

# Step by step guidance for the implementation of energy management

This handbook has been composed by the Austrian Energy Agency within the following project:

**BESS**  
**Benchmarking and Energy Management Schemes in SMEs**  
**Intelligent Energy – Europe (IEE)**  
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## **Preface**

This handbook has been developed within the BESS project (Benchmarking and Energy Management Schemes in SMEs) which is supported by the European Commission under the EU's Intelligent Energy – Europe (IEE) 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 drink industry.

The project website [www.bess-project.info](http://www.bess-project.info) offers an e-learning scheme which contains all information a company needs for implementing energy management. When clicking on the bulls eye on the e-learning dashboard on [www.bess-project.info](http://www.bess-project.info), you get information about the BESS energy management approach

The present handbook is a supportive tool within the BESS project which leads the SME in logical steps through the implementation process of energy management. Most tools which are available within the e-learning scheme are included in the handbook and references to the e-learning scheme are given consequently. It is recommended to download certain tools like the full energy management checklist or the business case from the website as they contain automatically calculations and data interpretations.

Basically the handbook can be used by industrial SMEs of all branches and sectors. It contains horizontal measure lists that are useful for all branches. Sector specific information is offered as a separate attached document. Within the BESS project sector specific information for bakeries, meat processing industries and dairies has been developed.

The colours of different boxes and numberings in this handbook are related to the colours on the website [www.bess-project.info](http://www.bess-project.info). Documents to be downloaded are mentioned in the text. The links where you can find these documents on the BESS website are added in quotation marks.

## Executive summary

It is well known that many companies are reluctant to focus on energy management or to invest in energy efficiency measures. Nevertheless, there are many good examples that prove that the right approach to enhance energy efficiency can very well be combined with the priorities of companies. Especially SMEs can benefit from a European facilitated approach because normally they have a lack of resources and time to look for those best practices which are relevant for their sector.

Therefore the BESS project was started focussing especially on SMEs. So you can benefit from a European facilitated approach and minimize the resources and time to look for your best practices.

To be able to implement energy management successfully a user-friendly web based e-learning scheme ([www.bess-project.info](http://www.bess-project.info)) for implementing energy management and benchmarking has been developed. The handbook for the e-learning scheme describes the topic energy management, contains several supportive tools and describes why and how to work with them. Several practical tools to support the cycle of continuous improvement of energy efficiency in the company are supplied such as checklists, measure lists, templates for auditing and energy action plans. All these tools can be downloaded on [www.bess-project.info](http://www.bess-project.info). Furthermore, there is the possibility to anonymously benchmark your energy situation against others of the same sector.

BESS provides the energy management implementation model (EMIM) which shows the logic of the implementation process within the PDCA principles. It contains 19 actions and several tools and instruments which support the process. The actions are not in a sequential order.

First of all it is important to create a common understanding. Therefore a set of definitions for basic terms of energy management within BESS has been elaborated. The BESS Energy Management Specification offers the requirements for an optimal Energy Management System which is based on the ISO 14001 on environmental management systems (Plan–Do–Check–Act ).

The BESS Linking List is a tool which shows how the BESS energy management specification matches with existing ISO (2000, 9001 and 14001) standards and the HACCP specification.

The implementation of an energy management system ensures that a company continually passes through the cycle of making energy policy, planning energy efficiency actions, implementing those and checking the results, on the basis of which new policy is made. The ambition to check and improve the quality level of the energy management system at regular intervals is an essential part of the system itself.

The timing of implementing the BESS energy implementation model (EMIM) begins with the first phase (getting started), consisting of the preparation of the business case to get an overview of essential basic company data and indicators to recognise if there is the need for energy management implementation or not. Thereafter follows the completion of the pre-self assessment checklist in order to find out the actual level of your energy management. The commitment to the energy management will eventually act as a “go” for the project implementation plan signalling the support of top management.

Then you define your energy policy. One of the elements of the energy management policy is that the organisation will observe all relevant laws, regulations and other subscribed requirements. Therefore BESS provides an explanatory note on legislation and regulations.

The energy audit is carried out considering the legislative framework. An energy audit quantifies trends of current energy use, equivalent greenhouse gas emissions and related costs and recommends energy efficiency improvements. The energy audit description and the energy audit data collection sheet facilitate the company which starts with auditing activities. The description explains the work to be done, different types of audits and the expected results.

Based on findings from previous phases, an action plan has to be prepared, defining roles and responsibilities. On the next stage, this action plan is to be implemented, together with procedures for operation and maintenance (e.g. from measure lists).

A set of indicators (e.g. SEC – specific energy consumption) has to be developed to be able to benchmark and thus monitor the process and performance. Finally, the energy management is checked through the set of questions in the energy management checklist. Based on regular review, modifications are to be explored and performed.

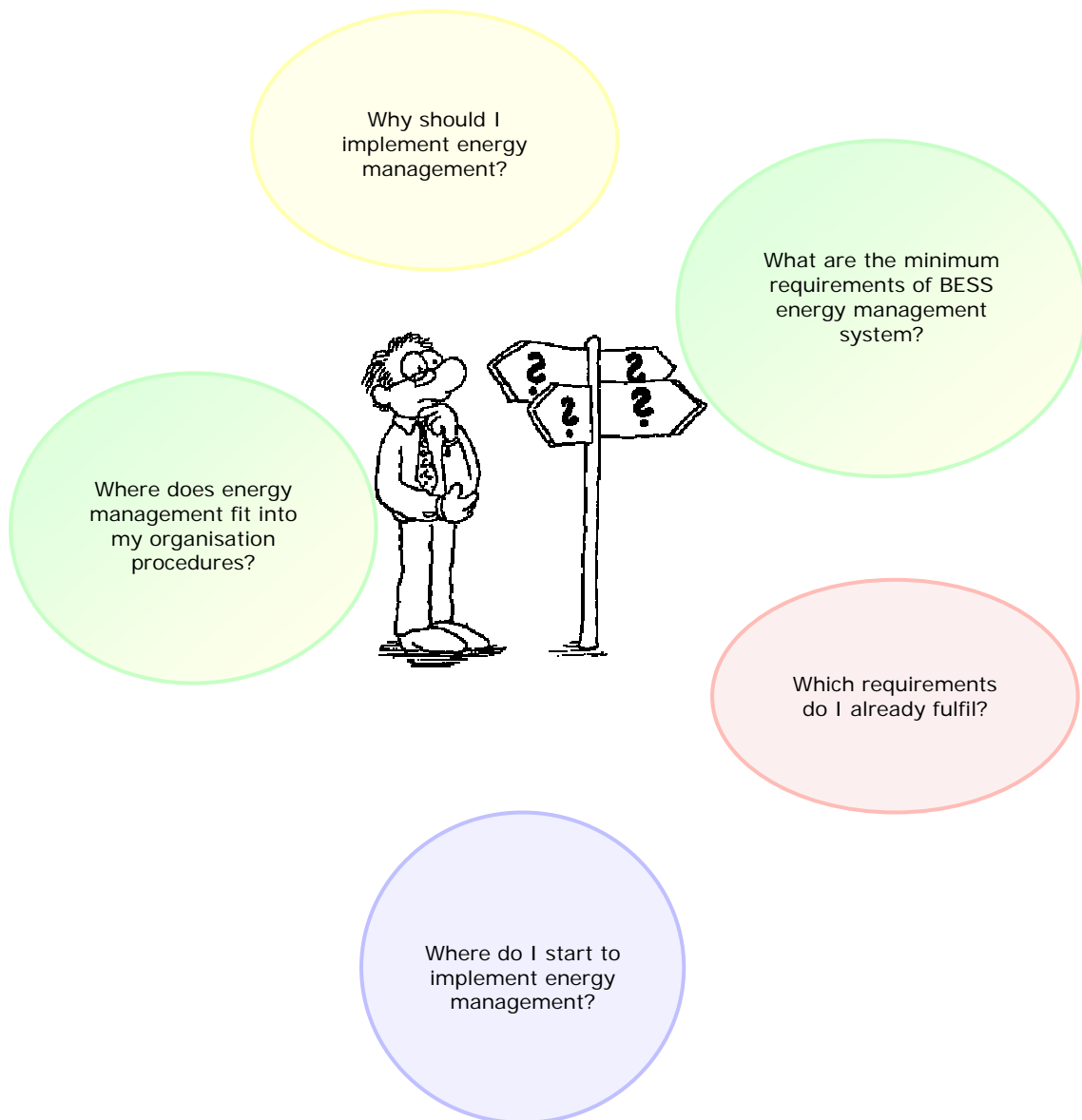
The moment when to appoint an energy coordinator depends on the company situation. In most companies the role of an energy coordinator has already been taken by someone, without declaring him as the “energy coordinator”. This person usually undertakes the starting actions and builds up an energy team. There is also the possibility to assign an external consultant for undertaking the starting actions and building an energy team whose members appoint the energy coordinator.

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# 1 Introduction

This handbook facilitates the implementation of energy management in small and medium sized enterprises. It provides a logical step-by-step guidance of implementation actions and most effective ways to find out where energy and cost savings can be made. In combination with the e-learning scheme on [www.bess-project.info](http://www.bess-project.info) this handbook answers following questions:



In chapter 3.9 you find the set of definitions which explains all important terms.

## 1.1 What is energy management?

Energy management is effectuating organisational, technical and behavioural actions in an economically-sound manner in order to minimise the consumption of energy, including energy for production, and to minimise the consumption of basic and added materials.

Energy Management means structural attention for energy with the objective of continually reducing energy consumption and maintaining the achieved improvements. It ensures that a company or an organisation continually passes through the cycle of making policy, planning actions, implementing actions and checking results, on the basis of which new policy is made. This cycle makes continual improvement possible, as reflected in Deming's Circle (Figure 10 on page 45).

The implementation of an energy management system is not an objective in itself. What matters are the results of the system: anchoring attention for energy in daily practice.

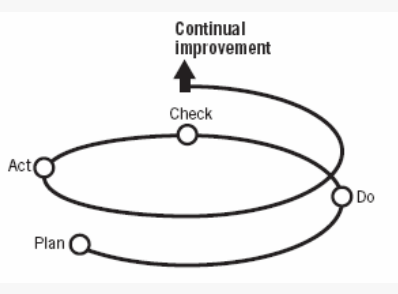
Whether an energy management system works is dependent on the willingness of the (relevant) organisation to manage energy consumption and energy costs.

The organisations of the BESS consortium ensure that companies that participate in BESS translate that willingness in their deeds whatever their main reasons are: controlling costs, environmental considerations, legal requirements, social agreements or image.

## 1.2 Why should I implement energy management?

There are several reasons for implementing energy management.

One important reason why you should implement energy management is the improvement of your environmental performance. Non less important is the **minimisation of costs!**



If you have an energy management system you map the energy flows at a certain point in time, identify the relevant energy aspects and subsequently take action. The analysis of the energy consumption must be performed regularly to keep insight up to date and to make new measures possible when changes occurred.

Even if the measures work, you continue to pass through the circle. In order to at least maintain the current level, you must regularly check to ensure that everything is still functioning optimally and make any necessary modifications.

### Difference between ad hoc energy management and a continuous energy management process

This graph shows the course of energy costs when energy saving actions are made occasionally, without regular control and improvement. [1]

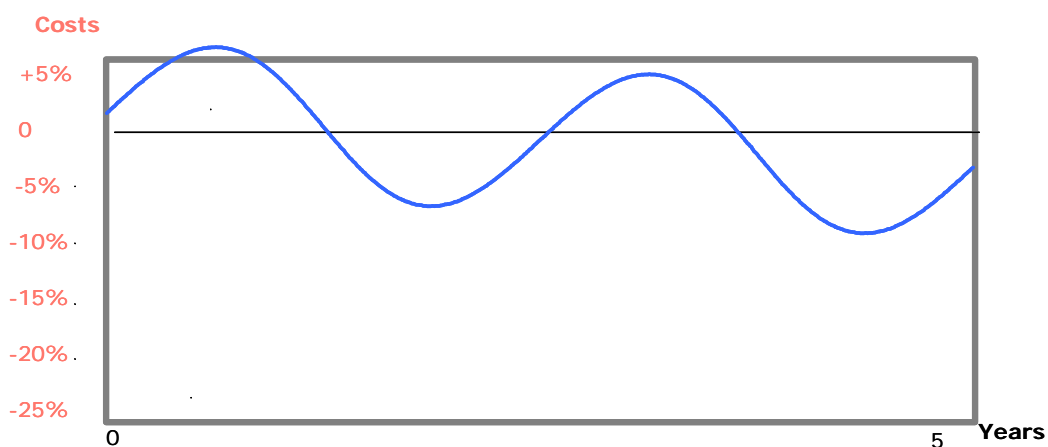
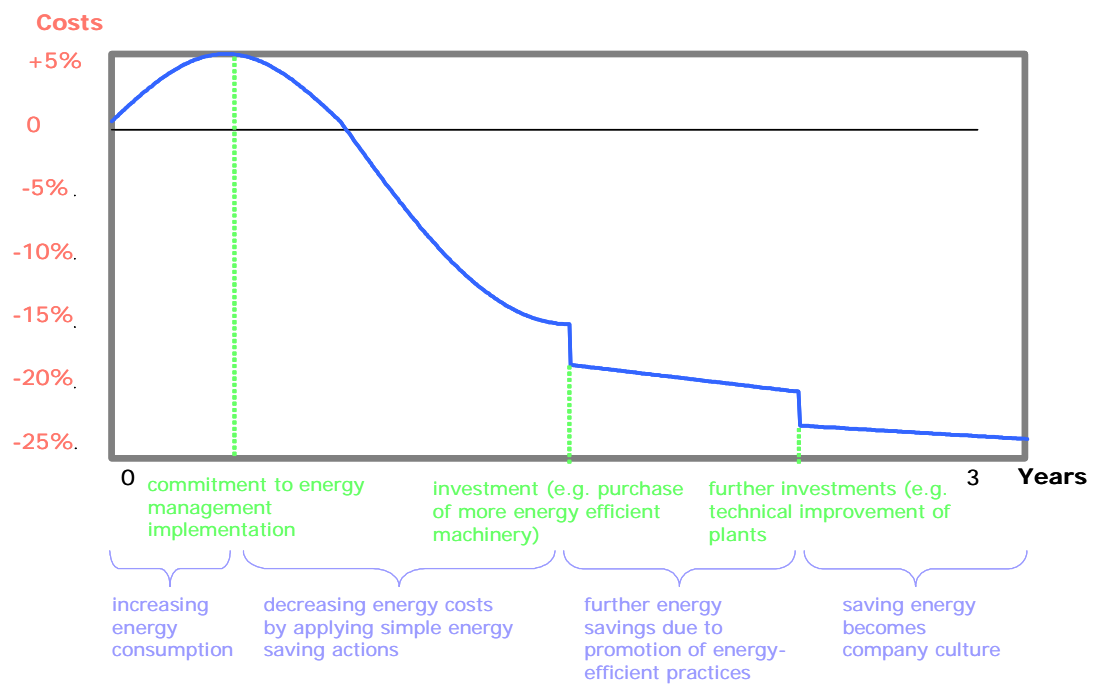


Figure 1: course of ad hoc energy management

In the graph below you can see that with continuous improvement, trainings and motivation the energy costs can successfully be decreased without rising again. [1]



**Figure 2: course of a continuous energy management process**

When you implement energy management you:

- know how much energy is used in your company for different areas (departments, production processes etc.),
- notice immediately when the energy consumption for one area has changed considerably, so you can find out the reason and act properly,
- have documented your energy system in a systematic and structured way.

Furthermore, energy management has various additional positive effects:

- **Direct effects** of energy management are e.g. lower energy costs, energy savings and an increase in profits.
- **Indirect effects** include a better environmental situation, cost reductions for assurances and maintenance, better working conditions etc.

### Examples for direct effects of energy management

- As a result of an energy audit a dairy equipped 203 electrical motors with a total power of 1,216 kW with frequency converters. The price of a 5.5 kW frequency converter is approximately € 600. The estimated annual saving is € 90,000,- (1,325 MWh), the investment costs being estimated to € 311,000,-. The pay-back time is only 3.4 years.

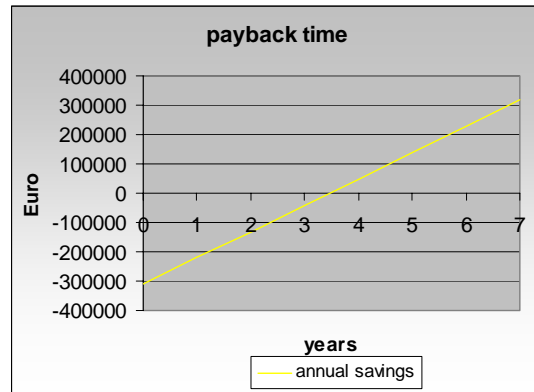


Figure 3: payback time of the undertaken measures

- A dairy installed a load management system and thus saves 14,000 Euro per year.
- The combustion air fan of the biggest dairy in Styria (Austria) was operated by an engine with a nominal capacity of 30 kW, which was run up by a star-delta starting. The fan caused an annual energy consumption of about 152,400 kWh. By installation of a frequency converter the speed was reduced and the actual air flow was adapted to the necessary airflow. This action results in energy cost savings of about 86 %. With investment costs of € 8,000,- the payback period was 9 months. [2]
- At an Austrian dairy, the biggest cottage-cheese-producer in Europe, the compressed air was supplied by three compressors, which were controlled by adjusted pressure levels. There was no superior controller and no use of waste heat. The strongly fluctuating workload and operating method of the compressors resulted in high consumption. The installation of highly efficient aggregates and of a superior control optimising the ratio between full load, part load and idle speed of the compressors, the waste heat utilisation for heating the neighbouring hall and the reduction of the leakages induced costs of € 50,000,- resulting in savings of € 24,975,- per year. Thus within two years the investment costs were amortised. [2]
- The dairy "Namdalsmeieriet" has invested in a combined heat recovery and purification plant. The combustion air is preheated by the flue gases and the sulphur dioxide is used for neutralisation of alkaline waste water. 91 % of the SO<sub>2</sub> content in the flue gases are absorbed in the waste water. The energy costs are reduced by approx. € 25.000,- per year and the chemical costs by approx. € 17.000,- per year. [3]

### Examples for indirect effects of energy management

- As a result of energy management a dairy changed its chemical cleaning process, thus decreasing the water usage by 6%, the lye by 46% and the acid by 34%.
- A food market invested in more efficient freezers which not only decreased its electricity costs by 26%, but also saved the total insurance for frozen food. Because of the new system that uses several aggregates the insurance was not necessary anymore.

Energy is a controllable resource. Using it efficiently helps to maximise profits by reducing energy costs.



### 1.3 What are the minimum requirements of BESS energy management?



Within BESS a specification for an energy management system has been developed. This specification offers the requirements for an optimal energy management system which is based on the ISO 14001 standard on environmental management systems and follows the plan–do–check–act (PDCA) cycle. **PDCA means that you map the energy flows at a certain point in time, identify the relevant energy aspects and subsequently take action.**

The **BESS energy management specification** can be regarded as the basis of the definition of a mature energy management system. It covers following areas:

- Energy policy
- Planning
- Implementation and operation
- Checking and corrective actions
- Management involvement

You can find the BESS energy management specification in chapter 3.1. and in the part “Definitions and Specifications” on [www.bess-project.info](http://www.bess-project.info).

### 1.4 Which requirements do I already fulfil?

Most companies already use different parts of energy management in their organisation, e.g.:

- The energy consumption is compared on a monthly or annual basis.
- Good measures are well known by all staff members.
- When purchasing electrical equipment energy efficiency is a decision factor.
- Etc.

But often the gathered information is not used consequently for improving the company's energy performance.

For a first rough overview of the existing level of energy management in your company you can use the **pre-self assessment checklist** (7 questions, chapter 2.1.2, “Getting Started”) or the full energy management checklist (26 questions, chapter 2.1.2, 3.2).

## 1.5 Where do I start to implement energy management?

As a result of the full energy management checklist you know which parts of the BESS energy management system are still missing in your company.

The BESS energy management implementation model (EMIM, chapter 1.1, “Energy Management Model”) contains all actions that are necessary for implementing energy management. EMIM covers:

- most of the ISO 14001 oriented energy management requirements,
- the BESS energy management specification and
- practical implementation procedures, which can be used by the company to achieve targeted energy saving goals.

In Figure 4 the major actions within the energy management implementation model (EMIM) are listed. Each action is subordinated to one of the nine main energy management implementation steps which are described in chapter 2.

The numbers 1 to 9 describe the time sequence for implementing energy management for the first time.

There is no fixed sequence of implementation actions. Figure 4 is only an example of a possible sequence. Depending on your company’s situation you will find the appropriate starting action.

If you have already implemented energy management you start again with the understand phase, go on with the plan phase and so on. That means that you continue improving your energy management system within the plan-do-check-act cycle.

