

Strategic Energy Management Maturity and It's Impact on Savings and Savings Persistence

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ABSTRACT

Many organizations have adopted strategic energy management (SEM) to improve their organizations energy efficiency and in turn reduce costs. Utilities are interested in how organizations continue to mature and what is the long-term impact of SEM on energy savings and its persistence. To meet the long term challenges and goals of SEM, organizations must continue to act strategically while integrating the tactical building blocks of energy management into the organization and provide the resources, time, equipment, and training to maintain real change in their energy management culture.

With multiple years of SEM implementations, organizations have demonstrated how SEM fits into their operating structure and united a systematic approach to quantifying the success of energy management. Participants have taken advantage of Utility and DOE courses broadening energy awareness, while continuously improving performance by establishing and implementing effective energy management programs that support operational activities. This paper examines the long term impacts of SEM by examining the maturity of multiple organizations with 3-8 years of experience in implementing a strategic energy management plan and comparing their SEM maturity to the energy use intensity results.

INTRODUCTION

Key to our success in implementing savings persistent utility SEM programs is the unique blend of practical experience and educational background that makes up the Strategic Energy Group (SEG) team. The founders of SEG (prior to their forming the company) were key contributors in the initial application of CI methodologies to the energy stream when, in 2004, they were commissioned by the Northwest Energy Efficiency Alliance (NEEA) to develop an industrial market transformation initiative for the Pacific Northwest region. The team developed, then, the first of its kind utility-focused CEI program in the United States which has become the basis for the many forms of SEM programs being implemented today. Since then, SEG has implemented SEM Programs for hundreds of different industrial facilities in numerous industries, including pulp and paper products, wood products, food processing, breweries, chemical plants, cement plants, technology solutions, and manufacturing (aircraft, plastics, machines). With equal success, we have applied our SEM approach in commercial sectors, including property management, municipalities, hospitals, school districts, colleges and universities, retail, hotel and resort management, and all levels of government, covering well over 1,200 sites. The timeline graphic below, Figure 1, summarizes the SEM / CEI Development SEG has brought to the market since our inception and our company growth in SEM implementation. The top of the graphic outlines milestones achieved (e.g. M&V Tool). The bottom of the graphic provides an overview of company implementation growth.

