More than High Efficiency Motors
Market Transformation for Industrial SEM

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ABSTRACT

Mention market transformation to energy efficiency business professionals and they think of S curves and High Efficiency Motors. Ask an industrial DSM program administrator to describe how organizational programs like Strategic Energy Management (SEM) fit on an S curve, and watch them squirm. It can be difficult to apply the traditional definition of DSM market transformation to the Industrial market due to some inherent limitations. Questions are raised: is market transformation a strategy or goal, how is it applied to a non-widget, non-mass market? Industrial energy management approaches are evolving with the introduction of management systems for energy, with DSM administrators deploying SEM programs to address business practices and move beyond equipment-focused programs. These approaches are transforming customer practices one-by-one. Traditionally, when trying to map business practices on an S curve, one would characterize customers who do or do not execute that practice. However, this approach misses whether that practice is enhanced or improved over time, to a practice that is more sophisticated. Is there a better definition of market transformation for Industrial DSM business practice (or SEM?) programs that will better capture these interventions and enable a more complete picture of the transformation over time? This paper will explore how improved market transformation frameworks can help administrators and regulators to agree on success and ultimately influence program designs to be most effective.

Definition of Market Transformation

Is Market Transformation a strategy or a goal of Demand Side Management (DSM) program implementation? According to the Northwest Energy Efficiency Alliance (NEEA) market transformation is defined as follows:

"Market Transformation is 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."

Figure 1 below displays the resulting difference in market adoption after the strategic intervention. The goal is to increase market adoption sooner and to a higher level than what baseline (non intervention) may have achieved.

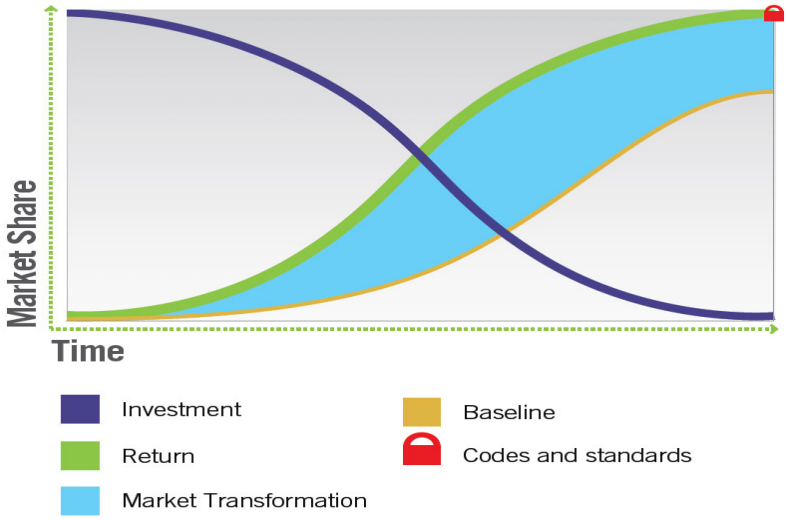


Figure 1. Market Transformation curve. *Source*: NEEA 2013

For the most part this definition can be applied to the industrial market from a broad DSM prospective. However, there are other definitions that offer a different perspective, that market transformation is not a strategy but the goal of the intervention. It is safe to say the objective of any DSM or market transformation program is the improved efficiency of behaviors, equipment, or processes leading to direct or indirect energy savings. For the purposes of this paper we propose that SEM is both a strategy for transforming an industrial market as well as a long - range goal supporting managing energy within the marketplace.

Introduction To Strategic Energy Management

In the early part of the last decade energy efficiency technical projects managed at the customer site had been the historical approach and remain the key method to achieving energy savings. This approach however did not leverage the business practices of an industrial firm or build longer-range customer relationships. It was a classic push model that was subject to changes in personnel, as well as business cycles, and was not owned by the customer. A new approach was needed. So, over ten years ago utility energy efficiency programs began to investigate a more systematic approach to energy efficiency for their industrial customers. BC Hydro and Northwest Energy Efficiency Alliance (NEEA) began pioneering programs that were able to help integrate energy efficiency into industrial business practices. Energy Trust of Oregon (ETO) and Bonneville Power Administration (BPA) both built programs leveraging the key learning's from these early efforts.

