Encouraging sustainable load growth: NYSERDA's approach to capture process-efficiency opportunities in the industrial sector

Ned Harris
Research Into Action, Inc.
3934 NE Martin Luther King, Jr. Blvd., Suite 300
Portland, OR 97212
USA
nedh@researchintoaction.com

Patricia Gonzales, Ph.D.
NYSERDA
17 Columbia Circle
Albany, NY 12203-6399
USA
pmg@nyserda.org

Keywords

process evaluation, industrial processes, trends, profits, policy-induced savings, sustainability, awareness, process efficiency, per-unit-of-production calculation

Abstract

Despite the recent economic downturn, market indicators suggest the industrial sector is poised for a new period of major capacity investments as existing capacity approaches full utilization. At the same time, global trends are encouraging a shift to domestic production for domestic consumption. These indicators represent a major opportunity to influence the energy efficiency of industrial facilities for generations to come (Elliott et al. 2008). Energy efficiency program providers will need new models to obtain large industrial energy efficiency savings. The Industrial Process Efficiency (IPE) Program offered by the New York State Energy Research and Development Authority (NYSERDA) provides one such model.

Introduction

This paper provides insights its authors gained about the 2009-2012 IPE Program from the three-stage process evaluation we conducted between 2010 and 2012. Put simply, the program succeeded: its innovative program design and strong implementation attained several of its goals. Here, we describe lessons we learned through this evaluation – particularly regarding how to capture the important, but often untapped, process-efficiency energy savings in manufacturing plants and data processing centres, and the relationship between industrial capacity utilization and industrial decision-making. Specifically, we explore NYSERDA's innovative per-unit-of-production calculation method. In addition, this paper examines the extent to which IPE Program processes conformed to industrial energy efficiency best practices the evaluators identified during their review of best practice studies. Finally, the report provides recommendations to energy efficiency program managers.

We hope that others can draw on this experience as they design, position, implement, and evaluate energy efficiency programs in the industrial sector.

Evaluation methods

The objectives of all the waves of research were to: help program staff assess the effectiveness of the program outreach; identify customers' reasons for undertaking efficiency improvements and participating in the program; examine program processes and operations; document program progress; and make recommendations for program improvement. In addition to these objectives, the evaluation team identified and assessed decision-making concerns and criteria, and barriers to process-efficiency and per-unit-of-production calculations.

To collect information, the process evaluation team developed structured interview guides for the six key groups involved in the program: program staff members, focus contractors, technical reviewers, customers, partial participants, and contractors. The team conducted in-depth interviews with representatives of each of these six groups between June 3 and July 14, 2011 (Table 1).

Table 1. Number of interviews conducted with each type of respondent.

Respondent	Wave 1	Wave 2	Wave 3
Program staff	9	11	8
NYSERDA C&I marketing manager	—	—	1
Focus contractors	—	3	3
Technical reviewers	6	6	4
Department of Energy (DOE) contractors	—	3	—
Participants	25	—	23
Partial participants	—	—	5
Participants' contractors	14	—	13
High-volume contractors	3	—	—

IPE program context

REGULATORY ENVIRONMENT

NYSERDA, a public benefit corporation established in 1975, began administering systems benefits funds throughout the state of New York in 1998. During 2008, several changes arising from the New York State Public Service Commission's (PSC) Energy Efficiency Portfolio Standard (EEPS) proceeding affected NYSERDA's program portfolio and evaluation efforts. EEPS included the goal to reduce the state's electricity and natural gas usage by 15 % from forecast levels by the year 2015. To support this ambitious goal, NYSERDA received an additional $80 million (60,615,280 Euro) per year for five new programs. One of these programs, IPE, targeted energy savings goals in the industrial and data centre sectors.

ECONOMIC CONTEXT

One important economic indicator for the industrial sector is capacity utilization. The capacity utilization rate describes the extent to which the industrial sector's production capabilities actually are being used to produce the current level of output (Federal Reserve 2011). In general, a high rate of capacity utilization is a positive indicator of economic health. The authors of a 2008 report for ACEEE noted, "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. The program can then maximize the potential for deployment of energy efficiency technologies in the marketplace" (Elliott et al. 2008, 3).

