Accelerating the Adoption of Strategic Energy Management through Stakeholder Engagement

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ABSTRACT

An increasing number of electrical utilities recognize the dynamic results Strategic Energy Management (SEM) offers industrial facilities looking to achieve deep and persistent energy savings. Utility efficiency programs are also discovering how big an impact relationships forged with stakeholders have on driving energy and cost savings.

The purpose of this paper is to show how engaging stakeholders throughout the wastewater industry ecosystem results in informed participation and increased buy-in. The paper discusses key stakeholder relationships developed during a wastewater SEM cohort program under the auspices of a Northwest utility. The program included a series of technical and organizational trainings consistent with the Minimum SEM Elements defined by the Consortium for Energy Efficiency. Prior to the program, the utility presented the concept to an advisory group of public utility commission staff, customers, and various advocacy groups. The range of workshop participants —working side-by-side with wastewater operators, plant superintendents, and public works directors, included:

- State Department of Environmental Quality
- Environmental Protection Agency
- Engineering design firms
- U.S. Department of Agriculture, Rural Development

The results, from this diverse group of stakeholders' participation in SEM workshops, were significant and wide-ranging. The utility benefited from greater buy-in around claiming operations and maintenance savings and increased participation in traditional capital-based incentive programs. The wastewater facilities benefited from the support of design and regulatory communities to optimize their processes within their permit requirements. All interested parties came together in a non-competitive environment to shape a shared vision for long-term wastewater capital planning, efficient plant design, and regulatory compliance.

Introduction

In the spring of 2013, Idaho Power Company, and its contractor, Cascade Energy, began planning a Strategic Energy Management cohort offering under their Custom Efficiency Program. Similar to other SEM cohorts, the program would take eight to twelve industrial customers through shared training and coaching. Idaho Power's previous experience running a cohort targeting refrigeration facilities had shown promise in generating low/no-cost energy savings in Operations and Maintenance (O&M), and their interest in cost-effective alternatives to efficiency resource acquisition remained high. "We knew wastewater was rich with low-/no-cost

and capital project opportunities, but we had few projects to show for it," said Chellie Jensen, Idaho Power Senior Engineer. "We wanted a way to increase awareness and develop relationships while capturing the low-hanging fruit. A cohort design was the best option because municipal wastewater plants aren't competitive, and we thought it was a cost-effective way to serve the wastewater industry in Idaho."

Even so, Idaho Power and Cascade were aware that targeting the wastewater industry has a unique set of challenges. For this new cohort to be successful, a comprehensive approach to SEM would be necessary—one that considered municipal infrastructure planning cycles, compliance-driven operations cultures, and engineering design firms with traditional business models.

Wastewater Industry Background

The job of bringing clean water to customers and treating wastewater accounts for roughly four percent of all electricity consumed in North America, according to research provided by the Electric Power Research Institute (EPRI 2002). Water resource recovery facilities are very capital intensive. Even with state and federal funding assistance, municipalities are under pressure to minimize upfront costs and meet increasingly stringent regulatory requirements while serving the wastewater treatment needs of a growing population. Therefore, it is common for water resource recovery facilities to be constructed for future wastewater loads using oversized capital equipment with poor part-load performance. For example, a facility may purchase two large, constant speed centrifugal blowers, rather than incurring additional upfront cost for three smaller centrifugal blowers with increased turndown capacity.

In a continuous planning cycle that often lasts decades, lifecycle energy costs have not been a priority for wastewater treatment plant owners or for their engineering consultants. As a result, energy costs can rival the initial capital outlay. For example, a modern design now used for wastewater treatment in smaller communities is a membrane bioreactor (MBR) plant. While these plants produce very high-quality water, their modular design makes it easy to increase treatment capacity, and their energy intensity can be three times that of other designs. In the experience of this paper's authors, an MBR plant that cost $20 million to build may spend $15 million on energy over 30 years whereas other types of more energy-efficient plants may incur only $5 million in energy costs.

Likewise, the design process seems to rarely incorporate input from plant operators. Particularly when budgets are tight, control systems and instrumentation tend to be the first items "value engineered" out of a design. The result is a facility with a system designed for large, future loads. This leaves operators running oversized systems and processing small loads at inefficient operating points on pump and blower curves for at least the first several years of operation. If population growth and/or local industrial flows do not materialize at the conservatively high rates that are often projected in planning documents, plants can end up operating in this way for 20 years or more. Energy is wasted, and the expensive equipment wears out more rapidly and requires more maintenance during its lifetime when it is forced to operate far from its "best efficiency point."