These Strategic Energy Management programs are centered on working with plants helping them set up a management system. This system manages energy as a controllable expense in a continual improvement environment similar to managing quality or safety. Customers practicing SEM have top management sponsorship and are setting energy goals, with annual project plans, and performance indicators to track achievement of energy savings. This management system is closed loop and can overcome personnel changes, business cycles and

other priorities. For program administrators, this management system can create demand (pull) for their efficiency measures. Third party evaluations to date are showing SEM to be effective at delivering savings from both behavior change as well as energy projects. Though programs in the Pacific Northwest have had success with SEM, larger opportunities remain for implementation across North America.

Cumulative Diffusion of Innovation Curve (S Curve)

For measuring market transformation (MT), NEEA has over the years used the diffusion of innovation curve used in understanding how a market has adopted a new energy efficiency technology. Initially, most all of the MT work was focused on new efficient products (widgets) like CFLs, high efficiency motors or variable speed drives. Market adoption of these new energy efficient products was displayed using a cumulative diffusion of innovation curve (S curve). With industrial SEM, the idea of understanding market transformation progress through a standard S curve can be more challenging. Though challenging, we believe that the S curve does apply in a fashion, but there are more promising approaches to measuring the market adoption of SEM that are in testing and development.

Diffusion of innovation is a field of study that has developed a generalized model for application across innovations. These innovations include new products, services, ideas, and practices. An innovation is adopted depending on a number of attributes including the degree to which it has relative advantage over the idea it supersedes, as well as its compatibility with existing values, past experiences and needs of the potential adopters. Additional attributes include the trialability, observability and ease of understanding among potential adopting organizations or individuals (Rogers, 2003). SEM as a business practice is an innovation that is in early stages of diffusion.

Challenges in using the S Curve in Industrial SEM

There are three major challenges in understanding industrial SEM MT and displaying it through the use of the standard S curve. These include: the heterogeneity of the industrial market, the complexity of SEM as an innovation, and the nature of innovation adoption in the industrial market.

Market Heterogeneity

The heterogeneity of the industrial market can be quite challenging, as there are multiple sectors in the market as well as sizes of enterprises. Industrial facilities are an integration of devices and end use equipment; each facility is unique and complex. In addition there are many decision makers that influence the implementation of energy using equipment or the management systems in place. Approaches used in mass -market energy efficiency adoption are not appropriate in reaching the customers in this one. Mass-market communication channels can be useful in helping industrial organizations *learn* about innovations however.

Complexity of SEM as an Innovation

SEM as a management system for energy is not as straightforward as an energy efficiency capital project or typical measure. The management system is a complex solution that both program administrators as well as their industrial customers need to deeply understand to take full advantage of its' energy saving potential. For advanced levels of practice for example, there are 12 elements of the ISO 50001 standard to consider. SEM is built on continuous improvement as an operating philosophy that most industrial firms have adopted. SEM with its long-range approach can be problematic for people who are looking for faster returns on their energy efficiency investments. This long- range investment requires perseverance and a constancy of purpose from the customer as well as the program administrator.

The Nature of Innovation Adoption in the Industrial Market

Industrial organizations depend mainly on a subjective evaluation of an innovation that is conveyed to them by organizations like them who have already themselves adopted that innovation. This is illustrated in the importance of referral customers offered by suppliers of new technology. In addition, focusing on firms in the similar sector such as food processing or pulp and paper makes use of this reference approach. Reference organizations like trade organizations were a critical strategy in some of the original industrial SEM work at NEEA. Customers of the SEM program at the Energy Trust of Oregon have in some cases asked their key suppliers and customers to get engaged with the program. Understanding how industrial customers adopt innovation is critical for program administrator's considering SEM programs.

