A Structure for Incentivizing Greater Achievements in Strategic Energy Management

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ABSTRACT

A well-defined strategic Energy Management (SEM) program is based on an Energy Management System (EnMS) that directs change in an organization's culture. An EnMS directs top management to provide sufficient resources to staff to save ever more energy. While a relatively small number of utility and energy efficiency providers offer SEM programs, SEM's value is evidenced by the growing number of participants and available programs. The growth in utility SEM program participation is occurring despite the relatively low financial incentives offered.

However, the wide spread uptake of EnMS business practices has not been proven rapid through non-incentivized market-based programs such as the U.S. DOE's Superior Energy Performance (SEP). SEP is built upon certification to the internationally developed EnMS standard ISO 50001 and requires third party verification of energy performance improvement. To accelerate the uptake of ISO 50001 nationwide, a financial incentive mechanism is needed.

This paper outlines a broad incentive structure that could be applied at the regional or national level as a tax incentive or a grant program or by an efficiency program administrator, such as a utility. The incentive structure encourages ambitious targets for improvement in energy performance indicators (EnPIs), and addresses the problems of assuring persistence of operation and maintenance measures and of discouraging free ridership in ways that are enabled by the structure of SEM.

Introduction

While industry has been the source of some 30 percent of U.S. energy use and greenhouse gas emissions for decades—numbers that are similar to those of virtually all other developed economies—less policy attention has been paid to industrial efficiency than to other sectors.

Similarly, the studies of savings potential show lower savings in the industrial sector than in others (NAS 2010). Likely one of the key reasons for this is the lack of data in sufficient detail to allow such analysis, especially since virtually all the information on how industry uses energy is taken from observations outside the fence, coupled with the fact that industrial facilities are less similar structurally and operationally to one another than residences or commercial buildings. Information regarding the technical efficiency of equipment and to a lesser extent systems used within industrial facilities is somewhat available, but information regarding the efficiency resulting from the way in which these equipment and systems are operated is largely unavailable.

This limitation means that savings potentials are calculated on a widget basis—this much for raising boiler efficiency; that much for variable frequency drives, etc.—while system-side savings are downplayed. System-level savings are generally larger as well as cheaper than widget-level savings for the buildings sector (NAS 2010), and the difference should be even greater for the industrial sector, where the prospect of major process changes creates potentials for which there is no analogue in buildings.

Beyond the energy savings potential from equipment upgrades, continual improvement in operational and maintenance procedures has been shown to deliver large savings with little or no cost. For example, the application of housekeeping and general maintenance can yield 10-20% greater efficiency at older, less-efficient industrial facilities and low-cost capital measures coupled with operational control can deliver 20-30% improvements (UNIDO 2001; Bakaya-Kyahurwa 2004; and Worrell et al. 2009). However, operational and maintenance savings generally are excluded from industrial energy savings potentials studies.

Strategic Energy Management (SEM) presents a large opportunity to realize these additional savings (Goldstein and McKane 2011). SEM was defined in the U.S. and Canada by a nonprofit organization of energy efficiency program administrators, the Consortium for Energy Efficiency, as: "Strategic Energy Management is taking a holistic approach to managing energy use in order to continuously improve energy performance by achieving persistent energy and cost savings over the long term. It focuses on business practice change from senior management through shop floor staff, effecting organizational culture to reduce energy waste and improve energy intensity…" (CEE 2014). This definition was intended to be broad enough to accommodate a variety of approaches and experiments by program administrators.

Estimates by those familiar with SEM programs from the implementation side suggest that energy savings of 25-40 percent are possible from SEM programs that operate over a period of ten years (U.S. DOE, 2017a).

Modern Strategic Energy Management (SEM) programs are based on a structured Energy Management System (EnMS) (such as that defined by ISO 50001) that directs change in an organization's culture. They are one specific program type that is consistent with the CEE definition—a type that is widely employed worldwide. An EnMS directs top management to provide sufficient resources to staff to save ever more energy. While a relatively small number of utility and energy efficiency providers offer SEM programs, SEM's value is evidenced by the growing number of participants and available programs. Efficiency programs in North America now support SEM efforts at more than 700 host industrial facilities in 2016, up from less than 450 in 2014, but budgets were only $20 million in 2015 (Burgess 2016). The growth in utility SEM program participation is occurring despite the relatively low financial incentives offered.