Figure 1. SEG SEM Development Milestones and Major Implementations

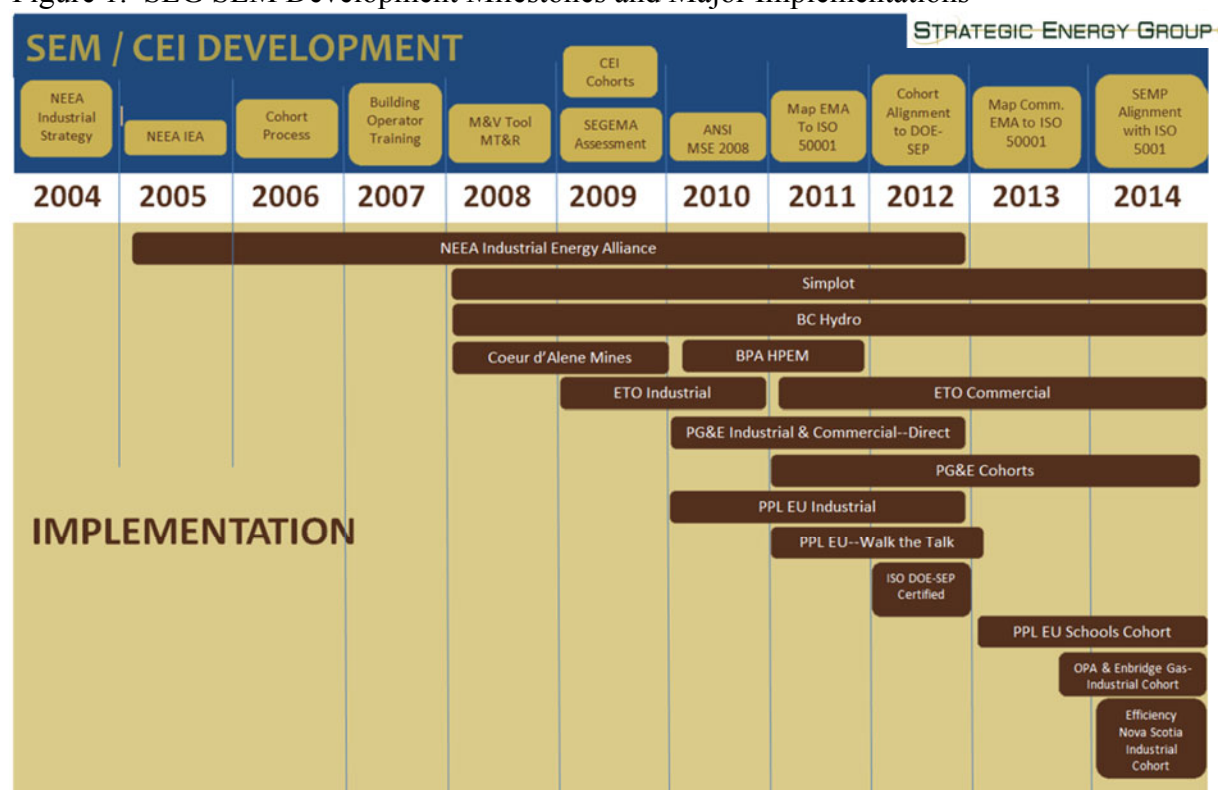


Table 1 SEM Delivery Experience on the next page outlines our experience delivering directly to utility customers as a group (cohort) and individually, and to end-users outside of utility programs. In the last five years alone, SEG has delivered SEM to over 1200 different sites.

Table 1. SEM Delivery Experience

Experience within utility programs	2010	2011	2012	2013	2014
# of SEM cohorts/ groups implemented	3	4	2	3	7
- # of sites served in cohorts	74	84	53	137	234
# of individual/corporate SEM sites served	99	108	104	72	75
Total sites served	173	192	157	209	309
Experience outside of utility programs					
# sites served - Industrial	21	23	21	21	23
# sites served - Commercial	1	27	27	0	0

SEM Technical Workshops

Energy Scan (O&M Kaizen) The Energy Scan approach engages an organization's energy team to study an energy stream or a significant energy using process to find operations and maintenance opportunities that can be addressed to support overall energy efficiency. We combine our coaching tactics with our ability to harness and develop the client's internal team's expertise in delivering sustainable, operational and practical technical improvements. We relay our knowledge enthusiastically in a simple and easy-to-understand language to inspire and engage the internal teams leaving knowledge embedded in the organization.

Energy Mapping & Sub-metering Strategy: Energy Mapping is a workshop where participants come together to learn the importance of and how to create an Energy Map. This provides a tool for the general workforce to come to a consensus on how energy is being used and serves as an energy savings brainstorming tool. In addition to understanding energy usage and its link to production, this event establishes the need to draft or revise a sub-metering strategy.

Performance Tracking Regression Tool and MT&R Training: This workshop covers best practice methodologies for tracking energy savings through energy intensity and multi-variant regression modeling. The objective of the workshop is to provide the necessary knowledge and sufficient training so that each customer has the capacity to understand, maintain, and utilize the energy intensity tool.

Operations Assessment Training: These workshops train facilities staff on assessing standard building systems and equipment operations, focusing on opportunities to improve air and water side operating performance and achieving significant energy savings without major capital investments while simultaneously helping to assure that when capital investments are made they continue to yield expected savings. This structured activity engages system operators and select team members in the identification of operational, maintenance, behavioral and capital opportunities, prioritizes those opportunities, and establishes the steps required to move the opportunities towards implementation.

Energy Intensity Models

It is vital to utilize a quantitative approach for improving energy intensity through applying statistical techniques aimed at identifying and controlling factors linked to the variability of energy consumption the industrial and commercial SEM implementations. The goal is to answer two questions: How does energy (dependent variable) use vary with production and other energy variability drivers (e.g. weather)? And, how does the relationship between energy use and these drivers (independent variables) change over time?

SEM implementations have provided hundreds of energy intensity tools to commercial, industrial and manufacturing customers depicting how and why energy consumption varies within facilities. Some examples include: breweries, wineries, vegetable and fruit processors, injection moulding, foundry, forest products, wastewater treatment, water treatment, apparel, mining, pharmaceutical, and dairy among many others.

The approach is compatible with the International Performance Measurement and Verification Protocol (IPMVP) Option C and is being used within a number of our utility sponsored programs, including Pennsylvania Power & Light EU's K-12 Schools SEM Program, Efficiency Nova Scotia's SEM Program, Energy Trust of Oregon's Commercial SEM Program, and Ontario Power Authority's Industrial SEM to name several.

Tracking performance is based on regression analysis and a standardized Excel based MT&R (monitoring, targeting, and reporting) tool. The results of for analysis go through a rigorous review process and is statistically validated for each application. Once validated, the regression coefficients are transferred to a customized Excel based spreadsheet tool and transferred to the customer for review and ownership.

One vital piece included in the tool addresses the customer's need to understand why energy performance changes while supporting utility evaluation requirements, is the event log. The event log tracks the actions taken with in the operation to target energy performance improvements. The energy intensity tools, constructed for tracking factory energy performance, drive credibility of the existence of the statistically valid relationships between energy consumption, and operations maintenance and production management factors.