	PLAN	PLAN	DO	DO	CHECK	ACT
START	A. UNDERSTAND	B. PLAN	C. COMMIT	D. IMPLEMENT	E. EVALUATE	F. REVIEW
Business Case <b>1</b>	Energy Audit <b>4</b>	Energy Action Plan <b>5</b>	Energy Coordinator <b>2</b>	Implement Energy Action Plan <b>6</b>	Indicators <b>7</b>	Revision <b>9</b>
Pre-Self assessment <b>1</b>	Analysis Tools <b>4</b>	Roles and Responsibilities <b>1 + 5</b>	Energy Team <b>2</b>	Operation and Maintenance <b>6</b>	Monitoring and Targeting <b>7</b>	Improve <b>9</b>
Energy Management Implementation Project Plan <b>1</b>	Legislative & Regulative Framework <b>4</b>		Energy Policy <b>3</b>		Benchmarking <b>8</b>	
Definitions Specifications					Full Energy Management Checklist <b>8</b>	

**Figure 4: Actions within energy management implementation model (EMIM) regarding plan-do-check-act (PDCA) principles**

A – F represent the (yearly) cycle of continuous improvements after implementation

## 1.6 Where does energy management fit into my organisation?

When energy management is integrated into the daily practice of your organisation, you create an instrument with which energy efficiency can be continually improved. The integration of this instrument into daily practice will run the smoothest if the process is based on the BESS energy management specification and the full energy management checklist.

Most companies do already have to fulfil different standards like ISO 9001/2000 or ISO 14001 or for food and drink industries the HACCP. Therefore it makes sense to connect the energy management procedures to management procedures which already exist. The BESS linking list (chapter 3.4, "Definitions and Specifications") shows the connections of energy management and the above mentioned standards.

Take the list and see where you can add energy matters to the procedures of the standards you already have to fulfil. In this way you **avoid double work** and you can **use procedures which are already well known**. You find the linking list and the description how to use it successfully in chapter 3.4 of this handbook.

## 1.7 The basic parts of BESS energy management

Before you start with the step-by-step implementation process it is recommended to contemplate the basic parts of the BESS energy management, which are:

- **the energy management specification** (chapter 3.1, "Definitions and Specifications")
- **the linking list** (chapter 3.4, "Definitions and Specifications")
- **the EMIM** (chapter 1.1. "Energy Management Model")
- **the website with the e-learning scheme** ([www.bess-project.info](http://www.bess-project.info))

When looking at these basics you will gain a profound knowledge of the BESS energy management scheme. You will recognise parts of it which you have already implemented into your organisation or on which you have already thought, but never realised.

Go ahead and contemplate the basics, then start with the implementation actions!

## 1.8 How do I work with the BESS e-learning scheme and the handbook?

This handbook describes how to implement energy management successfully. A lot of different tools are provided. Some of them you can find in the handbook. Others need to be filled in digitally because they contain automatic calculations. Such tools can be downloaded on [www.bess-project.info](http://www.bess-project.info). Necessary references to the e-learning scheme on [www.bess-project.info](http://www.bess-project.info) are given throughout the handbook. It guides you through these tools and the implementation process.

On the homepage of [www.bess-project.info](http://www.bess-project.info) you can enter the introduction to the e-learning scheme when you click on the dartboard symbol on the left side.

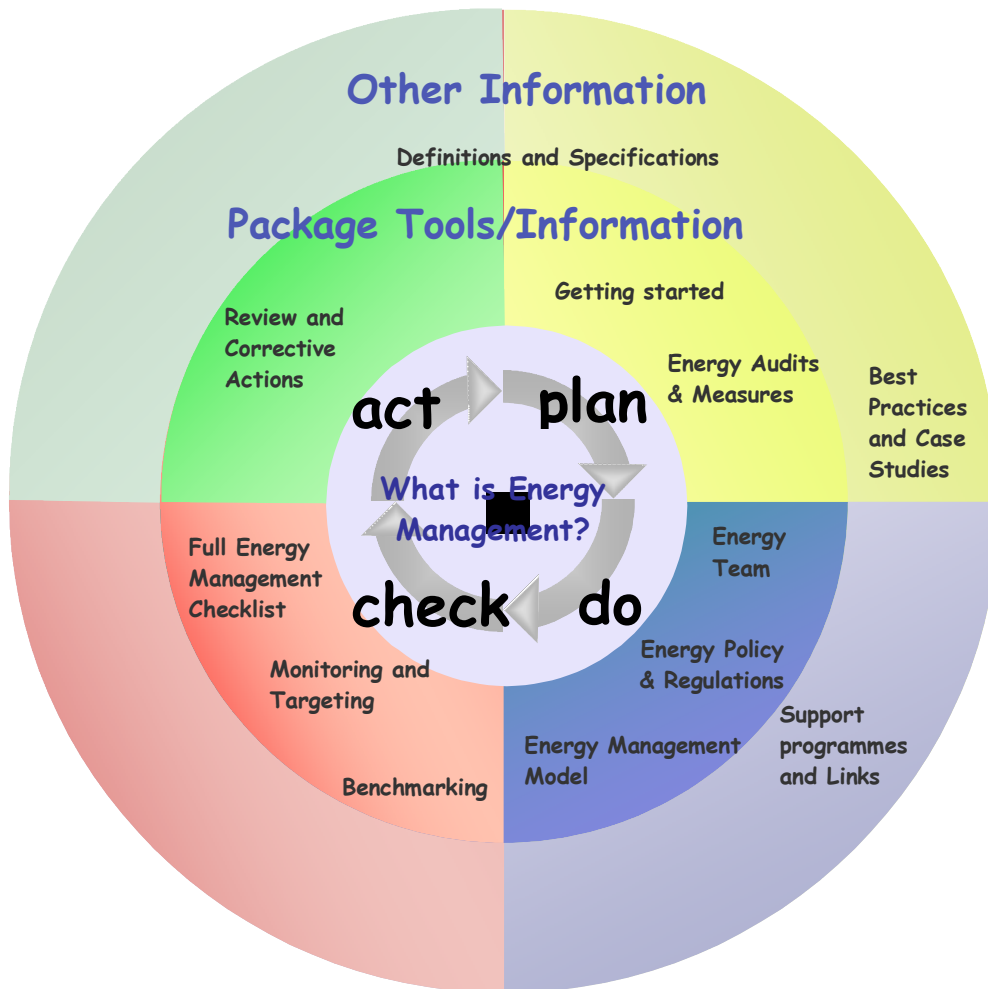


Figure 5: Dartboard on [www.bess-project.info](http://www.bess-project.info)

If you click on the bulls eye you will find a short introduction about reasons for implementing energy management, the energy management implementation model, the energy management specifications, the linking list and the full energy management checklist.

The inside ring displays the plan-do-check-act cycle. If you click on one of these links you will get information about all important aspects of the particular part.

If you click on a link at the middle ring you get access to all supportive tools of the e-learning scheme and information about legislative and regulative framework.

The outer ring supplies the definitions and specifications, best practices and case studies and information about support programmes.

## 2 Step-by-step guidance

This chapter describes a possible sequence of the energy management implementation actions regarding the BESS energy management implementation model. Where additional information on the BESS e-learning scheme is available, references to the website are given.

To implement energy management according to the BESS energy management implementation model we recommend to take the steps mentioned below. These steps are part of the actions within the EMIM (Energy management implementation model) as shown in Figure 4 (p. 13).

1. Getting started
2. Form your energy team
3. Define your energy policy
4. Understand the organisations energy matters – conduct an energy audit
5. Compile an Energy Action Plan
6. Promote and implement energy efficiency measures
7. Check your energy performance
8. Check your energy management system and energy efficiency
9. Achieve further efficiency improvements

You can of course modify the order of these several tasks according to your requirements. This is only a recommendation.

### 2.1 Getting started

You can find the supportive tools which are introduced on the following pages in the part “Getting Started” of the e-learning scheme on [www.bess-project.info](http://www.bess-project.info).

Start with your preliminary activities in order to understand your company's energy situation and to recognise the needs for implementation of energy management into your company structure and culture.

- **Business case** (chapter 2.1.1, 3.5)
- **Pre-self assessment checklist** (chapter 2.1.2)

The results of the business case and the pre-self assessment checklist are convincing arguments to enforce the importance of energy management when presenting this topic to the top management.

After elaborating the business case and the pre-self assessment checklist the following actions are to be undertaken:

- **Commitment to energy management** (chapter 2.1.3)
- **Description of the roles and responsibilities** (chapter 2.1.4)
- **Energy management implementation project plan** (chapter 2.1.5)
- **Energy management implementation model** (chapter 1.5)

Basically filling in these tools is the duty of the energy coordinator (chapter 2.2.1) but he can also assign the job to a member of his energy team.

### 2.1.1 Make a business case – recognise the need for energy management

Filling in the business case (chapter 3.5, "Getting Started") is one of your first tasks, resulting in an overview of essential basic company data for the past three years and indicators and identification of other influences affecting the company decisions.

As already mentioned these results can be used to convince the top management of the importance of energy management in your company.

The business case is an excel sheet which contains automatic calculations and therefore has to be downloaded from the website [www.bess-project.info](http://www.bess-project.info) ("Getting Started"). To get an overview of the required data you can find one calculation table out of the business case in chapter 3.5.

Necessary information for the business case are:

- the total amount of energy consumed, divided into fuels and electricity
- energy prices
- CO<sub>2</sub> emissions
- production data

Outcome of the business case:

- specific energy consumption for the last three years
- energy cost intensity
- specific CO<sub>2</sub> emission - direct and indirect

### 2.1.2 Check the level of your current energy management system

The next activity to be undertaken when implementing an energy management system within a company is to check the existing level of the energy management system in the company. The BESS energy management specification based on the ISO 14001 standard can be regarded as the basis of the definition of a mature energy management system.

The full energy management checklist (chapter 3.2, "Full Energy Management Checklist") evaluates the mandatory and optional elements of the energy management requirements. The results of the checklist indicate the extent to which energy management has been implemented in the company at this time.

The full energy management checklist consists of 26 questions, to be verified by the organisation by checking off the measures that have been taken. The checklist can be downloaded from the e-learning scheme and can be used to identify the main priorities for the implementation process. With the full energy management checklist you have also the possibility to check the quality of your energy management system in your organisation after you have finalised the energy management implementation project.

Placing a check in the "check box" confirms that one or more of the elements in the energy management requirements do already exist in the organisation. An explanation is provided at the right side of each question. The first column at the right side explains the question and the second column at the right side explains when to check it off. The results are automatically displayed at the top of the first page of the full energy management checklist and at the end of the checklist.

The **pre-self assessment checklist** contains **seven key questions** out of the full energy management checklist which can be used by companies in the initial stage of implementing or improving their energy management system.

The purpose of the pre-self assessment checklist is to identify the main priorities for a company regarding the implementation process.

You can find the pre-self assessment checklist on the next page and on the e-learning scheme ("Getting Started").

### The seven key questions are:

1. Has the organisation identified the primary energy aspects based on the energy consumption figures and are they kept up to date?
2. Have tasks, responsibilities and authority been determined for all staff involved in energy management (e.g. energy aspects, energy consumption, objectives, corrective measures, etc.)?
3. Are the primary energy consumers (energy aspects) regularly measured, registered, analysed and reported?
4. Has a plan of approach been compiled for improving the energy performance in accordance with the policy and considering following matters:
  - Legal and other requirements
  - The primary energy aspects
  - The best techniques available (according to BESS list of measures, for example)
  - The time schedule within which these are to be achieved
5. Has it been documented (in writing or electronically) how energy management works and is a link made to the relevant instructions and procedures?
6. In the event of non-conformance\*, is the cause investigated and are corrective or preventative measures taken to prevent reoccurrence?
7. Is the evaluation of the energy management system performed at least once each year by the management based on the following information:
  - Energy performance based on monitoring information.
  - The evaluation of conformance with legal and other requirements pertaining to energy

\* Non-conformance means that an objective will not be achieved as defined if you continue in the same manner.

### 2.1.3 Commit energy management into the organisation

For long term successful energy management a company commitment is essential. Someone at the highest level of the organisation (for example, a board member or the managing director), whose signature on the company commitment will demonstrate the importance of the programme, has to be found. Support of highest level personnel will assist the managers who will be actively involved in implementing the strategy.

The commitment can be provided by assisting the senior management to clearly understand the level of energy management in the company. For this purpose the pre-self assessment checklist can be used. In second stage, the current situation should be presented to senior management with clear indication of trends of energy costs and energy issues. You must give specific emphasis to the presentation of the benefits that might be achieved. The benefits can be estimated based on figures from the business case and in a later stage by cross checking several other sources, e.g. horizontal and sector specific measure lists, benchmarking data or many other case studies which describe the energy management achievements in organisations.



The commitment is more than a statement of support – it should establish accountability among managers involved in the implementation of the strategy, and should require regular reporting on progress.

In addition to top-level commitment, staff from all levels of the organisation need to be encouraged to join the process of implementing energy management in the organisation.

The next page displays an example of a company commitment (“Getting Started”).

**Example 1: Company Commitment**

**We are committed to:**

- purchasing energy at the most cost-effective price
- purchasing a proportion of green energy (generated from renewable sources)
- increasing energy efficiency in terms of energy consumed per unit of production (or per degree day for space heating)
- reducing CO<sub>2</sub> emissions
- investing in new technology where this meets investment criteria (including renewable energy sources)
- considering life cycle energy costs when procuring new projects
- purchasing energy-efficient plants and equipment (including office equipment)
- reducing environmental emissions arising from transport (including employee transport to work, business travel and distribution of goods)
- entering into a climate change agreement via our trade association
- investing in energy-saving technologies that are eligible for enhanced capital allowances

**We will address energy efficiency in all areas of our business including:**

- Management issues
  - define roles and responsibilities for energy
  - educate and raise awareness among staff
  - encourage continual professional development (CPD) for technical staff involved in energy
  - establish clear reporting procedures
- Procurement issues
  - procure equipment with low energy ratings
  - consider life-cycle energy costs for new projects and modifications to existing plants
  - establish technical guidelines for new projects and refurbishment
- Financial issues
  - establish ownership of energy costs at departmental level
  - establish ownership for invoice verification
- Technical issues
  - establish procedures for operation of plant and equipment.

**We will improve on past performance:**

Over the past 5/10 years:

- our energy costs have increased/decreased by x%
- our energy efficiency has increased/decreased by x% - our emissions of CO<sub>2</sub> have increased/decreased by x%
- our consumption of fossil fuels has increased/decreased by x%
- our consumption of renewable energy has increased/decreased by x%
- our investment in clean, energy-efficient technologies has increased/decreased by x%.

We are committed to reversing/reinforcing/accelerating this trend/these trends through a strategic action plan which will be reviewed for progress and updated each year.

Chairman's signature: .....

Date: .....

## 2.1.4 Appoint the roles and responsibilities

Roles and responsibilities of persons who will work on the energy management have to be appointed. As a supportive tool a **TRA matrix** ("Getting Started") can be used. This is a list of tasks, responsibilities and authorisation to clearly identify individuals in the organisation who are directly and indirectly involved with energy.

This insight is extremely important for a properly-functioning energy management system. You find out which tasks are already performed in your company and the list shows at a single glance who does what and who bears responsibility.

When compiling the TRA matrix, there is really only one question: Who is in a position to influence energy consumption? Every individual in a position to influence energy consumption must be included in the TRA matrix. Not only because it shows who bears responsibility, but especially in order to create broad support. Participating in energy management with a clear task and responsibility creates motivation. The employees on the work floor are very directly involved. In their daily tasks, they work with the machines and exercise the most direct influence on energy consumption.



Ultimate responsibility for the effectiveness of energy management must be assigned to management members with sufficient authority and skills. The executive committee is the most logical candidate. They can allocate time, money and manpower, therewith establishing the necessary conditions.

### Example 2: TRA Matrix

#### Tasks, responsibilities and authorisation of the energy coordinator

Task	Responsible for	Actions	Authorisation
Work plan	Translating the plan of action into a yearly energy work plan	Compile energy work plan each year, including time schedule. Ensure that this plan is implemented	Call for cooperation needed to achieve the yearly objectives
Energy scans	Organising energy scans in order to update the plan of action	Contract external consultant, evaluate reports, incorporate recommendations into work plan	Contract external parties in accordance with authorised budget and responsibilities
Manual energy management	Keeping the manual energy management up to date	Modify (parts of) the manual in keeping with latest decisions and revised procedures	
Legislation and regulations, key figures and standards	Keeping abreast of applicable legislation and regulations, and keeping key figures and standards up to date	Follow sector publications, <name of sub sector> announcements and updating relevant matters. Keep individuals involved informed of developments/changes	Consultation with relevant authorities (permit issuer, <name of sub sector> etc.)
Data collection and Monitoring	Reading energy meters and (directing the) compilation of the monitoring reports	Register electricity, gas and water readings or direct this. Compile monitoring reports	Direct meter readings. Request management cooperation in reports on results achieved
Energy reporting	Compiling annual energy report for management	Compile annual energy report indicating progress and results from the work plan	Distribute the annual energy report after management approval
Internal and/or external audit	Periodically performing qualitative audits of the energy management system	Perform internal audits	
Communication	Completeness and accuracy of internal and external communication	Internal and external communication regarding energy management	
Energy contracts	Making recommendations with reference to energy contracts	Request quotes, evaluate quotes, advise management	
Document management Energy Management	A complete, up-to-date energy management archive	Compile and manage the (digital) energy management archive	Updating, deleting, supplementing documents in the file

### Tasks of other individuals in energy management systems:

Position	Task	Responsible for	Actions	Authorisation
<i>Managing director</i>	Energy management programme	Achieving objectives	Evaluate policy statement	Approve policy statement
			Allocate resources for achieving the energy management programme	Approve budget for energy management
	Evaluation	Monitoring and improving energy performance	Periodically evaluate the energy management system	
<i>Operations directors</i>	Energy management programme	Managing and improving production energy performance	Implement energy-conserving measures	Approve conservation measures for production
			Implement necessary corrective measures	
	Training and awareness	Good housekeeping	Motivate personnel with reference to good housekeeping	Inform personnel regarding training options
			Discuss energy aspects during work or toolbox meetings	
<i>Head of Purchasing</i>	Energy management programme	Purchasing energy-responsible materials	Consider energy aspects in purchasing decisions	Approve purchase of energy-responsible materials
Head of Technical Services	Energy management programme	Implementing technical improvement measures	Maintenance of production equipment	
			Implementation of technical changes to production equipment	
		Purchasing energy-responsible equipment	Consider energy aspects in purchasing decisions	Approve purchase of energy-responsible machines

### 2.1.5 Prepare a project plan for energy management implementation

Finally as the last step of the “getting started actions” you should elaborate an energy management implementation project plan which will show you the way for a successful planning and running of the energy management implementation process.

The BESS energy management implementation model (EMIM, chapter 1.1., “Energy Management Model”) shows the different aspects of implementing energy management.

When implementing energy management for the first time or for improving an energy management system substantially it is strongly advisable to compile an own energy management implementation project plan which is tailor made to your company’s situation and priorities. It will show you how to implement energy management, how long it takes and how much manpower is needed for successful planning and running of the energy management implementation process.

You can elaborate the project plan after filling in the business case and the pre-self assessment checklist to give an indication of the quality of the current energy management system.

The ultimate goal of the implementation project plan is to integrate energy management in the organisation to such extent that the PDCA (plan-do-check-act) cycle for continuous improvement of the company’s energy situation is secured.

To succeed in elaborating an energy management implementation project plan it is advisable to commission a specialised consultant who assists or elaborates such a plan. You should consider this as a serious option since consultants are independent, have a lot of experience in that field, have a broader view and know about the most modern techniques.

**The energy management implementation project plan includes the following topics:**

- The objective of the implementation project e.g. the desired quality level of the system
- The activities required in order to achieve the objective
- The actual outcome of such activities like an energy audit, the energy consumption analysis and the planning of energy efficiency measures and feasibility studies are not part of the implementation plan as such but are to be documented in a separate energy action plan (chapter 2.5).
- The project organisation within the company including the personnel needed
- The necessary budget
- The manner in which the quality and planning will be monitored



**The key elements which are part of the implementation of a good energy management system are:**

- an energy policy statement with clear objectives,
- properly determined and assigned tasks and responsibilities,
- sufficient resources available for maintaining the management system and
- regular communication of progresses achieved in the energy management.

**Other important elements include:**

- monitoring to determine whether the energy consumption of the relevant operational units is in keeping with the expectations,
- a system for corrective and preventative actions,
- regularly performing (internal) energy management audits in order to verify the functioning of the energy management system and to ensure continual improvement.

## 2.2 Form your energy team



If you are the energy coordinator of a small or medium-sized organisation you should form an **energy team** after completing the getting started-actions. It supports related activities and acts as a link between the energy coordinator and other departments. The energy team consists of people who have a sound knowledge of individual processes and technologies. Their knowledge might be used to influence energy consumption in their departments and to contribute to the development and support of a company-wide strategy. As practice shows this is necessary because individual departments rarely co-operate to increase efficiency.

To form the energy team the **TRA matrix** (Chapter 2.1.4, “Energy Team”) and the **template of organising an energy management team** (“Energy Team”) are useful.

The energy management implementation team should be retained after the implementation stage to coordinate and regularly assess the energy management system. The team may include:

- a senior manager,
- people who have shown an interest and whose assistance will be of benefit to the smooth introduction of the energy management system,
- a representative from each key function or area so that all parts of the company are represented and participating,
- the financial manager,
- the production manager(s),
- the quality and occupational health and safety managers and
- communications or training staff.

An implementation team should:

- provide guidance and advice to the energy coordinator,
- provide assistance in drafting an energy management policy and an action plan,
- assist in the dissemination of information and programme progress reporting,
- assist in the promotion of the energy management initiatives and
- provide general support to the energy coordinator.

## 2.2.1 Appoint an energy coordinator

Irrespective of a company's size, it is necessary to appoint an **energy coordinator** (energy manager), who will act as the responsible person, at least on a part time position, depending on the size of the company.

