PEER-REVIEWED PAPER

The more the merrier: leveraging diverse players to deploy energy management systems in industry

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Abstract

Governments and industry are increasingly looking for cost-effective ways to reduce industrial demand for energy. Energy management systems (EnMS) are proving to be very effective in achieving this goal, and they also have the added benefit of improving productivity in companies. Governments around the world are now promoting EnMS as a viable means of reducing energy consumption. Some governments have mandated corporate adoption, while others are encouraging voluntary uptake by providing financial incentives or awards. Other players are also driving uptake and putting forward new business models in response. Energy providers, multinational companies and multilateral and commercial banks from across the globe have started to initiate large-scale energy efficiency programs that have EnMS at their heart. Despite this global push for EnMS, encouraging widespread adoption remains a challenge.

This paper suggests how the private sector can work with governments to help strengthen energy management programs. It looks at the key design elements of large-scale energy management programs as well as the role of government, industry, energy providers and banks in promoting corporate adoption. It also discusses different types of public-private collaboration and how they can encourage other players to complement governments' efforts.

Introduction

Encouraging results regarding the annual 1.7 % decrease in industrial energy intensity in the past decades are counteracted by the annual 1.2 % increase in energy demand.[1] Industrial energy use still accounts for roughly one-third of this global energy demand.[2] However, the 2013 IEA World Energy Outlook demonstrates that this sector still holds significant potential to decrease energy consumption.

Yet opportunities to improve energy efficiency remain severely underexploited (UNIDO 2011). Although energy efficiency measures have repeatedly demonstrated their effectiveness in increasing company competitiveness and productivity, they have yet to attain mainstream recognition as a strategic investment in future profitability.

Energy management is gaining increasing attention among industry leaders who recognise the strategic potential of energy efficiency as a means to cost-effectively save energy, reduce GHG emissions and enhance energy security. Systematic energy management is indeed one of the most effective approaches to continuously improve energy efficiency in industries because it equips companies with practices and procedures to identify and implement new opportunities for improvement, and achieve energy-saving objectives on an ongoing basis.

When compared to selective measures (ad hoc energy management), continuous application of this process clearly reduces the energy-related costs of a company, as shown in Figure 1.

1. While in recent decades industrial energy intensity has been decreasing at an average rate of 1.7 % per year, energy demand is still expected to increase by at least 1.2 % annually up to 2035. Source: IEA.

2. Source: IEA.

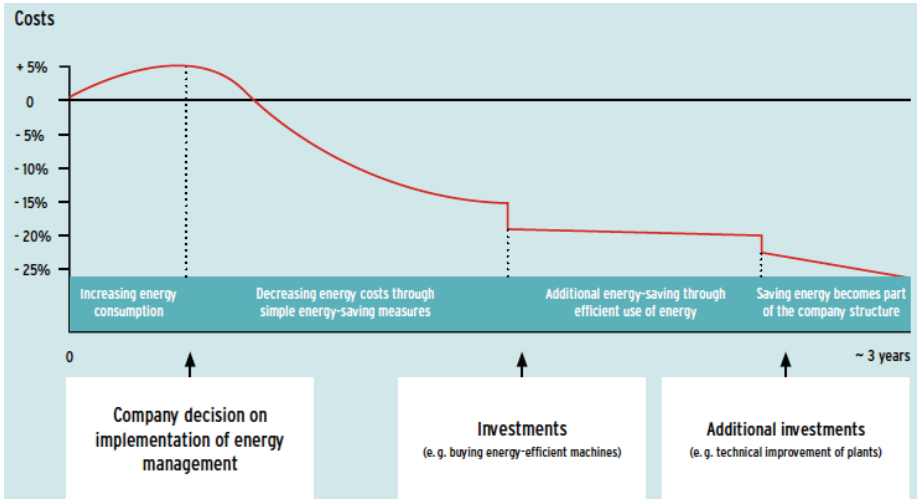

Figure 1. Continuous cost reduction from EnMSs. Source: Kahlenborn et al. (2012).

