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EIE/04/246/S07.38678

BESS

Benchmarking and Energy management Schemes in SMEs

Intelligent Energy – Europe (EIE)

EIE/04/246/S07.38678

**Definition of the Main Challenges
and Roll Out of Best Practices**

Final Report

June 2005

This report is composed within Work Package 1 (leader Motiva Oy)

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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

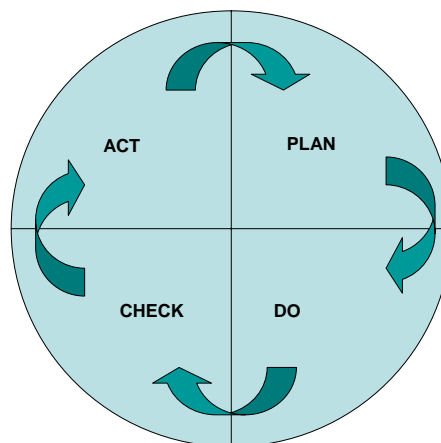
The objective of the Work Package 1 (WP 1) was to choose the best practices in energy management and benchmarking for further analysis and application in the piloting phase of the BESS Project. Another objective was to streamline the project and prepare guidelines for the implementation of the other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

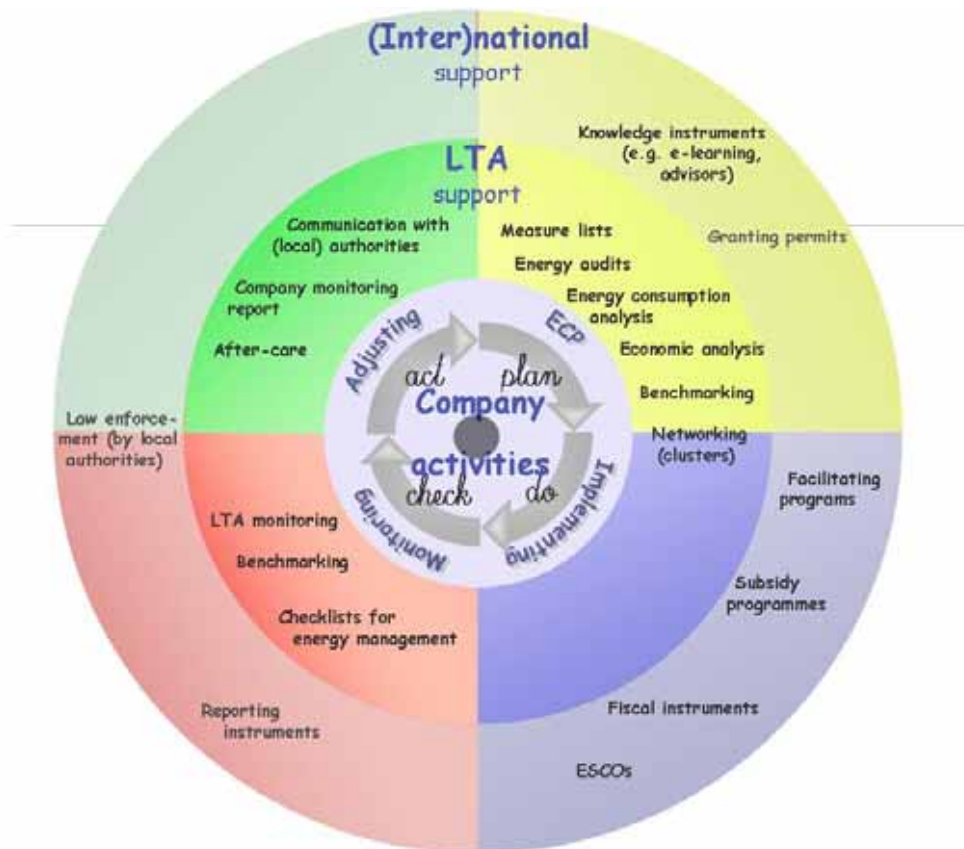
Figure 0.1
The Basic Plan-Do-Check-Act (PDCA) Cycle



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.

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ABBREVIATIONS AND ACRONYMS

Annex 1	Work Package 1: Definition of main challenges and roll out of best practices
Annex 2	Information sources
Annex 3	International studies on success factors and barriers for energy management and benchmarking in the SMEs
Annex 4	Pre-study questionnaire
Annex 5	Ranking Workshop
Annex 6	Inventory of Existing Energy Management Systems and Energy Management Standards (by JSI)
Annex 7	E-learning Schemes (by CRES)
Annex 8	The New Dutch E-learning Scheme (by SenterNovem)
Annex 9	Benchmarking of Sub-Processes (by Sofena)
Annex 10	Energy Monitoring and Reporting in the Netherlands (by SenterNovem)
Annex 11	Environmental Permits
Annex 12	Long-Term Agreements
Annex 13	Contact Information of the Project Partners

1 Objectives and Outline of WP 1

1.1 Objectives

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.

1.2 Tasks and Schedule

Table 1 presents a summary of the tasks performed in WP 1. A more detailed description of the different tasks in WP 1 can be found in Annex 1.

Table 1
WP 1 Tasks and Schedule

Task no.	Activity	Date
	Project start	1.1.2005
	First CIAA contact	27.1.2005
Task 1.1	Pre-study	7.2.2005
Task 1.1	Kick-off meeting, Utrecht, the Netherlands	7-8.2.2005
Task 1.2	- Pre-study results	
Task 1.2	- Draft model of needs and success factors	
Task 1.3	Collecting and describing the best practices applicable or already applied to SMEs (Documented in a Background Document prepared for the Ranking Workshop)	15.4.2005
Task 1.2	Ranking Workshop and 2 nd project meeting	17-19.4.2005
Task 1.4	- Final model of needs and success factors	
Task 1.4	- Selection of best practices	
Task 1.5	Informing and reporting	Continuous activity
Task 1.4	- Informing	
Task 1.4	- Draft WP 1 Report (detailing and documentation, reporting)	26.5.2005
Task 1.4	- Final WP 1 Report	June 2005

1.3 Project Participants and the Consultation Process

The WP 1 Leader was Motiva Oy (Finland). The other project partners participated actively by providing information on the practices in their countries as well as other relevant materials. Most of the partners also participated in the selection of the best practices.

The BESS Project partners are:

- Austrian Energy Agency (AEA), Austria
- Centre for Renewable Energy Sources (CRES), Greece
- Instituto para la Diversificación y Ahorro de la Energía (IDAE), Spain
- Jožef Stefan Institute (JSI), Slovenia
- Lithuanian Energy Institute (LEI), Lithuania
- Motiva Oy, Finland
- New Energy Performance AS (NEPAS), IFE Group, Norway together with BEKK Consulting AS, Norway
- SenterNovem, the Netherlands
- Sofia Energy Agency (Sofena), Bulgaria
- Sustainable Energy Ireland (SEI), Ireland
- Swedish Energy Agency (STEM), Sweden

To ensure the effectiveness of the project, relevant institutions such as CIAA, EC, IEA and national industry associations have been consulted during the implementation of WP 1.

1.4 Definitions

Best Practice

In the BESS Project, “a best practice” is defined as one of the best existing instrument (state of the art) which takes into account the specific needs, barriers and opportunities of the target group, namely the industrial SMEs and works in various policy frameworks. The objective is not to develop new instruments but to link to or build upon existing or past national and international instruments.

Energy Efficiency

Energy efficiency means different things for different stakeholders and therefore needs to be carefully defined. First, distinction needs to be made between energy efficiency at the macro level (e.g., national) and at the micro level (e.g., company level.). Here, only the latter is discussed.

One important question is, where to draw the boundaries in energy efficiency evaluation, i.e., deciding whether to apply or not to apply **product chain (life cycle)_approach**. Another question is to consider if and how **renewables** should be taken into account when evaluating the development of energy efficiency.

At least the following different definitions for energy efficiency improvement can be identified:

- Reducing the specific consumption (e.g. MJ/tonne of product) of primary energy. According to this definition replacing the use of fossil fuels by renewable energy does not improve energy efficiency.
- Reducing the specific consumption (e.g. MJ/tonne of product) of energy end-use. According to this definition replacing the use of fossil fuels by renewable energy does not improve energy efficiency.
- Reducing the specific consumption (end-use) of fossil fuels. According to this definition replacing the use of fossil fuels by renewable energy improves energy efficiency provided that the combustion efficiency of combustible renewables is at least as high as for fossil fuels.
- Reducing the amount of primary energy (or fossil fuels) needed to produce one unit of economic activity (e.g., energy per GDP or value added). Using this definition at the company level, however, is sensitive to changes in economic activity and production volume. Therefore, this definition is best suited for macro level (e.g., national) evaluation.

Within the BESS Project, it is proposed to concentrate on energy use within the factory boundaries without considering product life cycle to avoid an overly complex approach in the pilot phase of the project. Too many SMEs are only beginners in energy saving and have to improve energy management within their own factory before extending to the more complicated product chain approach.

The question about whether to include renewables or not (i.e., which definition of energy efficiency to adopt for this project) is more difficult. The EU has not yet provided a unanimous definition of energy efficiency in the directives concerning energy. It comes closest to doing so in the latest version (draft 19 May 2005) of the proposed Energy Services Directive where energy efficiency is defined as ‘a ratio between an output of performance, service, goods and energy, and an input of energy’. According to his definition the replacement of other fuels by renewables does not improve energy efficiency.

However, in energy and environmental management at company level renewables help to achieve other energy and environmental goals but energy efficiency given renewables’ contribution towards the reduction of greenhouse gas emissions, and in some cases other emissions. Fuel and energy prices can also be a driving force for the use of renewables. These reasons can make the use of renewables an important element of the company energy policy and hence energy management. Therefore, the use of renewables should not be completely excluded from the scope of the BESS Project.

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. A more detailed description of the implementation of energy management can be found in Chapter 3.6.

A distinction should be made between energy management (and other generic expressions such as energy management approach, energy management scheme and general energy management) and Energy Management Systems (EMS). Stand-alone Energy Management Systems, which typically comprise sophisticated energy management software and extensive

and often on-line sub-metering, can mainly be found in large energy-intensive industries, which are outside the scope of this project. However, energy management means managing all energy-related issues in the company and is applicable to all enterprises. Therefore, in the BESS Project, energy management is used according to this broader definition and the use of 'Energy Management Systems' should be avoided unless specifically referred to.

Use of the abbreviation EMS for energy management systems can be confusing because Environmental Management Systems are abbreviated EMS as well. Therefore, also the use of abbreviation EMS is not advisable.

Energy Policy (Energy Policy Framework vs. Company Energy Policy)

In the BESS Project report, expression "**energy policy framework**" is used when international and national energy policy is discussed. When company level energy policy is being discussed, expression "**company energy policy**" is being used. At the company level energy policy can be either a stand-alone policy or incorporated within its overall environmental policy. It is a statement made by the top management about the ways to meet the external obligations (e.g., legislation and long-term agreements), and to improve the efficiency of energy use or reduce energy consumption. It should also nominate the staff responsible for energy management and recognise the need for monitoring and continuous improvement. Other elements of company energy policy can be, for example, training and education of staff, statements about energy purchases and costs, priority projects, financing of energy saving investments and product life cycles.

Instrument

In the BESS Project, the word "instrument" is used for any energy policy or energy management initiatives either at the international, national or company level. International instruments comprise international commitments (e.g., Kyoto Protocol) and EU Acquis (e.g., legislation and regulations) and policies arising thereof (e.g., emissions trading). Long-term agreements, national regulations (e.g. energy management standards and environmental permit regulations) and financial and fiscal incentives are examples of national instruments. At the company level instruments comprise both different energy management approaches as well as various energy management tools which the companies have at their disposal (e.g., benchmarking, energy audits and e-learning). See Table 3 and Figure 1 for a more comprehensive overview of the different instruments.

Small and Medium-Sized Enterprises (SMEs)

The EC published a new recommendation on 6 May 2004 concerning the definition of micro, small and medium-sized enterprises. The new definition took force on 1 January 2005 and replaced the previous one from 1996. (For the full text, see: http://europa.eu.int/comm/enterprise/enterprise_policy/sme_definition/index_en.htm.)

Table 2
European Commission's Recommendation Concerning the SME Definition

Enterprise category	Headcount (unchanged)	Turnover	OR	Balance sheet total
Medium-sized	< 250	€50 million (in 1996: 40 million)		€43 million (in 1996: 27 million)
Small	< 50	€10 million (in 1996: 7 million)		€10 million (in 1996: 5 million)
Micro	< 10	€2 million (previously not defined)		€2 million (previously not defined)

The food and drinks industry has been chosen as the pilot sector in the project. The industry structure in the sector is changing. Certain sub-sectors in some countries have traditionally been characterised by the dominance of a few, or even just one, large company with several smaller processing sites. Furthermore, there has been a trend of consolidations and mergers in the food and drinks industry over the past years due to market conditions, principally increasing competition. Therefore the average company size is growing and a few larger companies account for most of the total energy consumption in the sector. However, there still are many very small companies in the sector.

Practical experience has shown that these larger companies often already have experience in energy management and may, in some cases, have participated different initiatives, such as benchmarking. Several attempts have already been made to approach the smallest industrial companies but motivating them to adopt more formalised energy management and to test new instruments has proved very difficult.

Given the above considerations, in the BESS Project the instruments to be developed will be primarily targeted to the SMEs as defined by the EC but keeping in mind the market structure and the practical limitations. Therefore, it is likely that a sizeable number of the pilot plants will be small or medium-sized sites of larger enterprises but utmost effort will be made to identify SMEs fully conforming to the EC definition. Furthermore, the suitability of the instruments to be developed for the small SMEs will be evaluated. It is proposed to not to put much effort to address micro-SMEs, i.e., companies with less than ten employees because another ongoing EIE project, Energy-Check in Small and Medium Craft Enterprises (E-Check in Craft SME), is addressing energy management in the micro-SMEs.