The energy coordinator's role is to manage both the company's current energy needs and its future energy strategy in an environment where supply and price fluctuations can have a significant impact on business performance.

The energy coordinator will be a multi-skilled individual with:

- an in-depth understanding of the company as well as its internal and external environments,
- good consultation, negotiation and liaison competency,
- sound knowledge of production and site services,
- solid general technical background and preferably engineering experience and
- project management experience, especially in new systems implementation.

### Key Functions of an energy coordinator

Managing energy consumption within a company requires a number of functions to be performed. These include:

- developing policy and work plan,
- monitoring and reporting energy consumption, performing energy scans and audits, dealing with energy contractual matters,
- researching and identifying best practice energy management,
- implementing programmes and policies to achieve energy savings,
- knowledge on legislation and regulations, key figures and standards
- securing the support of management and staff and
- influencing new work policies, tender specifications and construction briefs.

### A Successful energy coordinator

A successful energy coordinator should:

- link energy into key management systems, e.g. ISO 14001, greenhouse reduction programmes, quality systems or occupational health and safety systems,
- gain control over the way energy is used, ensure it is being purchased in the most economical way and promote good housekeeping and waste reduction,
- measure and monitor energy performance, and compare it with previous years as well as internal and external benchmarks,
- report energy performance simply and clearly to line managers and supervisors, report energy performance to senior management in a format that is integrated into other planning and business reporting processes, ensure investment requests are backed by data and a realistic business plan, take credit for achievements,
- involve staff - seek their input and ideas and share the credit for achievements with those who have contributed to them. This will motivate, create enthusiasm and further achievement.
- promote achievements to senior management and publicise success to staff to ensure ongoing support and enthusiasm for the energy management system.

If the company does not appoint a specific person for these tasks, nobody will feel responsible and you run the risk that the required tasks will not be carried out. In addition, the role and competency of the energy coordinator must be communicated throughout the organisation. The energy coordinator must have the power to ask for support in areas in which he/she has no detailed know-how.



One of the first tasks of the energy coordinator is to get an overview of the information and data which is already available in the organisation. Apart from written documents, there will be a lot of knowledge within the workforce. If appropriate, the energy coordinator should therefore identify people working in energy intensive areas and in areas which have an influence on energy consumption. Typically, these areas are the production, infrastructure and maintenance departments. Furthermore it would be helpful to set up a draft implementation project plan for the board.

### Outsourcing energy management

Some energy management functions may be performed by external consultants. For example, technical consultants can undertake energy audits. Specialists may also be engaged to perform particular tasks, such as tracking and monitoring energy use. Energy performance contracting may also be useful to fast-track and provide external funding for energy projects.

## 2.3 Define your energy policy

Set up a short document in which you devote attention to structurally reduce the energy consumption.

What is the organisation's position on energy management? In particular: What is the relationship between energy management and daily operations?

The **energy policy statement** ("Energy Policy & Regulations") is an official document with which the management explains the position energy management holds in the organisation.

The statement indicates the general direction and describes in general terms where responsibilities lie. The energy policy statement forms the basis for all future effort and measures within the framework of energy management. It is formal by nature, must satisfy clear requirements and contains a number of promises formulated as energy objectives that are to be translated into practical measures. However, the statement is not a formality.

It is a powerful tool that can be used to assess whether the organisation is keeping its promises and whether the policy is truly directed towards achieving the agreed objectives.

An energy policy statement must satisfy at least the following requirements:

- The energy policy statement indicates that the organisation's energy policy is subscribed by the highest level of management.
- The policy states that the organisation satisfies all relevant laws, regulations and other subscribed requirements.
- The policy states that the organisation continually strives to improve and to prevent unnecessary energy consumption.

With the energy policy statement, you have a document that gives direction and ensures you management support.

The difference between the commitment (chapter 2.1.3) and the energy policy is that the commitment indicates the targets of the company regarding energy management while the policy indicates how you are going to reach that targets in general.

### Example 3: Energy policy I

<Type here the name of your organisation> devotes attention to structurally reducing the energy consumption ensuing from its operations, based on:

- the relevant legislation and regulations
- agreements made with <Type here the project or organisation within the framework of which you have made relevant agreements>
- the perspective of optimising operations.

Realisation of the energy policy is achieved by <Type here the name of your organisation> through the implementation of a complete energy management system in which:

- the energy consumption is systematically evaluated,
- the energy flows are mapped and kept up to date,
- energy-conserving measures are planned and implemented,
- the results of the energy-conserving measures are periodically evaluated and
- the activities planned to improve the energy efficiency are continually updated.

In order to implement energy policy, an energy coordinator is appointed and an annual budget is made available. The premise is to apply the resources and time available as effectively as possible by means of a pragmatic approach.

For achieving the energy policy, <Type here the name of your organisation> continually strives to:

- satisfy the relevant legislation and regulations as well as agreements made within the framework of <Type here the project or organisation within the framework of which relevant agreements have been made> ,
- take fitting and effective measures in the areas of technology, organisation and behaviour. <If applicable, type here the regulations or the agreements that form the premise for these measures> ,
- measure, register and verify the various energy consumption figures,
- actively involve staff in the implementation of the energy policy and
- carefully evaluating energy-efficient alternatives at the proper times.

Date..... City.....

The <Type here the name of your organisation in> **executive committee**

**Name:**

**Position:**

**Signature:**

**Example 4: Energy policy II [4]**

Part 1: Statement	Part 2: Responsibilities and processes	Part 3: Energy management plan
<p><b>Declaration of commitment</b></p> <p>Company &lt;&lt;company name&gt;&gt; produces &lt;&lt;product description&gt;&gt; (company background information). As part of our environmental strategy, we are committed to responsible energy management and will practice energy efficiency throughout all our premises, plant and equipment, wherever it is cost-effective.</p> <p><b>Policy</b></p> <p>Our policy is to control energy consumption to:</p> <ul style="list-style-type: none"> <li>▪ avoid unnecessary expenditure</li> <li>▪ improve cost-effectiveness, productivity and working conditions,</li> <li>▪ protect the environment and</li> <li>▪ prolong the useful life of fossil fuels.</li> </ul> <p><b>Objectives</b></p> <p>Our long-term objectives are to:</p> <ul style="list-style-type: none"> <li>▪ buy fuels at the most economic cost,</li> <li>▪ use fuels as efficiently as is possible,</li> <li>▪ reduce the amount of pollution, particularly greenhouse gas emissions, caused by our energy consumption, and</li> <li>▪ reduce, wherever possible, our dependence on fossil fuels through the use of renewable energy.</li> </ul> <p><b>Immediate aims</b></p> <p>To gain control over our energy consumption by reviewing and improving our purchasing and operating practices.</p>	<p><b>Responsibilities</b></p> <ul style="list-style-type: none"> <li>▪ Nominate person responsible for tracking and monitoring energy consumption.</li> <li>▪ Nominate person responsible for expenditure.</li> <li>▪ Nominate person responsible for coordinating energy management activities.</li> <li>▪ Nominate members of the implementation committee and their roles.</li> <li>▪ Nominate person/committee responsible for formulating and implementing energy management policy.</li> <li>▪ State that the energy coordinator will be located in the section(s) most relevant and supportive to the current phase of energy management.</li> </ul> <p><b>Structure</b></p> <p>The energy coordinator will make a monthly report to the line manager on energy management activities and, through the line manager, will make a quarterly report to the Energy Management Committee.</p> <p><b>Lines of communication</b></p> <p>Formal communication on matters relating to the control of energy consumption by end users or budget holders will be directed through the energy coordinator who will, where appropriate, bring it to the attention of their line manager, other senior managers, and to the Energy Management Implementation Committee (include an organisational chart).</p>	<p><b>Resources</b></p> <p>The number of staff employed in energy management (indicate actions to be undertaken by designated personnel), their mix of skills, and the amount of investment (10% of our annual expenditure on energy) correspond with the demands of these activities.</p> <p><b>Review</b></p> <p>All energy management activities will be subject to periodic assessment and annual review in preparation for inclusion in the annual budget.</p> <p><b>Action plan</b></p> <p>During the coming year, the following energy management activities will be undertaken, in order of priority (list activities).</p>

## 2.4 Understand the organisation's energy matters – conduct an energy audit

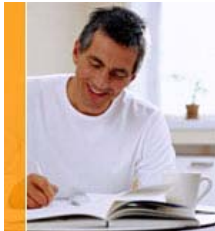
To identify energy saving opportunities in your business it is highly recommended to conduct an energy audit.

An energy audit quantifies trends of current energy use, equivalent greenhouse gas emissions and related costs and recommends energy efficiency improvements.

The scope of an energy audit can vary a lot and can include an entire building or plant, or the energy use associated with a specific process. An energy audit provides the baseline of your organisation's current energy use.

The work undertaken during an audit may include:

- investigating the usage of all types of energy consumed and energy using equipment within the building, complex or plant,
- identifying the energy usage of all major heating and cooling applications and its percentage against total energy use,
- identifying cost-effective measures to improve the efficiency of energy use,
- estimating the potential energy savings, indicative budget costs and payback periods for each recommended action and
- reviewing energy management strategies, including monitoring systems and evaluation processes.



An energy audit can be conducted by the energy coordinator who has been trained and has expertise in carrying out energy audits, or by hiring an energy auditing consultant. If you hire an energy consultant you reap the benefits that this person is independent, has a broader view and knows about the most modern techniques.

The results of an energy audit need to be compiled into a clear and concise energy report. Some of the key elements include:

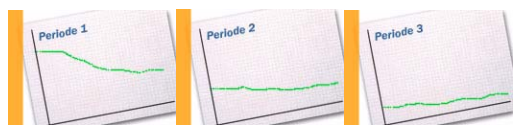
- an executive summary with recommendations in a priority order and estimates of their implementation costs and payback periods,
- relevant plant and process data,
- equipment data with measurements or estimates of the energy consumption for individual plant items,
- actual energy consumption records,
- energy use analysis in graphical form,
- details of energy efficiency improvements,
- a comparison of actual consumption with analysis of estimated results from recommended actions and
- recommendations to include energy management strategies such as monitoring systems and review processes.

To make an energy audit worthwhile, the recommendations from the audit report need to be incorporated into your energy management action plan (chapter 2.5). The types of initiatives that could come from an audit report include:

- changes to operational procedures,
- review of maintenance as it affects efficient use of energy,
- modification or replacement of existing plants and/or equipment,
- further in-depth studies of potential to reduce energy use of particular plant or processes and
- a commitment to ongoing training and information dissemination to increase awareness among staff.

As a supporting tool for an energy audit the “**energy audit data collection sheet**” can be used. This sheet can be downloaded from the BESS website at “Energy Audits& Measures”. In the following chapters filled in examples of the sheet are given.

## 2.4.1 Get an overview of your past and present energy consumption



The data collection tool contains sheets for general, financial and consumption data. By filling in these sheets you get an overview of the energy consumption of the last 3 years in relation to financial and general company data. Structured data collection is fundamental to the energy audit.

As a first step, only existing data sources should be used.

Sources of existing information:

- Invoices
- Outputs from measuring devices
- Test documents
- Manuals
- Other audit reports

A considerable amount of energy information is readily available to an organisation, but it often requires collating and interpreting.

By simply gathering appropriate information, a clearer picture of energy use and costs will begin to emerge. As already mentioned invoices provide the primary source of energy information. However, data may be available from other areas of the business, which if appropriate, should also be integrated. Cost data derived from invoices will be available in the accounting department.

Having collected invoice data, you will need to fill in required data. This step will help to get a better overview of all areas involved. Calculations can be undertaken for areas where the power requirement and the operating hours are known.

The following options exist:

- To obtain an estimate for light consumption, count light bulbs and multiply the number by operating hours and wattage.
- A rough estimate for engines and cooling equipment can be obtained by multiplying their power rating by operating hours.

### Example 5: Data collection sheet

You can find these data collection sheets on [www.bess-project.info](http://www.bess-project.info) at "Energy Audits & Measures".

#### Table to list general data

To list general data of your company and the area around like the name, address, spaces, production times, number of employees etc. this list can be used.

<b>General Data</b>	
<b>Company Information</b>	
Company Name	
Industrial Sector	
Range of Products	
Address	Zip
Telephone	Fax
Web Site	
<b>Site Characteristics</b>	
Total Space (m <sup>2</sup> )	Total Volume (m <sup>3</sup> )
Productive Space (m <sup>2</sup> )	Productive Volume (m <sup>3</sup> )
Office Space (m <sup>2</sup> )	Office Volume (m <sup>3</sup> )
Storage Space (m <sup>2</sup> )	Storage Volume (m <sup>3</sup> )
Prod. Hours per Day	Prod. Days per Week
Prod. Weeks per Year	Prod. Days per Year
Number of Employees	Annual Sales
<b>Remarks - Observations</b>	
Energy Contact Person	
Position in Company	

### Table to list financial data

This table sheds light on financial data. You list the company's annual sales, fuel costs, electricity costs etc.

Financial Data				
Input Data				
No.	Year	2004	2003	2002
1	Annual Sales (€)			
2	Net Profits pre tax (€)			
3	Cost of Products (€)			
4	Electricity Cost (€)			
5	Diesel Cost (€)			
6	Gas Cost (€)			
7	Other Fuel Cost (€)			
8	Total Fuel Cost (€)			
9	Total Energy Cost (€)			
10	Total Production (ton)			
11	Electricity Cons. (kWh)			
12	Diesel Cons. (kWh)			
13	Gas Cons. (kWh)			
14	Other Fuel Cons. (kWh)			
15	Total Fuel Cons (kWh)			
16	Total Energy Cons (kWh)			

### Table to list Output data

The benchmarks in this list are automatically calculated in the excel sheet. They tell you about different ratios - e. g. between the total energy costs and the net profit or the total production.

Output Data				
No	Year	2004	2003	2002
17	T. En. Cost / Net Profit (9/2)			
18	T. En. Cost / Cost Prod. (9/3)			
19	Elec.Cost / T. En.Cost (4/9)			
20	T. Fuel Cost / T. En.Cost (8/9)			
21	Elec. Cons. / T.Prod. (4/10)			
22	T. Fuel Cons. / T. Prod. (15/10)			
23	T. En. Cons. / T. Prod. (16/10)			

### Table to list consumption data

If you fill in this table you can easily see the monthly energy consumption of a certain year and the ratio between the total energy consumption and the production

Consumption Data I							
Energy Consumptions 2004 (kWh)							
Month	Electricity	Diesel	Gas	Other	Total Energy	Production (ton)	T. Ener. / Prod.
Jan.							
Feb.							
Mar.							
Apr.							
May							
Jun.							
Jul.							
Aug.							
Sep.							
Oct.							
Nov.							
Dec.							
<b>Total</b>							

**Table to list productive equipment**

Productive Equipment I				
No.	Machine Type	Nom. Power	Constr. Year	Oper. Hrs/Day
1				
2				
3				
4				
Remarks:				

You only have to list the type of the machines, their nominal power, construction year and how many hours per day the different machines operate.

**Table to list auxiliary equipment**

Auxiliary Equipment					
No.	Machine Type	Nom. Power	Cons. Year	Hrs/Day	Fuel - En.
1					
2					
3					
4					
Remarks:					

In this table you can fill in the machines of your auxiliary equipment. Data like the nominal power, the year of construction, running hours per day and the fuel or energy consumption are to fill in.

**Table to list building data**

The following table should be used to describe the building your company is accommodated in: the year of construction, different spaces, information about the building services, etc.

Building Data	
Year of Construction	City
Total Space (m <sup>2</sup> )	Total Volume (m <sup>3</sup> )
Number of Blocks	Number of Floors
Heating Area (m <sup>2</sup> )	Heating Vol. (m <sup>3</sup> )
Cooling Area (m <sup>2</sup> )	Cooling Vol. (m <sup>3</sup> )
<b>Insulation:</b>	
<b>Windows:</b>	
<b>Shadowing:</b>	
<b>Use of Renewables:</b>	
<b>Energy Conservation:</b>	
<b>Heating System:</b>	
<b>Control Systems:</b>	
<b>Cooling System:</b>	
<b>Control Systems:</b>	
<b>Lighting System:</b>	
<b>Control Systems:</b>	
<b>General Remarks:</b>	

## 2.4.2 Make a survey on energy use and identify significant energy users

As a next step, you will identify areas where no or little knowledge about the energy consumption is available. It will then be necessary to think about measuring the energy consumption of individual processes, plants or devices.



The measurement should be as close to the energy consumer as possible. If it is necessary (e.g. due to high energy costs) to collect data regularly, an automatic system should be installed.

The system analysis is only as good as the quality of the data used. Information based on the analysis of poor data will be meaningless. The accuracy of data as well as the consistency of data collection methods are of considerable importance.

It does not make sense ensuring that a meter is 100% accurate, or that cost data are calculated to five decimal places, if the person responsible for collecting data reads the wrong meter or calculates costs from estimated invoices.

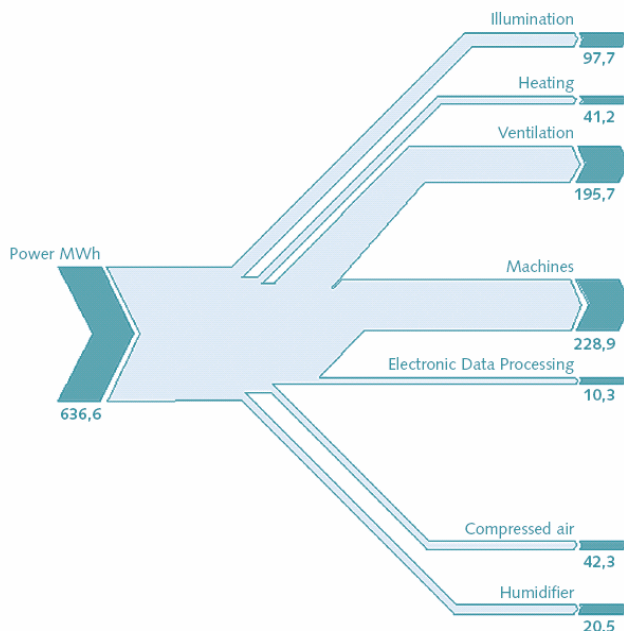
It is highly important that follow-up calculations and the development of indicators are based on real data rather than on estimates.

With the data collected to this point, the energy system should be visualised with an energy flow chart. This is a graphical representation of all relevant energy fluxes in the company.

A simple flow chart can be designed to illustrate energy fluxes as shown in the Sankey diagram of a joinery energy system. This kind of illustration can be prepared using professional software or by hand.

The goal is to identify the organisation's energy flows and the associated quantities. The different flows must have the same physical units.

The width of the flow depends on the energy consumption of the system or machine.



The example shown on the left side only considers the electricity flow. If other energy sources are used, it is useful to prepare a second flow chart for heat, for instance.

After the preparation of the simple energy flow chart, it is necessary to decide:

- Which areas need more analysis?
- Which machines and processes are responsible for most of the energy consumption and will therefore have to be analysed in detail?

Figure 6: Example of an Energy Flow Chart – Sankey Diagram [5]

### 2.4.3 Identify key factors that influence energy consumption

Having carried out this breakdown of energy consumption, specific energy consumptions should be determined and energy conservation opportunities identified via benchmarking, experience and knowledge of good practices. For these reasons energy audits are usually performed by qualified energy professionals.

The energy audit data collection sheet of the BESS project can serve for a “preliminary audit”. It provides the baseline of specific energy consumptions and identifies the significant energy conservation opportunities.

Since energy management is a continuous, multi-step process companies can start from the preliminary audit and then move to the system specific and comprehensive audits.

### 2.4.4 Identify energy-saving opportunities

#### Description of good housekeeping measures

Good housekeeping (also GHK, “Energy Audits & Measures”) is, as the words already indicate, taking good care of the resources of your company, in this particular case of energy.

In principle good housekeeping measures are based on common sense, not on high-tech or large modifications. Therefore, almost by definition, good housekeeping options are easy to implement and for free or cheap! Pay back times are extremely short and savings are instant.

Practice has shown, that in many enterprises the amount of energy that can be saved by good housekeeping is in the range of 25 to 50% of the total energy saving potential. The total energy saving potential would include more expensive measures and modifications of energy-infrastructure or production processes.

To see if good housekeeping measures are possible, you can ask yourself the following questions for each item that uses energy:

- Do I have to use this device?
- What can I do to make it use less energy?
- Can I make it use a cheaper form of energy?

It may be beneficial to ask the help of an expert to answer these questions.

The results of good housekeeping are:

- elimination of energy-users that are not needed,
- minimisation of energy losses,
- usually also improved operational procedures (also your production processes may benefit),
- optimised production level (increased efficiency = less energy per product) and
- savings on out-of-pocket costs for energy.

#### Measure lists

Measure lists (chapter 3.6) can be a useful tool for a company that is investigating the energy saving options subsequent to the results of an energy audit.

These lists support decisions on implementing energy efficiency measures and on feasibility studies within the framework of an energy action plan. Measure lists offer the company descriptions and impacts on energy consumption of potential measures that can be taken. Furthermore, these lists often refer to the payback times of these investments (short-term, medium-term or long-term).

Measure lists can be separated into two distinct categories: horizontal measure lists and industry-specific measure lists. Horizontal measure lists (“Energy Audits & Measures”) refer to measures that can be taken in any industry, whilst branch-specific measure lists (also available at “Energy Audits & Measures”) refer to measures that can be taken in specific industrial branches.