Energy Management System Benefits

Industrial energy efficiency is achieved as much by changing how energy is managed as by installing new technologies. Successful implementation of EnMS in many industries could have a dramatic impact on capturing more unrealised energy efficiency potential. Organisations, large and small, can save energy by applying the same sound management principles and techniques used in relation to key resources such as raw materials and labour. These management practices must include full managerial accountability for energy use.

WHAT IS AN ENMS?

An energy management system (EnMS) is a suite of procedures and practices to ensure systematic tracking, analysis and planning of energy use in industry (Reinaud et al, 2012). It enables companies to maximise energy savings and improve energy performance continuously through organisation and technology changes. An EnMS typically includes:

- Energy policy and targets.
- Cross-divisional management team with senior management support.
- Baseline of energy use.
- Energy review and planning process, identifying improvement opportunities.
- Energy performance indicators.
- Action plans, internal audit and third-party certification.

An EnMS enables continuous energy and cost reductions, which provide a competitive advantage in a global market, and identifies opportunities to adopt energy-saving technologies, including those opportunities that do not necessarily require capital investment (DOE 2013, ETO 2013, AEP Ohio 2013, Efficiency Vermont 2013).[3]

An EnMS is increasingly recognised as a means of overcoming informational, institutional and behavioural barriers to energy efficiency. For example, senior management and energy management staff are both involved in the execution of the processes and procedures called for in an EnMS, giving energy efficiency issues a higher profile and priority within the organisation. By creating internal company platforms for continual identification and implementation of energy savings measures, benefits include more comprehensive identification and prioritization of energy savings investments (including across organizations), high-impact and low-cost behavioural changes, and operational and maintenance improvements, all contributing to the company bottom line. For example, use of greater sub-metering as part of an EnMS activity may allow previously unclear issues and their solutions to come to light, or enable a new energy intensity program to be put in place. In another example, cross-unit analysis of secondary energy production and use (e.g. compressed air or steam), involving the secondary energy systems managers and the production units that use the energy, may identify key secondary energy system or production line operational adjustments that may have significant energy saving impacts (SEE Action Network, 2014).

ENMS RESULTS

Industries that adopt energy management practices may save up to 10–30 % of their total energy use. The number of companies that have achieved major energy-intensity improvement using EnMSs continues to grow. Dow Chemical achieved a 22 % improvement between 1994 and 2005 (USD 4 billion savings) and is seeking an additional 25 % between 2005 and 2015. United Technologies Corporation reduced global GHG emissions by 46 % per dollar of revenue from 2001 to 2006.

3. For example, as part of the U.S. Department of Energy's (DOE's) Superior Energy Performance (SEP) program, 14 pilot plants have implemented the global energy management standard, ISO 50001, and achieved SEP certification. Nine of these plants have shown an average energy performance improvement of 10 % in the first 18 months of SEP implementation, with an average payback of 1.7 years (DOE 2013). Energy Trust of Oregon (ETO) and AEP Ohio also estimate that their industrial customers can typically achieve 5 %–15 % savings through energy management with little or no capital investment (ETO 2013, AEP Ohio 2013). And Efficiency Vermont estimates its Continuous Energy Improvement program can help companies cut energy consumption by 10 %–15 % within the first three years and 25 %–35 % within six years (Efficiency Vermont 2013).

Toyota's North American Energy Management Organisation reduced energy use per unit by 23 % since 2002; company-wide energy savings efforts have saved USD 9.2 million since 1999 (Scheihing, 2009). Following adoption of the international standard ISO 50001 for energy management, St Marys cement in Canada gained an 8 % absolute reduction in energy operating costs over five years, amounting to savings of $C1 million in total operating costs per year. Similarly, the 3M Canada Brockville plant achieved a 15.2 % improvement in energy-intensity over two years. The Volvo Group's New River Valley Plant in Dublin, Virginia also improved its energy performance by 25.8 % over three years while maintaining its daily truck production levels, assisted by ISO 50001 and the U.S. Department of Energy's Superior Energy Performance (SEP) program.[4] Finally, broader results from the facilities certified with ISO 50001 under the SEP program show an average investment payback of 1.7 years. No-cost and low-cost operational measures have posted annual savings ranging from $87,000 to $984,000 (DOE 2014).

