



BESS

Benchmarking and Energy management Schemes in SMEs

Intelligent Energy – Europe (EIE)

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Definition of the Main Challenges and Roll Out of Best Practices

Final Report

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0 Executive Summary

0.1 Introduction to the BESS Project

The BESS project (Benchmarking and Energy Management Schemes in SMEs) is supported by the European Commission under the EU's Intelligent Energy – Europe (EIE) Programme.

The primary objective of the project is to promote widespread use of best practice energy management and benchmarking tools and to improve energy efficiency in industrial small and medium-sized enterprises (SMEs), with particular focus on the food and drinks industry.

The main tasks of the project are:

- Development of an interactive tool (jointly with the industrial associations) for the promotion of a systematic approach to energy management and benchmarking. The tool will contain the following elements: selection of appropriate measures, implementation and day-to-day management, an e-learning scheme, and a monitoring and benchmarking system for the food and drinks industry.
- Pilots in 55 industrial SMEs.
- Comparative analysis of energy monitoring and benchmarking in 11 pilot countries.
- Targeted dissemination of the interactive tool in co-operation with the food and drinks industry associations.
- Seminars, internet and other information dissemination.

The project started in January 2005 and the kick-off meeting was held in Utrecht, the Netherlands on 7-8 February 2005. The project is scheduled to be finalised by 30 April 2007.

The project's internet address is <http://www.bess-project.info>.

To ensure the effectiveness of the project, contactpersons from relevant institutions such as CIAA, EC, IEA, national industry associations and industry experts have been consulted during the project and in particular during the preparation of this report. Moreover contacts with other relevant EIE SME oriented projects have been established. All these activities were initiated already at the beginning of the project.

More information on the project can be obtained from the project partners (see Annex 13 for contact information) and the project co-ordinator:

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0.2 Objectives and Outcome of Work Package 1

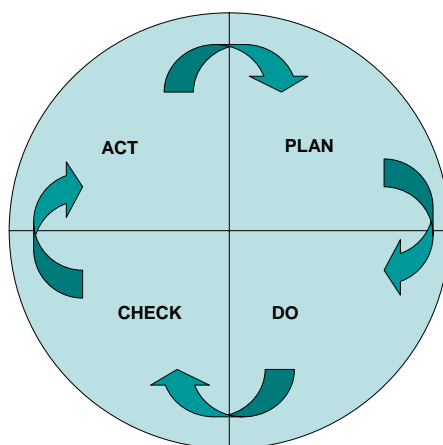
The objective of the Work Package 1 (WP 1) was to choose the best practices in energy management and benchmarking for further analysis and application in the piloting phase of the BESS Project. Another objective was to streamline the project and prepare guidelines for the implementation of the other work packages.

The tools and instruments proposed in this project as the best practices for energy management for industrial SMEs are flexible in terms of implementation in different energy and environmental policy frameworks. They can be effectively implemented in co-existence with long-term agreements or without them, in line with different energy and environmental regulations and are in some cases somewhat self-standing vis-à-vis economic instruments (see Chapter 5.2).

A good approach for energy management implementation is to use the Plan-Do-Check-Act (PDCA) Cycle. This is in line with the most commonly recommended management approaches that are relevant to SMEs, for example, the EMAS Toolkit for the SMEs and the EMAS Energy Efficiency Toolkit for the SMEs (see Chapter 2.1 under EMAS regulation). The PDCA Approach is well known across industry, and most SME managers know it by heart.

The PDCA Cycle provides a framework for the continuous improvement of a process or system. The cycle is designed as a dynamic model where the completion of one turn of the cycle flows into the beginning of the next.

