How to implement energy management in small and medium-sized enterprises

A guide with supporting tools
How to implement energy management in small and medium-sizes enterprises.
A guide with supporting tools.

Print: Danish Standards Foundation
Graphic design: Danish Standards Foundation
Published January 2014
Second edition, first issue

Published by Danish Standards Foundation
6 Kollegievej, DK-2920 Charlottenlund
Phone: +45 3996 6101
Fax: +45 3996 6102
www.ds.dk
ds@ds.dk

© Danish Standards 2014
Preface

This guide is the result of a joint Nordic project led by Danish Standards in collaboration with Icelandic Standards and Standard Norway, and with the participation of a number of small and medium-sized enterprises in Denmark, Iceland and Norway.

The project has been partly financed by Nordic Innovation.

As part of the project, the companies have received guidance and assistance on energy management, and during this process the companies have given feedback and instructions on the draft guide text and the associated tools. This means that the guide has been developed in collaboration with and to assist small and medium-sized companies.

The guide is based on the international standard on energy management, ISO 50001:2011 Energy management systems – Requirements with guidance for use.

For many small and medium-sized companies it is a difficult endeavour to read and translate the text of the standard into practical work on energy efficiency and energy management in the company. This guide gives a step-by-step and practical approach to working with energy management, based on the companies’ own experiences.
Is energy management a good idea for our company?

Focus on energy consumption means economic benefits for your company. Experience in Denmark has shown that systematic focus on energy (energy management) already the first year will yield energy savings of approximately 10%.

A reduction of the energy consumption will also benefit the environment. By reducing energy consumption, your company will also lower its CO₂ emission and contribute to addressing the political environment objectives which will enhance your company profile. At the same time, lower energy consumption will benefit the financial bottom line.

Energy management is a systematic way of addressing energy efficiency:

- Overview of energy use.
- Overview of opportunities for energy savings.
- Establishing regular routines.
- Focus and delegation of responsibilities with respect to progress and development.

The systematic approach focus and the routines that are the natural results may also have a positive impact on other areas of your company. And introducing energy management does not have to be a complicated affair. Perhaps your company already has a systematic approach in place with an overview and responsibilities with respect to improving energy efficiency or to quality or environmental management. If so, you are well on your way!

This guide provides step-by-step assistance to establish the methodology, the routines and the division of responsibilities which form the basis of energy management. It aims at making it easier for small and medium-sized enterprises to get started and successfully reach their goals. Large enterprises can, however, also benefit from the guide.

The guide divides the entire process into 6 steps. The steps are based on the Plan-Do-Check-Act approach, which is a fundamental principle in all management standards, including the energy management standard.

If you take one step at a time, the process will become practicable and clear. However, you do not need to take one step at a time. You may address several steps at the same time, fulfil some of the steps in reverse order, or even leave out some of the steps (as long as certification is not your goal).

Let each single step take the time that is needed – progress is the main thing. We recommend, however, not to let the process take too long, plan e.g. a process where most of the steps are implemented within a couple of months to 1 year.
The 6 steps are the following:

1. **Step 1** gives you an indication of the economic potential of establishing energy management in your company and provides you with an overview of the present stage: how far are you in terms of establishing energy management and what needs still to be done.

2. **Step 2** describes an initial examination of your energy consumption which will assist you in determining the level of ambition for introducing energy management. In addition, step 2 describes how you subsequently develop the energy policy, targets and objectives for your energy management work.

3. **Step 3** describes how to organise the work on energy management in an appropriate way: appointment of an employee to be responsible for the day-to-day energy work and the involvement of other employees.

4. **Step 4** describes how to map your energy consumption. A mapping is needed in order to determine the energy consumption to be used as the basis for transforming the energy policy into concrete action and for achieving a well-functioning energy management system.

5. **Step 5** describes how to identify, on the basis of the mapping, where and how energy can be saved, how to make an action plan and how to document your savings.

6. **Step 6** describes how to make energy management work in your day-to-day operations, how to check the activities, how to follow up and how to document.

We wish you good luck.
1. Energy management – what is in it for us?

Make a simple business case

The idea to introduce energy management may emerge several places in your company. It is often a management decision taken in response to demands from customers and collaborators, but in many cases ideas are presented by employees. It is not important where the initiative comes from, the essential thing is that the decision to introduce energy management is actively supported by top management.

