

EMIS Program Design, Delivery, and Results with Efficiency Nova Scotia

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ABSTRACT

Efficiency Nova Scotia launched a pilot “Energy Management Information System (EMIS)” program in August of 2012. The pilot objective was to evaluate a program model that would provide industry with specific tools to help organizations generate energy savings from systematic energy management operational actions that are informed by enhanced energy information. EMIS was launched as a Program in April 2013 and has produced very positive results engaging large industrial companies as well as producing cost effective energy efficiency program savings. This paper will explore:

- How the program was structured
- Positioning of EMIS as an energy management system rather than just as meters or a monitoring and targeting tool
- Type of industry participants and levels of the organization engaged
- Experiences and results from 4 initial companies

Efficiency Nova Scotia’s EMIS program helps industrial and institutional facilities manage their energy consumption. More importantly, EMIS works with organizations to incorporate energy management into existing management systems and communication structures. Facilities that engage in the program benefit from a customized holistic approach for managing their energy, with continued support to ensure technical and managerial skills are nurtured. EMIS participants demonstrate senior management commitment prior to enrollment in the EMIS Program through a Letter of Intent (LOI), which commits the participant to completing all stages of an EMIS project provided it meets their predetermined financial criteria. Program participants complete a three step process: EMIS Audit, EMIS Implementation Plan, and Implementation. After Implementation, participants benefit from a customized 12 month support plan. This program structure allows for energy savings that not only persist, but also grow over time.

Introduction

In 2011, Efficiency Nova Scotia offered a program for energy management information systems (EMIS) which provided participant companies with a prescriptive rebate for software based energy management solutions; this offering only addressed the technical components of an energy management system. After evaluating the participants from this program, and the delivery model itself, it was determined that in order to achieve energy savings and experience sustained energy management within an organization, the program would have to establish requirements that went well beyond the technical components of an energy management system. The management of energy could not be viewed as a project, software, or a technology alone.

During the spring of 2012, Efficiency Nova Scotia and its consultant, Energy Performance Services (EPS/Canada) Inc. (EPS) redesigned the energy management information system (EMIS) program to provide a holistic, structured approach to the organizational management of energy which requires organizations to not only invest in the technical components of energy management, but also explicitly address the organizational components. The result was the “Energy Management Information Systems (EMIS)” Program, which launched as a pilot in August of 2012. The EMIS Program was designed to engage the industrial sector which in previous years had experienced lower levels of participation within Efficiency NS’s traditional project/technology-centric programs. The objective of the EMIS pilot was to evaluate a program model that would provide industry with specific tools and a structured path to enable “information driven” ongoing organizational systematic management of energy. After a successful implementation of the EMIS program pilot with two prominent industries in Nova Scotia, EMIS was launched as a standalone program in April of 2013. The EMIS approach has proven to be very effective in drawing small, medium, and large industrial organizations into organizational energy management using a data driven approach. This paper presents the structure of the Efficiency Nova Scotia EMIS program, its results, and success factors.

EMIS Definition

Efficiency NS has defined EMIS as the organizational management of energy using enhanced energy management information rather than as a technology, project, or software. Although EMIS includes meters for energy measurement, data collection and storage infrastructure, and conversion of data to information using software, Efficiency NS stresses to participants that without the systematic conversion of information into action by the organization, that EMIS will produce little value. EMIS in this definition is therefore serving as another form of energy management system.

Pilot Phase Customer Recruitment

Following the design of the EMIS program, Efficiency NS and its EMIS consultant approached 8 industrial companies regarding potential participation in the EMIS pilot. Presentation materials were prepared and the concept of the EMIS program was presented at the senior management level at the 8 companies. The objective was to obtain 2 company commitments (Letters of Intent) within 1 month from the presentations to participate in the EMIS pilot. All meetings typically involved a cross section of management, operations, and technical levels. Management levels typically included the plant manager as well as in some cases the business general manager. By the end of September 2012, 2 companies had signed Letters of Intent to participate in the pilot EMIS program. The incentives were structured to cover approximately 50% of the development, design, and implementation costs of EMIS with the industry paying the other 50% of costs. One of the companies manufactures molded pulp products and the other is a food processor. One had annual energy costs (electricity plus fuel) of approximately \$1 million and the other had an annual energy cost over \$ 8 million.