2 Pre-Study

The first task in the WP 1 was to scan and summarise relevant materials to identify the barriers and success factors for good energy management. The task included the study of results of previous EU and national studies, projects and other publications, relevant EU Acquis¹ and national energy policy frameworks and programmes, such as long-term agreements and economic instruments. The project partners were consulted to gather experiences from their countries and organisations. Additionally, the Confederation of the Food and Drinks Industries in the EU (CIAA) was interviewed and some national market actors and important stakeholders were contacted.

Annex 2 contains a list of the consulted materials together with links to the web-sites where the materials can be found. Annex 3 contains more detailed descriptions of some of the most important studies.

2.1 EU Acquis

Several existing and proposed Green Papers and EU directives and regulations have been identified to be relevant for the project. Here, short descriptions are given on their contents and relevance. Links to full texts can be found in Annex 2.

Green Paper on Energy Efficiency or Doing More With Less (June 2005)

The paper seeks to put energy savings higher on the agenda. Faced with increasing oil prices and the prospects of having 70% of its energy needs covered by imports by 2030, the European Union needs to start a discussion on how to save energy. The Green Paper lists a number of options to save 20% of energy consumption by 2020 in a cost effective way through changes in consumer behaviour and energy efficient technologies.

The options listed by the Green Paper embrace all sectors – production and end-use, industry and services, households and buildings, transport and international relations. They concern all stakeholders, from national, regional and local decision-makers, to banks, international institutions and individual consumers. The Commission suggests a wide range of policy tools, including financial incentives, regulations, setting of objectives, information and training and international dialogue.

The Green Paper is the point of departure for a broad debate involving all stakeholders. In 2006, at the end of the consultation process, the Commission will come forward with a comprehensive Action Plan which will identify measures which should be put forward. In order to prioritise the options mentioned, thorough cost-benefit analysis will be carried out.

¹ EU Acquis (in full 'Acquis communautaire') is a French term meaning, essentially, "the EU as it is" – in other words, the rights and obligations that EU countries share. The "acquis" includes all the EU's treaties and laws, declarations and resolutions, international agreements on EU affairs and the judgments given by the Court of Justice. It also includes action that EU governments take together in the area of "justice and home affairs" and on the Common Foreign and Security Policy. "Accepting the acquis" therefore means taking the EU as you find it. Candidate countries have to accept the "acquis" before they can join the EU, and make EU law part of their own national legislation.

Directive 1996/61/EC on Integrated pollution prevention and control (IPPC)

The Directive requires that Member States shall take the necessary measures to provide that the competent authorities ensure that installations are operated in such a way that, among other things, energy is used efficiently. Furthermore, the Directive requires that permit applications include a description of the raw and auxiliary materials, other substances and energy used in or generated by the installation. While the IPPC Directive mainly concerns the largest industries, it also covers some industrial SMEs.

The Best-available-technology Reference Documents (BREF) in each sector include energy efficiency considerations. A horizontal BREF for energy efficiency (including energy management, methodologies to optimise energy use and assess energy efficiency, energy indicators, process control systems, heat recovery systems, heat pumps and CHP etc.) in industrial enterprises is in the early stages of preparation. The BREF will not deal with detailed sector-specific techniques which will continue to be dealt with in sector specific BREFs. It will serve to assist regulators, industry and other interested parties on how to approach energy efficiency, how to assess, implement and handle energy efficiency issues in industrial installations and in permit and supervising procedures. Work started in May 2005 and the BREF is expected to become final in two to three years. The findings within the BESS Project could be useful for the preparation of the energy efficiency BREF.

In the sectoral BREFs, typical energy consumption levels have been mentioned in many cases, energy efficiency is mentioned for consideration when determining best available techniques (BAT) but only in few cases it has been an issue in BAT. Two BREFs are relevant for the food & drinks industry. A BREF for slaughterhouses and animal by-products has been finalised. Another BREF for food, drink and milk processing industry is in advanced stages of preparation. Both discuss energy issues extensively in all parts of the processes and give typical and/or desirable consumption figures. However, neither establishes any upper limits or norms for energy use in the sub-processes. Documents can be found on the web-site of the European IPPC Bureau (see Annex 2).

Directive 2004/8/EC on the Promoting of cogeneration based on useful heat demand in the internal energy market

The objective of the cogeneration (CHP) directive is that high-efficiency CHP is taken into consideration whenever new capacity is planned, also in small-scale applications. The member states are to reduce the barriers for the use of CHP including prices and costs, grid system issues and the need to internalise externalities.

Directive 2002/91/EC on Energy performance of buildings

The Directive on energy performance in buildings may be relevant to industrial SMEs if in national implementation it is decided to include industrial buildings like factories and offices. Its implications will be a requirement for energy certification of buildings, requirement for feasibility studies on alternative energy systems including renewable energy sources, CHP, district heating and heat pumps, and regular inspections of boilers and air conditioning systems.

Directive 2003/54/EC concerning Common rules for the internal market in electricity and repealing Directive 96/92/EC

And:

Directive 2003/55/EC concerning Common rules for the internal market in natural gas and repealing Directive 98/30/EC

Community legislation for internal electricity and gas markets has in some cases brought about lower energy prices for industrial SMEs which may have had a detrimental impact on energy efficiency. However, the impact of increased competition in the energy markets has often been compensated by the fluctuations in world market fuel prices for power generation and for natural gas as well as emissions trading. This makes it complex to analyse the impact of energy market liberalisation.

Directive 2001/77/EC on the Promotion of electricity produced from renewable energy sources in the internal electricity market

While the Renewable Energy Directive does not have an impact on energy efficiency if defined as saved primary energy or final energy consumption, governmental policies for the promotion of renewables may encourage their use for, e.g., CHP production which saves primary energy. If energy efficiency is defined as saved fossil fuels, as some of the countries participating BESS do, the Directive can have a significant impact on energy efficiency through the use of renewables provided that this is promoted by government energy policy. The prerequisite for this, however, is that for combustible renewables the combustion efficiency is at least as high as for the fossil fuels.

Directive 2003/30/EC on the Promotion of the use of biofuels and other renewable fuels for transport

Industrial SMEs often operate vehicles for internal transport or goods delivery. If energy efficiency is defined as saved primary energy, the Directive will not have a direct impact on energy efficiency. However, biofuel use would reduce greenhouse gas emissions and contributes towards the companies' environmental objectives and possible obligations. If energy efficiency is defined as saved fossil fuels, the Directive has the potential of making a sizeable contribution.

Directive 2003/87/EC on Establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC.

And:

Directive 2004/101/EC on Amending the Directive establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms.

The Emissions Trading Directive and the related "Linking Directive", which governs the use of Kyoto flexible mechanisms, does not normally concern the SMEs directly. However, 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. Since they do not participate emission 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. In this context, (voluntary) energy efficiency measures may become an increasingly important for the SMEs as they strive to reduce cost, improve competitiveness and avoid regulatory intervention.

Regulation No 761/2001 allowing voluntary participation by organisations in a Community eco-management and audit scheme (EMAS)

While EMAS is more common in larger enterprises, some SMEs participate too. If a company wants to register under EMAS, it is obliged to conduct an environmental review addressing also the use of natural resources, including energy. Companies with a certified environmental management system are exempted from the review provided that they can provide the necessary information otherwise.

A specific tool kit (e-learning scheme) to help small companies to implement EMAS has been developed. Another toolkit, EMAS Energy Efficiency Toolkit has been prepared to provide a step-by-step procedure that evaluates energy consumption and costs in an organisation. It helps to identify losses and suggests improvements to achieve the highest possible level of efficiency. The toolkit is particularly targeted at SMEs and takes account of their specific needs. The Energy Efficiency Toolkit has been published as a brochure, not an e-learning scheme. See Annex 2 for links to both of them.

A new EC initiative is to complement the EMAS with an energy audit and management tool, provisionally called E2MAS to foster energy efficiency in industry, in particular in non-energy intensive sector and SMEs. The EC considers the E2MAS as a high priority. The scheme would particularly focus on the non-core processes in companies. The initiative shall also foster training and education of energy managers and maintenance personnel.

Proposed directive on energy end-use efficiency and energy services (ES Directive).

The Energy Services Directive is only in the preparatory stage but, when adopted, its implementation could bring sectoral energy efficiency target values for the industrial SMEs. The Member States will need to adopt national indicative targets to promote energy end-use efficiency and to ensure the continued growth and viability of the market for energy services. For the sixth year of the Directive, the Member States should aim to achieve 6% savings, attributable to energy services and other energy efficiency improvement measures.

Some of the practical measures suggested by the Directive to achieve the objectives are metering and informative billing, competitively priced energy audits, funding mechanisms and voluntary agreements or other market-oriented schemes with an equivalent effect. These measures, depending on the national implementation, may create a window of opportunity for the SMEs to improve their energy management.

The requirements for reliable data from SMEs in the implementation and follow-up of the 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.

Directive 2005/32/EC on establishing a framework for the setting of Eco-design requirements for Energy-using Products and amending Council Directives 92/42/EC, 96/57/EC and 2000/55/EC. [COM/200/0800 final]

The directive on eco-design requirements of energy-using products is in the final stages of the approval process. It concerns a wide range of final product using energy to perform their function. The directive will aim to improve the overall energy performance of these products by providing the option of introducing specific eco-design requirements.

Commission regulation 852/2004 on the hygiene of foodstuff

The regulation 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 proactive procedure or procedures based on the principles of Hazard Analysis Critical Control Point (HACCP). HACCP is a systematic approach to identifying and controlling microbiological, chemical or physical hazards that could pose a danger to the preparation of safe food. The HACCP process consists of the following steps: 1) hazard analysis, 2) identifying Critical Control Points (CCP), 3) establishing critical limits for each CCP, 4) monitoring CCP requirements and using the data gathered to effectively control processes, 5) corrective action, 6) record keeping and 7) verification.

2.2 EU and Other Programmes, Projects and Study Reports

Several EU and national programmes, projects and study reports were scanned and analysed within the project. A comprehensive list can be found in Annex 2 and a more detailed description of some of the most important project reports is in Annex 3.

Regarding ongoing EU programmes, two important ones for the BESS Project are EMAS and the Motor Challenge Programme. A new initiative is E2MAS which would be an energy efficiency extension of EMAS. The useful aspects of these programmes and initiatives to the BESS Project are discussed in several occasions within this report.

Some ongoing projects within the EIE Programme are relevant for the BESS project and it will be necessary to ensure effective exchange of information. These include, for example, the Energy-Check in Small and Medium Craft Enterprises Project (“E-Check in Craft”), Promotion of Energy Management Practices in the Textile Industries of Greece, Portugal, Spain and Bulgaria (“EMS-Textile”) and “Optipolygen” which concentrates on introducing c-generation in the food and drink industries..

2.3 Questionnaire and Responses

A questionnaire (see Annex 4) was distributed among the project participants to identify to which extent the participants are using different instruments, to gather information on the experience that has been gained on their suitability for the SMEs and to collect information on industry needs, success factors and barriers to energy efficiency.

Full responses by the participants have not been included into this report. The reason is that the responses were intended to inform the other project participants about national experiences in a very transparent and candid manner and were not intended for wider distribution. However, information gathered through the questionnaire is reflected throughout the report.

Table 3 shows a brief summary of the results. It also includes references to some selected countries which do not participate in the BESS Project but which have relevant experience for the project. For the non-participating countries, the table is not comprehensive but indicates some learning opportunities for the BESS Project.

Table 3
Summary of Initiatives among the BESS-Participants and Other Selected Countries

Instrument	Countries Participating in the BESS Project	Austria	Bulgaria	Finland	Greece	Ireland	Lithuania	Netherlands	Norway	Slovenia	Spain	Sweden	Some Observations on Other Selected Countries ¹²	Australia	Canada	France	UK	Denmark
		Policy Framework for SMEs:																
Long-term agreements		-	-	X	-	X ¹	-	X	O ⁴	O	-	O		X			X	
Tax exemptions		-	-	-	-	-	-	X	O ⁵	O	X	O					X	
Subsidies		X	-	X	X	-	O	X	X	X	X	X					X	
Energy management approach:																		
Energy management standards		O	O	-	O	O	O	X	-	O	-	X						X
Energy conservation plans		X	O	O	O	O	O	X	-	-	O	O					X	
Energy management tools:																		
Benchmarking		O	-	O	-	-	O	X	X	-	-	-					X	
Certified energy managers		X	X	-	O	O	-	O	-	X	-	-					X	
Checklists (of measures)		X	O	O	-	O ³	-	X	-	-	X	-					X	
Good housekeeping ¹³		X	-	O	-	O ³	-	X	-	-	-	-					X	
E-Learning		O	-	-	-	O ³	O	O	X ⁶	X	-	-			X		X	
Energy advisors		X	O	O	-	X	O	X	X	-	-	X					X	
Energy auditing		X	O	X	X	X	O	X	-	X	X	X				X	X	
Energy awards		X	X ¹⁰	X ¹⁰	-	X	O	-	-	-	-	X					X	
Energy efficiency indexes		O	-	O	-	X ²	O	X	X	-	-	-						
Energy networking		O	O	X	-	X	O	X ¹¹	X	-	-	X						
Third-party financing		X	X	X	X	-	O	-	-	X	X	O					X	
Other?		-	X ⁸					X ⁷		X ⁹								

X = Implemented, major activity (learning opportunity for the others); O = Under planning or a minor activity; - = Not used in this country.