The discretion operators do have is frequently curtailed by a risk-averse environment and a mindset focused on regulatory compliance. For example, wastewater operators often feel compelled to run energy-intensive blowers at full volume, keeping dissolved oxygen levels excessively high, in order to minimize the risk of violating discharge permits.

Wastewater Industry Ecosystem

Municipal governments, engineering design firms, regulators, and operators are members of a market ecosystem, as shown in Figure 1.

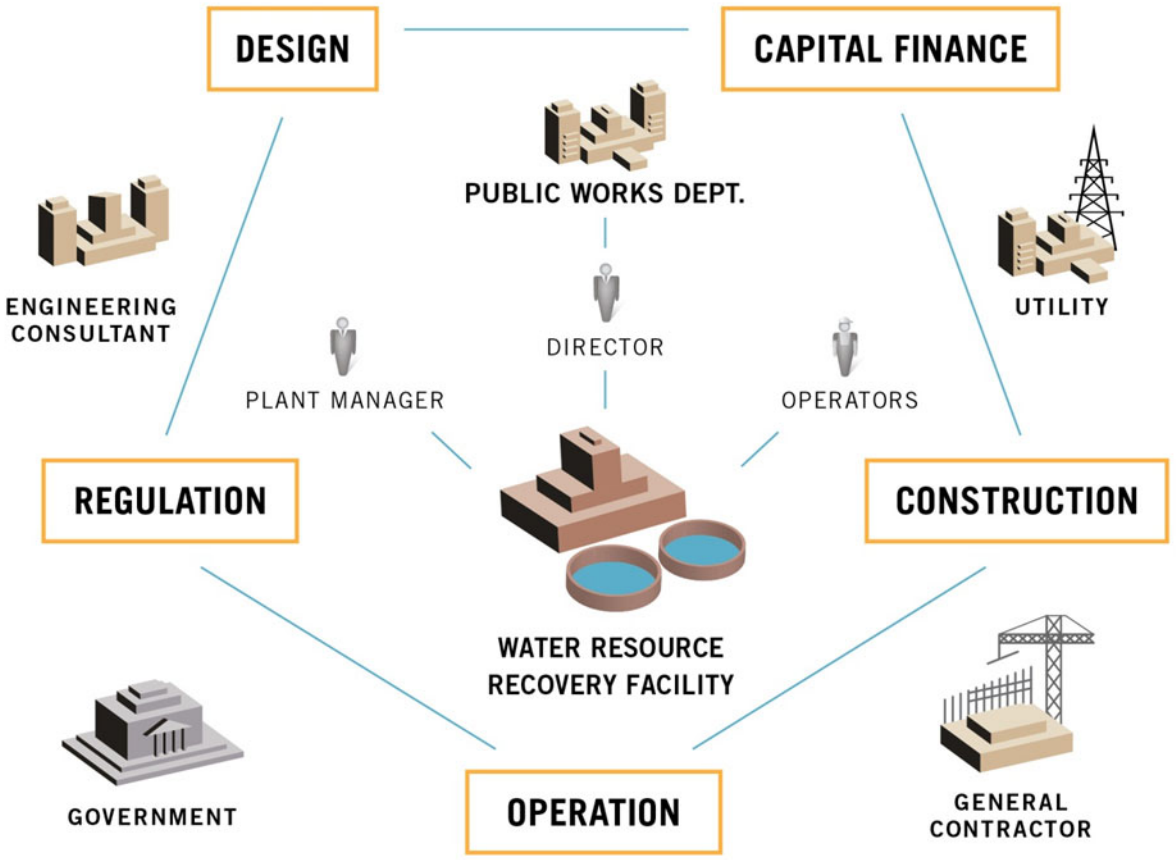

Figure 1. Wastewater industry design and operation cycle.

This community of well-meaning and methodical professionals rarely collaborates to manage growing energy costs, and, in fact, it is often the case that the actions of one entity will tie the hands of another. The status quo leaves operators subject to regulation and design decisions with few opportunities to provide feedback. One of the cohort program's goals was to give operators a stronger voice, in order to help drive greater optimization and influence the design process.

