

# Industrial Energy Efficiency Whitepaper – Turning Waste to Cash

## Strategic Energy Management (SEM) and Industrial Energy Efficiency (IEE) Project Implementation

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### SUMMARY

Beginning July 2014 and lasting through 2015, the Wisconsin State Energy Office (SEO), through a grant from the U.S. Department of Energy (U.S. DOE), facilitated a discussion among industrial energy efficiency experts (IEE) and stakeholders in the state to identify service gaps in the provision of services to support IEE investment. This investigation, named Turning Waste to Cash (TWTC), discussed Wisconsin's barriers to higher levels of IEE and the use of combined heat and power (CHP) and then brainstormed and selected opportunities that might be used to fill these gaps and improve delivery of IEE and CHP to Wisconsin industrial customers.

The experts and stakeholders representing industrial customers included: trade allies who support them; representatives from their business associations, utilities, academic researchers, non-profit organizations in support of manufacturing continuous improvement; and, energy program agents who include energy consultants, and government personnel who focus on policy issues. Meetings were held jointly with the statewide CHP working group, sharing information and presentations on those issues that affect both areas of energy efficiency. This paper pays particular attention to the IEE aspect of this investigation.

The industrial segment in Wisconsin consists of major industries such as pulp and paper, food processors, metal casters and heat-treaters, fabrication, printing, plastics, ethanol, mining, and general manufacturing. In 2011, this sector accounted for about 27 percent (444 trillion Btus) of Wisconsin's resource energy consumption, surpassing even the transportation sector<sup>1</sup>. For the same year, the industrial sector purchased over 34 percent of the electricity (23.4 billion kilowatt-hours) produced by Wisconsin's utilities.

While most industrial investment focuses on increasing or improving production, investment in reducing energy waste is often considered secondarily. This condition leaves Wisconsin with a large amount of untapped potential for saving energy in this sector.

The efforts of this stakeholder group focused on gaps and opportunities for medium to large sized industrial companies. Initial discussion centered on establishing the current baseline of program activity, particularly the Focus on Energy Programs that target mid-sized and large energy users.

**Large Energy Users Program:** By virtue of its customer base, this platform has deployed primarily a customer-focused approach to program delivery. The technologies with the most promising savings have typically been those that are part of specifically-applied manufacturing processes, such as drying,

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<sup>1</sup> Wisconsin Energy Statistics (2011-2012), Wisconsin State Energy Office, 2012.

cooling, heat recovery, compressed air, steam, motor systems, and industry-specific processes. Given the potential for large savings, it is not surprising to find that large energy users have also been the most interested in the advanced concept of Strategic Energy Management (SEM). Focus on Energy's SEM concept has evolved with initial forms appearing in the early 2000's. These efforts have increasingly helped customers establish internal systems to establish continuous, sustainable improvements in their energy use.

**Business Incentive Program:** This area, serving mid-sized manufacturers, has relied heavily on trade allies to deliver the program. This effort has focused on providing easy-to-use incentives for more common technologies, including lighting, heating, ventilating, and air conditioning (HVAC), compressed air systems, ventilation, etc.

Beyond the Focus on Energy public benefits program, several non-profit efforts, such as Wisconsin Manufacturers Extension Partnership and Mid-West Energy Research Consortium, have tied their core missions to IEE improvement.

In addition, since the early 1980's, the SEO has worked with U.S. DOE's State Energy Program (SEP) to administer research, grant and pilot programs that have been intended to advise general program development. Many of these efforts have been influential in IEE programming.

The U.S. DOE has also worked with Wisconsin over the past decade to implement programs to delivery Save Energy Now Energy Savings Assessments (SEN) and the Industrial Assessment Center (IAC) along with in-state Energy Expert Training events in steam, compressed air, pumping, and fan systems. Wisconsin has been particularly astute in leveraging these valuable opportunities.

Having outlined existing Wisconsin IEE efforts, the stakeholder group next discussed the various barriers that manufacturers face with respect to investment in energy efficiency. The barriers, including financial, technical, opportunity, and time risks, have often changed over time as business conditions and energy prices fluctuate. The changing economy over the past ten years has created considerable flux in the barriers and opportunities facing manufacturers.

Ultimately, the group identified areas where improvements in service that can overcome market barriers to IEE may be possible. The following recommendations are summarized below.

