Measuring Market Transformation through Adoption Diagnosis

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ABSTRACT

Strategic Energy Management (SEM) is a systematic approach to delivering persistent energy savings in organizations by integrating energy management into regular business practices. As SEM activity in North America advances, there is increasing interest in effective ways to measure the market with regard to savings potential, SEM adoption, and whether SEM is happening in the "wild" (i.e., outside of utility programs). However, the market is challenged because SEM adoption is not defined in the same way as traditional product technologies are. A comprehensive and consistent framework for measuring SEM adoption is critical to guide activities and to develop measurement strategies and tools.

This paper describes a maturity model that lays out a definitive list of SEM components and levels for implementation or adoption. A maturity model describes a multi-level evolutionary path of increasingly specific and systematically mature practices. Ongoing work in the Northwest is presented where the maturity model acts as the framework for key activities at the forefront of the SEM market measurement effort. The work includes the development of a Northwest Energy Management Assessment tool, development of strategies for aggregation of SEM implementation data, and research and analysis into validated savings associated with different levels of organizational SEM maturity.

Introduction

Strategic Energy Management Overview

In the past ten years, utilities and their customers have recognized a significant opportunity to gain savings by integrating energy management into customer business practices. This approach is now called Strategic Energy Management (SEM), defined by the Consortium for Energy Efficiency (CEE) as "taking a holistic approach to managing energy use in order to continuously improve energy performance, sustaining energy and cost savings over the long term."

SEM focuses on business practice change, affecting organizational culture and improving the capacity to successfully reduce energy waste and improve energy intensity from top management through all levels of the organization. Utilities across North America are rolling out a variety of programs to encourage these changes in the facilities of their industrial customers.

These programs encourage a broad set of activities, such as executive commitment, energy policies, full-time energy managers, energy teams, target setting, energy monitoring, implementation of planned activities, and employee engagement. As a management system, these components reinforce each other and lock in results that outlast challenges such as personnel changes or competing priorities.

In the 2014 SEM Program Case Studies Report (CEE 2015), CEE reviewed SEM programs launched dating back to 2007. Generally, SEM programs are in the early stages of development, reaching a limited set of the possible customers to whom these initiatives might apply. As of summer 2014, CEE identified 19 active programs across North America, with another 3-4 in the design phase.

By their nature in driving participants to manage energy as a controllable expense, SEM programs effectively drive savings in both electricity and gas consumption. Joint fuel programs are active in several states, such as California, Illinois, and Oregon.

Regional SEM Progress

The Northwest region is experiencing high adoption of straightforward energy efficiency measures in the commercial and industrial (C&I) sectors. Program administrators are therefore looking beyond these measures to operational and behavioral change programs to drive greater savings.

CEE's survey noted that more than 250 customers in the Northwest have participated in SEM programs run by Bonneville Power Administration (BPA), Energy Trust of Oregon (ETO), Idaho Power, and Snohomish County PUD. These customers span multiple industries across C&I sectors and range in size from medium industrial customers to very large product mills.

In 2014, the Northwest Industrial SEM Collaborative identified 2,670 industrial facilities with annual electricity consumption of more than 1 million kWh. Suggesting this is the potential market defined for SEM, clearly plenty of room exists for expansion from the current customer base.

Measurement of Market Transformation in (Industrial) SEM

ACEEE defines market transformation as "the strategic process of intervening in a market to create lasting change in market behavior by removing identified barriers or exploiting opportunities to accelerate the adoption of all cost-effective energy efficiency as a matter of standard practice." Measurement of market transformation is typically dependent on market share metrics, and the approach works well when applied to consumer products or a specific technology.

However, when the energy efficiency 'measure' is a practice whose adoption takes a varied form dependent on the adopting organization, it requires new methods of measurement and diagnosis. This is the case with measuring and truly understanding adoption of SEM. To start the process of developing new methods of measurement it is important to agree on what defines the practice of SEM.