The existing paradigm, shown above, will not change unless a coordinated effort is made to substantially improve wastewater energy efficiency—an effort that must include active communication between all interested parties. In some cases, adversarial relationships must be restructured and priorities aligned. In other cases, incentives must be recognized and reconsidered in order for the market to function efficiently.

Idaho Power Stakeholder Involvement

The Wastewater Energy Efficiency Cohort (WWEEC) is a new type of offering under the Custom Efficiency program for Idaho Power. Using the framework for custom projects, WWEEC will claim energy savings and provide a $0.12 per kWh incentive up to 70% of the costs incurred to achieve those savings. Those costs include staff time to attend workshops, time spent on repairs and optimization efforts, and the materials required for repairs to existing systems. In other words, water resource recovery facilities could receive a savings performance incentive in proportion to the material and labor costs incurred over the course of WWEEC program implementation.

Although this approach was not entirely new for Idaho Power, its energy efficiency staff felt compelled to get the support of their key stakeholders. The Energy Efficiency Advisory Group (EEAG) provides input on formulating and implementing energy efficiency programs. EEAG members represent a cross-section of customers from the residential, industrial, commercial, and irrigation sectors, as well as representatives for seniors, low-income individuals, environmental organizations, state agencies, public utility commission staff, and Idaho Power staff. EEAG-member response to Idaho Power's WWEEC was positive and wide-ranging:

- One EEAG member noted that given that wastewater is expensive for municipalities, WWEEC would be good for energy efficiency and for the municipality as well.
- Another member expressed an interest in Idaho Power using WWEEC as a vehicle for claiming behavioral savings.
- Following preliminary results and positive customer testimonials, a member asked if Idaho Power was planning another cohort offering.

The high level of enthusiasm from such an important stakeholder sent Idaho Power a strong message of support for WWEEC and for potential future cohorts.

The Wastewater Energy Efficiency Cohort Offering

As a SEM cohort, WWEEC works with design engineers, plant operators, and regulators to integrate energy efficiency into capital budgets, engineering designs, and water resource recovery facility operations.

Personnel from wastewater treatment plants with loads ranging from 1,600,000 kWh per year to 16,000,000 kWh per year were invited to join the two-year program offering that consisted of:

- Five mandatory workshops focused on the technical and organizational needs of plant participants.
- Energy management assessments at each plant to characterize existing energy management practices in the first and second years.
- Coaching on technical and organizational issues.
- On-site assistance to identify potential energy savings opportunities in operations, maintenance, and capital upgrades.
- Energy management information system software.
- Tailored coaching in the second year.

Table 1. First-year workshop agenda for the WWEEC cohort. (See figure 2 for the monthly schedule.)

Workshops	Topics
Kickoff	Introduction to concepts Guest speaker: Idaho Power leadership Guest speakers: Plant managers Guest speaker: Regulator Idaho Power program awareness
Opportunities in Operations and Maintenance	Guest speaker: Plant manager Wastewater systems efficiency training Organizational development Idaho Power program awareness
Enduring Management Systems	Organizational development Guest speaker: Engineering design firm Energy management best practices Idaho Power program awareness
Capital Projects	Guest speaker: Engineering design firms Guest speaker: Regulator Guest speaker: Idaho Power program administrator Capital budgeting
Report-Out and Celebration	Guest speaker: Idaho Power leadership Guest speaker: Idaho Power program administrator Report-outs by site Organizational development

Because substantive organizational change cannot occur without the support of management, public works directors, plant managers, and operations leads were required to sign enrollment agreements to document their commitments. The enrollment agreement is the first step to increasing awareness around the organizational needs ofSEM.

After several meetings where the merits of this unique program were explained, the municipalities and their water resource recovery facilities began to enroll. Chellie Jensen, Idaho Power Senior Engineer recalled that, "We targeted 12 of our largest plants and set up face-to-face meetings with each. Some signed up after the first meeting. For other plants, it took longer for them to consider competing construction and regulatory compliance timelines, but in the end we got 11 out of 12."

Royce Davis, Plant Manager at Boise Lander said, "When we were invited into the program we had to decide if it was a good use of our time, and we had to get buy-in from public works upper management and the engineering department. The enrollment process required us to have conversations about the importance of managing what is our highest operating cost after labor. It helped us structure those conversations, form a team, define roles, and set expectations."