Achieving the international ISO 50001 standard for EnMSs has also provided companies with an internationally recognised response to sustainability and energy efficiency issues. Worldwide, at least 5,055 industrial sites are certified under the ISO 50001 standard (according to the so-called "Peglau Statistics", Status: 01.2014). Table 1 provides a snapshot of certifications in the countries with the largest certification rates.

Table 1. Snapshot of ISO 50001 certifications. Source: Peglau Statistics, Status: 01.2014. Note that these are conservative figures based on publicly disclosed information.

Country	Number of sites with ISO 50001 certification (July 2012–January 2014)
Germany	2,917
UK	335
Spain	190
Sweden	187
Italy	180
India	125
Turkey	97
Austria	79
Taiwan	74
France	61
Denmark	58

IDENTIFIED BARRIERS

Part of the challenge of global EnMS adoption and of industrial energy efficiency more generally, is that the industrial sector is heterogeneous and different plants have different needs, all of which takes time and skill to grasp. Plant operational cycles must be understood and typically define project scheduling (SEE Action Network, 2014). Non-energy benefits associated with energy efficiency projects may also provide a key tipping point benefit in favour of pursuing a given line of projects, but such benefits may not be immediately obvious.

More specifically, a number of barriers to improving industrial energy efficiency and increasing EnMS adoption have been identified. These include (Clean Energy Ministerial, 2013):

- Market and Operational: low energy prices, tax structures and transaction costs may disincentivise investments in EnMS. The real or perceived technical and operational risk associated with implementation may also be a hindrance.
- Informational and organisational, which include limited knowledge of new energy savings technologies and strategies, a lack of institutional focus on energy issues and lack of communication and coordination among company personnel that deal with aspects of company energy use also present barriers.
- Financial barriers: Investment decisions are made that may not adequately consider the full value of energy efficiency in the financial criteria. Other financial barriers include short payback period requirements, lack of access to capital, views that energy efficiency is not a strategic investment in future profitability.

Because of these barriers, widespread uptake of EnMS in industry is not considered likely without supporting programmes from government or a third party such as a utility. For the implementation of the identified energy efficiency measures in the industry sector to materialise, in many cases, industry needs to be a participant in mandatory energy-saving programmes or be incentivised to fully realise the potentials.

Strategies to Enable Large-Scale Adoption of Energy Management and Subsequent Uptake of Opportunities

The two main complementary strategies identified to mobilise large-scale adoption of energy management in industry and trigger uptake of energy efficiency improvement opportunities include:

1. Government-led energy management programmes, which mandate or directly encourage companies to implement EnMS practices and to invest in identified energy savings;
2. Private-sector initiatives, which drive the uptake of EnMSs in industry and stimulate industry decision makers to take action.

1. GOVERNMENTAL ENERGY MANAGEMENT PROGRAMMES

Several countries around the world are now promoting EnMSs as a viable means of reducing energy consumption. Lessons learned from those countries show that government-led energy management programmes are most effective when planned and implemented as part of broader, legislated industry requirements or energy efficiency agreements between industry and government, coupled with a carefully designed mix of incen-

4. The Superior Energy Performance program (SEP) is a voluntary certification program that provides industrial facilities with a roadmap for achieving continual improvement in energy efficiency while maintaining competitiveness. http://www.iipnetwork.org/sites/iipnetwork.org/files/IIP_USA_SEP_factsheet.pdf

Table 2. Selected countries with energy management programmes.

Country	Program name	EnMS type	Voluntary Mandatory	Certification	Drivers
Australia	Energy Efficiency (EE) Opportunities	EEO Assessment Framework	M	No	Public reporting of EE opportunities
China	Top 10,000 Enterprise Program	GB 23331	M	Voluntary	Mandatory
Denmark	Agreement on Industrial Energy Efficiency (DAIEE)	ISO 50001	V	Yes	Tax rebate
Ireland	Energy Agreements Program	ISO 50001	V	Yes	Extensive technical support
South Korea	GHG and Energy Target Management scheme	ISO 50001	M	Yes	Mandatory
USA (Federal)	Superior Energy Performance	ISO 50001	V	Voluntary	Awards, technical resources, possible tax rebate

tives and support systems. Encouragingly, energy savings resulting from the adoption of EnMSs far exceed what companies had been able to achieve with the agreements alone.