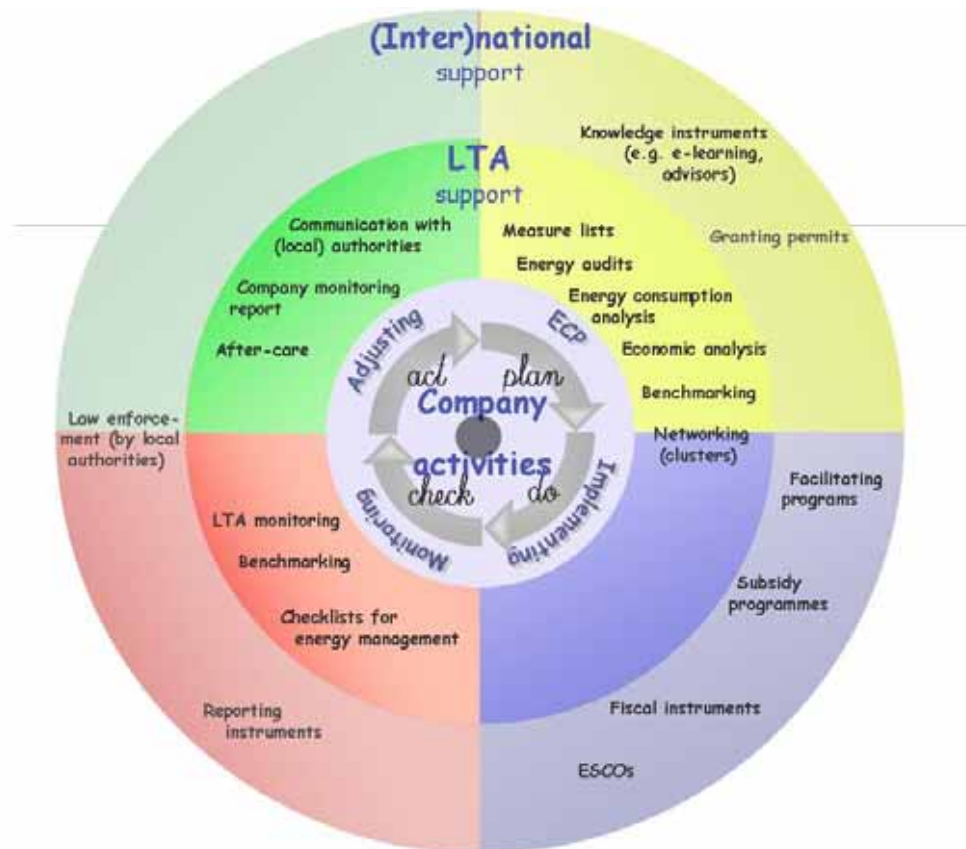
Figure 0.1
The Basic Plan-Do-Check-Act (PDCA) Cycle



The BESS approach is fully in line with the PDCA principles. It is even suggested to use the PDCA Cycle to illustrate how the best practices are interrelated and how they can play together. Furthermore, this way of using the PDCA Cycle effectively demonstrates how the best practices can be integrated into most SMEs' daily management challenges. Figure 0.2 is an extension of Figure 0.1. It has been prepared by taking the Dutch dart board for long-term agreement as the starting point and adjusting it by incorporating the instruments discussed in this report and by removing the Netherlands-specific items.

Figure 0.2 illustrates the multi-layer approach to energy management. The bull's eye, is the target whereby a company implements its own energy policy by which it is able to continuously reduce its energy consumption and make use of renewable energy sources. The mid-ring represents the potential supporting tools provided by a well-designed long-term agreement and the outer ring the support provided by national and international policy.

Figure 0.2
The Starting Point of the BESS Version of the PDCA Cycle



Source: Adjusted for the BESS Project from the Dutch LTA "Dart Board" by SenterNovem.

0.3 The Recommended Best Practice Tools

The recommended best practice tools that have emerged during the Work Package 1 are briefly described in the following. These briefs are taken from the more elaborated texts in Chapter 5 on Conclusions and Recommendations.

0.3.1 The Best Practice Policy Framework

International Commitments and Legislation

The best practices proposed in the BESS Project enhance the fulfilment of the Kyoto Commitments and are in line with the EU Acquis. Furthermore, the bottom-up approach also supports the objectives of legislative instruments. Particularly, the requirements for reliable data from SMEs in the implementation and follow-up of the EU Directive on Energy End-use Efficiency and Energy Services (ES Directive) will see direct benefits from the bottom-up approach of the BESS project, for example, by providing baselines for "business-as-usual" and indicative targets in the sectors dealt with by the BESS Project. To maximise the Project's impact, the project consortium will communicate and exchange information with the European Commission and with other organisations, such as those operating systems like the ODYSSEE database.