EMIS Program Structure

The EMIS program is structured to move participants through the steps outlined in Figure 1 – EMIS Program Structure:

Figure 1. EMIS Program Structure



Letter of Intent

Prior to being enrolled in the EMIS Program, Efficiency NS requires a member of the senior management team of the participant company to sign a Letter of Intent for participation in the EMIS program. The Letter of Intent addresses the first three steps of the EMIS program namely; EMIS Audit, EMIS Implementation Plan, and EMIS Implementation. The Letter of Intent clarifies:

- The role of the industry, Efficiency Nova Scotia as well as of the EMIS service provider in the sequence of stages for developing, designing, and implementing EMIS;
- The customer financial criteria for EMIS (customer provides required payback, and EMIS implementation not to exceed budget);
- The fixed cost proposal for the EMIS Audit by the EMIS service provider;
- Efficiency Nova Scotia incentive funding levels for each stage and payment terms and conditions to mitigate risks for Efficiency Nova Scotia, and the participant.

This approach was specifically designed into the EMIS process for a number of reasons:

- The requirement to sign a contract requires that a senior decision-maker from the customer organization is involved from the beginning in understanding the concept of EMIS and the magnitude of organizational commitment involved in implementing EMIS. This approach diminishes the risk that the EMIS initiative is started and driven from a purely technical level in the organization, treating it more like a project and without obtaining decisions regarding organizational implications.
- The outlining of the sequence of steps from EMIS Audit, EMIS Implementation Plan, and EMIS Implementation within the scope of the Letter of Intent focuses the organization on the whole process of EMIS Implementation rather than on just committing to the first (EMIS Audit) step. The focus on implementation elevates the level of decision-making right from the beginning and increases the probability that companies entering the EMIS program have properly understood it. To date, 100% of companies (4) who have entered the EMIS program have carried on to implementation of EMIS.

- The new approach to the EMIS Program allowed Efficiency Nova Scotia to ensure that all participants demonstrated a commitment to managing energy as an organization, and to integrating the management of energy into current practices as an initial requirement of program participation. This is achieved through the Letter of Intent; in addition to validating senior management commitment, the Letter of Intent also ensures financial and personnel resource availability for the duration of EMIS development and implementation.

EMIS Audit

Once the industries had signed the Letters of Intent during the pilot phase of the EMIS program, Efficiency Nova Scotia engaged its EMIS service provider, EPS to carry out the EMIS Audits for each of the 2 sites. The EMIS Audit is the initial step and aims to produce a preliminary definition of the custom EMIS scope for a specific organization and facility and to establish the plan and business case (costs and savings) for implementing EMIS. Some of the key steps undertaken during the EMIS Audit include:

- Discussion between management team and service provider regarding the specific purposes for EMIS at the participant's site;
- Evaluation of energy consumption and use, and development of preliminary Energy Account Centers (areas representing significant energy consumption where accountability can be assigned to specific people in the organization);
- Assessment of current energy consumption patterns and costs, and formulation of a preliminary energy management strategy based on potential for driving financial energy savings through better information and systematic management of energy;
- Assessment of current and required energy metering and development of metering scheme and cost estimate;
- Assessment of non-energy measurements needed to capture data on variables affecting energy consumption and development of plan for either gathering data on these variables from existing in-plant data systems and/or adding new non-energy measurements;
- Determination of plan for gathering measurement data via existing (and new) in-plant data communications systems;
- Data storage in new or existing data historians as well as identification of server requirements;
- Development of plan for converting data into energy management information through calculations in data historian tags, excel, or software;
- Development of plan for transmitting energy management information to people in the organization in various forms such as (i) real-time control information (often sent to human-machine interfaces (HMIs); (ii) supervisory information delivered via on-floor displays and shift level reports; (iii) management reports; (iv) custom analysis information produced by/for engineers and technical people;
- A training plan for establishing the skills in the organization to effectively use EMIS to drive energy improvement;
- A communications plan to engage the organization in the transition to an energy management culture;
- Recommended energy account centers and management system development.

