Action) can play a role in organizational and implementation specific activities on program design and implementation topics of greatest interest. Regional IEE organizations also are well-placed to help foster the increased cross-exchange needed to further ramp up the promising results in IEE programs in the states.

Conclusion

Many opportunities remain to incorporate cost-effective, energy-efficient technologies, processes, and practices into U.S. manufacturing. IEE remains a large untapped potential for states and utilities looking to improve energy efficiency, reduce emissions, and promote economic development. Successful IEE programs vary substantially in operational mode, scope, and financial capacity, but also exhibit common threads and challenges.

Gaining industry support for IEE programs is key; one of the best means to gain increased industry support is by demonstrating the high value of efficiency programs to industrial customers. Experience highlighted in this report will show that IEE programs can effectively deliver value to industries in terms of lower costs, reduced environmental impact, and improved competitiveness, and can help alleviate common resistance by industry to pay into ratepayer programs.

The development and operation of a highly valued IEE program requires a close understanding of the special needs of industrial customers, flexibility in program offerings, and sustained engagement. In practical terms, this means helping industry achieve concrete energy cost reduction benefits, improved competitive position, and additional NEBs such as enhanced productivity and product quality well above the costs of paying into the program. Flexibility in addressing project scheduling and investment cycles, provision of high-quality technical expertise, and comprehensive offerings that include both prescriptive and custom incentives are features of successful programs.

In addition to responding to the needs of industrial customers, IEE programs that leverage strategic partnerships, have robust M&V and evaluation methodologies, and seek to introduce more holistic program approaches, such as SEM and pooled gas and electric programs, will ultimately help program administrators operate more effective programs and deliver significant additional energy savings. As this report will show, states' experience in developing and implementing IEE programs is both diverse and rich. There are benefits from greater mutual understanding that can be gained from increased cross-state exchange among regulatory agencies, program administrators, industrial energy users, and associated experts.

Table ES-1 summarizes the key issues and considerations for regulators and program administrators in designing and implementing effective energy efficiency programs for industry, as well as programs that address that issue. They do not cover all decisions or issues that regulators and program administrators may need to consider because there will undoubtedly be jurisdiction- and case-specific topics that are not anticipated here. However, these considerations provide a starting point for addressing many of the issues that typically arise.

Table ES-1. Summary of Key Issues and Considerations for Regulators and Program Administrators

Topic	Issue	Considerations for Regulators and Program Administrators	Program Examples
The value of energy efficiency projects	Energy efficiency projects may compete with core business investments and decision-making is often split across business units.	• Clearly demonstrate the value proposition of energy efficiency projects to companies • Relay the operating cost savings and other benefits—including profits—lost if energy efficiency improvement opportunities are not addressed.	• Bonneville Power Administration • New York State Energy Research and Development Authority • West Virginia Industries of the Future
Relationships with industrial customers	It takes a long-term relationship for programs to understand industrial operation and needs, and for industrial companies to understand what a program can offer them.	• Long-term relationships with industrial companies enable joint identification of energy efficiency opportunities • Stability in program support and personnel over a number of years is critical.	• Energy Trust of Oregon
Industrial sector credibility and technical expertise	Addressing industrial companies' core needs requires understanding a plant's production processes, operating issues, and the market context the plant operates within.	Effective IEE programs develop credibility with industrial companies by employing staff/contractor experts that understand the industrial segment and have the technical expertise to provide quality technical advice and support issues specific to that industry and customer.	• Efficiency Vermont • Wisconsin Focus on Energy • Xcel Energy (Colorado and Minnesota)
Diverse industrial customer needs	Manufacturers use energy differently than the commercial sector, typically having significant process-related consumption. Focusing on simple common technology fixes alone will miss many of the opportunities.	A combination of both prescriptive offerings for common crosscutting technology and customized project offerings for larger, more unique projects can best meet diverse customer needs and provide flexible choices to industries.	• Rocky Mountain Power • CenterPoint Energy • Xcel Energy
Project scheduling	Scheduling of energy efficiency investments can be heavily dependent on a plant's operational and capital cycle, as proposed equipment changes must be guided through rigorous, competitive, and time-consuming approval processes.	Programs with multi-year operational planning can best accommodate company scheduling requirements, as scheduling of capital project implementation must consider both operational schedules that dictate when production lines may be taken out of operation as well as capital investment cycles and decision-making processes.	• NYSERDA

Topic	Issue	Considerations for Regulators and Program Administrators	Program Examples
Application processes	Industrial customers may perceive the application and implementation procedures for IEE programs to be administratively complex and burdensome.	Achieving the right balance between meeting key program administration needs for information and keeping program procedures simple and efficient may often require a continual process of evaluation and improvement.	• BPA • NYSERDA
Program outreach	Various industrial customers may be unaware of the industrial program offerings that may be most applicable or useful for them due to staff turnover and internal demands.	Steady and continual outreach and dissemination of information, such as examples of successful past projects, is important to encourage participation.	• AlabamaSAVES • NYSERDA
Leveraging partnerships	A range of federal, national, regional, and state initiatives and resources are relevant to state IEE programs, including those provided by the U.S. Department of Energy, the U.S. Environmental Protection Agency ENERGY STAR® program, state energy offices, and the Manufacturing Extension Partnership.	Successful IEE programs often partner with federal, state, and regional agencies and organizations to leverage their expertise, access to customers, and program implementation support capacities.	• AlabamaSAVES • Northwest Energy Efficiency Alliance, Northwest Food Processors Association and BPA
Medium- and long-term goals	Industrial companies and program administrators seek market certainty and reduced risk in ramping up the implementation of cost-effective energy efficiency measures.	Regulators and program administrators can set energy savings goals or targets for the medium- to long-term, coordinated with funding cycles (e.g., in three-year cycles).	• Michigan Self-Direct Energy Optimization Program • Southwest Energy Efficiency Project
Measurement, verification, and evaluation	Effective M&V is critical for program administrators to assess results and measure progress, and is also useful for industrial companies to verify results of their investments.	• Guidelines for M&V need to be clearly defined and periodically reviewed and adjusted • Periodic impact and process evaluations help identify where IEE program efficiency and results can be further improved • Non-energy benefits (NEBs) can be a key element of both project M&V and program evaluation.	• DOE's Uniform Methods Project • International Performance Measurement and Verification Protocol • ETO process evaluations • NYSERDA, Massachusetts, and BPA valuation of NEBs
Self-direct programs	There is a wide range in structures of self-direct programs: from those that are only vaguely defined, and include little M&V of energy saving actions, to those that require verified self-directed customer investment and energy savings to be achieved in order for payment into the programs to be waived.	Clarity in self-directed customer obligations and M&V of results are necessary if the policy goal is to ensure that self-directed industrial customers contribute to overall efforts to ensure least-cost electricity or gas service at a level on par with the contributions of other customers.	• Michigan Self-Direct Energy Optimization Program • Puget Sound Energy • Xcel Energy

Emerging Industrial Program Directions			
Topic	**Issue**	**Considerations for Regulators and Program Administrators**	**Program Examples**
Expanding and strengthening strategic energy management programs	Efforts to support implementation of SEM in industry are gaining momentum in state programs.	The challenge of crediting SEM (how to quantify and credit energy savings specifically achieved through SEM), as well as other SEM-related topics, is worthy of further research and cross-exchange.	• AEP Ohio • BPA • BC Hydro • ETO • WFE • Xcel Energy
Program approaches for whole-facility performance	Significant challenges exist in determining baselines and performance metrics that can provide sufficiently robust measurements of facility savings while maintaining practical and easy-to-implement methodologies.	Work on crediting energy savings from SEM could facilitate the provision of incentives and assessing savings credits for whole industrial facility performance, as opposed to performance of individual investments or measures.	• European experience
Capturing non-energy benefits at the project level	Although there is wide variation between projects, several studies have shown that NEBs from IEE projects, such as broader productivity or quality gains, can be as high as or even higher than the energy cost saving benefits achieved by the projects.	If programs employed systematic ways to assess NEBs earlier in the project cycle, the resulting total returns and shorter payback could tip the scale on a variety of projects from "wait and see" to implementation.	• Energy Trust of Oregon
Expanding natural gas programs	• There is less coverage of the industrial sector in natural gas efficiency programs than in electricity efficiency programs. • Most large industrial customers purchase their gas through third-party suppliers rather than their distribution companies. • Most single-fuel utilities administer energy efficiency programs on their own. However, energy efficiency opportunities typically lead to savings in both gas and electric energy use.	• Gas and electric efficiency measures—when delivered together as part of the same project or a combined program—can result in larger, more effective programs that capture more of the technically and economically viable energy efficiency potential. • Innovative concepts are under consideration to increase the effectiveness and the reach of natural gas efficiency programs.	• Efficiency Vermont • ETO • NYSERDA • PG&E • WFE

1. Introduction

The purpose of this report is to inform state regulators, utilities, and other program administrators about the significant benefits that states in the United States have experienced with industrial energy efficiency (IEE) programs, and to assist these stakeholders in successfully developing and implementing IEE programs in their service territories. This report defines a state IEE program in broad terms as a program that provides information, services, and/or financial support to interested industrial facilities within the state for energy efficiency activities.

This report recognizes that states have their own circumstances, industrial market characteristics, and regulatory structures, and therefore will respond with their own IEE program approaches. These approaches range from ratepayer-funded energy programs—often required under mandatory energy efficiency resource standards (EERS)[5] or other clean energy portfolio standard (CEPS)[6] or through demand-side management (DSM) programs—to knowledge sharing and technical assistance outreach programs without a regulatory incentive structure. The report does not attempt to make specific recommendations that could potentially conflict or be incompatible with individual state regulatory environments. Instead, it explores the practical, proven approaches states have taken. This information can be used by state policymakers and program administrators who wish to further develop their existing IEE programs or start new programs to achieve greater energy savings from industrial customers.

The best practices information presented in this report is based on a review of publically available literature on state energy efficiency programs and materials and presentations from related workshops,[7] and discussions with industrial efficiency experts and program administrators.

The report first provides an overview of why states support strong efforts to promote energy efficiency in the industrial sector and summarizes the current status of IEE programs in the United States. It then illustrates the breadth of existing approaches and program offerings and describes how programs have matured as administrators gain knowledge and experience of customer needs and ramp up energy efficiency improvements.

This is followed by a characterization of IEE program design features intended to respond to industrial customer needs, and highlights of proven practices from states with longstanding experience that have overcome challenges to engaging industrial customers and ensuring broad program uptake. The report focuses on the industrial manufacturing sector—as opposed to industry[8] more broadly defined (which typically includes agriculture, mining, and construction)—but recognizes that many state programs target broader industrial subsectors, combine offerings for industrial and commercial customers, or tend to structure offerings based on customers' energy consumption. In exploring how programs respond to manufacturers' needs, the report identifies programs that target specific industrial process improvements, as well as crosscutting support systems such as motor systems.

Finally, the report discusses two additional topics:

- **Self-direct programs** that allow some customers to "self-direct" their program fees directly into energy efficiency investments in their own facilities instead of into a broader aggregated pool of funding. Concepts that can be used to ensure these programs are achieving energy savings are discussed.
- **Next-generation IEE programs** that expand IEE savings options and industrial participation through strategic energy management (SEM) programs, facility-level programs, better integration of non-energy benefits (NEBs) and fuel sources, and other innovative approaches.

[5] EERS policies aim for quantifiable energy savings by recognizing that energy efficiency is a utility system resource and should be considered by the utility at the same time that supply resources are evaluated.

[6] Clean energy portfolio standards include renewable energy portfolio standards (RPS), EERS, and alternative energy portfolio standards (APS).

[7] Including: the ACEEE Summer Study on Industry (July 2013, Niagara Falls), the ACEEE Resource Acquisition Conference (September 2013, Nashville), the Industrial Energy Efficiency and CHP Regional Dialogue Meetings (held in 2011, 2012 and 2013), the Midwestern Governor's Association Industrial Energy Productivity Meeting (November 2013, Chicago).

[8] As defined by the Energy Information Administration, industry consists of the following types of activity: manufacturing (NAICS codes 31-33); agriculture, forestry, fishing, and hunting (NAICS code 11); mining, including oil and gas extraction (NAICS code 21); and construction (NAICS code 23). This report principally focuses on the manufacturing subsector.

The focus of the report is primarily on ratepayer-funded programs (funded by energy utility customers) due to their relative size in spending terms.[9] Programs that are funded from other sources such as state energy offices are also noted. Numerous examples, case studies, and program descriptions are provided throughout the report. The program examples highlighted here have been successful, not only because they have been able to respond to manufacturers' needs and achieve significant energy savings, but also because they demonstrate cost-effectiveness (according to the relevant cost test the state requires), have good rates of participation, or show they have some longevity and a track record of successful projects. Because this report does not attempt to profile all programs, this by no means suggests that other programs have not been successful.

Although not the focus of this report, the policy contexts for establishing IEE programs are important. These topics include[10]:

- Types of policy mechanisms, such as the decision process for setting CEPS and establishing ratepayer-funded energy efficiency programs
- Institutional guidance for including energy efficiency in integrated resource planning (IRP) processes
- Aligning utility and customer interests in increasing energy efficiency
- Funding sustainability and sources
- Standard criteria for evaluating and screening programs for cost-effectiveness (cost-effectiveness tests)
- Types of data and metrics derived by evaluators for use in impact evaluation of IEE programs
- Choice of program administrator.

[9] In a study of electric IEE program spending in 2010, the bulk of the spending (84%) came from ratepayer-funded utility program budgets, with the remainder of the funding coming from state and federal budgets, universities, nonprofit organizations, and other groups (Chittum and Nowak 2012).

[10] Key resources include Chittum 2012, DOE 2007, EPA 2006, Hayes et al. 2011, Nowak et al. 2011, Sedano 2011, SEE Action Network 2011a, 2011b, and 2012c, Taylor et al. 2012, and Woolf et al. 2012.

2. The Importance of Industrial Energy Efficiency Programs

Effectively managing and reducing energy use in the U.S. industrial sector through increased efficiencies is a key federal, state, and local policy priority as well as a good business decision. The industrial sector is a significant consumer of energy, accounting for about one-third of total U.S. energy consumption (EIA 2013). Implementation of cost-effective industrial energy efficiency (IEE) measures can help defer the need to build more power generation, transmission, and distribution capacity while also enhancing energy security and mitigating risk considerations. Beyond the local and national policy benefits of improved energy efficiency, it is also a key tool in helping U.S. manufacturers reduce their costs and increase competitiveness. To help meet state energy efficiency goals, energy efficiency program administrators are looking to tap the large and cost-effective resource potential the manufacturing sector holds.

2.1. Manufacturing is an Important Sector

The industrial sector accounts for around one-third of all end-use energy in the United States and remains the largest energy user in the U.S. economy (Figure 1). Although IEE has increased dramatically and manufacturing energy intensity has fallen since 1990, industry is projected to consume 34.8 quads of primary energy in 2020 (EIA 2013a). Estimates of the potential to reduce industrial energy consumption through efficiency measures by 2020 are as high as 18% (McKinsey 2009).[11] The energy intensity of production in industrial subsectors varies widely, from 52.3 end-use Btu per dollar of value added in cement production, to 0.4 Btu per dollar in computer assembly. Opportunities for subsector-specific processes make up 67% of the IEE potential, while opportunities in crosscutting energy support systems, such as steam systems and motor systems, comprise the remaining 33%. Sixty-one percent of the total opportunity resides in energy-intensive sectors such as iron and steel, cement, and chemicals, with the remaining 39% in non-energy-intensive sectors (McKinsey 2009).

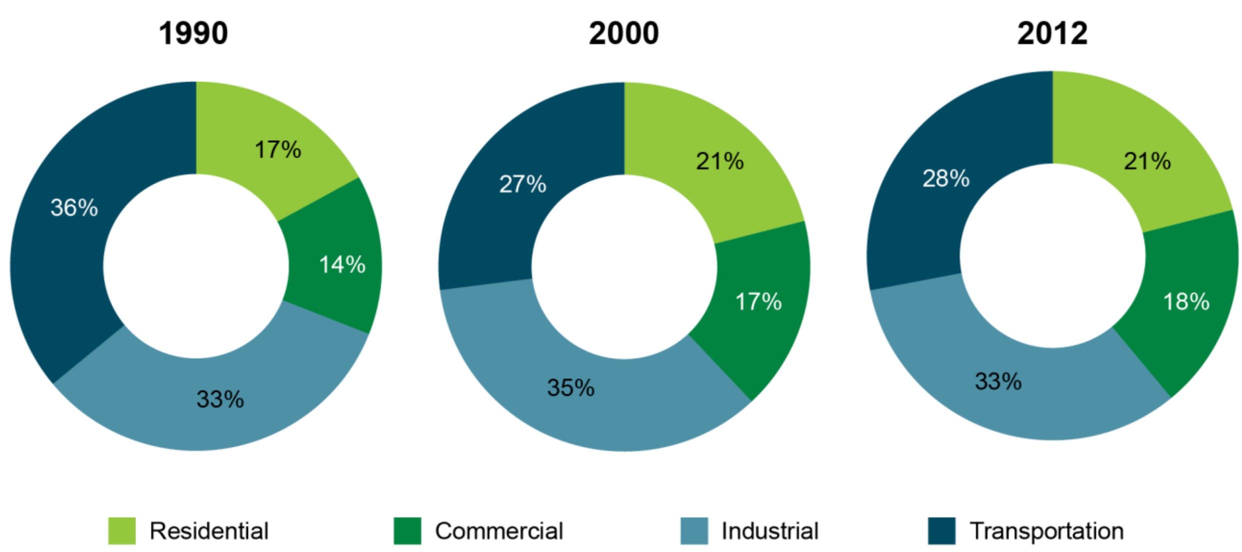


Figure 1. Energy consumption in the United States (1990, 2002, and 2012)

[11] Other estimates are similar; the National Academy of Sciences (NAS) concluded in 2010 in *Real Prospects for Energy Efficiency in the United States* that 14%–22% of industrial energy use could be saved through cost-effective energy efficiency improvements (those with an internal rate of return of at least 10% or that exceed a company's cost of capital by a risk premium). These innovations would save 4.9–7.7 quads annually by 2020.

Figure 2 shows the 2020 IEE potential in various subsectors and cross-sectorial systems, referred to as clusters. The energy savings potential is shown in both direct reductions in end-use energy and in primary energy terms that includes all of the upstream energy consumed in the delivery of energy to the industrial consumer. The potential in primary energy terms reflects the full fuel cycle basis and the avoided electricity losses possible through IEE.

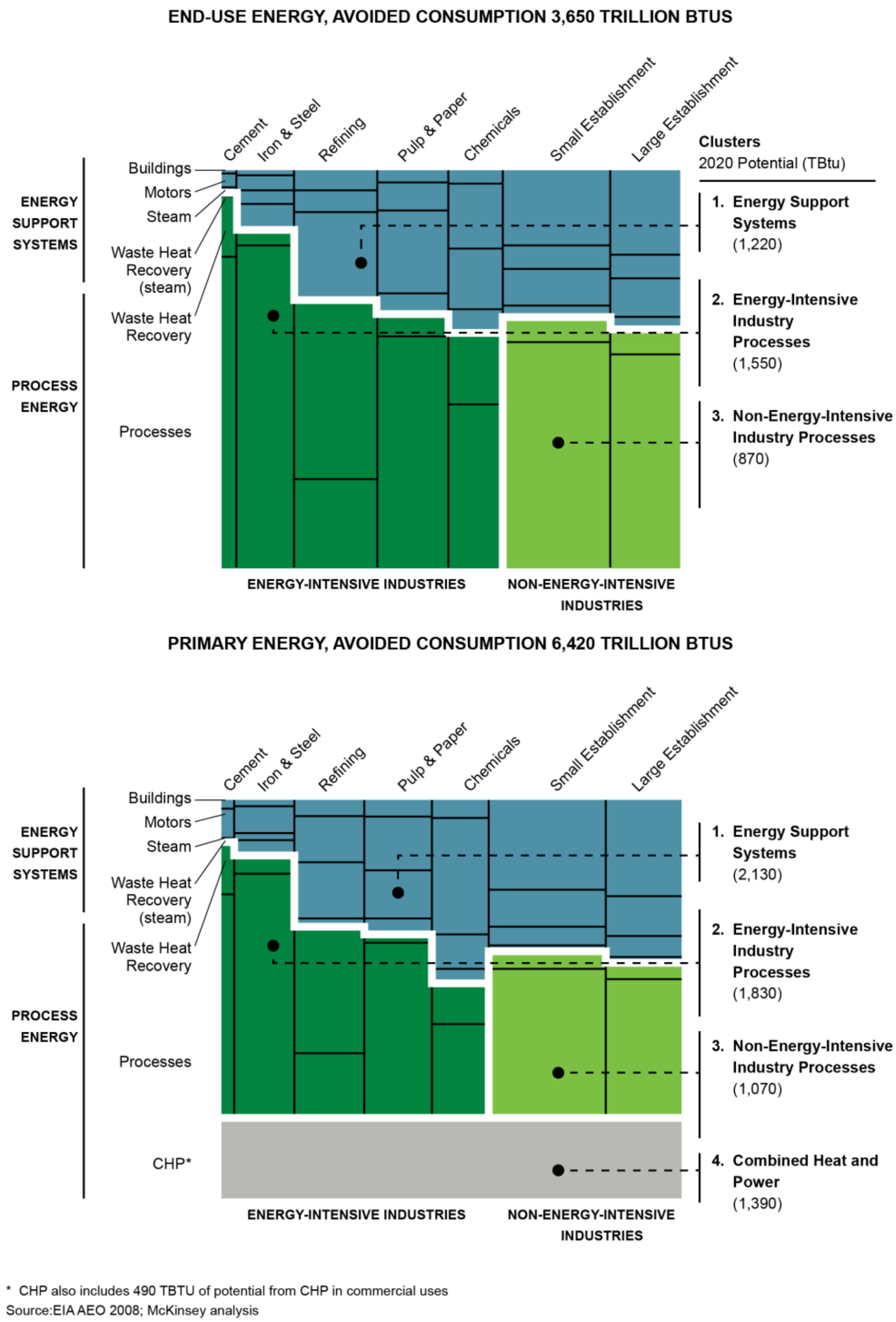
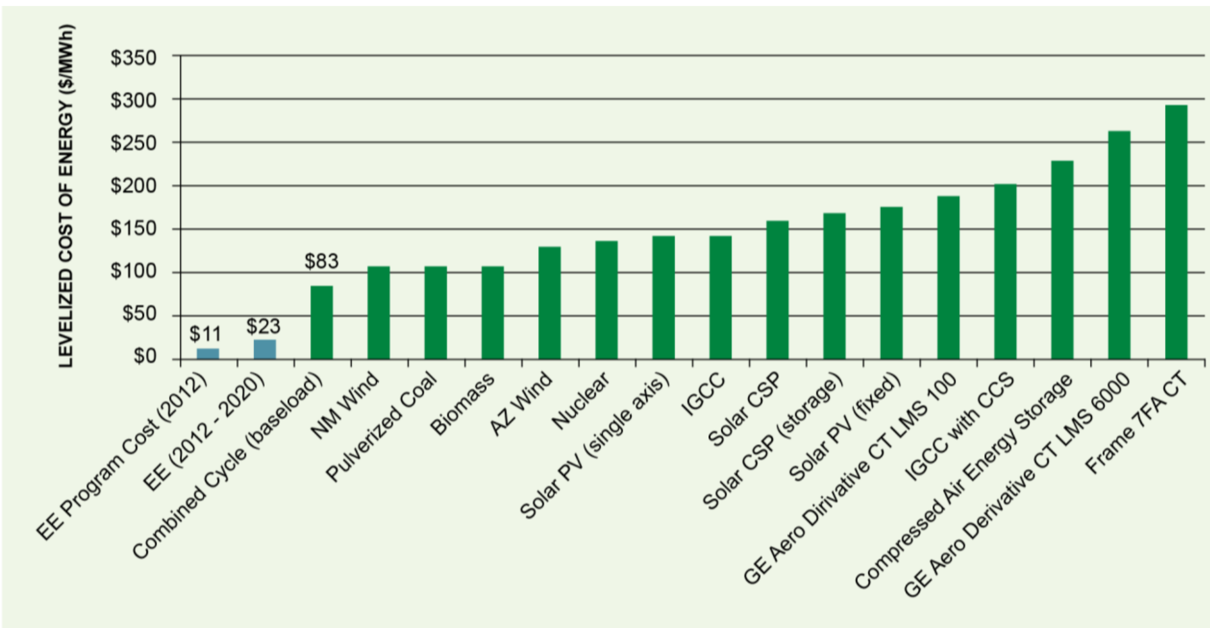


Figure 2. Clusters of end-use energy efficiency potential in the industrial sector

2.2. Industrial Energy Efficiency Resources Are Cost-Effective

Delivery of electricity efficiency resources generally costs much less than delivery of new electricity supply resources in most regions of the country. In most electric power systems, delivery of reliable energy efficiency resources to meet electrical energy consumption (kilowatt-hours [kWh]) costs somewhere between 15%–50% of the cost of power from new central station generation (Lazard 2011). A study examining evaluation results across 14 states found that energy efficiency programs on average cost the sponsoring utility or program administrator about $0.025 per kWh saved and about $3.40 per million Btu of natural gas saved over the life of energy efficiency measures. When costs paid directly by participants are also included, the average cost of efficiency savings is about $0.046 per kWh and $6.80 per million Btu. This is far less than the cost of power from new central station generating plants, which can range from $0.07 to more than $0.30 per kWh (ACEEE 2009, Lazard 2009, SEE Action Network 2011a).

Energy efficiency resources offer cost advantages for meeting new power capacity (kilowatts [kW]) needs as well. Similarly, the costs of improvements in the efficient use of natural gas also are generally substantially lower than acquiring new natural gas supply resources over the medium term, although gas industry structure and economics are different from those of the power sector (Trombley and Taylor 2013).[12] As an example of the economic attractiveness of energy efficiency, Figure 3 highlights the levelized costs[13] of different energy resources in Tucson Electric Power's service area.



Conventional resource costs include fuel, capital, O&M, transmission, and interconnection costs.
Renewable resource costs include generation, delivery, backup capacity, and system integration costs.
Data Source: Tucson Electric Power 2012 IRP, 2012 DSM Report, and 10/31/2012 TEP Rate Case Technical Conference

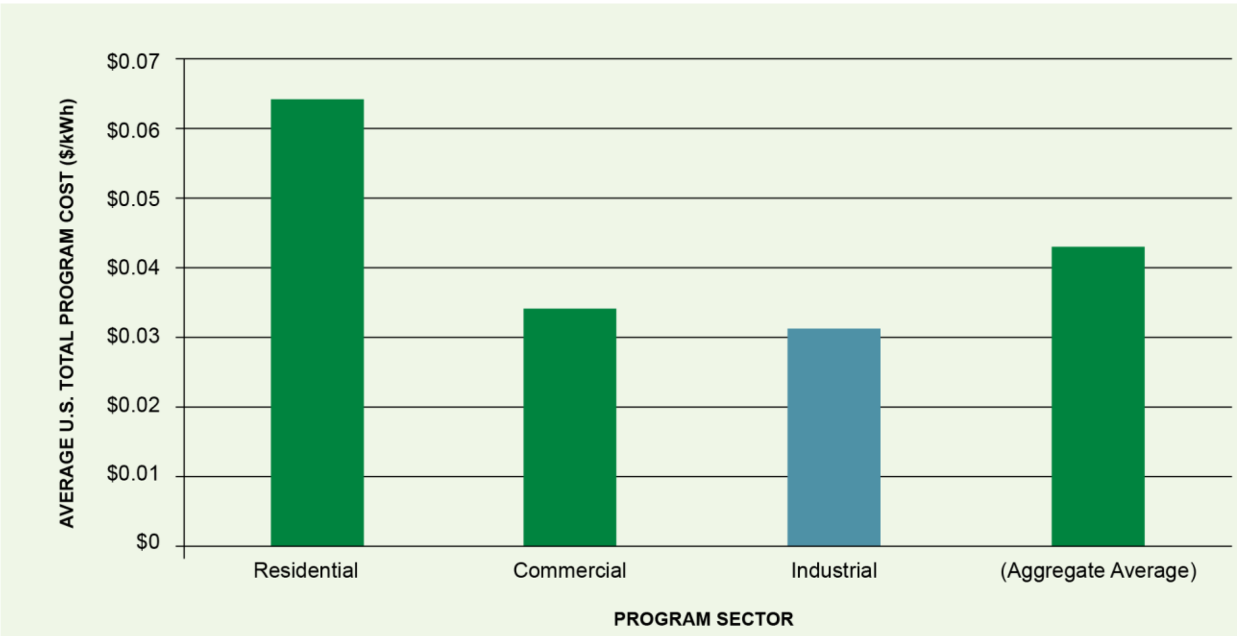
Figure 3. Levelized costs of energy resources in Tucson Electric Power's service area

[12] Although natural gas prices were at an all-time low in 2012, prices have already rebounded to around $4 per MMBtu and current forecasts estimate that prices will remain steady or slightly increase at $4 to $6 per MMBtu for the foreseeable future. Natural gas energy efficiency programs remain cost-effective when gas prices reach around $4 per MMBtu (using the Total Resource Cost test), so under the more likely natural gas price paths, these programs will continue to remain cost-effective. The program design implications of providing incentives for natural gas savings are discussed in Chapter 6.

[13] Levelized cost is often cited as a convenient summary measure of the overall competiveness of different generating technologies. It represents the per-kWh cost (in real dollars) of building and operating a generating plant over an assumed financial life and duty cycle, expressed in terms of real dollars to remove the impact of inflation, and often converted to equal annual payments. Key inputs to calculating levelized costs include overnight capital costs, fuel costs, fixed and variable operations and maintenance (O&M) costs, financing costs, and an assumed utilization rate for each plant type.

Not only is energy efficiency, in general, a more cost-effective option than new supply resources, recent studies suggest that IEE is often among the lower cost, if not the lowest cost, energy efficiency resource (Bradbury et al. 2013, Chittum 2011). Accordingly, many energy efficiency program administrators are not only looking to the industrial sector as a large potential source for energy efficiency resources, but also as a relatively low-cost energy savings acquisition option.

Figure 4 illustrates that the industrial sector has the lowest cost of saved energy on a national level, although it is important to note that cost structures vary by program and sector at the state level (Aden et al. 2013). In British Columbia, for example, the well-established industrial program under the electric utility's Power Smart Program is expected to provide energy savings at a cost to the utility of $0.015 Canadian per kWh during FY 2012–14, compared to utility costs of $0.031 Canadian per kWh for the residential program (Taylor et al. 2012). Additional examples are discussed in Appendix A, including programs in Wisconsin, Rhode Island, Oregon, and the Northwest. These show that industrial programs can often be twice as cost-effective as programs targeting the residential sector.



Source: Aden et al. 2013 based on EIA 2012 DSM, energy efficiency and load management programs data for more than 1,000 utilities www.eia.gov/electricity/data/eia861.

Note: To ensure consistency and comparability, this figure only includes the 182 organizations that reported residential, commercial, and industrial savings and expenditure data; transport sector energy efficiency program data are not included in this figure except as a component of the aggregate average.

Figure 4. Average costs of energy efficiency programs by sector (2012)

2.3. Industrial Energy Efficiency Creates Value for Companies and Society

IEE provides numerous benefits to industrial customers, to utilities, to all ratepayers, and to society as a whole.