On the other hand, several EU and other initiatives can enhance the implementation of the proposed best practices. Some examples are given hereunder.

The EU Emissions Trading Scheme is an important policy instrument although the SMEs do not usually participate in emissions trading. However, it is likely to have some indirect impacts on them because all sectors of the society need to contribute towards reaching the greenhouse gas reduction targets arising from the Kyoto agreement. Therefore, also SMEs need to participate in greenhouse gas abatement. Since normally they do not have access to emissions trading or the Kyoto flexible mechanisms, they may become subject to other - possibly less market-based - measures to address greenhouse gas emissions. Another implication is that their energy costs are likely to increase when the cost of CO₂ is transposed into energy prices which can be a driver towards better energy efficiency.

While the IPPC Directive mainly concerns the largest industries, it covers some industrial SMEs. If a SME falls under the Directive, its environmental permit application needs to include information on energy use and generation and energy efficiency, including future plans for improvement. Furthermore, the Best-available-technology Reference Documents (BREF) for best available techniques contain energy efficiency considerations. A horizontal BREF for energy efficiency (including energy management) in industrial enterprises is at the early stages of preparation.

The EC's regulation on the hygiene of foodstuff (852/2004) is significant specifically for the food and drinks industry. It outlines basic rules that all food businesses must follow to ensure food quality. They are obliged to put in place, implement and maintain a permanent pro-active procedure or procedures based on the principles of Hazard Analysis Critical Control Point (HACCP). The energy management approach produced by the BESS Project for the food and drinks industry can be integrated into the HACCP system to make it easier for energy efficiency to become business-as-usual. It is easier for companies to understand and adopt

good energy management practises if they can align it to something to which they already know, such as HACCP, ISO or EMAS.

The European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC) are developing either a European standard or guidelines for energy management as a priority project. The standard will be similar to the Danish, Swedish and Irish standard, or alternatively, guidelines will be prepared to establish such systems in a company or organisations, either by itself, or integrated in other management systems like quality or environment.

Long-Term Agreements

Long-term agreements (LTAs) are not a harmonious group and may be called energy conservation agreements, voluntary agreements, negotiated agreements, covenants or simply long-term agreements. For example, while the voluntary agreements are unilateral commitments made by industrial companies, negotiated agreements are between industrial companies and public authorities. Furthermore, some LTAs are targeted to improve energy efficiency or curb the growth of energy consumption whereas some of them target CO₂ emissions.

There are few examples of long-term agreements being applied to SMEs and they are a much more common instrument for the larger companies. However, they could provide a good framework for promoting energy efficiency also in the smaller companies, as suggested by, for example, the Dutch example.

The Dutch scheme, which is partly connected to national environmental regulations and economic instruments, requires the implementation of energy efficiency measures, energy management and yearly monitoring, all in the spirit of the Plan-Do-Check-Act Cycle. The LTA participants are provided with a package of several supporting services and tools. The LTA also provides the opportunity to reduce work load of the management by providing a possibility to link the energy management scheme to other (ISO) management schemes. The scheme is driven by an energy management specification which, like the Danish DS 2403 standard, is directly derived from the ISO 14001 environmental management standard.

An ISO 14001-related energy management system can be regarded as the best practice. However, it will be necessary to take regard of the planned EU energy efficiency BREF or the CEN/CENELEC energy management standards or guidelines as soon as their contents become clearer.