Market adoption of industrial SEM to date has yet to demonstrate the *appearance* of a traditional S curve that NEEA found with its' earlier work with CFLs. We believe the nature of SEM as a business practice will make it hard to understand the adoption rate and if it is really accelerating. Energy Management Assessments (EMAs) have been useful in understanding how a *plant* is implementing SEM, however they are not yet standardized to a level that can account for the depth of an SEM implementation at the *market* level. New approaches are being trialed to better measure market progress of SEM in the industrial market. Those approaches intend to detect market movement and better integrate the challenges discussed above. We will touch on one of these developments in the following sections.

Evolution of Strategic Energy Management

As more industrial customers and their serving program administrators are learning how to implement SEM, one of the larger positive outcomes is the deepening of the business relationships between them. BC Hydro pioneered the use of on site energy managers who were instrumental in developing annual energy plans and getting key capital projects implemented within the industrial plants. We learned that customers with long range energy savings goals are more apt to develop annual plans and partner with energy efficiency program administrators in order to implement those annual plans. SEM demands executive sponsorship of long-range goals as well as regular review of annual progress. As industrial customers continue to implement their plans they tend to ask for even more help than what is in the portfolio of the administrator's offerings. Some have asked for help in attaining certification to the ISO 50001 standard. Though

this might be challenging, it helps solidify the customer-supplier working relationship and generates a way to monitor SEM development at the plants. Implementing SEM is teaching a man to fish (building energy management capability within the plant) where previous approaches were more akin to giving a man a fish (ad hoc incentives per project)

Working with industrial plants over the course of five years, NEEA was able to track and characterize the nature of the SEM implementation at over 12 plants. Each of these plants had "graduated" from an "installation" effort and was engaged with their serving program administrators' energy efficiency portfolio. As expected some plants did not maintain SEM as originally implemented due to mergers, plant closures, and changes in ownership. Some integrated their SEM efforts as part of their LEAN business practices. Those that continued to invest into SEM had higher energy savings over time and a more robust management system they and their program administrators could rely on. Importantly none of these plant sought ISO 50001 certification.

"Installing" and implementing SEM takes time and resources from the industrial customer as well as the program administrator. As previously mentioned, each customer is unique and how its management system evolves and matures over time does not follow a regular pattern. Energy savings from SEM are fundamentally more *analog* in nature compared to the *digital* nature of a motor upgrade. The meaning here is that SEM does not act like a prescriptive measure but rather sets the environment whereby energy savings can come from practice as well as projects. The continuous improvement nature of SEM leads to a greater ability to attain energy savings from the system over time. Many plants practicing continuous improvement of SEM are attaining more robust management systems.

Customer Transformations lead to Market Transformation

As customer plants continue to develop more robust management systems they can reach deeper into the energy savings opportunities. These *journeys of transformation* are now becoming an important area for program administrators to study and understand if they are to realize the total amount of energy savings potential available within their industrial customers. Along the transformative journey, the persistence of that management system is an attribute to also study. We will refer to an application of a diagnostic later that will aid in the study and characterization of these plants. The nature of these changes at the customer plants will require a number of changes within the energy efficiency ecosystem.

The first change will require a deeper level of customer partnership engagement by program administrators. These relationships will start to become more mutually beneficial as plants continue to seek energy saving opportunities to meet their long -range goals. Progressive industrial customers seek to build partnerships with key suppliers. It makes sense they would do so with their energy efficiency service providers. These evolving partnerships therefore lead to both sides striving for continuous improvement in energy performance and savings. Partnership seeking program administrators are helping to change more industrial customers into SEM practitioners. Program administrators will need to continue this trend of developing more business consultative thinking. SEM requires holistic management practice understanding. The message is that programs are also transforming themselves along this SEM journey

The second change needed is a broader and deeper supply of SEM consultants as the program administrators' first tier of suppliers in this market. These firms are made up of both technical experts capable of building the appropriate energy performance tracking models, monitoring changes in energy performance over time, and dynamic changes associated to the life of a manufacturing plant. To be successful, these firms need to develop expertise in not only the technical side of SEM, but in supporting organizational change at the customer facilities. Indeed, facilitating SEM as with any management system implementation is an organizational change effort. Program administrators need SEM consulting suppliers with organizational development chops as well as technical expertise. This supply base is on a transformational journey.