Industrial Companies

Energy efficiency reduces costs and increases manufacturers' operational efficiency and productivity. It also often results in a number of co-benefits such as reduced material loss, improved product quality, and lower emissions. In addition, investors increasingly value corporate commitment to energy efficiency and sustainability as an indicator of sound governance and business acumen. Research consistently suggests that NEBs from efficiency measures in the industrial sector are substantial (Hall and Roth 2003, Worrell et al. 2003, Lung et al. 2005, Chittum 2012, Lazar and Colburn 2013). Facilities that take advantage of IEE program offerings provide a valuable hedge against energy supply disruptions or shortages, energy price volatility, and price spikes. For example, Darigold, a dairy and food processing company with 1,400 employees in the Northwest, adopted an energy reduction strategy in 2001. Due to SEM practices and energy-efficient capital improvements implemented since 2001, the company's energy intensity decreased by 21% in 2012. In addition, its productivity grew, the reliability and safety of its equipment increased, the risk of work-related injuries associated with operating machinery decreased, and the company experienced less workforce turnover (IIP 2012a). An analysis of NEBs in Wisconsin found that in calendar year 2010, participants in Focus on Energy business programs enjoyed $8.9 million in NEBs above and beyond the estimated $56 million in annual energy savings for the same year's business customers (Chittum 2012). Productivity and NEBs enjoyed by industrial customers are further discussed in Chapter 6.

System-Wide Benefits

States have found that specific IEE programs can help deliver a larger slice of the energy savings potential in industry than can likely be achieved if industrial energy users pursue energy efficiency on their own with no program assistance of any kind. Company staff are often aware of profitable energy saving opportunities, and many companies have a solid record of developing these projects to save money. However, focus is often on projects that can pay off in one or two years. Other projects that have substantial potential long-term benefits, but that have higher initial costs and longer payback periods, are left on the table. IEE programs can make a key difference, not only by fostering greater adoption of short payback projects, but additionally providing financial incentives that improve the payback of projects outside industrial managers' typical interest scope (less than two years). Program incentives to help industrial customers capture significant additional cost-effective energy savings potential can improve the alignment of company business practices with the broader interest of energy users statewide in developing lowest-cost energy supply resources.

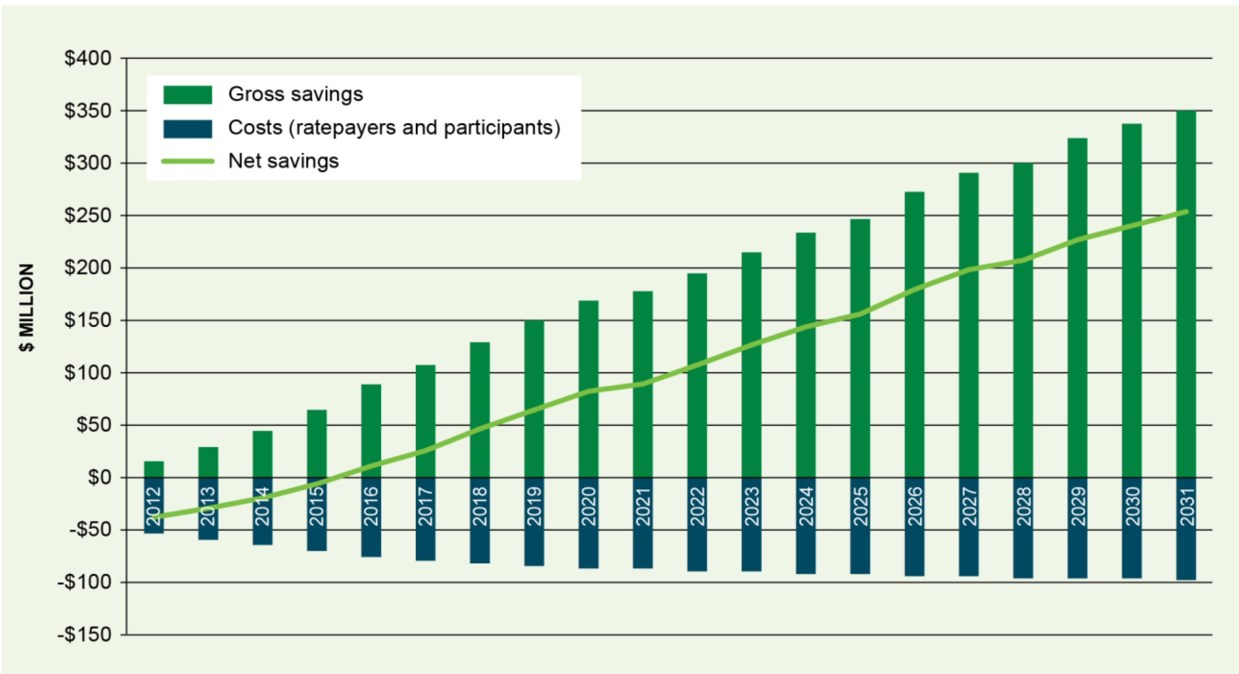
Implementation of cost-effective energy efficiency measures, if made within the context of ratepayer-funded energy efficiency programs, ultimately reduces the energy bills of all consumers. This is because energy efficiency can eliminate or delay the need to build more power generation, transmission, and distribution capacity. As a result, efficiency investments tend to lower electricity prices over the medium-to-long term due to the avoidance of utility rate increases otherwise necessary to develop more expensive new supply and transmission resources. How fast rates may decline relative to the no-energy efficiency base case, and by how much, depends primarily on how fast electricity demand is growing and the differences between the marginal costs for new supply and the marginal costs of energy efficiency resources. Generally speaking, however, a small rate increase in the near term (for energy efficiency program costs) will result in lower level rates in the long term compared to a no-energy efficiency base case (Taylor et al. 2012). This is especially true in regions where energy demand is growing and when other NEBs such as the environmental and public health externalities associated with the extraction of fuels and the extension of power transmission and distribution capacity are accounted for.

However, in order to achieve decreases in rates over time, it will be necessary to provide efficiency services to the vast majority of customers, including industrial customers, which represent a large share of potential savings. If this goal is achieved, then most customers will eventually be program participants and will enjoy the benefits of the efficiency programs, mitigating the issue of differential treatment. Therefore, pursuing the goal of achieving all cost-effective energy efficiency could lead to a reduction, not an increase, in rate impact concerns, as the vast majority of customers experience reduced bills over time. As participation levels increase, thoughtful program designs can ensure that all customers have a fair opportunity to participate (SEE Action Network 2011c).

As an example of the impact of energy efficiency programs on system costs, ACEEE recently modeled the benefits of Ohio's EERS, estimating it could save customers a total of almost $5.6 billion in avoided energy expenditures by 2020 and result in reduced wholesale energy and capacity prices, with wholesale energy price mitigation savings of $880 million (in 2012 dollars) and wholesale capacity price mitigation of $1,320 million (Neubauer et al. 2013).

In another example in the Pacific Northwest, acquisition of efficiency resources to meet additional electricity demand is far cheaper than developing new generation and can help moderate increases in consumer prices. The cost for additional supply of electricity from new sources is substantially higher than current average prices. The Sixth Northwest Conservation and Power Plan, issued in 2010, estimates the long-run averaged levelized cost of new electricity from natural gas-fired combined-cycle power plants to be about $0.092 per kWh, and the cost of Columbia Basin wind power to be about $0.104 per kWh. Compared to this, the average levelized cost of securing the Plan's aggressive portfolio of energy efficiency resources over 2010–2029 is $0.036 per kWh, including consumer costs (Taylor et al. 2012). The Plan also shows that energy efficiency reduced expected electricity loads by approximately 4,000 average MW since 1980 through the end of 2009, helping to level out demand.

Figure 5, from the Vermont Department of Public Service, illustrates how efficiency programs are expected to deliver long-term system savings relative to costs over 20 years.



Source: Vermont Department of Public Service (2011)

Figure 5. Efficiency Vermont costs and savings, high-efficiency case 2012–31 (current $)

Society as a Whole

IEE not only benefits individual companies at which the efficiency improvements are installed as well as all other utility ratepayers, but it also creates broader societal value. In addition to delivering cost-effective energy resources, energy efficiency reduces environmental impacts from energy production and use, and enhances energy supply security. Reductions in energy use, in addition to reducing greenhouse gas emissions, lead to lowering the burden of local air pollution, improving water use and efficiency, minimizing waste, and protecting the health and safety of workers. A recent U.S. Environmental Protection Agency (EPA) report calculated that each ton of reduced emissions from power plants (which might be displaced through IEE) has the following public health cost savings benefits: $130,000 to $290,000 for particle emissions ($PM_{2.5}$), $35,000 to $78,000 for sulfur dioxide (SO_2), and $5,200 to $12,000 for nitrogen oxides (NO_X) (EPA 2013a, Lazar and Colburn 2013).

Large quantities of water are also used in many industrial applications, mostly in process cooling. Energy efficiency measures often reduce water consumption and heat rejection control strategies can impact both process efficiency and water use. For example, significant opportunities exist to upgrade cooling towers to improve thermal capability, increasing energy efficiency and reducing water use. In water-constrained regions with significant industrial activity such as Texas, water- and energy-saving technologies can help to alleviate water scarcity and increase access for other users (Texas IOF 2013).

2.4. The Role of Energy Efficiency in an Expanding Manufacturing Base

Several trends suggest that the United States is beginning a major expansion of manufacturing capacity in a number of sectors (*The Economist* 2013). The U.S. government is tracking billions of dollars in planned manufacturing investments, including in fertilizers, chemicals, steel, cement, and assembly industries. Ample, low-cost natural gas supplies coupled with favorable foreign exchange rates and increasing labor productivity trends are attracting new investment in the U.S. manufacturing sector. For example, nearly 100 chemical industry investments valued at $71.7 billion had been announced through the end of March 2013 (American Chemical Council, May 2013). Companies such as Dow Chemical and Vallourec (steel tube producer) have announced new investments to take advantage of low gas prices and to supply extraction equipment.

The expansion of U.S. manufacturing has brought new awareness of the potential for energy efficiency to support the wider goal of increasing industrial competitiveness, productivity, and innovation. The installation of the most efficient processes and equipment (both in retrofitting existing systems and as new capacity is developed) serves as a hedge to maintain competitiveness for the future when energy supply and price conditions may once again change. Energy efficiency remains a profitable investment opportunity even in a low natural gas price environment and provides the added value of using this valuable domestic resource wisely and efficiently.

Lower American energy prices could result in up to one million additional manufacturing jobs (*The Economist* 2013). Manufacturing is often the key economic engine for local economies, so to the extent that energy efficiency investments help these facilities survive and grow, they support job retention and job growth within the local area. For example, Whirlpool attributes its ability to maintain the majority of its workforce at its Clyde, Ohio, plant, to industrial efficiency and production upgrades made at the facility, in addition to its production of a highly efficient line of front-load washing machines (NRDC 2012, Selko 2013).

2.5. The Current Status of State Industrial Energy Efficiency Programs

This report defines a state IEE program in broad terms as a program that provides information, services, and/or financial support to interested industrial facilities within the state for energy efficiency activities. IEE programs may have multiple goals but almost always have a public interest objective in mind—whether it is least-cost resource development, environmental benefits, consumer benefits, or economic development. State IEE programs can be administered by utilities, program administrators, or state energy offices. The most common are ratepayer-funded energy efficiency programs administrated by utilities and program administrators.[14]

IEE programs in the United States vary widely from state to state, as well as within states in both form and function. Some states have passed legislation mandating that a certain level of energy efficiency resources should be acquired or that all cost-effective energy efficiency opportunities should be pursued. Some programs may focus on electricity only, gas only, both of these energy sources, or all energy sources. State utility regulators, utilities, and energy efficiency program administrators often play pivotal roles in approving and delivering IEE programs. State energy offices are also important drivers of programs. Program funding may come from electric and natural gas ratepayers, funds from the state operating budget, federal and other sources, or a combination of sources. Program offerings are diverse, ranging from prescriptive incentives, custom/process efficiency, market transformation, strategic energy management, and self-direct program types (as described in Chapter 3).

In practice, because many states have chosen to include the manufacturing sector in energy efficiency programs funded by energy utility customers, ratepayer-funded programs are the focus of this report. These programs are predominantly funded by customers of electric and gas utilities. This is done either implicitly or explicitly, as charges added to electric and gas utility bills either as a cost of service and embedded in the total costs customers pay or as a separate line item to bills. These funds are often channeled into a public benefits fund or demand-side management (DSM) fund and programs are administered by utilities and/or energy efficiency program administrators.

[14] In a study of electric IEE program spending in 2010, the bulk of the spending (84%) came from ratepayer-funded utility program budgets; the remainder of the funding came from state federal budgets, universities, nonprofit organizations, and other groups (Chittum and Nowak 2012).

As of January 2014, 28 states have policies in place that establish specific energy savings targets, either through EERS, CEPS, or specific utility goals (ACEEE 2013a and ACEEE 2013b). Many states without energy efficiency targets still have ratepayer-funded programs.[15] In total, 41 states now require utility customers to contribute to supporting energy efficiency programs (Chittum in Uhlenhuth 2013). At least 35 state energy offices (SEOs) administer energy programs for manufacturers and the industrial sector (NASEO 2012). Appendix A provides a more detailed landscape of the scope and breadth of state IEE programs and the policy mechanisms that IEE programs currently operate under, including CEPS, energy savings targets for individual utilities, requirements to pursue all cost-effective energy efficiency opportunities, DSM mandates, or voluntary SEO-run programs.

Under these ratepayer-funded energy efficiency programs, utilities remain primarily responsible for administering and implementing programs with regulatory oversight. However, third-party energy efficiency program administrators also offer energy efficiency programs (ACEEE 2012). Although it is more common for each utility to develop and administer its own program, some states, such as Oregon, through the Energy Trust of Oregon (ETO), have unique programs set up to coordinate activities across the state and retain experts on staff to run the program. Others, like DTE Energy in Michigan, contract the work out to third parties while managing program savings targets (Taylor et al. 2012). Whatever the type of program administrator, each administrator operates under guidance and rules from the state utility regulator.[16]

Industrial Customer Class Coverage

Ratepayer-funded energy efficiency programs are typically designed to include all customer classes—residential, commercial, and industrial. In some states, however, industrial customers have been able to "opt out"[17] from programs altogether, or "self-direct" the funds—that they would have otherwise paid to the fund or utility—to their own direct energy efficiency actions.

Although there are many ratepayer-funded programs that include the industrial sector, there also are many states where development of programs has met with resistance by some manufacturers. In some cases, industrial customers may feel that they can design and implement energy efficiency efforts by themselves and do not want to provide funds through their utility bills for a separate entity to provide design and implementation assistance. In addition, industrial companies often are concerned that they fund a higher share of the program costs and receive less practical benefit compared with other ratepayer classes.

To address these concerns, some states allow industrials to opt out entirely as a "special customer class" from paying energy efficiency system benefit charges and not participate in programs at all. States with legislative opt-out clauses for large customers include Arkansas, Indiana, Kentucky, Maine, Michigan, Texas, and North Carolina (ACEEE 2013, Lewin 2013, Paradis 2013). States that are currently considering opt-out provisions include Oklahoma, Illinois, Louisiana, and Ohio (Ballard 2013, Elliott 2013, Ohio Township Association 2013).

Other states allow manufacturers (usually energy-intensive) to self-direct program funds toward their own energy efficiency activities. Examples include Massachusetts, Minnesota, Ohio, Oregon, Vermont, Washington, and Wisconsin. Note that regulatory oversight, use of program funds, and verification of savings will vary between states and program administrators. Self-direct programs, as opposed to full opt-out provisions, can be an attractive option if properly designed and monitored. Best practices in self-direct program design are further discussed in Chapter 5.

However, opt-out and loosely defined and monitored self-direct programs can be viewed as unfair to other customer classes who are required to pay program costs for energy efficiency resource acquisition that benefits all ratepayers, including manufacturers. Other system resources, such as new generation assets, are generally paid for

[15] Examples of states without EERS/energy efficiency targets but with ratepayer-funded energy efficiency programs include Idaho (Idaho Power), Wyoming (Rocky Mountain Power), and Utah (Rocky Mountain Power).

[16] For a discussion on choice of program administrator, see Sedano (2011).

[17] Opt-out programs allow large customers to fully opt out of paying their energy efficiency charges with no corresponding obligation to make energy efficiency investments on their own (ACEEE 2012b).

by all customers (Chittum 2011). The logic of energy efficiency programs is to procure least-cost energy efficiency resources, as opposed to only energy supply resources, for an entire utility system, ultimately reducing bills for all customers. Capturing cost-effective energy efficiency resources from all customer classes is an important element of an overall least-cost energy strategy for a utility, state, and region.

Many states have focused their energy efficiency program activities on the commercial and residential sectors due to the lower complexity of deploying common solutions throughout these markets. However, as regulators and program managers seek to meet increasing CEPS targets, they have begun to look at the industrial sector for greater energy savings. In addition, federal efficiency appliance standards are raising the baseline efficiency levels for many common residential and commercial measures such as lighting and home appliances, which further reduces the savings potential for these measures.

As a result, energy efficiency program administrators are increasingly turning to the industrial sector to help meet efficiency goals and are rethinking IEE program design and delivery to better meet industrial customers' evolving needs. Custom and tailored approaches are important for engaging industrial customers and responding to their specific needs.

Whatever framework they operate under, IEE programs can provide a variety of offerings and many programs offer a combination of services. For example, financial incentives for investments may be coupled with direct technical assistance. The major types of IEE program offerings generally in use in state IEE programs are discussed in Chapter 3.

3. How States Successfully Promote Industrial Energy Efficiency

Every industrial energy efficiency (IEE) program administrator can learn from its own experience and from the successes of others. This chapter summarizes the lessons and experiences of IEE program administrators, describes ways in which some states have been able to provide attractive offerings to manufacturers in a cost-effective manner, and explores how programs have matured and adapted through time to match evolving manufacturers' needs while simultaneously meeting statewide goals. Many states have effective IEE programs that have active participation from manufacturers and are producing verifiable energy savings.

As shown in Figure 6, these successful IEE programs represent a "spectrum of approaches," ranging from efforts by some states to promote IEE generally through knowledge sharing and technical assistance, to direct financial support of the implementation of strategic energy management and continuous improvement practices. Each offering can be effective in its own way and be an appropriate choice for individual states, depending on their regulatory contexts and circumstances. However, a more comprehensive set of program offerings—including combinations of the approaches on the spectrum (Figure 6)—is likely to deliver greater overall energy savings.

The spectrum highlights the range of program offerings that states can leverage as experience accrues and relationships develop with industrial customers. Effective IEE programs typically evolve over time with program administrators refining the program in cycles to increase its effectiveness.

Many mature IEE programs offer a suite of services to address diverse needs according to manufacturing sector, regional cluster, and each company's knowledge of and experience with IEE. These programs also provide companies with access to different offerings as they progress through an energy management pathway and look to implement more sophisticated improvement measures over time.

EXAMPLE 1: THE COLORADO INDUSTRIAL ENERGY CHALLENGE

The Colorado Industrial Energy Challenge (CIEC) is a voluntary program designed to help industrial facilities improve energy performance. The CIEC program challenges companies to set a five-year energy efficiency goal, and provides assistance in the form of free energy assessments, networking and training opportunities, and public recognition from the governor's office. The program is open to industrial facilities in Colorado with more than $300,000 in annual energy costs. The Southwest Energy Efficiency Project leads and coordinates the program with funding from the Colorado Governor's Energy Office and the U.S. Department of Energy (DOE). To join the program, companies sign a commitment letter agreeing to set a five-year goal for reducing total energy use or energy intensity and report energy information, energy efficiency project implementation, and progress toward the goal. As of 2013, the program has participation from around thirty facilities, and many have undertaken innovative projects to save energy and money. For example, Avago, a manufacturer of semiconductor devices, set a goal as part of CEIC to reduce energy intensity by 40% from 2008 levels by 2013. Avago implemented a project to use waste heat from a chiller condenser that would have otherwise been sent to cooling towers to preheat ultra-pure water needed in the manufacturing process. A heat exchanger now intercepts the rejected heat and pre-heats the cold water needed as feedstock for the process. The project cost $14,000, with a payback of only one month. It generates yearly savings of nearly $200,000, saves 28,000 decatherms of natural gas per year, reduces water use (through evaporation), and reduces CO_2 emissions by 1,600 tons per year.

Source: SWEEP 2013b

The spectrum of program approaches is discussed below and includes examples of successful state programs in each category. Detailed information on successful programs is provided in Appendix B.

APPROACH	DESCRIPTION	PROGRAM EXAMPLES
KNOWLEDGE SHARING	• Low-cost or no-cost technical assistance • Workshops and other outreach • Peer exchange opportunities between industrial clusters or groups of companies • Success story dissemination	• West Virginia Industries of the Future • Southwest Energy Efficiency Project
PRESCRIPTIVE INCENTIVES	• Explicit incentives or rebates for certain specific eligible technologies (e.g., lighting, motors, drives, compressed air, process heating equipment)	• Rocky Mountain Power • Efficiency Vermont
CUSTOM INCENTIVES	• Specific energy efficiency projects tailored to individual customers or specific industrial facilities • May be a mix of technologies • Incentives or rebates often based on entire electricity or natural gas savings	• Xcel Energy • NYSERDA
MARKET TRANSFORMATION	• Streamlined path for introduction of new energy efficiency products to the market • Address structural barriers to energy efficiency (e.g., outdated building codes or lack of vendors offering an emerging technology)	• Northwest Energy Efficiency Alliance
ENERGY MANAGEMENT	• Operational, organizational, and behavioral changes through strategic energy management • Continuous energy improvement (e.g., embedded energy manager to provide leadership and organiza-tional continuity for implementing change)	• Wisconsin Focus on Energy • Energy Trust of Oregon
SELF-DIRECT	• Customer fees directed into energy efficiency investments in their own facilities instead of a broader aggregated pool of funds • Eligibility for customer participation often based on threshold amount of energy use or energy use capacity • Verified energy savings	• Puget Sound Energy • Michigan Self-Direct Energy Optimization

Figure 6. Spectrum of IEE state program approaches with program examples

3.1. Technical Assistance and Knowledge Sharing

Technical assistance and knowledge sharing programs are those that provide low-cost or no-cost expertise on energy-efficient technologies and practices, create networking opportunities between industrial clusters or groups of companies, and capture success stories and disseminate case studies. Some programs may also link companies with energy efficiency equipment and solution providers, leverage federal and other government resources so that industries may take advantage of equipment rebates, or direct customers to low- or no-cost industrial assessments funded through or by other programs.

Technical assistance and knowledge sharing programs are often initiated by program administrators voluntarily (i.e., without regulatory proceedings mandating ratepayer-funded programs and collection of a public benefits charge). Peer learning often provides a powerful driver for companies to implement energy efficiency measures and reap the productivity or competitive advantages their peers have enjoyed from similar investments. In those states that do not currently have ratepayer-funded programs, technical assistance and knowledge sharing programs can still generate significant energy savings to both manufacturers and society.

Examples of effective programs in this category include:

- The Colorado Industrial Energy Challenge (Example 1), which has been effective in its public recognition of IEE performance and providing companies with an opportunity to showcase their energy efficiency achievements
- The Industrial Energy Efficiency Network in the Southeast (Example 2), which hosts an effective peer exchange forum that provides a strong driver to share lessons learned
- The West Virginia Industries of the Future (WV-IOF) (Example 3), which has effectively leveraged partnerships with academic institutions and the U.S. Department of Energy (DOE) to provide training, technical assistance, and energy assessments to industrial staff.

EXAMPLE 2. THE SOUTHEAST INDUSTRIAL ENERGY EFFICIENCY NETWORK

The Industrial Energy Efficiency Network in the Southeast[18] is a regionally focused collaborative effort that unites cross-sector industrials in a peer-to-peer manufacturing network. As a platform for collaboration and education rather than providing technical assistance from a central program administrator to individual companies, the Network elevates energy efficiency best practices and project implementation, links manufacturers to financial and technical resources, and promotes strategic energy management practices.

Elevation of project ideas leads to implementation successes, with companies meeting regularly to share project experiences from initial conception through to measurable savings and other benefits. The exchange of qualified vendor references between peer energy managers is designed to shorten the time to project initiation. The Network offers a venue for activity at individual companies to be validated and celebrated by energy management peers.

The Network received an initial seed grant from DOE and is financed by public benefactors. Attendance at the peer-to-peer meetings continues to grow, with the average attendance around 80; manufacturers in the group have been actively making referrals to other firms in order to deepen the pool for collaboration. Firms are learning new tactics to manage energy at both the corporate and plant levels.

Sources: Marsh 2011, Marsh and Glatt 2011

3.2. Prescriptive and Custom Efficiency Offerings

Prescriptive and customized project offerings provide manufacturers with a financial incentive, often paired with technical assistance, for energy-efficient equipment and projects. Incentives for prescriptive and customized efficiency offerings are usually provided through ratepayer-funded programs. However, some non-ratepayer programs have designed IEE revolving funds in order to provide financial incentives (and technical support) on a self-sustaining basis.[19]

Prescriptive Offerings

Many energy efficiency programs have traditionally engaged the industrial sector through prescriptive incentives for lighting, motors, mechanical drives, compressed air, process heating equipment, and other energy support systems and equipment (Harris 2012). Prescriptive or standardized offerings provide explicit incentive or rebate amounts for certain specific eligible technologies. They can be useful for targeting those crosscutting pieces of equipment that are applicable across diverse commercial and industrial (C&I) sectors, and at both large facilities as well as small and medium enterprises (SME), such as variable speed drives for motor systems.

Prescriptive incentives for cross-cutting technologies can play an important role in helping to deploy high efficiency equipment across a broad base of industrial customers in different sectors and size classes. IEE programs have historically found it challenging to address the needs of SMEs as they have less staff capacity to address energy

[18] The program was previously administered by the Southeast Energy Efficiency Alliance (SEEA).

[19] Non-ratepayer-funded programs include AlabamaSAVES and the Tennessee Energy Efficiency Loan program administered by Pathway Lending. Pathway Lending received seed funding from the Tennessee State Energy Office, Tennessee Valley Authority, and DOE, but financing is leveraged principally through private community development banks. Low interest loans are available for businesses to invest in energy upgrades and the energy savings form a primary component of the principle repayment plan. These programs are profiled in Appendix B.

efficiency and generally have implemented fewer energy efficiency projects than larger companies. Taking advantage of less labor-intensive program offerings, such as prescriptive offerings—as long as eligible technologies are relevant to their situation—is a successful way to engage SMEs that may still have “low hanging” efficiency opportunities involving common technologies.

Prescriptive incentives are widespread throughout many states and are most often included as part of joint C&I rebate programs.[20] Although these measures may apply to manufacturing facilities, they do not address the majority of industrial energy-consuming equipment and processes. Some utilities have prescriptive measures for compressed air equipment, but in general a much larger percentage of energy savings projects specific to key industrial processes are categorized as custom measures (Seryak and Schreier 2013).

Custom Offerings

Instead of focusing on specific equipment upgrades, process or custom efficiency programs emphasize achieving savings from the manufacturing process itself, where the potential for energy savings is greatest (Harris 2012). Custom programs allow individual customers to develop specific energy efficiency projects that may be a mix of technologies and practices and qualify for incentives as long as they meet a required cost/benefit hurdle. Custom efficiency programs usually offer incentives based on a facility’s entire electricity (kWh) or natural gas (therm) savings. Custom programs that use a per-unit-of-production calculation method shift the emphasis from traditional equipment upgrades (e.g., drives, motors) to improving a firm’s ratio of energy use to physical output (Harris 2012). This allows program administrators to credit savings acquired via the implementation of a wide variety of technologies or plant and process modifications (Bradbury et al. 2013) rather than by choosing specific eligible technologies as in prescriptive rebate programs.

EXAMPLE 3. WEST VIRGINIA INDUSTRIES OF THE FUTURE

Industries of the Future West Virginia (IOF-WV), West Virginia’s IEE program, was the nation’s first state-level program (IOF-WV 2013) and helps manufacturers create financial savings through energy efficiency. IOF-WV teams work with individual companies to assess high priority research needs and develop projects that improve energy efficiency and environmental performance. IOF-WV grew out of a collaboration between West Virginia University, the West Virginia Development Office and DOE. The program provides technical assistance, conducts energy assessments, and runs best practice workshops on system-wide and component-specific topics to teach employees how to operate plants more efficiently. For example, the IOF-WV team conducted a plant-wide energy assessment at the Pechiney (now Alcan) facility in Ravenswood, West Virginia, from March 2002 to November 2003. The team identified $2.5 million in annual energy savings with average payback of less than 8 months. The assessment identified numerous areas for energy savings:

- Turning off comfort heating furnaces in summer months and in places where they are ineffective ($1,014,000 per year)
- Burner tuning and maintenance ($692,000 per year)
- Repair of compressed air leaks ($112,000 per year)
- Turning off idle equipment ($16,000 per year)
- Improving annealing furnace operating practice and modifying nitrogen plant control strategies to prevent waste of nitrogen ($75,000 per year).

The program is funded by a mix of state energy program funds, DOE funds, private sector leveraged funds, and cost-share.

Source: IOF-WV 2013, NASEO 2012

[20] The Database of State Incentives for Renewables and Efficiency (DSIRE) contains comprehensive information on rebates for specific technologies. See www.dsireusa.org.

Custom programs allow individual customers to develop specific energy efficiency projects that may be a mix of technologies and practices and qualify for incentives as long as they meet a required cost/benefit hurdle. Custom efficiency programs usually offer incentives based on a facility's entire electricity (kWh) or natural gas (therm) savings. Custom programs that use a per-unit-of-production calculation method shift the emphasis from traditional equipment upgrades (drives, motors, etc.) to improving a firm's ratio of energy use to physical output (Harris 2012). This allows program administrators to credit savings acquired via the implementation of a wide variety of technologies or plant and process modifications (Bradbury et al. 2013) rather than by choosing specific eligible technologies as in prescriptive rebate programs.

Custom programs generally require specialized resources to administer and support and may require greater program budgets than prescriptive offerings (Chittum et al. 2009). However, because they tend to deliver much larger savings and offer attractive paybacks per project, unit administration cost per kWh is often lower than prescriptive projects. Custom programs can be very cost-effective because they can unlock significant savings not possible through targeting individual pieces of equipment (Bradbury et al. 2013). CenterPoint Energy (see Example 4) has a successful custom program that was designed to address a gap in CenterPoint Energy's program coverage by reaching out to energy-intensive industrial customers who cannot avail themselves of standardized energy savings measures.

EXAMPLE 4. CENTERPOINT ENERGY CUSTOM PROCESS REBATE PROGRAM

CenterPoint Energy is an electric and gas utility based in Minneapolis, Minnesota, and has operated its rebate programs since the late 1990s. CenterPoint Energy provides financial incentives to customers who improve energy efficiency through innovative, customized energy-saving projects.

The Custom Process Rebate Program provides assistance and financial support to energy efficiency projects that do not qualify under prescriptive programs. Rebates primarily go to large-volume and dual-fuel customers that use throughput for process rather than heating purposes. Financial incentives are awarded to customers to assist with the first cost of the energy efficiency upgrade. The program has promoted such projects as bio-methane energy recovery, waste-heat energy recovery, boiler flue-gas condensers, thermal oxidizers, integral quench furnaces, heat-treat ovens, control packages, window replacement, stack economizers, and enthalpy wheels.

Each prospective project is compared to a base case to calculate efficiencies gained by installing the new technology. Once a project passes all requirements, an appropriate financial incentive is awarded to assist with the first cost of the energy efficiency upgrade(s). In some instances, C&I customers reach out to CenterPoint, seeking more effective energy efficiency processes. CenterPoint also works with customers to develop customized systems and solutions, and offers to buy down the new equipment, paying up to 50% of incremental cost.

In 2011, the program processed 148 custom projects that achieved a savings of 374,000 decatherms. The Custom Process Rebate Program addressed a gap in CenterPoint Energy's program coverage by reaching out to energy-intensive industrial customers who cannot avail themselves of standardized energy savings measures.