Approach to SEM Coaching

Sustainable SEM implementations focus on enabling participants to undertake the organizational changes needed for them to establish comprehensive SEM plans and successfully adopt critical SEM elements as characterized in Table 2 below.

Table 2: SEM Adoption Continuum

SEM Element	Statement	Adoption Metrics
Strategic Leadership	The company understands the business opportunity, vision and commitment to pursue it.	<ul style="list-style-type: none"> • Executive Sponsor • Energy Management Policy (mission, principles & goals)
Setting the Direction	Organizations assess current business practices and set the future direction.	<ul style="list-style-type: none"> • Assessment of Practices • SEM & Facility Plans
Mobilizing the Organization	The company is motivated and has the capability to achieve its goals.	<ul style="list-style-type: none"> • Energy Champion & Team • Staff Accountability
Focus on Core Practices	The organization is focused on improving its fundamental energy related business practices.	<ul style="list-style-type: none"> • Operations & Maintenance Optimization • Facility Upgrades • Occupant Engagement & Behavior
Continuous Improvement	The company reviews progress towards goals, makes adjustments and recognizes achievements.	<ul style="list-style-type: none"> • Monitoring/Tracking Performance • Reporting • Review/Update Plans

Managing and Tracking Progress

SEM coaches engage directly with the energy team and executive sponsor. Through monthly calls and participation in energy team meetings, the coaches are quickly aware of stalled progress and step-in to immediately address the cause. A major factor in the SEM approach is the Level Adoption Analysis that is conducted during the SEM implementation. The Level of Adoption Analysis Tool uses a management system checklist and the SEM tracking sheet and audits the customers SEM implementation results to identify stalled or overdue DSM project implementation and ineffective organizational measures requiring concentrated attention to bring to conclusion.

The tool evaluates 4 levels of adoption from initial forming through sustaining. From establishing a team and organizational commitment, through SEM planning, and implementation of sustaining elements (e.g. MT&R aligns with manufacturing statements and energy goals are integrated into job descriptions.) The table below shows the output from the tool for a single customer.

Level of Adoption Analysis Results					
Name	Adoption		% Complete	Initials	Date
<i>Kevin Collins – SEG</i>	Level 1- Forming	1-25%	71%	KAC	12/5/14
	Level 2- Planning	26-50%	100%	KAC	12/5/14
	Level 3- Performing	51-75%	73%	KAC	12/5/14
	Level 4 - Sustaining	76-100%	43%	KAC	12/5/14
	Average	Performing	73%		
33 Tasks					

An Energy Management Assessment (EMA) is one of the first activities in the SEM initiative. The EMA bridges the gap between the broader organization and facilities management by drawing attention to these areas and identifying opportunities. This gives an organization a solid understanding of where there is an opportunity for improvement within their current business practices. The EMA also demonstrates the extent to which energy management spans an organization's business practices, with assessment participants often coming away with a greater appreciation of the need for organization-wide involvement.

To date, energy management assessments have been conducted with forty-six industrial sites. The assessments have been conducted across an industrial sector including, food processing, mining, chemical processing, glass manufacturing, building materials, paper mills, plastic extrusion, plastic blow molding, and aluminum extrusion. Within the database, we have organizations that have assessment history as a baseline, baseline and secondary after SEM implementation and organizations with energy management assessments over a 12 year period. Capturing energy efficiency performance is more challenging over a 12 year period due to the lack of information available at the time of the EMA. We have been able to look at an

organization's progress through various metrics such as percent of improvement, energy intensity, cumulative sum of differences and reduction in gross energy usage and also have been able to quantify the shift in culture with the improvement in energy efficiency. To allow for evaluation of results and tracking progress over time, the EMA provides scores for each component: the overall Level of Rigor (LR) is what we are using for comparison. The LR score is determined on the basis of the responses provided by the management group for each of the characteristics presented in each topic area. An average LR score is also derived for each of the 3 Components and for the energy management business practice profile overall. Using the established requirements for compliance with the ANSI:MSE2008 and ISO50001, the following scale is used to interpret the SEGEMA LR scores:

- 0.00 - 0.50 – Establishing foundation for compliance
- 0.5 - 1.00 – Approaching compliance
- 1.01 - 1.50 – Somewhat compliant
- 1.51 - 2.00 – Mostly compliant
- 2.01 - 2.50 – Compliant
- >2.51 - Exceeding compliance

Figures 2 and 3 below compare the results of two EMA's completed with two separate fertilizer manufacturing facilities over a four year period.