While many countries may have formally adopted standards for EnMSs through their national standardisation bodies, including the international ISO 50001 standard, far fewer have integrated EnMSs (standardised or not) into mandatory or voluntary government energy-saving programmes. Countries that have integrated EnMSs into government programmes, or are planning such integration, include Australia, Brazil, China, Denmark, Finland, Germany, Ireland, Republic of Korea, the Netherlands, Sweden, the United Kingdom and the United States, as illustrated in Table 2.[5]

A combination of drivers, incentives and support mechanisms is also an integral part of government-initiated energy management programmes. Typical support for EnMSs includes:

- financial incentives (such as tax relief),
- recognition programmes,
- ease of access to information (best practice, exchange and co-operation schemes, networking, implementation guidelines, etc.) and
- technical tools (support to carry out energy audits, development of technical energy profiles, benchmarking tools).[6]

Support mechanisms such as these address specific barriers, such as lack of capacity, finance and limited access to technical know-how. They also contribute toward building the skills of the energy management workforce.

Governments can also play an important role in establishing a framework to stimulate uptake of EnMSs by promoting the creation of new business opportunities in the area of energy services. In addition to building the EnMS capacity of companies, government energy management programmes are often coupled with capacity building and technical assistance for third parties (including EnMS certification bodies).

2. ALTERNATE AND COMPLEMENTARY CHANNELS TO DELIVER CORPORATE ADOPTION OF ENMS

Other players are also driving EnMS uptake, driven by different needs and/or motives (see Table 2). Energy providers, multinational corporations, multilateral and commercial banks, and industry associations around the world have started to initiate large-scale energy efficiency programmes that have EnMSs at their heart. Such programmes stimulate companies to adopt EnMSs and invest in energy savings for the reasons mentioned in Table 3. Examples of such programmes are provided in the following sections.

EnMS and Supply Chain Initiatives

To mobilise energy efficiency on a large scale, corporations are initiating activities beyond their own boundaries, with their supply chains. These so-called "supply chain initiatives" (SCIs) are company-based programmes, whereby companies (*i.e.* buyers) work with supply chain partners to encourage or support them to save energy and/or reduce GHG emissions. These initiatives are driven principally by the need to foster the buyer company's reputation and credibility, and to respond to public, consumer and investor concern about opaque and complex supply chains involved in production of consumer goods (Goldberg et al., 2012).

5. Source: http://www.iipnetwork.org/databases/programs.

6. Small and medium enterprises (SMEs) usually have limited resources and capacity, and so may need additional capacity building, support and/or financial assistance, relative to the needs of larger enterprises.

Table 3. Delivery models for EnMS implementation.

Delivery Models	Drivers for Players to Develop EnMS Programs (examples)	Drivers for EnMS Adoption by Companies
Supply chains (large corporations)	• Enhance company's reputation • EnMS can be used by all industrial players, large and small • Government support: allowing companies to meet their EE obligations by engaging their value chain	• Buying power of the large company • Cost savings • Possible implementation support
Utilities/energy providers (utility or third parties)	• Improve the utility's customer relations • Strategy to improve reliability and availability of power supply at a lower cost than supply resources • Regulatory requirements for energy efficiency	• Sustainable source of financing • Technical assistance
Financial institutions	• Increase number of deals and project finance • Help assess the risks and returns of EE projects • Reduce investment risk • Improve and enhance customer relations	• Lower loan transaction costs • Blending technical assistance with financial products
Industry associations	• Provide valuable service to member companies	• Sharing of information • Implementation support

Buyers are employing a number of different approaches to influence and motivate suppliers. These approaches range from mandating energy or emissions savings and energy audits, to monitoring and reporting of supplier emissions and procurement requirements, to partnership approaches that include a wide spectrum of collaboration and support activities. For example:

- Ford requires/encourages supplier implementation of the environmental management standard ISO 14001.
- 3M, although they do not require their suppliers to implement EnMS today, they encourage them to become more energy efficient by sharing their best practices with them.
- Prorail, in charge of the rail network in the Netherlands, uses a preferential purchasing strategy (using the "CO_2 Performance Ladder") that gives a weighted preference to supply chain partners that achieve superior energy and GHG performance.
- IKEA has launched a supplier development programme, which works to improve supplier's performance across a range of sustainability criteria, including energy efficiency.
- Under Walmart's Supplier Energy Efficiency Program, Walmart covers the cost of energy audits if the energy efficiency opportunities identified through these audits are implemented.
- The Home Depot partnered with third party Intertek to work with 29 supplier factories in China. Intertek provides capacity building involving on-site energy assessments, and identification and implementation of energy-saving measures.
- Companies participating in the first phase of a new project, the Action Exchange, are the Bank of America, L'Oreal, PepsiCo, Philips, Vodafone and Walmart. Action Exchange is a collaborative international project being spearheaded by the Carbon Disclosure Project (CDP) to help participating firms to improve energy efficiency in their supply chains by conducting energy assessments in selected supplier facilities and sharing best practices on emissions reduction opportunities.

In the context of energy management, SCIs have the potential to drive and accelerate effective energy management practices across a broad business base. Companies are indeed taking interest in energy management systems (EnMSs) as one approach in engaging suppliers to continuously make cost savings and increase efficiencies across their value chains. While EnMS supply chain approaches are in the early stages of development, several initiatives are already emerging. For example, SKF requires all of its suppliers classed as "energy intensive" to be ISO 50001 certified by 2016, while Hewlett-Packard has piloted the implementation of the Chinese EnMS standard GB 23331 in selected supplier factories in China and Taiwan.

EnMS and Utility Energy Efficiency Obligations

Utility energy efficiency obligation (EEOs) programmes, also known in North America as energy efficiency resource acquisition (EERA) programmes, seek to encourage utilities or designated third parties, such as an energy services company, to deliver energy savings in customer premises, often through financial or technical assistance (Taylor et al., 2012). In most programmes, energy efficiency services and projects are primarily funded with money collected by utilities from end-use consumers. These funds may be collected through a special system benefit charge, or as an imbedded part of overall tariffs. This method provides a secure and stable source of funding.

While such programmes have traditionally focused on the residential and commercial sectors, utilities or third parties have begun to expand their services to the industry sector. Furthermore, programmes are also beginning to expand beyond technical assistance and financial incentives for simple technology/capital retrofit, and towards more comprehensive programmes with training and support on specific energy management approaches. These programs seek to promote operational, organisational and behavioural changes resulting in energy efficiency gains on a continuing basis. While diverse in nature, these programs usually offer incentives for O&M improvements, provide energy management training and workshops, and offer support to establish energy tracking systems.

Table 4. Selected Energy Management and Energy Manager/Staffing Programs.information.

Energy Management Offering	EnMS Incentives	Customer Size
BONNEVILLE POWER ADMINISTRATION – ENERGY SMART INDUSTRIAL PROGRAM		
– High Performance Energy Management (HPEM): Provides training and individual assistance to 8–15 companies for one year. Measurement and incentive funding is available for 3–5 years. – Track and Tune: Low/no-cost operations Operations & Maintenance (O&M) with incentive funding over 3–5 years and include tools for interval data acquisition and performance tracking. – Energy Project Manager (EPM) Program: Funding of energy efficiency staff to support project identification and implementation (see Example 6).	$0.025/kWh for 3 or 5 years, for O&M savings	18,000 MWh/yr (guideline)
ENERGY TRUST OF OREGON – PRODUCTION EFFICIENCY PROGRAM		
– Industrial Energy Improvement (IEI): Year-long engagement provides cohorts of manufacturing companies trainings on EnMS principles, tools, and practices designed to help companies manage their energy strategically. – Corporate SEM – strategic energy management (SEM) (CSEM): Focused on corporate sites, instead of the cohort model, CSEM provides training and on-site activities on SEM principles and practices (9–12 months). – SEM-Maintenance: Helps former SEM participants maintain, deepen, and continue the integration of SEM into their business' operations. – CORE Improvement: Offering similar to IEI in focus and structure but services and instructions are tailored to small to medium manufacturers. – ISO 50001 pilot implementation (see below).	$0.02/kWh, $0.20/therm for 1 year of savings. SEM-Maintenance: $0.01/kWh, $0.10/therm	IEI/CSEM: Over 8,000 MWh/yr, or if eligible for gas, 500,000 therms/yr usage CORE: Spending between $50,000–$500,000 on total energy costs (electricity & gas combined)
WISCONSIN FOCUS ON ENERGY – INDUSTRIAL PROGRAM		
– Practical Energy Management: Provides best practice training events and applies its industry-specific Energy Best Practice Guidebooks to key cluster industries. – Staffing grants: Allow companies to hire a FTE.	Grants for energy staff	Customers with over $60,000 in monthly bills
BC HYDRO – POWER SMART		
– Industrial Energy Manager: Offers funding for large customers to hire an on-site energy manager and a structured support group of local companies that share best practices. – Energy Management Assessment: Free assessment of opportunities, customized SEM action plan, and rating against the Energy Management Scorecard. – Various free energy management tools and training, employee awareness kits, and customer recognition through public media.	Co-funding of energy manager	>20 GWh annually