Source: Heffner et al. 2013

3.3. Market Transformation Programs

Market transformation programs work to streamline the path from the introduction and promotion of new energy efficiency products into the market to the establishment of customer acceptance. Market transformation programs require a long-term focus and are intended to address structural barriers to energy efficiency such as outdated building codes or lack of vendors offering an emerging technology. Their goal is to change marketplace behavior to increase acceptance of energy efficiency technologies and practices, but effecting this change can take time (often 5 to 15 years) (Taylor et al. 2012). Energy savings from these programs typically grow slowly in the early years, but are more likely to be persistent without relying on continued direct policy intervention once market acceptance is achieved (Taylor et al. 2012). An example of a successful market transformation program is the Northwest Energy Efficiency Alliance (NEEA) (Example 5). The initial phases of the process involve significant investments of time and effort to identify promising technologies and ideas and develop and test operational approaches to promote them. This type of effort is difficult for energy efficiency program administrators to justify because the costs are high for initial savings return. However, when an idea takes off, savings can materialize quickly, especially because program administrators in the Northwest (e.g., Energy Trust of Oregon and BPA) provide program support and leverage NEEA's market transformation solutions, pushing up market penetration rates and energy savings (Taylor et al. 2012).

3.4. Strategic Energy Management and Energy Manager/Staffing Programs

Traditionally, IEE programs have generally focused on promoting energy efficiency technology and supporting the installation of new, more efficient equipment or processes. In contrast, continuous energy improvement,[21] strategic energy management (SEM), or energy manager programs seek to promote operational, organizational, and behavioral changes that result in greater efficiency gains on a continuing basis. Although technology-based programs typically involve energy assessments to identify specific efficiency opportunities, organizational issues often prevent cost-effective measures from being implemented. SEM and energy manager programs focus on establishing the framework and internal processes for managing energy use, as well as on implementing capital projects.

Strategic Energy Management Programs

SEM programs help support the deployment of holistic energy management strategies and seek to encourage energy savings generated from changes in corporate culture, behavior, and operations and maintenance (O&M) practices. SEM programs, which in this report also include the adoption of energy management systems (EnMS), usually involve establishing a team representing personnel from across the organization (rather than just one energy manager) and require corporate management support to raise energy efficiency as a priority within the firm. SEM programs support the development of baselines, energy performance indicators, and metering capabilities. Although implementation of capital projects is still guided by energy management processes to identify and prioritize energy efficiency opportunities, SEM programs also encourage best practices in O&M independent of new investments.

SEM programs can be an effective tool for companies that want to extend their efforts to systematically identify and prioritize capital projects beyond the isolated technical improvements they may have already made at their facilities. At the same time, SEM can also provide a framework for saving energy at little or no cost through changes in operational efficiency. For example, J.R. Simplot's corporate energy manager noted that by simply

EXAMPLE 5. NEEA'S MARKET TRANSFORMATION PROGRAM

The Northwest Energy Efficiency Alliance is a regional nonprofit alliance of more than 100 Northwest utilities and energy efficiency organizations working on behalf of more than 12 million energy consumers. It operates in Oregon, Washington, Idaho, and Montana. Formed in 1996, NEEA was tasked to undertake energy efficiency market transformation initiatives throughout the region in support of both regional utility energy efficiency programs and the energy efficiency agenda overall. NEEA works across residential, commercial, and industrial sectors; helps accelerate the innovation and adoption of energy-efficient products; and identifies, develops, and advances emerging technologies to fill the energy efficiency pipeline with new products. NEEA's costs are paid by the Bonneville Power Administration, the Energy Trust of Oregon, and distribution utilities.

NEEA's market transformation initiatives involve identifying promising technologies and developing and implementing programs that allow them to be effectively picked up in the marketplace on a sustainable basis. NEEA tracks the energy savings resulting from its various initiatives, which include both savings from ratepayer programs of the utilities or ETO that build directly from NEEA's innovations, as well as savings directly from overall market penetration. Since 1996, the region has cost-effectively delivered, on average, over 900 MW of energy efficiency per year through market transformation.

Sources: Taylor et al. (2012), NEAA (2013).

[21] While the term "continuous energy improvement" was common in the past, the term "strategic energy management" has gained currency in today's programs.

applying behavioral changes, one plant was able to realize a 3% reduction in energy consumption in one year alone, with no capital expenditures (Sturtevant 2013). Energy management practices can be an especially attractive option for companies that do not have the capacity at that time to make significant investments, or are in the middle of operational cycles that limit plant modifications.

Examples of SEM programs include the BPA, the Energy Trust of Oregon (ETO), Wisconsin Focus on Energy (WFE), Xcel Energy Process Efficiency Program, BC Hydro, and AEP Ohio. An overview of the programs is provided in Table 1. Note that these programs' SEM offerings are often integrated into prescriptive or custom/process incentive programs but incentives for SEM can be different from custom or prescriptive incentives. Federal programs such as ENERGY STAR® offer resources that can be used and incorporated into an SEM offering.

BPA and ETO's SEM programs involve training "cohorts," or groups of non-competing companies, on SEM approaches. Companies typically meet monthly, with homework and coaching provided between meetings. These programs measure total energy savings achieved through the SEM training process, including savings from O&M changes, and provide incentives per unit of energy savings. BPA also offers a "track and tune" program to help companies find and implement low- and no-cost energy saving opportunities, and provides assistance with developing more sophisticated systems for monitoring energy consumption and measuring savings (Kolwey 2013).

Energy Manager Programs

A knowledgeable and dedicated energy manager is often the key to successfully implementing SEM within a company. An energy manager who works within and for the company for a period of time can provide leadership and organizational continuity for implementing change. Energy managers help guide energy efficiency capital expenditures through the company's approval process and provide the leadership and communication skills needed to inspire collaboration and minimize resistance to change within the organization. However, given the competitive pressures imposed on manufacturers today, many organizations are not able to obtain or reassign staff with the skill set to be a fulltime energy manager. Many organizations may lack awareness of the costs and benefits of hiring a fulltime staff member relative to other business investment opportunities and may also not anticipate the scope of the responsibilities. BPA's Energy Project Manager program (Example 6) has been successful in promoting the value of energy managers, as indicated by the fact that several facilities have gone on to hire their own energy managers after receiving BPA support.

To overcome these challenges, some IEE programs specifically support the placement of on-site energy managers in industrial facilities or with the corporate office. The energy manager can either be sourced as an existing staff member from within the company or brought in as an external expert (Russell 2013b). In some cases, programs provide support for on-site energy managers for a period of one year or longer. Program-sponsored energy manager initiatives promote the development of a cadre of experts needed to support SEM and achieve continuous energy efficiency gains over time (Russell 2013b).

For example, WFE provides a staffing grant to facilities that have already documented their major energy improvement needs. Reimbursements are paid upon implementation of energy efficiency projects. Twenty-eight facilities have been served to date. In 2010, 35 projects facilitated by the staffing grant in seven facilities generated energy savings of 278,872 MMBtu, or an average of 54,823 MMBtu per recipient). Staffing grant savings averaged $0.91 per MMBtu. Note that the energy savings totals include some projects that were not eligible for additional investment incentives (Russell 2013b).

BPA and Puget Sound Energy also have energy manager co-funding programs. Puget Sound Energy, BPA, and WFE programs provide partial financial support for the energy manager position assigned from existing personnel within the facility. The advantage of assigning an existing employee is that the person has already garnered trust of his/her colleagues and is familiar with the operational and technical processes of the workplace.

Roving energy project managers that assist multiple companies (as opposed to embedded energy managers for a single facility as described above) can also be an effective option, particularly for SMEs. SMEs often lack technical expertise and can thus benefit from external personnel who can share their technical and implementation experience from working with companies in similar applications. A roving energy manager can assist five to six companies at once by providing energy project management support and implementing energy efficiency opportunities identified through an energy audit (Weir 2013). For example, from 2010 to 2012, the Minnesota Energy Resources Corporation provided an energy management team coordinator to help the internal energy management teams of five industrial customers identify and implement energy conservation improvements (i.e., the coordinator dedicated 20% of total work time to each customer).

Table 1. Selected Energy Management and Energy Manager/Staffing Programs

Energy Management Offering	SEM Incentives	Customer Size
BONNEVILLE POWER ADMINISTRATION—ENERGY SMART INDUSTRIAL PROGRAM		
- High Performance Energy Management (HPEM): Provides training and individual assistance to 8–15 companies for one year. Measurement and incentive funding is available for 3–5 years. **- Track and Tune**: Low/no-cost operations O&M with incentive funding over 3–5 years and tools for interval data acquisition and performance tracking. - **Energy Project Manager (EPM) Program**: Funding of energy efficiency staff to support project identification and implementation (see Example 6).	$0.025/kWh for 3 or 5 years, for O&M savings	18,000 MWh/yr (guideline)
ENERGY TRUST OF OREGON—PRODUCTION EFFICIENCY PROGRAM		
- Industrial Energy Improvement (IEI): Year-long engagement provides cohorts of manufacturing companies trainings on SEM principles, tools, and practices designed to help companies manage their energy strategically. **- Corporate SEM (CSEM):** Focuses on corporate sites, instead of the cohort model, CSEM provides training and on-site activities on SEM principles and practices (9–12 months). **- SEM-Maintenance:** Helps former SEM participants maintain, deepen, and continue the integration of SEM into their business' operations. - **CORE Improvement**: Offering similar to IEI in focus and structure but services and instructions are tailored to small to medium manufacturers. - **ISO 5001 pilot implementation** (see Chapter 6).	$0.02/kWh, $0.20/therm for 1 year of savings. SEM-Maintenance: $0.01/kWh, $0.10/therm	IEI/CSEM: More than 8,000,000 kWh/yr, or if eligible for gas, 500,000 therms/yr usage. CORE: Spending $50,000–$500,000 on total energy costs (electricity and gas combined)
WISCONSIN FOCUS ON ENERGY—INDUSTRIAL PROGRAM		
- Practical Energy Management: Provides best practice training events and applies its industry-specific Energy Best Practice Guidebooks to key cluster industries. **- Staffing grants:** Allow companies to hire an FTE.	Grants for energy staff	Customers with more than $60,000 in monthly bills
XCEL ENERGY—PROCESS EFFICIENCY PROGRAM (CO & MN)		
Provides individual assistance in developing a 3–5 year energy management plan using the Envinta One-2-Five Energy Methodology that evaluates energy intensive processes, benchmarks energy management practices, and provides an assessment prioritizing opportunities.	For capital projects only	> 2,000 MWh/yr of savings potential
BC HYDRO—POWER SMART		
- Industrial Energy Manager: Offers funding for large customers to hire an on-site energy manager and a structured support group of local companies that share best practices. **- Energy Management Assessment:** Free assessment of opportunities, customized SEM action plan, and rating against the Energy Management Scorecard. **- Various free energy management tools and training**, employee awareness kits, and customer recognition through public media.	Co-funding of energy manager	> 20 GWh annually
AEP OHIO—CONTINUOUS ENERGY IMPROVEMENT PROGRAM		
- **Coaching assistance, tools, and templates** to help meet plant and corporate cost saving targets. - **Custom statistical models** to help measure and manage energy intensity. - An **Energy Coach** to help identify and implement opportunities.	$0.06 /kWh (or $0.02/kWh over 3 years)	> 10 GWh annually

Sources: Batmale and Gilless 2013, IIP 2013, Kolwey 2013, Russell 2013, Nowak et al. 2012, BC Hydro 2013, AEP Ohio 2013, Xcel Energy 2010

EXAMPLE 6. BPA'S ENERGY PROJECT MANAGER PROGRAM

BPA has introduced an Energy Project Manager (EPM) program that funds a position for an engineer at an industrial facility. This individual can be an existing staff engineer or someone specifically hired for the position. One of the primary requirements is that the facility has the potential for, and commits to, annual energy savings of 1 million kWh through efficiency projects.

Initially, BPA and the customer estimate achievable energy savings. The energy manager is then required to develop a plan with updates every three to six months. The savings are tabulated according to the upfront feasibility studies for specific projects and revised according to final measurement and verification of achieved savings. Once the EPM is assigned and the estimated savings have been agreed, an initial $25,000 funding payment is made to the facility. The program also reimburses a fixed rate per kWh saved ($0.025 per KWh saved) subject to a funding cap of $250,000 maximum annual amount. Additional incentives are available for capital and O&M projects.

From 2009 through March 2013, 28 energy managers had been placed in a variety of industries and capacity savings averaging 16.6 MW had been implemented. More than half of program participants apply for term renewals. Some facilities are currently in years 2–3 of their participation. BPA has found that several facilities have gone on to hire their own energy managers after receiving this type of funding support for several years.

Sources: BPA 2012a, DOE 2010, Kolwey 2013, Russell 2013b

4. Program Features that Respond to Manufacturers' Needs

The spectrum of program approaches discussed in Chapter 3 demonstrates that there are a range of program offerings designed to help manufacturers improve their energy efficiency. These can range from providing technical assistance to offering financial incentives for common technologies to sponsoring an energy manager to guide a facility toward behavioral changes that result in more energy-efficient operations and maintenance. These approaches can be customized to meet a variety of conditions, and fundamental success factors can be worked into a wide variety of program designs and policy environments.

Effective industrial energy efficiency (IEE) programs will adopt the language, engagement strategies, and metrics that are meaningful to the corporate managers who drive capital investment decisions. Understanding customer needs and the investment decision-making processes allows state IEE program administrators to boost implementation rates while making better use of limited resources.

This chapter first discusses the special needs and characteristics of industrial companies as energy users and provides basic information that may help program administrators recognize and navigate prevailing capital investment practices and corporate culture perspectives on energy. The reader should keep in mind these are generalizations, and may not be applicable to any specific industrial customer. It then discusses reasons why manufacturers may resist participating in state IEE programs. Finally, building on approaches that are currently operating in a variety of state contexts, it explores specific features that can respond to manufacturers' needs.

For the most part, these features are engagement strategies that have been proven to provide value to industrial customers. With greater industrial engagement and participation, state goals such as providing utility customers with low-cost energy resources and environmental benefits can be met more quickly and cost-effectively. The program examples highlighted here have been successful, not only because they have been able to respond to manufacturers' needs and achieve significant energy savings, but also because they often demonstrate cost-effectiveness (according to whatever cost tests a state may require for the program), have had good rates of participation, or show they have some longevity and a track record of successful projects.

4.1. Special Needs and Characteristics of Manufacturers as Energy Users

Manufacturing is Complex and Sophisticated

Understanding energy use patterns in manufacturing plants can be far more complex than in other end-user sectors. Manufacturing uses energy in various common technologies such as boilers, air compressors, or motors, as well as in processes that are specific to each industry.

Although the technical choices and energy use characteristics for various common technologies may at times be straightforward, the economics of adopting energy savings measures in these cases can still be complicated, as they are heavily related to production patterns that typically change with the ups and downs of market demands. Energy use tied to specific manufacturing processes, then, is highly plant-specific and typically requires a level of specialized knowledge that often is found only among subsector technical experts.

Industrial companies are also generally more knowledgeable about energy issues than other customer categories, especially in factories where the cost of energy is a substantial proportion of overall costs. For example, in the steel industry, energy accounts for about 15% of total manufacturing costs, and in the glass industry, energy costs are 8%–12% of production cost (DOE 2013a). Even in applications where energy is not a large proportion of costs, some industrial managers view energy as a cost that can be controlled more easily than labor or feedstock inputs—at least in the near term.

Manufacturing is Heterogeneous

The industrial sector is very diverse, comprising a wide variety of different industry subsectors with different production processes and energy use characteristics. Even within subsector processes, product mix output and energy use patterns vary substantially. In the chemical industry, for example, it is typical for individual plants to continually adjust their product outputs as market conditions change and new opportunities arise. Such changes often require adjustments in process flows and the equipment and energy use patterns of different parts of a facility.

The industrial sector includes a broad spectrum of company size and technical sophistication ranging from very large companies with internal engineering staff to small and medium enterprises (SMEs) with limited technical capabilities.

The heterogeneity of the manufacturing sector can make it difficult for IEE programs to meet the specific needs of individual companies. To some extent, fairly simple programs designed to assist companies to save energy in common technology applications can be designed to be relevant to a wide range of manufacturing plants, providing some value. However, focus on simple common technology fixes alone will tend to put programs on only the periphery of manufacturing energy use and savings concerns. Manufacturers use energy differently than the commercial sector, typically having significant process-related consumption in addition to heating, ventilating, and air conditioning (HVAC) and lighting loads. Although it varies depending on manufacturing subsector, HVAC and lighting typically make up around 20% of total energy consumption (Kolwey 2012).

Although manufacturing as a sector is usually heterogeneous, industries may cluster in certain service areas for a variety of reasons. This creates opportunities for program administrators to concentrate energy efficiency process expertise in such places. Wisconsin's cluster approach is discussed in Section 4.7.

Energy Efficiency is Often Not Integrated into a Company's Decision-Making Process

Because energy can be a significant percentage of total manufacturing costs, lowering energy costs through increased efficiency can improve a company's bottom line and overall competitiveness. However, the decision-making processes of industrial companies involve a variety of participants, concerns, and procedures. There is a range of reasons why internal decision-making processes may not result in implementation of highly cost-effective energy efficiency opportunities, including:

- Energy efficiency projects may compete with core business investments that dominate attention, as well as investments for safety, environmental, and other regulatory requirements
- Decision-making is often split across business units
- The skills required to identify and pursue energy efficiency opportunities are not always present.

Projects focusing on operating cost savings may not compete well internally with projects focusing on expansion or new market development, despite very attractive financial returns. The profit benefits of investments leading to operating cost reductions may be difficult to clearly identify or communicate. Sometimes, other major investments may be seen as more core to the business, attracting higher priority. At other times, access to financing for operating cost saving projects also may be a barrier. Projects may be difficult to finance with outside loan capital if they are relatively small, due to lukewarm interest among financiers and high transaction costs.

Large companies often split responsibility for plant operations, energy bills, and investment decisions across different organizational units. A plant manager may be interested in energy efficiency, but does not see the actual energy bills or get credit for reducing them. A procurement manager may be motivated to minimize first costs instead of life-cycle costs, even if efficient choices save operating costs at the plant level. These "principal-agent" or "split-incentive" barriers can keep cost-effective improvements from happening.

In addition, in some cases manufacturers concerned about controlling energy costs may focus on efforts to gain more favorable energy pricing and contractual arrangements with energy suppliers and not necessarily on improving the efficiency of energy use in operations.

Finally, the skills required to identify and implement IEE opportunities are not always present in existing staff or staff are tasked with addressing other priorities. Companies often lack in-house staff capacity and specialized expertise in energy management and technology skill sets. This prevents cost-effective measures from being identified, and also prevents known options from being advanced to the implementation stage.

Operational Cycles Influence When Energy Efficiency Investments Can Be Made

Energy efficiency investments are heavily dependent on the industrial customer's operational cycle, which can span four to seven years on average (Chittum 2009). Maintaining stable production is critical in industry. Project implementation can require temporary downtime for equipment installation and testing, impacting plant operations and production. Flexible scheduling to best match production requirements—for example, delaying implementation to times when many projects can be done at once or to planned shutdowns—will minimize plant interruptions and reduce management concerns.

In addition, IEE projects can often be significantly larger than projects in other sectors, requiring completion of comprehensive project approval processes and careful consideration by various personnel across a number of corporate divisions. Time horizons for project approval may be long. Moreover, implementation scheduling may require linkages to a variety of other project implementation measures at the same time.

Co-Benefits Are Often Not Included in the Cost-Benefit Analysis for Energy Efficiency Projects

Although additional co-benefits or non-energy benefits (NEBs) from energy efficiency projects may be substantial for the industrial customer, they are generally not included in the cost-benefit analysis for energy efficiency projects. This is despite extensive evidence that NEBs can be a key part of project benefits and can reduce payback times for new investments. Co-benefits may even exceed the value of energy savings. A 2003 study of commercial and IEE programs in Wisconsin valued these benefits at approximately 2.5 times the projected energy savings of the installed technologies (Hall and Roth 2003). In a recent survey of 30 energy managers, engineers, sustainability managers, plant managers, presidents, and vice presidents from a diverse pool of companies nationwide, 90% of energy projects were found to also have a broader productivity impact (Russell 2013a). For one company surveyed, energy improvements provided a fourfold return in the form of production improvements and some companies claimed that NEBs "dominated" the returns from energy projects. NEBs are further discussed in Chapter 6.

4.2. Industrial Participation in Energy Efficiency Programs

Historically, energy efficiency program administrators have struggled to create programs that overcome concerns from manufacturers about perceived or real costs, potential risk for production disruptions, or lack of flexibility in prescriptive incentive programs. When new ratepayer energy efficiency programs are being contemplated, large industries may resist paying systems benefits charges. In cases where some types of industrial programs have already been put in place as part of resource acquisition efforts, some industries remain lukewarm about participating. Several common reasons for this include:

- Saving energy is already claimed to be a business imperative and many industrial customers feel they can best manage their own energy needs, so they may think there is no added value in participating in IEE programs.
- Manufacturers are not aware of the IEE program offerings that may be most useful for their operations.
- IEE program offerings may not be flexible enough to meet the most pressing energy efficiency investment priorities of manufacturers and may be considered administratively complex and burdensome.
- Available IEE programs are perceived as being unresponsive to core energy issues in plants that are subsector- and site-specific.
- IEE program administrators may be perceived to have insufficient expertise in manufacturing and/or are not knowledgeable about key customer concerns and needs.
- There is a mismatch between industrial planning and project cycles and IEE program terms. Equipment replacement or refurbishment or plant retrofits can often only occur at the end of appointed times in operational cycles.

- Industrial firms can be sensitive about releasing confidential information and may be concerned that programs end up sharing information on what they consider to be their competitive advantage.

All of these observations help explain why manufacturers may not always respond quickly or positively to IEE program offerings. Program designers who are aware of the issues and concerns that can limit industrial participation can be better equipped to design programs that address these concerns and better meet the specific needs of their industrial market (Section 4.7 discusses how program administrators have been able to provide significant value to their industrial customers).

As described in further detail below, successful IEE programs that provide value both to individual industrial energy users and to society at large:

- Clearly demonstrate the value proposition of energy efficiency projects and IEE programs
- Develop long-term relationships with industrial customers, with continual efforts to identify effective projects
- Accommodate project scheduling issues
- Provide both common technology and customized project development options
- Ensure that program administrators have industrial sector credibility and can offer high quality technical expertise targeted to specific subsectors
- Streamline and accelerate application processes
- Leverage strategic partnerships
- Conduct active and continuing program outreach
- Set medium- and long-term energy efficiency goals as an investment signal for industrial customers
- Ensure robust evaluation, monitoring, and verification.

EXAMPLE 7. NORPAC'S WASHINGTON MILL BENEFITS FROM CUSTOM EFFICIENCY OFFERING

NORPAC, a large paper mill in Washington State, is the largest newsprint and specialty paper mill in North America. The 33-year-old mill produces 750,000 tons of paper a year and is the largest industrial consumer of electricity in the state, requiring about 200 MW_{avg} of power. It takes a lot of energy, water, and wood to make paper and the process begins with wood chips. Refining wood chips is a mechanical process that requires large amounts of energy.

Bonneville Power Administration (BPA) and the Cowlitz County Public Utility District (PUD) funded the installation of new screening equipment between refiners that reduces the electricity and chemicals used to refine wood chips and reduces the amount of pulp needed for the process. The equipment is estimated to save NORPAC 100 million kilowatt-hours of electricity per year, equivalent to cutting its power requirements by about 12%, and is enough energy to power 8,000 Northwest homes.

The improved refining processes have also allowed NORPAC to expand its product line. The mill can now produce a brighter and whiter paper that is made from fewer wood chips than a similar grade from its competitors.

NORPAC employs 415 full-time employees and about 30 contractors and the construction phase of the project created 64 full-time family-wage jobs.

BPA has funded about $21 million for three custom projects at NORPAC, and Cowlitz PUD will contribute up to an additional $3.9 million. NORPAC is funding the remaining $35 million of the $60 million project.

Source: Taylor et al. (2012); BPA (2012b)

4.3. Clearly Demonstrate the Energy Efficiency Project Value Proposition to Companies

Energy efficiency measures, which generally lower the cost of production or increase output per input costs, have repeatedly demonstrated their effectiveness in improving a facility's bottom line and in increasing company competitiveness and productivity. Benefits can include strong life-cycle cost savings with sometimes minimal capital investment, a variety of non-energy co-benefits, and even reputational advantages. It is not uncommon for manufacturing facilities to realize energy efficiency improvements as high as 10%, with corresponding cost savings and financial paybacks of two years or less when they implement basic operational and maintenance improvements. For example, as part of the U.S. Department of Energy's (DOE's) Superior Energy Performance (SEP) program, 14 pilot plants have implemented the global energy management standard, ISO 50001, and achieved SEP certification. Nine of these plants have shown an average energy performance improvement of 10% in the first 18 months of SEP implementation, with an average payback of 1.7 years (DOE 2013c). Energy Trust of Oregon (ETO) and AEP Ohio also estimate that their industrial customers can typically achieve 5%–15% savings through energy management with little or no capital investment (ETO 2013, AEP Ohio 2013). And Efficiency Vermont estimates its Continuous Energy Improvement program can help companies cut energy consumption by 10%–15% within the first three years and 25%–35% within six years (Efficiency Vermont 2013).

Many companies that have participated in IEE programs have experienced strong cost savings benefits, and successful IEE programs document how program offerings have helped their industrial customers' bottom lines. For example, the Bonneville Power Administration (BPA) extensively documents results from its Energy Smart Industrial Program. Success stories include:

- The NORPAC pulp and paper mill in Washington State, which cut its power requirements by 12% per year through upgrades financed by BPA (Example 7)
- J.R. Simplot, which identified energy savings of $715,000 per year with a three-year payback (Example 8)
- Irving Tissue, which, through participation in the New York State Energy Research and Development Authority's (NYSERDA's) industrial FlexTech and Industrial Process Efficiency (IPE) programs, was able to save 14,800,000 kWh per year (Example 9).

EXAMPLE 8. SIMPLOT AND CASCADE ENGINEERING IDENTIFY $1,000,000 IN ELECTRICAL SAVINGS

J.R. Simplot Company is one of the largest privately-held corporations in the United States, consisting of AgriBusiness, Land and Livestock, and Food Group divisions. The company was successful in developing and integrating a company-wide energy management program and worked with Cascade Energy within local utility energy programs to obtain energy study co-funding and implementation incentives. Simplot is also a U.S. Department of Energy Better Plants Challenge Partner and a U.S. Environmental Protection Agency (EPA) ENERGY STAR® partner.

Simplot and Cascade Energy have joined forces on 14 detailed energy studies at nine facilities over the past 10 years. Cascade provided facility scoping, energy analysis, project costing, design assistance, commissioning, and final inspection services on these projects. Cascade evaluated refrigeration, compressed air, hydraulics, pumping systems, processes, and controls at both existing and new facilities. Simplot implemented seven of the largest projects to date, capturing well over half the identified energy savings.

Energy Savings: $715,000 per year or 21,000,000 kWh per year ($1,000,000 or 36,000,000 kWh per year identified)

Investment: $950,000 to date ($2,000,000 identified)

Financial Return: Three-year simple payback on implemented projects

Source: EPA 2013b

PacifiCorp, an investor-owned utility operating in five northwestern states, offers extensive ratepayer-funded energy efficiency programs throughout their territory. For those customers participating in IEE programs, PacifiCorp has found that a one-dollar investment can yield $4.10 to $5.60 in long-term savings. The utility has documented that these energy savings are predictable over time, measurable, and long-lasting (WGA 2013).

A key point in making the value proposition case to industrial company managers is to lay out in simple and concise terms the operating cost savings and other benefits—including profits—that are being left on the table by not addressing cost-effective energy efficiency improvement opportunities. The case can then move on to the simple steps required to capture the most prominent savings opportunities. Cost-saving examples and success stories from similar companies in similar situations can also greatly help to further buttress the case. Discussion and exchange with peers can also be a strong driver for energy efficiency with individuals and companies. Many successful programs offer a venue for peer exchange.

SUCCESSFUL DESIGN AND IMPLEMENTATION APPROACHES

- Document results from successful IEE projects.
- Include non-energy benefits of energy efficiency measures in the value proposition.
- Develop case studies and examples for different industrial sectors.

4.4. Develop Long-Term Relationships with Industrial Customers and Continue to Refine Project Offerings

Maintaining multi-year and steady relationships with individual industrial customers is a key factor for achieving success in state IEE programs. All the energy efficiency programs that have been successful with industry have this element in common.

The reasons why long-term, steady relationships with individual customers are so important stem in large part from the particular characteristics and needs of the industrial sector described previously. Key reasons include:

- Strong understanding of industrial customer circumstances and needs. To add real value to existing energy efficiency efforts at a customer facility, program staff need to understand the specific circumstances of the plant as well as their plans and issues.
- Develop projects on a flexible timeframe. IEE projects tend to be identified over time, as plant circumstances change and opportunities arise. In addition, project implementation scheduling must accommodate a host of industrial client concerns (see Section 4.5). Successful program staff consistently report that the best results are maintained through steady dialogue and contact, responding to the opportunities when they arise.
- Build synergies between program offerings. Proven results with industrial customers often involve a variety of program offerings and services. Typically, these are delivered at different times, as opportunities and customer needs develop, but they are also often interrelated and build on each other. For example, assistance in completing an audit may often lead to identification of a project for program support or an energy management improvement opportunity. Joint work on completion of a customized project may lead to identification of a number of simple prescriptive project options that a company was not aware of. Advice on how to access a key process expert may lead to a new project.

EXAMPLE 9. IRVING TISSUE BENEFITS FROM NYSERDA'S INDUSTRIAL OFFERINGS

The New York State Energy Research and Development Authority's (NYSERDA's) longstanding technical assistance program—known as FlexTech—and its Industrial Process Efficiency grant programs have assisted Irving Tissue, a tissue, paper towel, and napkin manufacturer located in Fort Edward, New York, with increasing its new plants' efficiency. The company was considering a major plant expansion to improve productivity and competitiveness. To ensure that the new operation was cost competitive, Irving Tissue worked with manufacturers, suppliers, and NYSERDA to build energy efficiency into the new paper-making systems. A proposed upgrade for a more efficient vacuum system would create significant energy and cost savings while delivering a higher quality product. However, the cost of the system was too great for the company to self-finance. The Industrial Process Efficiency program was not only able to provide grant funding for the vacuum, but also was able to recommend the installation of premium efficiency motors and variable-speed drives. NYSERDA was able to finance $1.8 million of the full incremental cost of $4.3 million for the efficiency upgrades. The new papermaking machine is saving 14,800,000 kWh per year compared with a standard paper machine.

Source: NASEO 2012

The importance of building long-term relationships is bolstered by a stable and skilled IEE program contact for industrial customer interaction. Satisfaction of industrial customers with program delivery and results often hinge on the degree of success achieved in establishing a strong relationship with program staff. Within IEE programs, the industrial program account management system provides a structure for steady engagement with industrial customers. Individual account managers may be staff, long-term contractors, or a blend of these (see Section 4.7). Successful programs have a cadre of skilled staff and experts to develop, build, and maintain the long-term relationships with individual customers needed for industrial program success.

Many programs become steadily stronger because of long-lasting industrial customer relationships. IEE program administrators that have developed long-term relationships with industrial customers can track the status of the firm's energy efficiency efforts and investments made over time. This enables them to provide continued relevant solutions to the company.

In their efforts to maintain steady, regular dialogue with industrial customers, successful IEE programs engage at the customer's corporate level as well as the plant level. Note that this can be a challenging task for a regional program, especially when corporate headquarters is located outside the region. Identifying an internal energy champion within the industrial company and connecting with several additional staff so relationships can continue despite staff changes also helps foster long-lasting relationships.