Despite current global financial and economic challenges, including the unravelling of subprime mortgage investments, climate change, political instability, and globalization, credible market indicators predict an increase in industrial-sector capital investments (Elliott et al. 2008). For instance, U.S. Federal Reserve data show that manufacturing is approaching historically high levels of capacity utilization, while productivity growth is slowing. This suggests that many industries are nearing a point at which they will need to make new investments. These economic trends – combined with increases in the cost of marine freight that are offsetting much, if not all, of any benefit in manufacturing overseas – and recent declines in the dollar relative to other currencies, make domestic industrial production even more attractive. Without new capacity, industry will not be able to meet growth in demand for its products. These signs indicate that the industrial sector likely will experience a new capital investment cycle in the near future.

Figure 1 displays industrial capacity (bar graph) and industrial capacity utilization (line) between 1986 and 2012. Following the deep recession the economy entered in late 2008 (arrow), industrial output has risen by a strong average of 6.0 % per year, and has recovered 58.7 % of the losses that began in 2008 (Strauss 2012).

The IPE Program is positioned to take advantage of potential capacity investments. The program's per-unit-of-production calculation method appropriately shifts the emphasis from traditional equipment upgrades (drives, motors, etc.) to improving firms' ratio of energy use to physical output.

IPE Program goals, design, implementation, and results

PROGRAM GOALS

The program goals included saving approximately 840 million kWh and 1,682,265 MMBtu from projects completed between 2009 and 2013 – almost four times the savings NYSERDA's Existing Facilities Program had achieved in the industrial and commercial sectors during the previous 10 years (NYSERDA 2010).

PROGRAM DESIGN

NYSERDA designed IPE to be different from traditional industrial efficiency programs: The program sought to address a key problem in industrial energy efficiency – moving from measure-by-measure approaches to whole-of-enterprise approaches. Like traditional industrial energy efficiency programs, which achieve energy savings by focusing on replacing lighting, motors, drives, and other support equipment, IPE provides incentives for energy efficiency projects involving support equipment. IPE differs from traditional programs in that it also provides incentives for process-efficiency opportunities. To do so, IPE offers a per-unit-of-production method for calculating process-efficiency incentives. Plants that are expanding capacity may receive incentives if they increase production by using more-energy-efficient equipment (Neimann et al. 2011). NYSERDA refers to this approach as encouraging "sustainable load growth" (NYSERDA 2010). In addition, IPE incentives are available for firms that increase the productive capacity of existing facilities, provided they improve the ratio of energy use to physical output.

PROGRAM IMPLEMENTATION

NYSERDA administers the program. IPE Program staff assist customers and contractors with applications and oversee the incentive process. Key Account Managers serve specific large customers. The key account management approach emphasizes the development of one-on-one, long-term relationships with customers, to help them identify ways to use the program incentives to support energy efficiency in the projects they pursue.

NYSERDA also provides leadership, management, and oversight of two types of contractors assigned to this program: Focus Contractors and Technical Reviewers.

Focus Contractors work with program staff to: support the communication and relationship-building necessary to educate customers, service providers, and stakeholders; identify potential process- and energy-efficiency improvement projects; provide direct assistance with program participation; and further develop contact lists of potential customers.

IPE Technical Reviewers are independent contractors that support all phases of program implementation; they provide both pre- and post-installation support to program staff members, from the application process to post-installation measurement and verification (M&V).

PROGRAM RESULTS

The program succeeded in attaining several of its goals, First, IPE committed all of the funds budgeted for natural gas efficiency projects. Although initial electric (kWh) program savings acquisition did not occur at a rate to meet program goals – a situation that reflected the deep recession the economy entered into in late 2008 and customers' lack of familiarity with process-efficiency incentives – program uptake increased sharply beginning in fall 2010, and staff contacts expected to have encumbered all funds for kWh-saving IPE projects by spring 2012.

A major goal of the program was to increase the proportion of process-efficiency projects (in comparison to non-process equipment upgrades). The program was successful in that regard: the share of the total projects that were process-efficiency projects increased by a factor of three, from 9 % to 27 %. In addition, process-efficiency projects accounted for 40 % of total program savings (Table 2).