In most other countries participating the BESS Project there are no long-term agreements for the SMEs. Implementation of long-term agreements is not necessary in these countries for effective energy management. In Norway, for example, the implementation of benchmarking without long-term agreements is bringing positive results. Some other countries rely on energy auditing, energy awards, advisory services etc. In the new EC “Greenpaper on Energy Efficiency or Doing More With Less” the Netherlands are mentioned as one of the best examples in terms of energy efficiency thanks to the tradition of voluntary agreements with industry. The scheme is quite resource intensive but evaluations have also shown its cost-effectiveness. However, it is not clear that all countries are able to provide adequate resources to effectively implement and manage such a scheme. Furthermore, due to cultural differences attracting SMEs to enter legally binding agreements can be difficult in many countries. Given these considerations, it is recommended to make use of the tools and some of the mechanisms of existing long-term agreement for the SMEs.

If long-term agreements are not implemented, the next question of interest is, how the SMEs can be motivated to implement good energy management practices. The remaining instruments are regulations, economic instruments and “soft instruments”, such as providing easy access to energy management tools on voluntary basis and information dissemination. These are discussed hereunder.

Energy Efficiency and Environmental Regulations

Regulations concerning the maintenance of energy-consuming equipment, building standards, nomination of energy managers and mandatory reporting of energy consumption and CO₂ emissions are all compatible with the best practices proposed by the BESS Project. Some of them, such as mandatory energy managers, can provide significant help in implementation of the project’s proposals.

Evaluating the compatibility of mandatory energy saving/conservation/demand-side management plans is more complex due to their possibly different design and the evaluation should be made individually in each case. Implementation strictly in line with the proposed best practices may be limited by the requirements established by the national regulations.

In about half of the EU countries, large energy consumers are mandated to have regular energy audits but the requirement is seldom extended to the SMEs. This gives room for unimpeded implementation of the proposed best practices. However, if SMEs have been mandated to conduct energy audits, it rather supports than restricts the implementation of the proposed best practices, particularly for the companies with less experience in energy auditing and energy management. Nevertheless, mandatory energy audit programmes (with requirements to implement all measures with pay-back times under a certain threshold) need to be designed carefully to ensure good quality audits whereby the auditor genuinely tries to find all reasonable energy efficiency improvement opportunities regardless any pressure from the company.

Also environmental permit regulations and practices are relevant to the BESS Project. There may be an opportunity to integrate energy efficiency considerations into other existing procedures by integrating them into the environmental permit processes. For example, environmental permit procedures may already include reporting and data collection procedures which can facilitate better energy management if the opportunities are fully recognised. Some SMEs are subject to the regulations arising from the IPPC Directive, and in some countries, there are national environmental permit regulations which concern SMEs. Energy issues are also an integral part of ISO and EMAS but these are applied mainly to the larger companies. The proposed best practice for energy management incorporates the idea of providing linking lists to integrate energy management to ISO and EMAS, if applicable.

Economic Instruments

Economic instruments include fiscal incentives (e.g., accelerated depreciation, tax credits, tax deductions, tax reductions on energy efficient equipment or on energy efficiency investments) and financial incentives (e.g., investment subsidies, soft loans and energy audit subsidies). Quite often economic instruments are being used in relation to a long-term agreement.

The objective of economic incentives is to induce investments which are cost-effective from collective point of view, but which would not otherwise be undertaken. Practice has shown that promotion of energy efficiency through voluntary actions amongst the SMEs usually

needs to be supported by providing economic incentives. There are, however, some instruments which are more self-standing such as the use of e-learning, use of checklists and “light” auditing. However, even for these instruments some transaction costs, usually paid for by the state, are unavoidable.

Also energy service companies (ESCOs) are sometimes classified into the category of economic instruments because they are a way to finance energy efficiency improvements. While parts of energy management and services can be outsourced to an ESCO - particularly the Do-step of the Plan-Do-Check-Act Cycle - the overall energy management process still needs to be strongly in the hands of the SME’s own management. Furthermore, ESCOs are typically operating in the energy intensive industry.

“Soft Instruments”

Any “soft measures” implemented by the governments and energy agencies, such as energy advisors and other information desks, information campaigns, energy awareness days and weeks and energy awards can further promote the success of the best practices proposed by the BESS Project. Such measures may be implemented together with the abovementioned instruments or as stand-alone policy measures. Particularly for the smaller SMEs, it would be extremely useful to make advisory services - like those developed within the EIE E-Check in Craft Project - available at no cost or low cost.