This paper suggests a structure for a financial incentive program that has the prospect of increasing savings from SEM rapidly, boosting the level of savings from the industrial sector in particular.[1]

This broad structure—multi-year incentives for very large savings in energy documented by defined processes with third-party oversight, and payment of incentives based on measured performance—has been tried in the buildings sector for new homes, for new construction in

[1] SEM is also applicable to the buildings sector, to transportation, and to agriculture and mining, and could be used as a structure for considering energy savings in the supply chain. (Goldstein 2015).

commercial buildings, and for HVAC equipment and has been found to succeed in taking leading-edge efficiency measures to measurable market shares (Waltner 2012).

Results of SEM

The U.S. DOE operates a market-driven SEM program that recognizes industrial facilities for achieving certification to ISO 50001 as well as demonstrating energy performance improvement that has been verified by a third party. A 2015 study of SEP energy savings revealed that prior to participating in the SEP program participating facilities were improving their energy performance at an average rate of about 3% per year and a year after engaging in SEP that rate of savings jumped to 14% per year. The nearly 11% increase in annual savings is attributed by the participating facilities to the structured approach to managing energy provided by the EnMS, which enabled deeper operational and capital actions to save energy (Therkelsen et al. 2015). A prior study of SEP energy savings showed that nearly three quarters of savings were attributable to non-capital operational and maintenance type actions (Therkelsen et al. 2013). The energy performance improvement results stemming from the SEP program are in line with utility SEM savings (CEE 2014).

The conclusion we draw is that SEM has worked well for the organizations that have used it, but the growth of SEM has been far slower than what is needed to meet climate goals (Goldstein 2017). More policy efforts will be required to achieve the potential.

These efforts must concentrate both on expanding the breadth of SEM participation and on increasing the depth. Both are critical to achieve climate goals, but breadth should take a higher priority in terms of timing, for two distinct reasons.

First, meeting climate goals requires prompt achievement of emissions reductions, since climate pollution is cumulative (Goldstein 2017). Organizations adopting SEM can achieve significant savings—currently estimated at over 10%—in just a year or two (Therkelsen et al, 2015). However, without continuing incentives for continuing participation, organizations tend to drop out of SEM programs after an estimated average of 4.5 years (Vetromile 2015)—a disappointing result for a program intended to change corporate culture. This paper hypothesizes that incentives can improve this result.

Second, very few organizations have documented continual improvement at a high rate yet. Thus, target-setting for an organization is constrained by a lack of experience about how much is possible by the organization's peers. As a result, few programs have targeted high levels of savings and commensurately high incentives that the design of an incentive program is likely to itself require a process of continual improvement.

Thus, the programs suggested below should be considered as a first step, and if adopted should be monitored for its areas of success and of weakness, and should evolve with greater experience.

New Programs

As noted, an increasing number of utilities in North America run SEM programs. Participation in ISO 50001-based programs is also proceeding apace in many other countries. An ISO-maintained database of these certifications reports that nearly 12000 ISO 50001 certificates were issued worldwide in 2015, up nearly 80% from 6700 in 2014 (ISO 2015). Presentations by the staff who direct these programs suggest that the program designs require a high level of interpersonal interactions: essentially “selling” the program to the top management and sometimes also the operating management of the programs at the utility-customer level. The interventions often involve the sharing of technical information on efficiency options, co-funding energy audits, helping to provide the capital needed for physical upgrades and process improvements, co-funding the position of energy team leader, or simply running interference with stakeholders on accepting proposed improvements.

Such assistance may turn out to continue to be necessary both to expand program participation and to retain participants. The program suggested next is intended to complement such efforts.

This paper’s proposed program has two dimensions: 1) to increase participation in SEM, and 2) to increase the depth of savings achieved. The former dimension might best be accomplished through individual efficiency program administrators, such as utilities, while the latter might be more suited for a statewide or national-level program.