If the EMIS Audit recommends an EMIS which meets the customer's financial criteria and the customer moves forward to the EMIS Implementation Plan stage, then they are paid the EMIS Audit incentive agreed upon in the Letter of Intent. If the Audit recommends an EMIS which meets the customer's financial criteria, and the customer chooses not to move forward to the EMIS Implementation Plan stage, they are not eligible for an incentive payment. If the Audit recommends an EMIS which does meet the financial criteria of the customer, the customer has no obligation to move forward to the EMIS Implementation Plan stage, and Efficiency Nova Scotia will honor their initial incentive offer toward the cost of the EMIS Audit. These conditions are included to ensure organizational commitment and resource availability prior to a participant enrolling in the EMIS program.

EMIS Implementation Plan

The EMIS Implementation Plan stage is a detailed design stage for the implementation and integration of EMIS within an organization and builds upon each of the components addressed in the EMIS Audit. The EMIS Implementation Plan addresses detailed implementation issues such as:

- Final detailed cost estimate for the purchase, installation, and configuration of energy metering, energy driver metering, data capture, and data storage equipment as well as all services required for project management, information design and configuration, training and communications;
- Schedule for the implementation of EMIS: procurement, installation of equipment, configuration of energy performance information, integration of energy management within management processes, delivery of training, and communication of energy management to the organization;
- Development of an EMIS information plan to deliver actionable energy performance information to different levels of the organization in the form of control information, supervisory information, management information, and analytical information;
- Development of training plan to build capacity within the organization to maintain EMIS; meter installation and configuration, data capture and storage installation and configuration, report maintenance, interpretation of reports, data analysis skills, and energy management basics;
- Development and identification of delivery approach of the communication plan to increase energy management awareness within the organization.

Similar to the EMIS Audit incentive, if the organization proceeds to the EMIS implementation stage following the EMIS Implementation Plan stage, then they are eligible for an incentive. If the industry decides not to move to EMIS Implementation after the EMIS Implementation Plan stage, they are not eligible for the EMIS Implementation Plan incentive.

EMIS Implementation

The EMIS service provider leads participants through a staged implementation that includes the following stages and activities:

- Finalization of equipment procurement packages and purchasing of equipment. Typical equipment packages include: (a) energy & non-energy metering/measurement; (b) data communication infrastructure; (c) data historian and server; (d) software;
- Technical support to the organization for the installation and configuration of meters, data capture and storage equipment (all companies to date have installed equipment using their own labor);
- Configuration of all energy performance information as detailed in the Implementation Plan and training of the different levels of the organization to use the information;
- Implementation of communication plan; the communication plan leverages existing communication channels and tactics within the organization. Communication is persistent yet varied and support is provided for the following: (a) energy reporting; (b) EMIS kick-off events; (c) posters, newsletters, bulletin boards, intranet, multi-media screens, etc.; (d) employee engagement events;
- Delivery of the training as detailed in the Implementation Plan;
- The EMIS service provider also provides a project management structure for the Implementation to the client to ensure a successful implementation of EMIS.

Implementation incentive payments are made throughout the Implementation process in milestone payments, with the exception of 25% of the Implementation incentive being withheld until the customer has submitted their first quarterly energy savings report. As part of the agreement between the customer and Efficiency NS, the customer is required to report on their energy savings on a quarterly basis for a period of three years. A portion of the Implementation incentive is withheld to ensure that the customer has successfully deployed their EMIS and are using the system.

EMIS Operation Phase

Each of the 2 EMIS pilot companies successfully passed through each of the 3 steps and implemented their EMIS systems. At the end of the EMIS Implementation phase, one of the pilot companies expressed a desire to keep working together with Efficiency NS and its service provider for an additional 12-month period to fully operationalize EMIS in their organization. An agreement was eventually struck whereby Efficiency NS and the industry cost share the cost for the EMIS service provider to provide additional support to the industrial organization throughout the 1st year of operation. The activities to be undertaken during that period are:

- Carry out monthly meetings to focus on EMIS activity progress;
- Support modifications to and improvements in the EMIS reporting system;
- Keep working on the management and organizational aspects of energy management;
- Work on the energy management culture;
- Track and report on energy savings.

Both of the pilot EMIS companies chose to enter into EMIS Operational phase agreements. Based on the outcome of this evaluation, Efficiency Nova Scotia now offers a

customized 12-month operational support phase to maintain customer engagement, and ensure that energy management has truly been integrated into the organization.