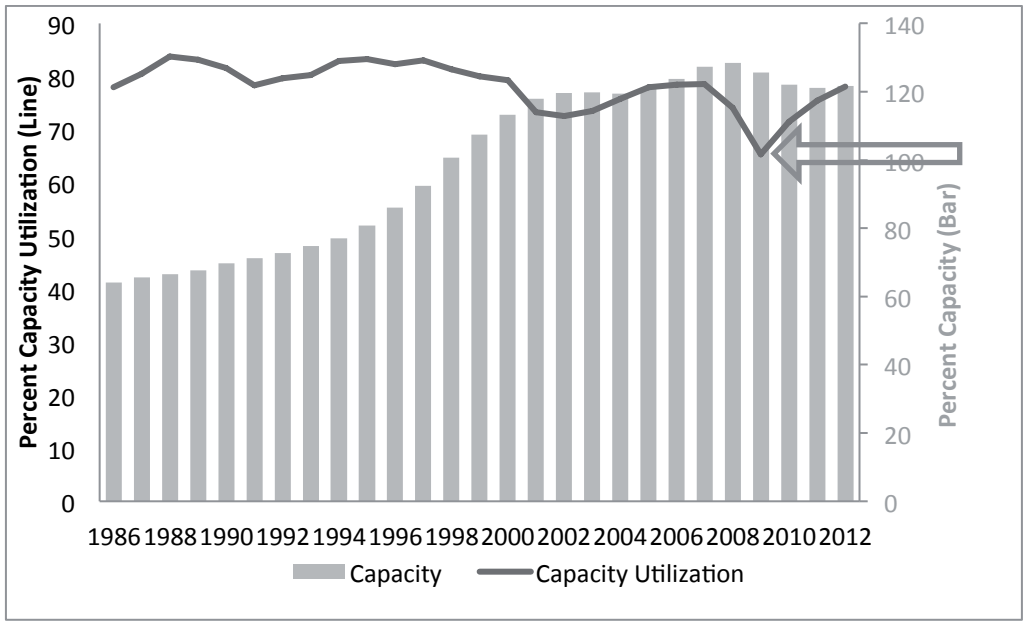

Figure 1. Industrial capacity utilization rates (1986–2012).

Table 2. Projected annual gross kWh Savings and percentage of total projected program kWh (electric) savings by measure category.

Measure Category	Projected Annual kWh Savings	Percentage of Total Projected Program kWh savings
Non-Process Equipment Upgrades		
Industrial non-process equipment upgrades	207,714,322	56%
Data centre non- process equipment upgrades	13,920,773	4%
Non-process equipment upgrades subtotal	*221,635,095*	*60%*
Process Efficiency Projects		
Industrial process-efficiency improvements	106,283,520	29%
Data centre process-efficiency improvements	42,136,556	11%
Process-efficiency improvements subtotal	*148,420,076*	*40%*
Grand Total	**370,055,171**	**100%**

Lessons learned: engaging the industrial sector with process-efficiency incentives

BARRIERS

All three research waves identified similar areas of concern for the program:

- Targeting customers, including list development and prioritization of outreach;
- Addressing barriers to program participation;
- Refinement of customer engagement strategies;
- Reducing delays in project approval, M&V, payment processing, and response time among IPE staff and contractors;
- Addressing confusion about baseline and *net* versus *per-unit-of-production* savings calculations; and
- Coordination with duplicative utility incentive programs targeting data and industrial firms.

We found that it can be challenging to convey to prospective participants that NYSERDA incentivizes process upgrades. The evaluation found that, in part, this is because industrial energy efficiency programs traditionally have engaged the industrial sector in energy efficiency, using a simplistic approach focused on replacement of lighting, motors, drives, and other support equipment.

Staff and Focus Contractors interviewed for the evaluation reported difficulty conveying the energy benefits of process upgrades to customers. According to one staff contact, industrial firms frequently "don't even see process upgrades as energy-efficiency projects – they do them for other reasons." Consistent with this, Focus Contractor contacts clarified that traditionally, process engineers have viewed such improvements as "saving time, not energy."

In addition, the evaluation found that, compared to non-process improvement projects, process upgrades generally are more complex, more expensive, and typically take longer to develop, which can conflict with these firms' capital budget cycles. Furthermore, firms frequently are unable to increase their production due to issues (choke points) such as a limited supply of raw materials. Moreover, many customers are not aware of NYSERDA's incentives for process-efficiency improvements and/or do not understand the concept of calculating savings on a per-unit-of-production basis.