- Instilling SEM as an internalized cultural concept:
  - Engaging upper management (Chief Executive Officers and Chief Financial Officers) more directly, where it is not already being done;
  - Creating tools to help customers manage IEE efforts, such as software for identifying opportunities/monitoring operations;
  - Providing incentives to assess energy management information systems (EMIS), including a gap analysis, including incentives to install monitoring/sub-metering in facilities to support operational energy management;
  - Providing customer incentives for SEM developed energy efficiency projects, including those that facilitate operational control changes that save energy;

- Providing incentives for staff time for project development and monitoring activities; and,
- Providing specialized training in SEM, coupled with mentoring/coaching, and increased general IEE training of company staff,
- Establishing a recognition program for successful SEM participants (motivator, competition, leading by example).
- Developing a streamlined model for mid- to smaller-sized companies to extract the key benefits of the SEM that is currently being implemented among large companies.
- Low-cost (time and dollars), actionable technical support, including independent engineering review, specific feasibility studies, and reliable, impartial project savings and cost estimates.
- Supporting CHP where it is cost-effective to the customer and Focus on Energy program.
- Allowing Focus on Energy to provide incentives for projects that use internally-generated renewable energy that is currently wasted (e.g., biogas, wood chip biomass) to improve a customer's overall "system energy efficiency" (this has recently been authorized).
- Develop a training model and training for potential SEM suppliers.

Additional suggestions for improving IEE in Wisconsin include developing State-level incentives, tax-credits, mandates; assisting the supply chain cohorts of manufacturers to help them emulate sustainability practices such as SEM; and establishing the true value of programs like [International Organization for Standardization](#) (ISO) 50001 and Superior Energy Performance (U.S. DOE).

## **INTRODUCTION**

The Wisconsin State Energy Office (SEO), through a grant from the U.S. Department of Energy (U.S. DOE), facilitated a discussion among industrial energy efficiency (IEE) experts and stakeholders in Wisconsin to identify industrial barriers and gaps in the provision of services to support IEE investment. This investigation, named Turning Waste to Cash (TWTC), discussed Wisconsin's barriers to improved industrial energy use (IEE) and the use of combined heat and power (CHP). The group of stakeholders also brainstormed and selected various new initiatives that might be used to overcome the identified barriers, fill service gaps and improve delivery of IEE and CHP to Wisconsin industrial customers. This paper addresses the IEE component of TWTC.

The following sections discuss observed industrial barriers to IEE, Wisconsin's program baseline, the current industrial program, an overview of Wisconsin's Strategic Energy Management (SEM), specific SEM related barriers, and recommendations to overcome critical barriers to IEE and SEM.

## **BARRIERS TO IEE**

Any successful energy efficiency program will provide resources that serve to reduce or overcome barriers to its customers' energy efficiency investments. Each business has unique challenges that often differ from others, even within the same business segment. Understanding a customer's specific barriers and needs often provides the program implementer the insight needed to provide meaningful intervention. The following discussion briefly describes key barriers that influence customer adoption of IEE.

### **Awareness of opportunities.**

- The customer does not have resources to help them understand energy efficiency opportunities.
- The customer does not fundamentally comprehend or care about the effect of energy use and costs on the business.
- The facility does not have an internal expert who can identify and assess opportunities.
- A consultant is needed to delve deeper into the technical and economic feasibility of projects, but the company does not know of an expert consultant or vendor who can help them identify and assess energy efficiency opportunities.

### **Customer has higher-priority, alternative investment needs or opportunities.**

- Management does not see or acknowledge the need and may believe the operation is already sufficiently energy efficient.
- Management may only consider investments that improve production.
- Energy efficiency projects may have lower capital priority and must compete with other projects for limited capital.

### **Project may involve potential technical threats or a high degree of uncertainty.**

- While a measure may save energy, its installation may create intolerable delays, stoppage, or other impacts on production, product quality, or worker conditions.
- Uncertainty about a new or emerging technology or about its application to the specific facility or process may render the risk insurmountable.
- Difficulty in identifying opportunities, quantifying benefits and costs, and/or understanding vendor proposals may prevent consideration of the project.

**Project may involve a high level of financial uncertainty.**

- The estimated savings for a project may be either uncertain or bound by uncertain parameters, making the project unreliable for investment.
- Market demand for a company's product may also change, affecting operation of the technology and, thereby, projected savings benefits.
- Project cost may simply be too high to allow for a suitable payback/return on investment (ROI).
- While the payback/ROI may be reasonable, the project may not meet internal threshold criteria, especially when competing with other investment options that have better paybacks/ROIs.

