

Improvement opportunities for the energy management systems standard

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Abstract

The compliance with an energy management systems standard like ISO 50001 alone is no guarantee that sustainable improvements of energy performance will be achieved. Also with regard to a substantial part and pre-requisite for a successful energy management system, which is the monitoring, measurement and analysis, there are very generic requirements defined in an energy management systems standard like ISO 50001.

The paper reviews selected voluntary schemes beyond the compliance with an energy management standard like ISO 50001, which require the achievement of concrete results in the improvement of the energy performance and/or switch to renewable energy supply.

Everywhere in the world small and medium-sized enterprises (SMEs) are of overwhelming importance in their countries, especially for employment or income generation. The situation for SMEs with respect to the main constraints is more or less similar between countries, namely, they might lack technical and managerial capabilities. Therefore the implementation of an energy management systems standard like ISO 50001, which requires additional resources, might be difficult.

This paper reviews selected approaches designed for SMEs and makes an own proposal for a simplified approach for the stepwise establishing an energy management system in SMEs. These simplified energy management systems could enable SMEs to a structured continuous improvement process, a first

step to a PDCA-cycle according to an energy management standard like ISO 50001.

Introduction

The ISO 50001 Energy Management Systems Standard is the world's first global energy management standard, which has been replaced other energy management standards which were already developed in certain countries and regions before (e.g. EU EN 16001).

The standard is a voluntary international framework for the management of energy for businesses of all sizes.

ISO 50001 is based on the "Plan-Do-Check-Act" continual improvement framework.

This voluntary international standard is applicable to any organization with a goal to conform to its stated energy policy and wishing to demonstrate this to others. Such conformity is confirmed either by means of self-evaluation and self-declaration or by certification to the energy management system by an external independent third party.

Some of the requirements of the above standard are quite general, e.g.

- **Introduction.** "... This International Standard can be used for certification, registration and self-declaration of an organization's EnMS. It does not establish **absolute requirements for energy performance** beyond the commitments in the energy policy of the organization and its obligation to comply with applicable legal requirements and other requirements. **Thus, two organizations carrying out similar operations, but having different energy performance, can both conform to its requirements. ...**"

- **Para 4.6.1 Monitoring, measurement and analysis.** "... An energy measurement plan, appropriate to the size and complexity of the organization and its monitoring and measurement equipment, shall be defined and implemented. NOTE: **Measurement can range from only utility meters for small organizations up to complete monitoring and measurement systems** connected to a software application capable of consolidating data and delivering automatic analysis. It is up to the organization to determine the means and methods of measurement. ... "

In order to achieve energy saving targets in a country's industrial and building sector the above standard might be a good starting point, but not a guarantee to achieve real measurable energy savings compared to a historic baseline. The maxim *"You can't manage what you don't measure"* is especially true for energy management. It is quite difficult to manage and control the energy consumption only on the macro level especially for a large organization. Therefore the minimum requirement should be to divide an organization into energy accounting centres for effective controlling of energy consumption. The ASEAN Energy Management Scheme (AEMAS) defines energy accounting centres based on functional areas or equipment and system or combination of functional areas and system.

Introduction to Selected Voluntary Schemes beyond compliance with EnMS ISO 50001

From view of the author the following voluntary schemes, which are beyond the simple compliance with the EnMS ISO 50001 provide more incentives for achievement of real measurable energy savings and should be also considered outside the boundaries of these standards as effective means for energy efficiency improvement, whereas for SMEs a simplified approach should be developed with a combination of minimum general requirements that lead to a "Plan-Do-Check-Act" continual improvement process (without requesting a certification according to ISO 50001) and requirements for measurable energy performance improvements:

ASEAN ENERGY MANAGEMENT ACCREDITATION SCHEME

The ASEAN Energy Management Accreditation Scheme (AEMAS) was designed in 2004–2006 under the Steering of the ASEAN Energy Efficiency and Conservation Sub-Sector Network and subsequently endorsed by the ASEAN Ministers on Energy Meeting (AMEM). It is now being established with funding from the European Commission (Switch Asia program) by the ASEAN Centre for Energy (ACE) and 7 partners in ASEAN countries and will be applicable in all 10 ASEAN countries.