EXAMPLE 10. XCEL ENERGY INCENTIVES AND TECHNICAL SUPPORT

Xcel Energy operates in eight states. Their incentives portfolio has been lauded by industrial customers for offering simple incentive applications for providing a full suite of programs—custom, self-direct, and process energy efficiency incentives. Xcel representatives noted that they see the most manufacturing participation where there is flexibility and incentive stability.

Xcel's Process Efficiency (PE) program in Colorado integrates its technical assistance, energy management support, and incentive programs. The PE program is available to industrial customers with energy conservation potential of at least 2 GWh, which usually translates to total annual electricity consumption of at least 20 GWh. The program offers a free scoping assessment and provides support for strategic energy management. A second more detailed assessment is then undertaken, for which the customers pays 25% of the cost, up to $7,500. After the detailed assessment is completed, Xcel Energy and the customer sign an agreement that specifies which projects will be implemented, the timeframe for implementation, and the incentive amount based on the rate of $400 per kilowatt of peak demand reduction. Xcel Energy encourages the customer to agree to complete projects within a year, but allows longer timeframes if needed.

Source: Kolwey 2012, WGA 2012

In ETO's Production Efficiency program (see Example 11), additional customer support has encouraged more cost-effective savings. The ETO program focuses on long-term relationships using a business-like approach to customer relations to help customers achieve significant ongoing savings. Increased program delivery expenditures have delivered higher savings and lower resource acquisition costs than increased incentive levels. Customers recognize the value of program assistance in customer satisfaction surveys (Nowak et al. 2012).

SUCCESSFUL DESIGN AND IMPLEMENTATION APPROACHES

- Understand the industrial customer's circumstances, needs, and operational cycles.
- Build synergies between program offerings.
- Develop stable, long-lasting relationships for maximum results.

EXAMPLE 11. ENERGY TRUST OF OREGON PRODUCTION EFFICIENCY PROGRAM

Recognizing that large manufacturers can realize deep energy savings with low-cost changes, the Energy Trust of Oregon (ETO) offers the Industrial and Agricultural Production Efficiency program, a custom and prescriptive rebate program, to help achieve these savings. Portland General Electric, Pacific Power, NW Natural, and Cascade Natural Gas customers, who pay into the state public benefit fund, qualify.

The program promotes innovative IEE technological and behavioral approaches and provides technical expertise, training, and project funding to help companies plan, manage, and improve their energy efficiency. All industrial size classes are eligible, but the program focuses on measures that will yield more significant energy savings: custom projects for industrial process improvements, strategies for large energy users, and projects with certain low-cost changes that can yield significant energy savings. The program also offers prescriptive incentives available for projects such as lighting and heat pumps.

ETO provides free technical services, typically valued at $20,000 to $50,000, to complete a study of energy efficiency opportunities. Custom incentives are calculated on a case-by-case basis. Incentives of $0.08 per kWh and $0.04 per therm are also available for operations and maintenance improvements (up to 50% of eligible project costs or up to 90% if completed within 90 days), energy management practices ($0.02 per kWh saved or $0.20 per therm saved), and custom process or production equipment projects (up to 50% of project costs).

ETO contracts with energy efficiency account managers throughout Oregon, termed program delivery contractors, and with energy efficiency process engineers termed allied technical assistance contractors, who provide detailed technical and scoping studies to determine the most cost-effective energy upgrades.

ETO’s 2013 energy savings from industrial customers reached 16.9 MW_{avg} of electricity and 2.2 million therms of natural gas. The Production Efficiency program completes nearly a thousand projects per year.

Sources: ETO 2012, ETO 2013b, Nowak et al. 2013

4.5. Ensure Program Administrators Have Industrial Sector Credibility and Offer High Quality Technical Expertise

As discussed in the previous section, development of long-term relationships between industrial customers, program administrators, and experts is important for IEE program success. Effective IEE programs also develop credibility with the industrial customer by employing staff and/or contracted experts that understand the customer’s industrial segment, and have the technical expertise to provide quality technical advice and support on energy efficiency options and implementation issues specific to that industry and that customer.

Addressing industrial companies’ core needs requires understanding a plant’s production processes, operating issues, and the market context that the plant operates within. Effective IEE programs will adopt the language, engagement strategies, and metrics that are meaningful to the corporate managers who drive capital investment decisions. Understanding customer needs and their investment decision-making processes allows IEE program administrators to generate trust with their industrial customers, boosting IEE implementation rates while making better use of limited resources.

Access to specific subsector technical expertise for specific short-term assignment is almost always necessary. Engagement of technical experts can address customers’ specific technical needs such as completing diagnostics, developing new internal metering programs, assessing technology options for new projects, and developing project-specific measurement and verification (M&V) plans.

There are different approaches to ensure that this key program contact function is effective. Some program administrators rely heavily on in-house staff for this function. For example, Efficiency Vermont maintains six account managers in charge of all day-to-day relations with industrial customers. On the other side of the spectrum, some program administrators rely heavily on contractors to undertake day-to-day account-manager type functions for their industry programs. One example includes Wisconsin's long-standing Focus on Energy program, which one contractor has operated successfully for almost 14 years, providing steady service to large industrial customers under the Focus on Energy brand (Taylor et al. 2012). Others rely heavily on contractors to undertake day-to-day account-manager type functions.

A mixed approach can also be adopted, using both in-house and contractor staff to maintain day-to-day dialogue. In Oregon, for example, nine of ETO's 80–85 internal staff are responsible for delivery of the industry and agriculture Production Efficiency program. These staff work together with six outsourced Program Delivery Contractor (PDC) teams. The PDC teams include six to seven people each, working on day-to-day delivery of the program. There are currently 30–35 PDC full-time equivalent employees (FTEs), and approximately 10–20 FTEs that provide technical assistance and energy management advice that, in 2012, served 800 discrete facilities with 1,000 projects covering a mix of types and sizes of industrial and agricultural customers (Crossman 2013).[22] ETO places emphasis on maintenance of close individual client contact by its in-house staff as well as by its PDCs (Taylor et al. 2012).

Wisconsin's Focus on Energy program has used a "cluster" approach to organize program delivery with greater subsector and industrial process expertise for specific industrial groups, such as food processors, pulp and paper manufacturers, or plastics companies. Including workshops with cluster members and relevant trade associations, this approach also has fostered cross-peer exchange and learning (Taylor et al. 2012, Chittum 2009). In 2012, its program for large energy users generated savings of 61,344,005 kWh and 3,119,919 therms (see Appendix B-7).

Xcel found that one of the biggest challenges in implementing IEE projects is that technical needs vary from industry to industry and company to company with no standard template for implementation. To address this, Xcel's team of account managers works closely with industrial customers to understand their production processes and operational needs, and provides both initial energy audits and continued support throughout project construction (WGA 2013). Similar to many other programs, Xcel's efforts to provide project development support expertise extends beyond basic diagnostic service to help move projects through the implementation stage, helping decision makers to make a go/no go decision based on accurate, complete, and customized project information. In Colorado, Xcel's custom and process efficiency programs generated average savings of 10,838,108 kWh per year from 2010–2012 (see Appendix B-8).

SUCCESSFUL DESIGN AND IMPLEMENTATION APPROACHES

- Invest in knowledgeable, skilled technical staff.
- Use high quality technical assistance to enhance prescriptive and custom program success.
- Recognize that technical needs vary from industry to industry and company to company.

4.6. Offer a Combination of Prescriptive and Custom Offerings to Best Support Diverse Customer Needs

A combination of both prescriptive offerings for common cross-cutting technology and customized project offerings for larger, complex projects in IEE programs can best meet diverse customer needs and provide flexible choices to industries. Prescriptive offerings—typically involving rebates for a portion of the cost of common technology equipment upgrades or certain other clearly defined actions—can be relatively simple for both customers and administrators. However, their value to large customers may not be significant. Custom approaches are needed for the larger, complex, or process-specific projects. If both types of offerings are included, IEE incentive program offerings can be tailored to accommodate both large manufacturers and SMEs, depending on the state's industrial base.

[22] For ETO's Production Efficiency program, incentives are budgeted at 63%, delivery at 26%, and internal costs are 11% (Crossman 2013).

Xcel's programs (Example 10) have been lauded by industrial customers for offering simple incentive applications for providing a full suite of programs—custom, self-direct, and process energy efficiency incentives. ETO (Example 11) has been successful in its ability to help its Oregon industrial customers realize deep energy savings through low-cost changes as well as complex custom approaches. Rocky Mountain Power (Example 12) couples its custom Energy FinAnswer program with the complementary Energy FinAnswer Express program offering prescriptive rebates to target deep savings as well as quick wins. Efficiency Vermont, NYSERDA, and PG&E, among others, also provide both prescriptive technology and customized project development options.

Including customized project offerings requires administrator investment in program capacity and development of mechanisms to access specific technical expertise (see Section 4.7). However, the energy savings can be well worth the investment. In Vermont, six industrial account managers are actively engaged full-time in Efficiency Vermont industrial programs, centering primarily on customized project identification, development, delivery, and savings measurement and verification. Their work yields nearly 90% of Efficiency Vermont's annual industrial program energy savings delivery (Taylor et al. 2012).

SUCCESSFUL DESIGN AND IMPLEMENTATION APPROACHES

- Prescriptive offerings support common cross-cutting technologies or practices.
- Custom offerings support larger, complex, or process-specific energy efficiency measures.
- Offering prescriptive and custom offerings allows programs to accommodate large industrials and SMEs.

4.7. Accommodate Industrial Project Scheduling Needs

Scheduling energy efficiency investments can be heavily dependent on a plant's operational cycle. Equipment is normally renewed or refurbished at the end of an operational cycle. The timing of a major investment window can be difficult to predict, particularly by someone not engaged in the plant's day-to-day activities (Chittum et al. 2009).

Operational cycles and investment windows can be few and far between, and proposed equipment changes must be guided through rigorous, competitive, and time-consuming capital expenditure approval processes. Firms often have long timeframes between identifying an opportunity and project implementation, especially when large companies consider large dollar proposals.

IEE program cycles may not match industrial company timing for allocating capital for projects. Manufacturers, particularly large organizations, need time to secure capital and plan for potential plant shutdown to accommodate energy efficiency assessments and project implementation. This often leads to a "phased approach" to energy efficiency implementation.

Programs with flexible timelines that can accommodate an industrial client's investment cycle will help to maximize energy efficiency implementation. Programs that are not limited to one-year timeframes but instead accommodate multi-year projects and application periods—or have multi-year planning and operation as their standard operating procedure—allow companies the flexibility to consider and implement program offerings on a schedule that matches their decision and investment cycle. This, in turn, can promote higher program participation levels. To the extent possible, program managers should also be mindful of industrial operational and investment cycles and time recruitment and outreach accordingly (Russell 2013b). In addition, by examining current and projected economic trends in the industrial sector, an efficiency program can anticipate when the next large cycle of construction, infrastructure, and capital investment is likely to occur (Harris 2012) and therefore help to encourage energy efficiency, either from new production equipment or a new facility (Seryak and Schreier 2013).

For example, evaluations of NYSERDA's IPE program suggested that program managers should target specific industrial subsectors based on an understanding of a firm's hours of operation, capital plans, level of interest in energy efficiency and sustainability initiatives, and capacity utilization.[23] The IPE Program is positioned to take advantage of potential capacity investments by developing lists that classify industrial customers using North American Industry Classification System (NAICS) codes to include evidence of plant capacity constraints, using capacity utilization data published by the U.S. Federal Reserve System. Companies with a high capacity utilization rate relative to their historical averages are prioritized for targeted outreach concerning large infrastructure investments. Firms reporting mid- or low-capacity utilization rates are targeted to increase the productive capacity of existing facilities, implement and/or adopt a strategic approach to energy management, and/or implement low- and no-cost operational improvements (Harris 2012). NYSERDA estimates that its IPE program will save 200,000 megawatt-hours per year and 735,000 million Btu (MMBtu) per year from 2012 through 2015 (see Appendix B-5).

SUCCESSFUL DESIGN AND IMPLEMENTATION APPROACHES

- Accommodate multi-year projects and application periods or have multi-year planning and operation as their standard operating procedure.
- Understand the operational cycle and capital approval process cycle of individual industrials.
- Monitor economic and investment trends of industries in your region to plan for expansion and new plant opportunities industrials and SMEs.

EXAMPLE 12. ROCKY MOUNTAIN POWER'S ENERGY FINANSWER AND FINANSWER EXPRESS PROGRAMS

Rocky Mountain Power's (RMP's) Energy FinAnswer program in Idaho offers engineering services, technical expertise, and cash incentives to help industrial and commercial customers upgrade to the most energy-efficient systems, tailored to the needs of retrofit or new construction projects. The Energy FinAnswer program is a long-standing program that has been in place in some form since the 1990s. It has continued to evolve to accommodate changing market and company resource positions.

RMP is involved from the very beginning of projects and starts by reviewing facility plans and identifying possible efficiency opportunities. The next step involves the utility preparing a free energy analysis report to provide specific recommendations and estimates of what each efficiency measure will cost and how much the customer will save. RMP also includes an incentive offer and any commissioning requirements. The incentive amount available is typically $0.12 per kWh of annual energy savings plus an additional $50 per kW for average monthly on-peak demand savings. Prior to July 2013, incentives were capped at 50% of the project cost and at least one-year payback (if the payback is less than one year, the incentive is reduced so that the payback equals one year). Program revisions in July 2013 increased the incentive cap to 70% of project cost. The two parties sign an incentive agreement form before the company proceeds with any purchase orders for the equipment. RMP allows two years for customers to implement the projects.

The program provides a number of resources, including case studies of past projects, to help those interested in the program determine their own project plans, and provides a list of engineering firms under contract to provide program services. Energy FinAnswer has a complementary program, Energy FinAnswer Express, which offers simple, prescriptive incentives for lighting, HVAC, and other common efficiency upgrades. Customers typically receive the incentive payment within 45 days of completing a post-installation report. These two programs complement each other in the market, providing a broad platform of services and incentives for a wide variety of energy efficiency projects.

In 2012, RMP generated electrical gross savings of 4,473,114 kWh per year across 81 measures under its FinAnswer Express program and 318,915 kWh per year across seven measures under its Energy FinAnswer program.

Source: Rocky Mountain Power 2013a, Rocky Mountain Power 2013b, Kolwey 2012

[23] The capacity utilization rate describes the extent to which the industrial sector's production capabilities are actually being used to produce the current level of output. In general, a high rate of capacity utilization is a positive indicator of economic health.

4.8. Streamline and Expedite Application Processes

Industrial customers may perceive the application and implementation procedures for IEE programs to be administratively complex and burdensome. Achieving the right balance between meeting key program administration needs for information and streamlining the application process is helpful.

As an example, BPA began using a third party to evaluate and then help streamline procedures to address industrial concerns about the application process. A third party also helps individual companies navigate application procedures.

NYSERDA also provides upfront assistance to help companies navigate the application process, and uses a Consolidated Funding Application (CFA) developed as part of a statewide plan to streamline and expedite the grant application process. Because the CFA is commonly used across a range of programs, this simplifies the application process and applicants may already have experience with this documentation.

SUCCESSFUL DESIGN AND IMPLEMENTATION APPROACHES

- Streamlined application procedures encourage participation.
- Assistance in navigating the application process is helpful to industrials.
- Balancing program administrative needs for information with keeping procedures simple and efficient may require continual evaluation and improvement.

4.9. Conduct Continual and Targeted Program Outreach

Manufacturers are sometimes unaware of the industrial program offerings that may be most applicable or useful for them. Significant outreach and development of information, such as examples of successful past projects, is often necessary to encourage participation. As an example, Wisconsin's Focus on Energy program provides program engineers who reach out to industrial firms via numerous training classes, webinar series, and outreach to industrial associations. The AlabamaSAVES loan program formed partnerships with Bank of America, Philips Lighting, Metrus Energy, and Efficiency Finance, not only to provide private sector leveraging of funds, but also to conduct marketing and outreach for the program itself. Using their existing sales and marketing channels and networks with Alabama industries and contractors, these private partners are driving program uptake and demand in the market (NASEO 2012). As of April 2013, more than 20 loans have closed and nearly $17 million in funding has been put toward the installation of energy efficiency projects. The initial $60 million in funding will continue to cycle through loans and has the potential to finance up to $121 million in projects over the next 20 years (see Appendix B-1).

NYSERDA's IPE program demonstrates an awareness of industrial customers' decision-making processes when it markets its offerings to potential program participants. When marketing IPE incentives for non-process equipment upgrades (motors, lighting, etc.), NYSERDA targets facility directors and executives. In contrast, when working to secure process-efficiency projects, NYSERDA conducts targeted outreach to industrial staff in charge of production lines and revenue-generating projects, as well as members of continuous improvement teams and executives, who consider the costs and benefits of energy efficiency projects that affect production capability. This approach reflects research findings that show facility maintenance and process engineers play a critical role in the decision-making processes within their companies (Harris and Gonzales 2013).

SUCCESSFUL DESIGN AND IMPLEMENTATION APPROACHES

- Continual and targeted outreach is needed to make sure industrials are aware of applicable program offerings.

4.10. Leverage Strategic Partnerships

Successful IEE programs often partner with a variety of federal, state, and regional organizations to share technical expertise, program design, and implementation guidance, and leverage access to customers for outreach and implementation. For example, the collection of assessment and recommendation data in DOE's Industrial Assessment Center Database is commonly used by program staff and support contractors to inform thousands of investments in state and utility IEE programs.[24] The database includes information on the type of facility assessed (size, industry, energy usage, etc.) and details of resulting recommendations (type, energy and cost savings, etc.). In addition, DOE's Combined Heat and Power (CHP) Technical Assistance Partnerships (formerly called the Clean Energy Application Centers) promote and assist in transforming the market for CHP, waste heat to power, and district energy technologies and concepts throughout the United States. And the EPA ENERGY STAR for Industry program provides guidance, tools, and recognition to help industrial companies improve their energy performance.

Efforts by SEOs complement and support ratepayer-funded programs. States can provide resources or programs, such as tax incentives, that utilities often cannot. States are not constrained by regulatory cost-effectiveness tests that may limit what programs are offered. Therefore, states can often support IEE activities such as training, certification, and recognition awards. SEOs use their established partnerships with other relevant stakeholders and program administrators, such as utilities, regional energy efficiency groups, and the National Institute of Standards and Technology's Manufacturing Extension Partnership (MEP), to coordinate and expand programs with existing resources available to manufacturers. SEO energy assessment and audit programs typically include utility cost-share. Training workshops organized or supported by SEOs are often offered in conjunction with universities and MEP, and typically leverage DOE efforts (NASEO 2012). For example, Washington State has an IEE award program that is hosted by the governor, who recognizes leaders in IEE.

In another example, the Alabama SEO brought together key state partners including the Alabama Industrial Assessment Center, University of Alabama in Huntsville, and the Alabama Technology Network to implement AlabamaSAVES, a revolving fund loan program, and Alabama E3.[25] Over time, the SEO will coordinate both programs so they can grow together and companies who take advantage of E3 assessments can finance energy efficiency upgrades through AlabamaSAVES (NASEO 2012) (profiled in Appendix B).

BPA partnered with the Northwest Energy Efficiency Alliance (NEEA) to consolidate costs and expand program resources in an effort to reach more customers and initiate more projects. As a regional organization, NEEA was able to support replication of the BPA approach across a variety of local distribution utilities in the BPA service area. Similar regional energy efficiency organizations exist in most regions of the United States, and can be engaged in similar ways.

In 2008, NEEA partnered with the Northwest Food Processors' Association (NWFPA), the largest industrial trade organization in the region, representing more than 100 food processing enterprises, to convene food processing industry leadership around common energy reduction goals and strategic energy management practices. Aggregating energy saving efforts through NWFPA allows the industry to apply resources toward a unified energy reduction goal—sharing the risk, efficiency, and energy savings potential. The partnership was able to secure buy-in and establish trust when reaching out to potential customers and leveraged funding from the State Technologies Advancement Collaborative and DOE's technical assistance resources to establish a customized program dedicated to the unique needs of the northwest region's food processing industry (IIP 2012, Chittum et al. 2009).

SUCCESSFUL DESIGN AND IMPLEMENTATION APPROACHES

- Partner with federal, state, and regional organizations to leverage their expertise, access to customers, and program implementation support capacities.
- Partnerships can help programs by providing technical expertise, program design, and implementation guidance as well as expanding program outreach and implementation channels.

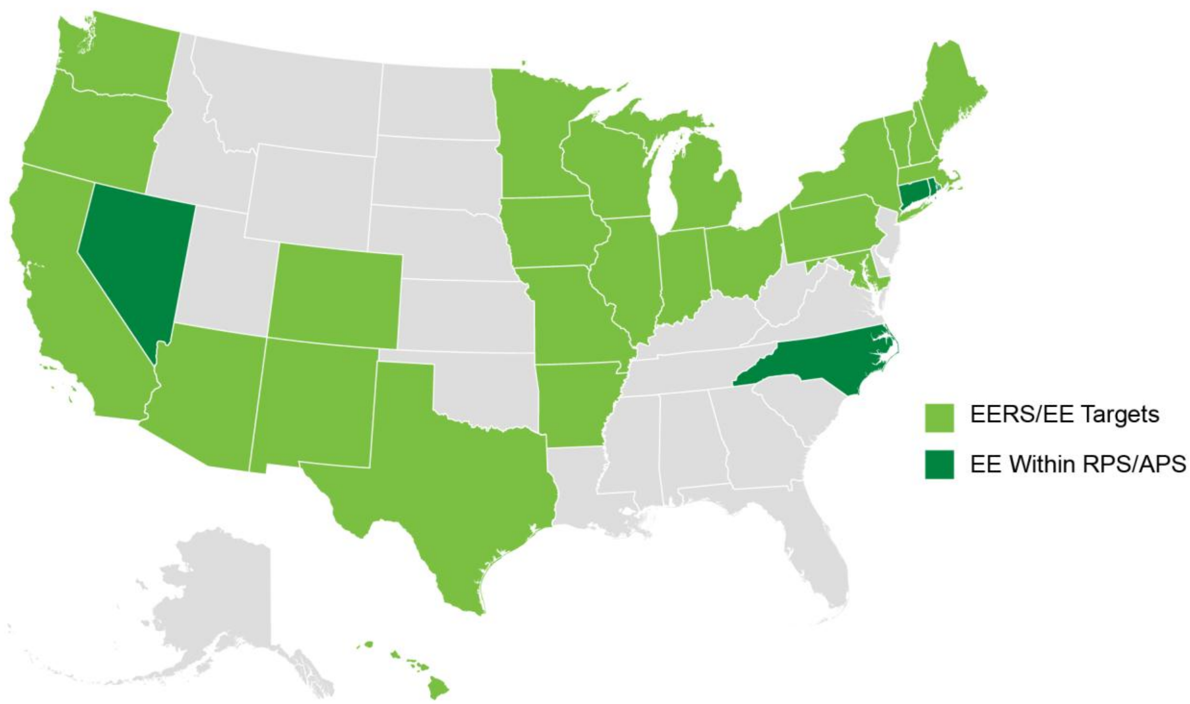
[24] http://iac.rutgers.edu/database

[25] E3—Economy, Energy, and Environment—is a coordinated federal and local technical assistance initiative that helps communities work with their manufacturing base to adapt and thrive in a new business era focused on sustainability for SME manufacturing companies.

4.11. Set Medium- and Long-Term Energy Efficiency Goals as an Investment Signal for Manufacturers

To provide signals of certainty to the market, regulators and program administrators can set energy savings goals or targets for the medium- to long-term to reduce risk in ramping energy efficiency measures implementation. Specific targets and extended program lengths (minimum three years) can give both program administrators and manufacturers the confidence to invest over sufficiently long program timeframes.

CEPS are an important tool states use to set goals and targets. A CEPS sets electricity and/or natural gas energy savings targets, usually expressed in energy savings delivered per year (including cumulative delivery over a period) or a percentage of utility sales. CEPS have gained popularity in the United States, and 28 states now have some sort of high-level energy savings target (see Figure 7). The longer-term goals associated with CEPS send a clear signal to market players about the importance of energy efficiency in utility planning and create a level of certainty to encourage large-scale investment in energy efficiency technology and services. Longer-term goals also help build customer engagement and develop an energy efficiency workforce and market infrastructure (ACEEE 2012, SEE Action Network 2011a).



Sources: ACEEE 2013a and 2013b

Figure 7. Energy efficiency resource standards and targets

CEPS are often designed and integrated into the integrated resource planning (IRP) processes to ensure that acquired energy efficiency resources are cost-effective compared with supply resources. An IRP can be a powerful impetus for promoting energy efficiency and other demand management alternatives to new supply. Although the amount of available cost-effective energy efficiency will vary based on local circumstances, some quantity will likely always be available at a lower levelized cost per megawatt-hour than supply side alternatives. Thus, any planning process that requires utilities to consider demand-side resources as part of an integrated strategy to meet customer demand is likely to promote energy efficiency. This is especially true where IRP processes are mandatory and overseen by a utility regulatory commission, because the IRP requirement may require utilities to consider demand-side programs that benefit ratepayers even if the programs do not benefit shareholders. In some circumstances, cost-effective energy efficiency measures may even be available in sufficient quantities to satisfy all of the projected load growth within the planning timeframe (SEE Action Network 2011b).

SUCCESSFUL DESIGN AND IMPLEMENTATION APPROACHES

- Longer-term goals provide increased certainty to the market and to program administrators.
- Higher annual savings targets require a more comprehensive set of program offerings and will drive programs to IEE.

4.12 Ensure Robust Measurement, Verification, and Evaluation

M&V of project energy savings is critical to program administrators and regulators to assess the actual results of program activities and to measure the contribution of projects and aggregate programs for achieving their goals. Robust M&V programs also allow customers to obtain clear views of the results of their efficiency investments. In addition, effective M&V enables program administrators to undertake periodic process and operational strategy evaluations to assess where program efficiency and results can be further improved.

Require Robust Measurement and Verification

Measurement and verification requirements

Planning for M&V during the design phase of a program is key to ensuring that energy savings can be tracked and program success can be systematically assessed. M&V is required at some level in all programs, and M&V plans and requirements are a condition of funding in most programs. For example, NYSERDA has stringent technical analysis and M&V requirements for its programs, and performance-based incentive payments are only provided on a verified kWh or MMBtu energy-saved basis (Taylor et al. 2012).

Clear, concise guidelines for M&V requirements benefit both project and program evaluations. Planning for M&V during the program design phase and periodic evaluation and adjustment in M&V guidelines are both important. In most custom projects, M&V plans are an integrated part of the process. Some program administrators will help design project M&V plans and may assist in arranging financing of meter installation to execute the plan.

Submetering can further strengthen M&V programs, because measuring energy use at the project or equipment level provides the discrete data needed to demonstrate the savings from a specific project or plant improvement (which is typically not the case when this type of data is not collected). Submetering can be a necessity for proper M&V of many projects, and is best applied both before and after project implementation.

Broadening the scope of project M&V to include benefits beyond energy savings can be used in the cost-effectiveness analysis of projects and programs, further quantifying the full economic and societal benefits of energy efficiency investments, and improving overall cost-effectiveness of energy efficiency measures. If these are to be included, M&V plans need to extend requirements and guidelines to non-energy benefits.

Consistent methodologies in measurement and verification protocols

Current M&V practices in the United States use multiple methods for calculating verifiable energy savings. These methods were initially developed to meet the needs of individual energy efficiency program administrators and regulators. Although the methods serve their original objectives well, they have resulted in differing and incomparable savings results—even for identical measures. These differences can be significant, and inconsistent results have limited the acceptance of reported energy savings beyond specific program applications.

Increasing the consistency and transparency of how energy savings are determined through consistent and clear M&V protocols strengthens the credibility of energy efficiency programs. Examples of existing protocols include the International Performance Measurement and Verification (IPMVP) protocol, which is used in Xcel's self-direct programs, and the Superior Energy Performance (SEP) M&V protocol, which will play an important role in DOE's Industrial Strategic Energy Management Accelerator[26] initiative.

Another opportunity for common methodologies is DOE's Uniform Methods Project (UMP). Through UMP, DOE aims to establish easy-to-follow protocols based on commonly accepted engineering and statistical methods for determining gross savings for a core set of commonly deployed energy efficiency measures. The protocols provide guidance on energy savings determinations, which will be available as a reference to improve M&V practices. The addition of industrial measures in UMP provides a potential opportunity to create consistent protocols for IEE programs that would make it easier and less costly for efficiency programs to quickly establish good M&V practices because they no longer have to develop protocols from scratch (DOE 2013b).

Use Evaluations to Support Continual Program Improvement

Periodic process evaluations identify ways to improve program design and delivery

Robust M&V plans enable program administrators to conduct periodic process evaluations that identify successes and weaknesses in program implementation and point to ways to improve program design and delivery. Process evaluations can be initiated during the first year of operation to identify lessons learned from implementation as soon as possible and to apply them to subsequent program cycles. They can also be helpful in adjusting programs to match manufacturers' needs on a continuing basis. ETO regularly commissions process and impact evaluations, which have identified specific areas for improvement in its Industrial Production Efficiency program. These areas include:

- To maximize the effectiveness of program marketing, program staff can improve their understanding and augment the marketing skills of contractors to increase uptake of programs.
- To add credibility to program reporting and enhance marketing efforts, staff improved specific and consistent definitions of data entry categories and date variables to report program activity by year, thereby improving data collection, tracking, and processing.
- To simplify the program review and oversight function, and to enhance quality control of technical studies, program staff promulgated and implemented uniform procedures and standards or guidelines for both the technical studies and the review of those studies (ETO 2006).

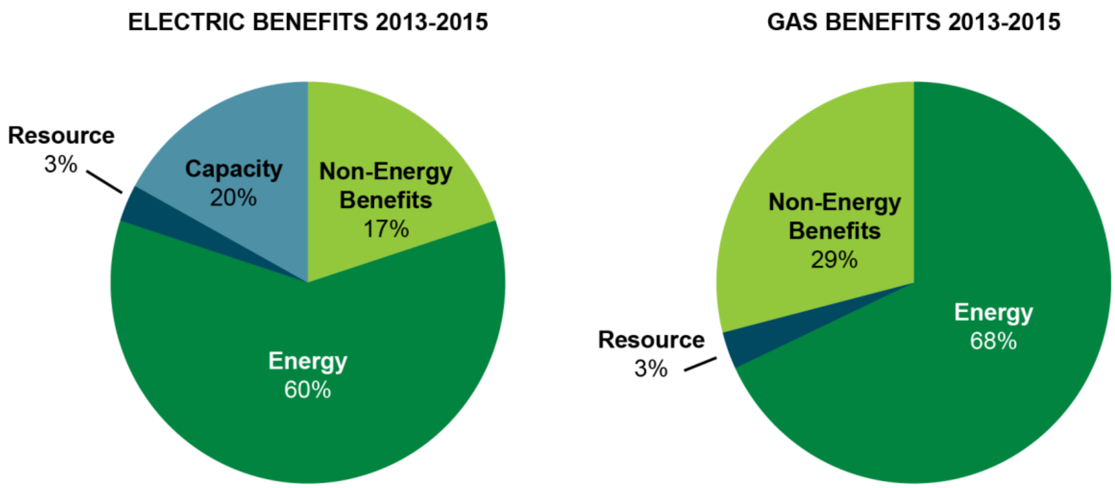
Include non-energy benefits in program evaluations

In addition to M&V methods, NEBs can be included in program evaluation to prove the improved cost-effectiveness resulting from NEBs additional to energy saving benefits in both projects and programs (for a discussion of NEBs at the industrial customer level, see Chapter 6). Many studies suggest that the NEBs of IEE measures can be quite large, often far greater than any energy savings (Chittum 2012). Including NEB elements in program cost-effectiveness evaluations could significantly increase the benefit-to-cost ratios of IEE programs.