1 - There are two types of LTAs. The Large Industry Energy Network (LIEN) has been implemented and other Energy Agreements are in development

2 - Linked to the Large Industry Energy Network (LIEN). The energy efficiency indexes are comparable to benchmarking.

3 - Linked to the Energy Agreements.

4 - Under planning for pulp and paper industry (not SMEs).

5 - Related to activity on long-term agreements.

6 - Commercial products exist.

7 - Other measures include a technology scan and an AIMS scan.

The technology scan is developed to help companies participating in the LTA 2 to identify innovation in the production process (e.g. application of new and innovative technologies). The AIMS scan has been developed to help the participants to identify the feasibility of following the expansion themes within the LTA 2.

8 - Credit programmes and guarantee funds.

9 - Energy managers' conference with over 150 participants each year.

10 - Given to energy producers and utilities.

11 - Energy networking in the Netherlands is implemented under activity called "user groups".

12 - For countries not participating in the BESS Project, the table has not been fully filled in. Only some selected measures have been highlighted.

13 - The box for good housekeeping has been ticked only if it has been explicitly emphasised in the SME activities in the country.

3 The “Model” of Needs, Barriers and Success Factors

3.1 Overview of the “Model”

The outcome of this pre-study has been summarised in a “Model” of Needs, Barriers and Success Factors. The Model includes a graphic presentation (Figure 1) and explanatory notes. The graph gives an overview of the policy framework in which a SME operates, alternative energy management methods at the company level, the elements of energy management approach and energy management tools available.

The Model is not complete as the graphic presentation only but also includes the succeeding chapters which describe the different elements of the Model in more detail:

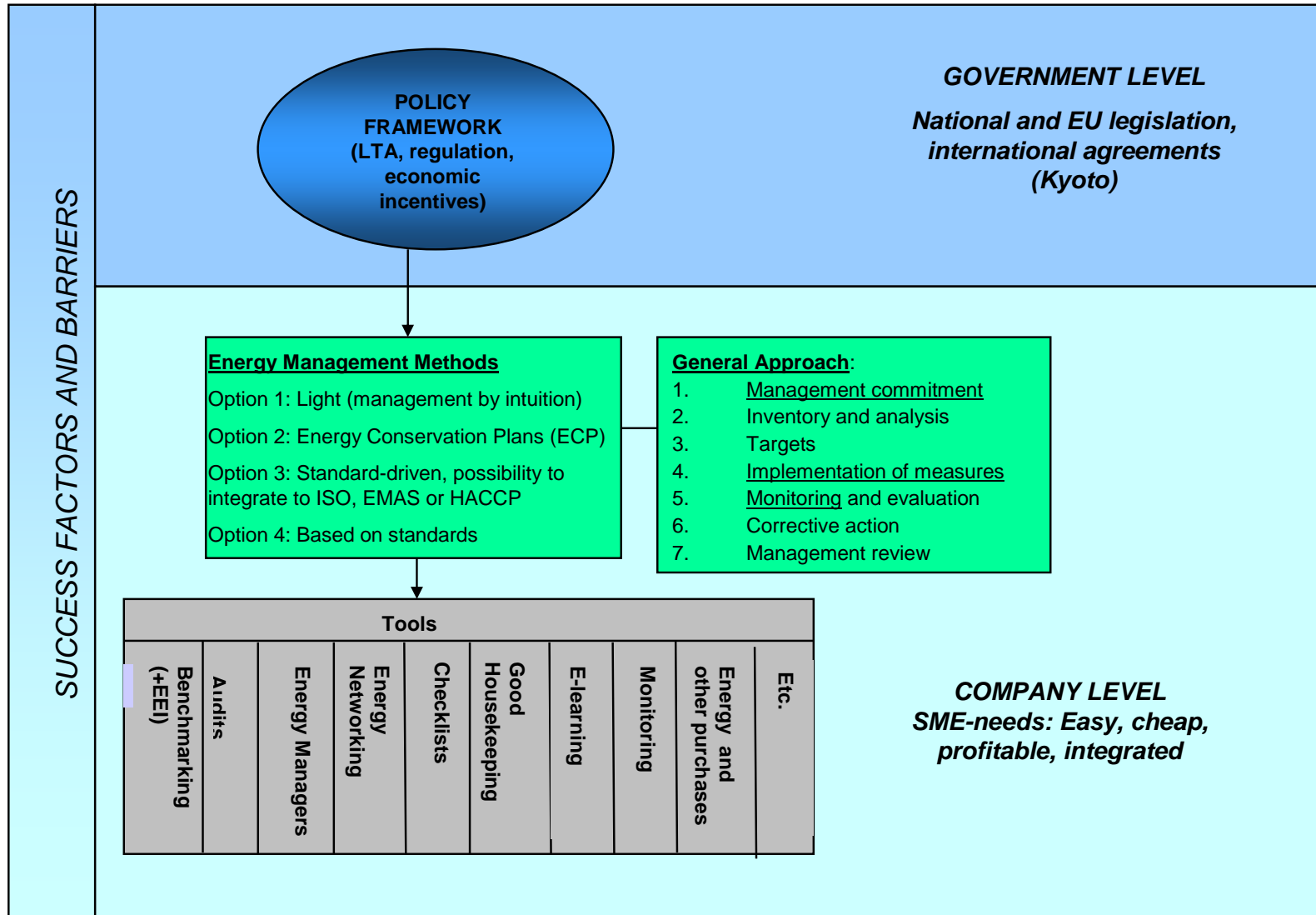
- Chapter 3.2: SME needs
- Chapter 3.3: Barriers to energy efficiency
- Chapter 3.4: Success factors (drivers)
- Chapter 3.5: Energy policy framework
- Chapter 3.6: Energy management approach
- Chapter 3.7: Energy benchmarking
- Chapter 3.8: Energy management tools

Benchmarking actually is one of the energy management tools but it is discussed separately given its significant role in the BESS Project.

In Figure 1, the upper part represents the policy framework in which the SME operates. This framework is defined by national government policies and legislation, EU legislation and regulation and by different international commitments, such as the Kyoto Protocol. Typical elements of the policy framework are long-term agreements, legislation and regulation (e.g., energy market laws, energy efficiency and energy management standards, environmental permits and emissions trading) and economic incentives (financial and fiscal).

At the company level, the SMEs can and have followed different methods in their energy management. All serious energy management approaches, however, should be based on the principle of continuous developed as shown in the figure in the box “general approach”. For the practical implementation of energy management, the SMEs have different tools in their disposal. The choice of the energy management approach and the accompanying tools is affected by the needs of the industry. However, various barriers as well as success factors to the effective implementation of energy management have been identified. These are all discussed in more detail in the following chapters.

Figure 1: Model of Needs, Barriers and Success Factors



3.2 SME Needs

The project partners responded to the questionnaire in a quite uniform manner regarding the needs of the industrial SMEs. These responses have been summarised hereunder and need to be taken into account when designing any instruments for the industrial SMEs:

- Energy efficiency improvements need to be ‘easy, cheap and profitable’:
 - ‘Easy’ means that yet another independent system meaning more reports and more bureaucracy cannot be proposed. Energy savings must come easily to the company because for reasons of competitiveness and efficiency, personnel resources are limited.
 - ‘Cheap’ means that the cost of energy efficiency activities cannot account for an excessive high proportion of the energy bill of the company. The companies prefer free or low-cost consultation and other services.
 - ‘Profitable’ means that the pay-back-period of the investments must be less than two years and that of consultation activities from 3 to 12 months because the companies prefer immediate results over long-term development. Investments in energy efficiency need to be more profitable than investments in core businesses in order to be implemented because of the low priority of energy efficiency in the SMEs.
- They prefer voluntary actions over regulation.

In addition to the general industry needs, the food and drink industry has some specific characteristics and require attention. They are:

- The environmental considerations have already been integrated into the core business.
- The life-cycle approach is already understood better than in most other industries.
- The hygiene requirements are high.
- Transports and packaging are important operations.
- The auxiliary systems and buildings often use more energy than the processes.
- There is extensive use of cooling, freezing and process heat.
- There is a trend towards more refined products (e.g. frozen food sales are growing rapidly).
- Competition is tightening and margins are small.
- There are many small companies but also many mergers and acquisitions.
- The EU has created a single market for the food industry replacing protectionism. This has led to increasing trade.

3.3 Barriers to Energy Efficiency

Report “Reducing Barriers to Energy Efficiency in Public and Private Organisations” (BARRIERS) published within the Joule III Programme in 2000 provides a useful classification and insight to the different barriers to energy efficiency (see Table 4). It is recommended that in the other work packages the results of the BARRIERS Project are consulted when any instruments are planned or piloted. This could help in identifying possible weaknesses in advance and adjusting the approach accordingly.

In addition to the above study, real-life experience was collected from the project partners. The barriers reported are similar to those reported by the BARRIERS Project. However, one new type of barrier was emphasised in one response. That was “insufficient stimulus and government support as the government has not yet established energy efficiency, norms and regulations or the programmes and the strategies are too generic”. Also targets may be missing. The response came from a ‘new’ EU Member country whereas the BARRIERS Project collected information from the ‘old’ Member countries. The new barrier seems to fall within a new perspective, i.e. political, which would be additional to the economic, behavioural and organisational perspectives identified by the BARRIERS Project.

Hereunder is a summary of the barriers identified by the project partners:

- Profit margins in SMEs are traditionally low. Therefore:
 - Human and financial resources are restricted to core production activities.
 - Resources to develop and give training to personnel are limited.
 - Companies concentrate on operational energy management and do not develop the strategic dimension of energy management, including proper planning.
- For many SMEs energy management or energy measures lack priority because, for example:
 - The cost of energy is small in proportion to the overall cost structure. For many SMEs energy typically accounts from 0.5% to 2% of the total costs. However, there are exceptions.
 - Management has ‘other worries’ such as competition, personnel issues and quality issues.
 - Investments to the ‘core business’ have priority over those for energy efficiency.
- There is a tendency to require immediate solution with reluctance to commit to long-term sustainable programmes.
- Lack of well-trained and qualified personnel.
- The personnel have insufficient time to implement measures.
- The person responsible for energy and energy efficiency is not a part of the management team. Therefore, (s)he has limited organisational power and budget.
- Reluctance to adopt current managerial procedures for energy efficiency.

- Lack of a culture to make energy efficiency ‘business as usual’, i.e., to make energy management an integrated part of the management processes. Energy management and planning to a certain degree new for the SMEs.
- Lack of awareness of wherefrom to acquire information.
- Universal information on the cost of energy efficiency investments does not exist. Instead, each energy-saving measure has its individual cost depending on the local situation and is determined by the amount of supplementary work (rebuilding etc.) that has to be done to implement it.
- Reluctance to change the existing production process.
- Lack of investments and process improvements which would improve energy efficiency as a side-benefit due to new and improved technology.
- The follow-up after the energy audits or the implementation projects thereafter may have been inexistent. Supervision and maintenance work may have been neglected and, as a result, their energy performance has fallen.
- Expectations for energy saving have been too high and unachievable due to:
 - Over-estimation by an energy consultant to enhance the possibility of the proposal being accepted.
 - Over-estimation by the energy consultant due to a lack of knowledge and correct calculation methodology.
- Just one bad experience, even from hearsay, causes reluctance to work on energy efficiency.
- The industry is already highly regulated leading to suspicion on any further government programmes.
- Insufficient stimulus and government support. In some countries the governments have not yet established energy efficiency norms and regulations or the programmes and strategies are too generic.
- There is a preference for action-based energy efficiency programmes over generic guidance programmes.

Table 4
Taxonomy of Barriers to Energy Efficiency

Perspective	Subdivision	Barrier	Claim
Economic	Non market failure	Heterogeneity	While a particular technology or measure may be cost effective on average, it may not be so in all cases.
		Hidden costs	Engineering-economic analyses fail to account for either the reduction in benefits associated with energy efficient technologies, or the additional costs associated with them. As a consequence, the studies tend to overestimate efficiency potential. Examples of hidden costs include overhead costs for management, disruption, inconvenience, staff replacement and training, and the costs associated with gathering, analysing and applying information.
		Access to capital	If an organisation has insufficient capital through either internal funds or borrowing, energy efficiency investments may be prevented from going ahead. In the public sector, additional borrowing may be inhibited by public sector rules. In the private sector, companies may be reluctant to borrow due to concerns about the risk of increased gearing. Where internal funds are available, other priorities may take precedence, thereby also preventing the energy efficient investment.
		Risk	The short paybacks required for energy efficiency investments represent a higher technical or financial risk than other types of investment, or that business and market uncertainty encourages short time horizons.
	Market failure	Imperfect information	Lack of information may lead to cost effective energy efficiency opportunities being missed. This may be considered a market failure in that information has public good aspects, which make it likely that it will be under-supplied by markets. Furthermore, unlike energy supply, energy efficiency consists of a wide range of complex technologies and services, which are purchased infrequently and for which it is difficult to determine their quality either before or after purchase. As a consequence, the transaction costs for obtaining and processing information on energy efficiency are higher than for energy supply. Over consumption of energy may be the result.
		Split incentives	Energy efficiency opportunities are likely to be foregone if the party cannot appropriate the benefits of that investment. For example, individual departments in an organisation may not be accountable for their energy use and therefore have no incentive to improve efficiency.
		Adverse selection	Suppliers know more about the energy performance of a good than purchasers. The latter face difficulties in both obtaining information prior to purchase and verifying performance subsequent to purchase. As a result, purchasers will tend to select goods on the basis of visible aspects such as price, and be reluctant to pay the price premium for high efficiency products. In some cases, inefficient products will drive efficient products out of the market.
		Principal-agent relationships	Principal-agent relationships occur when the interests of one party (the principal) depend on the actions of another (the agent): This type of relationship is pervasive in hierarchical firms. It is characterised by information asymmetry, since the principal lacks detailed information about the activities and performance of the agent – and in particular about the merits of individual investment projects proposed by the agent. Such monitoring and control problems can lead principals to require stringent investment criteria to ensure that only unambiguously high value projects are undertaken.