While WWEEC's program design reflects the Consortium for Energy Efficiency's Strategic Energy Management Minimum Elements, the offering actually went further by encouraging active workshop participation on the part of associated engineering design firm and

various funding and regulatory agencies. The program's two-year schedule (Figure 2) front-loads much of the cohort's activities based on the philosophy that participants should identify opportunities and have tools in place so they can achieve quick-wins as soon as possible to cement buy-in and catalyze further development. "Organizational Coaching" and "Energy Management Information Software" indicate the program support and tools that are provided on an ongoing or as-needed basis through the end of the program's second year. "Reporting" involves deliverables to the energy efficiency program engineer, such as the scoping, energy management assessment, and the year-end completion reports that estimate energy savings and summarize activities.

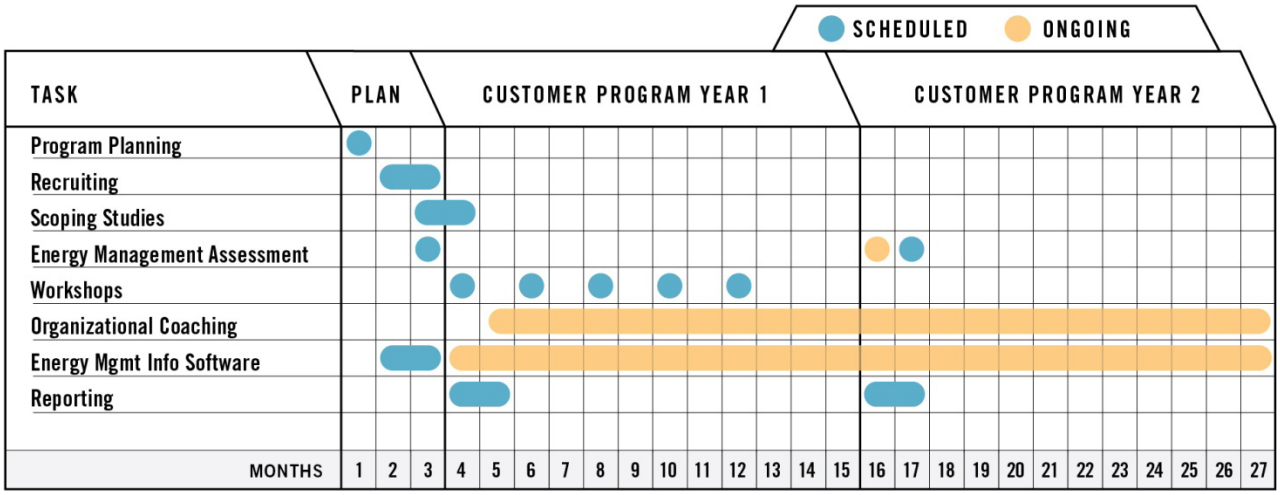

Figure 2. The WWEEC program offering schedule.

Wastewater Operators Develop Trust and Gain Confidence

Plant discharge permits are at the top of every wastewater operator's list of concerns. The permits define the limits of biochemical oxygen demand, total suspended solids, ammonia, and other substances that can be released into the receiving waterway. If limits are exceeded, water resource recovery facilities may be fined and operators can lose their jobs. Under these circumstances, wastewater operators are reluctant to do anything that could risk violating their discharge permit. Persuading operators to make changes, even changes that clearly garner positive results, requires credibility and trust.

The coaches delivering the WWEEC program offering worked to establish that credibility with plant operators by demonstrating a deep understanding of wastewater systems, processes, and regulations. Prior to the first workshop, the coaches conducted scoping audits and energy management assessments of each plant. They learned about each plant's systems, organizations, and challenges. Subsequent coaching opportunities and workshops were informed by this firsthand knowledge.

Cohort planners knew that the considerable expertise of WWEEC coaches would not be enough to convince plant operators to make changes. They invited veteran plant managers with experience optimizing for energy efficiency as workshop guest speakers. These industry peers validated WWEEC program offering coaches' claims and helped reduce the perceived risk around making changes.

Concerns over risks to permit limits were further alleviated when representatives of the Idaho Department of Environmental Quality and the federal Environmental Protection Agency attended the workshops. Despite some apprehension, the operators warmed up to the regulators quickly when they understood that the regulators were there to listen and offer support.