Because valuing NEBs can be difficult and has sometimes proven controversial, most states that currently account for NEBs typically do so only for benefits that are readily quantifiable, mostly confined to water and other fuel savings (Kushler et al. 2012). Some regulators and stakeholders resist including benefits such as improved participant/public health, comfort, and property values because they are "externalities" outside the usual realm of utility regulation, and if benefits occur outside the system, it could create an implication that other stakeholders might be expected to contribute to energy efficiency funding to the extent that they receive benefits. Estimating the value of some NEBs can also be complicated, leading many administrators to resist attempts at monetizing all of them (Lazar and Colburn 2013). Thus, it may be most practical to focus on only the key NEBs most amenable to quantification. Examples of programs that incorporate a relatively large range of NEBs include NYSERDA, Massachusetts, and BPA.

[26] The Industrial Strategic Energy Management Accelerator is designed to demonstrate SEP as a practical and cost-effective energy efficiency program offering. Signatories to this Accelerator are utilities and energy efficiency program administrators that agree to deploy SEP to a set of industrial customers across their service territories. This Accelerator was launched in December 2013.

Over the last decade, Massachusetts has integrated NEBs when estimating the value of its energy efficiency program offerings to the whole utility system (using the Total Resource Cost Test). Figure 8 shows that NEBs represent approximately a quarter of total benefits that accrue to the system. Note that many benefits, such as productivity gains or environmental benefits are not included, meaning that if these positive environmental and social externalities were included, NEBs would in fact be much greater.[27]



Source: Halfpenny 2013

Figure 8. The value of non-energy benefits in Massachusetts' energy efficiency programs

Acknowledge free ridership and positive spillover effects

Free ridership is a situation in which a program incentivizes a company to implement an energy project that they would have conducted on their own without the program's financial and/or technical assistance. Program administrators want to get the most from the incentives they offer by encouraging projects that would not have otherwise been implemented. However, identifying and preventing free ridership is complicated, and estimating the impact can be costly. Based on surveys that ask people to relate why they made energy conservation investments, it is difficult to make accurate estimates.

Although the number of "free riders" can be high for certain programs, other end users may see substantial energy cost-saving advantages from some of the investments or concepts being promoted in an energy efficiency program and decide to undertake measures themselves without receiving any program incentives or being otherwise involved with the program. This "spillover effect" can work to mitigate or neutralize the level of free ridership. For example, NYSERDA has found that for most (though not all) IEE delivery programs, "spillover" equals or exceeds "free riders" (Taylor et al. 2012).

Programs in Vermont, British Columbia, New York, and Oregon attempt to estimate free riders and report net savings against targets for at least some of their specific IEE programs (Taylor et al. 2012). Regulators and program administrators can expect some level of free ridership, and may wish to accept moderate levels, as long as the programs remain cost-effective overall.

As with other key elements of project M&V, it is important that any needs to consider free ridership or spillover effects in assessing how energy savings from specific project and programs will be credited to users and administrators be clearly stated and agreed to by all parties prior to project and program implementation efforts.

[27] **Approved NEBs**: 1) C&I new construction and retrofit: operations and maintenance costs, administrative costs, material handling; 2) Low income: utility savings, rate discounts, bad debt write off, terminations and reconnections, collections and notices; 3) Residential new construction and retrofit: customer perceived savings, thermal comfort health benefits, noise reduction rental marketability, property value increase, reduced tenant complaints, lighting quality, home durability, equipment maintenance. **Not approved**: national security, economic development, reduced waste.

This includes clarification of both what specific types of projects must consider free ridership and spillover, and details on the quantification methodologies to be used. Ambiguity about how reported savings may be discounted in after-the-fact evaluations may lead to contentious arguments or inhibit project implementation.

SUCCESSFUL DESIGN AND IMPLEMENTATION APPROACHES

- Effective M&V is critical for program administrators to assess results and measure progress, and useful for industrials to verify results of their investments.
- Guidelines for M&V need to be clearly defined and periodically reviewed and adjusted.
- Periodic impact and process evaluations help identity where IEE program efficiency and results can be further improved.
- NEBs can be a key element of both project M&V and program evaluation.
- Any needs to make allowances for free ridership and spillover effects should be clearly stated and agreed by all parties prior to project or program implementation.

5. Designing Effective Self-Direct Programs

Effectively capturing energy efficiency opportunities within the industrial sector adds substantially to total state program energy savings and often helps lower total unit costs of saved energy. As discussed in Chapter 3, maximizing industrial energy efficiency (IEE) typically brings down overall system costs over the medium term, which is in the interest of all utility customers.

There is a strong public policy case for including the industrial sector in ratepayer-funded energy efficiency programs. A large portion of the overall available energy efficiency potential resides in this sector, and the unit costs of energy savings in industrial projects is typically lower than in most other sectors targeted for resource acquisition (see Chapter 3). In addition, many advocates point out an issue of fairness—why are certain customers exempted from paying into ratepayer-funded programs even though they ultimately benefit from lower total system costs?

However, industrial customers often raise legitimate concerns about the extent to which ratepayer-funded energy efficiency programs will be able to meet their specific needs. Especially when programs are first being contemplated, industries may be skeptical about whether the programs will be administered with enough flexibility to meet their priorities. They may be skeptical about the IEE capability of program administrators compared with their own capabilities, and they may have concerns about administratively complex and burdensome participation requirements. In essence, many industries—especially larger ones—may raise concerns that the benefits that they might receive from a ratepayer energy efficiency program will not be commensurate with the costs of paying into the program and dealing with administrative requirements.

As of January 2014, 16 states offer “self-direct” programs. To achieve energy savings, these programs must be designed and implemented to meet both the public policy objective of the programs and the industrial customers’ desire for greater flexibility and control of energy efficiency efforts in their own companies. Self-direct programs should not be confused with “opt-out” program clauses. “Opt out” means that a class of consumers is allowed to not participate in a ratepayer-funded energy efficiency program—these customers do not pay into the system, do not have an obligation to deliver energy savings, and do not directly benefit from participation in the programs. Under self-direct programs, qualifying consumers implement their own energy savings programs, often without design and implementation assistance from a program administrator. However, they are still obligated to spend money and deliver energy savings, either on a project-by-project basis or over a certain amount of time. A self-direct option keeps large customers in the energy savings portfolio but allows them the flexibility to take advantage of cost-effective energy efficiency opportunities. There is wide variability in terms of the industrial savings requirements and measurement and verification (M&V) rigor across existing self-direct programs. As such, those that employ high levels of M&V rigor and achieve robust industrial savings can serve as the best examples for delivering successful self-direct programs.

Some self-direct programs have proven to be effective tools to both deliver low-cost energy savings for system-wide benefits and to help industrial customers achieve substantial cost savings and bottom-line benefits through energy efficiency improvements. This chapter describes the types of self-direct programs common among the states, outlines program features that help achieve both public policy goals and increased flexibility for industrial customers, and provides examples of successful self-direct programs currently in operation. Readers should note that the program design features discussed in Chapter 4, such as demonstrating the value proposition of energy efficiency to customers, also apply to self-direct programs.

5.1. What are Self-Direct Programs?

In this report, self-direct programs are defined as programs that allow some customers, usually large industrial ones, to “self-direct” fees directly into energy efficiency investments in their own facilities instead of into a broader aggregated pool of funds collected through a public benefits charge for energy efficiency programs. This is in contrast to opt-out provisions, which allow large customers to fully opt out of paying their energy efficiency charge with no corresponding obligation to make energy efficiency investments on their own (ACEEE 2012b).[28]

Self-direct programs usually define eligibility for customer participation in terms of a threshold amount of energy use or energy use capacity (e.g., megawatt-hour [MWh] or megawatt [MW]), with the view that, generally speaking, only larger customers are likely to have the capacity to undertake serious energy efficiency programs themselves and attempting self-direction among small consumers is inefficient.

Self-direct programs may be administered by a utility, state regulatory authority, or state agency. In Oregon, for example, the state's self-direct program is overseen by the state energy office (although the customized administrator-managed industrial offering—the Production Efficiency program—is implemented by the Energy Trust of Oregon). In Vermont, self-direct customers report their programs to the state utility regulator, although there is currently only one customer that uses the large self-direct program and two customers that use the smaller self-direct program.[29] In Michigan and Washington, self-direct customers report their plans to their utilities, and validation of plans falls to the state utility regulatory commission.

Table 2 illustrates the continuum of self-direct programs existing in the states, showing differences in the rigor with which the programs are structured to ensure achievement of public policy energy savings delivery goals. As programs move down the continuum from the least to the most structured programs, they vary in two key ways: 1) accounting with respect to energy efficiency payments that would be required without self-direction and with respect to use of funds, and 2) extent of M&V of energy savings and follow-up by utility regulatory commissions or program administrators.

Table 2. Structure of Self-Direct Programs

Public Benefit Maximization

Program Type	Energy Efficiency Payment	Measurement and Verification of Savings	Use of Funds	Follow-Up	Examples
Less structured self-direct	None	Minimal; self-reported	Company uses retained cash for energy efficiency	None to minimal	MN, OH
More structured, lower oversight self-direct	Fully or partially paid on bill	Minimal; self-reported	Rate credit or project rebate	Minimal	MT, OR
More structured, higher oversight self-direct	Fully or partially paid on bill	Robust; similar to ratepayer-funded programs	Personal escrow, rate credit, or project rebate	Minimal to substantial	WA, CO

Source: Adapted from Chittum in Elliott 2013

In the less structured cases, programs may exempt a customer entirely from paying energy efficiency charges, and require them to simply channel the funds directly into their own energy efficiency projects. To be considered self-direct programs as defined above, however, there should be some level of formal reporting on funds spent and the projects implemented. In more structured cases, there are reporting mechanisms that aim to ensure that self-

[28] It should be noted that some states have "self-direct" terminology in legislation that provides energy-intensive customers to be fully exempted from energy efficiency charges to direct towards energy efficiency measures, but there is minimal to no oversight or requirements to report on implementation of measures. This is in reality equivalent to opt-out provisions (Chittum 2011).

[29] See http://aceee.org/sector/state-policy/vermont for more information that distinguishes both programs.

direct customers spend at least as much on energy efficiency projects as they would have on energy efficiency charges. Customers may be exempted from paying energy efficiency charges for a certain time if they undertake a reported project or set of projects as planned. More commonly, customers are required to pay most or all energy efficiency charges and then receive project rebates or rate credits against their qualified expenditures on self-direct projects. Ongoing accounts of energy efficiency payment requirements against qualified energy efficiency project expenditures also may be used.

Programs also vary substantially as to the extent of program follow-up on project execution and on energy savings M&V. Some less-structured programs require some documentation stating the customer has invested in energy efficiency in the past or plans to do so in the future, but the customer is not required to provide detailed information on its investment. More structured programs require that purchase receipts or other evidence of investments be submitted, but energy savings reporting may be minimal or the reported savings may not be verified. Finally, the most structured programs with high levels of administrative oversight are subject to M&V protocols in the same way as administrator-managed IEE programs. In some cases, a small portion of energy efficiency charges may be retained by program administrators rather than fully rebated to customers to help cover oversight costs (Chittum 2011).

Figure 9 provides a snapshot of the prevalence of self-direct programs among the states as of January 2014. At least 16 states have some type of self-direct program, and six states have opt-out provisions. Figure 9 also provides a sense of the prevalence of less structured and more structured programs by state. However, it should be noted that definition into these categories is not a perfect science and characterization of individual state programs requires customized review.

Source: Elliott (2013)

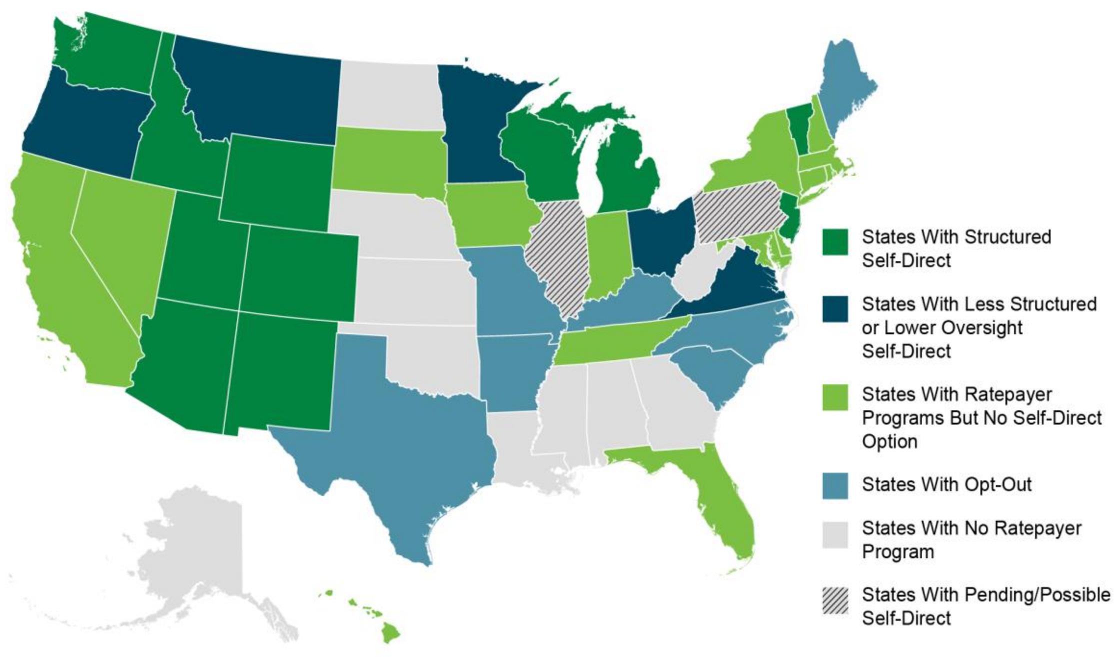


Figure 9. Current snapshot of self-direct programs (subject to review)

5.2. Ensuring Achievement of Public Policy Goals

To meet basic energy efficiency public policy goals, it is necessary to ensure that self-direct programs are producing cost-effective energy savings equal to or greater than what would have been realized in a traditional, administrator-directed program. Based on the experience of the most successful programs, one path to achieving this is to operate self-direct programs as one option within the overall energy efficiency program. Rather than designing a self-direct program as a means of avoiding participating in the state's resource acquisition effort altogether, the program can be designed as a program choice for industry's participation in the state's overall resource acquisition effort. Industries can choose to direct their own efforts or to have staff and consulting experts from the program administrator work with them as part of an administrator-directed program. Minimum expenditures (e.g., energy efficiency charges or equivalent amounts) are expected to be the same for either choice.

From the public policy perspective, it is important to ensure that self-direct customers meet their energy savings requirement with the funds they would otherwise pay into the ratepayer-funded program for the benefit of all.

There are competing viewpoints about whether one type of program can achieve greater savings or leverage greater benefits for the industrial customers as well as all system users, and states have had differing experience with the value of self-direct programs compared with core programs managed by a utility or program administrator. This report does not compare the effectiveness of these two types of programs. Instead, for states that are choosing to introduce or allow self-direct programs as an option, it highlights how self-direct programs in some states have been able to provide an attractive alternative to large customers while meeting public policy goals.

Set Goals to Achieve at Least Equivalent Performance

Where self-direct programs are offered as part of overall energy efficiency programs, large consumers are asked to report on their actual programmed energy efficiency investments. If the investments are assessed by program administrators as meeting program criteria, the customers receive rebates or credits against ongoing energy efficiency payments or they receive energy efficiency payment exceptions related to the size of the investment. The assumption is that customers participating in the self-direct program must pay the energy efficiency contributions, similar to all other customers, unless they are excused from payment based on evidence of comparable investments they have programmed themselves.

Some self-direct programs simply ask that customers spend a certain amount of money on energy efficiency. However, solely focusing on spending fails to take account of the quantity of energy savings delivered. Developing concrete savings goals can help improve the working relationship between the customer and the self-direct program administration. Instead of focusing on dollars, these goals keep the conversation focused on energy. When customers buy into the idea of energy savings goals, they may squeeze more energy savings out of every dollar spent (Chittum 2011).

For example, in Michigan's self-direct program, large customers must develop energy optimization plans that set annual energy savings targets based on the previous year's energy consumption, factoring out changes in business activity, energy required for pollution control equipment, or, if relevant, weather normalization (see Example 13).

Another example is the Eugene [Oregon] Water and Electric Board (EWEB) self-direct program. EWEB's individual self-directing customers develop energy savings goals in collaboration with utility staff. Goals are based primarily on the percent of load a customer represents. EWEB notes that they are acquiring more efficiency from their two self-directing customers than they had in the past when the customers were using EWEB's standard program offerings (Chittum 2011).

Energy Savings Measurement and Verification

Some form of energy savings M&V is needed to ensure that self-direct programs are achieving expected energy savings. Data collection to track the amount of funds directed toward energy efficiency projects—and the savings achieved from those projects—is necessary to determine whether a self-direct program is performing as effectively as a traditional program might (Chittum 2011).

Most self-direct programs do not penalize customers for failure to demonstrate verified energy savings or meet goals. Although such structures may not be always necessary, some self-direct program administrators have found that requiring companies to pay back energy efficiency charges if no or insufficient action is taken can encourage customers to meet energy savings goals or use up all of their allotted energy efficiency funds. If a company earns rate credits or rebates in advance of project implementation, customers may have to pay back a portion of the rate credit or rebate if a planned project does not come to fruition. Michigan's self-direct program (see Example 13) asks customers to meet set energy savings targets. If a customer fails to meet its targets, it must repay energy efficiency charges in proportion to the shortfall. Puget Sound Energy's self-direct customers simply lose their allotted energy efficiency fund credits if they do not dedicate all resources toward implementation of energy efficiency measures (Example 14).

Self-Direct Options as Complementary to Core Industrial Offerings

In states that may be starting out and do not have mature industrial offerings that provide quality technical assistance or if manufacturers may be seeking opt-out provisions, self-direct programs can be viewed as attractive options to ensure the industrial sector remains in the program portfolio. If IEE potential is substantial and capacities can be developed, the most complete service package can include both strong administrator-directed industrial programs and strong self-direct programs. Ultimately, both administrator and self-direct programs have their comparative advantages.

As experience accumulates, states may wish to offer self-direct options as complementary to, rather than instead of, core program offerings for companies interested in going beyond those offerings (Elliott 2013). For instance, Xcel Energy (Example 15) in Colorado provides a self-direct program alongside a range of other prescriptive and custom program offerings. With the potential for wide variability in participation, not all industrial customers can be expected to self-direct funds effectively toward all cost-effective opportunities. They also may be interested in the specialized technical support that a statewide program can potentially provide. Comprehensive and mature industrial offerings as part of administrator-directed core programs have many times demonstrated added value to manufacturers. At least three self-direct programs—in Oregon, Michigan, and Wisconsin—reported that customers who had been self-directing or had considered self-directing chose to return to paying the energy efficiency charge and using core ratepayer programs because these programs yielded substantial benefits. The ratepayer-funded industrial offerings in these states are robust and have evolved to meet customer needs over time (Chittum 2011).

It is interesting to note that Rocky Mountain Power allowed industrial customers above a certain size threshold to opt out of paying 50% of the ratepayer surcharge if they could show—through third-party audit—that there are no more energy efficiency opportunities below a certain payback period. During the 10-year period that the credit was in place, no companies took up the credit, which implies that participants either could not prove that all energy efficiency opportunities had been implemented or valued the energy efficiency program offerings more than the exemption.

SUCCESSFUL DESIGN AND IMPLEMENTATION APPROACHES

- Structure self-direct programs as part of a larger portfolio of robust IEE programs that are responsive to industrial and other large customers' needs.
- Develop self-direct programs with active engagement with industrial customers to ensure the programs meet user needs.
- Allow flexibility in eligible technologies and timelines.
- Require verified energy savings equivalent to what would be achieved with core program offerings, with routine progress reporting and robust approaches for measurement and verification.
- Consider escrow-like accounts to structure a "use it-or-lose-it" fund base that encourages greater participation.

EXAMPLE 13. MICHIGAN'S SELF-DIRECT ENERGY OPTIMIZATION PROGRAM

Under Michigan's 2008 Public Act 295 (PA 295), certain customers may create and implement—or self-direct—a customized energy optimization (i.e., energy efficiency) plan and thus be exempt from paying the full energy optimization (EO) surcharge to its utility provider. The EO plan is consistent with the energy savings goals required of electric utilities as part of the state's energy efficiency resource standards. The plan identifies targets, planned projects, and verification process for approval by their utility, and the utility approves the plan and reports aggregated program data to the Public Service Commission.

Self-direct customers do not pay fully into the energy efficiency fund in exchange for the execution of their energy savings plan. They do pay a portion of their assigned charges to cover administration of the self-direct program and a portion of the public benefit charge that funds programs for low-income consumers.

In the first years of PA 295 implementation (2009 and 2010), the self-direct option was made available only to large customers with at least 2 MW of peak demand (or 10 MW peak demand for aggregate sites). For 2011 and 2012, PA 295 allows customers with at least 1 MW annual peak demand in the preceding year or 5 MW aggregate at all of the customer's sites within a service provider's territory to participate. The number of customers enrolled to self-direct their own EO program has dropped from 79 in 2010 to 47 in 2011 to 32 in 2012. This reflects the perceived value of the flexibility and comprehensive program options that are being offered under utility programs. Electric reductions from self-direct programs reached 53,593 MWh across customers from all providers (DTE Electric, Consumers Energy, Efficiency United, and cooperative and municipal utilities).

PA 295 specifies that all but the largest self-direct customers must hire an energy efficiency service company to develop an EO plan, which sets annual energy savings targets based on the previous year's energy consumption, factoring out changes in business activity, energy required for pollution control equipment, and weather normalization. As an alternation to normalizing for weather, the self-directing company can choose to base savings off of a three-year average annual demand for all retail customers in the state. Very large customers (more than 2 MW per site or 10 MW in aggregate) are not required to hire an energy efficiency services company.

Every year, the self-direct customer must submit a report detailing the energy savings projects and estimated energy savings. The third-party energy efficiency service company hired by the company is responsible for notifying the utility if the targets are not being met. If the targets are not met, the self-direct customer must pay the utility a portion of the avoided public benefit charge proportional to the percentage by which it missed the target. If the company exceeds their goal, excess savings may be applied to the following year's goal.

For 2009 and 2010, 26 customers of DTE Energy took advantage of the self-direct option, although DTE has reported that several customers may opt back in to DTE Energy's efficiency program due to the low surcharge.

Source: Taylor et al. 2012, Chittum 2011, Michigan Public Service Commission 2013

EXAMPLE 14. PUGET SOUND LARGE POWER USER SELF-DIRECTED ELECTRICITY CONSERVATION PROGRAM

Program Overview

One of Puget Sound Energy's (PSE) four commercial and industrial programs is the Large Power User Self-Directed Electricity Conservation Program, which started in its current form in 2006 (a pilot program was initiated in 1999). The self-direct program provides funding for customers that contribute to a conservation fund. Self-direct customers have access to 82.5% of the fund. Although participants in other PSE commercial and industrial programs are limited to maximum incentives of 70% of the measure cost, self-direct customers may fund up to 100% of measure cost. PSE keeps 7.5% of the conservation fund for program administration and 10% for Northwest Energy Efficiency Alliance market transformation programs activities. Customers are eligible under the self-direct program when they take three-phase service at greater than 50,000 volts.

PSE requests customers to calculate electric energy savings using standard engineering practices and to document data, assumptions, and calculations for PSE review. PSE reviews savings calculations and reserves the right to modify energy savings estimates. After receipt of project final cost documentation, a PSE Energy Management Engineer conducts a post-installation site inspection to review installed equipment and confirm implementation of the M&V plan. Actual savings may be trued-up based on post-installation energy use monitoring.

PSE works with self-direct customers to track energy efficiency contributions for future use and allows them to earn an incentive against their tracked contributions whenever an approved project is completed. The program focuses on large customers that often have in-house engineering resources, which can help reduce overall program costs and guarantee successful implementation of efficiency measures funded. PSE relies on trade allies such as energy service companies to help self-direct customers identify and implement projects.

Participation Process

PSE's program is creatively structured in that it combines grants with a competitive bid process. The program begins with a non-competitive phase during which customers are guaranteed access to their portion of energy efficiency fees and are responsible for proposing cost-effective projects to use their allocation. At the end of the non-competitive phase, customers not proposing projects to fully use their allocation forfeit their remaining balance to a competitive bid phase. Funds are aggregated together and disbursed via a competitive bid process among all self-direct customers, encouraging highly cost-effective projects. The projects funded as a result of this competitive bid process are generally more cost-effective than those funded during the first two years, as customers compete against each other to make a case for their projects. The program saw a very large volume of competitive projects proposed during the competitive bid process. For example, in 2009, self-direct customers proposed cost-effective energy efficiency investments of more than four times the amount of funding actually available in the aggregated fund.

All projects must meet PSE's avoided cost requirements. Although the customer submits its own proposal and M&V plan, PSE reviews the proposal and plan. Upon approval, PSE enters into a funding allocation agreement with the company and conducts a post-installation inspection after the measure is implemented.

Program Performance

PSE reports its self-direct program is acquiring energy efficiency at a cost equal to its other programs and that the program is acquiring more efficiency resources than would have otherwise been the case. Participation rates are also higher in the self-direct program among eligible customer classes than in other programs.

Each year, more customers qualify for the self-direct program; for the 2010–2013 program period, 54 customers were eligible. PSE has awarded more than $12 million in project incentives and projects 42,000 MWh per year in annual savings. As the program matures, PSE is seeing a shift toward longer payback projects, in part because more commercial customers have begun to participate in the self-direct program.

Sources: Puget Sound Energy 2012, Chittum 2011

EXAMPLE 15. XCEL ENERGY'S COLORADO SELF-DIRECT PROGRAM

Program Overview

Xcel Energy launched the Colorado Self-Directed Custom Efficiency Product in 2009. The program provides rebates to large commercial and industrial electricity customers who engineer, implement, and commission qualifying projects at their facilities. Self-direct customers perform the design, engineering, measurement, verification, and reporting of energy efficiency projects approved by Xcel Energy. The intent of the offering is to allow customers with the internal expertise, or access to expertise (through a third party), to drive their own energy efficiency projects while providing utility incentives to help them overcome financial barriers to implementation. Customers must have access to appropriate resources to properly identify, quantify, scope, and implement a project—without the assistance of Xcel Energy.

Due to this increased reporting and validation burden placed on the customer, Xcel Energy is able to provide a larger rebate than those offered through other incentive programs in exchange for the in-house engineering analysis required of a self-direct customer. Self-direct customers continue to pay their assigned energy efficiency charge, and self-direct projects are reimbursed through a rebate. Customers may earn rebates of up to 50% of the incremental project costs, either $525 per kilowatt (kW) or $0.10 per kilowatt-hour (kWh). Eligible business customers must have aggregate peak demand at all meters of at least 2 megawatts (MW) in any single month and have an aggregate annual usage of at least 10,000,000 kWh.

Participation Process

Participation is a multi-step process:

- Customers receive a rebate application from their Xcel Energy account manager, who ensures that all eligibility requirements are met. Pre-qualified customers then identify energy efficiency opportunities in their building and submit a detailed energy efficiency improvement plan to Xcel Energy.
- Xcel Energy reviews the project and provides a total resource cost (TRC) calculator for the customer to analyze the cost/benefit relationship of the project. To qualify for a rebate, the TRC must be greater than 1.0 and payback periods must be greater than one year and less than the lifetime of the equipment.
- Upon review and pre-approval of the improvement plan, customers are notified of project approval and potential rebate amount. At this stage, a monitoring plan is finalized to verify the project's results.
- Upon project completion, the customer submits a completion report including measurement and verification of the energy savings if savings are anticipated to be greater than 250,000 kWh. Once Xcel Energy approves the completion report, the rebate, based on measurement and verification savings, is issued to the customer.

Program Performance

Since its inception, the program has seen considerable customer interest and has achieved early success. Participating customers report high satisfaction with the program and vendors are optimistic about the future of performance contracting due to increasing customer prioritization in addressing energy costs.

- Since the 2009 launch, the self-direct program has achieved more than 26 gigawatt-hours (GWh) and 3,531 kW of savings and paid rebates in excess of $3.4 million (average savings per participant is 1.7 GWh with TRCs of more than 2.0).
- 2010 had 10 projects and achieved savings of 8.97 GWh against a goal of 4.4.
- 2011 had two participants and achieved 7.67 GWh against a goal of 5.6 GWh.
- 2013 has a pipeline of more than 8 GWh.

In 2012, TRC was 1.79, Utility Cost Test was 4.67; and lifetime cost of conserved energy was $0.01 per kWh.

Source: Nowak et al. 2013

6. Emerging Industrial Program Directions

Well-designed self-direct programs such as those discussed in the previous chapter are likely to play an important role in states that have clean energy portfolio standards (CEPS) but do not have mature industrial program offerings, or where manufacturers may be seeking opt-out provisions. However, in other circumstances, other types of programs may be more relevant. For example, states with long-standing industrial programs may want to ramp up efforts or, at the other end of the spectrum, there may be no regulatory driver to acquire energy efficiency resources. This chapter discusses promising opportunities for the next level programs that can further address some of the traditional barriers to industrial participation and expand the development of energy efficiency potential present in manufacturing facilities.

This chapter focuses on new program opportunities rather than providing detailed pathways for immediate implementation because further research, regulatory guidance, and implementation experience is needed. Some approaches, such as next-level strategic energy management (SEM) programs, are based on proven practices that states have implemented for years, while others are in the development stage and may not be market-ready.

The approaches discussed below could result in increased industry participation, develop deeper or harder-to-find savings, enhance the value of certain energy efficiency projects to manufacturers, and expand the fuel options for IEE programs. Initial discussions on these innovative or emerging approaches include:

- Further expanding the use of SEM programs and overcoming current challenges with crediting savings from SEM improvements
- Compensating customers beyond individual energy management or equipment installation and for performance at the whole-facility level
- Integrating non-energy benefits (NEBs) more effectively at the industrial customer level
- Developing new mechanisms that allow natural gas saving projects to receive incentives.

6.1. Next-Level Energy Management Programs

As discussed in Section 3.4, SEM and energy manager/staffing programs seek to promote operational, organizational, and behavioral changes that result in greater efficiency gains on a continuing basis. SEM programs seek to move beyond incentives for equipment and technologies toward a systems focus that rewards operational efficiency, maintenance improvements, “lean” techniques, and ongoing implementation strategies. SEM programs, although diverse in nature, usually offer incentives for operations and maintenance (O&M) improvements, provide energy management training and workshops, and offer support to establish energy tracking systems. Energy manager/energy staffing placement programs provide financing for an energy manager or dedicated personnel to provide leadership and technical expertise beyond discrete projects to identify opportunities and bring them through to implementation on a continuous basis. In practice, several program administrators have tended to offer both SEM and energy manager/energy staffing programs. Incentives are often provided for operational efficiency measures, energy tracking systems, and staff time (see Chapter 3).

The success of these programs has been noted by long-standing administrators, such as Wisconsin Focus on Energy, which has been offering SEM for 1 years, and there is growing interest in applying this approach in new service territories. Administrators that have traditionally offered prescriptive and custom programs are now piloting energy management programs. Recent programs have been introduced by DTE Energy, the Energy Trust of Oregon (ETO), Southern California Edison, Vectren (Indiana), Rocky Mountain Power (PacifiCorp) in Utah and Wyoming (the latter as an energy manager pilot), and Minnesota Energy Resources Corporation (see Table 3).