A very simple business case may be a good tool if you wish to get an overview to see whether energy management will be a benefit from an economic point of view and as a basis for decision. See an example of a simple business case in the table below.

Table 1. Example of a simple business case which may give an indication of the potential of introducing energy management

<table>
<thead>
<tr>
<th></th>
<th>Expense/year</th>
<th>Estimated savings in %</th>
<th>Total/year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy consumption</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>25,000</td>
<td>3</td>
<td>750</td>
</tr>
<tr>
<td>Gas consumption</td>
<td>20,000</td>
<td>5</td>
<td>1,000</td>
</tr>
<tr>
<td>Oil consumption</td>
<td>5,000</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Fuel consumption</td>
<td>10,000</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td><strong>Related consumption</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>5,000</td>
<td>7</td>
<td>350</td>
</tr>
<tr>
<td>Chemicals</td>
<td>20,000</td>
<td>15</td>
<td>3,000</td>
</tr>
<tr>
<td>Repairs/loss of production</td>
<td>15,000</td>
<td>75</td>
<td>11,250</td>
</tr>
<tr>
<td><strong>Total savings</strong></td>
<td></td>
<td></td>
<td>16,500</td>
</tr>
<tr>
<td><strong>Consumption to operate energy management</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Man hours</td>
<td>10,000</td>
<td>-</td>
<td>10,000</td>
</tr>
<tr>
<td>Investments</td>
<td>5,000</td>
<td>-</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>Total expenses</strong></td>
<td></td>
<td></td>
<td>15,000</td>
</tr>
<tr>
<td><strong>Total savings</strong></td>
<td></td>
<td></td>
<td>1,500</td>
</tr>
</tbody>
</table>
How far are you in the energy management process?

If your business case shows that energy management will benefit your company, it is necessary to establish an overview of the energy management elements that you need to address and those that are already being handled. The fact is that it often turns out that many of the elements are in place and that only a bit of adaptation and adjustment are needed to incorporate them in order to establish a well-functioning energy management system.

Fill in the table 2 on the next page to get an overview of your energy management work.

---

**Tool box, tool no. 1 – Make a simple business case**

Use this tool to get an indication of the economic potential of establishing energy management in your company.

**Fact box – Reference to ISO 50001**

4.1 General requirement

---

**Step 1 has been fulfilled when:**

- You have made a simple business case
- Your company and top management are motivated to work systematically with energy management
- You know the stage of progress of energy management in your company
Table 2. How far are you in terms of establishing energy management?

<table>
<thead>
<tr>
<th>Planning the energy management activities</th>
<th>Yes</th>
<th>We are almost finished</th>
<th>We have some material</th>
<th>We have taken the first small steps</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Do you know how much energy you use?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Do you know where most energy is used?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Have you identified areas where you wish to conserve energy?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Has the energy management task been allocated to named employees?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Have funds been allocated in the budget for energy savings?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The basis of energy management activities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Have you developed an energy policy or an energy strategy?</td>
<td></td>
</tr>
<tr>
<td>• Have you established objectives and targets for how much energy you wish to save?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating energy management</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Have you established an action plan stating when your energy projects are to be completed?</td>
<td></td>
</tr>
<tr>
<td>• Do you know the amount of energy savings that your energy projects will yield?</td>
<td></td>
</tr>
<tr>
<td>• Do your employees know why and how energy is saved in your company?</td>
<td></td>
</tr>
<tr>
<td>• Do you retain documents relating to your energy management work?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Checking the energy management activities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Do you keep track of your energy consumption on a regular basis?</td>
<td></td>
</tr>
<tr>
<td>• Is follow-up action taken if the energy consumption suddenly changes?</td>
<td></td>
</tr>
<tr>
<td>• Do you follow up on your action plan to ensure that projects are completed as planned?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Management review of the energy management work</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Does top management follow up on the energy management work performed in your company?</td>
<td></td>
</tr>
<tr>
<td>• Does top management appoint employees to carry out the energy management work?</td>
<td></td>
</tr>
<tr>
<td>• Does top management allocate funds to the energy management work?</td>
<td></td>
</tr>
<tr>
<td>• Is top management involved in writing the energy policy?</td>
<td></td>
</tr>
</tbody>
</table>
2. How to get started with energy management?