**Example 6: Abstract of the horizontal energy efficiency measure list**

**BESS - Benchmarking and Energy management Schemes in SMEs**  
**Horizontal energy efficiency measure list**  
**PRODUCTION PROCESSES**  
**Thermal energy**  
**Heat generation**

<b>Low-cost / short term opportunities</b>	
<b>Energy saving opportunity</b>	<b>Action to check</b>
1. Reduce excess combustion air to minimum	1. CO <sub>2</sub> /O <sub>2</sub> measurement
2. Maximise completeness of combustion	2. Soot/CO measurement
3. Maintain boiler cleanliness (soot/scale)	3. Monitor for rise in flue gas temperature
4. Repair (replace) boiler insulation	4. Periodic inspection of boiler insulation condition.
5. Insulate feedwater tank – cover tank	5. Check possible feedwater temperature losses
<b>Higher cost / longer term opportunities</b>	
<b>Energy saving opportunity</b>	<b>Action to check</b>
1. For rapidly varying demand, convert one or more boilers to live accumulator (buffer tank).	1. Monitor/evaluate demand change patterns.
2. Alter controls to “High-Low-Off” or “modulating-Low-Off”	2. Monitor/evaluate demand change patterns.
3. Install flash steam heat recovery	3. Consider in large capacity situations with high (continuous/frequent) blowdown.
4. Improve combustion controls.	4a. Provide adequate heat input to meet demand. 4b. Minimise fuel/pollution. 4c. Protect personnel/equipment.

The results of your audit and the analysis of energy saving options should be documented in the energy action plan.

## 2.4.5 Set up a legal register



Find out the legislative & regulative framework that influences your company. What directives do you have to follow? What are the emission limits? etc.

As energy consumption has high economic impacts, the EU parliament and national governments have created a legislative and regulative framework to facilitate a more efficient way of energy consumption. Following these requirements is an essential part of a well functioning (energy) management system.

The best way to keep track of all requirements for a company is, to set up a **legal register** (“Energy Policy & Regulations”) which contains all regulations the company must comply with and check the state of compliance regularly. It is important that one person is in charge of updating the legal register regularly and that all persons who can influence the achievement of objectives are informed and aware of the requirements. It is also important to create a procedure for saving all files which belong to the legislative and regulative framework of the company.

### Example 7: Legal register

Legal register of:		COMPANY XY		
Regularly updated by:		Mr / Ms XY		
Date of last update:				
Date of next update:				
Number	Act / Regulation / Directive	Short description of content	Process / site affected by the regulation(s)	Person in charge for meeting requirements
1				
2				
3				
...				

## 2.5 Compile an energy action plan

There are always several ways to achieve goals and to realise improvements. The management will normally try to find the optimal solution for all demands.

In practice there arise obstacles which prevent successful implementation:

- lack of money and time,
- little know-how about the energy system and
- preconceived opinions.

Therefore it is necessary to establish a firm procedure which ensures the successful realisation of improvements. The following subsections focus on this procedure.

Within the development of an energy programme it is, first of all, necessary to get an overview of possible areas of improvement.

The energy team will collect all improvement possibilities and set up a system for a transparent and comprehensive procedure from the selection of actions to the implementation. This ensures that the best solution will be selected and that employees support the improvement activities.

The essential and most important part of the energy management implementation model (EMIM) is the preparation of an action plan ("Energy Audits & Measures"), where companies (with or without help of consultants) set up an energy conservation measure list, listing it according to implementation costs into: no cost, low cost and high cost actions. The actions should be described in a simple way with clear aims, saving targets and definitions of roles and responsibilities for its execution.

The action plan is part of the plan phase within the cycle for continuous improvement of energy efficiency.

It documents:

- the commitment of your company to carry out current and future actions (for the duration of the plan e.g the coming four or more years) for further steps to implement energy management and actions to be taken to increase energy efficiency of the company and
- an overview of the current status of the planning and the implementation of the actions so far (the energy saving register part contains the achievements).

The energy action plan contains the following items:

- The commitment and ambitions related to the energy policy of your company
- The energy (specific) consumption figures of your company in the reference year\*
- Relevant legal and regulatory obligations
- A description of the energy situation (historical development of the energy consumption, an energy consumption analysis, the energy saving register, the actual quality of the energy management system)
- Energy saving options and selection criteria for saving actions/ measures
- Planned actions (per year for the duration of the plan) for savings and improving energy management
- Planned (feasibility) studies (per year for the duration of the plan) for identified attractive future saving options and other relevant activities
- Description how the (yearly) monitoring, targeting and benchmarking is carried out

\* The reference year is the year the first action plan was made or another appropriate fixed year of which the (specific) energy consumption figures are known. The reference year should preferably be representative for the current products and circumstances of the company.

## Example 8: Energy action plan

### FrontPage

Title: Energy Action Plan period 20XX – 20XX

Company name:

Sector:

Company Name

Postal address Zip code Town

Energy Coordinator Name

Telephone, Fax and E-mail address

Place, date, signature, name and function of the responsible person in the company  
(if applicable consultant involved)

### Executive summary

Short description of the company, the commitment and ambitions within the plan period of XX years (level energy management system of company and the total planned energy savings and improvement of the energy efficiency index)

### Table of content

- 0. Executive summary
- 1. General data
  - 1.1 Background for the energy action plan and co-operation or obligations with/towards other parties
  - 1.2 Energy consumption of the company in the reference year
  - 1.3 Specific Energy Consumption figures of the reference year and the last years (e.g. 4 years)
  - 1.4 Relevant legal and other regulatory obligations
- 2. Description of the energy aspects
  - 2.1 Overview of energy consumption per energy category and total (in GJ)
    - 2.1.1 Short description of the type of company – products and processes
    - 2.1.2 Overview of historical energy consumption figures and production per energy category & total (in GJ)
    - 2.1.3 Overview of energy consumption per energy category and process category (e.g. Sankey diagrams)
    - 2.1.4 Overview of total primary energy consumption per process category
    - 2.1.5 Energy saving register part I (historical overview of energy saving measures per year over XX years)
  - 2.2 Actual level of implementation of the energy management system
- 3. Energy efficiency possibilities
  - 3.1 Description of audits undertaken, methods, analysis, measure lists used and outcome
  - 3.2 Selection criteria like maximum pay back period, other policies, opportunities and restrictions
  - 3.3 Energy saving opportunities
- 4. Planned Actions
  - 4.1 Starting points, calculation assumptions
  - 4.2 Planned measures\* (savings & energy management) and energy savings register II (for the plan period per year)
  - 4.2 Planned (feasibility) studies of saving options and other relevant activities (for the plan period per year)
  - (4.3 Identified options which are not feasible)

\* planned measures are divided in: energy management and good housekeeping, energy saving projects in processes, energy saving projects in utilities & buildings and strategic projects. Strategic projects are projects which are initiated within the company for other reasons than energy saving but which have energy saving effects.

- 5. Monitoring, targeting and benchmarking (description, method and budget allocation for the yearly M&T/BM activities)

### 2.5.1 Set objectives and targets

In the action plan, the management defines the objectives to be achieved within the framework of the BESS project. It is important for these objectives to be known within the organisation. The energy team has then to develop a written energy programme. The energy programme includes 5 points about the planned activities:

- Quantitative goals
- Detailed budget
- Deadline for completion
- Responsibilities
- Description of the tasks

Staff receive a clear overview about necessary activities in the area of energy efficiency. The information is needed to present a clear idea about actions and requirements to be fulfilled by the staff. The tasks to achieve the aim are clear and the improvement proposal will be translated into action.

### 2.5.2 Allocate adequate resources



Make sure that for all actions you plan to perform within the next time adequate resources (human, financial, technical) are available.

## 2.6 Promote and implement energy efficiency measures

### 2.6.1 Promote energy-efficient practices and awareness amongst employees

All employees must take their responsibilities and perform the tasks in such a way that they optimally contribute to energy management. They must be continually aware of the importance of the part they play in energy management.

The awareness, that the potential to save energy exists, clear job descriptions, unambiguous work instructions and supplementary training are vital to the success of energy management. But it needs more to successfully implement energy management. The individuals must be and remain motivated to make a contribution.

For continual improvement of energy management, tasks must be properly performed. But it is at least as important to get people thinking, making suggestions and trying to achieve more than expected. The individual him/herself must be motivated for energy management.



Give feedback regularly and celebrate success with your staff. Give them the credit they deserve. This will ensure that the eyes and ears in production will be attuned to identify irregularities and non-conformance.

You can generate and enhance people's motivation by a forceful statement of the board's involvement. And by clearly demonstrating your appreciation for results achieved and individual initiatives that result in more efficient energy consumption.

A simple way to motivate staff is to hand out leaflets or posters, including information about easy ways to reduce the energy consumption. Easy steps like switching off lights when leaving a room, reducing room temperature instead of opening windows and switching off office equipment.

Such an information campaign was undertaken in a large office building in Vienna. Before the campaign the total energy consumption was 9.8 Million kWh per year. Costs were € 819,040.

As a result of the campaign the energy consumption decreased by 2.5 %, equivalent to 250,000 kWh and € 20,894 in one year.

Another important factor is green procurement. That means the procurement of products and services that have less impact on the environment than their traditional counterparts. A goal of the analysis might be to **identify areas for which purchase criteria for energy savings can be used**. Higher initial investment in energy saving equipment can be quickly profitable because of lower operating costs.

### 2.6.2 Train key personnel in energy efficient practices

You have mapped out who is to do what. Now the time has come to determine whether the relevant people have the skills and know-how to perform their newly-assigned tasks. It would certainly be wise to talk with the head of personnel.

Supplementary training can consist of vocational training courses that directly contribute to the efficient use of energy, such as energy-efficient driving for chauffeurs. But it can also consist of training programmes that have an indirect effect, such as training courses for communicative, social and organisational skills, or a project management course for the energy coordinator.

With the proper training, you provide the right know-how and skills to properly perform the new task. It also makes the individual aware of changes in his daily tasks and the importance being placed on energy management.

### 2.6.3 Establish an Energy Savings Register

The energy saving register is a part of the energy action plan. In this energy savings register you list the year in which measures are in use, the savings in that particular years, the contribution improvement and an explanation for the following four parts: energy management and good house keeping, energy saving projects in processes, energy saving projects in utilities and buildings and strategic projects so that you can see your progress in the past. To list the future energy savings another energy savings register can be used. You can find these two lists in chapter 3.7 and 3.8.

### 2.6.4 Ensure energy efficient operation and regular maintenance

Ensure the efficient design, purchase, operation and maintenance of significant energy users.

### 2.6.5 Define your documentation system

The most important elements involved in energy management must be verifiably organised and defined in written or electronic documents. These documents must be readily accessible. Therefore it is advisable to organise them systematically.



What do the documents pertain to?  
Which part of the organisation?  
Which activities?  
For which positions are they intended and who needs to work with them?

The documents must be clear and readily available at the location where they are needed. If the energy consumption is recorded daily by the machine operator, s/he needs easy access to the right forms.

The documents must be up to date and complete. Outdated work instructions do not contribute to energy management. It must be easy to keep the documents up to date in the documentation system. Outdated documents need to be removed.

If your organisation already has a management system into which energy management is being incorporated, it is only logical to use the documentation system in the existing management system.

A sound documentation system reflects the energy management system. It reflects how the various elements are related and how they are collectively intended to ensure that energy management functions as a coherent system.

The documents define the measures taken, why they were taken, and which energy aspects they pertain to (technology, organisation, behaviour). They indicate how these measures are implemented in actual practice and the various activities involved. By continually documenting what, how and why, you will satisfy two important requirements for an energy management system: **verifiability** and **understandability**.

Properly compiled work instructions, for example, to accompany a measure will sufficiently reflect that measure's implementation. Simple, clear, current documents compiled coherently will make energy management manageable, and will give you the tools you need during the evaluation and monitoring to demonstrate that you have an energy management system.

## 2.7 Check your energy performance

You have agreed to a number of measures in the action plan that will directly or indirectly result in more efficient energy consumption. Your organisation is prepared for energy management and the measures have been implemented in accordance with the action plan.



The question now is whether the measures have the desired effect. This cannot be determined by simply recording the meter readings. The data must be correctly analysed.

What kinds of data are needed? Data that will enable you to compare the energy consumption with a reference value and with which you can explain the improvement or deviation. Thus you must not simply start to collect data. What you need is a proper reference. The major influential factors must also be recorded: data regarding the machines (technology), regarding the organisation, and regarding the production (volumes, times).

### 2.7.1 Measuring period

When recording meter readings, the circumstances that have affected energy consumption must be taken into account. One obvious factor is the production quantity. Measuring only during “quiet” periods is useless. Correction of the data is also important. Peak loads should not affect insight into the actual energy consumption. Thus the measuring periods in which the data are collected must be carefully determined and defined.

### 2.7.2 Production

Record not only the meter readings for the various machines and the quantity of produced products.

Also register **which** products were made, and **when**. This makes it possible during the analysis to make a comparison between the energy consumption as registered and the consumption to be expected based on the quantity and specific energy consumption of the product.

### 2.7.3 Influencing factors

Does the season significantly affect the extent of energy consumption? Record as much relevant climate data as possible so that you can calculate the extent the weather influences energy consumption.

### 2.7.4 Analysing data

Are the measures satisfactory and have they resulted in more efficient energy consumption within the organisation? Or do they need to be modified or supplemented? The measures taken must ultimately be expressed in concrete figures. Only then you can assess whether the results satisfy the objectives.



Analysing data is a difficult task. General conclusions can often be drawn, but if you want detailed insight into the effects of each individual measure on energy consumption, statistics as a helpful tool can shed light on that topic.

To make sure you are comparing similar data, you need not only the recorded measurement data but also the data you have collected regarding the measurements. The energy consumption as measured will often need to be corrected for significant changes, such as putting new machines or buildings into operation, malfunctions or climate factors. Thus it is extremely important to have an accurate reference value to compare with.

### 2.7.5 Define indicators on energy performance

Energy performance indexes are most typically constructed in terms of the development of specific energy consumption by end-product over time. They allow companies and competent authorities to watch how their energy efficiency evolves over time and how they compare to other companies within the same sector. In this respect energy performance indexes are a variety of energy performance benchmarking. Both Ireland and the Netherlands have created energy performance indexes (EPI), while Norway has a web-based benchmarking scheme for SMEs that is based on comparing the specific energy consumption (SEC) of the companies, (e.g. kWh/kg product). SECs are calculated according to the total energy use and total production of the site.

In order to secure consistency as well as to facilitate the understanding of products etc, the standard classification lists with respect to country codes, sector codes, product codes, energy codes, climate correction factors, etc. should be used. However, these standards will have to be supplemented by a set of specific product correction factors due to energy circumstances in this project.

### 2.7.6 Monitoring and targeting

Monitoring and Targeting (M&T) is an essential part of the company's energy management system (the "check" within the PDCA cycle). Besides regularly checking the actual level of implementation of the energy management system by using e.g. the full energy management checklist, information handling techniques can be used to manage the energy usage effectively within the company. There are many similarities with other production and financial information systems and monitoring and targeting (M&T) should be developed in accordance with the organization's existing management systems. It can be regarded as an extension of quality-led activities and can even be the starting point for more general improvement. Only by regularly measuring and comparing insight into the effectiveness of the measures taken can be gained and any non-conformance will be identified.

The Monitoring and targeting technique uses regularly collected data on energy (or other sources) use, production, efficiencies etc. in a converted way of performance indicators. The M&T analysis of (energy) performance indicators allows the company to evaluate its energy performance against its energy targets, industry sector norm (see also chapter 2.8.2 benchmarking), efficiency changes in time, and allows systematically checking of compliance with relevant legal and other requirements. The data should be collected on a regular basis:

- Periodically as part of the PDCA cycle - e.g. yearly to check the progress of and compliance with the energy action plan and to update the relevant (yearly) energy consumption figures
- Continuous attention for short term adjustments (shift, day, week, month).

As we have described before different data sources and registration methods can be used (metering and other data from data information systems, spreadsheets etc.).

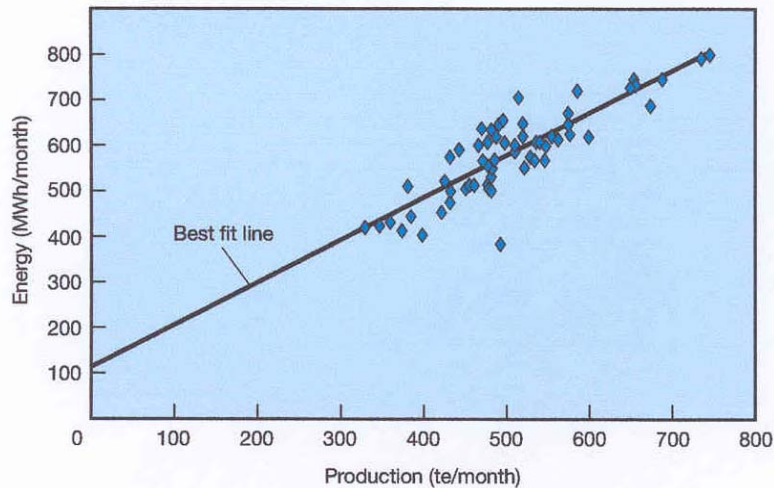
Since the M&T addresses past energy performance and sets up trends or expected energy performance, it is suitable to be used in combination with the energy saving register to provide energy saving targets and to check if the targets have been achieved.

There are four main elements of a successful M&T system:

- **Data collection:** Most of the data needed for M&T are available from existing meter readings, energy bills and production-related data.
- **Analysis:** Analysis transforms data into useful information on which action can be taken. M&T software is available, although standard PC spreadsheets are quite adequate for many applications. Different charts can be drawn, e.g. energy use vs. production, specific energy consumption vs. production, CUSUM graph (Cumulative Sum of variances; This technique not only provides a trend line, it calculates savings/losses to date and shows when the performance changes. CUSUM represents the difference between the baseline and the actual consumption data points over the baseline period of time ) etc. Best fit lines (targeting) are used to predict expected energy consumption and regular control (monitoring) discovers nonconformance of the process leading to action to improve the performance.
- **Reporting:** Reporting ensures that the right information reaches the individual with the ability and responsibility for action. Information needs to be timely, concise and delivered in a form that is appropriate and useful to the recipient.
- **Taking action:** Monitoring and targeting does not make sense if subsequently no action is taken: without action the data collection and analysis are a waste of effort! M&T needs to be geared to the management activities of the company so that action is taken and energy-saving results are achieved. Chapter 2.9 describes how further actions should be carried out within the periodical (e.g. yearly) cycle of continuous (energy efficiency) improvement.

In a textile factory, the graph indicated that the measures taken did not have any effect. Until it was learned that in the relevant period an uncommonly large quantity of fabric was made with a thickness requiring more energy in the drying process.

M&T can be applied to single, or groups of processes or buildings, or entire factories. The initial choice will depend on available energy metering, but over time this will be refined by the increasing understanding of areas where energy can be better controlled. M&T techniques are not limited only to energy usage but *are* equally applicable to water consumption and production indicators such as scrap rates or yield.



**Figure 7: Chart to demonstrate important features of the energy demand**

There are three important features on the chart:

- **Intercept (c)** - The energy that would still be required even if production was reduced to zero (in this case it is 113.5 MWh/month).
- **Slope (m)** - The amount of energy required to process each additional unit of production, leading to the process efficiency.
- **Scatter** - The distribution of the data points away from the best fit line, indicating the variation in energy per unit production from one period to another. Large differences between scatter and best fit lead to the conclusion of poor process control.

Once a basic level of management control has been achieved, further savings depend on extending M&T to other areas of the plant or company and increasing the level of sophistication.

## 2.8 Check your energy management system and energy efficiency

### 2.8.1 Complete the energy management checklist

At the beginning of your energy management implementation procedure you filled in the pre self assessment checklist (chapter 2.1.2) which includes seven questions. At this stage you have already a good overview about your energy situation. This is an appropriate time to complete the energy management checklist consisting of 26 questions. It is recommended to fill in this list ("Full Energy Management Checklist") annually to see the improvement of the implementation.

## 2.8.2 Benchmark your specific energy consumption

### Benchmarking



By comparing the data with data collected earlier, you will gain insight into the extent to which the measures taken within your organisation have been successful. All important comparison values (benchmarks) are listed in the data collection sheet (chapter 2.4.1) and the business case (2.1.1, 3.5) you filled in at the beginning. After a number of analyses, it will become clear whether the organisation is consuming energy more efficiently.

### But how are you doing in comparison to other organisations in your sector? And on the international level?

You may be making excellent progress, but others may be doing even better. Compare your data (e.g. energy use per unit of physical production otherwise known as energy intensity or specific energy consumption (SEC)) not only with earlier data from your own organisation, but also with data from other organisations in your sector, country and if possible even on the international level. Then you will know how your organisation is doing in comparison to similar organisations.

Within the BESS project an international benchmarking system has been developed. The benchmarking tool has strong links to the e-learning module.

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.

Energy 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. Energy benchmarking and monitoring allows your company to identify deficiencies and adopt better practices.

### Ad-hoc benchmarking and registered benchmarking for pilot companies

On [www.bess-project.info](http://www.bess-project.info) you can enter the BESS benchmarking scheme. You can download benchmarking data collection sheets for your specific sector. These sheets are used by the pilot companies to collect the necessary data for the BESS benchmarking scheme. After the pilot phase there will be the possibility for interested companies to put these required data online into the system and benchmark their specific energy consumption with the specific energy consumption of the registered companies.