Perspective	Subdivision	Barrier	Claim
Behavioural	Bounded rationality	Bounded rationality ¹	Actors do not make optimising decisions in the manner assumed in standard economic models. Instead, constraints on time, attention, and the ability to process information lead to reliance on imprecise routines and rules of thumb. These economise scarce cognitive resources. A consequence of this type of decision-making is that actors may not maximise utility, even when given good information and appropriate incentives. Hence, bounded rationality may be considered as an additional barrier that does not fit into conventional economic models.
		The human dimension	Form of information ²
	Credibility and trust		The credibility of the source and the trust placed in the source are also critical. Trust is particularly encouraged through interpersonal contacts. If these factors are absent from information on energy efficiency, inefficient choices will be made.
	Inertia ²		Agents resist change because they are committed to what they are doing and justify inertia by downgrading contrary information. Individuals also treat gains differently from losses, thereby undervaluing opportunity costs; give greater weighting to certain outcomes than uncertain; and have a strong desire to minimise regret. All these factors cause individuals to favour the status quo. Inertia creates a bias against energy efficiency since (unlike energy purchasing) this involves investing in hardware with uncertain outcomes and represents a departure from the status quo.
	Values ³	Energy efficiency has clear environmental benefits. Individuals motivated by environmental values may therefore give a higher priority to efficiency improvements than those that are not. Efficiency improvements are most likely to be successful if 'championed' by a key individual within top management. Hence, the environmental values of key individuals is a relevant variable in explaining organisational performance on energy efficiency.	
Organisational theory		Power	Organisations can be viewed as political systems, characterised by conflicts between groups with different interests. The influence of a particular group depends upon its formal authority, the control it has of scarce resources (particularly finance) and its access to information. Often energy management has a relatively low status and is viewed as a peripheral issue by top management. Lacking power, funds and management support, the scope for effective action may be circumscribed. This may constitute an organisational barrier to efficiency improvement.
		Culture ³	Organisations may encourage efficiency investment by developing a culture (values, norms and routines) that emphasises environmental improvement. Hence, organisational culture is relevant variable in explaining organisational performance on energy efficiency.

Source: Reducing Barriers to Energy Efficiency in Public and Private Organisations. Final Report June 2000. Joule III Programme.

^{1,2,3} Due to some overlap in the definitions, the BARRIERS Project recommended combining the following barriers: values with organisational culture, bounded rationality with inertia and form of information with credibility and trust.

3.4 Success Factors (Drivers)

The project partners have substantial experience in implementing energy efficiency programmes and projects in the industrial SMEs. They reported practical experiences about factors which have led to successful programmes and projects. Most emphasised the commitment of the senior management, effective communication, availability of energy management tools and supporting energy policy framework.

As a summary, these are the success factors reported by the project partners:

- Commitment of the senior management is essential. The manager has to embrace energy efficiency as one of his/her fields of interest and put it on his/her agenda:
 - This will make it clear to the staff that energy efficiency is to be taken seriously. It will give it a higher status.
 - Organisationally, this gives the SME a platform where energy problems crosscutting various departments can be solved.
 - Investment decisions can be taken at the appropriate level.
 - Prevents decline in attention to energy efficiency.
- Enable feedback to the management on the effectiveness of energy efficiency measures. Take care that those responsible for energy efficiency have the ability to control it. This means that good monitoring (“if you can’t measure it, you can’t manage it”) and reporting are essential.
- Communication:
 - Inside an individual SME all staff should be involved.
 - Involving several SMEs from the same sector in a working group (energy networking) to exchange experiences has proven useful. The companies should all be in the same level of energy management implementation. Networking is especially useful for solving typical difficulties such as defining an energy efficiency index or setting up an energy monitoring system. Networking may also introduce an element of competition in energy efficiency and provide a platform that can negotiate with potential energy efficient equipment or service suppliers.
 - Positive effects should be made clearly visible. Awards for best practices are a possibility to implement this.
- Case studies of good practise are helpful.
- Guide the SME step-by-step through the implementation of energy management. Energy advisors and other help desks are instrumental in this process. Practical action-specific programmes are better than generic support and guidance.
- Work in a methodical way; do not implement measures in a random way.
- Give the SME access to tools that are easy to use, for example:
 - Checklist for the level of energy management.
 - Tools for the implementation of energy management.
 - Tools for the daily/monthly/yearly energy monitoring.
 - Reporting modules (e.g., for the competent authorities).
- Participation in a well-designed long-term agreement can be a good driver to work on energy efficiency.
- Need to gain competitiveness by reducing production costs as the competition in the European markets is increasing.

- Increasing energy prices are a driving force.
- New investments in industry enhance the penetration of new technologies in the market. As a rule, new technologies are more energy efficient.
- In some countries new legislation and regulations are preconditions for improving energy efficiency.
- Liberalised energy markets with new emerging energy services, as well as public promotion of co-generation and renewable energies, create new opportunities for effective energy management.

3.5 Energy Policy Framework

One of the fundamental questions for the BESS-project is: “Which measures and tools work best in a certain energy policy framework?” The same question can be turned around and formulated: “What kind of national energy policy framework is necessary for a certain potentially effective measure/energy management scheme to function?” The typical instruments of any national energy policy framework are regulations, economic instruments (subsidies and taxation) and quite often in the EU countries also long-term agreements. To facilitate the discussion, this chapter provides some information on relevant energy policy instruments.

3.5.1 Long-Term Agreements

Note: More detailed information on long-term agreements can be found from Annex 12.

An LTA is an agreement concluded between public authorities and industry. The trade association or individual companies commit themselves to a quantified targets (e.g, improvement in energy efficiency by certain year) or to take certain action (e.g., conduct energy audits and implement cost-effective measures). In exchange, they will be able to demonstrate energy efficiency improvements in a reliable manner for the authorities and clients, may get some financial and fiscal benefits and may avoid sanctions.

World Energy Council (WEC 2004)² summarises the motives and reasons for the popularity of LTAs in the following way: “Voluntary/negotiated agreements (VAs/NAs) were developed in the 1990s to address the prevailing view that environmental regulation, in particular in respect to climate change, had reached its limits, and at the same time economic instruments seemed too costly (subsidies) or too unpopular (energy/CO₂ taxes).” Though, the EU Emissions Trading Scheme might somewhat reduce the interest in implementing new LTAs, in the new EC “Greenpaper on Energy Efficiency or Doing More With Less” the Netherlands are mentioned as one of the best performing economies in the world in terms of energy efficiency thanks to the tradition of voluntary agreements with industry.

Long-term agreements (LTAs) are not a harmonious group and may be called energy conservation agreements, voluntary agreements, negotiated agreement, covenants or simply long-term agreements. The name depends on the initiative to establish the agreements (industry or public authorities), LTAs design and national political traditions. For example, while the

² Energy Efficiency: a Worldwide Review – Indicators, Policies, Evaluation. July 2004. WEC in collaboration with Ademe.

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. Examples of negotiated agreements on the European level are those concluded between the EC and individual consumer electronic manufacturers and the EU trade association EACEM (later EICTA) to reduce energy consumption of TV's & VCR's, audio equipment and DVD's (1997, 2000 and 2003).

While LTAs are quite common for larger industries, they are not yet very common for the SMEs. However, examples of schemes involving also smaller companies can be found in Australia, Finland, the Netherlands and the UK (Energy Efficiency Accreditation Scheme). Ireland and Finland are developing schemes for the SMEs. Different potential approaches to the LTA design can be found. The least stringent is a scheme where entry to the LTAs is voluntary and where there are no mandatory targets to achieve (e.g. Finland). The second level is a scheme where entry to the LTA is voluntary but once a company enters the scheme it is obliged to reach the targets (e.g. the Netherlands). The UK scheme is not a traditional LTA but rather an award scheme for companies having demonstrated good energy efficiency. Accreditation is achieved by meeting set standards that are independently assessed and moderated.

Austria has not much tradition with voluntary agreements in industry as far as energy efficiency on production sites is concerned. In the course of the discussions how to achieve the Austrian Kyoto target of -13%, LTAs are mentioned as possible instrument.

Countries with a LTA scheme usually perceive the LTAs as successful policies. For example, the Dutch Government emphasises the self-regulation aspect of the LTAs which allows the participating companies to decide for themselves how the energy efficiency obligations should be met. It is of the opinion that the sectors are themselves best equipped to decide which improvements are most successful and when they should be implemented. The Finnish Government considers that the agreements help to raise improvement of energy efficiency to a higher level of importance in the hierarchy of enterprises, i.e., to the level required by efficient and successful energy and environmental management today. Furthermore, voluntary agreements can create an umbrella for energy efficiency promotion and they are a good link to and provide support to other policy measures.

In a presentation given the 2005 ECEEE Summer Study, an EC official concluded that LTAs are one of the most efficient instruments in energy intensive industry to improve energy efficiency. He stated that while LTAs have been so far concluded at national level, it should be explored if European agreements could be concluded in order to avoid internal market distortions. The Commission will develop guidance on target-setting, monitoring and reporting, etc. LTAs should aim at achieving the economic CO₂ saving potentials in core processes of energy intensive sectors or to promote the top of the class concept.

The OECD and the World Energy Council have expressed doubt about the effectiveness of the LTA schemes. While it remains unclear what would have been the realistic practical alternative, they seem to prefer an approach combining regulation and economic instruments or at least decisively addressing the shortcomings in the current design and implementation of the LTAs.

While finding LTAs effective from an economic perspective, WEC has identified several shortcomings in the past performance of LTAs. They were found in many areas such as the overall effectiveness of this instrument, target setting including baseline considerations,

monitoring, independent evaluation, participation of independent third parties and communication to the public. WEC concluded that LTAs may be more suited as complementary to other existing regulations, rather than being the prime policy instrument.

The OECD³ has stated that while the environmental targets of most – but not all – voluntary approaches seem to have been met, there are only a few cases where such approaches have been found to contribute to environmental improvements significantly different from what would have happened anyway. Therefore, it concludes that the environmental effectiveness of voluntary approaches is still questionable and that significant degree of policy capture may have taken place.

3.5.2 Regulations

Energy regulations most typically targeting industrial SMEs include mandatory energy consumption reporting, energy managers, energy saving plans and maintenance as well as building standards⁴. In the BESS Project also environmental regulations are relevant. Energy issues are an integral part of ISO and EMAS regulations but these are applied mainly to the larger companies. In some countries environmental permits are required even from small companies.

Some countries have set up regulation requiring designated or large consumers to report their energy consumption, either directly to the government or in their annual report. This is seen as an incentive to companies to closely monitor their energy performance. More recently these measures have also been extended to CO₂ emissions.

In some countries, there is a regulation requiring the nomination of energy managers in companies above a certain size. Yet, some other countries establish specific requirements for their competences. This measure usually applies to large consumers in industry.

Mandatory energy saving plans or demand side management plans are required, for example, in Spain. Such requirements exist for several sectors, including utilities and municipalities.

Maintenance of energy-consuming equipment (e.g. boilers) is an important field of regulation. The concern is that without proper maintenance of energy consumers' equipment their efficiency will decrease over time. The objective of the regulation is to maintain as long as possible the initial efficiency of the equipment.

All EU countries apply building standards for new residential and service sector buildings but not always to industrial buildings. The EU Directive on energy performance in buildings (2002/91/EC) may be relevant to industrial SMEs if in national implementation it is decided to include industrial buildings like factories and offices. Its implications will be a requirement for energy certification of buildings, requirement for feasibility studies on alternative energy systems including renewables, CHP, district heating and heat pumps, and regular inspections of boilers and air conditioning systems.

³ OECD 2003: Voluntary Approaches for Environmental Policy. Effectiveness, efficiency and usage in policy mixes.

⁴ The Chapter is largely based on WEC's report Energy Efficiency: a Worldwide Review – Indicators, Policies, Evaluation (2004) supplemented by information from other sources.

In about half of the EU countries, regulations mandate large energy consumers to have regular energy audits. This requirement is seldom extended to industrial SMEs. Often audits are totally or partly funded by authorities or utilities.

The results of and a way to carry out an energy audit depend on to whom energy audit is carried out for or who is paying for it. A totally market orientated energy audit paid only by SME will probably concentrate to “low hanging fruits” which means that it identifies measures with a pay-back period less than 2-3 years. If the audit is subsidised (or even free), the audit guidelines may oblige the audit to show also saving measures with longer pay-back periods. In these two cases the auditor gives suggestions and the company makes decisions according to the suggestions. If the legislative framework demands all measures with shorter pay-back time than a given number of years (a pre-set threshold) be implemented, the characteristics of energy audit change totally. The auditor is no longer a neutral independent consultant but can be considered as a decision-maker. If the auditor suggests something with shorter pay-back-time than the pre-set threshold it means that the customer must do it. In a practise this could lead to a situation where an auditor does not notice any unwished saving proposals, or even “double-reporting” (one report for the customer and one for the authorities).

Environmental permit regulations and practices are relevant to the BESS Project. Environmental permit process may provide an opportunity to integrate energy efficiency considerations in other existing procedures. 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. However, environmental permits concern usually larger companies which are subject to the IPPC Directive, not the SMEs. Nevertheless, some SMEs are subject to the regulations arising from the Directive, and in some countries, there are national environmental permit regulations which concern SMEs. A description and practical examples on environmental permit procedures, particularly in respect to the IPPC Directive, are included in Annex 11.