The regulators reassured plant operators by expressing their interest in partnering to improve energy efficiency and collaborating on compliance. As the operators and regulators listened to one another during the workshops, misperceptions were corrected and constructive relationships formed.

One of the most persuasive elements of the program offering hinged on creating an environment where peer-to-peer communication provided encouragement, accountability, and gentle pressure to step beyond the comfort zone. The best ideas for energy-efficiency optimization often came from the operators themselves.

WWEEC coaches were deliberate about communicating cohort participant success stories with leaders in the public works departments. Municipal governments are eager to prove that they are good stewards of public resources. Public works and other municipal administrators were delighted and supportive when they attended the workshops and learned about the progress plant operators made. Misgivings operators may have had at seeing municipal government representatives in the room during the workshops disappeared once it became apparent that everyone involved was interested in cultivating an atmosphere of respect and support.

Getting all stakeholders together to talk about their experiences, show support, and share information went a long way toward helping operators gain trust and build confidence in their ability to make positive changes—without risk to their discharge permits.

Regulators Communicate Support

At the same time that WWEEC wastewater treatment cohort participants were recruited, contacts were made with the Idaho Department of Environmental Quality (DEQ) and the federal Environmental Protection Agency. These regulators are not only code enforcers; they are also major funders. For smaller communities, regulatory agencies are a primary source of technical support. Regulators are involved in many aspects of the wastewater industry, and they have the power to initiate corrective action should they feel that corners are being cut.

To the credit of the Idaho regulation community, securing their attendance at the workshops was easy. However, the challenge to overcome was initiating a dialogue to overcome misperceptions of "gotcha" enforcement. When the Idaho DEQ Wastewater Engineering Program Manager presented at the third workshop and talked about DEQ's program to promote sustainable infrastructure with energy efficiency as a central pillar, it was a powerful moment. His urging of more intelligent plant design and sensible operating strategies signaled that thoughtful process experimentation is acceptable for reducing energy consumption. Based on their presentations and their active participation in the workshops, the regulators conveyed the message that not only do they support the operators' efforts, but they are on the same team and willing to help.

"Before the WWEEC program we didn't know the regulators very well," said Royce Davis, Plant Manager. "A lot of what we heard were rumors. It was important for us to sit down face-to-face with the regulators to get their perspective on permits, energy, and enforcement. From there, we knew what we had to work with."

WWEEC offered a rare opportunity for regulators to connect directly with the frontline of water resource recovery facility operation. It was as much a chance to get their message out as it was to hear and address operators' concerns—and it gave the operators a sense of the bigger picture with respect to legislation and policy. Likewise, the regulators gained valuable insight from the operators' perspective, as they went back to their organizations to formulate policy and outreach strategies. By the third workshop, the regulators were receiving unfiltered feedback from operators, and a constructive working relationship had taken root.

Although not "regulators" per se, the attendance of other government agencies, such as the U.S. Department of Agriculture Rural Development, reinforced the messages operators received from WWEEC coaches and DEQ. For example, operators heard WWEEC program coaches propose better designs and operations practices, they heard DEQ say such proposals weren't a worry, and they saw the USDA Rural Development jump in with offers for funding.

Engineering Design Firms Gain New Perspectives

Historically, the involvement of engineering design consultants for wastewater treatment plant efficiency has been limited to major capital projects. Engineering firms' projects have clear start and end dates, and within that timeframe their task is to design a system that meets both their client's budget and regulatory requirements. Engineering firms often rely on template designs to reduce costs and shorten development time, but they compete with one another on increasingly sophisticated control systems that automate plant functions.

Although innovation and automation in plant control systems can hold promise for greater energy efficiency, the practical reality in many cases is that operators struggle to work with these systems. At times, control systems are left in an "almost finished" state due to a need for late-stage cost reduction. Additionally, controls are generally the final component installed and optimized, and many plants receive new control systems that have not been fully tuned prior to project closeout. The result is that systems are left in manual operation mode because plant operators either don't trust the system or because the controls are simply too difficult to work with – especially in emergencies.

The engineering design firms are under pressure to keep design and initial construction costs down. System specifications often come at the expense of long-term energy efficiency. For example, a plant that requires 1,000 SCFM of blower capacity for its ultimate design will be constructed with three 500 SCFM blowers, two for production and one for redundancy, to ensure compliance. This is cheaper than installing four 335 SCFM blowers which provide the same ultimate capacity, but which also have the benefit of better turndown, and therefore, greater efficiency.