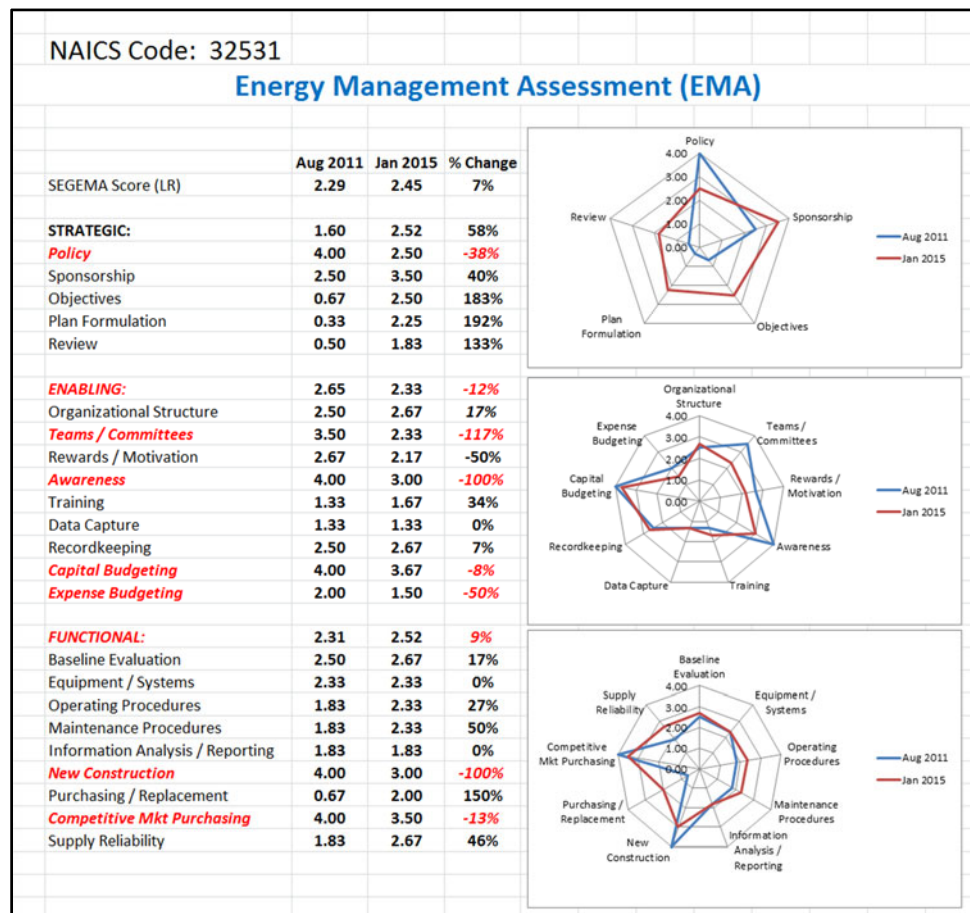


Figure 2: EMA Results – Four Year Comparison

Although both comparisons depict an overall improvement in the combined level of rigor, the scoring does not always show improvement in each components subcategories. This can be due to changes in policy, management, operations and the overall business plan for the facility. Overall, improvement in the balance of the operations across all components is the driving initiative for establishing consistency and sustaining an ongoing energy improvement program.