Staff noted that process-efficiency projects require effective and regular interaction between the Project Manager and Technical Reviewers. Staff and Technical Reviewers said that it was particularly challenging to complete engineering analyses and develop M&V plans for process-efficiency projects that are calculated on a per-unit-of-production basis.

In addition, a Technical Reviewer working with data centres to complete process-efficiency projects noted that that it is more difficult to calculate process-efficiency incentives in data centres than in manufacturing facilities. According to one Technical Reviewer, "No one knows how to define a unit of processing." In addition, a staff contact said, "It's a little harder to get the M&V because data centres can't turn anything off."

To address confusion about baseline and net versus per-unit-of-production savings calculations, the program staff worked with Technical Reviewers to develop calculation protocols for baseline measurements, variations in production schedules, and data centre per-unit-of-production calculations.

Staff and contractors also reported that it is difficult to find individuals with the necessary qualifications to complete Focus Contractor and Technical Reviewer activities. To address this issue, the evaluation recommended NYSERDA engage in workforce development activities to increase the number of qualified technical service providers (Albert 2012). Furthermore, the evaluation recommended that additional training and resources would facilitate the technical service providers' ability to effectively identify and assist individuals in the implementation of process-efficiency improvements.

Despite these challenges, Staff and Focus Contractors provided expertise to identify and deeply engage with stakeholders, trade allies, economic development entities, and customers to effectively identify opportunities, support project development, submit applications, and deliver guidance for the program. As noted, the program succeeded in increasing the share of total projects comprised of process-efficiency projects by a factor of three – from 9 % to 27 % – accounting for 40 % of total program savings (Neimann et al. 2011).

When asked what additional NYSERDA support might facilitate customers' pursuit of process-efficiency projects, participant contacts most frequently identified feasibility studies or energy audits to identify potential process-efficiency projects. Contacts also requested: 1) general public education about incentives for process-efficiency improvements; 2) presentations to management and/or stakeholders; and 3) case studies geared toward specific industrial subsectors.

Best practices in industrial energy efficiency programs

NYSERDA's implementation of the IPE Program conformed to several industrial energy efficiency best practices, including:

- Demonstrating an awareness of industrial decision-making processes;
- Building and maintaining lasting relationships with customers;
- Employing targeted industry subsector-specific outreach and program deployment strategies;
- Having partnerships to learn of new and expanding businesses; and
- Coordinating multiple program offerings.

DEMONSTRATING AN AWARENESS OF INDUSTRIAL DECISION-MAKING PROCESSES

In many cases, the person who makes energy-use decisions may not be the same person who makes decisions about the uses of capital expenditure moneys (Chittum, Elliott & Kaufman 2009). A series of evaluations in the 1980s described decision-making processes for industrial energy efficiency (Peters, Way & Seratt 1990). A key finding in this research was

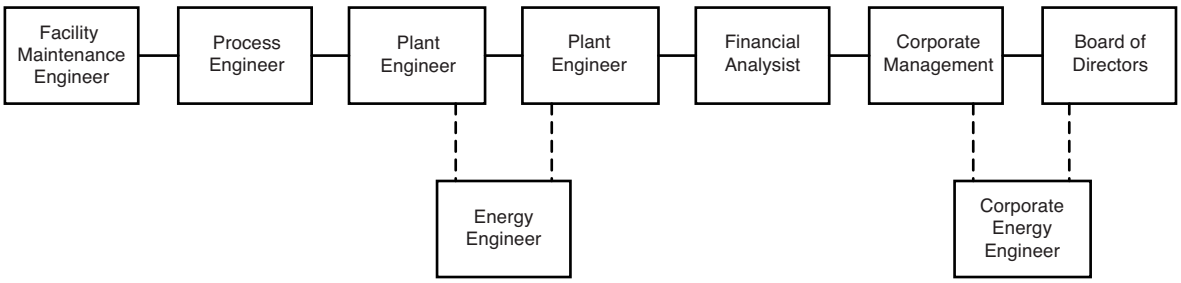

Figure 2. Schematic of levels for industrial firm decision-making.

that industrial firms' staff who were below the level of senior management (particularly facility maintenance and process engineers) played a critical role in the decision-making process within their companies. These staff frequently identified energy efficiency improvements and carried them to management for review and approval.