It defines 3 levels. Energy end-users that will be AEMAS certified will be awarded the Energy Management Gold Standard (EMGS) brand in 3 star ratings.

The certification requirements of the different ratings, which have been amended at the 4th Project Partners Meeting on 22–23 February 2012 in Jakarta, Indonesia are shown below:

AEMAS Energy Management Gold Standard 1-star

To be eligible for Energy Management Gold Standard (EMGS) 1-star certification, the energy end-user, which is considered as energy intensive enterprise, defined as a designated facility

by law (in Thailand: with a peak demand above 1,000 MW or an energy consumption of more than 20 million MJ per year) or an enterprise with a relatively high amount of energy costs compared to the overall material costs, must have the following:

- Companies need to demonstrate compliance with EMGS 1 star criteria¹ or a copy of ISO 50001 certificate;
- an AEMAS-certified Energy Manager(CEM);
- motivation plan for personnel involved in energy management;
- budget allocation for investment in energy efficient measures.

Validity of certification is 2 years from the time it was awarded. This certification cannot be renewed and should be upgraded to 2-star rating. If the 2-star rating is not achieved within 2 years, the 1-star certification rating is withdrawn.

AEMAS Energy Management Gold Standard 2-star

To be eligible for Energy Management Gold Standard 2-star certification, the energy end-user must have the following: 1-star requirements are met.

In addition, the energy end-user must implement any one of the following energy efficiency improvements:

- At least 30 % of past 2 years allocated budget is actually spent on energy conservation measures (ECMs)
- Any of the following:
 - Overall energy efficiency index (EEI) improves by 5 % (over 2 years); OR
 - Overall EEI improves by minimum 2 % on year basis over 2 consecutive years; OR
 - The company must implement a certain number of ECMs that represent at 30 % of total energy savings potential; OR
 - One fuel switching project has been implemented (Using natural gas or biomass or biogas) over the past 2 years; OR
 - The company has installed Solar Water Heaters that represent at least 30 % of the historical energy consumption of the respective energy accounting center (EAC) over the past year; OR
 - The company has installed Solar PV systems that represent at least 30 % of historical energy consumption for the respective EAC over the past 1 year; OR
 - One of the following projects has been implemented over the past 2 years: waste heat recovery (WHR), Combined Heat and Power (CHP), Combined Cooling and Heating (CCHP).

1. Companies, which are not ISO 50001 certified, will be evaluated for their energy management performance based on the level of fulfillment to requirements that cover the following aspects: Management; Organization; Process; Information; Financing; Social Responsibility; Achievement. More details are available for applicant organizations from the country coordinators in the different ASEAN countries.

Validity is 2 years. Companies must apply & achieve 3-star within 2 years, otherwise, the company would be downgraded to 1 star.

Remark: Companies can apply directly to 2 star EMGS certification.

AEMAS Energy Management Gold Standard 3-star

This certification rating is open only to energy end-users which are 2-star rating certified.

In order to recognize continuous improvement & sustainability (2nd time of 2-star):

- Company that has been certified as 2 star for at least 18 months, can apply for 3 star
- 2 star criteria are met

Validity is 2 years.

Remark: In case of no further improvement an audit by an external consultant and an approval by the AEMAS country expert is required according to the explanations of the AEMAS country coordinator at the AEMAS Council – Thailand on 25th of April 2012 in Bangkok.

SUPERIOR ENERGY PERFORMANCE (SEP) SCHEME (APPLICABLE IN THE USA)

The Superior Energy Performance (SEP) Scheme is a market-based, ANSI/ANAB-accredited certification program, which is launched in 2012, that provides industrial and commercial facilities with a roadmap of achieving continual improvement in energy efficiency while boosting competitiveness. Using ISO 50001 as a foundational tool, SEP establishes a tiered program that provides according to Fred Fendt of the U.S. Council for Energy-Efficient Manufacturing (U.S. CEEM) an entry point for all companies in the US, including SMEs, at all levels of experience with energy management according to his presentation at the Exploratory Meeting for an ANSI Energy Efficiency Standard Panel on 25th of April 2012.