When you have completed step 1, you have made a simple business case. You have motivated top management to support the idea of energy management and you know the stage of energy management progress in your company. Then it is a good idea to make an initial examination to find out e.g. which resources have to be allocated from top management to establish/operate energy management.

Make an initial examination

There are many good reasons to make an initial examination before embarking on energy management. The purpose of the initial examination is to provide an overall picture of the energy consumption in your company, its distribution, opportunities for savings, and the quantity of resources required in terms of time and investments. The initial examination will give you the basis for determining the level of ambition with respect to energy management and for identifying which parts of the company to address first. This information will enable you to establish an overview of the size of your energy consumption and the resources that your company can afford to spend on implementation and operation of energy management.

The level of ambition should be determined on this basis and be decisive in identifying where energy management should be introduced in your company e.g. which part or department should start.

Tips & tricks – How to make an initial examination

– Give one person two or three days to compile the necessary information and form an overview of the consumption.

– Do a simple mapping on the basis of easily accessible information, e.g. from utility companies, previous consumption data, your own readings such as those made in connection with statements of green taxes, etc.

– Identify opportunities for savings – see if you have previously sought consultancy services, if your buildings have energy labels, if energy saving projects have previously been carried out. Or ask an impartial energy consultant for advice and ask your colleagues if they have any good ideas for savings.
Energy policy, energy objective and energy targets

The next step is to elaborate an energy policy, energy objectives and energy targets based on the initial examination.

The energy policy is to lay down the overall guidelines, determine delimitations and the level of ambition and answer the questions:

- What do we want to do about our energy consumption?
- Where in the company do we concentrate our effort?
- What will our overall savings amount to?

The objectives clarify the policy and provide a first overall picture, and are to answer the questions:

- Which areas (technologies or physical areas) will we address?
- What is the time frame?

The targets are a further development of the objectives and take a concrete form; they are to be included in the action plan together with persons responsible, economy, etc. The targets are to answer the following questions:

- Which departments of the company and/or which technologies will be the focus of attention?
- How much do we expect to save?
- What is the time frame?

There are no restrictions on how detailed the energy policy, energy objectives and energy targets have to be, but there has to be an increasing degree of detail from the energy policy through energy objectives to energy targets.

Tool box, tool no. 2 – How do we develop our energy policy, energy objectives and energy targets

As a minimum, you need to have an energy policy, energy objectives and energy targets – all approved by top management. This tool provides proposals which may serve as a source of inspiration for an energy policy, energy objectives and energy targets.
Fact box – Reference to ISO 50001

4.2 Management responsibility
4.3 Energy policy
4.4.6 Energy objectives, energy targets and energy management action plans

Step 2 has been fulfilled when:

You have carried out an initial examination
You have developed an energy policy
You have established energy objectives
You have set energy targets
Top management has approved the energy policy, energy objectives and energy targets
3. Who is to take part in the energy management work?

When top management has committed itself to work with energy management and is willing to allocate resources, it has to be decided how to organise the work. The resources must include an employee responsible for the energy management work as well as the necessary time and means.

After having appointed an employee responsible for the energy management work, it is important that top management approves a clear description of:

- What do the tasks consist in?
- What are the responsibilities of the employee responsible for energy management?
- What are the authorities of the employee responsible for energy management?
- Are there other people/resources within the organisation which the employee responsible can draw on?
- How many resources, people and funds have been allocated and for how long?
- What are the competences required for the task?

When appointing the employee to be responsible for energy management, it will be beneficial to select an employee who:

- takes an interest in energy management work;
- has good cooperation and communication skills;
- is well-liked and respected by company staff;
- performs in-house tasks, i.e. does not operate outside the company premises.

An energy management team can be established. In small enterprises such a team may consist of only one single person, e.g. the employee responsible for energy management. In large enterprises an energy management team may be composed of an inter-disciplinary team, which is an effective way of committing different parts of the company to energy management.

Employee involvement is an essential part of energy management, and it is important to encourage employees to participate – partly because employees often present good suggestions for improvement, and partly because employees should not experience energy management as something which is forced upon them. In the text box below a number of ideas and suggestions for involving employees in energy management work are presented for inspiration.

It is also important that two-way communication is maintained between employees and top management and that employees feel and are given responsibility. In addition employees must experience success by participating in energy management activities.
Tips & tricks – How do we involve employees in energy management activities

Active involvement of the employees is essential for successful establishment of energy management. Below is a list of ideas on how to motivate employees to participate in the energy management activities and how to involve them.