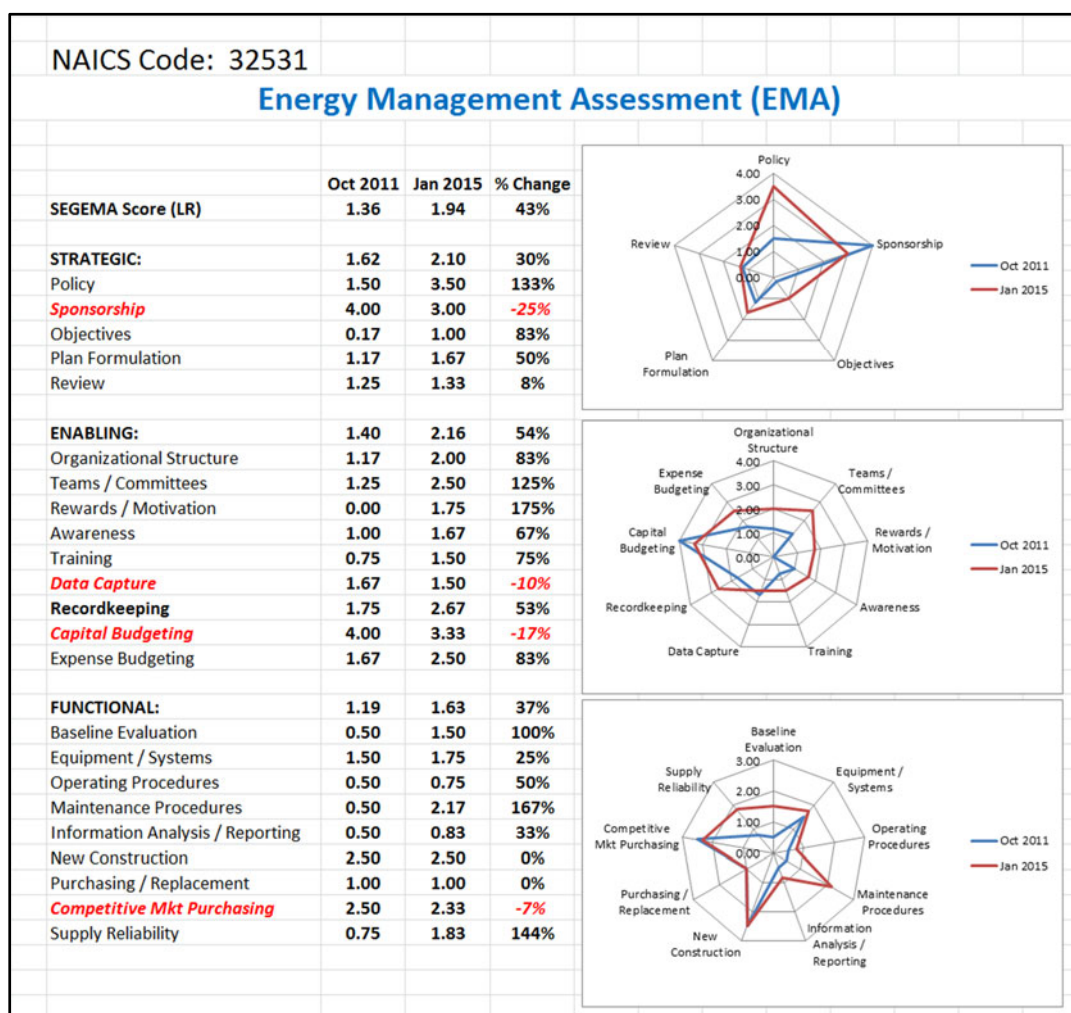
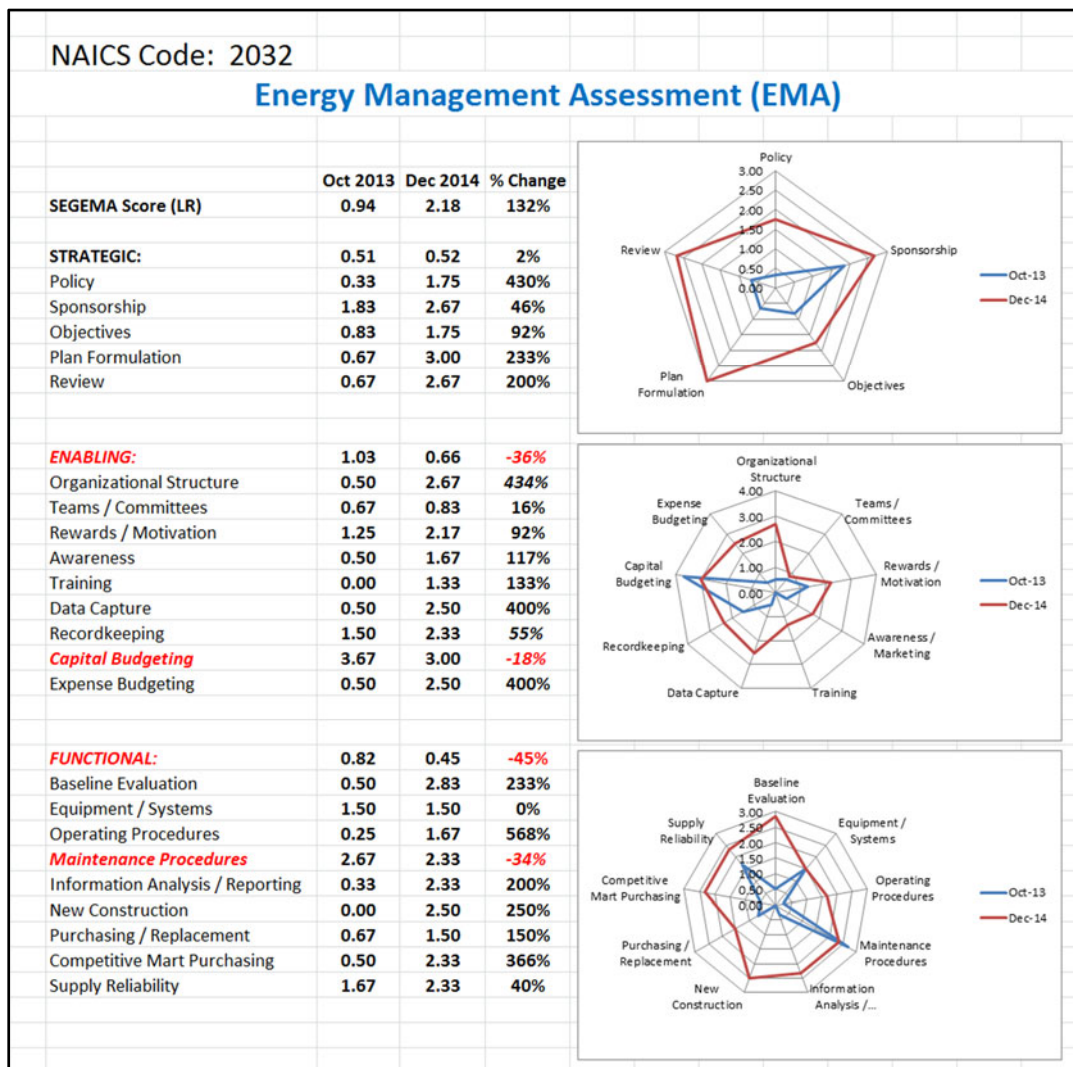