All participating facilities are required to verify conformance to ISO 50001 and to verify an energy performance improve-

ment using a specially developed sector-specific SEP Measurement and Verification Protocol. Two methods for verifying results are offered in accordance with the: Superior Energy Performance Certification Protocol, dated April 17, 2012 (Draft for Review).

- A. Self Declaration (Partner): Facilities applying to become SEP Partners will self-declare their conformance to the program requirements.
- B. An ANSI/ANAB-accredited Verification Body will conduct a third-party audit to verify that the following requirements are met:
 - Energy Management System Conformance to ISO 50001 Energy Management Standard
 - Energy Performance Improvement (two options)
 - Energy Performance Pathway OR
 - Mature Energy Pathway

It can be summarized that to qualify for the Energy Performance Pathway, the energy performance improvement has to be demonstrated within a shorter time frame, namely the last 3 years with increasing amount from Silver Level (5 %) up to Platinum Level (15 %), whereas to qualify for the Mature Energy Pathway, the energy performance improvement has to be demonstrated within a longer shorter time frame with 15 % over the last 10 years. The Energy Performance Pathway is focussing on the energy performance improvement only, whereas the Mature Energy Pathway is focussing on both the continuous improvement of the energy management system and of the energy performance.

Table 1 shows the requirements for both pathways for improvement of the energy management system and the energy performance in detail:

INITIAL COMPARISON OF THE ABOVE VOLUNTARY SCHEMES

The comparison in Table 2 is based on the initial knowledge of the current situation of industries in ASEAN countries.

Table 1: SEP Performance Criteria for Certification Levels.

Performance Characteristics		Silver	Gold	Platinum
Energy Performance Pathway	Energy Performance Improvement	Meets 5 % energy performance improvement threshold over the last 3 years	Meets 10 % energy performance improvement threshold over the last 3 years	Meets 15 % energy performance improvement threshold over the last 3 years
Mature Energy Pathway	Energy Performance Improvement	Demonstrates an energy performance of 15 % or more over the last 10 years	Demonstrates an energy performance of 15 % or more over the last 10 years	Demonstrates an energy performance of 15 % or more over the last 10 years
	Score on Best Practice Scorecard <i>Includes credits for energy management best practices and energy performance improvements beyond 15 % over the last 10 years</i>	Meets a score of at least 35 and up to 60 out of 100 total points for Best Scorecard Minimum of 25 points required for the energy management best practices	Meets a score of at least 61 and up to 80 out of 100 total points for Best Scorecard Minimum of 25 points required for the energy management best practices and 10 for energy performance	Meets a score of at least 81 and up to 100 points for Best Scorecard Minimum of 25 points required for the energy management best practices and 10 for energy performance

Table 2: Initial Comparison of the selected voluntary schemes in addition or independent to ISO 50001 with focus on ASEAN.

Type of EnMS	ISO 50001 + AEMAS***)	ISO 50001 + SEP	Only AEMAS***)
Size/Kind of Enterprise			
Small Sized Enterprise	XX	XX XXX**)	X
Medium Sized Enterprise with low energy intensity	XX	XX XXX**)	X
Medium Sized Enterprise with high energy intensity	X	XX	X
Large Enterprise	X	X	X

X Applicable

XX Limited applicable

XXX Not Applicable

**) SEP so far is limited to USA.

***) AEMAS so far is limited to the 10 ASEAN member countries.

Examples from the USA show, that medium-sized companies, which are belonging to large global corporations, are also applicants of ISO 50001 plus SEP. The same applies for applicants to the AEMAS system according to best practice examples from the Philippines.