Lack of Clarity on SEM Components and Definitions

Until recently, interpretations varied widely on what specifically constitutes an SEM implementation at a C&I facility or organization. A growing collection of disparate standards and definitions has evolved over the past three years to address specific needs; these provide some clarity to support SEM programs. The most widely-recognized of these is the International Organization of Standardization (ISO) Standard 50001 (ISO 2011), which is based on a continuous improvement model similar to other ISO standards for quality improvement and

environmental management. However, this standard sets a high bar for many facilities and has not yet seen widespread adoption in North America. In 2014, CEE established the Strategic Energy Management Minimum Elements to describe the "the minimum conditions that an industrial company or facility should have in place in order to effectively and continuously improve their energy performance" (CEE 2014). Aside from these recent ISO and CEE descriptions, existing definitions either fail to sufficiently detail expected actions or lack any relationship to the concept of organizational development that forms the foundation of management systems.

Resulting Problems. For utility SEM deployment, the lack of agreed-upon definitions leads to the following problems:

- Regional planners are unable to clearly understand the extent to which the SEM market is being transformed.
- Utility program planners are frequently "reinventing the wheel" because there is no ready-made list of SEM components.
- Program designers cannot leverage best practices from their colleagues because programs are so different that it is hard to benchmark success.
- Utilities pay higher implementation costs because service providers cannot fully leverage their investments in previous programs.
- Utilities pay higher costs and risk quality of results for impact evaluations because each program is unique.
- SEM program providers face a lack of clarity on the state of SEM market adoption and what future opportunities might exist.
- Customers with facilities across multiple utility service areas risk being encouraged to practice different, unconnected elements of SEM within the same organization.
- Regulators have less faith in delivered energy savings due to the lack of consistency among C&I utility programs across jurisdictions, particularly in comparison to residential behavior programs.

The breadth and depth of these challenges to broad-scale SEM adoption dictates a critical first step of identifying an accepted assessment framework rubric of SEM elements; allowing for/enabling a better common understanding among all parties addressing these challenges. The capability maturity model of SEM components comes into play here by providing tools for regional and program planning, design, implementation, and evaluation.

Need for Common Framework

The lack of a common SEM framework impedes measurement of how customers have adopted the approach, and therefore how much the market has been transformed. A claim of "SEM installed" is insufficient, given that SEM is a system of business practices; we really want to know "How much SEM has this facility adopted?" A good analogy to help describe this is to think of SEM adoption as analog (infinite possibilities) vs. the digital nature (1's and 0's or discrete) of traditional product adoption.

In particular, we are promoting standardized measurements of SEM to facilitate quantitative tracking of adoption over time. Leveraging a common assessment format of SEM

adoption may yield opportunities for much greater precision in program impact analysis. The ultimate goal for this work is the ability to use statistically significant historical data to predict answers to questions such as "Which interventions will establish SEM in more firms in a particular sector in the Northwest?" or What is the relative cost-effectiveness of moving populations between different levels of SEM engagement?"

Contents of This Paper

The rest of this paper discusses program administrators' difficulties in objectively measuring SEM progress and how a software development approach called the "capability maturity model" can solve this problem. We show how the Northwest Energy Efficiency Alliance (NEEA) has applied the Maturity Model approach to SEM, resulting in a matrix of capabilities for assessing SEM adoption by organizations and facilities.

Concept of Capability Maturity Model

In our experience, customers adopting SEM differ in their value interpretations and capability requirements for each SEM component, similar to the differing systems and processes that challenged the software development industry in the late 1980s. As computers gained significant traction in military applications, United States defense agencies became a significant funder of software development. However, early software contractor experienced significant budget and schedule overruns. So, United States defense agencies sought improved methods for evaluating the capability of software contractors (Humphrey 1987).

The issues encountered by those 1980s software developers drove creation of the capability maturity model, a process improvement approach through which processes are rated in the model according to defined maturity levels. The model is used (1) to appraise the maturity of an organization's functions and (2) to guide development and process improvements to meet established goals. It is appropriate for any process to have different levels of maturity, without making any judgments on those levels (CMMI 2013).

Astute demand side management (DSM) practitioners will recognize that this concept of maturity can also be applied in interesting ways to other programs, such as retro-commissioning, custom projects, or even the way administrators run a portfolio of DSM programs.