Figure 3: EMA Results – Four Year Comparison

Figure 4 below compares the results of two EMA's completed with one food manufacturing facility over a twelve month period. The LR shows considerable improvement in over 83% of the subcategories for all three components. Ideally, a comprehensive EMA should be completed every three years to ensure the ongoing efforts of developing a SEM program are continuously engaged. The ultimate goal is to align an organizations overall business plan to improvements in energy performance. For all EMA's that are completed, and action plan is generated that identifies specific actions that the facility will engage over the next twelve months. The action items are assigned responsibility and accountability. The results of EMA's

depicted thus far will be aligned to improvements in energy intensity identified in cultural shift and savings results.



Cultural Shifts and Savings Results

The energy culture of an organization is the shared mindset that creates and sustains an environment leading to continual improvement of the energy performance of an organization. It is focused on the behaviors of the people of an organization and their impact on the energy use and consumption. Defined commitment from senior management has proven to be essential to any organizational initiative, and includes strategic energy management success. Driving cultural change begins with an aligned leadership team. Leaders not only provide a clear picture of the direction for the organization, but they also strive for strategic alignment and commitment among the entire leadership team. Values can then be translated into the behaviors that are followed and policed by the people within the group. This is the same concept used for driving

cultural change and savings persistence that the following documented and verified for long term savings provide.

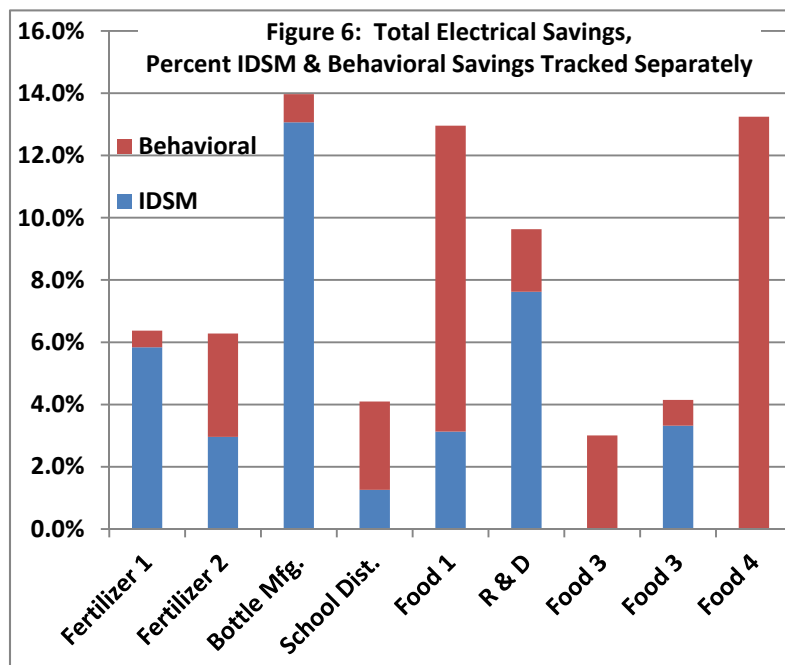
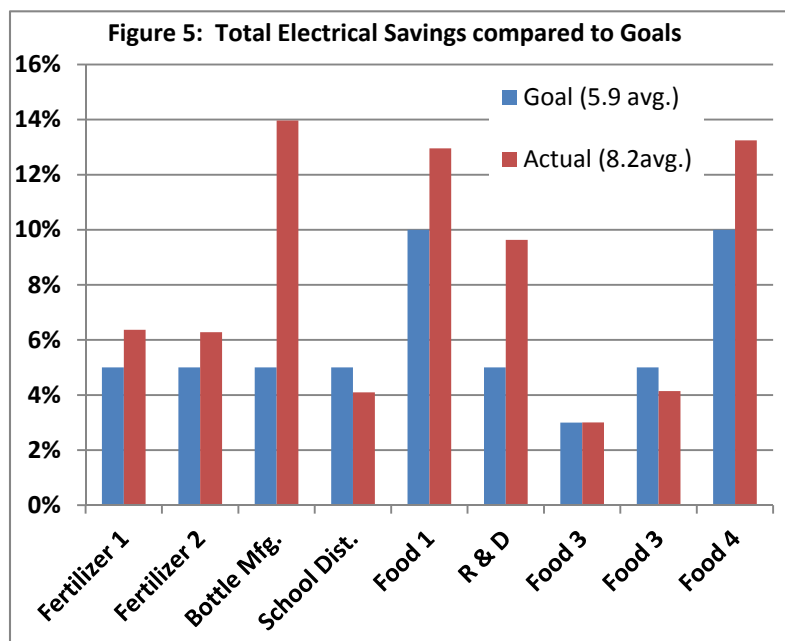
Pacific Gas & Electric Company (PG&E)