Finally, SEM has the capability to totally change the paradigm of how industrial energy efficiency programs are evaluated. (Chittum 2012) This is due to the continual improvement foundation SEM is built on, where plants are constantly optimizing their energy performance. They are now managing and measuring energy performance at the system level and in some respects with little regard to the source of the progress. Progress comes from capital projects, business practice and manufacturing process change. This holistic approach to energy programming and measuring will be hard to marry with the typical existing approaches to industrial evaluation. Metrics such as energy productivity might become more relevant to evaluators as they are reflective of how industrial customers manage their business and chart progress of their management system. With every new SEM practicing plant there will be more information available in how these plants are using energy. Those evaluators with experience in SEM are aware of the challenges of applying previous evaluation methods to understanding SEM progress at the plant and market levels. The journey has started here as well.

We believe that these individual journeys of transformation are the make-up of SEM market transformation. Ultimately this is a customer transformation by customer transformation journey. Importantly, program administrator's stronger evolving relationships with SEM adopting plants are very useful when it is time to better understand total market level progress.

Critical Developments Aiding Long Range Market Transformation

Over the past three years in particular there have been key developments in SEM that are of importance in deeper understanding of SEM market transformation.

1) Further refinement of the definition of SEM as a product category
2) Deeper understanding what makes up an SEM industrial market
3) Developing a SEM Maturity Model to understand plant level adoption
4) Applying the model of strategic market management to industrial SEM

SEM as the Product Category for Management Systems for Energy

As more administrators began developing energy management programs for their industrial customers, standardization began to emerge as ISO 50001 was developed and USDOE defined Superior Energy Performance (SEP). NEEA participated in some of the early ISO 50001 developments as well as hosted one of the early demonstration efforts for SEP. All of these efforts were based on SEM fundamentals. In 2013, CEE as a member of the NW SEM Collaborative, took on the responsibility of helping define the minimum elements of SEM. CEE is now leading an industrial SEM initiative and is utilizing this definition in its annual review of

members programs. A standardized definition has eliminated any lingering confusion of what SEM is all about. Harmonization has continued as the various names of programs that meet the CEE minimum elements like NEEA's CEI, SEP, ISO 50001, and others are all members of the SEM product category. Applying SEM as a product category label helps to orient all of the market participants.

SEM Market Analysis and Planning

We are interested in understanding how SEM can act as a transformative approach to the industrial market for energy efficiency. The long-term vision promulgated by the Northwest Industrial SEM Collaborative (Wallner 2013) was to have a high degree of market adoption of SEM. The rationale for this was that the more industrial facilities practicing robust SEM, the stronger those firms could be and the more energy savings could be acquired. Like some vision statements this sounds appealing but requires a great deal of work to characterize the market and how it is actually moving. We wanted to characterize the market according to the breadth of adoption as well as the depth (robustness) of that adoption. How do we measure progress in breadth as well as depth? The NW SEM Collaborative decided to develop an approach to this market analysis in a multi-step fashion.

Which plants and how many (breadth) are the best targets for SEM implementation? In the beginning of rolling out demonstration projects, recruiting plants can be difficult if this level of characterization is not understood. This key learning was made as part of the NEEA demonstration project evaluations.