Table 3. Recent Energy Management Programs, Pilots, and Initiatives

Activities	Incentives (Where Applicable)
Energy Trust of Oregon CORE Improvement	
The CORE Improvement offering is designed to implement strategic energy management (SEM) for highly motivated small and medium industrial cohorts. Through a 12–15 month engagement, plants participate in four peer-to-peer cohort workshops, and SEM coaches meet with participants individually. These meetings leverage tools and resources to ensure that assignments are applicable to the site and effective for each facility.	Technical services in the form of the SEM coaches, which cost around $25,000–$40,000 per facility over the 15 month engagement.
Energy Trust of Oregon ISO 50001 Pilot	
In 2012, the Energy Trust of Oregon (ETO) initiated a pilot offering under the Production Efficiency program to deploy energy management practices to the ISO 50001 level to establish a system that could be externally certified.	Financial incentives for achieving certification within six months of completing the statistical energy savings model (as well as incentives already available from existing ETO programs)
Minnesota Energy Resources Corporation Energy Management Team Coordinator Pilot	
Minnesota Energy Resources Corporation (MERC) undertook a pilot program from August 2010 to June 2012 to help industrial customers identify and implement energy conservation improvements. The pilot provided an Energy Management Team Coordinator to assist the internal Energy Management Teams of five MERC customers (i.e., the coordinator dedicated 20% of work time to each customer). Customers were recruited as part of MERC's Commercial & Industrial Turn-Key Efficiency program, requiring minimum annual gas usage of 500,000 therms. During the two-year pilot, the coordinator worked with each participating customer to implement an energy management system similar to ISO 50001 and based on U.S. Environmental Protection Agency's ENERGY STAR program publication, Teaming Up to Save Energy. The results of the pilot were positive. Participants outperformed the comparison group by implementing an average of nearly twice the number of energy savings projects, achieving higher annual energy savings, and attaining a conversion ratio of three times the achieved therms savings compared with identified potential therms savings.	
Northwest SEM Collaborative	
The Northwest Energy Efficiency Alliance (NEEA), Bonneville Power Authority (BPA), Energy Trust of Oregon (ETO), BC Hydro, and a number of Northwest utilities are taking a collaborative approach to industrial SEM to share best practices in SEM research, design, implementation, and evaluation. The Collaborative aims to help energy efficiency program administrators accelerate the adoption of SEM in the industrial sector by focusing on: • Strategic planning: Provide long-term direction for the Northwest SEM community • Solution improvement: Enhance the efficiency and effectiveness of Northwest SEM offerings • Program innovation: Increase the reach of industrial Northwest SEM programs • Knowledge transfer: Broaden and deepen the extended SEM community's capabilities and skill sets.	
NEEA SEM Cohorts (Montana)	
NEEA and Northwestern Energy are partnering to work with SEM cohorts, groups of Montana companies that share both their experiences launching energy-saving programs and their vision of a more competitive Montana business community. Representatives from each organization champion energy management goals and regularly share results. Northwestern Energy and NEEA provide training and support on developing SEM plans, and participating companies meet regularly and share their experiences and progress throughout the nine-month program (NEEA 2013b).	
Rocky Mountain Power (PacifiCorp) Schedule 24 Revisions (Utah)	
Effective July 2013, Rocky Mountain Power (PacifiCorp) revised its programs through Schedule 140, which introduces incentives for operations and maintenance (O&M) savings and copayment for an internal energy project manager over 12–18 months.	$0.02/kWh for annual O&M savings; and $0.025/kWh annual savings for energy project manager co-funding with minimum savings of 1,000,000 kWh for 12–18 months

Source: Carl 2012, Batmale and Gilless 2013, ETO 2013a, Franklin Energy 2013, Rocky Mountain Power 2013

Despite the interest in expanding SEM programs in other service territories, these efforts are challenging to implement because of the following issues, which include the lack of common policy guidance and regulatory rules:

- Crediting savings from improvements from SEM
- Determining appropriate baselines
- Justifying incentives for energy management hardware such as submetering and for support of energy managers, which do not directly save energy
- Evaluating SEM typically requires both quantitative information (demonstrated energy savings) as well as qualitative information (energy management practices).

An initial discussion of design considerations that would support more and better energy management programs—i.e., "next generation energy management programs"—is provided below. It is important to note that early adopters have been leading the way in overcoming these challenges and some of their experience is touched on here. For example, the Northwest SEM Collaborative is leading a work program that would drive greater understanding and consensus on SEM research, design, implementation, and evaluation. In-depth coverage of these issues, however, is not provided in this chapter.

Incentives for Submetering

Attention to improving facility metering can generate more accurate knowledge of where energy is being used. This is often the first step to create a continuous energy savings program. Constant monitoring allows the facility to gauge the ongoing effectiveness of its portfolio of energy savings investments and measures. Utility incentives that include submeters and other energy monitoring equipment would allow companies to fine tune operational performance, identify new opportunities for projects, and inform where to focus resources, and track progress.

However, many program administrators face challenges in providing incentives for submetering or other energy management hardware. Although meters do not directly save energy, accurate metering is a critical element of effective benchmarking and verifiable measurement and verification (M&V). Effective strategies that could be used by energy efficiency program administrators include rolling meter costs into the overall measure cost or treating submetering as a persistence strategy for certain energy efficiency measure types, especially O&M measures.

Energy Management Maturity

Energy management approaches are diverse and can range from a set of principles with top-level commitment based on the "Plan Do Check Act" framework, focused O&M improvements, implementing energy management system (EnMS) standards (ISO 50001), lean manufacturing techniques, or use of energy management software tools such as energy management information systems. In addition, the energy management approach employed by an individual company will mature as experience accrues—implementing new technologies, replacing outdated technology with newer, more energy-efficient systems, and investing in energy management assets throughout the organization. The SEM approach itself becomes more sophisticated and energy savings persist.

As well as focusing on the quantitative aspects of M&V from SEM (i.e., energy savings—see next section), program administrators and industrial customers need to be able to assess industrial customer energy management practices and maturity. Energy management assessments are used as a diagnostic tool to determine baseline practices at the beginning of a customer's participation in SEM and are also useful to assess progress and evaluate programs. In addition, maturity models can help to integrate SEM within other business improvement and productivity models (IIP and MSS 2013).

Several successful programs that already assess energy management maturity include:

- The Northwest Energy Efficiency Alliance (NEEA) and the Northwest Food Processors' Association's (NWFPA's) Industrial Energy Roadmap outlines an "Energy Efficiency Self-Assessment" to help enterprises gauge their current level of energy efficiency efforts and understand how energy is viewed within the organization. The self-assessment helps both enterprise and evaluator establish a level of energy management sophistication, creating a roadmap on SEM implementation improvement.

- BC Hydro's Energy Management Scorecard serves to rate companies' energy management in multiple areas, identifying critical areas for improvement and outlining ways to excel in those areas.
- Xcel Energy helps companies benchmark their energy management practices.
- The U.S. Department of Energy's (DOE's) Superior Energy Performance (SEP) program has developed an industrial facility Best Practice Scorecard, which enables companies with mature EnMS to earn credits by implementing energy management best practices as well as improving energy performance. The best practices are activities, processes, or procedures that are above and beyond what is required by ISO 50001 and encourage "best in class" companies to continually improve their EnMS, which will lead to improved performance and sustained energy savings (SEP 2012).
- EPA's ENERGY STAR® program has several assessment matrices that gauge the amount of energy management implementation presently in place for an industrial company or facility. Matrices address energy management programs, plant programs, and small or medium sized plants.

Baselines, Energy Models, and Measurement and Verification

Traditionally, prescriptive approaches use deemed savings for common equipment or verify the savings from replacing a piece of equipment, where estimating the before and after energy consumption is relatively straightforward. With industrial custom projects, M&V analysis is done for each project at the measure level because of the high specificity of the industrial process and application. Using either method, utilities can be relatively confident in the amount of energy savings resulting from replacing existing equipment with more efficient equipment.

SEM programs move away from the equipment focus to continuous improvement across all factors that affect energy use—equipment, systems optimization, O&M, and behavior. In this way, SEM programs unlock the potential of persistent O&M and behavioral savings, which have rarely been included as eligible measures in traditional programs. However, SEM programs that focus on "how,"—for example using a piece of equipment less or using it more optimally—often suffer from an inability to confidently quantify savings or demonstrate persistence over time (Milward et al. 2013).

Attributing savings to projects identified through SEM programs is challenging, but tracking success will be increasingly important as SEM programs become more widespread and their effectiveness is put under regulatory scrutiny. SEM M&V can also be a valuable tool for industrial managers, by making energy performance visible, meaningful, and actionable. SEM M&V requires the development of a robust baseline (typically for a period of one year or more) and an energy model against which actual performance is measured. The general approach is described in Example 16.

Although SEM is broader than just O&M or operational efficiency, the approach as described in Example 16 that subtracts out the savings from capital projects is currently the most common M&V approach to credit financial incentives for SEM. Current programs deploying this approach apply traditional incentives for custom retrofit measures, where retrofit measure savings are subtracted from facility-wide savings, and then a lower incentive is paid on the difference (Gilless 2013). Programs that estimate and incentivize SEM program savings in this way include NEEA, ETO, the Bonneville Power Administration (BPA), and Rocky Mountain Power (PacifiCorp).

In contrast, in addition to crediting operational efficiency, BPA also tracks the increased number of equipment retrofits due to SEM and includes this information in its program results. Companies participating in BPA's High Performance Energy Manager Program (HPEM) show that companies tend to significantly increase the number of capital projects after enrolling in the program: new capital projects submitted after HPEM adoption rose to 23 projects compared with 10 projects beforehand (Wallner 2011). Energy management programs that estimate program results solely in terms of increased numbers of equipment retrofit projects (i.e., they do not count operational, behavioral, or non-equipment savings) include BC Hydro and Xcel Energy (Wallner 2012).

Experience from energy management programs in Europe also supports this observation. Participants in Ireland's Energy Agreements Programme were surveyed to understand how the Irish energy management standard, primarily driven by impending carbon limits, had contributed to their energy efficiency efforts. Surveys report that 67% of the projects to save energy were derived or driven by the EnMS process, and since the introduction of EnMS in Ireland in 2005, the pace of energy savings has increased (Reinaud et al. 2012).

Engaging Supply Chains

Utility or third-party energy management programs may wish to encourage these leading companies with mature SEM experience to collaborate with their supply chains to improve supplier energy management performance. For example, the NEEA-NWFPA Energy Efficiency Assessment recognizes "Industry Collaborators" as companies that actively work outside their own facilities to collaborate with suppliers, utilities, organizations, competitors, consortiums, and associations. Similar program initiatives also exist abroad. In the Netherlands' Long Term Agreements, companies meet one third of their reduction target outside the plant boundaries by engaging their value chains. In Japan's benchmarking policy, companies that demonstrate that they are already at global best practice can collaborate with other companies in their supply chain instead of searching for additional savings within their own operations (Goldberg et al. 2012).

EXAMPLE 16. BASELINES AND ENERGY MODELS

To isolate the effect of strategic energy management (SEM) versus capital projects and other variables, program administrators and customers typically develop an energy use baseline and an energy (regression) model for the entire facility. Payments are made based on actual savings once equipment changes and other variables have been subtracted. Robust models require reliable sources of facility and production data to establish the facility baseline and any savings. For example, the Energy Trust of Oregon and the Bonneville Power Administration model a facility's energy consumption as a function of production and other variables such as weather to determine a baseline level. Using meter-level analysis, they then track actual performance against projected usage—the difference is the potential savings. Actions and measures taken to reduce energy use and the dates of those actions are also tracked in order to be able to tie changes in energy use in the model to actual energy efficiency actions taken. To calculate the annual SEM incentive for the customer, savings from all capital projects are subtracted out (because capital projects receive their own incentives) so that only operations and maintenance savings are included in the cost-effectiveness evaluations of SEM programs (Kolwey 2013, Crossman 2013).

The Consortium for Energy Efficiency and the Northwest SEM Collaborative are actively working to develop a greater common understanding of these issues and to provide guidance to regulators and program administrators to promote more widespread deployment of SEM programs.

At the implementation level, new developments in intelligent technology are emerging as promising tools to ease the burden of determining baselines and using energy models. Companies with longstanding experience with SEM approaches perhaps started out looking at their energy use once a week or month and might have updated their energy models once a year. However, recent developments in information technology systems such as for submeters, energy management information systems, and Intelligent Efficiency, are paving the way toward giving manufacturers the ability to track and measure their energy use and savings performance data in real time across their entire operation. Self-diagnostic, comparative, and anticipatory analytical capabilities of smart devices are enabling a new level of process energy management and systems optimization within companies and can help prevent the degradation of energy savings. With this information, companies can prioritize different operations, tune up systems and integrate demand response, and support less costly measurement and verification.

6.2. Whole-Facility Energy Intensity Programs

The building up of energy baseline and consumption models that were developed to allow customers to receive incentives for SEM implementation provides possible new directions: customers could be compensated beyond individual energy management or operational efficiency and be paid for performance at the whole-facility level—i.e., incentives are not separated by project or equipment installation.

Under this new program model, utilities or program administrators could work with customers to agree on an energy baseline for a certain period (e.g., a year) and provide incentives based on improvements in energy intensity below the baseline. These types of pay-for-performance programs resemble power-purchasing agreements for renewables or white certificates schemes in Europe. They could also be closely integrated into national initiatives and provide greater applicability for a single company with industrial facilities in multiple service territories.

However, the outlook for these programs is likely longer-term because of a range of technical and policy questions such as:

- Accepted methods for setting baselines. There already are existing methods, such as the International Performance Measurement and Verification Protocol (IPMVP) Option D and those used by the New York State Energy Research and Development Authority (NYSERDA), Connecticut Light & Power, and outlined in BPA's Energy Efficiency Implementation Manual (2013) (Seryak and Schreier 2013). The Consortium for Energy Efficiency (CEE) and the Northwest SEM Collaborative are working to gain a common understanding of these issues.
- Whether incentives for improvements in energy intensity can become a commonly accepted policy approach for regulators and legislators across different states—there can be regulatory concerns and restrictions to base analysis of savings on intensity reduction (Crossman 2013).
- The inability of many industrial customers to quickly and effectively analyze their energy consumption information provided by utilities.

EXAMPLE 17. EPA ENERGY STAR PROGRAM

EPA's ENERGY STAR program for industry has developed a number of whole-plant energy benchmarks known as ENERGY STAR plant energy performance indicators (EPIs). These tools provide an energy performance score for plants based on the energy performance of the plant type nationally. To learn more about which industrial sectors have an EPI, visit www.energystar.gov/epis.

6.3. Enhancing the Value of Industrial Energy Efficiency Projects through Non-Energy Benefits

Energy efficiency measures often result in a number of non-energy benefits (NEBs) such as increased productivity, reduced material loss, improved product quality, and lower emissions. In addition, investors increasingly value corporate commitment to energy efficiency and sustainability as an indicator of sound governance and business acumen. Several studies have shown that NEBs from IEE projects, such as broader productivity or quality gains, can be as high as or even higher than the energy cost saving benefits achieved by the projects (Kushler et al. 2012, Chittum 2012, Lazar and Colburn 2013). Full quantification of NEBs for use by implementers and industrial customers at the project or measure level is not commonplace.

NEBs can play an important role in persuading industrial customers to participate in programs. A 2003 study of commercial and industrial (C&I) energy efficiency programs in Wisconsin valued these benefits at approximately 2.5 times the projected energy savings of the installed technologies (Hall and Roth 2003). Worrell et al. (2003) analyzed the NEBs that accrued to industrial customers from 52 energy efficiency projects, where 55% of the cost savings came from productivity improvements as summarized in Table 4. Lung et al. (2005) undertook a similar study with 81 projects (Table 5), showing that 31% of the savings were attributable to NEBs.

Table 4. Energy Cost Savings and Non-Energy Cost Savings from 52 IEE Projects

Total project investment	$54.2 million
Total annual energy savings	$12.9 million (45% of total savings)
Total annual productivity savings	$15.7 million (55% of total savings)
Combined total savings	$28.6 million
Average energy payback	4.2 years
Average payback including energy and non-energy benefits	1.9 years

Source: Worrell et al. 2003

Table 5. Energy and Non-Energy Cost Benefits from 81 IEE Projects

Total project costs	$68.2 million
Total annual energy savings	$47.7 million (69% of total savings)
Total annual non-energy savings	$21.1 million (31% of total savings)
Total annual savings	$68.7 million
Simple payback of energy savings	1.43 years
Simple payback of non-energy benefits	0.99 years

Source: Lung et al. 2005

In a recent survey of 30 energy managers, engineers, sustainability managers, plant managers, presidents, and vice presidents from a diverse pool of companies nationwide, 90% of energy projects were found to also have a broader productivity impact (Russell 2013a). For one company surveyed, energy improvements provided a four-fold return in the form of production improvements and some companies claimed that NEBs "dominated" the returns from energy projects.

However, at the industrial customer level, NEBs are often not quantified prior to making an investment. Some assessment of NEBs may be undertaken post-implementation for evaluation or recognition purposes, but this is for measures that already pass the cost-effectiveness test on energy cost considerations alone. ETO tries to address NEBs upfront and will help industrial customers to quantify NEBs to support the investment decision for projects that are of interest to the industrial customer but do not quite satisfy the cost-effectiveness test. For ETO, water savings is a common NEB to be quantified and is relatively straightforward to quantify relative to other NEBs, such as improved safety and employee morale (Crossman 2013).

Valuing NEBs at the project level prior to an investment could significantly broaden the number and types of projects eligible for program support and incentivize additional efforts for the industrial customer. Although this may require additional engineering resources, collaborative opportunities with water utilities could be pursued to bring additional incentives for water and energy efficiency measures (e.g., steam leaks, steam traps).

As well as focusing on water benefits, using lean approaches can provide benefits in the "non-energy wastes." For example, an hour shaved off of a two-hour line start-up saves energy, scrap material (from sub-optimal line speed), and an hour of staff labor (Gilless 2013).

6.4. Natural Gas Industrial Efficiency Programs

Energy efficiency programs designed to help natural gas customers reduce energy use and costs have existed for more than 30 years in a number of states (ACEEE 2012c). The first customer energy efficiency programs were primarily targeted at residential customers and typically focused on increasing home insulation, reducing air leaks, and installing high-efficiency furnaces. Also, many of these early programs targeted the needs of low-income customers who had difficulty keeping up with rising winter heating costs at a time when natural gas prices were increasing rapidly. Making energy affordable was a primary objective of many of these early gas programs and still is one of the goals of most programs today.

Although the roots of natural gas efficiency programs lie within residential markets, there are a growing number of programs that now serve a broad range of gas customers, from homeowners to, increasingly, large industries. However, although opportunities for natural gas savings in the industrial sector are significant, most of the current IEE program activity at the state level focuses on electricity. In 2011, $6.8 billion was budgeted for overall electric programs (residential, commercial, and industrial); C&I program budgets were approximately $2.6 billion. In contrast, $1.2 billion was budgeted for overall gas programs in 2011, with approximately $350 million for natural gas C&I programs (CEE 2012). Total C&I natural gas program expenditures were approximately $225 million in 2011, with $50 million specific to industrial programs (AGA 2013).[30] Further, estimates show that C&I customers accounted for more than 50% of gas efficiency program savings in 2011 (approximately 71.8 trillion Btu out of a total savings of 125.2 trillion Btu), with industrial programs accounting for 30 trillion Btu on their own (AGA 2013).

Natural gas utilities recover energy efficiency costs in a number of ways, one of which is to apply a surcharge to the delivery charge (other methods include special energy efficiency tariffs or riders or cost recovery via base rates). Nearly 40% of U.S. industrial customers have separate purchasing agreements with wholesale gas suppliers or third-party marketers for the commodity. However, 88% of the natural gas volumes delivered by U.S. utilities to industrial customers were purchased from a third party, which implies that large industrials predominantly acquire their natural gas supply from a source other than the utility. Thus gas utilities serve those large industrial customers mainly with transportation services, so typically they would not include large-volume industrial customers in their gas efficiency programs. With the industrial sector being the second largest end-use consumer of natural gas (after electric generators)—accounting for 26% of total U.S. end-use gas consumption (EIA 2013)[31]—this represents an enormous opportunity in gas savings by targeting industrial customers.

In addition to this challenge, recent low gas prices have made energy efficiency challenging from a cost-effectiveness perspective. Gas utilities are continuing to deliver energy efficiency programs in this low price environment and most gas efficiency programs still continue to pass cost-effectiveness tests. Where engaged, industrial customers tend to be one of the most cost-effective options in the portfolio of efficiency program offerings. Although natural gas prices were at an all-time low in 2012, prices have already rebounded to around $4 per million Btu (MMBtu) and current forecasts estimate that prices will remain in the range of $4 to $6 per MMBtu for the foreseeable future (EIA 2013).[32] In addition, the attractive price outlook for natural gas has created an opportunity for industrial customers to invest in new technologies, processes, and systems. Industrial gas efficiency programs can help ensure that these investments are based on the latest, most efficient practices and technologies, ensuring continued benefits for customers and the state. A particular efficiency opportunity driven by the positive long-term outlook for natural gas supply and price in the United States is combined heat and power (CHP). CHP can play a unique role in IEE programs because it is not only a highly efficient use of the natural gas resource, but reduces load requirements on electric utilities similarly to straight electric efficiency measures. By providing both electricity and useful thermal energy at the industrial facility in one energy-efficient step, CHP delivers overall energy savings both from its own high efficiency and from avoiding transmission and distribution line losses that normally occur in delivering power from the central station generator to the customer.

The organization of utility service provision often impacts the way in which energy efficiency program services are delivered and their cost-effectiveness evaluated. Most single-fuel utilities administer energy efficiency programs on their own. However, energy efficiency opportunities typically lead to savings from end uses that reduce both gas and electric energy use. Delivered together as part of the same project or program, gas and electric efficiency measures may very well pass cost-effectiveness tests even if the gas measures on their own do not. Delivering gas and electric efficiency programs together has the benefit of avoiding the loss of technically and economically viable energy efficiency potential. Energy efficiency technical potential comes from individual end uses and the interaction of those measures with one another and the facility itself in which they are implemented. Ignoring the benefits of energy savings from "other fuels" may lead regulators and administrators of gas efficiency programs to

[30] Overall gas efficiency program budgets for 2012 were $1.4 billion (AGA 2013).
[31] The power generation sector is the largest consumer of natural gas, using an estimated 32.5% of total gas consumption in 2013 (EIA Annual Energy Outlook 2013).
[32] Natural gas energy efficiency programs remain cost-effective when gas prices reach around $4 per MMBtu (using the total resource cost test).

undervalue investment in packages of measures that deliver savings across fuels. The resulting customer under-investment may foreclose on energy efficiency savings opportunities because long-lived equipment is installed that is oversized or because certain improvements can only be technically or economically installed in conjunction with a broader package of measures (Hoffman et al. 2013).

Some states have been able to overcome the cost-effectiveness challenges and can serve as promising examples for other states that wish to further increase gas savings and meet CEPS targets through industrial gas efficiency programs and/or combined electric and gas efficiency programs. For example, PG&E's gas efficiency program in California achieves 60% of its savings through industrial customers, in contrast to 20% of its electricity savings from industrial programs (Sethuraman 2013).

Programs that offer incentives for industrial gas savings as well as electric savings include NYSERDA, ETO, Wisconsin Focus on Energy, Efficiency Vermont, NSTAR, and CenterPoint Energy (Example 4). Another example of a holistic approach to energy savings is an innovative mechanism being proposed by the Utah Association of Energy Users. The proposal suggests that gas utilities offer large industrial customers the opportunity to voluntarily "opt in" to a demand-side management fund, through a self-assessed contribution of 1%–3% of their gas expenses, and to pool these funds with contributions already made to electric public benefits funds. Participating manufacturers could then self-direct these funds to cover both electric and gas energy efficiency opportunities, thereby implementing larger and more effective programs with the flexibility to deliver both electricity and gas savings (Weir 2013).

In summary, industrial customers provide a large savings potential for natural gas utilities and regulators that aim to reduce energy consumption and costs, infrastructure costs, and greenhouse gas emissions through efficiency programs. To achieve this, it is important to align policy goals with implementation rules and evaluation methodologies. Clear and streamlined guidance can help utilities to work with their industrial customers to implement building and process efficiency measures and optimize energy use, while being able to track and credit energy savings to the efficiency program, rather than to new, more stringent energy codes.

7. Conclusion

Building on the improvements in energy efficiency in the U.S. industrial sector that have occurred over the past decades in response to volatile energy prices, fuel shortages, and technological advances is essential to maintaining U.S. industry's viability in an increasingly competitive world. The fact is that many opportunities remain to incorporate cost-effective, energy-efficient technologies, processes, and practices into U.S. manufacturing. Industrial energy efficiency (IEE) remains a large untapped potential for states and utilities that want to improve energy efficiency, reduce emissions, and promote economic development. Successful IEE programs vary substantially in operational mode, scope, and financial capacity, but also exhibit common threads and challenges.

As this report shows, the states' experience gained in developing and implementing IEE programs is both diverse and rich. In Table 6, specific issues discussed in each of the preceding chapters are summarized for regulators and program administrators to consider when designing and implementing effective energy efficiency programs for industry. They do not cover all decisions or issues that regulators and program administrators may need to consider because there will undoubtedly be jurisdiction- and case-specific topics that are not anticipated here. However, these considerations provide a starting point for addressing many of the issues that typically arise.

Table 6. Summary of Key Issues and Considerations for Regulators

Topic	Issue	Considerations for Regulators and Program Administrators	Program Examples
The value of energy efficiency projects	Energy efficiency projects may compete with core business investments and decision-making is often split across business units.	• Clearly demonstrate the value proposition of energy efficiency projects to companies • Relay the operating cost savings and other benefits—including profits—lost if energy efficiency improvement opportunities are not addressed.	• Bonneville Power Administration • New York State Energy Research and Develop-ment Authority • West Virginia Industries of the Future
Relationships with industrial customers	It takes a long-term relationship for programs to understand industrial operation and needs, and for industrial companies to understand what a program can offer them.	• Long-term relationships with industrial companies enable joint identification of energy efficiency opportunities • Stability in program support and personnel over a number of years is critical.	• Energy Trust of Oregon
Industrial sector credibility and technical expertise	Addressing industrial companies' core needs requires understanding a plant's production processes, operating issues, and the market context the plant operates within.	Effective IEE programs develop credibility with industrials by emp-loying staff/contractor experts that understand the industrial segment and have the technical expertise to provide quality technical advice and support issues specific to that industry and customer.	• Efficiency Vermont • Wisconsin Focus on Energy • Xcel Energy (Colorado and Minnesota)
Diverse industrial customer needs	Manufacturers use energy differently than the commercial sector, typically having significant process-related consumption. Focusing on simple common technology fixes alone will miss many of the opportunities.	A combination of both prescriptive offerings for common crosscutting technology and customized project offerings for larger, more unique projects can best meet diverse customer needs and provide flexible choices to industries.	• Rocky Mountain Power • CenterPoint Energy • Xcel Energy

Topic	Issue	Considerations for Regulators and Program Administrators	Program Examples
Project scheduling	Scheduling of energy efficiency investments can be heavily dependent on a plant's operational and capital cycle, as proposed equipment changes must be guided through rigorous, competitive, and time-consuming approval processes.	Programs with multi-year operational planning can best accommodate company scheduling requirements, as scheduling of capital project implementation must consider both operational schedules that dictate when production lines may be taken out of operation as well as capital investment cycles and decision-making processes.	• NYSERDA
Application processes	Industrial customers may perceive the application and implementation procedures for IEE programs to be administratively complex and burdensome.	Achieving the right balance between meeting key program administration needs for information and keeping program procedures simple and efficient may often require a continual process of evaluation and improvement.	• BPA • NYSERDA
Program outreach	Various industrial customers may be unaware of the industrial program offerings that may be most applicable or useful for them due to staff turnover and internal demands.	Steady and continual outreach and dissemination of information, such as examples of successful past projects, is important to encourage participation.	• AlabamaSAVES • NYSERDA
Leveraging partnerships	A range of federal, national, regional, and state initiatives and resources are relevant to state IEE programs, including those provided by the U.S. Department of Energy, the U.S. Environmental Protection Agency ENERGY STAR® program, state energy offices, and the Manufacturing Extension Partnership.	Successful IEE programs often partner with federal, state, and regional agencies and organizations to leverage their expertise, access to customers, and program implementation support capacities.	• AlabamaSAVES • Northwest Energy Efficiency Alliance, Northwest Food Processors Association and BPA
Medium- and long-term goals	Industrial companies and program administrators seek market certainty and reduced risk in ramping up the implementation of cost-effective energy efficiency measures.	Regulators and program administrators can set energy savings goals or targets for the medium- to long-term, coordinated with funding cycles (e.g., in three-year cycles).	• Michigan Self-Direct Energy Optimization Program • Southwest Energy Efficiency Project
Measurement, verification, and evaluation	Effective M&V is critical for program administrators to assess results and measure progress, and is also useful for industrial to verify results of their investments.	• Guidelines for M&V need to be clearly defined and periodically reviewed and adjusted • Periodic impact and process evaluations help identify where IEE program efficiency and results can be further improved • Non-energy benefits (NEBs) can be a key element of both project M&V and program evaluation.	• DOE's Uniform Methods Project • International Performance Measurement and Verification Protocol • ETO process evaluations • NYSERDA, Mass-achusetts, and BPA valuation of NEBs

Topic	Issue	Considerations for Regulators and Program Administrators	Program Examples
Self-direct programs	There is a wide range in structures of self-direct programs: from those that are only vaguely defined, and include little M&V of energy saving actions, to those that require verified self-directed customer investment and energy savings to be achieved in order for payment into the programs to be waived.	Clarity in self-directed customer obligations and M&V of results are necessary if the policy goal is to ensure that self-directed industrial customers contribute to overall efforts to ensure least-cost electricity or gas service at a level on par with the contributions of other customers.	• Michigan Self-Direct Energy Optimization Program • Puget Sound Energy • Xcel Energy
Emerging Industrial Program Directions			
Expanding and strengthening strategic energy management programs	Efforts to support implementation of SEM in industry are gaining momentum in state programs.	The challenge of crediting SEM (how to quantify and credit energy savings specifically achieved through SEM), as well as other SEM-related topics, is worthy of further research and cross-exchange.	• AEP Ohio • BPA • BC Hydro • ETO • WFE • Xcel Energy
Program approaches for whole-facility performance	Significant challenges exist in determining baselines and performance metrics that can provide sufficiently robust measurements of facility savings while maintaining practical and easy-to-implement methodologies.	Work on crediting energy savings from SEM could facilitate the provision of incentives and assessing savings credits for whole industrial facility performance, as opposed to performance of individual investments or measures.	• European experience
Capturing non-energy benefits at the project level	Although there is wide variation between projects, several studies have shown that NEBs from IEE projects, such as broader productivity or quality gains, can be as high as or even higher than the energy cost saving benefits achieved by the projects.	If programs employed systematic ways to assess NEBs earlier in the project cycle, the resulting total returns and shorter payback could tip the scale on a variety of projects from "wait and see" to implementation.	• Energy Trust of Oregon
Expanding natural gas programs	• There is less coverage of the industrial sector in natural gas efficiency programs than in electricity efficiency programs. • Most large industrial customers purchase their gas through third-party suppliers rather than their distribution companies. • Most single-fuel utilities administer energy efficiency programs on their own. However, energy efficiency opportunities typically lead to savings in both gas and electric energy use.	• Gas and electric efficiency measures—when delivered together as part of the same project or a combined program—can result in larger, more effective programs that capture more of the technically and economically viable energy efficiency potential. • Innovative concepts are under consideration to increase the effectiveness and the reach of natural gas efficiency programs.	• Efficiency Vermont • ETO • NYSERDA • PG&E • WFE

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Appendix A: Background

A.1. How Energy Efficiency Can Be Achieved in Manufacturing

There are numerous opportunities for industrial enterprises to be more efficient, both at existing facilities and in new production. Opportunities range from simple technology retrofits to corporate behavioral changes supported by strategic energy management systems that result in continuous energy improvement. Measures involve:

- **Adopting more efficient equipment and technology**. Replacing inefficient compressors, which often lose up to 80% of input energy as heat (IEA 2012), is just one example of energy efficiency gains from upgrading individual equipment. Some pieces of new equipment can even produce energy from facilities' own industrial processes. For example, retrofitting industrial boilers with combined heat and power (CHP) systems generates electricity on-site and captures the waste energy usually lost in the power generation process and uses it to provide heating and cooling to factories and businesses.
- **Managing energy and optimizing operations**. Adopting an energy management system (EnMS) can help facilities make a range of operational improvements and could lead to savings of 10%–30% of their annual energy use. Systems optimization means going beyond component replacement toward integrated system design and operation. Although energy-efficient components can provide efficiency gains of 2%–5%, optimizing energy use at the systems level can deliver average efficiency gains of 20%–30% within a payback period of two years or less (UNIDO 2012).
- **Transforming production systems.** More radical reductions in industrial energy use can be achieved through resource and waste management over the whole industrial process and consumption chain. For example, using municipal solid waste as an alternative fuel and raw material in cement manufacturing can substantially improve energy efficiency, reduce greenhouse gas emissions, and divert waste from the landfill.