The BESS pilot web-based benchmark application is flexible regarding establishment of new benchmark-classes and new indicators. It has options for adjustment regarding external factors like climate (heating and cooling), capacity utilisation, production mix and boiler efficiency.

The web-application system is designed to enable yearly benchmarking of energy data in Europe based on national data gathered by national systems. The illustration below describes how pilot companies, national systems (for energy reporting) and the BESS web application interact.

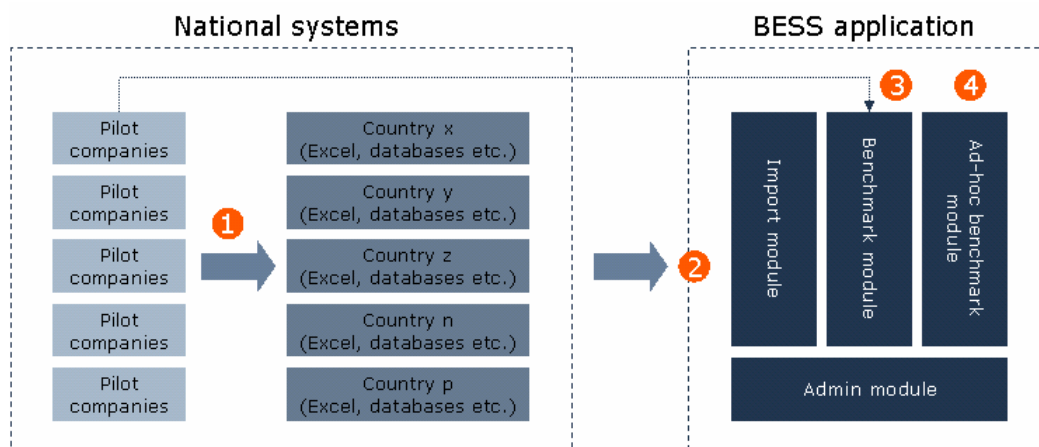


Figure 8: Interaction between pilot companies, national systems and the BESS web application

1. Pilot companies report energy data into national systems.
2. National systems' quality assures registered data and distributes it to BESS.
3. Pilot companies access BESS-application and benchmark their own energy use with other companies in the same industry (BESS registered companies).
4. Non-registered users can use an ad-hoc benchmark module.

The access to the BESS benchmarking application has several provisions to ensure access to correct data and to safeguard confidentiality of the data to be provided by the pilot companies.

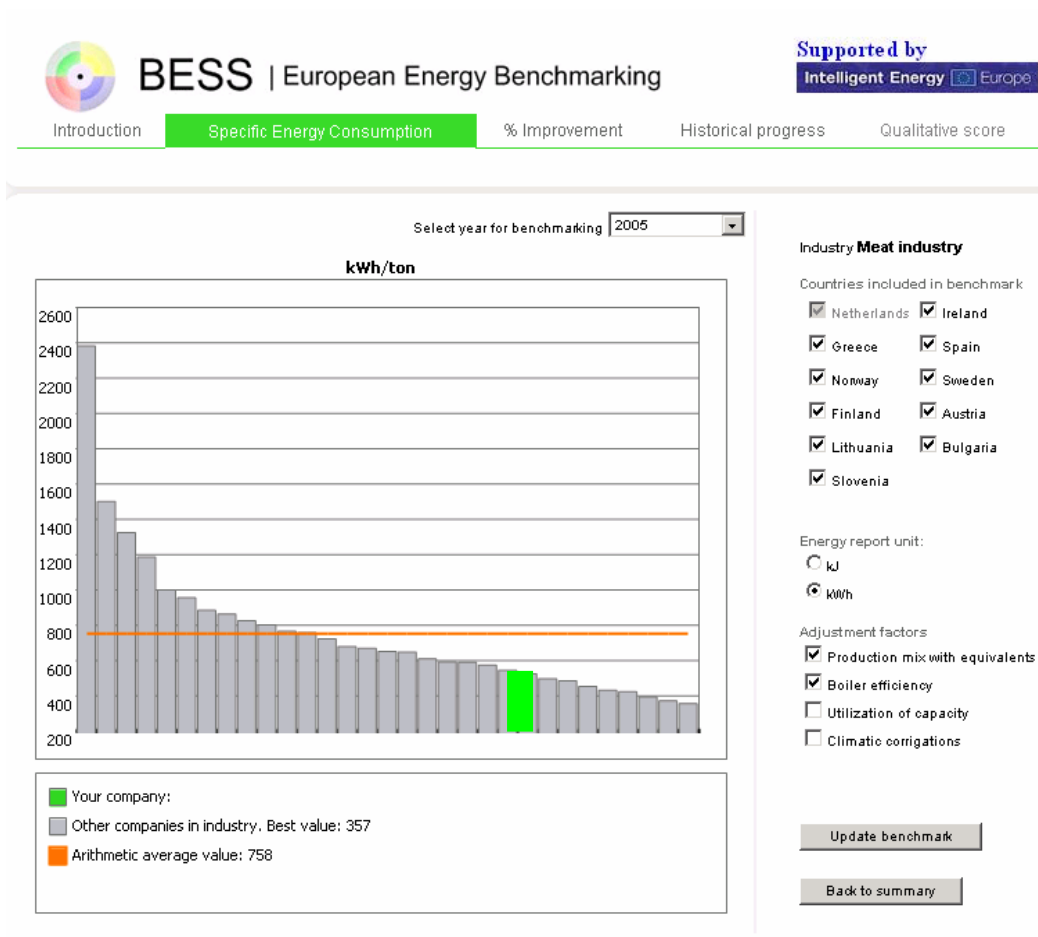


Figure 9: Output of the Benchmarking scheme

The benchmarking results can be influenced by specific production procedures, the type of companies and other circumstances differing from country to country. Companies taking part in the benchmarking are in the optimum position to interpret their results best and to identify key opportunities to improve their own energy efficiency.

### Non-conformance

The continuous measurements, audits and checks generate a flow of data. By registering and analysing these data, you can identify consumption fluctuations caused by specific circumstances from non-conformance.

Non-conformance means that you will not achieve an objective as defined if you continue in the same manner. You respond to non-conformance with corrective or preventative measures.

## 2.9 Achieve further efficiency improvements

### 2.9.1 Revise the implementation process

In the “act” phase, you implement measures so that objectives can be achieved as yet and so that the energy management system can be improved. A distinction is made between corrective, preventative and supplementary measures.

Corrective measures are measures that are related to machine settings, control settings, or the location of measurement indicators. The measure as implemented is good but does not yet function for 100%. What is involved is fine tuning the measure.

Preventative measures are intended to prevent non-conformance from occurring in the future. The measure as implemented is good, but the non-conformance is caused because the working instructions, targets, etc. have not yet been modified to fit the new situation or because there are no work instructions for the new situation, etc.

Supplementary measures:

- are taken when it is learned that the objectives cannot be achieved,
- pertain to measures already implemented respectively to the system,
- go beyond optimising the machine or modifying the work instructions.

Some aspect may have been missed. You must once again make a study. Why is the measure or the system not working? You may need to consult with the management for these supplementary measures.

### 2.9.2 Improve procedure and start again

When modifying the measures (ACT), you once again apply the circle, but now in detail. You plan the improvements, implement them, check whether they have helped, and modify if necessary. Then you check whether this has helped, etc.

Even when you are on schedule and the measures are working, you continue to pass through the circle. In order to at least maintain the current level, you must regularly check to ensure that everything is still functioning optimally and make any necessary modifications.

But you will also need to assess new possibilities for improving your energy efficiency. Then you pass through the circle again. But now the premise is the new measure that has been added to the action plan.

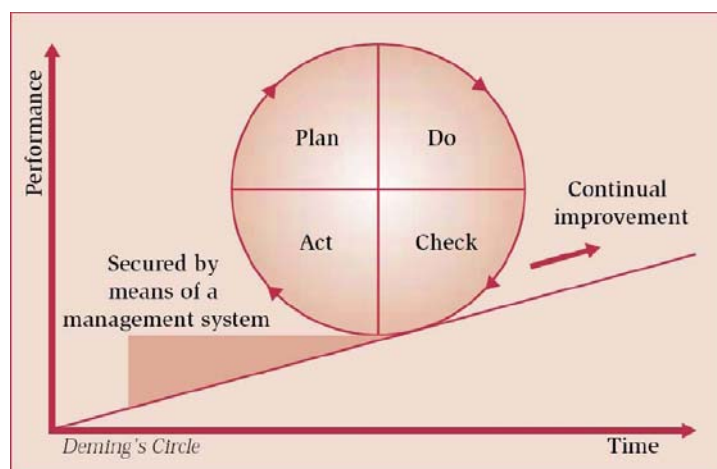


Figure 10: Deming's Circle

### 2.9.3 Review and corrective actions

Energy management systems in place need regular review to ensure that the system is functioning properly and on a continuous basis. Possible improvements can be identified during these reviews with strong ambition to prepare a set of corrective activities in the next steps of the energy management cycle.

Since an energy management system is a continuous process, each element must deliver the required performance in order for the whole process to be running smoothly. If one of the steps is not being implemented properly this can affect other elements and the performance of the whole programme. Therefore, the **energy management review** is vital for continuous improvement of the system. The outcome of the review is fed back into the whole process to ensure that improvements are made, the system is working effectively and continuous improvement achieved.

It is essential to review the key elements of energy management regularly, at least on an annual basis, as an annual task or more likely on a rolling programme basis, either as internal or external energy management check. To carry out the energy management review you will need to plan your review, inform others, collect information, evaluate it and feedback the findings to ensure continuous improvement of your activities. **The full energy management checklist** (see chapter 3.2) is a useful tool to identify the quality level of your energy management and the shortcomings in it.

Depending on the size of your organisation, the actual time to conduct the review could take anything from several days to more than a week. You will need to start planning the review well in advance in order to gather the background information and inform the necessary people. The review is considered completed when the findings have been reported, actions (including description of follow-up, outcome monitoring) identified and responsibilities assigned. This does not only relate to the improvement of the energy management system but also to the comparison between the outcome of the actual energy efficiency actions carried out and the plans and ambitions laid down in the energy action plan. The outcome of energy performance check (see chapter 2.7) and in particular the **monitoring & targeting exercise** (chapter 2.7.6) is the basis for identifying the follow up.

Top management must review energy management to ensure its continuing suitability, adequacy and effectiveness. The **management review** should address the possible need for changes to the energy management and identify areas where improvements can be made. Finally, management should document the review and make the necessary changes to the energy management with action items implemented, monitored and reported.

The management review is one of the key elements in ensuring that top management is involved and committed to the management of energy in the organisation. The final responsibility rests with top management and the review is a means of putting this into practice and closing the management loop on energy management.

The management review addresses the suitability, adequacy and effectiveness of energy policy, objectives, targets and energy performance indicators and energy management overall.

The review should assess the results of any audits or surveys conducted since the last management review and the current status of any recommendations, the key factors that influence energy consumption, the adequacy of resources for the continued operation of energy management, current and proposed regulatory compliance in relation to energy management etc.

To ensure that recommendations are taken into account, **the management review must be documented and the energy team must agree follow-up actions and designate persons responsible for implementing the actions.** This can be determined in a review meeting which can be carried out in a matter of hours, however, the preparation for the meeting may begin weeks or even months before the meeting date.

### 3 Supportive tools presented within the handbook

#### 3.1 Energy Management Specification

<b>BESS Energy Management Specification</b> <i>(italic requirements are desirable)</i>	<b>Explanatory notes (adopted from the EIE EMS-Textile project)</b>
<p><b>1 Energy policy</b></p> <p>1.1 Energy policy statement</p> <p>1.1.1 The organisation has specifically included energy as an important aspect of its (environmental) policy. The energy policy is appropriate to the environmental impact of the operations.</p> <p>1.1.2 The organisation has explicitly defined that legislation and regulations, - and if applicable - any LTA or the energy aspects of an environmental covenant will be complied with.</p> <p>1.1.3 The organisation has defined its commitment to continual improvement of the energy efficiency and prevention of unnecessary energy consumption.</p> <p><i>1.1.4 The energy policy has been communicated to all employees</i></p> <p><i>1.1.5 The energy policy is available to the public</i></p>	<p>Top management of the organisation should establish and maintain the energy policy of the organisation. The energy policy expresses the organisation's commitment to energy efficiency and respective continuous improvement. Top management ensures that the energy policy:</p> <ul style="list-style-type: none"> <li>▪ is appropriate to the nature, scale and energy consumption of the organisation's activities, products and services</li> <li>▪ includes a commitment to continual improvement in energy performance and abatement of unnecessary energy consumption</li> <li>▪ includes a commitment to comply with the legislation and the regulations related with energy and with other requirements to which the organisation subscribes</li> <li>▪ provides the framework for setting and reviewing energy performance objectives and targets</li> <li>▪ is documented, implemented, maintained and communicated to members of the organisation</li> <li>▪ is available to the public</li> </ul>

## 2 Planning

### 2.1 Energy aspects

2.1.1 The organisation's significant energy aspects have been identified and will be regularly updated.

2.1.2 A clear relationship exists between the identified energy aspects and the energy objectives.

### 2.2 Legal and other energy requirements

2.2.1 Applicable legal and other requirements related to the processes, products and services of the organisation have been identified - and if applicable - including Environmental Act and LTA/environmental covenants.

### 2.3 Objectives and targets

2.3.1 The organisation has formulated energy objectives for the medium long term (e.g. four years or the duration of a permit's validation or of an LTA) and energy targets for the short term (less than or equal to one year).

2.3.2 The organisation has taken the following into consideration in determining the targets:

- legislative and other regulation
- significant energy aspects
- best practices
- financial, business and other operational requirements
- views of interested parties

2.3.3 The objectives of the organisation are in line with the energy policy as formulated (including continual improvement).

### 2.4 Programme

2.4.1 The responsibilities regarding achievement of the energy objectives and energy targets have been determined.

2.4.2 The organisation has compiled a list of activities with time schedule with which the energy objectives and energy targets can be achieved.

2.4.3 Energy aspects are considered in important decisions, such as investments and product development.

2.4.4 The progress of the activities is monitored.

## 1. Initial energy audit

The organisation should make an initial energy audit in order to identify and prioritise its energy consumptions and efficiency goals. Accordingly focused more detailed analysis can follow. Relevant action areas for improvement and energy efficiency opportunities should be identified. The initial energy audit results should be documented:

- the identification of areas or activities with significant consumptions
- the determination of appropriate energy consumption indicators
- the collection and analysis of energy consumption data
- the determination of baseline energy consumptions
- the identification of energy efficiency opportunities
- the identification of legal and other requirements

## 2. Legal and other requirements

The organisation should systematically identify and comply with legal and other requirements to which the organisation subscribes and are applicable to the energy aspects of its activities, products or services.

## 3. Energy performance targets

The organisation should systematically set and revise appropriate energy performance targets for the processes and activities, which have significant energy consumption, conservation potential and are related with legal or other rules and requirements.

The energy performance targets should be clearly defined and measurable. They should be documented and a time frame for their achievement should be set. Systematically energy management achievements should be monitored and benchmarked.

The organisation should set and revise its energy performance targets systematically, according to: the energy consumption significance, the relevant legal aspects and the organisation's current technological, operational and financial capacity. The energy performance targets should be appropriate for benchmarking and consistent with the energy policy.

## 4. Action plan

The organisation should establish and maintain an action plan for achieving its energy performance targets and the materialisation of the energy policy. The action plan should include:

- actions for the achievement of the energy targets
- the means and resources for each action
- designation of responsibility for each action
- determination of the time frame for each action

The action plan should be documented.

The action plan should be consistent with the organisation's energy policy and its current technical, financial and operational capacity.

<p><b>3. Implementation and operation</b></p> <p><b>3.1 Structure and responsibility</b>  3.1.1 The tasks and responsibilities on various levels of the organisation have been determined in such a way that the objectives and targets in the area of energy can be achieved. A management representative has been assigned ultimate responsibility.  3.1.2 Sufficient resources have been made available for the implementation and maintenance of the Energy Management System (e.g. competent personnel, technology and financial resources).</p> <p><b>3.2 Training and awareness</b>  3.2.1 Training needs have been identified among the employees performing tasks that could cause significant energy impact.  3.2.2 <i>Relevant know-how and experience of individual employees has been identified.</i>  3.2.3 <i>Attention is regularly devoted to the awareness of the employees</i></p> <p><b>3.3 Communication</b>  3.3.1 The progress achieved in the Energy Management programme is regularly communicated internally.  3.3.2 <i>The progress achieved in the energy policy and/or the Energy Management programme is regularly communicated externally if desired or required.</i></p>	<p><b>1. Structure and responsibility</b>  Roles, responsibilities and authorities should be defined, documented and communicated in order to facilitate effective energy management. Top management should provide resources essential to the implementation and control of the energy management system. Resources include human resources, specialised skills, technology and financial resources.  The organisation's top management should appoint an Energy Coordinator who, irrespective of other responsibilities, shall have defined roles, responsibilities and authority for:</p> <ul style="list-style-type: none"> <li>▪ the continuous improvement of the organisation's energy performance</li> <li>▪ the implementation of the energy management system</li> <li>▪ the monitoring, benchmarking and reporting of the energy performance</li> <li>▪ the staff involvement in the effort for energy performance improvement</li> <li>▪ The organisation should assign responsibilities according to function, level, education, experience, personality and capability, in order to achieve efficient implementation of the energy management system.</li> </ul> <p><b>2. Awareness raising and capacity building</b>  The energy policy should be communicated to everyone in the organisation. Personnel should be informed and encouraged to contribute in energy performance improvement.  The organisation should perform activities to inform its personnel about:</p> <ul style="list-style-type: none"> <li>▪ the importance of energy efficiency to the organisation</li> <li>▪ the organisation's efforts towards energy efficiency</li> <li>▪ the consequences of their work activities in energy consumption</li> <li>▪ their roles and responsibilities in the effort towards energy efficiency</li> </ul> <p>The organisation should identify the key personnel affecting significantly its energy performance and its specific training requirements for efficient energy management. Appropriate training activities should be planned and conducted.</p> <p><b>3. Communication and motivation</b>  The organisation should implement practices that ensure efficient two-way internal communication, concerning the effort towards energy efficiency.  The organisation should inform its members about energy efficiency and encourage them to contribute in it by: conserving energy, preventing unnecessary consumption, working efficiently and making recommendations and observations.  The organisation should systematically support, encourage and motivate its members to contribute in energy efficiency.</p>
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### 3.4 Documentation energy management system

3.4.1 The elements of the Energy Management System have been described, as have their relationship with other documentation.

### 3.5 Control of documents

3.5.1 The documentation control method has been described in procedures.

3.5.2 *All of the documents related to the management system are stored in an orderly and accessible manner.*

3.5.3 *All of the documents related to the management system are periodically assessed, revised if necessary and approved by authorised employees.*

### 3.6 Operational control

3.6.1 Documented insight exists into the energy consumption of the significant energy consumers, as well as into the mechanisms (organisation, behaviour and/or technology) with which these are managed.

3.6.2 Significant energy aspects of purchased services and goods are evaluated.

3.6.3 *Third parties are instructed and informed (including suppliers and sub-contractors).*

### 4. Energy management system documentation

The organisation should establish and maintain information, in paper or electronic form, to

- describe the core elements of the management system and their interaction
- provide direction to the energy management system implementation and the related documentation

### 5. Information control

The organisation should implement practices that ensure that information affecting energy management is

- available and easily accessible to members that perform activities essential to energy management
- systematically updated, reviewed and revised as necessary by appropriate, authorised members
- obsolete information is removed accordingly
- obsolete information preserved for legal and/or knowledge purposes is appropriately identified
- Information should be maintained in comprehensible, identifiable, dated and orderly manner and retained for appropriate time. Responsibilities should be appointed for the creation, modification and updating of the energy management information.

### 6. Operational control

Operational Control shall aim to the implementation of the energy policy and the achievement of the energy performance targets. It should be one of the primary responsibilities of the Energy Coordinator.

The organisation should identify the activities with significant impacts on energy performance, policy and targets. Current energy consumption and improvement potential should be assessed.

Actions significantly affecting energy efficiency, including:

- design and provision of products and services
- design and implementation of processes and activities
- selection and purchasing of facilities, equipment and materials
- establishment of operation criteria for activities and processes
- operation, control and maintenance of equipment
- use, inspection and maintenance of facilities
- design, modification and renovation of facilities

should be examined and appropriate practices should be implemented.

#### **4 Checking and corrective actions**

##### **4.1 Monitoring and measurement**

4.1.1 The energy consumption of relevant operating activities is regularly measured, registered, analysed and reported.

The organisation has progress reports and evaluations available with reference to energy objectives and targets.

4.1.3 Periodic evaluations are performed to determine whether requirements pertaining to energy in legislative and other regulations are satisfied.

4.1.4 *Measuring and registration equipment is regularly maintained and calibrated.*

##### **4.2 Nonconformity, corrective and preventative actions**

4.2.1 Responsibility for identification and dealing with nonconformity and the actions to be taken in order to correct and prevent nonconformity in the energy consumption have been established.

4.2.2 *The implementation, correctness and effectiveness of the actions taken are regularly checked.*

#### **1. Monitoring and measurement**

The organisation should systematically measure and monitor its energy consumption. Appropriate energy indicators should be periodically calculated, registered, analysed and reported. The organisation should evaluate its energy performance according to its energy targets. Actions and practices should be amended for the achievement of energy targets whenever necessary.