Not all industrial plants are going to be SEM candidates, and it is important to identify the potential market as a bounding box for understanding market transformation. To answer this, one needs to do a market study to determine total number of plants in service territory. This census can then be first categorized by energy consumption. The NW SEM Collaborative focused on the top 10% of the plants that used 90% of the energy since it is believed that the larger the energy consumption at the firms, the more a systematic approach like SEM was a fit for their business environments. This was referred to as the addressable market for SEM. We have now identified which plants and how many (breadth) are in the regional SEM market and can be part of that market transformation vision. The NW SEM Collaborative continues to refine the configured approaches of SEM programs that work best with the types of plants within this addressable market.

SEM Maturity Model

To what level of robustness (depth)? As each plant can be viewed as unique as a snowflake, the analog nature of SEM becomes a challenge for program administrators. How can plants that have participated in the SEM programs be relied on to continue to practice SEM under their own power. How can you refine the level of depth of practice in order to help determine how to best serve the customers transformational journey? Can you compare a customer who has been practicing SEM for one year to one that has been practicing for three or five? Is practicing alone enough or is there a need to continually invest in SEM to ensure the most robust management system is in place? These questions require a standardized diagnostic

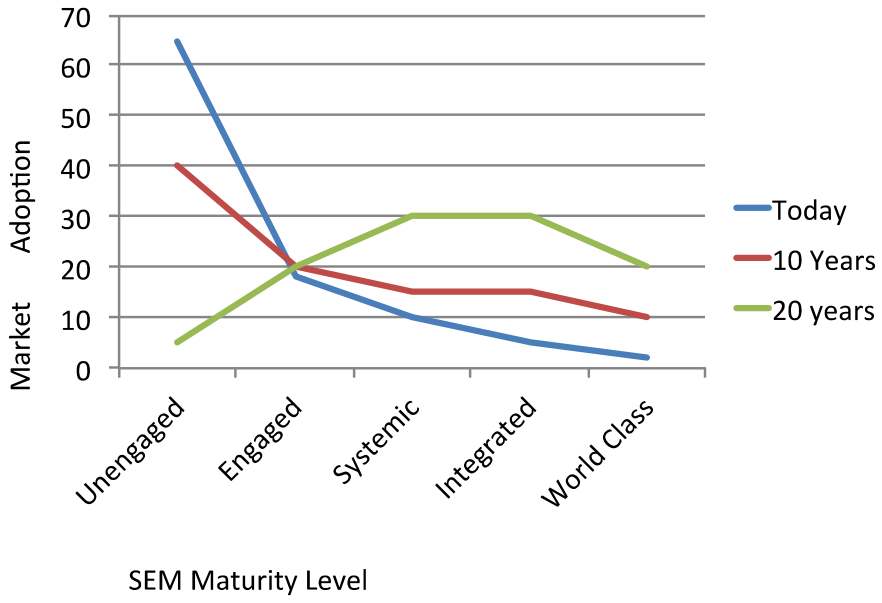
tool that can be applied to the customers. Fortunately, creating the operational definition of SEM programs and their key components has led to the development of the SEM Maturity Model (Leritz, Gilles, Hart 2013). The SEM Maturity Model was built on the minimum elements of SEM as published by CEE as well as ISO 50001. Though not detailed in this paper, it defines five levels of maturity across 12 critical components of SEM. It utilizes the capability maturity model approach first used in software development. It is appropriate for processes to have different levels of maturity without making judgments about them. As this diagnostic is tested and refined it will aid program administrators in characterizing their customer's journey. This can help with additional program development and in program design that encourages development within their installed SEM customer base.

Applying Strategic Market Management

In developing market transformation programs, one of the early activities is to establish the long-range vision of the market change that is being attempted. Sometimes that is a numeric goal such as achieving a market adoption of X% in Y years. This identifies the end state that is driving the program's market transformation strategy. Setting the vision then is as important in driving market change as it is in other business endeavors. In the initial meeting of the NW SEM Collaborative in the spring of 2011, a vision was to have a high degree of industrial plants practicing SEM. This vision was developed only after the initial SEM programs from Bonneville Power Administration and the Energy Trust of Oregon were deployed. Importantly, we understood that with a long-range vision, we could then begin to adopt the overall regional plans and actions, define interim progress measurements, review progress of that market movement and make course corrections as required. This fundamental work of closed loop strategic market management is eerily reminiscent of SEM within an industrial plant. From this perspective then, being able to measure progress with appropriate market progress indicators becomes a critical component to strategic market management.