A Model and Tool for Measuring SEM Capability

NEEA has taken the capability maturity model to the logical next step by developing the Northwest Energy Management Assessment tool (NW EMA), an assessment tool that program administrators and market evaluators can use (1) to create profiles of many organizations and (2) to measure the progress of the SEM initiative in those organizations over time. Previous papers on the SEM maturity model have described the need, the concept, its development, and an overview of its many applications to SEM program evolution. The next sections briefly review these subjects then describe the process and current status of developing the NW EMA based on the capability maturity model.

Consistent application of this tool to a large population of organizations would provide an invaluable baseline of SEM activity. Combined with further analysis of program impact

evaluations results, the assessment tool could drive a deeper understanding of how SEM delivers savings and the degree to which the market has been transformed.

During the SEM maturity model and EMA tool development, NEEA received input from many sources on the value of building alignment around a consistent SEM framework, including results and recommendations from research projects; breakout session conversations at the Northwest Industrial SEM Collaborative's 2014 Fall Workshop; and through outreach to key regional, national, and international program administrators, implementation consultants, and subject experts.

Constructing the SEM Maturity Model

The SEM maturity model is based on (1) research into SEM programs; (2) research on other frameworks or matrices used to gauge levels of engagement or maturity of process; and (3) experience with the manners in which C&I organizations implement SEM within their own facilities.

In addition to using the two earlier-mentioned efforts to establish definitions of SEM components (ISO 50001 and CEE's Minimum Elements of Strategic Energy Management for the industrial sector), we reviewed maturity models from a variety of sources including the Carbon Trust (CT 2013), US EPA (EPA 2013), US DOE (DOE 2013), Carnegie-Mellon's Capability Maturity Model Integration (CMMI 2013), and the Colorado Department of Public Health (CDPH 2013). These sources helped us to determine a useful number of categories and levels. Lastly, staff from BC Hydro, the Northwest Power and Conservation Council, and the CEE reviewed the model concept.

SEM Maturity Levels

The model itself is visually displayed as a grid or matrix, as shown in Table 1. The columns show the level of SEM engagement, while the rows include the components of energy management. As one moves across the table from left to right, the level of engagement in the SEM process increases, as indicated by the column labels:

- 0, Unengaged — the organization has not paid serious attention to its energy use and has no established energy policies or formal processes
- 1, Engaged — the organization is more seriously engaged with energy management: formal processes are emerging and basic measurement is in place
- 2, Systematic — the organization has made a formal commitment to energy management; this level corresponds well to the minimum SEM guidance of CEE
- 3, Sustaining — the organization has a comprehensive system and is demonstrating improvement in energy management practices
- 4, Integrated — the organization integrates a management system that supports continuous improvement; this level corresponds well to the requirements of ISO 50001
- 5, World Class — the organization goes beyond the minimum requirements of existing standards to incorporate all elements of SEM best practices, such as setting stretch goals and communicating performance broadly

SEM Maturity Components

The energy management components used in the SEM maturity model are as follows:

- Management Commitment — the involvement of executives and senior managers in promoting and deploying energy management
- Resources (financial, human) — the organizational resources that are engaged with energy management, such as budgets, energy leaders, energy teams
- Energy Review and Analysis — the regular assessment of energy-consuming activities across the organization or in the facility
- Energy Key Performance Indicators (KPIs) and Targets — the definition and use of strategically relevant metrics of energy consumption and waste
- Action Plans — organizational and technical plans related to energy management
- Operations and Maintenance — the ongoing attention to energy during regular business operations
- Monitoring and Analysis — the monitoring of energy consumption at the appropriate level and the continuing analysis of data
- Employee Engagement — the degree to which employees across the organization concern themselves with energy consumption
- Regular Reporting, Review, and Reassessment — the information flow across the organization and the periodic adjustments in response to new strategy or new information
- Procurement and Design — the inclusion of energy consumption as a criterion in purchasing equipment and supplies, and in the design of new facilities, equipment, and processes
- Documentation and Records —the documentation of operational processes, the management system; evidence of results or activities performed
- Management System Audits — the periodic assessment of the entire system for energy management

Table 1. Layout of maturity model

Component	0 Unengaged	1 Engaged	2 Systematic	3 Sustaining	4 Integrated	5 World Class
Management Commitment						
…						
Management System Audits						

Proving the Structure and Content

In 2014, NEEA began to test and validate the model structure and content. In evaluating the presence of SEM in NEEA's Commercial Real Estate (CRE) Initiative (Cadmus 2014), we used the model together with a survey for targeted information gathering. Doing so enables more

effective use of the results by correlating the presence of specific markers of SEM adoption to levels of energy savings within an organization to determine whether more mature practices lead to greater or more persistent savings. The SEM maturity model application to the CRE evaluation provides useful qualitative feedback but the sample size is too small to provide statistically significant results. This is an indicator of the need for SEM program data collection and aggregation using a consistent framework to enable more meaningful results.