3.5.3 Economic Instruments

Economic instruments include fiscal and financial incentives such as investment subsidies and soft loans. Also energy service companies are sometimes classified into this category.⁵

Fiscal incentives include measures to reduce taxes paid by consumers who invest in energy efficiency. They comprise accelerated depreciation, tax credits, tax deductions, and tax reductions on energy efficient equipment (on VAT or import duties) or on energy efficiency investments (reduction in VAT rate on equipment or labour costs). Tax credits, tax reductions and accelerated depreciation are less costly than subsidies but work well only if the tax collection rate is sufficiently high, which is usually not a major problem in the EU Member countries.

In Norway new legislation is under preparation allowing the pulp and paper industry be exempted of electricity tax if the companies participate in an energy programme, with certification of the companies' energy management systems. In the UK, exemptions are provided from the Climate Levy for companies which are able to demonstrate, e.g., through the Energy Efficiency Accreditation Scheme, that they meet the requirements under the Climate Change Agreements. In Spain, Law 51/2002 allows City Halls to give a bonus up to 50% in the Tax on Economy Activities to companies which use renewable energies or CHP and up to 95% on the Tax on Construction, Installation and Works to those companies which acquire solar energy systems for their own use (excluding electricity sales to the grid).

The objective of investment subsidies is to induce investments which are cost-effective from collective point of view, but which would not otherwise be undertaken. Grants are given as a fixed amount, a percentage of the investment (with a ceiling) or as a sum proportional to the amount of energy saved. Economic incentives may also be given to equipment producers to encourage the development and marketing of energy efficient equipment. WEC 2004 identified several typical drawbacks in the past grant schemes:

- Existence of “free-riders”, i.e., the schemes attract applicants who would have carried out the investment even without the incentive.
- Many consumers who could use the subsidy are unaware of its existence and therefore investments are not made.
- Procedures for grants applications have often been too bureaucratic and complex.
- The grants have been expensive in terms of operating costs (transaction costs.)

These drawbacks have not prevented the use of subsidies. Instead, authorities have paid more care in their utilisation. Grants are now better targeted to certain consumers and to certain types of investments (from a selected list of equipment), with a long payback time but high efficiency gains or involving innovative technologies.

Soft loans are loans offered at subsidised interest rate. They have the advantage of being easily implemented by banking institutions. Due to the current low level of interest rates, such measures are often not attractive to industrial companies.

⁵ The Chapter is largely based on WEC's report Energy Efficiency: a Worldwide Review – Indicators, Policies, Evaluation (2004) supplemented by information from other sources.

Quite often economic instruments are being used in relation to a LTA scheme. For example, companies joining a LTA may be fully or partly exempted from energy-, CO₂- or eco-taxes on the condition that they meet their target. In such a scheme, companies who do not meet their target or who choose to stay outside the LTA become subject to the tax. Other examples are subsidy schemes for studies and investments for companies participating to a LTA. A third example is grants which are given to kick off energy efficiency projects. In such cases the projects may be required to show benefits and results within a short time (one year) and to communicate the results.

3.6 Energy Management Approach

3.6.1 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. This can be implemented, for example, following energy management standards or specifications and using different monitoring/metering systems as tools to support the measuring and analysis activities.

In the following some structured approaches to energy management are discussed in more detail. An increasingly popular approach are energy management standards, which have been developed in three EU countries and which (a standard or guidelines) are also planned by the CEN/CENELEC. One country implements energy management specifications which resemble standards. Furthermore, the EC has taken initiative in promoting energy management by including it as one of the aspects of the forthcoming energy efficiency BREF document and preparing for an energy management and audit scheme similar to EMAS (provisionally called E2MAS). These initiatives are discussed in more detail in the following chapters. A common feature for all these instruments is the concept of continuous improvement which is discussed hereunder.

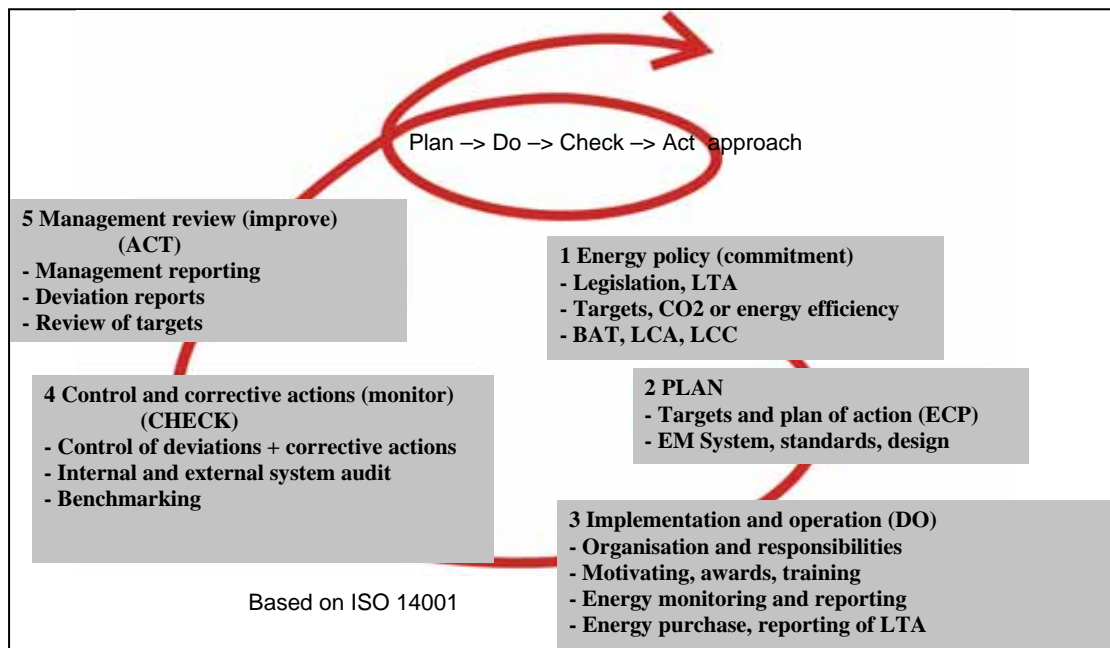
3.6.2 Continuous Improvement

All effective energy (and environmental) management standards, programmes and guides contain the notion of continuous improvement meaning that energy management is a process, not a project which eventually comes to its end.

To illustrate the process, different models have been developed but one of the most commonly used is the Plan-Do-Check-Act (PDCA)⁶ cycle (Figure 2). The PDCA cycle is often known by company management from other contexts but energy.

⁶ The PDCA Cycle was developed by Walter Shewhart, the pioneering statistician who developed statistical process control in the Bell Laboratories in the US during the 1930s. Therefore, it is also often referred to as 'the Shewhart Cycle'. It was taken up and promoted very effectively from the 1950s on by a famous quality management authority, W. Edwards Deming, and is consequently known by many as 'the Deming Wheel'.

Figure 2
An Energy Managing Approach Based on the Continuous Improvement Model



Source: The figure is based on a graph presented in ISO 14001 but the bullet points have been added by Motiva, Finland partly based on the standard.

In the Netherlands, a system for energy management, called Energy Care, is mandatory for companies which have joined the LTA 2. It has been constructed based on Plan-Do-Check-Act methodology and with respect to the ISO 14001 standard on environmental management systems. Figure 3 shows the Dutch LTA “Dart Board” where energy management is a central theme. The Netherlands also has so called ‘linking lists’⁷ for ISO 9000, ISO 14001 and HACCP giving guidance for the company how to take care of energy matters as an integrated part of company’s management system.

⁷ Linking lists are not available in English but SenterNovem has indicated that they can be translated if deemed useful for the project. The linking lists in Dutch can be found from the following web-site: http://www.energiezorg.novem.nl/waarom.asp#deel3_4.

Figure 3
The Dutch LTA “Dart Board”



Source: SenterNovem, the Netherlands.

The implementation of the Dutch LTA 2 Dart Board involves the following steps:

- Step 1/Bull’s eye: The LTA’s objective is that a company implements company-level energy policy by which it is able to continuously reduce its energy consumption and make use of renewable energy sources. This is the target in the bull’s eye of the dart board.
- Steps 2 and 3: SenterNovem provides LTA with support tools (first ring) and there is support from the government/EU.
- Step 4: The idea behind the LTA programme is to help companies who want to implement energy policy/management using the instruments needed to organise their company activities according to the PDCA Cycle. Therefore, companies should constantly look for new opportunities, maintain and optimise existing energy conservation and improve energy policy.
- Step 5: The LTA programme stimulates company activities, e.g., by setting up energy conservation plans, exercising scans and monitoring.

3.6.3 Energy Conservation Plans (ECP)

The Dutch LTA participants are obliged to prepare Energy Conservation Plans (ECP), also based on the principle of continuous improvement (Plan-Do-Check-Act). In a practise, an ECP is a report of about twenty pages. It has a public summary including use of energy, saving measures to be implemented with a schedule, energy efficiency index and energy saving target. Saving measures include assessment of energy saving volume and CO₂-reduction. In addition, ECP includes a non-public part for the use of the company itself, SenterNovem and local environmental authorities containing, for example, the consumption breakdowns and the criteria for measures to be implemented. See Annex 6 for more information on the Dutch scheme.

Also Austria uses ECPs as an instrument to promote energy efficiency and most of the other project partners have some experience in EPCs.

3.6.4 Energy Management Standards and Specifications

The development of the concept of the Danish energy management system was initiated already in early 1990s by the Danish Energy Authority in close cooperation with industrial organisations. As a result, in May 2001, an Energy Management Standard (DS 2403) was introduced in Denmark in order to provide organisations with guidance on energy management. The standard provides a framework for individual companies to tailor their own energy management system. More detailed information is provided for them in a separate pamphlet associated with the standard. The standard is also an essential part of the Danish voluntary agreements scheme on energy efficiency. DS 2403 has been developed with close connection to ISO 14001 and is meant to demand only minimal additional work if ISO 14001 has already been adopted by the company. It is the most comprehensive and up-to-date approach in energy management and some other countries have copied it. In practice, it costs €10 000-15 000 for a company to implement and certify an energy management system.

Like Denmark, Sweden has formal specification for energy management system (Swedish standard SS 62 77 50), approved in October 2003 and based on the Danish standard. The standard can be applied independently, but has been designed to complement ISO 14001. The standard's target group is mainly not the SMEs, but energy intensive industry within the Swedish LTA.

In 2004, the preparation on the Irish Standard on Energy Management was initiated following the principles of Danish standard DS 2403. Currently, a draft for Energy Management System has been prepared by Sustainable Energy Ireland and the approval of the standard is expected by the end of 2005.

European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC) are planning to develop either a European standard or guidelines for energy management. They consider this as a priority project. The standard would be similar to the Danish, Swedish and Irish standards, 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.

The Netherlands does not have energy management standards but instead, has developed an 'energy management reference specification'. It is similar to a standard and includes guidelines

for implementation. However, the Dutch specification has been developed without any connection to the existing or planned energy management standards in other countries. The specification was preferred over a standard because all relevant parties agreed to it. The specification was developed by the international certification bureau VERITAS for Novem in 1999 based on the ISO 14001 standard. The first brochures, 'Referentie Energiezorg met Leidraad' (Energy management System Specification with Guidance for Use) and the checklist 'Energiezorg' (Energy Management Checklist) was introduced in 2000 for the LTA 1. The checklist tool can be used for self-assessment or by the authorities to check the compliance of the company with the LTA obligations. The linking lists, which were published later, had been developed for SenterNovem by Lloyds.

Other BESS-countries which have some experience in energy management standards or other formal requirements are Austria, Bulgaria, Greece, Lithuania and Slovenia. Energy management standards or other formal requirements can also be found outside BESS-countries, e.g., in Australia, Canada, Portugal and the UK.

See Annex 6 for more information on the implementation of energy management and energy management standards in most of the countries mentioned above.

3.6.5 “E2MAS”

A new EC initiative is to complement the EMAS with an energy audit and management tool, provisionally called E2MAS to foster energy efficiency in industry, in particular in non-energy intensive sector and SMEs. The EC considers the E2MAS as a high priority. The scheme would particularly focus on the non-core processes in companies. The initiative shall also foster training and education of energy managers and maintenance personnel. Figure 4 shows the outline of E2MAS as compared to ISO 14000 and EMAS.

Figure 4
E2MAS for Energy Efficiency

<i>ISO 14000</i>	<i>EMAS</i>	<i>E²MAS</i>
1 Environmental Review	1 Environmental Review	1 Energy Review
2 Environmental Objectives	2 Environmental Objectives	2 Energy Efficiency Objectives
3 Environmental Improvement Program	3 Environmental Improvement Program	3 Efficiency Improvement Program
4 Environmental Management System	4 Environmental Management System	4 Energy Management System
5 Environmental Audit	5 Environmental Audit	5 Energy Efficiency Audit
6 Verification and Certification	6 Env. Statement	6 Verification (self assessment)
	7 Verification and Registration	7 Registration

Source: ECEEE Summer Study 2005. Paolo Bertoldi, European Commission/DG JRC.

3.7 Energy Benchmarking

Benchmarking Methodology

Typically, energy benchmarking composes of the following steps identified by the EU's EBPI Project (see Annex 2 for a link), applicable to any sector or in any country:

1. Definition of potential sectors for further investigations
2. Making close contact with representative bodies and selected companies
3. Definition of performance indicators
4. Estimation of correction factors
5. Discussion of indicators and correction factors with industry
6. Development of a questionnaire
7. Selection of companies
8. Analysing data
9. Preparing reports and discussing with the relevant trade body
10. Publishing reports and organising and distributing promotional material

Benchmarking by Energy Efficiency Indexes (EEI)

Energy efficiency indexes are most typically constructed in terms of the development of specific energy consumption by end-product over time. Energy efficiency indexes allow companies and competent authorities to follow how their energy efficiency evolves over time and how they compare to other companies within the same sector. In this respect energy efficiency indexes are a variety of energy benchmarking. Both Ireland and the Netherlands have created energy efficiency indexes.