0.3.2 The Best Practice Tools

Implementation of Energy Management

Energy management is inciting organisational, technical and behavioural actions in a structurally and economically sound manner to minimise the consumption of energy, including energy for production and to minimise the consumption of basic and added materials.

Energy management means structured attention for energy with the objective of continuously reducing energy consumption and sustaining the achieved improvements. It ensures that a company continually passes through the cycle of making policy, planning actions, implementing actions and checking results, on the basis of which new policy is made. The PDCA Cycle makes continued improvement possible.

Successful implementation of energy management requires commitment by the company management, conducting an energy audit, analysis and target setting, for example, by making an energy conservation plan and executing the actions needed to fulfil the targets. Finally, it is necessary to implement the energy management scheme throughout the organisation on a permanent basis.

Companies will understand and adopt good energy management practises easily if they are based on a standard or a specification which is derived from something which they already know, in particular the ISO 9001 management standard and the related environmental energy management standard ISO 14001. The BESS Project will provide such an energy management specification with implementation guidelines, a checklist and an implementation model which enables companies to introduce or improve their energy management.

In the pilot phase of the BESS Project, the energy management model will be applied in practice in selected national SME groups from certain sub-sectors of the food and drink industries in each country participating in the project.

The companies will be supported by interactive Internet applications, the project partner, the national sector associations and a consultant, if needed. All participants within the BESS Project will get access to these applications through a special BESS project website (www.bess-project.info).

Benchmarking

Energy benchmarking is a tool which comprises the collection, analysis and reporting of data to provide an industrial company with a context for assessing its energy efficiency in comparison to others in the same sector. It provides data on how energy is currently used within a particular industrial sector, process or building type.

In addition to technical factors, benchmarking can be applied to energy management to evaluate how far a company has progressed in its efforts compared to other companies in their own sector and in different countries and an “ideal” energy management approach.

Benchmarking has some features of energy monitoring because periodical benchmarking enables a company to follow its performance over time and, depending on the design of the benchmarking scheme (if also system specifications have been benchmarked), take informed corrective action.

The benchmarking tool should be easily adopted by any industrial association or other group of companies, e.g. dairy-companies. That means that companies could benchmark both the specific energy consumptions and all other relevant energy-based factors with or without correction factors.

Theoretically it would be desirable to establish a generic web-based benchmarking system that can benchmark any energy efficiency factors and figures a group of companies would like to benchmark. The BESS tool however will be limited to practical possibilities which can cope with available data. A pre-requisition to achieve this goal is that the BESS project provides practical formats and criteria for data to be used from the monitoring and measurement systems in the companies.

In benchmarking, data confidentiality is important. Therefore, it is essential to take into account the views of the participating companies and sector associations to safeguard the confidentiality of company data and to ensure the user-friendliness of the instruments.

Monitoring

Monitoring is an important element of the PDCA Cycle and a prerequisite for benchmarking. Distinction needs to be made between three types of monitoring:

- Continuous or periodic monitoring on daily, weekly or monthly basis, based on metering to allow the optimisation of ‘good housekeeping’. For this kind of

monitoring commercial systems are available; they also make it easier to prepare annual reports for other purposes.

- Monitoring on a yearly basis for company energy policy adjustments.
- (Annual) compliance checks for authorities (e.g. in connection with a Long-Term Agreement).

It is advisable to follow the total consumption of different energies like electricity, gas, other fuel and heat on a monthly basis, to compare the energy use against the targets and to identify consumption figures which are out of the range. One or more performance indicators (e.g., load curve in terms of peak load per base load) and other factors that have an effect on energy use (e.g., pressure level) should be monitored. It would be preferable (for the energy manager and technical staff) to have some on-line metering and data available from the critical points, e.g., through building automation system. However, this may not always be realistic for the SMEs. On the other hand, many SMEs employ hourly electricity metering (and billing). Analysing the levels and changes in hourly loads is useful to understand electricity use.