NYSERDA's implementation of the IPE Program demonstrated an awareness of industrial decision-making processes. For example, when marketing IPE incentives for non-process equipment upgrades (e.g., motors, drives, lighting, etc.), NYSERDA targeted firms' facilities directors and executives. In contrast, when working to secure process-efficiency projects, outreach staff conducted targeted outreach to people in charge of production lines and revenue-generating projects, such as process engineers, as well as members of continuous improvement teams and the highest-level executives, who could weigh the costs and benefits of making energy efficiency improvements that impact production capability (Figure 2).

BUILDING AND MAINTAINING LASTING RELATIONSHIPS WITH CUSTOMERS

Previous research indicates that building and maintaining lasting, one-on-one relationships with industrial end-users is critical to the implementation of successful industrial programs (Chittum, Elliott & Kaufman 2009). IPE's *key account management* approach emphasizes the development of these long-term relationships with customers, helping customers identify ways to use the IPE incentive to integrate energy efficiency into the projects they pursue. In addition, the program provides interested companies technical support and guidance, including identifying potential process and non-process industrial efficiency projects (Neimann et al. 2011).

EMPLOYING TARGETED INDUSTRY SUBSECTOR-SPECIFIC OUTREACH AND PROGRAM DEPLOYMENT STRATEGIES

Based on an understanding of market forces, the IPE Program targeted specific industrial subsectors, and provided relevant messaging and tools geared toward those subsectors. NYSERDA and its contractors used a Customer Relationship Management (CRM) software program to prioritize, coordinate, and communicate about customer outreach. Using this program, NYSERDA and its contractors tracked customer tier, annual kWh and gas usage, kWh and MMBtu savings potentials, and the status of outreach by IPE staff and Focus Contractors.

To identify energy-intensive mid-sized customers for targeted outreach, Focus Contractors conducted a cross-tabulation of Economic Census Data and the Manufacturing Energy Consumption Survey (MECS) published by the Energy Information Agency. Using the North American Industrial Classification System (NAICS) for sectors, the Focus Contractors developed consumption estimates to identify the most energy-intensive customers. This information was incorporated into the CRM system.

The evaluation further recommended that NYSERDA augment lists that classify industrial customers using NAICS codes to include evidence of plant capacity constraints, using capacity utilization data published by the U.S. Federal Reserve (Federal Reserve 2011). At the time of the evaluation research, NYSERDA and its contractors were considering the relative merits of this approach.

HAVING PARTNERSHIPS TO LEARN OF NEW AND EXPANDING BUSINESSES

In a 2009 report for ACEEE, the authors wrote, "Brand-new facilities can offer the best opportunities for making new energy efficiency investments, since every aspect of the new business – the building envelope, the production process itself, and the equipment purchases – can be designed to maximize efficiency" (Chittum, Elliott & Kaufman 2009, 10).

The report notes that economic development entities, real estate partners, and trade associations are good resources from which to learn of new and expanding businesses, because such entities frequently communicate with firms about potential new facilities years before they actually are built.During IPE implementation, IPE staff and contractors worked collaboratively with economic development entities, federal programs such as the Department of Energy's (DOE) Save Energy Now (SEN) Leaders, Manufacturing Extension Partnerships (MEPs), and trade allies (including vendors, trade associations, and project development organizations), and through participation in a variety of industry-related events. This permitted IPE implementers to stay informed about developments taking place among industrial and data centre firms, including new and expanding businesses where multiple IPE incentives may apply.

COORDINATING MULTIPLE PROGRAM OFFERINGS

IPE coordinates multiple program offerings, designed to suit a variety of industrial and data centre firms. The program incentives encourage implementation of non-process equipment upgrades, process-efficiency upgrades, firms' adoption of strategic energy management, and implementation of low- and no-cost operational improvements.

Summary

Industrial energy program managers should consider applying best practices demonstrated by the IPE Program, including:

- Building and maintaining lasting relationships with customers;
- Being aware of firms' investment plans;
- Having partnerships to learn of new and expanding businesses;
- Targeting specific industrial subsectors, based on an understanding of market forces;
- Using technically proficient engineering consultants to assess and develop energy efficiency projects;
- Providing relevant messaging and tools geared toward specific subsectors;
- Motivating trade allies to market the program's incentives as part of selling their goods and services; and
- Coordinating multiple program offerings.