Proposed selected simplified approaches to energy management systems EnMS for SMEs

Increasing energy costs pose a significant challenge to small and medium-sized businesses that may lack the knowledge and resources to address it systematically. The efforts to control the use of energy and its related costs depends not only on the size of the company but also on its energy intensity, that means how much are the total energy costs compared to the overall costs of the company and its turnover. To treat energy costs equal to raw material costs and labour costs would be the first step to manage energy appropriately.

Anyhow, the actual use of certified energy management systems is limited in all countries to larger energy-intensive businesses. For SMEs the cost for the preparation, implementation and operating of an Energy Management System according to ISO 50001 usually proves to be too high, the cost-benefit ratio is not sufficient. Often there is also a lack of appropriate human resources besides of the financial constraints. While a larger company may have its own staff working fully committed to energy efficiency and energy management, SMEs do not have such abilities. The standard costs include costs for preparation/consulting, implementation, documentation and auditing/certification. There is evidence, that governments in ASEAN countries subsidize the introduction of energy management like ISO 50001 in SMEs in order to overcome those barriers and constraints of resources, which might at the end lead to a more structured approach for energy management as a pre-step to ISO 50001 compliance.

The business landscape in many developing countries and countries in transition is composed mainly of SMEs. Mostly the relevant responsibilities are often centered to one person, and there is no appropriate personnel available with the specific knowledge for the introduction of the complex energy management standard with its comprehensive documentation requirements for documents and records. This is considered as problematic, especially if there is no other management system

such as a quality management system (QMS) or an environmental management system (EMS) in place, where the energy management system (EnMS) could be built upon. In developing countries, there are a number of SMEs, which until now hardly possess such knowledge and experience with management systems in general. In addition, those SMEs still operate mainly with technologies and equipments that is already outdated and do not comply with current state of the art energy efficiency standards.

Below there are two selected proposals for a simplified approach for SMEs that lead to a "Plan-Do-Check-Act" continual improvement process without requesting a certification according to ISO 50001 in the first place.

PROPOSAL 1 ACCORDING TO THE "GUIDELINES FOR EFFICIENT ENERGY MANAGEMENT" OF GUT CERT

The proposed approach is based on the "Guidelines for Efficient Energy Management" of the German certifying entity GUT Zertifizierungsgesellschaft für Managementsysteme mbH, Umweltgutachter, belonging to French Afnor Group, which describes the process in three stages as follows:

Stage I: Analyse your energy situation and identify many potentials automatically

(From the Project Idea to the First Acquisition of State Data and Uncovering of Potentials)

- **1st Step:** Management Resolution, Appointment of a Project Manager
- **2nd Step:** Project Planning
- **3rd Step:** Establishing the Scope (Establishing the System Boundaries)
- **4th Step:** Acquisition of Basic Data
- **5th Step:** Evaluation of Essential Energy Aspects, First Energy Targets, and First Energy Saving Program (Evaluation of Significant Influencing Factor, First Energy Targets, and First Energy Saving Programme)
- **6th Step:** Review of the Results and Self-obligation of Company Management (Review of the Results and Self-obligation of Top Management)

Stage II: Adapt the procedure to your own planning processes and – if possible – integrate it into the existing system

(Adaptation and Integration in the Planning Processes)

- **7th Step:** Energy Policy
- **8th Step:** Organization, Progress Communication, Provision of Resources
- **9th Step:** Documentation of the EnMS, Control of Documents and Recordings
- **10th Step:** Designing Energy Relevant Processes
- **11th Step:** Awareness, Training, and Capabilities
- **12th Step:** Type and Structure of the Communication
- **13th Step:** Acquisition and Processing Improvement Measures
- **14th Step:** Benchmarking, Developing and Comparing Energy Indicators and Characteristic Numbers, Planning Energy Use (Planning the use of energy, creating energy key figures and benchmarking)

The achievement of stage II would enable an SME to upgrade its Energy Management System to a rating system for energy performance improvements, e.g. according to AEMAS Energy Management Gold Standard and/or with starting of a continuous improvement based on a real PDCA cycle, leading after successful implementation to compliance with ISO 50001 requirements in the next stage.