Sources: SEE Action Network (2014) forthcoming sourcing: Batmale and Gilless (2013), IIP (2014), Kolwey (2013), Russell (2013), Nowak et al. (2012), and BC Hydro (2013).

Efforts to support implementation of EnMS implementation in industry are gaining momentum in U.S. state programs, as is also true in other countries and regions such as in Europe. Utilities and third parties are now considering EnMS training and implementation assistance as part of their core programme offerings to industry. Some states also have operated successful energy manager support programs, including programs to provide transitional funding for placement of energy manager staff and programs for energy manager training (SEE Action Network, 2014). In practice, several program administrators have tended to offer both SEM and energy manager/energy staffing programs.

This is the case for the Energy Trust of Oregon (ETO), which has an EnMS at the heart of its programme offering and provides an example for how EnMS adoption can be brought to scale by industrial customers with only high-level government oversight.[7] EnMS implementation is not mandatory for enterprises, but they are motivated to manage their energy use because of the cost savings and productivity gains that it provides.

Examples of other utility led programs that encourage EnMS adoption include the Bonneville Power Administration (BPA), Wisconsin Focus on Energy (WFE) and BC Hydro. An overview of the programs is provided in Table 4.

BPA and ETO's EnMS programs involve training "cohorts", or groups of non-competing companies, on SEM approaches (SEE Action Network, 2014). Companies typically meet monthly,

7. The Energy Trust of Oregon is an independent non-profit organisation that provides cash incentives, information and services help customers of several utilities (Portland General Electric, Pacific Power, NW Natural and Cascade Natural Gas) manage energy costs, increase comfort at home, improve productivity in the workplace and protect the environment.

Table 5. Milestones and incentives in a utility EnMS programme.

Milestones Achieved	Certification Path Incentives (required for enterprises >2,000 MWh/yr)
Energy Action Plan approved	• $7,500
Certification readiness Report issued	• $7,500
ISO 50,001 certification received	• $7,500
Superior Energy Performance certification	• $7,500

Source: Klaus (2012).

with homework and coaching provided between meetings. These programs measure total energy savings achieved through the SEM training process, including savings from O&M changes, and provide incentives per unit of energy savings. BPA also offers a "track and tune" program to help companies find and implement low- and no-cost energy saving opportunities, and provides assistance with developing more sophisticated systems for monitoring energy consumption and measuring savings (Kolwey 2013).

Utility programmes can further encourage EnMS implementation by linking its adoption to specific incentives. Incentives are often provided for operational efficiency measures, energy tracking systems, and staff time (SEE Action Network, 2014). As an example, in the U.S. state of Michigan, the Detroit Edison Company (DTE) teamed up with a third party (an energy and verification consultancy) to pilot the U.S. Superior Energy Performance (SEP)[8] programme with its customers. To achieve a SEP award, companies are required to implement the international EnMS standard ISO 50001. In this specific case, the utility has tied ISO 50001 adoption to financial incentives. Once specific milestones relating to EnMS implementation have been achieved, companies are eligible for direct financial incentives, as outlined in Table 5. Similarly, financial incentives for achieving ISO 50001 certification within 6 months of completing the statistical energy savings model are provided in ETO in addition to incentives already available from existing ETO programs (SEE Action Network, 2014).