Energy Management Assessments (How an EMA Fits into Market Transformation)

The best approach NEEA identified to validate the SEM maturity model is through a maturity model-based EMA for use at a regional or national level. EMAs can serve many purposes, such as serving as outreach tools for program providers to engage with customers, helping to identify the best customers for SEM programs, and measuring their progress as the result of an intervention. EMA content, transparency, delivery, and therefore the value to utilities and customers, currently vary widely. They are typically either proprietary and costly, or less-refined and under-leveraged. Using the model to build the NW EMA tool provides a more cost-effective, transparent solution with consistent results for utilities, SEM program providers, and participants. It also facilitates a centralized warehouse of results for analysis purposes.

Consolidated data from a standardized tool at a regional or national level significantly improves market measurement of SEM adoption. This in turn enables use of the SEM maturity model to analyze attributes of success as leading and lagging indicators. Leading indicators measure inputs (such as number of energy projects or energy suggestions from employees), while lagging indicators measure results (such as dollars saved or unit energy intensity). This analysis puts the data needs of potential solutions into meaningful context and facilitates additional analytical responses to research questions.

Organizational EMAs are codified in CEE's SEM Minimum Elements and in ISO 50001 auditing requirements and have become key components of every SEM program. An EMA tool built from an open source SEM maturity model provides SEM programs with core infrastructure for their programs, thus providing reduced program delivery costs and consolidating primary data collection challenges that have limited the full benefit of EMAs to programs in the areas of implementation, maintenance/sustainment, measurement and validation, and impact evaluation.

Constructing the NW EMA

NEEA set the following goals for the development of NW EMA:

- Develop a best-in-class online tool to ease access and data collection;
- Streamline the development to speed time-to-market;
- Ensure secure collection and warehousing of the comprehensive session data;
- Create an intuitive user interface to enable self-serve and facilitated sessions and easy data export;
- Provide structure and content that would typically result in 30-60 minutes to complete the assessment;

- Provide comprehensive reporting, including benchmarking and prioritized action item recommendations; and
- Ensure the capability to store multiple sessions for sites to enable progress tracking.

The Development Process

As a first step to accomplishing these goals, NEEA contracted with Envinta Corporation to develop the NW EMA tool. Envinta provides a customizable, easy-to-use and industry proven online platform with an exceptionally high level of customer acceptance.

Next, NEEA refined the model language down to key indicators for each SEM component at each level in the form of active statements representing key SEM activities at the organizational level. This process resulted in one to three draft statements per component level for 111 total statements (typical participants would cover fewer than 60 of these, given that most organizations lack mature energy programs). NEEA also developed mock-ups for the primary online tool interfaces and functionalities as well as supporting components.

With the draft statements and mock-ups, we began collecting and consolidating input from stakeholders. A project team including representatives of ETO's industrial and commercial sector teams and BPA's industrial team joined the representatives from NEEA and Envinta (the Team). Team members reviewed and provided input on the statement set, design, structure, and reporting. Results of this collaborative development process greatly improved key elements of the tool design and functionality. Key impacts to the tool and process include:

- More appropriate language as used in the market
- A level of understanding and buy-in to support piloting the NW EMA
- Opening a channel to end users for proving the structure, content, progression and tool capabilities NEEA believes are critical for success

Challenges Encountered

The collaborative process the Team followed provided insights into important tool development considerations. Most predictably, many questions were raised about the differences in language usage in the industrial and commercial sectors. Suggestions also included developing specific sector segment statement sets, such as for the commercial real estate and healthcare segments. Unique statement sets can be integrated into the tool and will be considered in future development efforts. Additional questions were raised about the unproven higher levels of maturity, including: their unknown value-added to an organization's energy program, whether EMA results can predict success in an SEM program, how frequently they should be conducted based on organizational characteristics, and most notably, whether they lead to greater proven savings than a lower-level (e.g., Level 2 or 3) energy program. Without making judgments about what the outcomes will be, these are some of the key questions that may eventually be answered after collection of sufficient data for analysis.