Period: April 2010 to present

Performance Goal: Initially intended as primarily a marketing channel for DSM programs, has matured into a distinct program producing savings of its own.

Results: Total savings average 8.4%, half each from DSM and behavioral; first ISO 50001 and DOE-SEP certification

Description: PG&E's initial goal for the CEI effort was to improve relations with key customers and increase the uptake of its IDSM incentive programs. There has already been a measurable increase in the implementation of capital projects and significant savings are occurring via operational opportunities identified through the process. Seven of the nine participants in the first cohort met or exceeded their electricity savings goals (Fig. 5) and the total savings averaged 8.2%. Overall the savings total was split roughly evenly between IDSM project savings and behavioral/operational savings. Individually, the behavioral/operational savings ranged from less than 10% to 100% of total savings; two of the plants were unable to complete any capital projects (Fig. 6). Of the six participants that had gas savings goals, five met those goals, averaging 16% savings.



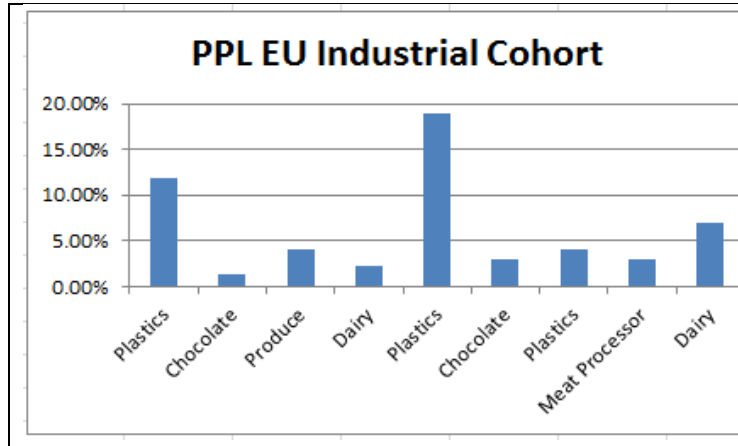
Pennsylvania Power & Light Electric Utility (PPL EU)

Period: July 2010 to present

Performance Goal: Increase participation in Act 129 programs, plus additional 5% savings

Results: 5-10% savings, ongoing initiatives and customer engagement

Description: Strategic Energy Group and PPL EU jointly developed and delivered an energy



management program offering to meet PPL EU's then goals and objectives for engaging the Industrial market within their service territory. PPL EU's initial goals were to a) establish themselves as a model for their customers and b) to improve relations with key customers and increase the uptake of their other demand-side management programs. At our first year Report out event, a state Public Utility

Commissioner attended, and provided the unsolicited quote, "It's just astounding. I'm moved by what I've seen here and by what's been accomplished."

The resulting energy savings, end-user satisfaction and engagement, and integration with other demand-side management programs convinced PPL EU to move the program into their resource acquisition program offering. Strategic Energy Group is currently working with PPLEU to obtain Act 129 approval of the programs Measurement & Verification Methodology from the Public Utility Commission.

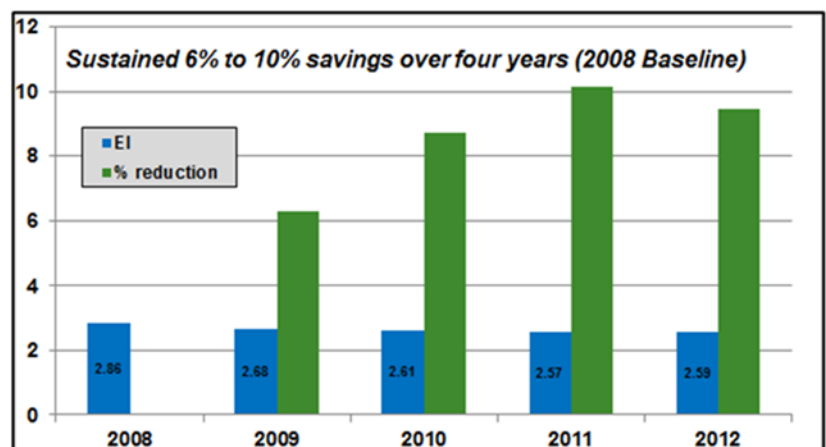
J. R. Simplot Company Food Group

Period: 2008 to Present

Performance Goal: Expand successful utility program to corporate initiative.