PROPOSAL 2 ACCORDING TO “A SIMPLIFIED ENERGY SYSTEM IN SMES” OF ADNAN HRUSTIC ET. AL.

1. **Energy Policy.** The company should define an energy policy that is published and it shows how the company plans to work with energy efficiency.
2. **Laws and standards.** Documenting a record of national, but also international laws and standards is a way to identify what rules the company should adjust its energy use for.
3. **Implementation.** The implementation part of the EnEnergy Management System (EEMS) consists of two parts, checklist and energy tools. Introducing a checklist could be used as guidance for companies in their energy use. By introducing different energy tools in the company, they will have more alternatives to improve the work with energy efficiency. The applied tools should exist of a benchmarking tool and specific tools for the kind of technologies applied in the SME, etc.
4. **Follow up.** Companies should review their results, through a review of the energy management practices conducted. By eliminating the discrepancies that exist in the energy targets, companies could improve their level of energy efficiency.
5. **Continuous improvement.** In order to improve the simplified EEMS, anomalies in the system could be reduced and the the energy efficiency could be increased.

At a later stage, there are expectations that the above described simplified EEMS in turn could help SMEs with the introduction of the international standard ISO 50001.

OWN PROPOSAL

Selected measurements over short periods as a result e.g. from energy audits are generally not sufficient as a basis for a systematic implementation of energy efficiency measures.

Integrated energy monitoring systems, which are often confused with energy management systems are an important prerequisite for a systematic implementation of energy efficiency measures.

Such an integrated energy monitoring system consists of the following components:

1. Measurement
2. Transmission technology (cabling)
3. Signal conversion
4. Data acquisition – database
5. Input of information from other existing data collection systems such as company data collection systems, process and building control systems, accounting systems
6. Evaluation system for energy consumption data and energy intensity data with target/actual comparisons, benchmark/performance comparison – subdivided for the overall operation, locations, cost centers, as well as existing production areas and individual energy consumers
7. Data visualization system for energy and specific energy intensity data with target/actual comparisons, benchmark/performance comparisons
8. Automatic generation of energy reports with target/actual comparisons, benchmark/performance comparisons

For SMEs with traceable energy use structures, a comprehensive energy monitoring system can be operated manually by the energy manager or energy coordinator in collaboration with the maintenance department, responsible for calibration of the measuring technique implemented. For this purpose, implementation of stages 1 to 4 might be sufficient.

For larger companies with complex energy use processes it is recommendable to apply an automated integrated energy monitoring system that contains the allocation of the collected and evaluated data to existing cost center structures.

In case of complex process energy use the simple analytic calculation is not sufficient as the energy use regime is depending on the production program and on availability of waste energy streams from certain processes as well as weather conditions, load levels of equipments, etc. Hence modelling and simulation are additional tools that can be applied. This should be based on a detailed process analysis, as it is common for even the most experienced plant manager to be unable to predict the behaviour of energy intensive equipment in a complex process industry, when a number of process variables exert their influence on the equipment's performance and efficiency.

Moreover it makes it easier later on to get cost center managers and energy managers of the energy accounting centers involved for example into agreements on objectives or targets of measures to increase energy efficiency.

Anyhow, such system does not replace the energy manager of the company or the energy coordinator within the energy accounting center because of the following reasons among others:

- Samples from existing building and process-control systems show, that these systems are not operating automatically in this sense, that adjustments are needed from time to time caused by fluctuating energy demand
- Immediate uncovering of leaks or energy losses and organizing mitigation measures
- Immediate actions after malfunctioning of equipment
- Designing new energy saving measures
- Training of all operating staffs with influence on energy use
- Give recommendations in case of new investments, replacements, purchase of energy consuming equipment
- Is in close contact with the operational and maintenance units of the company, as a good housekeeping (good operation and maintenance) is also important for the energy use besides of investments into energy saving equipment
- Interpretation of the collected energy consumption and energy intensity data
- Make the energy policy of the company sustainable

Following the above explanation about the importance of a energy monitoring system I would like to propose the following approach for the introduction of an energy management system in a SME:

1. Employ an Energy Manager and get senior management commitment to reduce energy costs and GHG emissions.
2. Assessment of current situation by introduction of a technical energy controlling system and an energy accounting system with allocation of energy costs and GHG emissions to energy accounting centers on a regular basis.