Monitoring needs a computer-based system and tailored energy reports. Energy monitoring and reporting should be based on an analysis of energy information needs at the different organisational levels.

Checklists

All countries have some kind of energy saving checklists or measure lists. Some of them are designed for individual companies and some for energy auditors. Checklists can be general (good housekeeping) or specific for some technical systems (utilities and buildings) or for some industrial branches (production processes). They also may be targeted to identify compliance or energy saving opportunities with best practices in energy management or in technologies.

In the BESS Project, the food and drink industry has been chosen as the pilot sector. The e-learning scheme could provide a checklist of system-specific energy saving measures in this sector. The list could include altogether a couple of hundred typical measures. These measures could include both good housekeeping (no-capital investments or very low cost measures) and typical investment projects with short pay back periods. The checklist should be detailed enough to allow the SMEs consult them themselves (self auditing).

Good Housekeeping

When adequate energy monitoring/metering equipments is available 'good housekeeping' means no capital investments and very low-cost activities. Good housekeeping measures are typically paid from the yearly budgets of the energy coordinators and do not require investments. Typical examples include switching off motors when not needed, ensuring that equipment operates properly, cleaning fouled surfaces and pipes and having regular maintenance.

Although good housekeeping is probably promoted in one form or another in most countries, it is not always being explicitly emphasised. Government officials, energy agencies and SME management may have some tacit information on good housekeeping but this may not have been formulated as specific action, projects and programmes. The e-learning scheme to be produced within the BESS Project provides a good opportunity to disseminate materials, e.g. checklists, which help to implement good housekeeping.

Energy Auditing and Auditing of Energy Management

The good housekeeping measures - possibly identified by using checklists - can take a company only to a certain level in energy efficiency. Energy auditing can help to identify additional cost-effective energy saving measures in a systematic way. A well-drafted technical auditing report can be a big help in improving energy efficiency.

In addition to technical energy audits, another auditing type is the non-technical energy management audits. These are directed to identify how experienced the company is in energy management and how it could be improved.

Industrial SMEs are not a homogenous group. The level of energy awareness and efforts in energy saving varies a lot from starters to very experienced companies. Another important viewpoint is the size of the company; the larger or energy-intensive SMEs are in a better position to pay also for heavier audits. Therefore, there is no single audit model which would be optimal for all SMEs.

For the beginners the most suitable options are non-technical audits/scans for energy management and monitoring or light technical walk-through audits/scans. For those with already some experience in energy management, targeted technical energy audit would be the best option. The most experienced energy savers and those with a large energy consumption would benefit most of the comprehensive energy audits.

If a company wants to improve its energy management, it is advisable to undertake an appropriate audit early in the process. In any case, usually at least very preliminary energy saving measures, targets and/or energy conservation plan should be established. As a next step, follow-up to the auditing, the company could make use of industrial branch-based checklists.

E-learning

Despite some examples, e-learning dealing with energy management and energy efficiency issues in the industrial sector, in particular regarding SMEs, is at a relatively early stage of development. There are very few existing and operational sites throughout the world which offer a comprehensive guide on matters like energy management, energy efficiency, best practices, energy audits, energy benchmarking and checklists. The sites usually contain one or more of the aforementioned topics but rarely all or most of them. Furthermore, the information they contain is almost always very difficult to locate and requires experience in the use of the Internet. Moreover, sites that have an easy-to-follow format and structure tend to be very simple sites with only basic information, not the in-depth information an SME engineer would be searching for. Identification of these difficulties within the existing schemes provides a good learning opportunity within the BESS Project and enhances the development of an "improved" scheme.

A couple of different ways to construct an e-learning scheme have been identified. One option is to make it an interactive step-by-step learning tool for energy management. Alternatively or additionally, it could include links to case studies, checklists and guidelines and to general energy efficiency technologies. Having an interactive learning tool appears to be the most interesting approach. However, this does not exclude the incorporation of other elements. Furthermore, if it turns out that the development of a full interactive learning tool is overly ambitious within the BESS Project, an effective e-learning scheme can be constructed from a user-friendly navigation structure only including other informative supporting elements.