Results: 6 to 10% savings over four years of the program

Description: SEG started with CEI implementation at several of their northwest plants under funding from the Northwest Energy Efficiency Alliance, and this grew to a corporate initiative funded by Simplot. Initially, SEG was hired for CEI implementation across the Food Products group. That was later expanded to the Agriculture Products group. As we implemented sustainable change within their company, SEG transitioned to a reduced role to maintain the process, and that has evolved to the current role in corporate strategic consulting. The results are shown in the graphic above, with an average of 6 to 10% savings across seven large food plants over the last four years.



7 plants over 4 years

Energy Trust of Oregon, Industrial and Commercial CEI

Period: February 2009 to present

Performance Goal: 5% energy savings

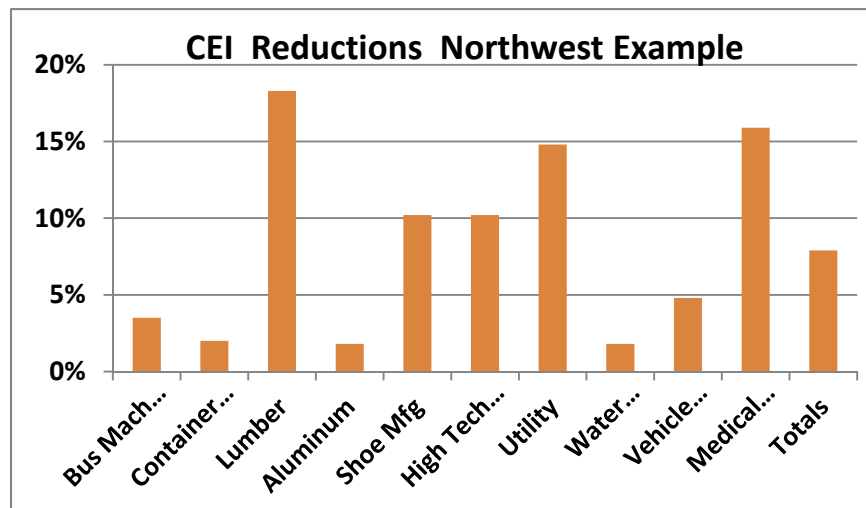
Results: Industrial Cohorts Year 1: 6.9%, Year 2: 9.3%,

Description:

Industrial Energy Improvement (IEI)

Cohort: SEG was engaged at the origin of Energy Trust's CEI Program, and we have been involved with them over four years. We ran our standard Cohort model for their industrial sector for two years. The energy savings attributable to the first group of participants was 6.9 percent of their total annual

electricity consumption, without capital or other incentive projects. The second group's electric energy savings are estimated to be 9.3% of the participants' total electric energy consumption, without including the additional capital or other incentive projects. The savings generated by the IEI account for almost 25% of the Energy Trust's Industrial market electrical savings. Natural gas savings are not tracked and constitute additional benefits to the customer.



Conclusion

In summary, with over 1200 SEM implementations, organizations have demonstrated how SEM fits into their operating structure and united a systematic approach to quantifying the success of energy management. This paper provides the documented and verified savings results that support the long term impacts of SEM by examining the maturity of multiple organizations with 3-8 years of experience in implementing a strategic energy management plan and comparing their SEM maturity to the energy use intensity results.

Managing energy has become part of their business plans, responsibility and accountability has been written into operating procedures, evaluations and the expectations are being achieved. The positive results are driven from having a dedicated senior sponsor, energy champion, cross functional energy team, and a thorough communication and awareness plan throughout the facility. The concepts presented in this paper serve as a foundation for companies in their efforts to create a Strategic Energy Management program. By modifying their culture to be driven towards seeking energy savings, and not just looking at energy as an assumed cost, companies can take major strides toward building a program that is clear on what the organization means by "energy improvement," stirs employee enthusiasm and passion for creating a value, and encourages employee actions that drive greater value for the organization as a whole. SEM has an "Impact on Savings and Savings Persistence".

References

Consortium for Energy Efficiency (CEE). 2014, January 14. *Industrial Strategic Energy Management Initiative*.

http://library.cee1.org/sites/default/files/library/11282/Industrial_SEM_Initiative.pdf

R. Diamond, C. Payne, E. Malone, T. Sanquist, A Wolfe, J. Dion. 2011. “Achieving Institutional Behavior Change: The Power of Roles, Rules and Tools”. Presented at *Behavior, Energy & Climate Change Conference*, Session 5F, Washington D.C.