Furthermore, program managers should consider offering incentives that are calculated on a per-unit-of-production basis. The per-unit-of-production calculation method appropriately emphasizes achieving industrial savings through process efficiency upgrades.

ADDITIONAL RECOMMENDATIONS

Include training efforts

Industrial energy efficiency programs targeting process efficiency should include training efforts to ensure that the process efficiency technical service providers can properly identify and implement process-efficiency projects. The training programs should address potential confusion about establishing baseline and *net* versus *per-unit-of-production* savings calculations.

Refine market characterization approaches to provide enhanced methods to designate firms for prioritized outreach

Program managers should target specific industrial subsectors based on an understanding of firms' hours of operation, capital plans, level of interest in energy efficiency and sustainability initiatives, and NAICS code classifications. Programs should augment lists that classify industrial customers using NAICS codes to include evidence of plant capacity constraints, using capacity utilization data published by the U.S. Federal Reserve System. Firms classified under NAICS codes reporting a high capacity utilization rate – relative to their historical averages – should be prioritized for targeted outreach concerning large infrastructure investments. Firms classified under NAICS codes reporting mid- or low-capacity utilization rates should be 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. To be useful, modelling of the industrial sector must take into account regional differences among industries; frequently, regional Federal Reserve offices can provide relevant regional data.

References

Albert, Scott (GDS Associates, Inc.). 2012. Personal communication. April 6.

Chittum, A.K., R. N. Elliott, and N. Kaufman. 2009. *Industrial Energy Efficiency Programs: Identifying Today's Leaders and Tomorrow's Needs*. Research Report IE091. http://www.aceee.org/research-report/ie091. Washington, D.C.: American Council for an Energy-Efficient Economy.

Elliott, R. N., A.M. Shipley, and V. McKinney. 2008. *Trends in Industrial Investment Decision Making.* Research Report IE081. http://www.aceee.org/research-report/ie081. Washington, D.C.: American Council for an Energy-Efficient Economy.

[Federal Reserve]. Board of Governors of the Federal Reserve System. 2012. "Industrial Production and Capacity Utilization - G.17." http://www.federalreserve.gov/releases/G17/. Washington, D.C.: Board of Governors of the Federal Reserve System.

Neimann, L., M. D'Antonio, T. Hudgens, W. MacPherson, and R. Rappa. 2011. "Capturing Savings in the Industrial Sector: NYSERDA's Approach to Industrial and Process Efficiency." Paper Presented at the 2011 ACEEE Summer Study on Energy Efficiency in Industry, Niagara Falls, N.Y., July 26-29.

[NYSERDA] New York State Energy Research and Development Authority. 2009. *NYSERDA Industry and Process Efficiency Program Final Evaluation, Measurement, and Verification Plan*. http://www.dps.ny.gov/NYSERDA_Industry_Process.pdf. Albany, N.Y.: New York State Energy Research and Development Authority.

[NYSERDA] New York State Energy Research and Development Authority. 2012. *Industrial and Process Efficiency*. http://www.nyserda.ny.gov/en/Page-Sections/Commercial-and-Industrial/Programs/ Industrial-and-Process-Efficiency.aspx. Albany, N.Y.: New York State Energy Research and Development Authority.

Peters, J. S., R.E. Way Jr., and M. Seratt. 1990. *Energy Investment Decision Making in Industrial Firms.* Oakland, Calif.: Barkat and Chamberlin Inc.

Strauss, W. "Manufacturing Outlook." 2012. Paper presented at the Midwest Industrial Energy Efficiency Summit, Chicago, Ill, January 11.

Acknowledgements

The evaluation team gratefully acknowledges the support of Patricia Gonzales of NYSERDA and Kenneth Galarneau (formerly of NYSERDA) for their project management support and guidance. We would also like to thank the staff of the Industrial and Process Efficiency program, specifically Brian Platt, Mark Gundrum, Wendy MacPherson, Cheryl Glanton, and Christopher Stump for their insight into the program and willingness to provide the information required to conduct this evaluation.

Finally, this evaluation research would not have been possible without the cooperation of NYSERDA subcontractors, program participants, and participants' contractors. We acknowledge each of these constituents for their willingness to provide the information required in support of the research.