The organisation should systematically check the compliance with relevant legal and other requirements.

#### **2. Non-conformance response and prevention**

The organisation should implement practices to detect and investigate non-conformances that affect significantly its energy efficiency and respond to them, in order to minimise their negative impacts. The organisation should implement preventive practices in order to minimise the probability of occurrence of non-conformances. Response and preventive action should be appropriate to the non-conformance encountered and commensurate with its impact on energy consumption. The organisation should review and revise, when necessary, its non-conformance detection, response and preventive practices, in particular, after their occurrence.

<p><b>4.3 Record</b></p> <p>4.3.1 Records of the Energy Management System are identified, described, stored and where necessary removed from a(n energy) register.</p> <p>4.3.2 The records are legible and identifiable, and can be traced to the relevant activity, product or service.</p> <p>4.4 <i>Energy Management audits</i></p> <p>4.4.1 Regularly, but at least once each year, internal audits are performed with reference to the aspect energy as referred to in this Specification (may be part of another management system) in order to check the system's functioning.</p> <p>4.4.2 The results of the audit are reported to the management.</p>	<p><b>3a. Records</b></p> <p>The organisation should keep records of its energy performance that are tailored to their energy management system requirements.</p> <p>Records should be legible, identifiable, accessible and traceable to relevant process, activity or person.</p> <p><b>3b. Periodic Energy Audits</b></p> <p>The organisation should periodically perform energy audits in order to</p> <ul style="list-style-type: none"> <li>▪ determine its current energy performance</li> <li>▪ check system's implementation and maintenance</li> <li>▪ compare results with targets of the system</li> <li>▪ provide benchmarking information</li> <li>▪ investigate problems and identify causes and weaknesses</li> <li>▪ inform the management of the organisation</li> </ul>
<p><b>5 Management involvement</b></p> <p><b>5.1 Review</b></p> <p>5.1.1 The Energy Management System or the energy aspect within another management system is reviewed periodically, but at least once each year, by the management in terms of its suitability, adequacy and effectiveness.</p>	<p>The organisation's top management should periodically review the energy management system results to ensure its continuing suitability, adequacy and effectiveness and to evaluate its performance via benchmarking.</p> <p>The review process should ensure that the necessary information is collected to allow management perform this evaluation. The review results should be documented.</p> <p>The management review should address the possible need for changes to energy management policy, objectives and practices, in the light of energy audits results, changing conditions and the commitment to continual improvement of the organisation's energy performance.</p>

### 3.2 Full Energy Management Checklist

A	Basic information				Comments	Explanation of the question	Explanation of when to check off.
1	Are the energy consumption figures known and available (e.g. in the ECP (Energy Action Plan) or from your monitoring information)?	<input type="checkbox"/>	Yes	<b>Priority 1</b>		You are expected to have access to a summary (Energy Consumption Analysis) of the processes, buildings and utilities with energy consumption data, for example per product line or per sub-process.	Yes if you have a summary of processes covering at least three-quarters of the organization's energy consumption.
2	Has the organization identified the primary energy aspects based on the energy consumption figures (see definition above), and are they kept up to date?	<input type="checkbox"/>	Yes	<b>Priority 1</b>		The energy aspects that determine consumption within the processes are expected to be mapped. Both the primary and the secondary (e.g. compressed air equipment (primary energy consumption) and the use of compressed air, which also affects the consumption (secondary energy consumption)). This overview needs to be kept up-to-date when changes of e.g. processes occur.	Yes if a summary of the primary energy aspects is available that collectively represents three-quarters of the organization's total energy consumption.
<b>B</b>	<b>Implementation and Operation</b>						
<b>B.1</b>	<b>Structure and responsibilities</b>						
3	Have tasks, responsibilities and authority been determined for all staff involved in energy management (e.g. energy aspects, energy consumption, objectives, corrective measures, etc.)?	<input type="checkbox"/>	Yes	<b>Priority 1</b>		It is expected here that you have a list of employees with tasks, responsibilities and authority in the area of energy. For example: the employees, the coordinator, the heads of department and/or management, in so far as applicable.	Yes if this is visibly documented, e.g. in a Task-Responsibility-Authority matrix.
4	Are sufficient financial resources made available for managing and improving the energy aspects (consumption and efficiency)	<input type="checkbox"/>	Yes	<b>Priority 1</b>		This pertains to the financial resources for measures for reducing energy consumption, for example, or training employees in order to improve awareness/know-how, or for measurement systems, etc.	Yes if this is evident in the budgets (or objectives) and based on registered expenses.

<b>B0.2</b>	<b>Management of the activities</b>						
5	Has the manner in which the energy consumed by the operating activities will be managed been agreed?	<input type="checkbox"/>	Yes	<b>Priority 1</b>		The working method for managing energy consumption is expected to be defined for the major operational activities (energy aspects). For example: instructions about operating equipment, manuals with start values, automated process control, maintenance system for relevant equipment and the responsibilities and authorization of employees.	Yes if agreements have been made for three-quarters of the major energy consumers.
6	Is it true that in operations:	<input type="checkbox"/>	The energy policy is known and adhered to by all relevant employees?			Employees are expected to understand the organization's energy policy and to apply it in performing the day-to-day activities.	Yes if this is documented, e.g. during employee interviews and audits.
		<input type="checkbox"/>	Monitoring information is used to manage and improve the energy consumed by processes?			Measurement data are expected to be used and discussed in managing the energy consumption of processes and in reducing energy consumption.	Yes if the monitoring information is available and is evidently used.
		<input type="checkbox"/>	When purchasing goods and services, consequences on the energy consumption are taken into consideration (if relevant, suppliers, contractors and third parties are given instructions pertaining to energy consumption)?			In purchasing, the energy consumption of goods and services and requirements in this area are expected to be taken into consideration. When process and equipment are modified, a reduction can be achieved if energy consumption is taken into account in the design.	Yes if energy consumption is considered during purchasing, maintenance and new construction and requirements are defined, and this is documented in files or can otherwise be shown to be probable.
7	The primary energy consumers (energy aspects) are regularly measured, registered, analyzed and reported?	<input type="checkbox"/>	Yes	<b>Priority 1</b>		Measurement data of the major energy aspects (largest users) is expected to be available in sufficient detail. Sub-measurements are not always necessary, but are usually recommended, as is comparison of the data with key figures for the sector. Analysis provides insight into the progress being made and possible non-conformance.	Yes if measurement data are sufficiently specific to evidently contributed to management and improvement of the energy consumption, for example measures taken when non-conformance is identified.

8	The monitoring referred to above includes:	<input type="checkbox"/>	Energy consumption per department or process.			It is expected here that the measurement data of the primary energy aspects (largest consumers) are available to a sufficient degree.	Yes if registered data are available.
		<input type="checkbox"/>	Key financial or consumption figures			Think in this respect of (trends in) energy consumption per unit product/employee/shift/machine.	Yes if registered data are available.
		<input type="checkbox"/>	Target consumption figures			Data for department targets and processes are expected to be available.	Yes if registered data are available.
		<input type="checkbox"/>	Energy consumption projects (remodelling, major maintenance, etc.)</cf>			Data are expected to be available with which deviations in the normal consumption resulting from special projects can be identified.	Yes if registered data are available or if not applicable to the period under review.
		<input type="checkbox"/>	(Graphic) trend analyses			Graphic trend analyses are expected to be available with which insight into the performance is enhanced.	Yes if registered data are available.
9	Relevant measuring instruments are properly maintained and calibrated where necessary.	<input type="checkbox"/>	Yes			The meters are expected to measure accurate values, based on a maintenance and/or calibration schedule. The meters are expected to provide accurate measured values, based on a maintenance and/or calibration schedule.	Yes if the meters are included in a maintenance and/or calibration schedule.
<b>B0.3</b>	<b>Training and awareness</b>						
10	Is the necessary knowledge and information in the area of efficient energy consumption known, and have the employees that can influence the energy consumption been instructed and/or trained?	<input type="checkbox"/>	Yes	<b>Priority 2</b>		The individuals and groups within the organization are expected to have been trained or instructed with reference to energy consumption. The necessary know-how varies, depending on the part played by the employees, from highly specific to general.	Yes if the information to be given is known and it can be demonstrated as probable that the employees have the right know-how.
<b>B0.4</b>	<b>Communication</b>						
11	Are energy performance and energy management regularly discussed internally on the operations and management levels?	<input type="checkbox"/>	Yes	<b>Priority 2</b>		Energy (consumption, non-conformance, progress in achieving objectives) is expected to be regularly included on the agenda for internal consultation with the relevant employees.	Yes if energy management is documented to have been discussed in terms of content during consultation.

12	Has it been agreed how energy performance will be announced and who will make the announcement?	<input type="checkbox"/>	Yes			What is to be communicated externally by whom is expected to be defined. Examples include monitoring information for SenterNovem, or information for the municipality or province. (External interested parties are individuals and organizations outside of your organization who have an interest in the organization's energy policy.)	Yes this has been documented.
13	Is this energy policy available to external interested parties?	<input type="checkbox"/>	Yes			External interested parties are individuals and organizations outside of your own organization who are interested in the organization's energy policy.	Yes if the policy is available for external parties.
<b>C</b>	<b>Energy policy, planning and improvement</b>						
<b>CO.1</b>	<b>Energy policy statement</b>						
14	Has the energy policy statement been finalized by the highest management (operational) level?	<input type="checkbox"/>	Yes	<b>Priority 1</b>		A policy statement is expected to be documented as authorized (e.g. by means of a signature) by the management or the relevant manager on the MT level; can be part of the ECP.	Yes this authorization has been documented.
15	Does the policy statement indicate that the organization:	<input type="checkbox"/>	Satisfies the relevant laws, regulations and agreed rules?	<b>Priority 1</b>		The policy statement is expected to indicate that relevant laws, regulations and other agreed rules are satisfied. Previous text can used verbatim.	Yes if the policy statement contains this text or a similar one.
		<input type="checkbox"/>	Strives to continually improve the energy performance and prevent energy consumption?	<b>Priority 1</b>		The policy statement is expected to indicate that the organization strives to continuously improve the energy performance and to prevent the consumption of energy.	Yes if the policy statement contains this text or a similar one.
<b>CO.2</b>	<b>Objectives and targets and Energy management programme</b>						
16	Has a plan of approach been compiled for improving the energy performance, in accordance with the policy?	<input type="checkbox"/>	Yes	<b>Priority 1</b>		A document (e.g. an ECP and/or detailed ECP results) is expected to be available. General requirements on the plan of approach are that it be Specific, Measurable, Achievable, Realistic and Timed (SMART).	Yes if this document is available.

17	In determining and evaluating the objectives, are the following matters considered:	<input type="checkbox"/>	Legal and other requirements?	<b>Priority 1</b>		Any permit requirements, construction regulations and requirements, e.g. on the parent company, are expected to be taken into account.	Yes if this is documented as being the case, e.g. in the ECP.
		<input type="checkbox"/>	The primary energy aspects?	<b>Priority 1</b>		Energy objectives and tasks are expected to primarily focus on the (large) consumers, where the most improvement can be expected to be achieved.	Yes if this is documented as being the case, e.g. in the ECP.
		<input type="checkbox"/>	The best techniques available (according to SenterNovem's list of measures, for example)?	<b>Priority 1</b>		An organization is expected to be aware of the best techniques available and to use these if possible. The organization can keep up to date, for example, by actively participating in sector consultation with reference to energy.	Yes if the organization can demonstrate that it structurally follows developments and determines whether new techniques can be implemented.
		<input type="checkbox"/>	Improvement of the indirect energy effects as caused by choice of materials, for example, or transporters and/or suppliers?			Insight into energy consumption and conservation possibilities in the chain in which the organization participates are expected to be known, and relevant objectives and tasks are expected to be formulated.	Yes if the fact that attention has been devoted to this in formulating objectives can be demonstrated.
		<input type="checkbox"/>	The time schedule within which these are to be achieved?	<b>Priority 1</b>		The points in time when implementation of objectives and tasks start and are to be concluded is expected to be clear. General requirements on the objectives are that they be Specific, Measurable, Achievable, Realistic and Timed (SMART).	Yes if this is documented as being the case, and a time schedule is present.
<b>D</b>	<b>Documentation</b>						
<b>D.1</b>	<b>Documentation (registration) management system</b>						

18	Has how energy management works been documented (in writing or electronically) and is a link made to the relevant instructions and procedures?	<input type="checkbox"/>	Yes	<b>Priority 1</b>		The energy management system is expected to be defined in a set of formal documents that is accessible to users. These documents indicate who bears responsibility for the documents and how energy measurement data in particular is registered. The energy management documents may comprise a separate system or can be part of another management system (e.g. ISO 9001 or 14001, or HACCP).	Yes if a documented system of coherent documents exists for achieving the energy policy and objectives.
<b>E</b>	<b>Audits, measures and evaluation</b>						
<b>E.1</b>	<b>Energy management audits</b>						
19	Is the energy management system audited internally at least once each year, and is its functioning reported to the management?	<input type="checkbox"/>	Yes	<b>Priority 2</b>		The entire process of energy management is expected to be evaluated (audited). Preferably by employees who are not directly involved in performing the relevant activities. Companies with a limited number of employees can suffice by completing this Full Energy Management Checklist. The findings and results are reported to the management (e.g. explanation of the completed Energy Checklist).	Yes if an internal audit has been performed and the results have been reported.
20	The energy management audits are used to determine whether employees adhere to the approved working methods and agreements with reference to energy consumption.	<input type="checkbox"/>	Yes	<b>Priority 2</b>		The organization is expected to determine whether the relevant employees adhere to the agreements made so that good energy consumption performance can be achieved.	Yes if the employee working methods are discussed during the audit.
21	The energy management audits determine whether the activities for managing energy consumption satisfy the organization's energy management programme.	<input type="checkbox"/>	Yes	<b>Priority 2</b>		The organization is expected to determine whether the working method and objectives as defined contribute to achieving the objectives and the policy; prevention of energy consumption.	Yes if the working methods and objectives as defined are discussed during the audit.

<b>E.2</b>	<b><i>Non-conformance, corrective and preventative measures</i></b>						
22	In the event of non-conformance, is the cause investigated and are corrective or preventative measures taken to prevent reoccurrence?	<input type="checkbox"/>	Yes	<b>Priority 1</b>		How non-conformance occurs is expected to be analyzed (monitoring registered data). Based on these occurrences, corrective and structural measures are taken to prevent them from reoccurring. Matters that will go wrong in the future if preventative measures are not taken are anticipated.	Yes this shown to be probable.
<b>E.3</b>	<b><i>Evaluation</i></b>						
23	Is the evaluation of the energy management system performed at least once each year by the management?	<input type="checkbox"/>	Yes	<b>Priority 1</b>		The entire package of energy management measures is expected to be discussed at least once each year in order to determine whether agreements are being satisfied and the desired results (policy) are being achieved.	Yes this shown to be probable.
24	In preparing for the evaluation, at least the following information is collected:	<input type="checkbox"/>	Newly-defined energy aspects.			When equipment, processes, buildings, etc. are changed, the organization is expected to check the list of major energy consumers and to update it where necessary.	Yes if this is documented and lists of energy aspects are up to date.
		<input type="checkbox"/>	Energy performance based on monitoring information.	<b>Priority 1</b>		The energy consumption is expected to be analyzed as a trend.	Yes if this has been documented.
		<input type="checkbox"/>	An evaluation of measurement registration figures based on key figures and/or ratios for the sector/process (if relevant).	<b>Priority 2</b>		The energy consumption figures are expected to be compared to similar processes/organizations in order to properly evaluate the performance.	Yes if this has been documented or is not relevant.
		<input type="checkbox"/>	The evaluation of conformance with legal and other requirements pertaining to energy.	<b>Priority 1</b>		The organization is expected to determine whether agreements and regulations have been satisfied in accordance with the policy statement.	Yes if this has been documented.

25	During the evaluation, the effectiveness of the system for achieving the policy and the objectives is assessed.	<input type="checkbox"/>	Yes	<b>Priority 2</b>		The organization is expected to determine whether the whole of energy management measures ("the system") results in better management of the processes and a reduction in the energy consumption.	Yes if this is evident in the management's evaluation of how the energy management system functions.
26	During the evaluation, discussions are held to determine whether the policy and the objectives need modification based on changing conditions and the obligation to continuously improve performance.	<input type="checkbox"/>	Yes			The management or the relevant manager on the MT level is expected to determine whether the results of the measures taken within the framework of energy management are satisfactory or whether additional measures are needed in order to improve the results.	Yes if policy and objectives have been evaluated.
	<b>Results:</b>	-	<b>This is a blank Energy Management Checklist.</b>		<b>This is a blank Energy Management Checklist.</b>		

### 3.3 Energy management implementation model BESS

PDCA		PLAN	PLAN	DO	DO	CHECK	ACT
ACTION	START	A. UNDERSTAND	B. PLAN	C. COMMIT	D. IMPLEMENT	E. EVALUATE	F. REVIEW
<b>ACTIVITIES</b>	<p><b>BUSINESS CASE</b></p> <ul style="list-style-type: none"> <li>- Initial data</li> <li>- Energy profile</li> <li>- Outer influence</li> </ul> <p><i>Make a business case, recognize need for EM, check basic data and indicators and identify other influences defining the company decisions.</i></p> <p><b>PRE-SELF ASSESSMENT</b></p> <ul style="list-style-type: none"> <li>- Key questions</li> <li>- Decision on energy management</li> <li>- Commitment</li> </ul> <p><i>Preparation of key questions based on results the level of company commitment and implementation of EM is defined.</i></p> <p><b>ENERGY MANAGEMENT IMPLEMENTATION PROJECT PLAN</b></p> <ul style="list-style-type: none"> <li>- Level</li> <li>- Organisation, personnel and budget</li> <li>- Implementation monitoring</li> </ul>	<p><b>ENERGY AUDIT</b></p> <ul style="list-style-type: none"> <li>- Different types</li> <li>- Energy audit description</li> <li>- Data collection</li> <li>- Energy consumption and trends</li> <li>- Investigate large users</li> <li>- Tracking energy use, costs, emissions</li> <li>- Investigate benchmarks</li> </ul> <p><i>Detailed description and procedures for 3 types of energy auditing, including data collection, trends and benchmark..</i></p> <p><b>ANALYSIS TOOLS</b></p> <ul style="list-style-type: none"> <li>- Energy bookkeeping software</li> <li>- Horizontal measure list</li> <li>- Sectoral measure list</li> <li>- Links to existing national measure list</li> </ul> <p><i>Detailed description and attached tools on energy bookkeeping for data collection, measure list for horizontal and sectoral activities..</i></p>	<p><b>ENERGY ACTION PLAN</b></p> <ul style="list-style-type: none"> <li>- Energy saving activities: separate for no cost, low cost and high cost activities</li> </ul> <p><i>Action plan describes reasons and plans activities for energy saving activities and procedures. It divides them into different cost categories. It includes detailed measure list.</i></p> <p><b>ROLES AND RESPONSIBILITIES</b></p> <ul style="list-style-type: none"> <li>- People</li> <li>- Resources</li> <li>- Timescale</li> </ul> <p><i>Describe roles of people in the company structure, define resources for planned activities and detail the timeframe for execution of the action plan.</i></p>	<p><b>ENERGY COORDINATOR</b></p> <ul style="list-style-type: none"> <li>- Job description</li> <li>- Qualifications</li> </ul> <p><i>Describes appointment, role, job description and key qualifications for energy coordinator.</i></p> <p><b>ENERGY TEAM</b></p> <ul style="list-style-type: none"> <li>- Job description</li> <li>- Qualifications</li> </ul> <p><i>Describes selection, structure, role, job description and key qualifications for energy team.</i></p> <p><b>ENERGY POLICY</b></p> <p><i>It includes objectives, goals, roles and responsibilities</i></p>	<p><b>IMPLEMENT ENERGY ACTION PLAN</b></p> <ul style="list-style-type: none"> <li>- Energy Savings Register</li> <li>- Awareness /Communication</li> <li>- Training /Education</li> <li>a) needs</li> <li>b) people</li> <li>c) learning tools</li> </ul> <p><i>Implementation describes simple execution with supporting materials like energy saving register (similar to measure list from action plan), describes ways to raise awareness and how to communicate on the topic both internal as external. Training and education needs must be prepared taken into account people and learning tools (including e-learning)..</i></p>	<p><b>INDICATORS</b></p> <ul style="list-style-type: none"> <li>- Company level</li> <li>- Energy users level</li> <li>- Compare over time</li> </ul> <p><b>MONITORING AND TARGETING</b></p> <ul style="list-style-type: none"> <li>- Analysis of the indicators</li> </ul> <p><i>Describe M&amp;T technique for indicators' analysis for internal evaluation of energy performance over time with monitoring and targeting function for better planning of energy saving activities.</i></p> <p><b>BENCHMARKING</b></p> <ul style="list-style-type: none"> <li>- Compare against others</li> </ul> <p><i>Describe method of benchmarking – comparison against performance of other companies.</i></p>	<p><b>REVISION</b></p> <p><i>After implementation the process should be reviewed and evaluated.</i></p> <p><b>IMPROVE</b></p> <p><i>Improve procedure, improve policy, improve execution, improve targets, improve goals, and start again.</i></p>

	<p><b>DEFINITIONS</b> - <b>Dictionary</b></p> <p><i>Definition of basic terms of EM for common understanding.</i></p> <p><b>SPECIFICATION</b> - <b>Requirements</b> - <b>Linking lists</b></p> <p><i>List of requirements of an EM system which is in accordance with the existing ISO standards with a prioritization for SMEs and compatibility lists between the EM requirements and relevant ISO and HACCP standards</i></p>	<p><b>LEGISLATIVE &amp; REGULATIVE FRAMEWORK</b> - <b>Regulations</b> - <b>Other influence</b></p> <p>a) <b>Green procurement</b> b) <b>Voluntary programmes</b> c) <b>Outsourcing</b> d) <b>Etc.</b></p> <p><i>Include legislative and regulative framework into company's knowledge about energy and environment. Check different instruments for_achieving goals.</i></p>			<p><b>OPERATION AND MAINTENANCE</b> - <b>Internal energy organisation and procedures</b> - <b>Good housekeeping</b></p> <p><i>Description of different levels in company dealing with energy use, describe procedures for operation and maintenance etc. Propose good housekeeping measures.</i></p>	<p><b>FULL ENERGY MANAGEMENT CHECKLIST</b></p> <p><i>Questions to allow companies self asses their implementation level of energy management..</i></p> <p><i>Define indicators for energy performance on company (e.g. energy vs. production) and end-user level (e.g. compressed air system). Allow comparison of indicators over time for evaluation.</i></p>	
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Notes: - This EMIM is amongst others based on the Energy MAP approach developed by SEI, Ireland

- During the pilot phase of the BESS project several tools and examples which are connected to the EMIM are available to selected pilot companies for testing.
- The sole responsibility for the content of this publication lies with the authors. It does not represent the opinion of the Community.
- The European Commission is not responsible for any use that may be made of the information contained therein.