**Customer has other priorities and/or insufficient resources to adequately manage energy usage.**

- Project manager may have insufficient time to learn about the energy efficient option.
- Even if capital and technical understanding exist, a company may feel that it must dedicate all of its staffing resources toward production, assigning lower priority to energy efficiency improvements.

**Available services (technical support or incentive) may not fit a customer's scheduling requirements.**

- Project decision is time-sensitive, often dependent upon the facility's annual budget cycle, production cycle, or construction cycle. This factor can affect a project's installation schedule, making a project decision is time-sensitive.
- A specific business may be undergoing a merger, acquisition, litigation, or market downturn.
- Conditions in the overall market may make it difficult for any company to make seemingly risky or unnecessary investments.

**Potential program barriers to participation in supported IEE.**

- The company may not know about or understand what program services are available.
- Program processes and/or paperwork may make it difficult to participate in the program.
- While a customer may want support, they may not know where to go for assistance. Also, the customer may need a type of support that is not currently being provided by the program. Examples of this include CHP support.

## **FOCUS ON ENERGY – PROGRAM BASELINE**

Wisconsin operates mature energy efficiency programs which began in the late 1970's. At that time, most programs were implemented by the State's energy utilities under the regulation of the Public Service Commission of Wisconsin. Any discussion of Wisconsin IEE must acknowledge the evolution of programming efforts, which bring us to the more recent efforts of the Focus on Energy Program.

Beginning in 2001, in the interest of providing consistent services across Wisconsin, the State Legislature established Act 141, which essentially merged the utility programs into a single entity called Focus on Energy (Focus). While offered statewide, Focus is funded by rate-payers of participating energy utilities and is operated as a partnership with utilities. As a utility-based, state-administered, public benefits program, overseen by the State Energy Efficiency and Renewable Administration (SEERA), Focus' offerings have evolved in response to the identified barriers and needs of its customers.

## **CURRENT INDUSTRIAL PROGRAM**

Focus offers various energy efficiency services, including project incentives (both prescriptive/standard and custom types)<sup>2</sup>, study incentives, and technical engineering support for both energy customers and their trade allies.

Structurally, the Focus program is divided by amount of energy use, generally by customer size, to give three core industrial service programs:

- Large Energy Users Program (businesses with power usage in excess of one megawatt or greater than 100,000 therms per month);
- Business Incentive Program (businesses with power usage between one megawatt and 100 kilowatts); and,
- Small Business Program (businesses with power usage less than 100 kilowatts).

## **SEM OVERVIEW**

Focus on Energy's explicit efforts to promote the concept of SEM have targeted large companies and those with at least a semi-mature energy efficiency culture. SEM is of particular interest to larger companies with several facilities and those that may also be interested in U.S. DOE's Superior Energy performance or ISO 50,001 certification. Large companies also usually have the internal staffing resources and funding capacity to implement the SEM approach. Typically, they have a history of participation in Focus. These

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<sup>2</sup> **Prescriptive** (or **Standard**) incentives are based on deemed energy savings for a particular technology that has proven to have consistent energy savings, regardless of application. **Custom** incentives are for more complex projects and require engineering review. They pertain to customer-specific applications and require energy inputs and calculations that are directly related to the specific application, including hours of operation, loadings, temperatures, etc.

companies also tend to have more potential opportunities that can be revealed through more intense investigation.

SEM employs a team-based model that includes various stakeholders within a company from operations to engineering to financial to corporate management. The intent is to achieve comprehensive ownership of mission and goals related to energy efficiency with the assumption that energy efficiency will support overall corporate goals. The long-term outcome is to establish a corporate culture that values energy efficiency and recognizes its importance in overall sustainability, both for the company and for the environment.

Furthermore, because SEM requires a cross-functional effort within the company, energy use by the company's core manufacturing processes can be addressed more effectively (especially on the process side). Production-related energy use, which usually accounts for the largest share of energy use within a company, tends to be more difficult to target and quantify since projects may have impacts on production. Therefore, applying a cross-functional team approach is advantageous in ensuring that other company goals are not jeopardized by energy efficiency goals.

Having begun as an ancillary service to the Focus Large Energy Users Program in 2014, with about six companies, the Public Service Commission of Wisconsin decided to provide additional funding to allow SEM to expand to 30 committed companies in 2015. Continuing direct support for these participants will extend through 2016, with project support into 2017.

Helping the state's largest industrial energy users, the Wisconsin SEM Leaders Program creates a sustainable program for effective energy management. SEM is a partnership between participating companies, Focus, and Wisconsin utilities to integrate energy considerations into organizational decision-making by improving operational procedures, administrative practices and individual behaviors affecting energy use.