EnMS and Financial Institutions

International financial institutions have also been active in helping companies to identify energy efficiency opportunities, promoting corporate EnMS adoption and addressing the lack of availability of finance for energy efficiency investments in industry. By leveraging the power of banks to encourage companies to adopt EnMS, ongoing and growing energy efficiency savings can be expected as companies take up energy efficiency projects that are closely integrated into their investment and financing decision-making processes.

Models that blend financing with technical assistance and energy management systems capacity building are beginning to emerge. The leader in this area is the European Bank for Reconstruction and Development (EBRD), which has developed internal technical capacity to make energy efficiency assessment part of its standard loan evaluation process in order to mainstream EE finance. EBRD promotion of EnMS to its customers (they offer both capacity-building assistance and financing for monitoring equipment and analytical software) has become increasingly important as EBRD's financing for energy efficiency and climate change has grown from 4 % to over 30 % of its loan portfolio in the past ten years. Every euro of EBRD's EE technical assistance produces EUR 1,000 of energy efficiency investments.

Another example of this approach is the Global Environment Facility (GEF)-funded programme, Energy Efficiency Market Transformation, which is running from 2010 to 2015 in Russia. In this programme, EBRD and the United Nations Industrial Development Organization (UNIDO) jointly work to develop effective business models for energy efficiency finance and to promote EnMS adoption in industry. EBRD provides support to larger enterprises, while UNIDO focuses on small to medium-sized enterprises (SMEs) and policy support.

As part of this programme, specific implementation support for industrial companies provided by EBRD includes:

- Technical assistance and capacity building to industry chief financial officers (CFOs) to develop bankable EE projects (i.e. investment-grade EE projects that lenders deem are viable to finance).
- Implementation of EnMSs compatible with the ISO 50001 within large industrial companies. This implementation includes intensive on-site training, energy audits, system assessments and the development of energy efficiency investment plans.

EnMSs and Industry Associations

Industry associations can also play a role in initiating large-scale energy efficiency programmes that have EnMSs at their heart. For example, in the United States Pacific Northwest, the largest industry trade organisation, the Northwest Food Processing Association (NWFPA), introduced a voluntary collaborative EnMS framework to its the 100+ members. Partnering with an energy service provider, the Northwest Energy Efficiency Alliance (NEEA), this collaborative framework convenes company leadership and action around common energy reduction goals.

Food processing companies are encouraged to implement EnMS, funded by utilities that are mandated to save energy in their customers' premises. NEEA's role in this effort is to convene government, enterprises and utilities to provide industry

8. SEP is a voluntary certification programme that provides industrial facilities with a roadmap for achieving continuous improvement in energy efficiency. The programme is based around the EnMS standard ISO 50001, which provides a transparent, globally accepted system for verifying energy performance improvements and management practices. Several levels of awards (silver, gold, or platinum) are delivered to companies depending on the energy performance achieved.

wide education on EnMS practices, and assist with the implementation of this energy management programme across an entire industry.

Aggregating energy saving efforts through NWFPA allows an entire industry – as opposed to individual enterprises – to apply resources toward a unified energy reduction goal – sharing in the risk, efficiency and energy savings potential and adoption of EnMSs as an ongoing business practice.

In 2009, NWFPA member enterprises set an industry wide energy intensity reduction goal of 25 % in 10 years, and 50 % in 20 years. NWFPA was the first U.S. industry wide association to commit to this goal, and signed a pledge with the U.S. Department of Energy.

In addition to helping the NWFPA members achieve energy savings, the NEEA-NWFPA Energy Efficiency Assessment recognizes "Industry Collaborators" as companies, which actively work outside their own facilities to collaborate with suppliers, utilities, organizations, competitors, consortiums, and associations.