Energy efficiency can make money for enterprises, improving their bottom lines. Energy efficiency can also increase manufacturers' operational efficiency and productivity, improve risk management, and generate a host of co-benefits.

Some investments will have a very short payback period, which is useful for demonstrating to senior management the benefits of energy efficiency improvements. Other investments will have higher costs, possibly leading to a change in production technology and process, resulting in additional gains in reducing labor costs and improving product quality (Reinaud and Goldberg 2011). The different types of energy efficiency actions investment decisions are illustrated in Table A-1.

A.2. Cost-Effectiveness of Industrial Programs

Measuring the Cost-Effectiveness of Ratepayer-Funded Programs

The use of public and ratepayer funds for acquiring energy efficiency resources means that projects need to demonstrate the cost-effectiveness of demand-side resources. Cost-effectiveness tests help to decide what programs will be invested in and some states specify that public purpose funds may be invested only in cost-effective energy efficiency measures. That is, efficiency measures must cost less than acquiring the energy from conventional sources (cost-effective programs therefore have a cost-benefit ratio greater than 1.0).

Standard criteria are often determined by utility regulatory commissions and used by program administrators to evaluate and screen programs for cost-effectiveness. There are five major types of tests: for society as a whole (societal cost test), for all utility customers (total resource cost), for the program administrator (program administrator test—also known as the utility cost test), for participants in the program (participant test), and for the price impact on non-participant ratepayers (rate impact measurement) (Woolf et al. 2012).

Table A-1. Energy Efficiency Action and Investment Examples

Level of Investment	Action/Investment
No- to low-cost	• Turning off lights and other equipment when not in use • Behavioral/operational change (e.g., switching to low-rate overnight power) • Strategic energy management (SEM)*
Lower cost	• Replacement lights with high bay fixtures • Variable-frequency drive motors, new pumps • SEM*
Medium cost	• Heating, ventilating, and air conditioning replacement • New boilers, refrigerators • Back-up generator replacement • SEM*
Higher cost	• Process equipment upgrades and selective equipment replacement • Combined heat and power • SEM*
High cost	• Replacement of complete production lines • New power generation units, if off-grid; on-site energy generation
Highest cost	• New plant, new facility

Source: adapted from Mason in Reinaud and Goldberg 2011
* SEM is a broad approach and can incur varying levels of cost depending on how it is implemented by the company.

Each test includes different costs and benefits according to different stakeholder perspectives. For example, the program administrator cost test includes energy costs and benefits that are experienced by the program administrator. The costs include all expenditures by the program administrator to design, plan, administer, deliver, monitor, and evaluate efficiency programs offset by any revenue from the sale of freed up energy supply. The benefits include all the avoided utility costs, including avoided energy costs, avoided capacity costs, avoided transmission and distribution costs, and any other costs incurred by the utility to provide electric services (or gas services in the case of gas energy efficiency programs). The societal cost test includes avoided utility costs, any other program impacts experienced by the participating customers, such as avoided water costs, other fuel savings, reduced operations and maintenance costs, improved productivity, improved sales for businesses with improved aesthetics, improved comfort levels, and health and safety benefits. It also includes externalities, such as environmental costs and reduced costs for government services (Woolf et al. 2012).

Cost-Effectiveness Examples of Industrial Programs

Wisconsin Focus on Energy's non-residential program consists mostly of energy efficiency projects with industrial customers, and had a benefit-cost ratio almost double that of the residential program in 2011, 2.7 compared to 1.5. This is despite the fact that the non-residential program expenditures ($81 million) were almost double the residential program expenditures ($42 million) (Wisconsin Focus on Energy 2011).

Another example is the Narragansett Electric program in Rhode Island, where the benefit-cost ratios for its 2013 electric offerings are estimated to be almost twice as high for commercial and industrial (C&I) customers as for residential customers. The lifetime cost (from a total resource perspective) of energy savings from the C&I sectors is less than half the cost for the residential sector (as shown in Table A-2).

The Energy Trust of Oregon (ETO) has also found its industrial offerings to generate low-cost electricity and natural gas savings. Table A-3 highlights that industrial electricity savings cost 20%–40% less than savings in the residential sector. Similarly, gas savings in the industrial sector cost less than half those generated from ETO's residential programs. In 2010, industrial sector costs from electric savings were almost 40% lower than residential costs.

Similarly, Table A-4 shows that ETO's industrial "Production Efficiency" program was one of its most cost-effective programs in terms of utility and societal benefit-cost ratios.

Table A-2. Narragansett Electric 2013 Energy Efficiency Program Benefits, Costs, and Participation

Electric Program by Sector	Total Resource Cost Benefit-Cost Ratio	Total Resource Cost ¢/lifetime kWh	Participants
Non-income eligible residential	1.5	12.9	466,834
Income-eligible residential	1.6	7.7	5,601
Commercial and industrial	2.9	3.7	3,910
Total	2.3	4.7	476,345

Source: Narragansett Electric 2012, Woolf 2013

Table A-3. Electricity and Gas Savings in Different Customer Classes in ETO Programs (2010–2011)

Sector	Electric Savings: Levelized Cost (¢/kWh)		Gas Savings: Levelized Cost/Therm (¢/kWh)	
	2011	2012	2011	2012
Industrial	2.5	2.6	19	25
Commercial	2.9	2.6	32	34
Residential	3.2	3.0	44	44

Source: Energy Trust of Oregon Annual Reports to the Oregon Public Utility Commission 2011, 2012

Table A-4. Benefit-Cost Ratios for Different ETO Program Offerings (2011)

Program	Combined Utility System Benefit-Cost Ratio	Combined Societal Benefit-Cost Ratio
New Homes and Products	1.8	2.0
Existing Homes	2.3	1.8
Existing Buildings	2.4	1.7
New Buildings	3.5	2.5
Production Efficiency (ETO's Industrial Offering)	3.0	2.0
NW Energy Efficiency Alliance	3.7	1.2

Source: Energy Trust of Oregon Annual Report to the Oregon Public Utility Commission 2012

Average levelized costs estimated for the Bonneville Power Administration's (BPA) 2010–2014 industrial sector plan are $0.029 per kWh, far below the $0.05 per kWh for the residential sector plan, but higher than the $0.018 per kWh estimated for the commercial sector (see Table A-5). It is worth noting, however, that the energy savings capacity costs (cents per kWh per year) for the industrial sector are assessed as the highest of all three sectors. Yet although the industrial sector projects in BPA's program persist over more years, their levelized costs[33] become more attractive over time.

[33] Levelized cost is often cited as a convenient summary measure of the overall competiveness of different generating technologies. It represents the per-kilowatt-hour cost (in real dollars) of building and operating a generating plant over an assumed financial life and duty cycle, expressed in terms of real dollars to remove the impact of inflation, and often converted to equal annual payments. Key inputs to calculating levelized costs include overnight capital costs, fuel costs, fixed and variable operations and maintenance costs, financing costs, and an assumed utilization rate for each plant type (EIA 2013b).

Table A-5. BPA Budgets, Capacity Costs, and Levelized Costs (2010)

Sector	2010 Actual (Million $)	2011 Estimated (Million $)	2010–2014 Total Target (Million $)	2010–2014 Capacity Cost (¢/kWh/yr)	2010–2014 Levelized Cost (¢/kWh)
Industrial	30.4	35.1	115	24	2.9
Commercial	43.5	34.6	157	20	1.8
Residential	47.8	76.4	314.6	21	5
Other	15.7	17.4	74.8		
TOTAL	**137.4**	**163.5**	**661.4**	**21**	**3.7**

Source: Action Plan Update BPA 2012a

Appendix B: Selected Effective Industrial Energy Efficiency Program Profiles

B.1. AlabamaSAVES

Launched in 2010 by the Alabama State Energy Office, AlabamaSAVES is a revolving loan program funded through the American Recovery and Reinvestment Act providing credit enhancement to Alabama businesses, enabling them to secure fixed rate financing specifically for energy efficiency upgrades. Originally conceived for industrial businesses and manufacturers, AlabamaSAVES now includes commercial and institutional facilities, enabling loans for efficiency upgrades and retrofits in lighting, heating, ventilating, and air conditioning (HVAC), controls, envelope, process improvement upgrades, solar photovoltaic systems, and compressed natural gas or propane fleet conversions. Program funding excludes new construction of buildings and factories, and installed fixtures are required to have a 10-year simple payback or better.

Program Description

Qualifying Alabama businesses can secure fixed-rate financing for projects with interest rates between 1%–2% through credit enhancements in the form of loan loss reserves, interest rate buydowns, or a combination of the two. These are direct monetary subsidies applied by the U.S. Department of Energy (DOE), the State Energy Program, and the Energy Division of the Alabama Department of Economic and Community Affairs (ADECA) and funded by the American Recovery and Reinvestment Act of 2010.

Eligible Businesses

Program subsidies are available to all private companies with a place of business in Alabama that are duly organized and/or qualified to do business in the state and that operate one or more existing commercial, industrial, or institutional facilities in the state.

Eligible Projects/Improvements

Subsidized loan funds may be used to purchase and install equipment for renewable energy systems and energy-efficient fixtures and for retrofits installed on property owned and/or operated by an eligible business. Eligible renewable energy systems may employ solar, biomass, biofuels, geothermal, micro-hydroelectric, methane capture and use, or fuel cell technologies. Eligible energy-efficient fixtures and retrofits may include mechanical systems and components including HVAC and hot water, electrical systems and components including lighting and energy management systems, doors and windows, insulation, refrigeration, and combined heat and power. Subsidized funding from the program is for retrofits of existing properties and not for new construction of buildings and factories.

Application Process

Companies wishing to apply must first complete an "expression of interest" allowing for the collection of basic project information. After this, a financial discussion takes place in which the company is consulted on financing and following steps. The loan application formalizes the request for a subsidy or direct loan. A fee of $500 is collected for projects less than $250,000 and a fee of $1,000 for projects $250,000 or larger. All applications are reviewed for conformance with program policies on a timely basis by the Loan Review and Governance Committee, which consists of representatives from ADECA Energy Division, Abundant Power (administrator), and other parties appointed by ADECA Energy Division. Before funding is awarded, an energy assessment defining the project and estimated energy savings impact is submitted and reviewed to ensure a simple payback of 10 years or better.

Loan/Subsidy Terms

Program subsidies are offered in the form of a loan loss reserve and interest rate buydown for accepted applicants. The available subsidies can support approximately $60 million in loans throughout the state of Alabama. Project financing is available to cover up to 100% of project costs. Financing criteria include the following:

- Minimum loan size: $50,000
- Maximum loan size: $4,000,000
- Interest rate: as low as 1%, fixed, per annum (maximum buydown of 5%)
- Closing costs: 2% program origination fee and reasonable and customary costs from a participating lender partner
- Other program requirements, as applicable.

A limited amount of funding exists for direct loans from AlabamaSAVES LLC. Direct loans are available under different terms.

Eligible Service Providers

Installing contractors, energy service providers, product vendors, consultants, engineers, and auditors all could serve a potential role in energy savings projects, dependent on the project's specific needs. A list of eligible service providers is available from AlabamaSAVES. Providers not already on the list are encouraged to review requirements for participation and contact AlabamaSAVES.

Program Results

As of April 2013, more than 20 loans have closed and nearly $17 million in funding has been put toward the installation of energy efficiency projects. The initial $60 million in funding will continue to cycle through loans and has the potential to finance up to $121 million in projects over the next 20 years. Partnerships with Bank of America, Philips Lighting, Metrus Energy, and Efficiency Finance have provided private sector leveraging, valuable marketing and outreach capabilities and been instrumental in driving demand and market uptake.

Program Information and References

AlabamaSAVES: www.alabamasaves.com/Overview.aspx

CASE STUDY 1. WISE ALLOYS

Company: Wise Alloys, Muscle Shoals, Alabama

Wise Alloys, LLC is the third leading U.S. producer of aluminum can stock for the beverage and food industries with a 15% domestic market share of the beverage can stock market. Wise Alloys partnered with Poplar Hill, Blake & Pendleton, and iZ Systems for the project implementation.

Efficiency Measures: Lighting and compressed air energy conservation measures

Project Cost: not available

Loan Amount: $3.75 million

Energy Savings: 30.6M kWh per year

Cost Savings: $1.5 million per year

Payback Period: not available

Non-Energy Benefits: not available

B.2. Bonneville Power Administration

Overview

The Bonneville Power Administration (BPA) is a federally owned interstate wholesale electric power utility, which sells power (mostly hydro) to 135 retail electricity utilities in the Northwest. BPA has energy efficiency resource acquisition requirements mandated through the federal government and purchases electric efficiency resources from the region's retail utilities.

Public utilities in the Pacific Northwest serve more than 2,200 megawatts (MW) of industrial load, making industrial sector users a vitally important factor in BPA's energy efficiency programs. The Energy Smart Industrial (ESI) program encompasses all BPA-offered industrial sector programs and is designed to bring regional consistency to BPA utility customers and their end users.

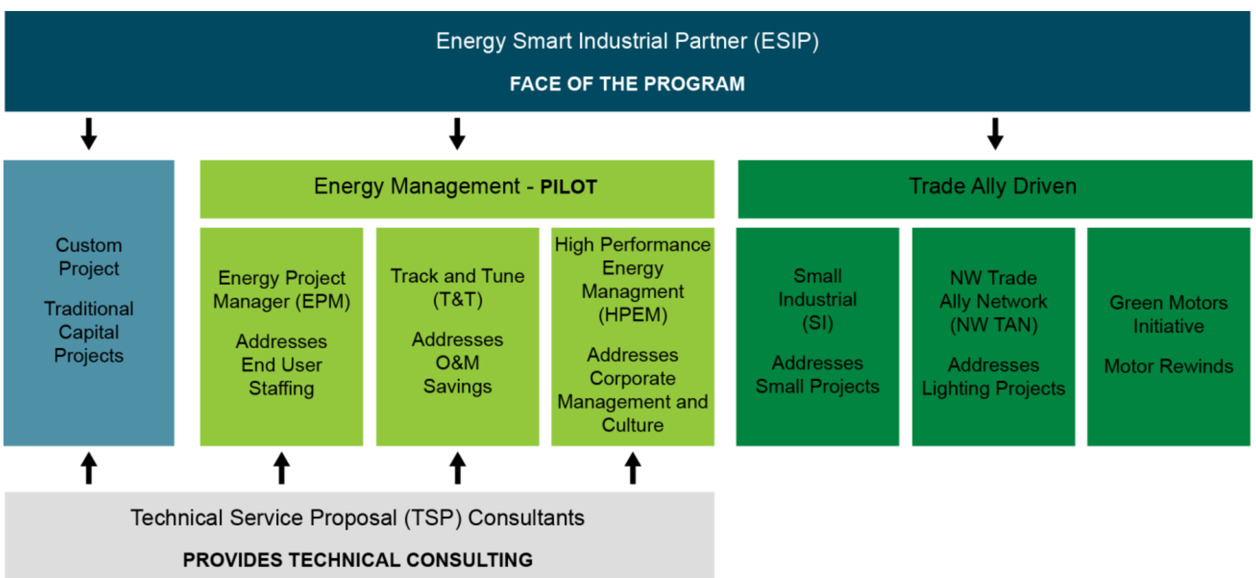
BPA industrial sector staff and dedicated engineers provide overall ESI program management as well as project technical review and approval. The BPA program partner Cascade Energy, Inc. and its subcontractors, Evergreen Consulting and Triple Point Energy, Inc., work with BPA and utilities to provide a variety of services to regional utilities and their industrial end users. These services include project development, marketing, technical service proposal consultant contracting, and implementation of industrial sector energy efficiency acquisition.

ESI technical experts work with facilities to build customized solutions that protect privacy and minimize impact to production process. ESI offers technical expertise in industries including pulp and paper, wood products, food processing, high tech, data centers, water/wastewater, mining, and more.

Energy Smart Industrial Program Components

There are a wide variety of program options for all industry sizes and budget levels (see Figure B-1).

Energy Smart Industrial Partner (ESIP): The ESIP is a dedicated IEE expert assigned by the ESI program to serve as a single point of contact for utilities, coordinating the program and its resources. ESIPs help utilities achieve the goals and needs of their conservation program, provide technical expertise and other assistance to utility staff, and can also market, upon request, the ESI program to industries and facilitate the development and implementation of industrial projects.



Source: BPA 2012

Figure B-1. BPA's Energy Smart Industrial Partner Program

Energy Management: Energy Management is a pilot component of the ESI program that addresses the opportunities to acquire energy savings through improved operations and maintenance (O&M) and overall energy management practices. There are three core features of the pilot.

1. **Energy Project Manager (EPM) Co-Funding:** The purpose of EPM co-funding is to increase end user management and engineering manpower devoted to electrical energy projects/activities and increase the number of industrial projects submitted. This EPM will identify energy saving opportunities and help manage projects from beginning to end. Participating industries set an annual (verifiable) energy savings goal (at least 1,000,000 kilowatt-hours [kWh]) and receive co-funding proportionate to that goal (subject to minimum and maximum co-funding levels). If the end user meets these verified energy savings goals on schedule, co-funding continues. If, however, milestones are missed, co-funding could be suspended and/or ultimately ended. The process and incentives include:
   - Sign a one-year EPM agreement with your utility.
   - An EPM is assigned (either an existing employee, a new hire, or subcontracted employee to the facility) and the utility funding is secured, an initial $25,000 funding payment is made to the facility (See Table B-1 for details).
   - Develop an EPM comprehensive plan to implement energy efficiency projects with milestones to reach the energy savings goal.
   - Annual EPM co-funding of $0.025 per kWh of energy savings, not to exceed the total base EPM salary, benefits, and other associated costs. ($250,000 annual maximum).
   - Additional incentives available for capital projects and/or O&M projects.

Table B-1. BPA Energy Project Manager Incentives

Annual EPM Installment	Timeline	EPM Payment Amount	Annual EPM Co-Funding To Date	EPM Payment Methodology
1a	EPM assigned	$25,000	$25,000	$0.025 per kWh at the 1,000,000 kWh per year minimum savings goal requirement
1b	Comprehensive plan approved	$8,333	$33,333	1/3 of the energy savings goal less payment 1a
2	6 months after EPM assigned	$33,333	$66,666	2/3 of the energy savings goal less payments 1a and 1b
3	12 month after EPM assigned	$38,334	$105,000	100% of the energy savings achieved less payments 1a, 1b, and 2

Source: BPA (2013)

2. **Track and Tune Projects:** Track and Tune is designed to provide financial and technical help to the end user to implement no-cost/low-cost improvements, and install a tracking system that allows for monitoring of energy performance and savings over multiple years. Track and Tune centers on realizing O&M savings instead of implementing large capital projects. To achieve savings on industrial projects, Track and Tune continuously tracks the performance of the area of focus (e.g., whole facility, system, or process). This tracking establishes the baseline, shows the effect of the initial tune-up effort, and tracks the performance over the long term. This methodology transforms industrial O&M improvements into a reliable, verifiable source of savings.
3. **High-Performance Energy Management (HPEM):** HPEM provides training and support that allows industrial facilities to integrate energy management and the principles and practices of continuous improvement into their core business practices.

Small Industrial Measures: Small Industrial Measures provide a cost-effective mechanism to handle specific efficiency measures when the energy savings for a project are small in relation to typical industrial projects. This allows the ESI program to target small-scale industrial facilities and/or small systems that are historically underserved by traditional industrial efficiency programs. Currently, small compressed air (<75 hp) measures fall under the Small Industrial Measures component. Additional technologies (e.g., refrigeration, variable frequency drives, etc.) may be added in the future.

Enhanced Lighting: Enhanced Lighting is considered an extension to the existing Northwest Trade Ally Network, with the focus of driving more industrial lighting projects. Industrial lighting specialists are assigned to participating utilities to assist with these efforts.

Enhanced Technical Service Providers (TSP): This includes expansion and enhancement of traditional TSP services, including quick-response time and materials work, and BPA funding of scoping assessments, detailed assessments, and measurement and verification (M&V) activities where appropriate.

Results

Since 2009, the ESI program has saved 66 MW_{avg} and has helped more than 500 Northwest industrial customers in such market segments as pulp and paper, wood products, food processing, high tech, water/wastewater, and mining.

Program expenditures, energy savings, demand savings, and participation levels are provided in Table B-2.

Table B-2. BPA Program Expenditures, Energy Savings, Demand Savings, and Participation Levels

	2010	2011	2012	2013
Program expenditures ($ million)	$30.4	$36.7	$15.2	$21.9
Energy savings (kWh)*	115,632,000	253,514,400	91,980,000	970,059,936
Demand savings (MW_{avg})*	13.20	28.94	10.50	11.08
Participation				
Enrolled utilities	99	104	105	108
Engaged utilities	63	80	86	86
Participating end users	219	378	478	516

*net savings
Source: Nowak et al. 2013, BPA 2013

Average levelized costs estimated for BPA's 2010–2014 industrial sector plan are $0.029 per kWh, far below the $0.05 per kWh for the residential sector plan, but higher than the $0.018 per kWh estimated for the commercial sector (see Table B-3). It is worth noting, however, that the energy savings capacity costs (cents per kWh per year) for the industrial sector are assessed as the highest of all three sectors. Yet, as the industrial sector projects in BPA's program continue over more years, their levelized costs[34] become more attractive over time.

[34] Levelized cost is often cited as a convenient summary measure of the overall competitiveness of different generating technologies. It represents the per-kilowatt-hour cost (in real dollars) of building and operating a generating plant over an assumed financial life and duty cycle, expressed in terms of real dollars to remove the impact of inflation, and often converted to equal annual payments. Key inputs to calculating levelized costs include overnight capital costs, fuel costs, fixed and variable operations and maintenance costs, financing costs, and an assumed utilization rate for each plant type (EIA 2013b).

Table B-3. BPA Budgets, Capacity Costs, and Levelized Costs (2010)

	2010 Actual (million $)	2011 Estimated (million $)	2010–2014 Total Target (million $)	2010–2014 Capacity Cost (¢/kWh/yr)	2010–2014 Levelized cost (¢/kWh)
Industrial	30.4	35.1	115	24	2.9
Commercial	43.5	34.6	157	20	1.8
Residential	47.8	76.4	314.6	21	5
Other	15.7	17.4	74.8		
TOTAL*	137.4	163.5	661.4	21	3.7

* Industrial includes capitalized program costs. Expense budgets were not included. All other sectors are primarily expense budgets. The difference is about $0.02/kWh
Source: Action Plan Update BPA 2012a

Cost-Effectiveness

BPA's ESI program had a benefit-cost ratio of 7.3 in 2011 (Aden 2013).

Program Information and References

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CASE STUDY 2. NORPAC

Company: NORPAC, Longview, Washington

A large paper mill in Washington State. The 33-year-old mill produces 750,000 tons of paper per year. The largest electricity consumer in the state, it requires 200 MW per year on average.

Efficiency Measures: New wood chip pretreatment and screening process

Offering/Incentive: $21 million for three custom projects (BPA), plus an additional $3.9 million (Cowlitz County Public Utility District)

Project Cost: $60 million project (NORPAC funded the remaining $35 million)

Energy Savings: 100 million kWh per year (12% saving)

Energy Cost Savings: not available

Payback Period: not available

Non-Energy Benefits: Reduced chemical, wood chip, and pulp inputs, improved refining process and product quality.

B.3. Efficiency Vermont

Program Summary

In 1999, Vermont´s Public Service Board consolidated the efficiency acquisition programs of all of Vermont utilities into a single, statewide energy efficiency utility—Efficiency Vermont—and a smaller energy efficiency utility, covering Burlington, Vermont's largest city. The Public Service Board is responsible for the overall oversight of Efficiency Vermont. Efficiency Vermont has been operated since its inception by the Vermont Energy Investment Corporation (VEIC), an independent nonprofit entity. Vermont's Public Service Department is responsible for monitoring and evaluating service offerings. Performance against targets determines VEIC´s compensation.

Efficiency Vermont provides a full suite of program offerings for businesses and industrial customers. Efficiency Vermont maintains six account managers in charge of all day-to-day relations with industrial customers.

Program Offerings

Efficiency Vermont's programs for industrial customers include prescriptive and custom incentives, technical assistance in the form of auditing, project development, training on energy management and lean techniques, and employee energy efficiency awareness.

Prescriptive Incentives: Financial assistance is provided for the purchase and installation of efficient common technologies such as lighting, motors, and variable speed drives on a prescriptive ($/unit) basis.

Custom Incentives: More complex projects are eligible for custom incentives that are negotiated with program staff and linked to annual energy savings. Customized projects are by far the dominant source of efficiency acquisition, accounting for perhaps 90% of the industrial project total. Six account managers currently cover large industrial customers, developing multi-year assistance relationships with their clients, and providing skills in areas such as finance and business as well as technical expertise for addressing complex projects and challenges. Account managers are at liberty to negotiate financial incentive and cost-sharing levels. A key emphasis is to partner with customers to create a portfolio of opportunities that can be incorporated into industry planning processes. Account managers may also engage consultants for specific technical tasks, for which costs may be shared with customers.

Continuous Energy Improvement (CEI): The CEI program provides comprehensive assistance on capital upgrades, process improvements, employee engagement, and energy efficiency maintenance protocols. Efficiency Vermont estimates CEI can help cut energy consumption by 10%–15% within the first three years and 25%–35% within six years.

Energy Leadership Challenge: Efficiency Vermont launched a new Energy Leadership Challenge in July 2011. Under this challenge, 69 large energy consumers are asked to commit to saving 7.5% of their energy use over a two-year period. Efficiency Vermont provides special technical assistance to these customers in addition to other offerings.

Results

Tables B-4 and B-5 provide Efficiency Vermont's electric and gas resource acquisition results in 2012 and progress toward its three-year goals.

Table B-4. Electric Savings Results in 2012 and Progress Toward 2012–2014 Goals

Electric Savings 2012 (MWh)	2012 Results	3-Year Goal	% of 3-Year Goal Achieved
All programs—TOTAL	110,179	274,000	40%
Business Energy Services—TOTAL	67,687	193,200	35%
Business—New Construction—SUBTOTAL	15,310	26,400	58%
Business—Existing Facilities—SUBTOTAL	52,377	166,800	31%
Residential Energy Services—TOTAL	42,492	80,800	53%

Source: Adapted from Efficiency Vermont 2013, Table 3.7

Table B-5. Heating and Process Fuel Savings Results 2012 and Progress Toward 2012–2014 Goals

Heat and Process Fuel Savings in 2012 (MMBtu)	2012 Results	3-Year Goal	% of 3-Year Goal Achieved
All programs—TOTAL	78,361	126,000	62%
Business Energy Services—TOTAL	51,876	29,690	175%
Business – New Construction—SUBTOTAL	18,834	1,850	1,018%
Business – Existing Facilities—SUBTOTAL	33,042	27,840	119%
Residential Energy Services—TOTAL	26,485	96,310	27%

*The three-year goal and percentage of three-year goal for savings in MMBtu reflect target changes proposed by Efficiency Vermont and approved by the Vermont Public Service Board in 2013.

Source: Adapted from Efficiency Vermont 2013, Table 3.18

Cost-Effectiveness

The key cost-effectiveness metric is total resource benefits, which includes the present value of lifetime economic benefits resulting from resource saving measures, including avoided costs of electricity, fossil fuels, and water:

- The ratio of gross electric benefits to spending was 3.3.
- The total resource benefits in 2012 from electric and thermal investments was $173,800,000.
- Net lifetime economic value of electric and thermal energy efficiency investments in 2012 was $102,300,300.
- The total resource benefits in 2012 for Efficiency Vermont's reporting categories were:
    - Business New Construction: $38.8 million
    - Existing Businesses: $58.7 million
    - Retail Efficient Products: $26.6 million
    - Residential New Construction: $10.4 million
    - Existing Homes: $14.7 million.

Efficiency Vermont delivered significant value compared to the costs of other sources of energy:[35]

- Efficiency Vermont supplied electric efficiency in 2012 at $0.035 per kWh. Taking into account participating customers' additional costs and savings, the levelized net resource cost of saved electric

[35] Numbers in the two ensuing bulleted items do not include customer credit. The "levelized net resource cost of saved electric energy" comprises: 1) Efficiency Vermont costs of delivery, plus customer and third-party contributions to measure costs, all adjusted to reflect the comparative risk adjustment of 10% adopted by the Vermont Public Service Board in Docket 5270; and 2) costs or savings associated with fuel, water, and building operation and maintenance.

energy in 2012 was less than $0.001 per kWh. By contrast, the cost of comparable electric supply in 2012 was $0.086 per kWh.

- Efficiency Vermont's heating and process fuels efforts supplied fossil fuel efficiency in 2012 at $0.005 per million British thermal units (MMBtu). Taking into account participating customers' additional costs and savings, the levelized net resource cost of fossil fuel saved through efficiency in 2012 was $0.014 per MMBtu, whereas the avoided cost for that fuel was $0.029 per MMBtu.

Program Information and References

Efficiency Vermont (2013). *2012 Annual Report*. Submitted Vermont Public Service Board and to the Vermont Department of Public Service, October 18, 2013.

Efficiency Vermont (2013). www.efficiencyvermont.com/For-My-Business/.

Taylor et al. (2012).

CASE STUDY 3. HUSKY INJECTION MOLDING SYSTEMS

Company: Husky Injection Molding Systems, Milton, Vermont

Husky Injection Molding Systems is a manufacturer of injection molding equipment. Having recently joined the Energy Leadership Challenge, Husky was committed to reducing its electricity use by 7.5%, and Efficiency Vermont partnered with them to help them achieve their target.

Efficiency Measures: installation of submeters, optimization of pressure and volume of metal working fluid, operational changes in equipment

Offering/Incentive: not available

Project Cost: not available

Energy Savings: 4,500,000 kWh per year

Energy Cost Savings: $340,000 total saved per year, including $160,000 per year in 2012 through systems optimization and $120,000 per year through shutting off equipment during downtime

Payback Period: not available

Non-Energy Benefits: not available.

B.4. Energy Trust of Oregon

Program Summary

The Energy Trust of Oregon (ETO) Production Efficiency (PE) program offers industrial and agricultural businesses of all types and sizes technical services and cash incentives to help them identify and implement electric and natural gas energy efficiency projects and practices. ETO promotes innovative technological and behavioral approaches to IEE and provides technical expertise, training, and project funding to help companies plan, manage, and improve their energy efficiency.

In 2008, PE began an intentional strategy to diversify the program's offerings with new O&M and SEM offerings delivering a substantial increase in savings in 2010, which has been maintained for the past three years. The diversification of offerings has helped the program round out its portfolio as the contribution of savings fluctuates between offerings.