Participation is limited to large industrial companies that demonstrate a commitment and readiness to improve their energy performance. Participants are further characterized as having significant energy costs and, since they have a long-term business outlook, they have a desire for a long-term vision for energy efficiency at their facilities.

Focus applied a "cohort" structure whereby entrant groups are broken into groups of about 10 customers each, based on the time of entry and location. Participants are guided through a process to implement and operate the basic elements of the SEM program within 12 months of signing the SEM Leaders agreement. SEM Leaders, now actively participating, are involved in periodic group workshops, can acquire benefits through unique financial incentives and have access to staff development and technical training opportunities.

The program is designed to both demonstrate the value of SEM for generating cost-effective energy savings and develop an energy-related workforce that can add to the economic vitality of Wisconsin. Active participants already have senior management support for energy management, experience with

continual improvement systems, a basic sub-metering network capable of collecting data for key energy uses, and immediate access to four years of monthly energy and production data.

While similar to other SEM programs across the country, the path of Wisconsin's participants incorporates the following milestones:

1. **Gap Analysis** – to determine the maturity of current SEM efforts and areas for improvement.
2. **Energy Review** – to quantify primary energy sources and identify significant energy uses.
3. **Energy Team** – to support the company's SEM efforts and identify saving activities.
4. **Project Opportunities** – to build an effective process for routinely pursuing energy saving opportunities.
5. **Energy Modeling** – to create a valid mathematical model that can baseline and track energy performance based on key performance indicators.
6. **Energy IT Assessment** – to specifically identify the hardware and software needed to collect, process, and effectively display energy data.
7. **Operational Control Limits** – to set boundaries around expected energy use to identify and understand deviations in usage.
8. **Administrative Infrastructure** - to ensure a culture of sustainable energy management behavior.

The Large Energy Users Program continues to engage with potential new participants through its Energy Advisor network, utility contacts, and various industrial associations, including the Wisconsin Paper Council, the Wisconsin Cast Metal Association, and the Wisconsin Industrial Energy Group. Utility account managers often provide facilitation support and other complementary resources for energy team efforts.

SEM has developed a full class-room training schedule, including Introduction to SEM, Certified Energy Manager Training, industrial refrigeration, pump systems, compressed air systems, steam systems, and energy management information. Webinars on various topics, including building cohesiveness and peer networking, are conducted. The Large Energy Users Program is also coordinating with the U.S.DOE to provide several in-plant trainings with their Experts.

Four participating companies have even expressed interest in pursuing the ISO 50001 standard. Several participants have also committed to the U.S. DOE's Better Buildings, Better Plants (BBBP) program. The Large Energy Users Program is coordinating with the U.S.DOE contractor providing technical support to BBBP participants to ensure support is aligned with the best interests of the customers.

#### **SPECIFIC SEM-RELATED BARRIERS**

The IEE stakeholder group also attempted to identify barriers to SEM development that could serve a broader market, i.e., to include smaller industrial companies that are not currently served by SEM under the Focus framework. This service gap has proven difficult for many programs in the past and is probably largely due to the economy of scale as it relates to effort costs versus ultimate benefits.

In addition to the barriers that are generally in play for all IEE investments, more impediments often prevent small and mid-sized industrial companies from instituting SEM concepts. Some of these barriers were drawn out at stakeholder discussions.

First, larger customers often have higher numbers of dedicated energy staff who can identify and commandeer the resources necessary to implement opportunities. They can also afford the time it takes to develop an organization-wide approach to energy use optimization. In contrast, smaller customers may not have any staff who can dedicate time to achieving energy efficiency goals. And many times, energy costs may not be significant enough when compared to other costs and production goals. The allocation of time for projects, not to mention team activities, is often constraining.

Second, unlike large energy users, smaller companies will not have internal expertise to dedicate and manage energy projects. This makes it difficult for a company to assess both the technical and financial risks of investing resources in SEM activities in addition to doing projects. Nor will they have the ability to pay for external consultants to do the work. SEM activities are usually more labor intensive than energy project installation management and are expected to be long-term efforts. External energy consultants wishing to serve this market may have difficulty pricing their services where finding opportunities may be risky.

Third, small companies are likely to have slimmer margins for investments and must carefully weigh the benefits and costs, as well as lifetimes, of energy projects. In addition, since energy costs are going to be lower for smaller companies (and perhaps even a smaller percentage of operating costs), they will experience diminishing returns sooner than for a larger company that may have a great amount of untapped energy savings.