EMIS Program Results to Date

To date, 5 organizations have engaged in the EMIS program. Table 1 outlines the type of industries engaged and their respective level of program completion to date:

Table 1. Program Participants Level of Completion

Organization Type	EMIS Audit	EMIS Implementation Plan	EMIS Implementation	EMIS Operation
Large Industrial-<i>Molded Pulp</i>	Complete	Complete	Complete	In-progress
Small & Medium Industrial-<i>Food Processing</i>	Complete	Complete	Complete	In-progress
Small & Medium Industrial-<i>Aerospace</i>	Complete	Complete	Complete	In-progress
Small & Medium Industrial-<i>Sawmill</i>	Complete	Complete	In-progress	
Institutional-<i>University</i>	In-progress			

For the 4 organizations who have reached up to the implementation stage of EMIS, the overall average costs for the participant vs. Efficiency NS are provided in Table 2: Average Program Costs:

Table 2. Average Program Costs

Organization Type	EMIS Audit	EMIS Implementation Plan	EMIS Implementation	EMIS Operation	Total
Participant Net Cost	\$6,800	\$18,800	\$111,500	\$5,500	\$142,600
Efficiency Nova Scotia	\$12,000	\$18,800	\$66,200	\$5,500	\$102,500
Total	\$18,800	\$37,600	\$177,700	\$11,000	\$245,000

Please note the average incentive for the EMIS Audit is higher due to an increased Audit incentive during the Pilot stage where participants were offered an incentive of 75% of the total Audit cost.

The scope of the EMIS systems implemented included the components defined in Table 3. EMIS Implementation Scope:

Table 3. EMIS Implementation Scope

Plant	Electricity Meters	CT's	Non-Electricity Metering	Data Collection	Data Storage	Data Analysis and Reporting
1	37x new 15x existing		6x steam 3x gas	Industrial data communication gateway	Addition of new industrial data historian	Real-time: HMIs Supervisory: On-floor display; shift reports Management: Excel Engineering: Data historian
2	1x existing	12x new	3x steam 2x air 4x water 1x refrigeration	Industrial data communication gateway	Addition of new industrial data historian	Real-time: HMIs Supervisory: Daily report Management: Excel Engineering: Data historian
3	23x new	4x new	1x air	Industrial data communication gateway	Addition of new industrial data historian	Real-time: HMIs Supervisory: On-floor display; shift reports Management: Excel Engineering: Data historian
4	8x new	119x new		Industrial data communication gateway	Use of existing industrial data historian	Real-time: PC Supervisory: On-floor display Management: Excel Engineering: Data historian

EMIS Program Savings

To date 2 of the 4 industrial participants have reached the stage of using EMIS actively in their organizations. The other 2 are finishing their installations. To date the following strategies are being deployed by these industries in order to generate energy savings using EMIS:

- Bringing daily and month to date energy costs into focus;
- Allocating responsibility for energy costs, consumption, and improvement to department leaders in the plants;
- Understanding, establishing control options, and then controlling plant electrical peaks. This includes establishing alarms and procedures for response to peaks and assigning responsibility to a specific operation within the facility to shed or shift load in response to peak conditions based on real-time information;

- Bringing energy consumed during non-production periods into focus, defining controls and procedures to eliminate unnecessary energy waste during those periods, and then holding resources accountable for the procedures;
- Defining targets for input energy per unit of product that are visible to operators on their HMI's for specific energy intensive sub-systems/processes, setting alarms and using a red light/green light reporting method at the supervisory level for reporting on shift performance, and then having daily performance reports at the daily management meeting;
- Setting standards for energy used by ventilation relative to the number of lines running, making this visible in real-time, and then then reporting on target vs. actual at the management level;
- Using CUSUM analysis at the sub-system level to determine changes in energy performance;
- Being able to report on savings by month/quarter to the utility program based on data rich analysis correlating energy with relevant variables.

In the EMIS Audits, it was estimated that it would take participants a period of 3 years to achieve the projected energy savings. Table 4. EMIS Pilot kWh Savings identifies the 3 year target vs. the actual verified savings in the first full year of EMIS operation for the two pilot organizations.