### 3.4 Linking Lists

#### Structure of the tables

In the first column of the list (Reference Energy Management), the literal text from the Reference Energy Management is shown; this must serve as the foundation for your energy management system. A distinction has been made between the parts that are necessary for a minimum quality level of the system and the parts that are desirable for the system. The desirable elements are elective and are therefore listed in italics.

Column two (Relevant paragraph ISO or HACCP) indicates which sections of ISO standard or HACCP food safety system deal with a similar requirement or is closest to the Reference. The result that you will achieve if you satisfy this ISO 14001 section is shown in parentheses.

The third column (Modification recommendation ISO 14001) recommends how the ISO 14001 management system can be modified to satisfy the Reference Energy Management.

#### Linking list for the ISO 14001 system

<b>BESS Energy Management Specification</b>	<b>Relevant section ISO 14001</b>	<b>Modification recommendation ISO 14001</b>
1 Energy policy	4.2 Environmental policy This ISO 14001 section dictates that your organisation must define an environmental policy and the requirements it must meet.	
1.1 Energy policy statement	4.2 Environmental policy	
1.1.1 The organisation has specifically included energy as an important part of its (energy) policy. The energy policy is in keeping with the energy aspects of the operations.	4.2.a) Environmental policy (environmental policy)	In this section, include energy management in the corporate policy. Indicate the relationship between operational activities and energy consumption.
1.1.2 The organisation has explicitly defined how legislation and regulations, or -if applicable - any LTA or the energy aspects of an energy covenant will be complied with.	4.2.c) and d) Environmental policy (environmental policy)	Include the statement listed in column three in the policy statement.
1.1.3 The organisation has defined its commitment to continual improvement of the energy efficiency and prevention of unnecessary energy consumption.	4.2.b) Environmental policy (environmental policy)	Also include a statement with this content in the policy statement.
<i>1.1.4 The energy policy has been made known to all employees.</i>	4.2.e) Environmental policy (communication tool)	Make sure personnel members are familiar with the organisation's energy premises.
<i>1.1.5 The environmental policy is available to the public.</i>	4.2.f) Environmental policy (documented decision)	Determine how and by whom the (energy) policy can be requested and register this.

<b>BESS Energy Management Specification</b>	<b>Relevant section ISO 14001</b>	<b>Modification recommendation ISO 14001</b>
2 Planning	3 Planning	
2.1 Energy aspects	4.3.1 Environmental aspects This section of ISO 14001 states that your organisation must have a procedure for identifying environmental aspects and specifies the requirements this procedure must satisfy.	
2.1.1 Inventory has been taken of the organisation's major energy aspects and the inventory is regularly updated.	4.3.1 Environmental aspects (procedure and registration)	Include the energy consumption in the application area of the aspects procedure. Make sure that the matters listed here are dealt with as energy aspects. Make sure that new activities, products and services are evaluated in terms of energy aspects in accordance with the procedure.
2.1.2 A clear relationship exists between the inventoried energy aspects and the energy objectives.	4.3.1 Environmental aspects (procedure and registration)	The energy aspects described -if applicable - within the LTA must be included in the environmental aspects register. See 2.3.2 of the BESS Energy Management Specification for more information.
2.2 Legal and other requirements	4.3.2 Legal and other requirements This section of ISO 14001 states that your organisation must define and maintain a system for identifying requirements, including legislative and other regulations.	
2.2.1 Relevant legal and other requirements that pertain to the processes, products and services of the organisation have been identified (or -if applicable - including Environmental Act and LTA/energy covenants).	4.3.2 Legal and other requirements (procedure and registration)	Include all relevant regulations in the register of regulations and legal and other requirements. In this, consider energy aspects as environmental aspects.
2.3 Objectives and targets	4.3.3 Objectives and targets This section of ISO 14001 describes how the organisation is to register and maintain objectives and targets.	
2.3.1 The organisation has formulated energy objectives for the medium-long term (e.g. four years or the duration of a permit's validity or of a LTA) and energy targets for the short term (less than or equal to one year).	4.3.3 Objectives and targets and 4.3.4 Environmental programme: This specifies the requirements that your organisation's environmental programme must satisfy. (documented objectives)	Compile energy objectives and the ensuing targets. The applicable periods can be included in the environmental programme.

<b>BESS Energy Management Specification</b>	<b>Relevant section ISO 14001</b>	<b>Modification recommendation ISO 14001</b>
2.3.2 The organisation has taken the following into consideration in determining the objectives: <ul style="list-style-type: none"> <li>▪ legislative and other regulations;</li> <li>▪ significant energy aspects;</li> <li>▪ the current state of technology;</li> <li>▪ financial, business and other operational requirements;</li> <li>▪ vision of interested third parties.</li> </ul>	4.3.3 Objectives and targets (traceable)	Assess the objectives based on the aspects listed here and modify them where necessary.
2.3.3 The objectives of the organisation are in keeping with the energy policy as formulated (including continual improvement).	4.3.3 Objectives and targets (traceable)	Make sure that the objectives are in keeping with the energy policy as formulated; also formulate improvement intentions in the objectives.
2.4 Energy management programme	4.3.4 Environmental programme This section of ISO 14001 describes the requirements that the environmental programme to be implemented and maintained by your organisation must satisfy.	
2.4.1 The responsibilities regarding achievement of the energy objectives and energy targets have been determined.	4.3.4 Environmental programme (documented)	Include the responsible employees in the objectives.
2.4.2 The organisation has compiled a list of activities with time schedule with which the energy objectives and energy targets can be achieved.	4.3.4 Environmental programme (documented)	Compose a time schedule for achieving the objectives and targets (project planning).
2.4.3 Energy aspects are considered in important decisions, such as investments and product development.	4.3.4 Environmental programme (documented)	Make sure that energy consumption is a criterion that is considered in investment proposals.
2.4.4 The progress of the activities is monitored.	4.5.1 Monitoring and measuring This section of ISO 14001 places requirements on the procedures for monitoring and measuring the primary characteristics of the activities that can have an important effect on the environment. (procedure)	Include energy aspects in the monitoring of environmental performance.
3 Implementation and operation	4.4 Implementation and operation	

<b>BESS Energy Management Specification</b>	<b>Relevant section ISO 14001</b>	<b>Modification recommendation ISO 14001</b>
3.1 Structure and responsibilities	4.4.1 Structure and responsibilities This section of ISO 14001 explains how your organisation must determine the division of tasks, responsibilities and authority to stimulate effective environmental management.	
3.1.1 The targets and responsibilities on various levels of the organisation have been determined in such a way that the objectives and targets in the area of energy can be achieved. A management representative has been assigned ultimate responsibility.	4.4.1 Structure and responsibilities (documented)	Make sure that the responsibility for energy aspects and energy management has been identified as part of the line responsibilities. Make sure that the responsibilities of the board member responsible for environmental management are expanded to include energy management. Define reporting responsibility in the procedures for internal communication or the monitoring reports.
3.1.2 Sufficient resources have been made available for the implementation and maintenance of the energy management system (e.g. competent personnel, technical and financial resources).	4.4.1 Structure and responsibilities (traceable)	The resources must enable the employees to perform the tasks.
3.2 Training and awareness	4.4.2 Training, awareness and proficiency This section of ISO 14001 places requirements on personnel training.	
3.2.1 Inventory has been taken of the training needs of employees whose activities can have an important effect on energy consumption.	4.4.2 Training, awareness and proficiency (documented)	Determine whether specific tasks in the organisation require training and document this. More general knowledge can be communicated through internal consultation, intranet or newsletter.
<i>3.2.2 Inventory has been taken of the relevant know-how and experience of individual employees.</i>	4.4.2 Training, awareness and proficiency (registration)	List employee qualifications in a summary or in the employee's file.
<i>3.2.3 Attention is regularly devoted to the awareness of the employees.</i>	4.4.2 Training, awareness and proficiency (evidenced)	Communicate the policy, its execution and the results of energy management via internal consultation, intranet or newsletter.
3.3 Communication	4.4.3 Communication This section of ISO 14001 states that the organisation must define and maintain procedures for internal and external communication.	
3.3.1 The progress achieved in the energy management programme is regularly communicated internally.	4.4.3 Communication (documented)	Communicate the execution and results of energy management via internal consultation, intranet or newsletter. Define a procedure for doing so.
<i>3.3.2 If desired or obligatory, the progress achieved in the energy policy and/or the energy management programme is regularly communicated externally.</i>	4.4.3 Communication (procedure and registration)	Include communication about energy in procedures for external communication: subject, frequency and responsibilities.

<b>BESS Energy Management Specification</b>	<b>Relevant section ISO 14001</b>	<b>Modification recommendation ISO 14001</b>
3.4 Documentation energy management system.	4.4.4. Documentation of the environmental management system This section of ISO 14001 describes how the organisation must maintain information about the management system and relevant documentation.	
3.4.1 The elements of the energy management system have been described, as have their relationship with other documentation.	4.4.4. Documentation of the environmental management system (documented)	In the documentation of the environmental management system, determine that energy management is part of environmental management and that this management system is also applied to the energy aspects.
3.5 Document management	4.4.5 Document management This section of ISO 14001 describes how your organisation must manage documents.	
3.5.1 The documentation management method has been described in procedures.	4.4.5 Document management (procedure)	Make sure that the (general) procedure also applies to energy.
3.5.2 All of the documents related to the management system are stored in an orderly and accessible manner.	4.4.5 Document management (evidenced to be in keeping with procedure)	Make sure that the (general) procedure also applies to energy.
<i>3.5.2 All of the documents related to the management system are periodically assessed, revised if necessary and approved by authorised employees.</i>	4.4.5 Document management (evidenced to be in keeping with procedure)	Make sure that the (general) procedure also applies to energy.
3.6 Management of the activities	4.4.6 Management of the activities This section of ISO 14001 places requirements on the management and execution of all activities that are related to important environmental aspects.	
3.6.1 Insight into the energy consumption of the major energy consumers exists and can be evidenced, as well as into the mechanisms (organisation, behaviour and/or technology) with which these are managed.	4.4.6 Management of the activities, specifically 4.4.6 a and b (documented planning)	Plan the activities with energy aspects in such a way that the policy, the law and -if applicable - the LTA are satisfied. Translate these requirements to the departments and responsibilities as part of executing the activities.
3.6.2 Significant energy aspects of purchased services and goods are evaluated.	4.4.6.c) Management of the activities (procedure and registration)	Include stipulations regarding energy for purchased services and goods that involve important energy aspects.
<i>3.6.3 Third parties are instructed and informed (including suppliers and sub-contractors).</i>	4.4.6.c) Management of the activities (registration and evidenced)	Determine who is responsible for instruction, information and including contractual requirements for these matters.

<b>BESS Energy Management Specification</b>	<b>Relevant section ISO 14001</b>	<b>Modification recommendation ISO 14001</b>
4 Checking and corrective measures	4.5 Checking and corrective measures	
4,1 Checking and measuring	4.5.1 Monitoring and measuring	
4.1.1 The energy consumption of relevant operating activities is regularly measured, registered, analysed and reported.	4.5.1 Monitoring and measuring (procedure and registration)	Include energy aspects in the monitoring of environmental performance. Make sure that figures are related to sector data or other information. Define who is to perform this task.
4.1.2 The organisation has access to progress reports and evaluations with reference to the energy objectives and targets.	4.5.1 Monitoring and measuring (registration)	Report in accordance with the monitoring or communication procedure regarding energy performance, including both management of the activities involved and the extent to which objectives are being met.
4.1.3 Periodic evaluations are performed to determine whether requirements pertaining to energy in legislative and other regulations are satisfied.	4.5.1 Monitoring and measuring (procedure and registration)	Include the evaluation of energy aspects in the procedure for evaluating compliance with legal and other requirements as indicated in this section of ISO 14001.
<i>4.1.4 Measuring and registration equipment is regularly maintained and calibrated.</i>	4.5.1 Monitoring and measuring (procedure and registration)	Determine the need and execution of maintenance and calibration of equipment involved in energy management, and register these.
4.2 Non-conformance, corrective and preventive measures	4.5.2 Non-conformance, corrective and preventive measures This section describes how your organisation is to define and maintain procedures, including for dealing with corrective and preventive measures.	
4.2.1 Responsibility for studying and dealing with non-conformance and the measures to be taken in order to correct and prevent non-conformance in the energy consumption have been determined.	4.5.2 Non-conformance, corrective and preventive measures (procedure and registration)	Make sure that the (general) procedure applies to energy aspects and to energy management.
<i>4.2.2 The implementation, correctness and effectiveness of the measures taken are regularly checked.</i>	4.5.2 Non-conformance, corrective and preventive measures (procedure and registration)	Make sure that the (general) procedure applies to energy aspects and to energy management.
4.3 Registrations	4.5.3 Registration This section regulates procedures for identifying, maintaining and deleting environmental registrations.	
4.3.1 Registrations of the energy management system are identified, described, stored and where necessary removed from a(n energy) register.	4.5.3 Registration (procedure and registration)	Make sure that the (general) procedure also applies to energy aspects. If necessary, compile an index of energy registrations. Define how long the registrations are to be saved.

<b>BESS Energy Management Specification</b>	<b>Relevant section ISO 14001</b>	<b>Modification recommendation ISO 14001</b>
4.3.2 The registrations are legible, identifiable and can be traced to the relevant activity, product or service.	4.5.3 Registration (evidenced)	Make sure that the (general) procedure also applies to energy aspects.
4.4 Energy management audits	4.5.4 Environmental management system audits This section of ISO 14001 regulates matters including the procedures for audits of the environmental management system.	
4.4.1 Regularly, but at least once each year, internal audits are performed with reference to the aspect energy as referred to in these specifications (may be part of another management system) in order to check the system's functioning.	4.5.4 Environmental management system audits (procedure, planning and registration)	Make sure that the (general) procedure also applies to energy aspects. Determine in the procedures for environmental management audits that the energy reference must also be audited. Modify the audit programme so that the time involved is also based on the important energy aspects.
4.4.2 The results of the audit are reported to the management.	Environmental system audits (registration)	Determine that reports to the management regarding the audit also discuss the energy aspects.
5 Management involvement	4.6 Assessment by the executive board This section of ISO 14001 places requirements on the manner in which the highest level of management is to regularly assess the environmental management system	
5.1 Evaluation	4.6 Assessment by the executive board	
5.1.1 The energy management system or the energy aspect within another management system is evaluated periodically, but at least once each year, by the management in terms of its applicability, adequateness and effectiveness.	4.6 Assessment by the executive board (registration, if applicable a procedure)	Determine whether the energy and environmental management system is able to achieve the policy; adjust where necessary. Record the outcome.

### 3.5 Business case

Business Case								
<b>Energy Usage (per year)</b>	MWh	% of total	EUR	% of total	Energy Price (EUR/MWh)	Direct CO2 emissions (tCO2)	Indirect CO2 emissions (tCO2)	Total CO2 emissions (tCO2)
Fuels	1000	67%	40000	57%	40	190		190
Electricity	500	33%	30000	43%	60	0	250	250
<b>Total</b>	<b>1500</b>	<b>100%</b>	<b>70000</b>	<b>100%</b>		<b>190</b>	<b>250</b>	<b>440</b>
<b>Energy costs (per year)</b>	EUR	% of total costs	% of company profits					
Energy Costs (Fuels+Electricity)	70000	3,5%	14,0%					
Total Company Costs	2000000	100,0%	400,0%					
Company Profits	500000	25,0%	100,0%					
<b>Production (per year)</b>	unit	Energy Intensity with relation to Product 1	Combined Production Value					
Production Product 1	200	1	200					
Production Product 2	100	0,75	75					
<b>Total</b>			<b>275</b>					
<b>Specific Energy Consumption (SEC) Data</b>	2005	% of 2003	2004	% of 2003	2003	% of 2003		
SEC (MWh/prod.unit)	5,5	94%	5,7	98%	5,8	100%		
Energy Costs Intensity (EUR/prod.unit)	254,5	94%	260	96%	270	100%		
Specific CO2 emission - direct (tCO2/prod. Unit)	0,69							
Specific CO2 emission - indirect (tCO2/prod. Unit)	0,91							
Specific CO2 emission - total (tCO2/prod. Unit)	1,60							
Typical Sectoral SEC								
Targeted Company's SEC								
<b>Saving Data</b>		unit	%					
Potential Energy Savings	50	MWh	3,3%					
Potential Costs Savings	2000	EUR	2,9%					
Estimated Costs	6000	EUR						
Payback	3	lyrs						
<b>Energy Management Implementation</b>			% of energy costs	% of total costs	% of company profits			
Estimated Energy Management Costs	10000	EUR	14,3%	0,5%	2,0%			
Estimated time for implementation	6	months						

### 3.6 Horizontal measure list

#### PRODUCTION PROCESSES

#### Thermal energy

#### Heat generation

<b>Low-cost / short term opportunities</b>	
<b>Energy Saving Opportunity</b>	<b>Action to Check</b>
1. Reduce excess combustion air to minimum	1. CO <sub>2</sub> /O <sub>2</sub> measurement
2. Maximise completeness of combustion	2. Soot/CO measurement
3. Maintain boiler cleanliness (soot/scale)	3. Monitor for rise in flue gas temperature
4. Repair (replace) boiler insulation	4. Periodic inspection of boiler insulation condition.
5. Insulate feedwater tank – cover tank	5. Check possible feedwater temperature losses
6. Insulate condensate return lines	6. Check possible heat loss from condensate return lines.
7. Optimise quality of make-up water and feedwater	7. Monitor quality of make-up water and feedwater: hardness, acidity, O <sub>2</sub> .
8. Minimise blowdown	8a. Monitor concentration of dissolved solids in boiler water. 8b. Improve blowdown controls
9. Maintain nozzles, grates, fuel supply pressure/temperature at manufacturers' specifications	9a. Ensure specifications are available and in use. 9b. Regular check and resetting/maintenance.
10. Maximise combustion air temperature	10. Draw air from highest point in boilerhouse.
11. Reduce steam pressure where it exceed system/process requirements.	11. Check system/process needs; adjust controls.
12. Use duct for intake of warmer combustion air	12. Install duct from combustion air intake to higher parts of room.
13. Install an automated gas leakage detector.	-
14. Repair leaks in steam pipework.	-
<b>Higher cost / longer term opportunities</b>	
<b>Energy Saving Opportunity</b>	<b>Action to Check</b>
1. For rapidly varying demand, convert one or more boilers to live accumulator (buffer tank).	1. Monitor/evaluate demand change patterns.
2. Alter controls to "High-Low-Off" or "modulating-Low-Off"	2. Monitor/evaluate demand change patterns.
3. Install flash steam heat recovery	3. Consider in large capacity situations with high (continuous/frequent) blowdown.
4. Improve combustion controls.	4a. Provide adequate heat input to meet demand. 4b. Minimise fuel/pollution. 4c. Protect personnel/equipment.
5. Waste heat recovery	5a. Economiser 5b. Air heater (recuperator)?
6. Install boiler blowdown heat recovery.	6. Consider in large capacity situations with high (continuous/frequent) blowdown.
7. Use process integration	7. Couple process units that have significantly different heat requirements (i.e. low-pressure steam leaving a high-pressure steam consuming production process can be used for a process requiring low-pressure steam).