NW EMA (Beta) Tool

A beta version of the NW EMA tool was completed and ready for piloting in the spring of 2015, at the time of publishing this paper. The tool is comprised of the following web-based elements:

- Landing page: includes self-serve, facilitated and return user log-in, and links to self-serve and facilitated session user guides;
- Business information page: data entry of user contact, session attendees, and business-specific information, and a link to an introductory presentation to orient users to the assessment, see Figure 1 below;
- The assessment: the conditionally rendered SEM component level statements with progress tracking and user interface controls, see Figure 2 below;
- Results report: includes business information summary, session access data, benchmarking, assessment results, and prioritized recommended actions, see Figure 3 below; and
- Administration pages: for managing completed sessions and exporting data.

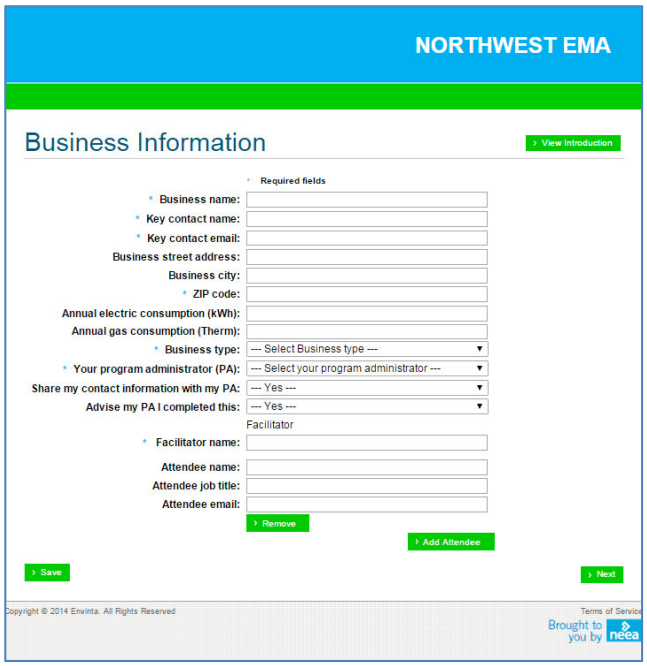

Figure 1. NW EMA business information page

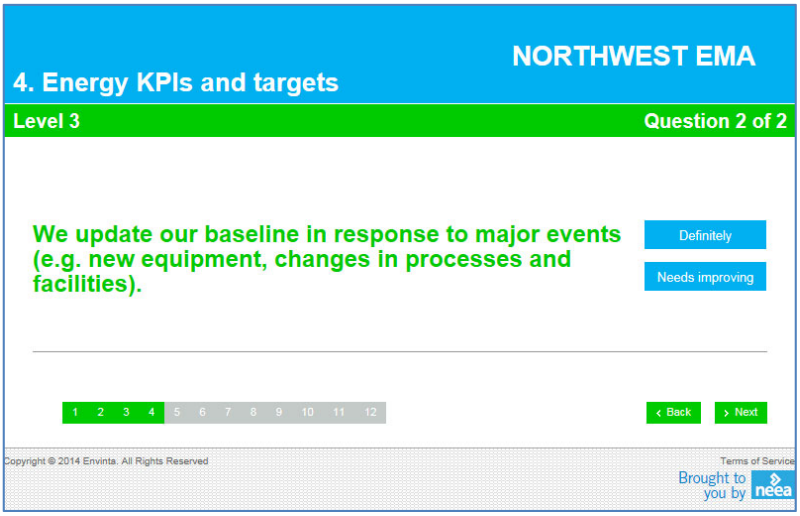

Figure 2. NW EMA sample question page

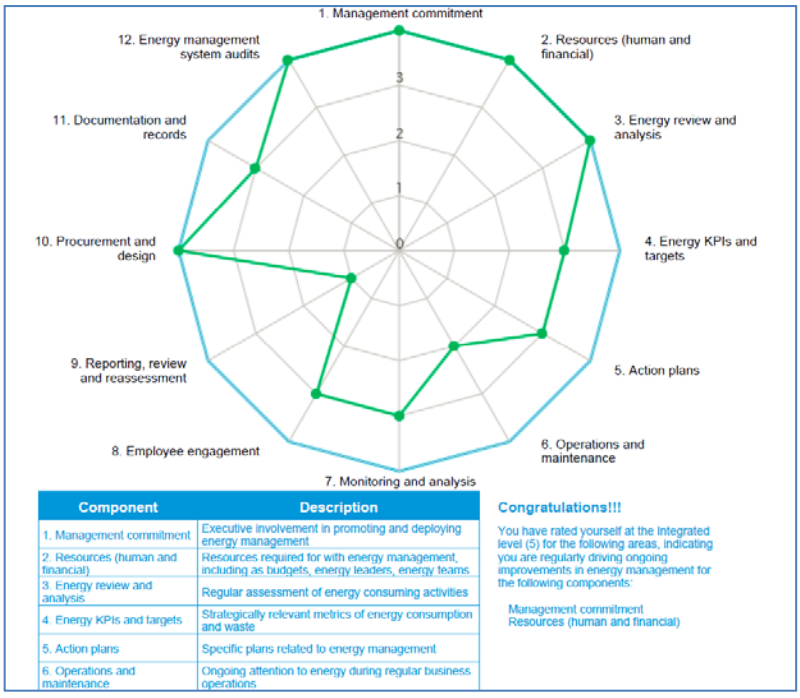

Figure 3. NW EMA report sample

Conclusions and Next Steps for the NW EMA

Piloting the Tool

The collaborative development process identified opportunities with ETO commercial and industrial program participants to pilot the NW EMA. ETO industrial sector leadership agreed to provide access to participants in her Technical Advisory Committee formed of prior SEM program participants. Within the commercial sector, discussions have started on piloting

the NW EMA as part of a new cohort to begin later in 2015. To provide the most value to the NW EMA development effort, pilots will be structured to capture end-users both with and without EMA experience, facilitated sessions will be witnessed, detailed notes captured, and a survey administered with the program administrator, facilitator, and user of the EMA. User feedback on the NW EMA program design in which they have participated will provide helpful context for evaluating the NW EMA results and pilot process.

Use of Statement Set for Impact Evaluation