The step-by-step implementation of a monitoring system covering at the end all energy accounting centers would be an essential part for the assessment of the current situation and the situation after implementation of energy saving measures.

At the beginning the use of a deemed energy savings approach or scaled engineering estimates could be used, which would reduce the monitoring and verification costs, before a comprehensive monitoring system would be in place.

3. Develop a medium-term and annual plan for energy use in the company with allocation of energy allowances to the energy accounting centers.

4. Allocate resources (finance, human resources, subcontracted energy audit specialists) for the establishment of an energy action plan to reduce use of energy costs and GHG emissions.
5. Implement the energy action plan, divided into organizational measures, low cost measures and high cost measures.
6. Regularly reporting of the progress of the implementation of the energy action plan.
7. Quarterly and annual reporting of the energy costs and GHG emissions of the whole company and its energy accounting centers.

At a later stage, there are expectations that the above described simplified energy management systems in turn could help SMEs with the introduction of the international standard ISO 50001 and a corporate carbon footprint assessment and reporting.

Enterprises that are already applying a quality and/or environmental management systems such as ISO 9000/ISO 14001 will face less difficulties, as they might be already familiar with the method for the implementation of a formal energy management system according to ISO 50001, which follows the similar structured 'plan-do-check-act' method. For enterprises, which have no other quality and/or environmental management systems such as ISO 9000/ISO 14001 in place, it would be a first step to establish in addition an energy management handbook, which should contain the main documents relevant for the energy management like relevant laws, technical documents, internal norms, organizational plans, process informations.

INITIAL COMPARISON OF THE SELECTED SIMPLIFIED APPROACHES TO ENMS FOR SMES

The definition and concept of SMEs vary among member countries in ASEAN. There is no common agreement on what distinguishes a microenterprise (MIE) from a small enterprise (SE), a SE from a medium enterprise (ME), and a ME from a large enterprise (LE). Most enterprises that form this SME category are actually very small and about 70 % to 80 % of them employ less than five people. There are only a very small percentage of firms, typically ranging from about 1 % to 4 %, which have more than 100 employees. Unfortunately, there is no consistent definition of a MIE among countries.

The below comparison is based on the initial knowledge of the author of the current situation of industries in ASEAN countries.

Table 3: Initial Comparison of the selected simplified approaches to EnMS for SMEs with focus on ASEAN.

Type of EnMS Approach	Approach GUT-Cert	Approach Hrustic et. al.	Own Proposal
Size/Kind of Enterprise			
Small Sized Enterprise	XXX	X	X
Medium Sized Enterprise with low energy intensity	XX	X	X
Medium Sized Enterprise with high energy intensity	X	XX	XX
Large Enterprise	X	XXX	XXX

X Applicable

XX Limited applicable

XXX Not Applicable

Whereas the approach of GUT Cert is designed to lead mainly large and medium-sized enterprises to a systematic step-wise introduction of the PDCA-cycle leading to a complete compliance to ISO 50001 with all the documentation required, which allows a verification and certification of a certification body, the two other approaches are specially designed for SMEs.

In order to reduce transaction costs for consultation, auditing and certification by third party consultants and certification bodies, a self-declaration of compliance with ISO 50001 or an voluntary standard like AEMAS respectively might be the entry point into a systematic PDCA-cycle for SMEs.