## Heat Distribution

Low-cost / short term opportunities	
Energy Saving Opportunity	Action to Check
1. Repair/replace faulty insulation	1. Pipework insulation – especially around valves.
2. Repair inefficient steam traps/drains. valve spindles etc.	2. Regular checks for leaks throughout the system.
3. Insert valves to isolate “periodic-use” items in system.	3. Check system for periodic (e.g. seasonal, nightly) items (e.g. space heaters).
4. Remove/isolate “dead-legs” and redundant Pipework	4. Check for dead-legs and redundant piping.
Higher cost / longer term opportunities	
Energy Saving Opportunity	Action to Check
1. Replace steam traps/drains with more efficient designs.	1. Monitor efficiency of, and heat losses from existing traps.
2. Replace or increase insulation	2. Check existing insulation; estimate heat losses in system.
3. Maximise condensate returns.	3. Measure “discarded” heat from condensate.
4. Redesign system to minimise pipe runs.	-
5. Generation pressure reduction.	-

## Heat Utilisation a) process

Energy Saving Opportunity	Action to Check
1. Plant insulation	-
2. Local burner efficiency	-
3. Maximise heat transfer rate	-
4. Improve controls (e.g. thermostats)	-
5. Consider alternative energy source	-
6. Ensure plant at high load factor	-
7. Eliminate uneconomic “hot standby” periods	-
8. Recycle waste heat to process	-
9. Recover heat, for use elsewhere	-
10. Train all staff to operate manual controls and to watch for energy saving opportunities.	-

## Heat Utilisation b) space heating

Low-cost / short term opportunities										
Energy Saving Opportunity	Action to Check									
1. Use heat only when area is occupied	-									
2. Set thermostats to minimum for comfort	-									
3. Minimise loss of hot air	-									
4. Clean and effective heaters	-									
5. Maintain pipe insulation in unheated areas	-									
6. Check condensate traps	-									
7. Vent air from hot water systems	-									
8. Time switches	-									
9. Manual controls where appropriate	-									
Higher cost / longer term opportunities										
Energy Saving Opportunity	Action to Check									
1. Install more/more efficient thermostats	-									
2. Use motorised valves to divide building into different zones	-									
3. Air curtains	-									
4. Change energy source	-									
5. Change heating system – where: <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: left;"><u>Insulation</u></td> <td style="text-align: left;"><u>Ventilation</u></td> <td style="text-align: left;"><u>Use</u></td> </tr> <tr> <td style="padding-left: 20px;">Good</td> <td style="padding-left: 20px;">High</td> <td style="padding-left: 20px;">Radiant Heat</td> </tr> <tr> <td style="padding-left: 20px;">Poor</td> <td style="padding-left: 20px;">Low</td> <td style="padding-left: 20px;">Convective Heat</td> </tr> </table>	<u>Insulation</u>	<u>Ventilation</u>	<u>Use</u>	Good	High	Radiant Heat	Poor	Low	Convective Heat	
<u>Insulation</u>	<u>Ventilation</u>	<u>Use</u>								
Good	High	Radiant Heat								
Poor	Low	Convective Heat								
6. Improve building insulation	-									

## Electrical Energy

### Motors

Energy Saving Opportunity	Action to Check
1. Try to ensure that motor capacity is not more than 25% in excess of full load.	-
2. Install motor controllers (voltage, power factor and fixed speed controllers).	-
3. Build in "soft-start" facilities.	-
4. Install variable speed drives	-
5. Install high efficiency motors	-

## Compressed Air

Low-cost / short term opportunities	
Energy Saving Opportunity	Action to Check
1. Switch off whenever possible.	-
2. Install low-cost solenoid valves on air supply lines to individual machines. Switch off compressed air supply as soon as machine is switched off.	-
3. Clean air intake filters regularly	-
4. Use lowest possible operating pressure. Reduce pressure locally if possible.	-
5. Use lowest air intake temperature possible.	-
6. Fit 2-speed motors.	-
7. Fix leaks	-
8. Check on correct pressure setting regularly.	-
Higher cost / longer term opportunities	
Energy Saving Opportunity	Action to Check
1. Fit a small (jockey) compressor to meet off-peak demand.	-
2. Duct air intake to ensure coolest possible.	-
3. Fit air flow and kWh meters to monitor power and air use.	-
4. Install modern controls on multi-compressor installations.	-
5. Fit a standard heat recovery unit.	-
6. Air pre-cooling.	-
7. If <u>some</u> users are using low pressure air (2.5 – 3 bar), install two separate systems.	-
8. Use frequency control for compressor.	-
9. Use an individual compressed air supply for special applications.	-
10. Replace pneumatic tools be electrical tools	-

## Vacuum

Low-cost / short term opportunities	
Energy Saving Opportunity	Action to Check
1. Switch off whenever possible.	-
2. Regular maintenance is necessary to maintain pump efficiency and prevent breakdown, especially when the vacuum-space contains condensing vapours;	-
3. Fix leaks	-
Higher cost / longer term opportunities	
Energy Saving Opportunity	Action to Check
1. Fit a standard heat recovery unit.	-
2. Use a central vacuum system with several delivery points	-

## Refrigeration

Design measures	
Energy Saving Opportunity	Action to Check
1. Group refrigeration cells according to temperature.	-
2. Use an integrated plant layout – optimise use of evaporators or condensers (i.e. remove obstacles)	-
3. Limit energy losses through open doors	-
Low-cost / short term opportunities	
Energy Saving Opportunity	Action to Check
1. Switch off lights, fans, pumps. etc., when not required.	-
2. Repair damaged insulation/seals.	-
3. Check for refrigerant contamination.	-
4. Check for scaling on condenser and evaporator surfaces.	-
5. (Multi-compressor systems); set controls to activate minimum number of compressors.	-
6. Monitor timing and duration of defrost cycles. Defrost on demand rather than at fixed intervals.	-
7. Use load rescheduling (e.g. cool at night) where maximum-demand tariffs are in operation.	-
8. Minimise cooling space by installing removable plastic screens or panels or by filling cooling space with polystyrene foam blocks	-
9. Switch off evaporator fans when compressor is off	-
10. Regulate condenser pressure (and therefore temperature)	-
11. Delayed start-up of compressors. Initially, only start-up of ventilation.	-
12. Increase the evaporation temperature.	-
Higher cost / longer term opportunities	
Energy Saving Opportunity	Action to Check
1. Install kWh meters and instrumentation to monitor equipment and cold room.	-
2. Install an energy management system which analyses operation of the whole refrigeration system.	-
3. Use effective insulation and sealing.	-
4. Install efficient electronic expansion valves. Avoid “head pressure control” where possible.	-
6. Recovery of waste heat at the condenser	-
7. Automatic bleeding of refrigerant to remove any penetrated air	-
8. Install frequency control (i.e. VRF) on chiller compressor.	-
9. Install high efficiency or 2-rev electromotor on evaporation fan	-
10. Build a cooled front space for refrigeration units.	-
11. Use hot refrigerant gas from the compressor for the initial stages of the defrosting cycle.	-
12. Use excess heat from other production processes for the production of cooling using adsorption/absorption cooling.	-

**PRODUCTION BUILDINGS**

**Lighting**

<b>Energy Saving Opportunity</b>	<b>Action to Check</b>
1. Use the most efficient lamps consistent with required illumination levels and colour rendering.	-
2. Use the light output from lamps efficiently.	-
3. Maintain lamps and fixtures clear of light-blocking dust and dirt.	-
4. Switch off lights where lighting is not needed.	-
5. Consider automatic control of lighting (time clocks and/or photo cells).	-
6. Make the best use of daylight.	-
7. Avoid the absorption of light by the surroundings (light-coloured wall, ceilings, and floors).	-
8. Replace lamps which have exceeded their rated life.	-
9. Use "switch-off" and "save-it" stickers as a tool of good housekeeping.	-
10. Consider new technologies in order to reduce installation cost, such as infrared switching.	-
11. Divide the lighting system of a large space into several independent lighting groups.	-
12. Use presence detection switches	-
13. Use a lighting system that is continuously variable (e.g. high-frequency fluorescent lighting).	-

**Building skin**

<b>Low-cost / short term opportunities</b>	
<b>Energy Saving Opportunity</b>	<b>Action to Check</b>
-	-
<b>Higher cost / longer term opportunities</b>	
<b>Energy Saving Opportunity</b>	<b>Action to Check</b>
1. Thermal insulation of floor	-
2. Thermal insulation of walls	-
3. Thermal insulation of roof	-
4. Use of double-glazed or solar shading glass windows	-

## Central Heating

Low-cost / short term opportunities	
Energy Saving Opportunity	Action to Check
1. Use a weather dependent control to regulate the temperature of the boiler water in relation to the outside temperature.	-
2. Install an advanced timer for the boiler operation schedule.	-
3. Insulate pipework	-
4. Insulate hot water storage tanks	-
Higher cost / longer term opportunities	
Energy Saving Opportunity	Action to Check
1. Divide large interior spaces into smaller areas.	-
2. Use radiation heating in cases where large ventilation rates are required.	-
3. Use displacement ventilation in the case where the heated indoor areas are higher than 6 meters.	-

## Ventilation system

Low-cost / short term opportunities	
Energy Saving Opportunity	Action to Check
-	-
Higher cost / longer term opportunities	
Energy Saving Opportunity	Action to Check
1. Heat recovery of exhaust air using a rotary wheel.	
2. Reduce the amount of ventilation air as much as possible by the installation of: <ul style="list-style-type: none"> <li>▪ Timer switch;</li> <li>▪ Occupancy sensor;</li> <li>▪ Air quality;</li> <li>▪ Frequency control on the fan motor</li> </ul>	
3. Prevent infiltration through door openings with: <ul style="list-style-type: none"> <li>▪ Thermal insulation</li> <li>▪ Draught curtains</li> <li>▪ Air cushion</li> <li>▪ Automatic door</li> <li>▪ Slip door</li> <li>▪ Rubber seal between door and doorpost instead of brushes or no sealing.</li> </ul>	

### Exhaust systems

Low-cost / short term opportunities	
Energy Saving Opportunity	Action to Check
-	-
Higher cost / longer term opportunities	
Energy Saving Opportunity	Action to Check
1. Use <i>local</i> exhaust ventilation systems. The purpose of a local exhaust system is to remove the contaminants (dust, fume, vapour etc.) at the source.	-
2. Some options for improving the efficiency of exhaust systems are: <ul style="list-style-type: none"> <li>▪ Frequency control on the electromotor of the fan</li> <li>▪ Close exhaust points that are not in use.</li> <li>▪ Start up the exhaust system with all exhaust points closed.</li> </ul>	-

### Air-conditioning

Low-cost / short term opportunities	
Energy Saving Opportunity	Action to Check
-	-
Higher cost / longer term opportunities	
Energy Saving Opportunity	Action to Check
1. Use thermal energy storage systems (i.e. ice banks)	-
2. Use shading devices for windows.	-

### 3.7 Energy Savings register I (Realised projects before 2006)

Short overview of the realised projects over the last 11 years

Important measures from the period 1995-2005 (description)	Year measure in use	savings GJ/year	contribution improvement of the EEI (+%)	Explanation
Energy management and good house keeping:				
Energy saving projects in processes:				
Energy saving projects in utilities and buildings:				
Strategic projects:				
<b>Total energy efficiency</b>				

### 3.8 Energy savings register II (planned and unplanned actions) 2006-2010

#### Overview of actual executed actions and their contribution to the Energy Efficiency Index-improvement

Energy saving measure <sup>1</sup> (number and description)	actual year measure in use	actual <sup>2</sup> savings in 2006	actual <sup>2</sup> savings in 2007	actual <sup>2</sup> savings in 2008	actual <sup>2</sup> savings in 2009	actual <sup>2</sup> savings in 2010	investment needed staff & mat.	pay back period yrs	savings in kWh per year  (actual)	savings in m <sup>3</sup> natural gas per year (actual)	Energy savings (Gj/yr)  (actual)	Energy efficiency improvement (% ) (actual)	Avoided CO <sub>2</sub> emissions (ton/year) <sup>3</sup> (actual)	Remarks
electricity consumption in the reference year (kWh)														
natural gas consumption in the reference year (m <sup>3</sup> )														
Primary energy use in the reference year (GJ)														
Energy Management & good housekeeping														
1)														
2)														
etc)														
Energy saving projects in processes														
Energy saving projects in utilities & buildings														
Strategic projects														
<b>Total energy efficiency</b>														
1) If possible refer to energy saving measure lists used 2) The actual savings are presented on a yearly basis only in 1 year or divided over 2 subsequent yaers when the actual date of in use is during the year 3 ) Avoided CO <sub>2</sub> emissions (ton/yr) = saved electricity (kWh/yr) * 0,000671 (ton CO <sub>2</sub> /kWh) + saved natural gas (m <sup>3</sup> /yr) *0,00177 ton CO <sub>2</sub> /m <sup>3</sup> + saved consumption of other energy sources * adjustment factor N.B. The standard formula only takes electricity and natural gas into account; for other energy sources adjust the formula														

### 3.9 Set of Definitions for the BESS project

<b>Action Plan</b>	It describes the measures, means, responsibilities and time frame, for the achievement of specific energy performance targets. [6]
<b>Benchmarking</b>	It is the comparative evaluation between the organisation and the relevant sector previous and current energy performance. [6]
<b>Best practice</b>	The application of the most appropriate and cost-effective energy efficiency technologies and management techniques. Refers to the techniques and technologies at the upper end of the performance range identified in a benchmark comparison. [7]
<b>Branch-based measure list</b>	A list of potentially relevant energy saving measures typical for the companies in a certain industrial branch; i.e. meat processing, bakery or dairies [7]
<b>Continual Improvement</b>	It is the process of amending year by year the results of energy management, increasing efficiency, avoiding unnecessary consumptions. [6]
<b>Corrective action</b>	Action taken in order to eliminate the cause of an established deviation, or other undesired situation [8]
<b>Deviation</b>	Non-compliance with the requirement [8]
<b>E-learning</b>	Integration of information and communication technologies (ICT) in education and training systems. In BESS-project e-learning is used to help SMEs to adopt energy management system. E-learning system is a web-application with information and energy efficiency tools. [7, also known as online training, online education or online learning]
<b>Energy</b>	Energy in any form oil, gas, coal, other kinds of fuel and renewable energies consumed as electricity or heat to cover the needs of the organisation. [6]
<b>Energy aspect</b>	The part of organisation's operations, products or services which affects the use of energy. [10]. Any technological (e.g. equipment and starting up), organisational (such as work processes and maintenance) and behavioural (e.g. compliance with job instructions) related matter that has a positive or negative effect on the energy consumed by the operational activities is an energy aspect. [7]
<b>Energy Audit</b>	The process of identification of the energy consumptions, of the conservation potential and of the appropriate efficiency practices [6]
<b>Energy audit model</b>	A public, standard and repeatable procedure for the performance of an energy audit service by specifying the scope, the thoroughness and the aim of the audit work [9]
<b>Energy Consumption</b>	The amount of energy used to cover specific needs of the organisation; i.e. lighting, heating, air-conditioning, mechanical equipment operation, process heat, etc. [6]
<b>Energy coordinator</b>	A person who is responsible for the energy performance of the company (known as an energy manager in bigger companies but for the SMEs term coordinator is considered better) [7]

<b>Energy efficiency index (EEI)</b>	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. [7, see also EPI)
<b>Energy management</b>	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. [7]
<b>Full Energy management checklist</b>	A checklist (tick box questionnaire) which can be used for energy management system audit to assess the quality of the energy management system. [7]
<b>Energy management System</b>	The part of the overall management system, which is dedicated to the continual energy performance improvement. [6]
<b>Energy management system audit</b>	The Energy Management system audit is one of the most important parts of an energy management system. The results of the audit reflect whether the system is functioning and where improvements can be made. During the Energy Management system audit, the Full Energy Management Checklist is used as an instrument to determine whether your energy management system functions as it should if you strive towards full compliance with the BESS Specification. Any non-conformance is identified, and possible improvements are noted and subsequently presented to management. [7]
<b>Energy management system specification</b>	Non-official 'standard' about energy management system [7]
<b>Energy management system standard</b>	Formal and official standard about energy management system [7]
<b>Energy performance</b>	The amount of energy consumed in relation with the obtained results. The lower the Specific Energy Consumption the higher the Energy Performance. [6]
<b>Energy performance benchmarking (EPB)</b>	The process of comparing own companies energy performance against similar companies to identify areas for improvement and try to learn of best practice. [7]
<b>Energy performance index (EPI)</b>	Annual change in specific energy consumption (SEC) related to a basis year normalised to 100%. [7]
<b>Energy policy</b>	The statement of the organisation's commitment to continual energy performance improvement. Expression of the relative intentions and principles, which provide the framework for setting energy targets and for taking action. [6]
<b>Energy saving register</b>	The energy conservation measure list deriving from the Action plan is transformed into monitoring of energy saving activities implementation, with reference to timeframe, resources and results in an ENERGY SAVING REGISTER. [7]
<b>Energy team</b>	A group of persons from different levels of an organisation who are responsible for the energy performance of the company [7]
<b>Energy Target</b>	The measurable energy management result, which should be achieved in specific period of time. [6]
<b>Energy use</b>	The use of energy delivered to, or converted in, the operations of organisation [10]
<b>Good housekeeping</b>	Means no-cost and very low-cost energy saving activities/measures which are typically paid from the yearly budgets of the energy coordinators and do not require investments [7]

<b>Good housekeeping measure list</b>	A list of potentially relevant energy saving good housekeeping measures for a company to consider to be implemented. [7]
<b>Horizontal measure list</b>	A list of potentially relevant energy saving measures typical for all kind of companies in different industrial branches (i.e. motor driven systems, compressed air etc). [7]
<b>Linking list</b>	Specification how to connect the BESS energy management specification and the other management systems/standards i.e. ISO 9001/2000, 14001 and the HACCP food safety). [7]
<b>Measure list</b>	A list of potentially relevant energy saving measures to consider to be implemented in a site. There are measure lists for a) good house-keeping b) typical for certain industrial branch (i.e. meat processing) and c) horizontal (generic) measure lists (i.e. motor driven systems, compressed air etc). These measure lists are used when trying to identify energy saving measures relevant for the site (i.e. in energy audits) Also a term check-list could be used but to avoid misunderstandings the word check-list if only in use with full energy management checklist. [7]
<b>Monitoring</b>	The process of systematically tracking and analysing appropriate energy performance indicators over time. [6]
<b>Organisation</b>	A company, corporation, authority or institution, public or private that has its own functions and administration. [6]
<b>Plan-do-check-act approach</b>	Generic approach for continual improvement of processes.
<b>Procedure</b>	Described manner of implementing an activity or process [8]
<b>Prevention</b>	Planned actions aiming to the elimination of the causes of negative events. [6]
<b>Response</b>	Immediate actions aiming to the minimisation of the consequences of negative events. [6]
<b>Review</b>	Actions aiming to the assessment of energy management system's sufficiency, appropriateness, quality, improvement potential and need for revision. [6]
<b>Self assessment</b>	An energy management system audit carried out by the organisation itself. This is an internal audit and carried out with the help of the full energy management checklist [7]
<b>Senior management</b>	Person or group of persons who, at the highest level, manage the organisation, or part thereof, for which the energy management system is defined. [10]
<b>Significant Energy Consumption</b>	It is the energy consumption that accounts for a high proportion of the total energy consumption of the organisation or presents considerable potential for energy conservation. [6]
<b>Small and Medium-Sized Enterprise (SME)</b>	An enterprise with the headcount of less than 250 persons. Furthermore the turnover must be less than 50 million euros or balance sheet total less than 43 million euros.
<b>Specific Energy Consumption</b>	The amount of energy consumed per unit of appropriate reference, i.e. energy consumed per unit of product, mass or volume of product, per person, per building's surface or volume (kWh/unit, kWh/ton, kWh/m <sup>3</sup> , kWh/person etc.) [6]

### 3.10 Abbreviations

BESS	Benchmarking and Energy Management Schemes in Small and Medium Sized Enterprises
CPD	Continual and Professional Development
CUSUM	Cumulative Sum
ECP	Energy Conservation Plan
EEI	Energy Efficiency Index
EM	Energy Management
Energy MAP	Energy Management Action Programme
EMAS	European Eco-Management and Audit Scheme
EMIM	Energy Management Implementation Model
EU	European Union
EPI	Energy Performance Indexes
GHK	Good Housekeeping
HACCP	Hazard Analysis and Critical Control Points
ISO	International Organisation for Standardisation
LTA	Long Term Agreements
M&T/BM	Monitoring & Targeting/Benchmarking
PDCA	Plan-Do-Check-Act
PM	Project Management
SEC	Specific Energy Consumption
SEI	Sustainable Energy Ireland
SMART	Specific, Measurable, Achievable, Realistic and Timed
SMEs	Small and Medium Sized Enterprises
TRA	Tasks, Responsibilities and Authority
VRF	Virtual Routing and Forwarding

### 3.11 Sources

- [1] Gold Standard - IS393 Energy Management System (SEI Sustainable Energy Ireland)
- [2] MCP
- [3] <http://www.caddet.org/brochures/display.php?id=871>
- [4] "Developing an Energy Management System", State Government of Victoria, Australia
- [5] EMAS Energy Efficiency Toolkit for Small and Medium sized Enterprises
- [6] EIE EMS-Textile project
- [7] EIE BESS-project
- [8] SS-EN ISO 9000 Management system for quality - principles and terminology
- [9] SAVE, Audit I –project
- [10] Swedish standard 62 77 50

### 3.12 Literature

EMAS Energy Efficiency Toolkit for Small and Medium sized Enterprises  
(<http://www.europa.eu.int/comm/environment/emas>)  
Good Practice Guide 209 "Reducing energy costs in dairies"  
BESS e-learning scheme  
Handbuch für betriebliches Energiemanagement (Austrian Energy Agency, Austrian Energy Consumer's Association)  
Energy management system specification with guidance for use (NOVEM)  
Structural attention for energy efficiency by energy management (NOVEM)  
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