There was an attempt to develop an energy efficiency index to a food factory in Finland. The site had seven different end-products (pizzas, nuggets, pies etc.) and each production line had its own electricity measurements. Creating a reliable index took more than 100 hours of work, the final index was very complex and when implementing the index it was realised that the updating the index was also laborious. Developing energy efficiency indexes for many other industrial branches proved to be difficult, even though a lot of resources were available. The main lesson learnt was that total energy use divided by total production is not enough to evaluate the changes in energy efficiency. Main problem with the EEI is that the measurement of real energy efficiency is very difficult. Sub-metering could facilitate this process. An accurate EEI might consist of many sub-processes making it expensive to implement. This is one of the key challenges and needs more R&D although large studies are ongoing.

What to Benchmark?

Benchmarking only the specific consumption is problematic. To complement this data, benchmarking the sub-processes or other energy-based factors would be helpful. This kind of “hybrid” benchmarking of both specific consumption and sub-processes that have an impact on the company-level energy efficiency has the benefit of explaining why there are differences in specific consumptions between companies. Some information on benchmarking other factors but specific consumption can be found in Annex 9.

Benchmarking is learning of best practises. However, benchmarking specific consumption does not give more than an appetizer to a SME because it does not provide the possibility to benchmark other relevant energy efficiency factors. To get most out of this information it needs to learn about the key processes in other similar companies and to thoroughly learn its own key processes from the point of view of energy efficiency. This can be done by benchmarking the specific consumption in sub-processes, or preferably explanatory factors such as the pressure level of compressed air or cooling condenser, boiler efficiency, share of condensate recovery, kWh per square meter of cooled space, temperatures and luminous intensity.

In line with the concept of BAT, an interesting alternative approach is creating a set of benchmarks (indices) for best possible (optimal) values. As this may be overly ambitious, a practical application could be “user defined benchmark” – indices defined by the user, based on its own experience. These could serve as part of the target setting process in energy management and the PDCA Cycle.

One example of benchmarking other factors but specific energy consumption can be found from AEA’s report “Energy benchmarking at the Company Level, Company Report Dairy”. The study included an investigation of, for example, how frequently boilers are being checked (100% of the plants reported frequent boiler checks) or how frequently compressed air lines are checked (25% systematically removed dead-legs from systems when process is changed and

50% occasionally check dead legs). Next, scores (Technology Scores) were assigned to plants about the use of energy-saving technologies (variable speed drives, EEMs, heat recovery, heat pumps and energy efficient lighting, boiler maintenance and compressed air). A plant's scores on each of these were aggregated and the results were converted into an overall percentage score with a low of 0% and high of 100%. In addition, an Energy Management Score was formulated following a similar approach and an aggregated Technology Score and Energy Management Score was made.

Availability of Data

One of the preconditions for successful benchmarking is the availability of data. In some cases, the companies involved may consider the required data for benchmarking commercially sensitive and they may have concerns over the confidentiality and use of any data provided. In principle, these concerns can be alleviated by asking the relevant sectoral and trade associations to play an intermediary, facilitating or coordinating role in the collection of the data or even to undertake the benchmarking exercise.

In some cases, it is also possible that national statistical procedures limit the possibilities for benchmarking. An example would be the availability of statistical data on the production volumes.

Country Studies

Norway has a web-based benchmarking scheme for SMEs. Benchmarking is based on comparing the specific consumptions (e.g. kWh/kg) of the companies. Specific consumptions are calculated according to the total energy use and total production of the site. To date, 43 different benchmark groups have been established among the 800 participating companies. Because one factory usually produces different products with different energy intensities, correction factors are used to normalise these differences.

In the Netherlands, long-term agreements for large companies (consuming over 0.5 PJ/year) are based on benchmarking. The Dutch view is that benchmarking for some branches is a relatively good instrument for energy management in larger companies. About one third of the industrial companies having joined the Benchmarking Covenant have actually participated benchmarking. For others within the Covenant, the main tools have been BAT and energy auditing.

Examples of correction factors can also be found from the Dutch benchmarking scheme for large industries. For example, in the sugar beet industry sugar content is normalised by correction factors. In the breweries some correction factors in use are for the packaging mix and climate. In the starch industry they are used for, e.g., water content and climate and in the candy bar industry for the production mix and climate.

Web-based benchmarking tools are available also in other BESS countries (e.g. Austria and Finland) but in addition to the Norwegian scheme, no other nation-wide benchmarking schemes for the SMEs have been identified.

Outside the BESS participants, for example in Canada, there are examples of energy benchmarking. Some can be found from the web-site of Natural Resources Canada (see Annex 2 for a link; the site also contains some other relevant information for the BESS Project).

3.8 Energy Management Tools

Various tools have been developed to support energy management. Some of them are self-standing tools used by energy consumers with their own expense (e.g. energy networking). Others are promoted by energy policy and made mandatory (e.g. energy managers) or possibly supported by subsidies (e.g. energy auditing) in some countries. Hereunder is a list of various tools which have been identified during the pre-study and which are described in more detail in the succeeding chapters.

- Benchmarking (given the importance of this tool in the BESS Project, it has been discussed separately and more extensively in Chapter 3.7)
- E-learning
- Energy auditing
- Checklists
- Energy managers
- Energy networking
- Energy awards
- Energy advisors, consultants and other “help-desks”
- Good housekeeping

3.8.1 E-learning

In Finland, public lists are available of hundreds of energy saving measures implemented in companies at the headline level (giving name of the measure, for example, installing heat recovery for a pizza oven). Recently there have been three studies in Finland about the information needs of the companies. The studies showed that enterprises have found these lists very valuable but would like to have a “database of energy saving measures” describing in a bit more detail the measures implemented by others. Companies would like to know, for example, how the saving potential was identified, how much was saved, the investment required, the pay-back time and information on how the new installation has worked. With large number of measures, creation of such a database would require a lot of resources.

In Norway, there are commercial e-learning tools for implementation of environmental management systems (www.grip.no/Miljoledelse/Vimpel/banner.htm) and NEPAS has also some experience with e-learning on energy management. Other countries with some experience are Austria, Ireland, Lithuania, the Netherlands and Slovenia.

Outside the BESS Project group, Canada, Italy, Slovakia, UK and the US have been identified to have e-learning schemes for energy management. The EU’s Leonardo da Vinci Programme finances the development of a package of training and guidance material that will help managers and engineers in SMEs and local authorities to improve their organisation's energy efficiency and compliance with EU legislation on energy-related environmental issues.

A specific tool kit (e-learning scheme) to help SMEs to implement EMAS has been developed. It explains the objective and benefits of EMAS, takes the company step by step through the Plan-Do-Check-Act cycle, provides case studies and indicates sources of further information. Another toolkit, EMAS Energy Efficiency Toolkit has been prepared to provide a step-by-step procedure that evaluates energy consumption and costs in an organisation. It helps to identify

losses and suggests improvements to achieve the highest possible level of efficiency. The toolkit is particularly targeted at SMEs and takes account of their specific needs.

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 and none of these offers 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 never all of them and 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.

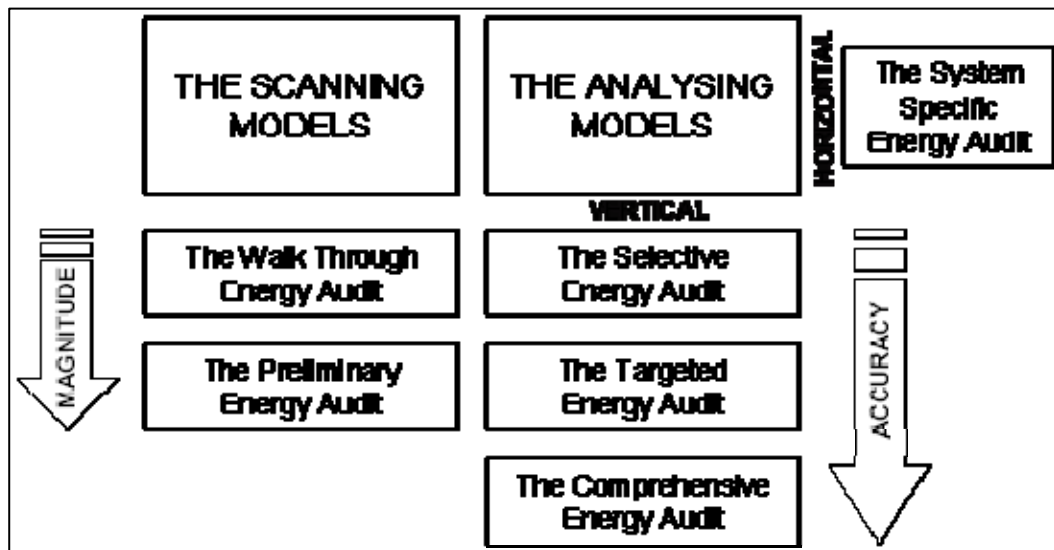
More information, including practical examples, on e-learning can be found in Annexes 7 and 8.

3.8.2 Energy Auditing

There is energy auditing in some form in almost every country in Europe and generally the results have been encouraging. In most cases energy audit is one module among other energy efficiency activities. Figure 5 shows the basic energy audit models.

System-specific energy audits give high saving potentials compared to the energy use of the system. The problem is that when looking at only one part of the site the “bigger picture” is missing and a risk of partial optimisation exists. For example, when studying only energy efficiency of compressed air or cooling systems one cannot evaluate heat recovery opportunities because there is no knowledge where heat could be used in the most efficient way. Energy systems are usually interrelated and seldom independent.

Figure 5
Basic Energy Auditing Models



Source: Audit 1 Project, Final report, Picture 9, page 28.

Comprehensive energy audits give biggest total saving potentials but even when subsidised many SMEs consider them too heavy and/or expensive. Even when not considered excessively expensive, they are not among the top priorities.

There are at least three possible approaches for energy auditing which might be suitable to the needs of the SMEs:

- Preliminary audit(s) to start with (focusing, for example, on the interest of the company) followed by a more comprehensive audit at a later stage
- Walkthrough energy audit (focusing on good housekeeping)
- Branch-based selective energy audit (focusing on typical saving potentials and investments with short pay-back times)

3.8.3 Checklists

All countries have some kind of energy saving checklists. Some of them are designed for the companies and some of them are for the energy auditors. Checklists can be general or specific for some technical systems or some industrial branches. They also may be targeted to identify compliance with best practices in energy management or in technologies.

For example, many useful system-specific checklists can be found from the Motor Challenge Programme, the US Department of Energy, the EU-financed 3E Project and the Canadian Guide Energy Efficiency Opportunities in the Dairy Processing Industry (1997) (see Annex 2 for links).

The Netherlands has industrial branch-based checklists (100-500 typical saving measures per branch) but they are not available in English. Furthermore, at present, a new shorter checklist has been developed and is currently tested among the LTA 2 participants. The new checklist is

likely to be published in June 2005. SenterNovem has agreed to translate some information into English if deemed useful for the project. In Ireland, in contrast, checklists are not public because getting them is an incentive for companies to join the voluntary agreements.

In Austria, a handbook for industrial energy management compiled by the AEA and Der Österreichische Energiekonsumenten Verband (ÖEKV) is available for downloading from the AEA website. This handbook, which is in German language, includes detailed checklists for branch-specific and inter-branch measures.

3.8.4 Energy Managers and Energy Networking

Certified energy managers can be found in Austria, Bulgaria, Slovenia - and outside BESS Countries, e.g., in the UK. There is also some activity in Greece, Ireland and the Netherlands. Energy networking exists in Ireland, the Netherlands, Norway, Sweden and to some extent Austria, Bulgaria, Finland and Lithuania.

Energy efficiency is a significant issue to co-ordinated like, for example, safety and environmental topics. Struggling together against inefficient use of energy is cost-efficient as each participant does not have to “re-invent the wheel”. In practise, a network of energy managers can work in user groups who are looking for the best solutions for, for example, compressed air in some pilot-sites; thereafter the coordinator will disseminate the results to other sites.

3.8.5 Energy Awards

In Ireland, SEI hosts the Sustainable Energy Awards which are open to all organisations in the industrial, commercial and public sectors. Nominees can enter various award categories such as Coordinated Energy Management Programme Award, Electrical Project Award, Thermal Project Award, Energy Awareness Campaign Award, Energy Service or Supply Company Award, Excellence in Design or Specification, and Energy Manager of the Year Award. Awards are given based on award-specific applications where candidates need to demonstrate their energy efficiency. For example, in the Coordinated Energy Management Programme Award, the winner should be able to demonstrate continued energy savings over a number of years through a coordinated energy management programme, which includes energy audits that identify potential electrical and thermal energy projects. The results of the energy audits should be used to prioritise energy projects so that they are implemented when resources become available.

Also Austria, Lithuania and Sweden have award schemes. In Bulgaria and Finland, awards are given to power producers and utilities.

For information on the UK energy award scheme, please see Annexes 6 and 12.

3.8.6 Energy Advisors, Consultants and Other “Help-Desks”

There are 125 energy advisers in Sweden. Every commune is expected to have an energy adviser. Some of the communal energy advisers offer information and educational services to

SMEs in their respective communes. Furthermore, the Swedish Business Development Agency (NUTEK) has actively worked to increase the awareness in SMEs about how environmental management can contribute to a positive and profitable business development. Within the framework of reducing waste, energy efficiency has also been incorporated in the programme. The programme, called "Miljöstyrning i småföretag" (Environmental management in small companies), was initiated by the Swedish Government and covered three main fields of activities, namely information dissemination, financial support and guidance to regional and local projects.