The program works closely and consultatively with industries over the long term, helping these businesses employ best practices and continuously improve their energy performance. The program has been designed and managed in-house since 2008 and is delivered with the support of a large number of contractors:

- Program delivery contractors (PDCs) with deep technical and program expertise bring the program to market and make it easy for customers and trade allies to participate.
- Allied technical assistance contractors (ATACs) provide high quality technical studies to enable customers to make investment decisions on custom energy efficiency projects.
- Industrial technical service providers (ITSPs) support the development of customer capacity to manage their own energy use and reduce energy waste in their operations with SEM.
- Trade allies and other vendors act as an additional sales force program, speeding the implementation of more standard measures such as lighting and irrigation and streamlining the customer experience of project development and working with the program.

Program Offerings

Production Efficiency is organized around and achieves savings through two primary pathways—custom and streamlined. Each is targeted to specific industry needs and/or market segments with differing complexity, delivery channels, and development timelines.

Custom Track: The Custom Track is delivered by PDCs acting as energy efficiency account managers. It includes custom capital and O&M projects as well as SEM offerings. By performing custom analysis and verification of savings for each project, the program has the flexibility to work with large industrial retrofits, unique process improvement projects, and emerging technologies and practices. The Custom Track works with medium to large industries, which are provided with energy efficiency services and incentives to drive deep and persistent process efficiencies. Custom capital and O&M projects are supported by assigned PDCs and ATACs, who provide detailed technical studies. SEM opportunities are identified by PDCs and delivered by a separate pool of ITSPs. All in all, approximately 30 Oregon firms participate as contractors in some role in the custom track.

Custom incentives are project-based. ETO offers cash incentives, calculated on an individual case-by-case basis, for almost any type of energy efficiency project with savings that can be quantified through a study and verified. PE provides free custom technical analysis studies through qualified ATACs.

- Custom Track incentives are $0.25 per annual kWh saved and $2.00 per annual therm saved, capped at 50% of eligible project costs.
- The 90 x 90 industrial O&M incentive is for standalone custom O&M measures and provides 90% of implementation costs to sites that implement recommended O&M measures and required persistence strategies within 90 days, capped at $0.08 per kWh and $0.40 per therm. Sites that complete after the 90 day implementation period revert to the standard O&M incentive for 50% of project costs.
- SEM initiatives receive valuable free training, technical support, and coaching to establish or develop a comprehensive SEM program at their plant. Incentives for achieving behavioral/O&M energy savings during implementation of SEM offering are $0.02 per annual kWh saved, or $0.20 per annual therm saved.

Streamlined Track: The Streamlined Track includes Industrial Lighting and the Small Industrial and Agricultural Initiative. Streamlined projects are delivered through trade ally networks, developed and organized by a different set of PDCs. Trade allies are recruited and provided with calculated savings tools and a simplified incentive process. This is effective for standard measures where savings are easily calculated by common formulas with a small number of inputs. It streamlines program participation and reduces the cost of delivery, enabling a cost-effective approach to smaller projects.

Results

A summary of energy savings from industrial customers is provided in Table B-6.

- Program volume for the PE program has more than quadrupled over the past 5 years as ETO has expanded tracks and created new initiatives. The trade ally tracks in lighting and small industrial have been the major contributors to this growth. Currently, PE completes close to a thousand projects a year and expects this to be about the same or higher in 2013.
- The savings from SEM engagements increased by nearly 50% in 2012.
- In 2012, 73% of electric savings in 2012 came from the Custom Track (capital, O&M, SEM) while 27% of savings came from Streamlined Tracks (lighting & small industrial).

Table B-6. ETO Energy Savings From Industrial Customers (2010–2013)

	2010	2011	2012	2013
Electric savings (MW_{avg})	15.2	14.8	14.7	16.9
Gas savings (million annual therms)	0.6	1.0	0.9	2.2

Cost-Effectiveness

ETO has also found its industrial offerings to generate low-cost electricity and natural gas savings. Table B-7 highlights that industrial electricity savings cost 20%–40% less than savings in the residential sector. Gas savings in the industrial sector cost less than half those generated from ETO's residential programs. In 2010, industrial sector costs from electric savings were almost 40% lower than residential costs.

Table B-7. Electricity and Gas Savings in Different Customer Classes in ETO Programs (2011–2012)

	Electric Savings: Levelized Cost (¢/kWh)		Gas Savings: Levelized Cost/Therm (¢/therm)	
	2011	2012	2011	2012
Industrial	2.5	2.6	19	25
Commercial	2.9	2.6	32	34
Residential	3.2	3.0	44	44

Source: Energy Trust of Oregon Annual Reports to the Oregon Public Utility Commission 2011, 2012

Similarly, Table B-8 shows that ETO's industrial PE program was one of its most cost-effective programs in terms of utility and societal benefits to cost ratios.

Table B-8. Benefit-Cost Ratios for Different ETO Program Offerings (2012)

Program	Combined Utility System Benefit-Cost Ratio	Combined Societal Benefit-Cost Ratio
New Homes and Products	1.8	2.0
Existing Homes	2.3	1.8
Existing Buildings	2.4	1.7
New Buildings	3.5	2.5
Production Efficiency (ETO's industrial offering)	3.0	2.0
NW Energy Efficiency Alliance	3.7	1.2

Source: Energy Trust of Oregon Annual Report to the Oregon Public Utility Commission 2012

Program Information and References

Nowak, S., Kushler, M.; Witte, P.; York, D. (2013). *Leaders of the Pack: ACEEE's Third National Review of Exemplary Energy Efficiency Programs*. Report Number U132. ACEEE.

ETO (2013). *2012 ETO Annual Report.*

ETO (2013). *Brief: Energy Trust of Oregon Energy Efficiency Programs*. June 7, 2013. http://energytrust.org/library/reports/Brief-Energy_Efficiency_Programs.pdf.

ETO (2013). "Oregon Sawmill Cuts Energy Waste In Product Expansion." http://energytrust.org/library/case-studies/IND_CS_SouthportForest.pdf.

CASE STUDY 4. SOUTHPORT FOREST PRODUCTS

Company: Southport Forest Products, North Bend, Oregon

Small log sawmill and whole log chipping facility

Efficiency Measures: new efficient gas-fired boiler, dry kiln improvements: heat exchange vents; dry kiln improvements—fan variable-frequency drive control

Offering/Incentive: $240,600

Project Cost: $568,419 total

Energy Savings: 226,421 therms; 181,073 kWh per year

Energy Cost Savings: $131,321 per year

Payback Period: not available

Non-Energy Benefits: lower operating and energy costs, improved controls, facilitated diverse product line.

B.5. New York State Energy Research and Development Authority

Program Summary

New York State has one of the largest and longest running state-run energy efficiency programs in North America. The New York State Energy Research and Development Authority (NYSERDA) is a public benefit corporation created in 1975 to help New York meet its energy goals. NYSERDA offers objective information and analysis, innovative programs, technical expertise, and funding to help New York increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels. NYSERDA industrial programs are funded from a number of sources, of which ratepayer system benefits charge funding is the primary source. Process and energy efficiency, combined heat and power (CHP), and research and development programs help manufacturers and data centers compete and succeed in the global economy.

Program Offerings

NYSERDA offers several programs for its large commercial and industrial customers, with an overview provided in Table B-9.

Industrial and Process Efficiency Program (IPE): NYSERDA's IPE Program provides financial incentives to manufacturers and data centers in New York State that enhance productivity and energy efficiency. Eligible projects include improvements to industrial processes, information technology efficiency, and support systems. Incentives are available to both new and existing facilities.

Table B-9. Overview of NYSERDA Industrial and Process Efficiency Incentives Available to Manufacturers and Data Centers That Implement Energy Efficiency and Process Improvements

Incentive Type	Utility	Upstate	Downstate
Process and Energy Efficiency Incentives	Electric	$0.12/kWh	$0.16/kWh
	Natural Gas	$15/MMBtu	$20/MMBtu
Operations and Maintenance Incentives	Electric	$0.05/kWh	$0.05/kWh
	Natural Gas	$6/MMBtu	$6/MMBtu
Maximum Incentive	All Projects	50% Project Cost	
	Electric	$5 million/facility/year	
	Natural Gas	$1 million/facility/year	

Note: The incentive rates shown in Table B-9 are based on annual energy savings. Incentives are determined by multiplying the annual energy savings by the rates shown.

Flexible Technical Assistance Program (FlexTech): NYSERDA's FlexTech Program offers a wide range of flexible, cost-shared technical services to help businesses operating in New York State make intelligent energy decisions. A dedicated team of engineers, technology experts, and energy consultants works with customers to create a customized assessment to identify specific opportunities for reduced energy consumption and cost. FlexTech's goal is to increase the productivity and economic competitiveness of participating facilities by identifying and encouraging the implementation of process and energy improvements. Technical evaluations, process improvement analysis, energy master plans, retro-commissioning, and CHP are eligible for cost-sharing incentives.

Manufacturing Technology Development Program: NYSERDA's Manufacturing Technology Development Program activities advance the application of new energy-efficient technologies in New York State's manufacturing base with strategic focus on strengthening competitive advantage, increasing productivity, and reducing the state's energy and environmental footprint. Activities support the identification and validation of new manufacturing processes and industrial products through demonstration and other methods designed to help defray risk to industrial innovators and the supporting engineering community.

The research and development programs are typically run as periodic competitive solicitations, and consider not only the amount of energy to be saved at a factory where a project is implemented, but also the energy to be saved by the retail consumers of the clean energy product that the factory produces. A prime objective of these research and development projects is to facilitate the growth and expansion of the clean energy economy in New York State by overcoming technical hurdles to enable the efficient mass production of newly-invented clean energy products.

Combined Heat and Power: NYSERDA also offers incentives to promote the installation of clean and efficient CHP systems.

- **CHP Acceleration Program (CHP < 1.3 MW):** NYSERDA provides incentives to promote installation of pre-qualified (or conditionally qualified), pre-engineered CHP systems by approved CHP system vendors at customer sites. The maximum incentive per project, including bonuses, is $1.5 million.
- **CHP Performance Program (CHP > 1.3 MW):** NYSERDA offers incentives to promote the installation of commercially available CHP systems. Incentives are performance-based and correspond to the summer-peak demand reduction, energy generation, and fuel conversion efficiency achieved by the CHP system on an annual basis over a two-year M&V period. The maximum incentive per project, including bonuses, is $2.6 million.

Program Support

In order to fully support the complex needs of large industrial and data center customers, NYSERDA implemented a key account manager strategy in which a dedicated project manager is assigned to be the main point of contact and develop a long-term relationship with the customer. In addition to this staff, a network of industrial outreach consultants, competitively selected for their proven expertise, provides customer assistance with the application process and the determination of the best productivity and efficiency opportunities to pursue.

Program Application

Applications for the IPE and FlexTech Programs are accepted through the Consolidated Funding Application (CFA), which was developed as part of a statewide effort to streamline and expedite the grant application process across a range of New York State grant programs.

Results

Table B-10 shows energy savings goals based on NYSERDA's commercial and industrial electric and natural gas resource acquisition programs through 2015.

Table B-10. NYSERDA Program Savings Goals, 2012–2015

Program Energy Savings	2012	2013	2014	2015	2012–2015
Industrial and Process Efficiency—Electric (MWh)	200,000	200,000	200,000	200,000	800,000
FlexTech—Electric (MWh)	111,250	111,250	111,250	111,250	445,000
Industrial and Process Efficiency—Gas (MMBtu)	1,470,000	735,000	735,000	–	2,940,000
FlexTech-Gas (MMBtu)	100,000	100,000	100,000	100,000	400,000

Cost-Effectiveness

Information not available.

Program Information and References

NYSERDA (2013). www.nyserda.ny.gov/Energy-Efficiency-and-Renewable-Programs/Commercial-and-Industrial/CI-Programs.aspx.

Energy Efficiency Case Study: Irving Tissue. www.nyserda.ny.gov/Publications/Case-Studies/IPE-Case-Studies/Irving-Tissue.aspx.

Taylor, R.P.; Trombley, D.; Reinaud, J. (2012). "Energy Efficiency Resource Acquisition Program Models in North America." Institute for Industrial Productivity. www.iipnetwork.org/IIP_resource_acquisition.

IIP (2013). Industrial Energy Efficiency Programs Database. www.iipnetwork.org/databases/programs/

NYSERDA (2013). *Energy Efficiency Portfolio Standard: Supplemental Revision to the Systems Benefit Charge (SBC) Operating Plan (2012–2015)*. February 15, 2013

CASE STUDY 5. IRVING TISSUE

Company: Irving Tissue, Fort Edward, New York

Construction of new pulp processing, paper machine, production support systems, boiler plant, and associated buildings

Offering/Incentive: NYSERDA incentive is $1,775,000

Project Cost: incremental cost for these energy-saving improvements was $4.3 million

Efficiency Measures: built energy efficiency into the new manufacturing processes and systems, vacuum systems, motor systems, and process-specific improvements

Energy Savings: 14,800,000 kWh per year (compared with a standard paper machine installation)

Energy Cost Savings: not available

Payback Period: not available

Non-Energy Benefits: not available.

B.6. Rocky Mountain Power wattsmart Business (Utah)

Program Summary

Rocky Mountain Power (RMP) offers energy efficiency programs, technical expertise, and incentives for new construction and retrofit projects to qualifying commercial, industrial, and agricultural customers. RMP is an electric utility in Utah, serving approximately 800,000 customers in Utah and responsible for 44% of total energy sales in the state.

Effective July 1, 2013, RMP's Utah program consolidated its energy efficiency programs for businesses and increased its incentives. To make the program easier for customers to understand and participate in, and to streamline program administration, RMP combined Energy FinAnswer (the main industrial program), FinAnswer Express, Recommissioning, and Self-Direction Credit into a single program, known as "wattsmart Business." This request was approved under Schedule 140 by the Utah Public Service Commission.

Program Offerings

RMP Utah's revised offerings for C&I customers include the following.

Typical upgrades/incentive lists: Incentive lists provide pre-calculated cash incentives for improvements to lighting, HVAC, compressed air, motor systems, and other equipment. It was previously known as the FinAnswer Express program.

Custom analysis: Offers energy analysis studies and services for more comprehensive projects. RMP is increasing incentives from $0.12 to $0.15 per kWh for non-lighting custom measures, and project incentives will now be capped at 70% of project cost, an increase from the previous cap of 50%. It was formerly known as the Energy FinAnswer program. The custom lighting incentive remains unchanged at $0.10 per kWh.

For the bill credit option previously known as "Self-Direct Program": Eligible customers continue to receive a credit of 80% of qualifying project cost. This credit offsets the monthly customer efficiency service charge until all available credits have been used. An eligible customer has an annual energy use of 5 million kWh per year or 1,000 kW demand per month, and customers may aggregate their sites to qualify. Qualifying projects have a simple payback of between one and eight years; projects with more than an eight-year payback may qualify pending a secondary review of cost-effectiveness. Participating customers have the option of taking the available lump sum cash incentive or the bill credit option. Verification requirements are the same as under typical equipment and custom projects, where a pre-inspection and/or post-inspection may be undertaken to verify savings.

Energy management: Offer provides expert analysis to help lower energy costs by optimizing facility's energy use. Facilities receive $0.02 per kWh for verified savings implemented through energy management strategies under the wattsmart Business program.

Under the energy management program, there are different opportunities, each requiring an increasing level of engagement from the participant:

1. **Recommissioning**: A 3–6 month engagement targeting single systems, e.g., "chilled water loop" or "primary air handlers"—a "find the problem and fix the problem" approach.
2. **Industrial recommissioning**: A 3–9 month engagement targeting process systems, e.g., compressed air or refrigeration—track baseline and tune-up system operations.
3. **Persistent commissioning**: A 6–12 month engagement that is data driven, focusing on the whole building/facility and targeting more comprehensive improvements over time.
4. **Strategic energy management**: An 18–24 month commitment requiring an internal energy manager and focusing comprehensively on the whole building and/or industrial processes. There are two participation options—the cooperative option pairs business and organizations with similar operations, such as school districts, water treatment, etc. The one-to-one option offers engagement with a single customer, requires executive sponsorship, and includes monthly in-person meetings.
5. **Energy project manager co-funding:** Available to customers who commit to an annual goal of completing energy projects resulting in 1,000,000 kWh per year in energy savings. The available co-funding is based on $0.025 per delivered kWh per year up to the full salary of the customer-selected energy project manager.
6. **Peak management:** Offers incentives to businesses to reduce their energy use during peak demand.

RMP also offers businesses the Energy Profiler Online program, which monitors facility electricity consumption and converts it into easy to understand charts and graphs. Once enrolled, daily meter reads will be posted to a secure website to help facilities track energy usage versus budget, find energy issues that may be wasting money, manage monthly demand charges, and measure effectiveness of energy efficiency projects.

Results

Sector level and industrial program results for 2012 are provided in Table B-11.

Table B-11. Rocky Mountain Power Utah Electricity Savings and Program Expenditures

Energy Efficiency Programs	kWh/Yr Savings (at site)	kWh/Yr Savings (at gen)	Program Expenditures
Total Industrial:	28,795,470	30,478,565	$4,781,027
Energy FinAnswer (125)	15,272,168	16,164,826	$3,003,454
FinAnswer Express (115)	5,492,904	5,813,964	$1,312,532
Recommissioning (126)			$6,664
Self-Direct (192)	8,030,398	8,499,775	$458,378
Total Residential	94,627,738	103,445,150	$15,423,913
Total Commercial	93,878,382	102,057,067	$13,816,366
Total Agricultural	244,794	267,406	21,027
Total Energy Efficiency	217,546,384	236,248,188	$35,880,194

Source: Rocky Mountain Power 2013c

Cost-Effectiveness

The latest results available for RMP Utah's previous programs under the industrial and commercial portfolio are summarized in Table B-12.

Table B-12. Rocky Mountain Power Utah Benefit-Cost Ratio

	Total Resource Cost Test	Utility Cost Test	Participant Cost Test	Ratepayer Impact
Commercial and Industrial Portfolio	1.99	3.84	2.32	0.91
FinAnswer Express	1.51	3.42	1.79	0.9
Energy FinAnswer	2.31	4.77	2.62	0.94
Re-Commissioning	1.54	1.66	11.35	0.77
Self-Direct	2.43	2.63	2.98	0.86
Residential Portfolio	2.26	2.51	4.33	0.74
Total Energy Efficiency	2	3.14	2.82	0.84

Source: Rocky Mountain Power 2013c

Program Information and References

Pacificorp (2013). Pacificorp Facts. www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/About_Us/Company_Facts/6709-30_RMP_FACTSHEET_2013_Fweb.pdf.

Rocky Mountain Power (2013c). Rocky Mountain Power Electric Service Schedule No. 140. State Of Utah. Filed: May 21, 2013. Effective: July 1, 2013.

Rocky Mountain Power (2013d). Utah Energy Efficiency and Peak Reduction Annual Report. www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Demand_Side_Management/2013/UT2012AnnualReport_062613_FINAL_V2.pdf.

Rocky Mountain Power (2013e). Energy Efficiency Case Study: BD Medical. www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/Business/Save_Energy_Money/Energy_FinAnswer_13.pdf.

CASE STUDY 6. BD MEDICAL

Company: BD Medical, Sandy, Utah

Efficiency Measures: 62 energy efficiency projects since 2001 including 29 lighting projects, compressed air upgrade/replacement. (BD ran five compressors and four dryers prior to upgrade. After the upgrade the company runs three compressors and three dryers.)

Offering/Incentives: $712,900 incentive payments, with a total project cost of $1,880,500

Project Cost: not available

Energy Savings: 10.4 million kWh per year

Energy Cost Savings: $580,000 per year

Payback Period: not available

Non-Energy Benefits: operational process improvements, facilitates maintenance of ISO certifications, lower environmental impact, improved employee comfort

B.7. Wisconsin Focus on Energy Industrial Programs

Program Summary

Wisconsin has more than 100 separate electric and natural gas utilities, including investor-owned, municipal, and rural cooperative utilities. Systems benefits charges from these utilities' ratepayers fund Wisconsin Focus on Energy (WFE). WFE consolidates all of the state's utility-managed energy efficiency programs into one statewide program, representing 98% of the state's electric and natural gas load. WFE's industrial programs offer assistance to all eligible industrial customers, consisting of approximately 12,000 customers ranging in size from small light manufacturing to heavy industrial processes.

Although WFE began by offering prescriptive and custom incentives, other types of offerings, including feasibility studies, performance-based assessments, staffing grants, and competitive RFPs, developed over the years and have helped generate more participation in the programs. Practical Energy Management™ (PEM) is now a main feature of the programs for large energy users, geared toward teaching and providing individual customers with a customizable template that enables them to gain control of their energy costs.

In 2012, WFE restructured the program to target customers stratified by energy usage: the large energy users program, a general business incentive program, a chains and franchise program, and a small business program.

Program Offerings

There are five types of incentives offered to large energy users:

- **Prescriptive Incentives**: Hundreds of prescriptive incentive offerings for technologies such as lighting, compressed air, variable-frequency drives, and boiler tune-ups.
- **Custom Incentives**: Offered for verified electric and natural gas projects at $0.04 per kWh, $125 per kW, and $0.40 per therm.
- **Feasibility Studies**: Up to 50% of the cost of a study, not to exceed $7,500, paid to studies that show good potential for energy saving projects.
- **Staffing Grants**: For customers who demonstrate a need for human resources to complete projects.
- **Special Offers**: Include compressed air leak study and repair, compressed air retro-commissioning, process energy bounties, and performance-based assessments used to engage trade allies and leverage new projects.

For larger customers with more than $60,000 in monthly bills, WFE offers PEM, a systematic energy management approach to profile energy use, identify and prioritize energy-saving projects, capitalize and implement projects, communicate results to management, and continually improve overall process. The PEM process is customized to meet the user's specific needs. The tools provided by PEM include project-tracking software and energy best-practice calculations. It provides a tool for large energy users to identify energy savings after WFE has left the facility. Staffing grants are available to pay for staff time to implement energy projects.

By working closely with each industry, WFE is able to offer process-specific expertise and build a relationship with the consumer. The program applied its *Energy Best Practice Guidebooks*, training events, and webinars to bring best practices to key cluster industries including pulp and paper, food processing, metal casting, plastics, ethanol, and water/wastewater. The program also developed and supported training in the key industrial systems such as steam, heat processing, compressed air, and refrigeration, relying heavily on the DOE's suite of energy efficiency decision tools. Program staff work with facilities to identify projects and negotiate the amount of incentive needed to initiate a project. Expert field energy advisors provide direct service delivery through communication channels with customers, trade allies, and utility key account managers. The program has partnered with one contractor successfully for almost 14 years, providing steady service to large industrial customers under the WFE brand.

Results

The WFE industrial program has consistently exceeded its goals for both natural gas and electric savings. Over the years, spanning from 2001 into 2012, the program reached almost 4,000 customers—more than one-third of the market—including all of the top 200 eligible industrial energy users in the state. There were 952 individual companies participating in 2011 alone. Verified net savings values since the industrial programs were restructured in 2012 are summarized in Table B-13.

Table B-13. Summary of First-Year Annual Savings by Program (2012)

Program	kWh	Therms
Business Incentive	91,681,793	2,152,273
Chain Stores and Franchises	37,036,344	433,661
Large Energy Users	61,344,005	3,119,919
Small Business Program	13,642,762	21,904
Nonresidential Legacy	130,712,439	7,475,589
Nonresidential Programs Total	334,417,343	13,203,348

Savings include carryover from previous year(s)
Source: Public Service Commission of Wisconsin 2013

Cost-Effectiveness

The benefit-cost test approved for WFE use is based upon the total resource cost (TRC) test. A recent evaluation of the residential and nonresidential (commercial and industrial) is provided in Table B-14.

Table B-14. Total Resource Cost Test Ratios by Sector in 2012

	Residential	Non-residential	Total
TRC with renewables	2.41	3.07	2.89
TRC without renewables	2.69	3.83	2.69

Source: Public Service Commission of Wisconsin 2013

Emissions Benefits

The program evaluation also quantified the benefits of reduced nitrogen oxides, sulfur dioxides, and carbon dioxide emissions in 2012 (see Table B-15).

Table B-15. Program Emissions Benefits

	Nonresidential	Residential	Total
2012 Emissions Benefits	$110,122,130	$30,961,768	$141,083,899
2011 Emissions Benefits	$84,075,436	$19,667,147	$103,742,582

Source: Public Service Commission of Wisconsin 2013

Program Information and References

Wisconsin Focus on Energy (2013). http://focusonenergy.com/business.

ACEEE (2013). http://aceee.org/sector/state-policy/wisconsin.

IIP (2013). www.iipnetwork.org/databases/programs/wisconsin-focus-energy.

Nowak, S.; Kushler, M.; Witte, P.; York, D. (2013). *Leaders of the Pack: ACEEE's Third National Review of Exemplary Energy Efficiency Programs.* Report Number U132. ACEEE.

Public Service Commission of Wisconsin (2013) *Focus on Energy: Calendar Year 2012 Evaluation Report.* Volume I. April 30, 2013. Cadmus Group.

CASE STUDY 7. AMERICAN FOODS GROUP

Company: American Foods Group, Green Bay, Wisconsin (beef processing facility)

Offering/Incentive: training on Practical Energy Management™

Project Cost: not available

Efficiency Measures: a wide range of energy management projects

Energy Savings: six energy management projects implemented in 2006

Energy Cost Savings: $143,000 in energy cost savings from six projects. An additional 11 projects were underway to save an additional $0.9 million

Payback Period: average 6 months

Non-Energy Benefits: not available.

B.8. Xcel Energy (Colorado and Minnesota)

Program Summary

Xcel Energy in Colorado and Minnesota provides simple incentive applications for a full suite of programs—prescriptive, self-direct, and custom process energy efficiency incentives—to provide flexibility for their industrial customers. Xcel's Process Efficiency program integrates its technical assistance, energy management support, and incentive programs. The program is available to industrial customers with energy conservation potential of at least 2 GWh, which usually translates to total annual electricity consumption of at least 20 GWh.

Program Offerings

Process Efficiency is the major industrial program. The program helps industrial customers evaluate both business practices and technical projects, and supports companies to practice energy management as a tool to strengthen existing and ongoing energy efficiency activities. The program operates in three phases:

Phase 1—Identify Opportunities: Xcel offers a no-cost, one-day energy management session (based on the EnVinta One-2-Five energy management model) to evaluate energy-intensive processes and benchmark energy management practices; Identify energy-saving technical opportunities during a high-level, walk-through audit; and review follow-up assessment report that outlines industrial customers' energy management practices and high-priority action items

Phase 2—Scope Energy Efficiency Potential: Facilities then develop an energy action plan based on the assessment report. Xcel prepares a customized proposal to help support additional project scoping and provide engineering and technical studies to develop energy-saving opportunities. Xcel funds 75% of the cost of the study. Facility contributions are limited to 25% with a cap of $7,500. If the study costs more than $30,000, Xcel will cover the balance.

Phase 3—Implement Energy Efficiency Improvements and Qualify for Rebates: After the detailed assessment is completed, Xcel Energy and the customer sign an agreement that outlines improvements to implement, set a timeline for their installation, and detail customized rebates, bonuses, and support. Xcel Energy encourages the customer to agree to complete projects within a year, but allows longer timeframes if needed.

Prescriptive and custom measures are available within the program. The guidelines and rebate levels of the other products are mirrored with enhancements to drive customers to approach conservation on a system level versus a component level.

Delivery of this product is resource intensive both internally and externally. The magnitude and complexity of the projects require significant resources from Xcel's technical staff to support the project and the M&V requirements. The more developed relationship with the customer requires significant account management resources, and the customization of the offering to match customer needs requires significant marketing resources. External resources are used to deliver both the identification and scoping phases of the product. Third-party providers deliver the Phase 1 session. The product emphasizes building on what the customer has in place, so, when possible, Xcel includes vendors that the customer is already working with who are familiar with the operations. This has included various engineering firms and equipment vendors.

Xcel Energy has a range of other commercial and industrial offerings, including:

- **Prescriptive offerings** for equipment and systems (compressed air, cooling, heating, lighting, motors)
- **Custom efficiency** for a wide variety of equipment and process improvements that do not fall within predetermined rebates under prescriptive products
- **Data center efficiency**, which provides rebates for data centers and large-scale information technology operations
- **New construction**, which provides energy expertise and design assistance supporting an integrated design process for new construction or a major renovation project
- **Recommissioning**, which reviews existing equipment and systems within a building to ensure that they are working as efficiently as possible and operating as intended. The program is designed to assist electric and/or natural gas business customers to improve identification of existing functional systems that can be "tuned-up" to run as efficiently as possible through low- or no-cost improvements.
- **Self-direct program** provides large commercial and industrial electricity customers in Colorado the opportunity to self-fund electric energy saving projects at their facilities (see Chapter 5).

Results and Cost-Effectiveness

Tables B-16 and B-17 show Xcel's electric and gas savings and cost-effectiveness ratios for the commercial/industrial programs in both states.

Table B-16. Xcel Energy (Colorado) Electric and Gas Savings and Total Resource Cost Ratios

	Electric and Gas Savings		Total Resource Cost Tests	
	2010–2012 average (electric kWh)	2010–2012 average (decatherm gas)	2010–2012 average (electric programs)	2010–2012 average (gas programs)
Commercial and Industrial Programs	**188,661,742**	**76,327**	**2.70**	**1.37**
Compressed Air Efficiency	2,723,733	-	2.08	-
Custom Efficiency	5,530,809	8,419	1.85	1.38
Motor and Drive Efficiency	26,329,811	-	3.67	-
New Construction	18,657,939	24,570	2.17	1.60
Process Efficiency	5,307,299	-	2.27	-
Recommissioning	5,602,323	12,667	1.95	2.39
Self-Direct Custom Efficiency	8,784,932	-	2.34	-
Standard Offer	2,748,717	2,421	1.14	0.88
Residential Programs	**113,285,966**	**270,841**	**4.04**	**1.28**

Table B-17. Xcel Energy (Minnesota) Electric and Gas Savings and Cost-Effectiveness Ratios

	Electric and Gas Savings		Cost Tests	
	2012 (electric kWh)	**2012** (decatherm gas)	**2012 Total Resource Cost** (electric programs)	**Triennial Societal Test** (gas programs)
Commercial and Industrial programs	**307,749,043**	**468,710**	**2.77**	**4.72**
Compressed Air Efficiency	13,582,375	0	2.79	-
Cooling Efficiency	12,751,893	0	2.82	-
Custom Efficiency	18,902,718	37,232	2.12	5.27
Motor & Drive Efficiency	29,144,249	0	3.35	-
New Construction	34,926,304	64,312	2.98	7.11
Process Efficiency	49,473,722	217,344	3.54	10.99
Recommissioning	10,960,929	18,946	1.51	2.49
Self-Direct Custom Efficiency	0	0	-	-
Turn Key Services	1,423,070	0	1.57	-
Residential programs	**156,667,754**	**245,219**	**3.15**	**2.29**

Program Information and References

Xcel Energy (2010). *Process Efficiency Information Sheet—Colorado and Minnesota*.

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Xcel Energy (2013a). "New Technology Helps Frozen Food Warehouse Roll Up Big Energy Savings." Arctic Cold Storage custom efficiency case study. www.xcelenergy.com/staticfiles/xe/Marketing/Files/Case-Study-Dock-Door-Replacement.pdf.

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CASE STUDY 8. ARCTIC COLD STORAGE

Company: Arctic Cold Storage, St Cloud, Minnesota

Arctic Cold Storage stores meat, poultry, packaged foods, and raw materials for food processing. With more than 5.5 million cubic feet of temperature-controlled warehouse space, energy consumption plays a significant role in day-to-day business.

Efficiency Measures: high-speed roll door with operating speeds of more than eight feet per second

Offering/Incentive: $8,300

Project Cost: $16,965

Energy Savings: 110,000 kWh (estimated)

Energy Cost Savings: $8,130 (estimated)

Payback Period: 1.1 years

Non-Energy Benefits: not available.

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