Increasing Breadth of Savings: Encouraging More Participation

The U.S. Department of Energy has developed a series of programs to encourage participation by industrial organizations. Despite the lack of financial incentives for its use (most SEM programs offered by efficiency program administrators such as utilities do not rely directly on the U.S. DOE products) it has made progress in the marketplace.

The new 50001 Ready Program recognizes operational excellence by enabling, promoting, and providing recognition for the establishment of sound business practices around the productive use of energy, based on best practices described in the ISO 50001 Energy Management System standard. 50001 Ready recognition is received upon completion and self-attestation of implementing an ISO 5000-based EnMS through the new 50001 Ready Navigator, an online-based EnMS tutorial and submission of self-performed determination of energy performance improvement.

As part of increasing the value of ISO 50001 certification, the U.S. DOE has stood up the Institute for Energy Management Professionals. This training and personnel certification nonprofit offers the Energy Professionals International ISO 50001 Lead Auditor credential. The Energy Professionals International ISO 50001 Lead Auditor credential supports the creation of an international workforce focused on maximizing the energy savings impact of ISO 50001 implementation. This consensus-based, internationally relevant certification scheme for ISO 50001 Lead Auditors builds greater consistency and higher value in ISO 50001 implementations.

The SEP certification program for U.S. industrial facilities provides a transparent, globally accepted system for verifying improvements in energy performance and management practices. Facilities that achieve SEP certification obtain ANAB accredited third party verification for conforming to the ISO 50001 energy management standard and for achieving a defined level of energy performance improvement (U.S. DOE 2017b).

This paper proposes to accelerate the uptake of EnMS nationally by providing an incentive for participation in the various U.S. DOE ISO 50001-based programs, regardless of whether the organization’s energy performance improvement goals are very high or merely typical of decently performing peers.

Such an incentive could equally well be provided by a tax deduction at the national or state level or by an efficiency program administrator.

The amount of the incentive should be set based on the current level of energy bills; this number and the results of evaluated programs allows an estimate of the value of energy savings over the first year of the program. An incentive of somewhere around 25% of the value of expected energy savings (adjusted for savings that historically would have happened without SEM) could be appropriate for ISO-50001-certified SEM programs, with lower levels for lower levels of documentation.

For example, the incentive might be:

- 1/3 X for achieving DOE 50001 Ready
- 2/3 X for achieving ISO 50001 certification from an Energy Professionals International certified Lead Auditor
- X for SEP certification

Facilities must progress from 50001 Ready to ISO 50001 certification to SEP. SEP is the only program of the three to provide third party verification of an ISO 50001 conformant EnMS and energy savings.

After receiving the initial tax credit, a facility should receive an additional incentive for recertifying to ISO 50001 or SEP. This renewal incentive is important because despite the lofty goal of SEM to change corporate culture such that energy performance is always considered an important organizational goal, the record of SEM in the U.S. has been that even when participation is incentivized, the mean retention time for SEM participation by an organization is about 4.5 years (Vetromile 2015). This paper suggests no additional incentive for remaining at the 50001 Ready level due to its lack of ISO 50001 certification, but any would be eligible for the higher levels. It should be less than the original amount to get certified, but still meaningful. It could be something like this:

- 1/3 X every 3 years for maintaining ISO 50001 certification
- 2/3 X every 3 years for maintaining SEP certification (with the option of receiving a 1/3 fraction of the recertification tax credit annually based on successful completion of a surveillance audit)

An incentive for participation is valuable for two reasons. First, experience has shown that incentives for participation work: Germany has achieved the highest rate of ISO 50001 certifications in the world by providing certifying organizations with a discount on their electricity tariffs (In 2015, German companies held 5900 ISO 50001 certifications, approximately 50% of the worldwide total (ISO 2015)). Second, the level of participation needed to meet climate goals is orders of magnitude higher than current rates in the United States.