Encouraging engineering design firms to consider both energy efficiency and plant operators' needs requires timed outreach and strategic consideration. First, many civil engineering design firms are simply unaware of utility program funding that can help offset capital costs. The authors have generally observed that many engineers at engineering design firms are not aware of utility efficiency programs and the support they provide. To address this barrier, the most successful jurisdictions utilize a water/wastewater specialist to conduct sustained outreach with engineering firms and other market actors.

Second, most major design-related decisions are made in a relatively short period of time. Once designs are 30% complete, changing equipment and system specifications is often impractical because of the cost of implementing those changes over multiple sheets of design documentation. Finally, firms need an economic incentive to design for efficiency, and cities

need to ask for efficient designs. On a $50,000,000project, an engineering firm is not inclined to engage a utility program for a $100,000 incentive that would likely require additional engineering time to integrate.

In spite of these challenges, the municipalities that hire engineering design firms can require efficient design and include an adequate budget that balances long-term cost savings. In other words, if clients ask and pay for it, the engineering firms will respond in kind.

During the WWEEC workshops, engineering design firms were invited to attend and speak. Although not all the invited firms attended the workshops, those that did saw the workshops as an opportunity to support their clients, as well as share some of their experiences, good and bad, with energy conservation within the industry. The firms in attendance saw, first-hand, their clients' interest in energy efficiency and operator-friendly plant and system design.

Municipalities Open Doors and Encourage Collaboration

Municipalities are complex organizations with unique challenges. Depending on the size of the municipality, the public works departments commonly have multiple layers of oversight between the water resource recovery facility operators and the public works director. In smaller communities, plant managers report directly to the public works director. But even in small communities, water resource recovery facilities are often insulated from other aspects of public works that receive more public attention. Given the compliance-driven nature of water resource recovery facilities, the lack of public attention has been welcomed.

Wastewater operators are generally not inclined to draw attention to themselves or their plants. In order for energy efficiency efforts and sustained energy savings to take hold in these facilities, operators attending WWEEC were encouraged to advocate for projects and process changes they believe in. As the Report Out and Celebration workshop neared, the WWEEC coaches urged plant operators, managers, and city engineers to communicate their accomplishments. The WWEEC coaches invited public works directors and elected city leaders to the celebration workshop specifically for the purpose of hearing success stories and building support for future efforts.

"Rarely do we get an opportunity to present directly to the public works director," said Plant Manager Royce Davis. "In the Report Out workshop we were able to share our accomplishments and talk about what else was possible. The public works director, in turn, was able to show his support and learn what other cities were accomplishing."

Prior to WWEEC, Idaho Power energy efficiency engineering staff had limited relationships with its municipal public works directors, but after the workshops, city governments in Idaho Power territory began opening doors for the utility. This was a great opportunity for Idaho Power energy efficiency staff to increase awareness of their capital project incentive programs. In the course of these interactions, the public works directors gained information that would influence their work with engineering design firms.

Public works directors are critical to energy efficient design and operation. If specified and budgeted in design contracts, engineering firms will engage utility efficiency programs and make energy efficient design choices. However, public works directors must first be aware of utility programs and the discretion they have when entering into design contracts. All too often, design is driven by first cost, and not the lifetime energy costs, which makes the operator's job of energy efficient operation all the more difficult.

By the latter workshops, fluid conversations between operators, plant managers, public works directors, and engineering design firms about energy efficiency were taking place. "We

learned that all decisions have an impact on energy consumption," said Mick Mummert, a utilities operator in Ketchum, Idaho. "We learned that capital projects are not the only way to save. Small operational changes combined can make a big difference. We would come back from the workshops with all these great ideas, and they made a lot of sense to our management, so we gave them a shot. We were able to break through the mentality that, 'this is always the way we've done it,' to, 'let's try some things.'"

WWEEC coaches strongly encouraged public works administrators to specify and budget for energy efficiency in their contracts with engineering design firms on an ongoing basis. All cohort participants were encouraged to reach out to their Idaho Power energy efficiency program engineer or customer representative as soon as new design projects came up for consideration.