The role of public-private cooperation

To overcome existing EnMS implementation barriers and provide high value to industrial customers, EnMS programmes – whether public- or private sector-led – require, steady and close interaction with customers, a critical mass of knowledgeable staff and strategically engaged consultants, and operational stability, among other factors. This requires that appropriate skills are developed both in companies and in the energy service community and that adequate capacity building is provided; that there is broader financing for investment in industrial energy efficiency and investment assistance; that energy efficient technology and measures are understood and adopted; and that there is a common agreement on how to account for energy savings from EnMS driven improvements.[9]

Traditionally, encouraging EnMS adoption and energy savings has been the role of governments, which have targeted a specific group of companies directly (*i.e.* large energy users or energy-intensive industries). However, mentoring from companies to their suppliers, and other soft drivers such as codes of conduct, are proving to be effective mechanisms to implement EnMS in supply chains (Goldberg et al., 2012). Similarly, utilities and third parties, mandated by governments, have been providing sustainable sources of technical expertise and funding to industry and facilitating EnMS adoption as is shown in the U.S.

A strong commitment from both government and the private sector are integral to the success of EnMS adoption. In order to scale private sector initiatives, it is important to ensure that the variety of actors referred to in this paper that might have different incentives and priorities, encourage EnMS adoption and collaborate if they see an incentive to do so.

Governments can play an important role in establishing a framework to encourage third parties (utilities, financial institutions, ESCOs) to drive EnMS implementation in industry. For example, efforts to encourage corporate supply chain energy management are now receiving governmental attention/support. This is the case in the Netherlands Long Term Agreements (LTAs), where companies can meet one third of their reduction target outside the plant boundaries through less material use or recycling, waste heat or renewables use/generation, or by making efficient products (Goldberg et al., 2012). Similarly, in Japan's benchmarking policy, companies that demonstrate that they are already at global best practice can collaborate with other companies in their supply chain instead of searching for additional savings within their own operations (Reinaud et al., 2012). More than half of states in the U.S. now have Energy Efficiency Resource Standards that compel utilities (or third parties on their behalf) to acquire energy efficiency resources at their customers' sites, financed through ratepayer contributions to their electricity or gas bills. And under the EU Energy Efficiency Directive, each Member State shall set up an energy efficiency obligation scheme (or an alternative policy measures) according to which energy distributors and/or retail energy sales companies that are designated as obligated parties achieve a cumulative end-use energy savings target. Simultaneously, large companies will also be required to undertake an energy audit every four years and exemptions will be provided for those that implement EnMS.

Beyond these examples, governments may also have a role to play to help scale and replicate private sector EnMS initiatives globally by facilitating the following activities, which would strengthen the design of effective EnMS programs:

- defining/validating the GHG and energy saving MRV methodologies that will also help demonstrate the value of energy efficiency to those companies for whom it is not a priority;
- unleashing financing for energy efficiency projects, such as by providing best practices to commercial banks on mainstreaming EE finance (see IIP, 2013 for IFC's and EBRD's approaches), and through supply chain approaches (e.g. if governments and large buyers jointly set up energy saving risk-sharing facility that the suppliers can tap into)[10] or if they design utility EE models like in the US where part of the utility bills finance energy efficiency in industry);
- helping establish catalogues of best practice EE measures and technologies;
- continuing to demonstrate to industry the benefits of EnMS by collecting case studies and facilitating peer-to-peer dialogue (including how EnMS can help industrials and utilities meet EE targets and clean power objectives).

As this paper shows, the experience gained in developing and implementing industrial EnMS programs is both diverse and rich. To date however, there remain too few examples of coordination both the government and the private sector, as well as within government. Enhanced coordination across a large "ecosystem" of actors that involves local and central governments, companies, energy service companies (ESCOs), utilities, and financial institutions, to improve policy development

9. This is particularly important in utility-driven EnMS programmes where the utility or the third party can receive credit for energy efficiency improvements only once energy saving have been measured and verified; as well as in supply chain programmes where governments recognize the efforts of the large companies outside of their plant boundaries.

10. A risk-sharing facility is an entity created to guarantee repayment of all or a certain portion of loans, typically offered for borrowing for specific purposes or to a certain class of borrowers to increase their creditworthiness and enhance return on equity and to reduce risk, iipnetwork.org/databases/finance.

and communications would increase efficiencies and create buy-in from a range of players and audiences. This discussion of private-public collaboration opportunities will hopefully inform the "next generation energy management programmes".

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