Table 4. EMIS Pilot kWh Savings

kWh Savings				
Company	Total Projected Savings (3 yr.)	2014 Target	2014 Actual	2015 Q1
Plant 1	3,532,756	1,177,585	4,211,391	411,162
Plant 2	1,053,755	351,251	583,664	172,464

The EMIS program advocates energy savings resulting from operational actions rather than through identification of capital energy efficiency projects. Operational savings opportunities are identified throughout the Audit and Implementation Plan processes and strategies for achieving these savings are developed collaboratively between the participant and the service provider. Standard operating procedures are implemented or amended to ensure the continuation energy savings and increased energy performance. Examples of standard operating procedures include: (a) targeted energy input to an energy intensive process where operators have control over energy input; (b) procedures for shutting down equipment to avoid unnecessary idling during non-production or reduced production periods and; (c) procedure related to the running of systems with multiple equipment components (HVAC, compressors, vacuum pumps, hydraulic power packs etc.) where in some production conditions, not all of the sub-systems need to be operating. Throughout the program opportunities for additional savings through capital projects may be identified, such projects are able to be funneled back through Efficiency Nova Scotia for support through additional program offerings.

Program Evaluation

Each year, the savings claimed through Efficiency Nova Scotia's Program are evaluated by a third party evaluator to determine adjustment factors to be used to estimate the overall gross program savings.

To measure and verify the energy savings at each pilot site, the service provider works with the organization to provide Efficiency Nova Scotia with quarterly energy savings reporting. The savings are calculated based on the Superior Energy Performance Measurement and Verification Protocol using a top down, bottom up approach. In 2014 both pilot sites became operational and began reporting on energy savings. The claimed EMIS program savings were evaluated by the regulator's evaluator and were accepted as claimed.

Industrial Participants Feedback on EMIS Program

Industrial participants have been surveyed in order to determine their attitude towards their experience of deploying EMIS.

When asked to describe EMIS in their own words, participants responded with an understanding that EMIS (as delivered by Efficiency NS) is a holistic approach for managing energy;

“EMIS is a structured approach to energy management that will be used as the main tool to establish energy efficiency culture”. –**COO**

“EMIS represents a culture shift into organizational energy management” –**Process Engineer**

When participants were asked the following question; Do you see EMIS mostly as:

- a) A Metering System
- b) An Energy Information System
- c) An Organizational Process for Managing Energy
- d) All of the above

The six responding participants unanimously answered, d) All of the above.

When asked “What is the most beneficial component of the EMIS Program for your organization?” participants responded with a variety of responses, these responses are identified in Table 5. Most Beneficial Component of the EMIS Program:

Table 5. Most Beneficial Component of the EMIS Program

Most Beneficial Component of the EMIS Program?	
Process Engineer	Benchmarking for high energy usage machines, demand management
Facilities Manager	The reporting capabilities
Site Electrical	Having the Audit for the business case for EMIS within our organization,

Engineer	without that the project couldn't have moved forward
General Manager	The data historian and the gathering of data
Plant Manager	We expect it to help us manage peak demand and improve energy usage on individual machines by comparing one to another
COO	The initial selection of the consultant, and the cost sharing approach with minimal red tape in terms of applications and recurring paperwork

Conclusions

The EMIS Program approach developed and delivered by Efficiency Nova Scotia has been an effective mechanism for drawing industrial companies (*large, medium and small*) into systematic energy management. The EMIS program has demonstrated success from the industrial market perspective as well as from the Efficiency Nova Scotia perspective. The contributing factors to this success are as follows:

1. Market penetration: One of the strategic objectives for the EMIS program was to engage the industrial market in Nova Scotia with programming that it would perceive as valuable. This was against a backdrop of low participation by the industrial market in Efficiency Nova Scotia's traditional project-centric programming. Customer surveys have demonstrated very positive attitudes from EMIS participants regarding the value of the EMIS Program. The fact that each participant has made not only substantial investment into EMIS in financial expenditures (*on average \$140,000 net cost to the participants*) but has also made significant commitments of *human resources* including at the very highest levels of the organizations (*plant managers, production managers, COO's, etc.*) is a confirmation that they see real value in the EMIS approach. Furthermore, the fact that 100% of the participants who have entered the program have gone all the way to EMIS Implementation is another confirmation of their perception of its relevance and value. For the 2 participants who reached completion of their EMIS implementation phase, both have decided to engage in a further 12-month process for which they are paying 50% of the costs. For both companies which have completed EMIS, achieved energy savings have exceeded the original estimates and have resulted in attractive financial payback periods.