WWEEC Program Offering Results and Conclusions

As of this paper's submission date, WWEEC is in its second year and official results have not been determined. However, preliminary results suggest strong savings for the cohort. While the performance of some plants was flat, and other plants experienced so much construction that savings accounting was impractical, overall the group was on pace to save 7.8% or 5,000,000 kWh per year on Operations and Maintenance (non-capital projects) alone. Several plants are saving in excess of 14% with respect to their baselines.

Figure 2 shows the cumulative savings of one outstanding participant in the cohort. The increase in savings at this facility coincides with the schedule of WWEEC workshops and improved operations of the plant's aeration system.

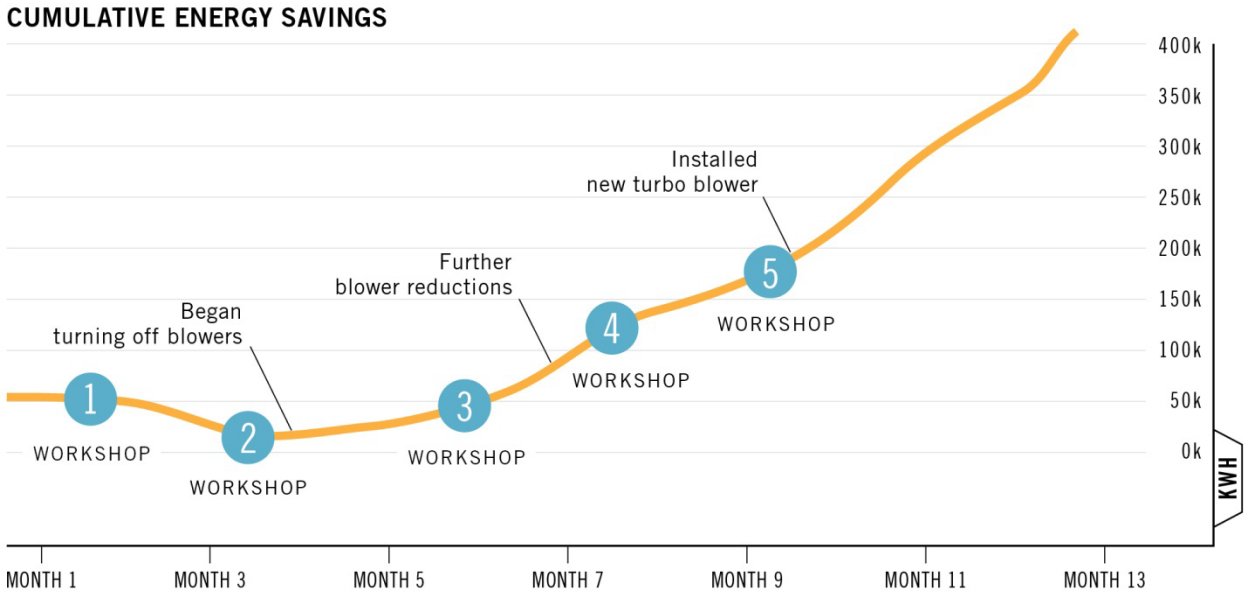

Figure 2. Cumulative savings and actions of a cohort participant.

The cohort savings are due, in large part, to strong participation from plant operators, plant managers, engineering design firms, and regulators. All parties demonstrated an earnest desire to try new things and together they created an environment that made energy savings possible.

The greatest long-term accomplishment is arguably the relationships that were developed. Idaho Power's energy efficiency program engineer is now in regular contact with many of the public works directors and environmental programs managers. Idaho Power has the credibility to have meaningful conversations about projects and process. Together they are exploring how to serve the other departments within the municipal customer base. Idaho Power's capital project incentive programs are being incorporated into the capital planning and design processes of the various public works departments. Chellie Jensen says, "We now have allies inside these organizations who are identifying projects and factoring our programs and incentives into their decisions. It's been a complete game changer. These are the kinds of relationships that are bringing us closer to all of public works, not just the water resource recovery facilities."

These successes are being communicated through the public works departments and in some cases the cities as well. The wastewater community is a relatively close-knit group, and the experiences of WWEEC operators have become a topic of conversation. It's becoming clear that by deeply engaging wastewater industry stakeholders, WWEEC is accelerating the discussion and application of energy management best practices.

References

Electric Power Research Institute. 2002. *Water and Sustainability (Volume 4): U.S. Electricity Consumption for Water Supply and Treatment – The Next Half Century.* http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001006787