This incentive for participating in an ISO-50001-based EnMS appears to be complementary to the types of programs that Efficiency Program Administrators are currently operating. Informal discussions of programs indicate that very little use is made of ISO 50001; instead Administrators provide customer-specific advice, encouragement, and incentives for savings (usually limited to operational savings); in some cases, Administrators may help the customer with implementing detailed plans with assistance that may include financing or rebates for capital improvements.

Increasing Depth of Savings

One of the key observations concerning barriers to industrial investment in energy efficiency is that industry does not use the concept of net present value or return on investment in analyzing the economics of energy efficiency, but relies more on the simple payback concept.

Simple paybacks of less than 3 years are generally required by American businesses to consider efficiency upgrades; and usually the threshold is closer to 18 months or a year. The reasons for this hurdle are hard to explain when businesses collectively are sitting on trillions of dollars of cash that is returning next to zero in real dollars. But evidently money now is worth a lot more to businesses than money later.

Assuming this is a key barrier, then, it would seem that the best way of overcoming the barrier is to provide cash in advance for a firm commitment to save energy over a medium-term timeframe. Thus, for example, if an organization committed to saving 1 unit of energy in the first year and increasing this savings by 1 unit per year (thus saving 9 units per year in year 9) the cumulative savings would be 45 units over nine years. It would seem that paying up front for this savings would reverse the attitude towards efficiency investments.

Such a program would be difficult to establish by a regulated utility or program administrator because of issues relating to making and holding true to nine-year promises. It would also face difficulties in terms of being able to claw back the incentive if the goal is not met in Year 9. And one could imagine the heartburn that a utility manager would feel if in that 9th year he or she was required by contract to essentially penalize a large customer—one that could pull out of the service territory and relocate elsewhere—that they now owed a large bill to the utility. The problem is further exacerbated if the organization has plants in different states or Administrator service territories and might move production—or a whole plant—across political borders even without the threat of penalty.

Thus, the preferred vehicle for such a program might be a tax deduction. It is easy for Congress to pass a tax bill with a ten-year (or longer) time horizon, and tax incentives do not have budget restrictions, in the sense that a runaway success in a program will not mean that it runs out of money and that later participants lose out.

If this hypothesis is correct, then the tax deduction program will have a range of possible outcomes along a spectrum, all points of which are acceptable. At one end of the spectrum, the program will be a great success and large quantities of energy will be saved. This could lead to problems at a utility because a runaway success will bust the budget. But tax expenditures are not subject to budget limits. At the other end of the spectrum, the program will fail because of its inability to attract many participants, but the failure will be a soft one, because the costs will also be minimal.

The net cost of such a program to the Treasury will be negative. This outcome is almost assured for each participant because energy is tax deductible. If the program succeeds in saving energy in participating organizations, their deductible energy costs will go down each year and corporate income taxes will increase (which is fine with the organization because it means that profits increase).

What about companies that don't pay corporate income tax? They do not qualify for benefits under the proposed structure because they do not benefit from new deductions.

Some details of the program are suggested next.

The basic design of the program, to reiterate, is based on the observation that industrial energy-consuming companies act as if they have extremely high needs for fast payback, or to say it differently, for cash available now rather than a stream of money going into the future.

So the proposed program pays the incentive based on projected cumulative savings over the life of the company's commitment to an energy goal. Thus, in the 9-year example above the incentive would be based on saving 45 units of energy cumulatively. The value of the incentive would be about 25% of the cost of the energy saved. Thus, if the corporate income tax rate ends up being 25% (it now is 35% but there is significant momentum behind a decrease) the deduction would be equal to the full value of saved energy.

The taxpaying organization would choose a time period of commitment of 3, 6, or 9 years corresponding to the 3-year cycle of the U.S. DOE programs. It would be required to certify to the U.S. DOE levels of quality assurance, rising to Superior Energy Performance certified within 3 years. It would propose an Energy Performance Index (EnPI) by which its savings will be measured, and U.S. DOE would approve its reasonableness.

Incentives would be based on net improvement, equal to the measured improvement minus the improvement implicit in the historic energy performance of the NAICS category into which the facility(ies) fall(s) ***plus one percent per year***. The additional 1% is to assure that the taxpayer is not paying for savings that might have happened anyway. The U.S. DOE would develop a list of the baseline improvement rates by category.