2. Cost effectiveness: From a Demand Side Management perspective, the EMIS Program has proven to be extremely cost effective. Each program within Efficiency Nova Scotia is evaluated against several metrics including the cost effectiveness of the claimed energy savings, or dollars spent per kWh saved, this is referred to as the unit cost. The unit costs for the programs in the Business, Non-Profit, and Institutional (BNI) Program Division range between \$0.15/kWh - \$0.40/kWh. The EMIS Program was expected to yield savings at a lower unit cost than traditional BNI Programs, and a target of \$0.10/kWh was established for 2014. After third party review and acceptance of the EMIS Program savings, the final unit cost for 2014 was \$0.03/kWh.

3. EMIS Definition: By clearly integrating the 3 elements in the EMIS definition of (i) *meters and measurements* generating data with; (ii) the *conversion of data into information* and then; (iii) the *conversion of information into action*, the EMIS program has signaled to the

industrial companies that it is promoting a well-thought out approach to the management of energy. As mentioned previously, the original EMIS offering through Efficiency Nova Scotia only supported the technical components, and did not integrate the organizational components of energy management. That prior EMIS program model did not succeed whereas the newly adopted EMIS program model with a more holistic definition has been very successful;

4. Industrial Alignment: The current EMIS approach seems to align very well with *industrial process control culture*. The idea of *managing* energy is one thing, but the idea of *controlling* it is another. The concept of bringing energy under the *control of the organization* through the availability of *higher resolution energy performance information* and then aligning responsibilities for improvement in energy performance within the existing organizational structure makes a lot of sense to industrial companies. EMIS is equipping the organizations with tools that enable not just the understanding or general management of energy, but the actual control of energy at the subsystem level through the availability of real-time information. Essentially, industrial companies are already controlling many materials and fluids in order to manufacture their products. With the availability of information at a detailed level on energy, they are able to leverage their pre-existing organizational strengths to apply the same management techniques to energy that are already used to;

- Control processes and systems in their day to day activities;
- Set targets
- Allocate accountability for performance & results
- Assess technical and financial performance.

5. Structured path: The EMIS program uses a structured path approach. The provision of a very clear and well laid out pathway has proven very effective in leading organizations towards systematic energy management. The pathway includes:

- a. Initial EMIS presentation at senior management levels;
- b. Signing of Letter of Intent;
- c. EMIS Audit;
- d. EMIS Implementation Plan;
- e. EMIS Implementation;
- f. EMIS Operation

It is important to note that the EMIS Audit effectively provides senior management with a clear strategy and plan for managing energy in a systematic manner in their organization and facility. The EMIS Audit has proven to be a very effective document in facilitating organizational buy-in for the fundamental decision to manage energy.

6. Whole organization engagement: Successful energy management requires involvement of the organization as a whole from senior management, to operators. As part of the structured path from conceptual design of an EMIS, to full implementation and integration, a substantial cross section of the organization is involved to identify the roles and responsibilities that each

stakeholder will play in managing energy operationally. The organizational engagement has been a crucial component to ongoing success experienced by the participants and Efficiency Nova Scotia.

The approach taken with the EMIS Program is one of the many delivery models used to engage organizations in continuous energy management. The objective of energy management models whether it is Strategic Energy Management or EMIS is consistent: to continuously improve energy performance by achieving persistent energy and cost savings over the long term. (CEE 2014).

EMIS has proven to be a very effective approach to engage industrial companies in Nova Scotia in systematic energy management. The goal of energy management systems is systematic improvement in energy performance. EMIS has proven to be one approach that seems to resonate well with industrial organizations due to the fact that it approaches energy as something to be controlled and is aligned with how industrial organizations already operate, namely in a control mode.

References

CEE (Consortium for Energy Efficiency). 2014. *CEE Strategic Energy Management Minimum Elements*. February 11.

<http://library.cee1.org/content/cee-strategic-energy-management-minimum-elements/>