SEM Market Transformation requires a New Measurement Approach

Though we are still in the middle of much of this effort, we propose a multi dimensional process that reinforces deep understanding of the industrial SEM market as the breadth of adoption as well as depth of practice. We realize that using the practice of sizing the addressable market and the adoption of a diagnostic such as the SEM Maturity Model are key first steps. We propose the use of customer-by-customer transformation as the approach to understanding the progress in overall market transformation. Understanding that the customers are dynamic organizations subject to multiple changes over their lifetimes creates both challenges as well as opportunities. With this approach would the S-curve look like Figure 1? We believe that while it can display the breadth of SEM market adoption it is unable to display the depth of the adoption. Figure 2 is an attempt to display how this the market adoption curve could develop over the next 20 years. The y-axis is market share while the x-axis is the five levels of maturity called out in the SEM Maturity Matrix. Not all firms will adopt in the addressable market, not all firms adopting will achieve world-class maturity. At the market level we do not yet have all the data to create the curves, but in the future we believe the graphic to be reflective of the multi-dimensional nature of SEM market transformation.



The Transformational Journey

We have been exploring the work associated with moving the industrial market to a high level of SEM adoption. When we started, our theory was that if you equip industrial customers with the management system for energy (SEM), they would drive their organizations towards optimal energy performance. As more industrial customers adopted this business practice based on continuous improvement there would be a more energy performance optimization within the market as well as better working relationships between industrial market and the energy efficiency program administrators. It is important to note the work of understanding industrial SEM market transformation is driving transformative journeys in our work in the industrial energy efficiency industry. All of the key players in the market inclusive of program designers and administrators, the consulting suppliers, the evaluators, and ultimately the regulators are on transformational journeys. (Chittum 2012)

We have continued in our journey in a number of key ways including:

- Developing techniques in market analysis and planning by borrowing from what many large consumer product companies do.
- Building out a multi organizational Collaborative to share working knowledge, refine solution definitions as well as measurement techniques.
- Continuing to develop additional tools and techniques needed to characterize the heterogeneous industrial market and to better serve them.
- And finally, questioning the applicability of models such as the generalized S-curve.

Conclusion

SEM is a transformational opportunity in the industrial energy efficiency space. It will make a large impact on industrial plants as well as the energy efficiency market players. Leveraging business models like the capability maturity model can help to build market understanding and enable progress. SEM was originally designed to move the direction of energy efficiency projects from a *push* by program administrators onto their industrial customers to a *pull* by industrial customers from their energy efficiency program administrators. In reviewing some of the program results over the past three years it is clear we have made significant progress in making this change. An additional benefit is a deeper customer partnership relationship and more reliable level of customer engagement. As energy efficiency is the least cost energy resource and the industrial energy efficiency is often the most cost effective efficiency resource to acquire, it is vital that industrial firms treat energy as a controllable expense, and manage it strategically. Adding energy to the portfolio of controllable expenses is the start of the journey of transformation in each industrial customer. Over time we have developed some key practices that will aid our understanding of market progress. In the future the work is to improve these practices on how we monitor continued progress of each of these customer journeys and to characterize the overall market transformation over time. We started with the idea that borrowing the S curve to display market transformation for SEM may not be applicable. The discussion of how to best understand the market transformation of SEM illustrates the continued challenge. It leads us to finding other approaches without completely throwing out the backdrop of diffusion of innovation. We believe SEM is one of the more complex innovations for the industrial energy efficiency marketplace. This innovation has the potential to radically transform our customers as well as us. And as Steve Jobs used to say "The journey is the reward".

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