Fourth, there is less awareness about SEM among smaller energy users. The understanding of benefits, even if other barriers can be overcome, may be difficult to achieve.

Fifth, since much of the available energy saving opportunity derives from manufacturing production processes (which facility managers are often unwilling to interfere with to investigate energy savings), customers often remain unaware of certain energy-related opportunities. While consultants or suppliers can easily identify issues with lighting and HVAC, process-specific opportunities can be more elusive. SEM provides the framework for a company's internal experts to uncover their own opportunities for efficiency improvements in their core processes.

#### **KEY RECOMMENDATIONS AND CURRENT ACTIVITIES TO ADDRESS THEM**

1. Increase **program funding** in order to provide a more direct, SEM-type customer service. Consider state-level incentives, tax-credits, and mandates for IEE implementation.

These recommendations would all likely require legislative or administrative action and would depend upon political support

2. Develop a service for an **SEM gap analysis** to give interested companies a sense of where they may stand with respect to energy-related opportunities.

This effort is underway, begun under the new Focus on Energy SEM Leaders program. Customer experience from this effort should provide direction on how best to design a service that can support expansion to other customers.

3. Focus should **develop “SEM-lite”**, a scaled down version of the current SEM offering, to address the operational needs of smaller energy users. This offering could take many different forms, including incentivizing special trade allies or organizations that can provide circuit training and direct services to smaller customers. This would require training and mentoring of providers of these services which could be done through the existing program experts. It may include developing streamlined tools to help customers manage the effort, including software or other resource for identifying opportunities and monitoring operations.

The Program Administrator for Focus on Energy and the Public Service Commission of Wisconsin have begun discussions about potential new designs for SEM delivery to smaller customers. Program cost and customer economy will be important considerations.

4. Learning from the Large Energy Users Program experience, any new **project study incentives** should be designed so that they take any energy efficiency recommendation closer to implementation. Study reports should be explicit in their descriptions of the specific customer application; show the energy benefits and costs, including non-energy related effects, such as on production; provide real project cost estimates; and where possible, indicate potential trade allies who can perform the work. The study should also include recommendations that may not receive program incentives, but yield beneficial savings, such as low and zero payback projects.

Project study incentives under the Focus Program have evolved to become more directive, specific, and useful to customer decisions to implement recommendations. These incentives will continue and are being expanded and often simplified for smaller customers. Utility support, through identification of opportunities and sub-metering incentives has also been helpful. These studies can also help identify viable SEM candidates, i.e., those with motivation and significant energy saving potential

5. Provide **special, targeted incentives** for the following:
  - Assessing the feasibility of installing an Energy Management Information System (EMIS)
  - Installation of monitoring/sub-metering that can support Key Performance Indicator tracking
  - Verifiable energy savings derived from system operational changes

Focus' Large Energy Users Program has begun to do this for SEM Leader participants. Lessons learned from this experience over the next two years will show how these incentives can be expanded to other industrial companies, both large and small.

6. Encourage program evaluators to **address evaluation protocols for studying operational control**. Improved protocols could provide a better understanding of the impact of SEM activities that purportedly save energy, (i.e., what are the true impacts of implementing an EMIS?).

Over the past year, The Large Energy Users Program has participated in multiple discussions with the Focus on Energy Program evaluator to address this very issue. The evaluator is developing methods to address this concern.

7. **Engage business associations and trade allies** to support expansion of SEM-type activities to new customers. Collaborate with organizations such as the Wisconsin Paper Council, the Wisconsin Cast Metals Association, the Food and Beverage Association, and others to pilot new efforts to bring SEM to new customers.

The Large Energy Users Program has provided presentations to some of these organizations to recruit first-round SEM Leaders, resulting in the commitments of 30 participants. As new approaches to stream-lined SEM activities that are considered more appropriate for mid- and small-sized manufacturers are developed, Focus on Energy will consider ways to expand, particularly by reaching out to different business associations.

8. **Showcase the experience** of current SEM Leader participants. The sharing of peer experiences can be an effective way to increase awareness and acceptance of both standard (lighting, HVAC, etc.) and production-related/business-specific energy opportunities.

Focus plans to provide case studies and learning events that show new customers the benefits and costs experienced by companies that institute SEM over the next few years.

9. **Establish a recognition program** for successful SEM efforts. Reward Leaders for their motivation, ability to incite competition, and provide leadership by example.

The Focus Large Energy Users Program has developed and will continue activities that will recognize individual company initiative, through awards, on-site showcases, press releases, and case studies.