Conclusions

The above described solutions for large corporations as well as small and medium-sized enterprises are different ways which use besides of the generic PDCA-approach (Plan-Do-Act-method) other tools to utilize the hidden energy saving potentials. It is the opinion of the author that especially a well functioning Energy Monitoring and Tracking Process ensures that all savings are quantified and documented for a regular Management Review, which is also a pre-requisite of an GHG emissions assessment for an organization's carbon footprint.

It can be concluded that both high quality energy management systems and high quality corporate carbon footprints require a good working monitoring of the energy supply, energy distribution and energy consumption and the related GHG emissions before and after implementation of measures.

The implementation of an Energy Management System according to ISO 50001 and in addition a voluntary scheme like for example AEMAS Gold Standard will assist companies to:

- Actively managing energy use, reducing costs and exposure to rising energy prices
- Continually improve energy performance
- Better utilize company personnel and resources, including capital stock
- Adopt energy efficiency best-practices and low-carbon technologies and reduce GHG emissions
- Improve enterprises' bottom line

and finally produce not only a compliance document but really improve energy productivity against a historic baseline and enhance competitiveness while delivering a dividend to the environment and the goal of sustainable development.

The implementation of an Energy Management System according to ISO 50001 might be a good foundation, but may amount to nothing more than "windows dressing" in order to improve a organization's public image. On the other hand it is common sense among practioners that adherence to an Energy Management System like ISO 50001 does not by itself improve the energy performance of an organization automatically, especially in organizations which lack a serious commitment through the top management in this regard.

The introduction of a voluntary Energy Management Scheme such as the AEMAS Gold Standard with specific targets for energy savings and reductions of GHG emissions and an appropriate monitoring and verification system (MRV-system) to re-trace the achieved energy savings and reductions

of GHG emissions against a historic adjusted baseline could qualify if further developed and endorsed by a host country's Designated National Authority (DNA) from view of the auditor as a supported or credited National Appropriate Mitigation Action (NAMA).

For SMEs the reduction of energy costs will be in the first place. The introduction of an strategic energy management system according to ISO 50001 can be justified in case the auditing and certification costs are only a small percentage of the overall achieved energy cost reductions followed the implementation of the strategic energy management system according to ISO 50001 and in addition another management system such as QMS or EMS is already in place, which might be applicable only for large and medium sized enterprises of energy intensive industries.

A solution in order to reduce the transaction costs for an energy management scheme in SMEs could be the outsourcing of the energy manager to an ESCO, which could bundle the energy management tasks and tasks for implementing energy monitoring measures and energy saving measures of a certain number of SMEs under one specific agreement.

From view of the author it would be beneficial to perform energy audits on a regular basis by independent energy consultants assigned by local governments or local energy agencies in agreement with industrial associations of the relevant industrial sector. The relevant energy audits for SMEs should be subsidized by local governments. The results of those energy audits could be used for the continuous improvement of the specific energy efficiency of the investigated enterprises on a stand-alone basis or as a integral part of a strategic energy management system.

These energy audits have to ensure that the energy balance will continue to be complete and will not contain any leakage of energy flows, which can not be identified and explained. Moreover it will be the pre-requisite for tracking the newly implemented energy improvement measures by measuring their performance and for further fine tuning the process after implementation, i.e., continually improving the process and follow-up.

Anyhow, from view of the author it should be in case of absence of mandatory requirements for energy management in the host country the decision of the company which approach is most suitable for their needs based on their specific circumstances, especially their human resources, their technical systems and status of already implemented other management systems and drivers for reducing of energy use and GHG emissions and drivers for the implementation of an energy management system, e.g. large corporations which demand their suppliers to participate.

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Endnotes

The contents of this abstract and the final paper is the personal opinion of the author based on his individual experiences within the industry, e.g. as former energy manager and lessons learned from work and attended seminars on energy and carbon issues and review of the papers described but do not necessarily reflect the views, policies or recommendations of Management System Certification Institute (Thailand) or CIM. The above presented views are the personal views of the author and may also not necessarily reflect the opinions, positions or claims made by others in this field.

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