Other countries with energy advisors are Austria, Ireland, Lithuania, the Netherlands, Norway, Sweden, to some extent Lithuania and outside BESS, the UK.

3.8.7 “Good Housekeeping”

Good housekeeping means no-cost 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. The brochure Boilers and Heaters - Improving Energy Efficiency by Natural Resources Canada (2001) (see Annex 2 for a link) provides some good housekeeping measures (as well as low-cost measures and measures requiring significant investments) for boilers and heaters.

Good housekeeping should be continuous. It should be noted that even when certain measures identified, for example, from checklists are implemented once, there may be need to check if the measure should be re-implemented or revised at a later stage.

Although good housekeeping is probably promoted in one form or in another in most countries, it is not always being explicitly emphasised. Austria, the Netherlands, to some extent Ireland - and outside BESS the UK – are explicitly emphasising the benefits of good housekeeping.

3.8.8 Software for Energy Management

Commercial applications to support continuous improvement of energy management exist. SenterNovem has prepared a brochure comparing those available in the Dutch market.

To give an idea what such software could be used for - with no prejudice to its merits compared to other alternatives - it is possible to consult, for example, a diagnostic tool called One-2-Five Energy and marketed by the US-company Envinta (see Annex 2 for a link). The product also comprises an international benchmarking service.

4 Best Practices

4.1 Organisation of the Ranking Workshop

A ranking workshop was held in Helsinki, Finland on 18 April 2005. The objective of the workshop was to roll out best practices in energy management in industrial SMEs that would work in piloting with real SMEs. A detailed description of the organisation of the workshop, working method, ranking criteria and ranking results is given in Annex 5.

The workshop covered the following three instruments:

- Energy management
- Benchmarking and monitoring
- Energy management tools (principally energy auditing and e-learning).

4.2 Energy Management

For energy management, the ranking was done among four alternative options (see Annex 5 for more detailed descriptions):

- A. “Light” energy management which could be described as “management by intuition.
 - B. Energy Conservation Plans (ECP) based on the Plan-Do-Check-Act cycle of continuous improvement.
 - C. Energy management based on national standards (such as the Danish DS 2403) or international guidelines (possibly the forthcoming EU energy efficiency BREF or international standards or guidelines on energy management). However, the company may not seek certification.
 - D. Energy management following a specific standard.
- The option chosen as the best practice was Option C, energy management which is driven by the standards with the possibility to integrate to other management systems.

Energy management needs to be based on the Plan-Do-Check-Act (PDCA) approach. Hence, the most important parts of the preferred option are company-level energy policy, commitment of senior management, energy targets, energy monitoring and reporting and corrective actions. Management review should be carried out regularly. Integration to other management systems could be made through linking lists.

Given that the recommended approach - which is somewhat resource intensive - is best suited for medium and large SMEs, specific consideration needs to be given to adapting it to the smaller SMEs. Nevertheless, there is a risk that the approach is too complex, expensive and time consuming for the small SMEs, and even the larger ones.

4.3 Benchmarking and Monitoring

The following guidelines for energy benchmarking were formulated to mark best practice in the BESS Project:

- Benchmarking will be based on the Norwegian system but with some revisions.
- Ability to benchmark 'any' energy efficiency factors and figures is desirable. This means that the scheme would be able to benchmark specific energy consumption (e.g. MJ/tonne), energy consumption of sub-processes, system specifications (e.g. pressure level of compressed air), level of energy management etc. Particularly, a possibility to identify explanatory factors for the prevailing energy efficiency level is needed.
- A module of best practise case studies is needed.
- A module enabling to benchmark the level of energy management (ref. the Dutch scheme) is needed.
- It is proposed not to put effort on creating new correction factors within this project but rather concentrate on finding explanatory factors that help an individual SME to improve its energy efficiency.
- In the choice of pilot sub-sectors attention should be given on their suitability for benchmarking so that too complex sub-sectors will not be chosen.
- 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 and it should be easily adoptable by any industrial association or other group of companies, such as SME companies in a specific country or dairy-companies in a given region of the world. That means that companies could benchmark both the specific energy consumptions and all other relevant energy-based factors with or without correction factors. 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 the ranking workshop it was decided not to recommend the use of any specific monitoring tool because there are numerous commercial monitoring tools and applications available in the market. Nonetheless, monitoring is a significant element of the PDCA approach and requires attention.

Distinction needs to be made between the following 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 several commercial monitoring systems are available making it also 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 LTA).

It is advisable to follow the total electricity, fuel and heat consumptions on a monthly basis, to compare the energy use against the target and to identify consumption figures which are out of the range. One or more performance indicators and other factors that have an effect on energy use should be followed, as well. 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., from 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.

4.4 Energy Management Tools

4.4.1 Energy Auditing

Multiple possibilities for energy auditing to support energy management were identified in the EU Audit I and Audit II Projects. Figure 6 illustrates the different alternatives representing light, medium and heavy approaches in terms of required resources.

Out of the multiple alternatives four were chosen for the ranking activity:

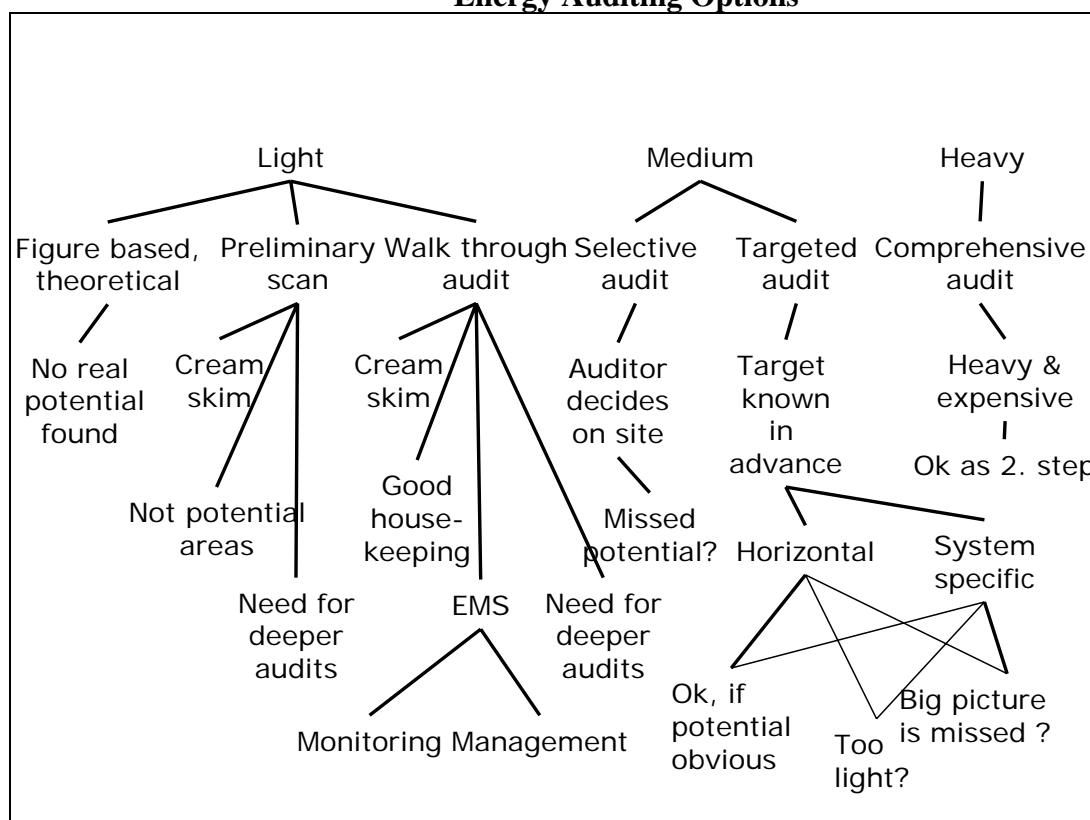
- A. Non-technical audit for energy management and monitoring
- B. Light technical walk-through audit
- C. Targeted technical energy audit
- D. Comprehensive energy audit

From the outset, it was clear that when defining the optimal audit model, SMEs cannot be handled as one homogenous group because the level of energy awareness/energy saving in the companies varies a lot (starters, advanced and experienced companies). Another point is the size of the company; the larger SMEs can afford to pay also for heavier audits. Therefore, for each option it was evaluated if each criterion is best fulfilled in case of application to companies which are starters, advanced or experienced in energy management or if the company is a relatively small or large energy consumer. The results of the ranking activity were:

- For the beginners the most suitable options are non-technical audit for energy management and monitoring or light technical walk-through audits.
- For those with already some experience in energy management, targeted technical energy audit would be the best option.
- More experienced energy savers with 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, the company could make use of industrial branch-based checklists.

Figure 6
Energy Auditing Options



Source: Olof Granlund Oy, Finland.

4.4.2 E-learning

Figure 7 shows several different ways to organise e-learning. An e-learning scheme could include link lists to useful web-sites, energy efficiency case studies, check-lists or the web-site could include several of these elements.

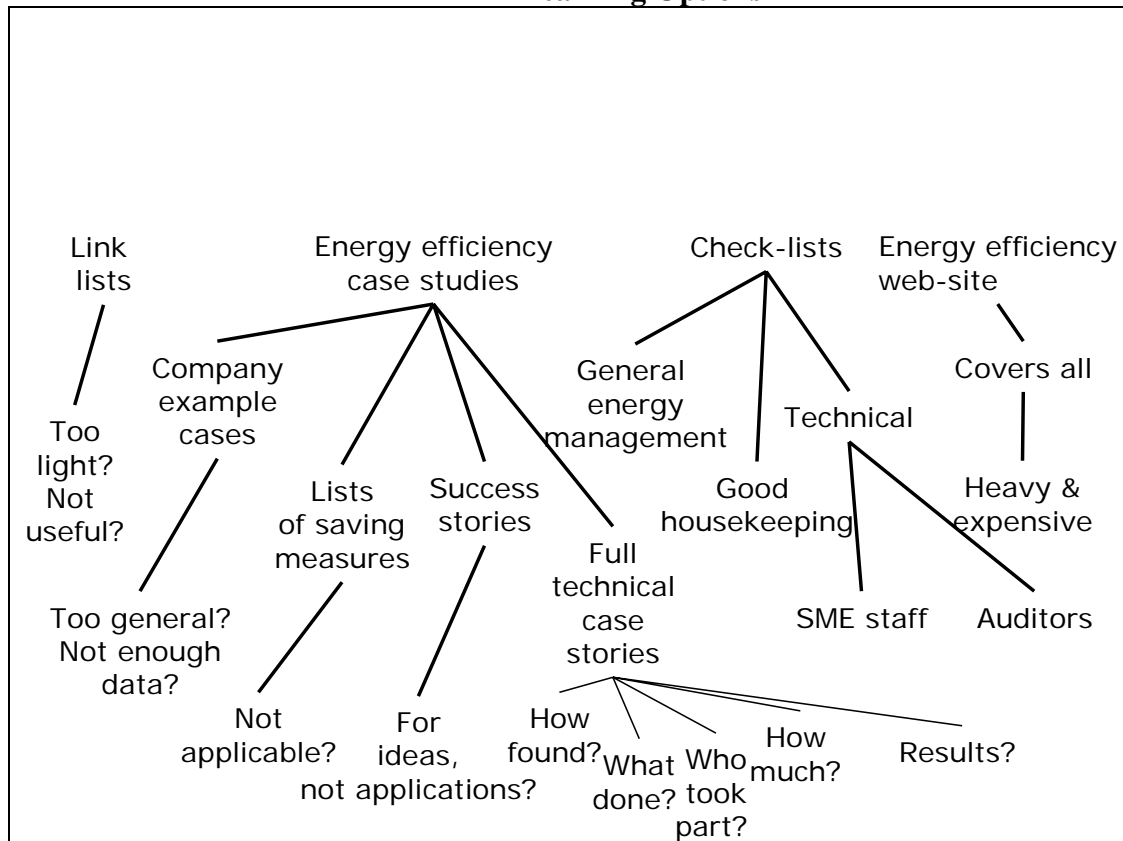
Out of the multiple alternatives, four were chosen for the ranking activity:

- A. Interactive step-by-step learning tool for energy management
- B. Case studies
- C. Checklists and guidelines
- D. General energy efficiency technologies

Outcome of the ranking activity:

- The interactive learning tool was found to be the most interesting approach.
- However, checklists and guidelines were found almost as useful.
- Choosing option A does not exclude incorporation of options B and C.
- Option D was considered too 'heavy' for the SMEs.

Figure 7
E-Learning Options



Source:

Olof Granlund Oy, Finland.

5 Conclusions and Recommendations

5.1 Best Practices for Industrial SMEs

5.1.1 Management Commitment and Company Energy Policy

Long-term success in energy management is dependant on strong management commitment. Therefore, a nominated senior member of the company management needs to have the overall responsibility for the company's energy management. Furthermore, a company needs to have a clearly stated company-level energy policy which is promulgated to all employees.

5.1.2 The Plan-Do-Check-Act (PDCA) Cycle

Energy management should be a continuous process instead of a one-off project. One of the most commonly used ways to ensure this is to follow the so-called Plan-Do-Check-Act (PDCA) cycle which may be familiar to the SME managers from quality or other management. The PDCA cycle provides a framework for the continuous improvement of a process or system. The cycle is designed to be used as a dynamic model where the completion of one turn of the cycle flows into the beginning of the next (see Figure 8). Table 5 explains the four steps of the cycle.