Thus, if a taxpayer proposes a rate of improvement of 4% annually, and the sector has improved historically at 1% annually, the savings are accumulated from year 1 until the end of the cycle based on the difference between a 4% rate and a 2% rate.

This method for correcting for free ridership could greatly mitigate a problem that has plagued industrial program EM&V particularly: how does one account for the amount of energy savings that would have happened anyway without the program? For conventional widget-based programs, answering this question is impossible from a scientific basis: if the organization upgraded a boiler or air compressor, how can you measure whether they would have done it anyway? This question is more difficult for industrial efficiency programs than it is for residential because the evaluation is performed on a single plant. For a residential furnace upgrade program with a specification of, for example, an AFUE efficiency metric of 95%, one can look at sales statistics for this efficiency level and make some reasonable assumptions about the trend of sales. Statistics makes this work, the evaluator does not try to find out if Mr. and Mrs. Smith would have bought the high efficiency furnace anyway, but can look at broad markets.

In contrast, if the evaluator wants to determine whether Smith in his or her capacity of plant manager for Robinson Chemical would have bought the high efficiency boiler without the program, statistics doesn't help. Thus, the problem is fundamentally indeterminate. As an example from physical science, if you have trillions of atomic particles that decay with a half-life of a day we can measure the decay rate repeatably. But if you ask how long one given particle takes to decay, the result is individual. One of those trillion particles will decay the first minute, and another will last 2 weeks.

This program design solves the problem by bringing back statistics: one can estimate the improvement rate of a plant, or of its peers, in a repeatable way based on historic measurements.

Incentives are limited to no more than the documented expenses of the energy management and energy management system improvements, a nearly universal requirement for all tax incentives.

Incentives would be awarded based on a two-step process. For the first step and as part of the incentive application, the organization would submit a proposed SEP achievement level in terms of percent savings annually and in terms of kWh of electricity and/or Btu of fuel to the U.S. DOE, and in terms of the length of the incentive cycle. These must be approved by the U.S. DOE. The applicant can then receive the incentive for the taxable year in which the approval is granted.

The second step is that the applicant must annually verify to the U.S. DOE the degree of progress that is recorded towards meeting or exceeding the energy performance improvement level set by the SEP program using the U.S. DOE Qualified Energy Saving Tool (QEST) augmented with the additional requirements of submission of supporting energy consumption and relevant variable data evidence which is verified by an accredited SEP PV.

If the annual energy performance improvement level is not obtained by the end of the 3rd, 6th and 9th years, the proportion of incentive related to the shortfall in that 3-year period will be clawed back. If organizations are unable to obtain SEP certification within the established time frame the entirety of the incentive will be clawed back.

(Note that if an organization is falling behind its goal and is in danger of clawbacks, it can accelerate its energy management efforts in the succeding year to meet the goal.)

There are a number of circumstances that must be addressed for the clawback to work. For example, if the organization enrolled in the incentive program is sold prior to completion of the incentive cycle, or the facility on whose performance the incentive is based is sold, or its operational arrangements changed such that the taxpayer is no longer in control of its energy use and consumption, the purchasing organization can elect to maintain participation in the incentive program;[2] otherwise the incentive cycle will be shortened to end at the point of the most recent annual verification of energy performance improvement and the remaining incentive will be clawed back to the extent that performance falls short of the goals. The U.S. DOE will need to write rules for clawback that would apply to the taxpayer under these or other circumstances.

As mentioned above, it should be considerably easier for these clawbacks to be administered on a national basis in the context of tax deductions than in a local context where the administrator is the operator of efficiency programs for industry.

This proposal is intended to be the opening step in a dialogue with stakeholders in business, utilities, government, and the nonprofit sector. Just as was the case with tax credits and deductions for energy efficient buildings and equipment that were adopted in 2005, the final legislation, while it resembled the early proposals, incorporated many improvements (and some necessary compromises) before adoption. The results were a high degree of success: the incentives brought advanced levels of efficiency into the market, raising most of the incentivized measures from market shares well below 1% to market shares of 14% and more (Waltner 2012).