Building on use of the maturity model for NEEA's Commercial Real Estate Initiative report on Cohort Adoption of SEM and Related Savings (Cadmus 2015), the streamlined NW EMA statement set facilitates adoption measurement more efficiently than the full SEM maturity model statement set. It also addresses recommendations made by BPA's and ETO's evaluation contractor, Cadmus, from its experience using the full model. At the time of this writing, BPA and Cadmus were using the NW EMA statement set to inform the Energy Smart Industrial High Performance Energy Management program impact evaluation project.

Market Acceptance

In addition to these pilot efforts, NEEA will continue to raise awareness of the SEM maturity model and its NW EMA tool with the goal of building acceptance of the model and ultimate adoption of the NW EMA tool by SEM program administrators. Additionally, where feasible, NEEA will work to align proprietary EMA tools to the model and NW EMA statement set. This would allow consistent market measurement and aggregation of SEM adoption data to support analysis efforts.

Mapping and Benchmarking Existing Data Sets of EMA Results

A potentially rich data aggregation opportunity exists on which to build with future NW EMA data. To take advantage of it, a data sharing process could be established to source prior EMA results from program administrators or implementation contractors. Prior EMA data could be mapped to the model and entered into the NW EMA tool to enable easier aggregation and data export capabilities, which could quickly build the EMA database of SEM adoption and accelerate resultant analysis.

Tying NW EMA SEM Adoption Data to Energy Savings

The manner and timing through which SEM adoption maturity will impact energy savings, both within the program cycle and beyond program participation, constitute key concerns. Collection of sufficient SEM adoption data to begin development of defensible energy savings projections for specific end use facility types would enhance NEEA's and the region's ability to understand our position on the savings journey and when market transformation has truly taken place.

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