Figure 8
The Basic Plan-Do-Check-Act (PDCA) Cycle

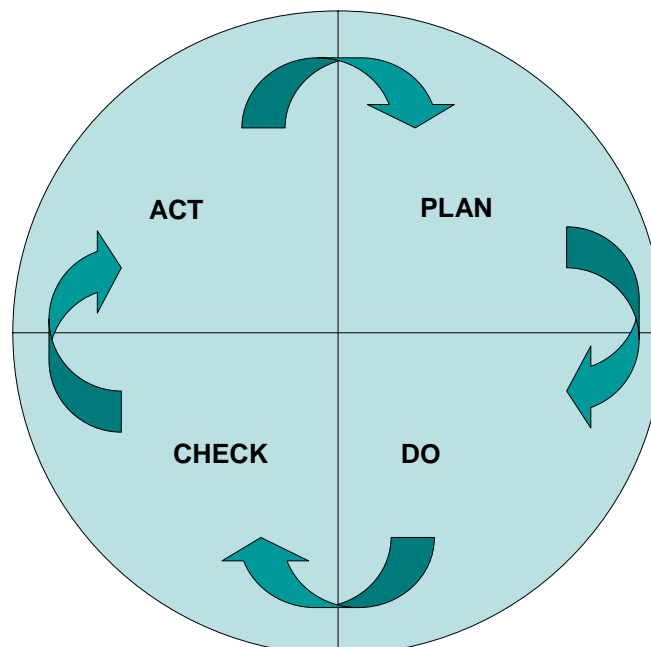


Table 5
The Implementation of the Plan-Do-Check-Act (PDCA) Cycle

	1. Plan	Plan improvements to energy management by: <ul style="list-style-type: none"> • Increasing knowledge of energy use in the company. • Identifying what are the problems. • Identifying possibilities to solve the problems. • Planning the change.
	2. Do	Carry out the improvements by: <ul style="list-style-type: none"> • Implementing the plan for change. The implementation could start with small steps (e.g. good housekeeping) to test the change. • Measuring the performance of the plan (monitoring).
	3. Check	Check progress by: <ul style="list-style-type: none"> • Using the monitoring results review the plan and analyse the results. Are the activities conducted achieving the results or not? • Look for responses to the following questions: What was learned? What went wrong? What went well? • Reporting the results to the top management.
	4. Act	Adopt the change, abandon it or run through the cycle again: <ul style="list-style-type: none"> • Decide on changes needed to improve the process based on what you learned in the Check-step. • Implement changes on a larger scale if the experiment with small steps was successful. If the change did not work, go through the cycle again with a different plan. • If you have now arrived at 'problem solved', go back to the Plan stage to identify the next 'problem'. • If the experiment was not successful, skip the Act stage and go back to the Plan-step to come up with some new ideas for solving the problem.

5.1.3 Practical Implementation of the PDCA Cycle

Energy Management Standards and Schemes

The PDCA Cycle can be implemented in different ways:

- By national or international energy management standards, either
 - through full compliance including certification or
 - through serious effort for compliance but without certification.
- By energy conservation/saving/demand-side management plans without the existence of national or international energy management standards or guidelines.
- By building upon reports and data which enables a systematic approach and provides adequate information on improvement potential and its cost, such as energy auditing reports.

The national energy management standards (such as the Danish, Swedish and forthcoming Irish standards) and the planned international standards or guidelines (CEN/CENELEC standard or guidelines or EU energy efficiency BREF) are likely to ensure effective energy management. However, full compliance and certification is likely to be excessively heavy approach for most are the SMEs due to the cost, need for resources, heavy reporting requirements or other considerations. Full-scale stand-alone energy management systems are likely to be another excessively heavy approach for the SMEs.

A better option for most SMEs could be to base energy management on the principles presented by the standards but without certification. A practical way to implement is to prepare energy conservation plans (ECP) in line with the guidelines given by the standards.

An ECP should start from the individual company's needs and take into account the starting level and realistic implementation possibilities. It should comprise energy saving targets and concrete saving measures with a financing plan. The targets should be based on the realistic economical energy saving potential (from the company's point of view) and continuous improvement. Energy saving potential for the site should be based on a comprehensive energy audit, an energy potential scan or other light energy audit conducted by using a list of branch-based energy saving measures. Alternatively, target-setting can be based on benchmarking if relevant data is available. In addition to energy efficiency measures, ECP should have elements of training of personnel and other information activities. Furthermore, the ECP should have means of evaluating the changes in energy efficiency in the company. Some options are energy efficiency indexes or benchmarking.

An alternative to ECPs is to use an energy auditing report as the starting point if the company does not have resources to prepare an ECP on top of an auditing report which the company may already have at its disposal. In this case targeting, training of personnel, information activities, and monitoring and evaluation need to be planned separately.

A company may want to integrate its energy management activities, monitoring and reporting to other management procedures, such as health, safety, quality and environmental management to reduce the number of overlapping systems and reporting. Examples could be EMAS and ISO 14001 but also HACCP for the food and drinks industry. For this purpose, linking lists would be useful. Such lists are being used, for example, in the Netherlands.

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.

A general approach to energy benchmarking has been proposed by, for example the EU EBPI Project. Here, advice is given on the application of these steps in the BESS Project:

1. **Definition of potential sectors for further investigations:** The food and drinks industry has been identified as the sector for benchmarking in the pilot phase of the project. However, in the choice of pilot sub-sectors (e.g. breweries, meat processing, dairy, bakeries etc.) attention should be given on their suitability for benchmarking so that too complex sub-sectors will not be chosen.
2. **Making close contact with representative bodies and selected companies:** The project partners are advised to do this as soon as possible.
3. **Definition of performance indicators:** Ability to benchmark ‘any’ energy efficiency factors and figures is desirable. This means that the scheme would be able to benchmark specific energy consumption (e.g. MJ/tonne), energy consumption of sub-processes, system specifications (e.g. pressure level of compressed air), specific consumption against “user-defined benchmarks”, level of energy management etc. Particularly, a possibility to identify explanatory factors for the prevailing energy efficiency level is needed.
4. **Estimation of correction factors:** It is proposed not to put effort on creating new correction factors within the BESS Project but rather concentrate on finding factors which explain the prevailing energy efficiency level in a SME and that help it to improve its energy efficiency.
5. **Discussion of indicators, explanatory factors and correction factors with industry:** Close involvement of national food and drink industry associations, and preferably also CIAA, is indispensable.
6. **Development of a questionnaire:** Will be developed in by Work Package 4 leader, NEPAS.
7. **Selection of companies:** Advice will be given by Work Package 5 leader, SenterNovem.
8. **Analysing data:** Part of Work Package 5.
9. **Preparing reports and discussing with the relevant trade body:** Part of Work Package 5.
10. **Publishing reports and organising and distributing promotional material:** To be implemented by Work Packages 4 (e-learning), 6 (project dissemination) and 7 (general dissemination). A module of best practise case studies is needed in the e-learning scheme.

The benchmarking tool should be easily adopted by any industrial association or other group of companies, such as SME companies in a specific country or dairy-companies in a given region of the world. 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. This can be enhanced by the National Pilot Coordination Groups to be established in each participating country. Each Group consists of the national representative from the BESS consortium, a national industrial association from the selected sector, representatives from the participating companies and a consultant (if needed).

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 monitoring 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 followed. 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 with 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 alternative 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 as 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 and the other elements.

5.2 Policy Framework

The 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.

5.2.1 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 (EE&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.

Specifically significant for food and drinks industry is the European Commission's regulation on the hygiene of foodstuff (852/2004). 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 could 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 could align it to something to which they already know, such as HACCP, ISO or EMAS.

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.

5.2.2 Long-Term Agreements

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. It 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 and the

Dutch LTA scheme could be adjusted to incorporate the planned EU or CEN/CENELEC energy management standards or guidelines.

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 shown also the cost-effectiveness of the activities. 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 whereas in the Netherlands there is a long-term tradition from public-private collaboration and partnerships. 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 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.

5.2.3 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 regulation.

In about half of the EU countries, large energy consumers are mandated to have regular energy audits but the requirement is seldom extended to SMEs. This gives room for unimpeded implementation of the proposed best practices. However, if the requirements have been extended to the SMEs, 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. Environmental permit process may provide an opportunity to integrate energy efficiency considerations into other existing procedures. 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 the ISO and EMAS regulations 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.

5.2.4 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 needed.

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 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 energy intensive industry.

5.2.5 “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 promote the success of the best practices proposed by the BESS Project. Particularly for the smallest SMEs, it would be extremely useful to make advisory services available at no cost or low cost.

5.3 Application to the Smallest SMEs

SMEs are not a homogenous group. They vary from micro-SMEs with less than ten employees to larger SMEs with up to 250 employees. It is clear, that with such a great variation, the companies have quite different needs and resources to pursue energy efficiency. The larger SMEs are in a better position to pay for consultant services and different energy management tools.

However, there is no reason why even the smaller SMEs could not actively manage energy and benefit of energy conservation. The approach just needs to be adjusted to their needs and scale.

The starting point could be the Plan-Do-Check-Act cycle also in the case of small companies. Clearly, standard-based and even standard-driven approaches to energy management are too heavy for this group of companies. A simplified energy conservation plan, based on a readily available template, could be an option.

A very light energy audit or self-audit using checklists could be the starting point to identify the possibilities for improvement. The emphasis should be on identifying ‘good housekeeping’ measures.

Monitoring of progress can be done by following the developments in total energy use by energy carrier and in specific energy consumption. Ready excel-based templates for preparing monitoring reports could be helpful.

The e-learning scheme to be developed within the BESS Project could help the small SMEs to get information on energy management and energy management tools applicable to them. Therefore, it is proposed to designate a specific section of the scheme for the use of these smaller companies. However, it should be noted that all SMEs still are not proficient in the use of the Internet which may limit the effectiveness of the e-learning scheme as an instrument for them.

5.4 Links to other Work Packages within the BESS Project

All work packages are more or less making use of the work done in WP 1. However, this is particularly important in WP2, WP 4 and WP6. In addition to the guidelines given throughout the report, hereunder are some observations, how WP1 can be useful for these work packages.

Work Package 2: Energy Management Implementation Model and Standards

Annex 6 of this report has been produced by Josef Stefan Institute which will also be the leader for WP 2. Therefore, there is a strong synergy between the two work packages. However, WP 1 has provided other input materials which can be used in WP 2 such as descriptions of the different long-term agreement schemes, providing policy analysts' views about them, identification of relevant EU acquis, descriptions of best practices in energy management and energy management tools etc.

Work Package 3: Web-Based Monitoring and Benchmarking Scheme

In WP 1, information was collected about the existing benchmarking schemes and web-based monitoring. Examples of both were found from the Netherlands and Norway but according to the inventory made within WP 1 (in collaboration with Sofena), only few useful practical examples can be found in Europe outside these two countries⁸.

Work Package 4: E-learning Scheme for Involved SMEs

WP 4 is responsible for creating an e-learning scheme. It will enable putting the best practices into a format in which the SMEs can easily use them for developing their energy management approach, doing benchmarking and so on. The outcome of the WP 1 forms the basis for the contents of the e-learning scheme by providing descriptions of best practices, links to information sources etc. However, it may be advisable to further develop the description of best practices into more user friendly format within WP 4 and possibly translate the materials into national languages. In further development of the descriptions, consulting WP 1 leader may help in ensuring consistency.

⁸ One of them is the benchmarking scheme operated by Promain in Finland.

Work Package 5: Pilots

Work done by work packages 2, 3 and 4 will serve as input to the pilots. However, WP 1 provides input to these three work packages.

Work Package 6: Project Dissemination

WP6 will develop handbooks and other material that shall be communicated by way of e-learning. These will be the materials which directed more towards the SMEs than, for example, this report. However, this report - and particularly the best practice descriptions in Chapter 5.1 can be used as input materials to the handbook. In this process, it is advisable during the implementation of WP 6 to consult the WP1 leader to secure consistency with WP 1 recommendations and to make maximum use of the work already done. One possibility to benefit from the work done in WP1 could be to produce a matrix which describes the interaction of the instruments developed within the BESS Project with the energy policy framework.

All Work Packages

Chapter 1.4 of this report provides some important definitions of key terminology and concepts for the use of the BESS Project. These are a SME, a best practice, an instrument, energy management, energy policy (energy policy framework and company energy policy) and energy efficiency. For example, the definitions advise against the use of the abbreviation EMS due to possible confusion between energy management systems and environmental management systems. Project partners are advised to consult these definitions and use the terminology in a uniform way to avoid confusion.

ABBREVIATIONS AND ACRONYMS

BAU	Business as Usual
BAT	Best Available Technology
BESS	Benchmarking and Energy Management Schemes in SMEs
BM	Benchmarking
BREF	BAT Reference Documents
CHP	Combined Heat and Power Production / Cogeneration
CIAA	Confederation of the Food and Drinks Industries in the EU
CO ₂	Carbon Dioxide
ECP	Energy Conservation Plan
EI	Energy Efficiency Index
EMAS	Community Eco-Management and Audit Scheme
EMS	Energy Management System OR Environmental Management System (given the possible confusion, the abbreviation should be avoided in the BESS Project)
ESCO	Energy Service Company
EU	European Union
EC	European Commission
FY	Fiscal Year
GHG	Greenhouse Gas
HACCP	Hazard Analysis Critical Control Point
IPPC	Integrated Pollution Prevention and Control
ISO	International Organisation for Standardization
LIEN	The Irish Large Industry Energy Network
LTA	Long-Term Agreement
LTA 2	Dutch Second-Generation Long Term Agreement
MURE	Mesures d'Utilisation Rationnelle de l'Energie
ODYSSEE	On-line Database on Yearly Assessment of Energy Efficiency
OECD	Organisation for Economic Co-operation and Development
PDCA	Plan-Do-Check-Act
SME	Small and Medium-sized Enterprises
VAT	Value Added Tax
WEC	World Energy Council
WP	Work Package