[2] Obviously the purchasing organization will not receive the tax benefits, as they have already flowed to the seller, but this continued compliance can be part of the negotiations of the sale. And since the improvements make economic sense without the incentive, the buyer may want to meet the targets in any event.

Conclusion

There is a large if impossible-to-quantify potential for increasing energy efficiency in industry through SEM, an opportunity that will be needed if America is to meet the climate goal to which our country, along with 189 other countries, signed on at the Paris meeting of the United Nations Framework Convention on Climate Change in Paris in December 2015. SEM also offers the opportunity to develop more manufacturing jobs through making industry more competitive globally as well as through making the materials and supplies needed to improve energy performance (Goldstein 2017).

This potential has a much greater chance of being realized if SEM is incentive broadly throughout the United States (or any country). Savings in costs and emissions can be achieved in the short run through incentives to participate in existing government and utility programs for SEM, incentives that aim to expand the pool of participating organizations and facilities rapidly. The savings can be increased by incentives for higher levels of ambition in the rate of energy performance improvement—incentives that will reward bold actions in the energy plans required in SEM by increasing levels of payment.

This paper has taken a first step in suggesting why such programs are valuable and what they would look like in terms of technical and policy content. The authors hope that it provokes further discussion, analysis, refinement, and eventual enactment of incentive programs.

References

Bakaya-Kyahurwa, E. 2004. Energy efficiency and energy awareness in Botswana; ESI. Power Journal of Africa, 2, 36–40.

(CEE) Consortium for Energy Efficiency. 2014. Jess Burgess. “CEE Industrial Strategic Energy Management Initiative”. January 17, 2014.

Burgess, J. 2016. Consortium for Energy Efficiency. . “CEE^{SM} 2016 Strategic Energy Management Program Summary”. November 21, 2016.

Goldstein, D. B. 2017. “A Jobs and Infrastructure Program to Arrest Climate Change.” Electricity Policy, February.

ISO, 2015. The ISO Survey of Management System Standard Certifications - 2014 [WWW Document]. Int. Stand. Organ. URL http://www.iso.org/iso/iso-survey (accessed 12.5.16).

NAS (National Academy of Sciences). 2010. Real Prospects for Energy Efficiency in the United States. Washington, DC: The National Academies Press. doi:https://doi.org/10.17226/12621.

Therkelsen, P., McKane, A., Sabouni, R., Evans, T., and Scheihing, P. (2013). Assessing the Costs and Benefits of the Superior Energy Performance Program. 2013 ACEEE Summer Study on Energy Efficiency in Industry, Niagara Falls, NY

Therkelsen, P., Rao, P., McKane, A., Sabouni, R., Tamm, Y., and Scheihing, P. (2015). Development of an Enhanced Payback Function for the Superior Energy Performance Program. 2015 ACEEE Summer Study on Energy Efficiency in Industry, Buffalo, NY

UNIDO. 2001. Africa industry and climate change project proceedings. UNIDO publication, Vienna: UN Industrial Development Organization.

U.S. DOE (United States Department of Energy). 2017a. "Certified Facilities" https://www.energy.gov/eere/amo/certified-facilities, accessed March 2017

U.S. DOE (United States Department of Energy). 2017b. "Superior Energy Performance" https://www.energy.gov/eere/amo/superior-energy-performance, accessed March 2017

Vetromile, J. 2015. "What Gives SEM Staying Power?" In Proceeding of ACEEE 2015 Summer Study on Energy Efficiency in Industry. Washington, DC: ACEEE.

Waltner, M. 2012. "A Retrospective Look at Federal Energy Efficiency Tax Incentives: How Do Cost and Performance-Based Incentives Compare in their Ability to Transform Markets?" In Proceeding of ACEEE 2012 Summer Study on Energy Efficiency in Buildings. Washington, DC: ACEEE.

Worrell, E., Bernstein, L., Roy, J., Price L., and Harnisch, J. 2009. Industrial energy efficiency and climate change mitigation. Energy Efficiency 2, 109-123.