**Employees are best motivated when they:**
- are familiar with the energy policy and the overall energy targets and objectives of the company;
- know who is responsible for energy management;
- are aware of their own role with respect to energy management and feel ownership for the project;
- receive regular information on the energy consumption, energy savings and energy efficiency improvements;
- are given the opportunity to present suggestions for energy savings or for energy management improvements;
- are given the opportunity to acquire the competencies requires for their roles with respect to the energy management work;
- are aware of and incorporate energy management into the day-to-day operations, maintenance, purchasing, use of equipment and in rehabilitation and new construction;
- are informed about top management decisions relating to the energy management work

**How do we involve employees in energy management activities:**
- Emails, e.g. information on start-up, progress, special projects and management reviews.
- Intranet, e.g. organisation of the work, status of implementation and operation.
- Meeting, e.g. brainstorming where employees are given the possibility to discuss anything and everything.
- Posters, screens displaying e.g. the energy consumption.
- Ambassadors, e.g. in each department.
- Suggestion boxes, where everyone can contribute ideas.
- Competitions, e.g. between departments or for best suggestion.
Step 3 has been fulfilled when:

An employee responsible for energy management has been appointed
The tasks, responsibilities, authorities and resources have been identified
Resources have been allocated to establishing/operating energy management
An energy team has been set up
A plan has been established describing how employees are informed about energy management
A plan has been established describing how employees are involved in the energy management work
4. How much energy do we use and for what?

Why is mapping required?

The company needs to know its energy consumption by means of mapping in order to transform the policy into concrete action and a well-functioning energy management system. Even though mapping may be a lengthy and complicated affair, it is very valuable – especially if opportunities for energy savings are included from the very start.

**Mapping serves as the focal point for getting energy management on the right track by:**

- identifying areas with the highest energy consumption as this is where efficiency improvement or savings are often possible;
- identifying consumption which is higher than expected;
- identifying areas where the distribution of energy consumption is not as expected;
- providing an overview of the variation of consumption over time and whether this is as expected;
- determining the energy consumed outside normal production hours – idle time energy consumption;
- establishing the energy baseline: you need to know your point of departure to get an idea of the savings potential and making it possible to see the subsequent savings;
- identifying ideas for savings.

How is mapping carried out?

**Start by doing the easy bit first – what information do you already have?**

- Annual consumption of electricity, heating, gas, oil and water will be available in statements from utility companies.
- Your finance department will know the annual consumption of petrol/diesel.

Go back several years, if possible!
If you wish to be more specific:

- Ask your utility company to provide you with electricity meter readings for your company every hour. See the example below showing hourly measurements of the electricity consumption in a company.
- Take meter readings every day or with the same interval during a period of time to see the trend in energy consumption.
- Check the consumption of oil on a monthly basis.
- Take electricity meter readings every morning, evening and weekend to determine the consumption outside production hours.
- Keep mileage records to determine the consumption of fuel and the number of kilometers travelled.
- One meter for each place of consumption gives you valuable knowledge.
- Look for general information on the internet about key figures and expected annual energy consumption for e.g. PCs, copying machines, coffee brewers, etc.

Consumption is to be stated in energy units as price changes will complicate comparisons of price.

![Figure 1: Hourly measurements of electricity consumption in a company during one week. Such measurements give valuable indications on e.g. consumption outside production hours.](image-url)
Counting and calculation

→ Count all energy consuming items.
→ Record the power consumption of all energy consuming items.
→ Assess whether the consumption stated on rating plates corresponds to the actual consumption.
→ Estimate the service life.

When counting, it is often a good idea to consult employees. They usually possess invaluable information about operating time and load, and come up with good ideas for savings. Do not forget to note down these proposals for future reference.

At first, assumptions and estimates are in order, but they should be recorded as such in case more concrete and detailed calculations are made at a later stage.

When calculating consumption, the easy way is to enter all data in a mapping chart. This will allow sorting and computing information in many different ways and subsequent plotting of curves and figures.

Measurements

Certain types of consumption may be difficult to estimate with respect to load rate and consumption time. Therefore, it may be necessary to measure consumption in select places. For large energy consumers it is important to make sure that consumption and consumption patterns are correct:

→ Consumers using a 230V supply voltage can measure their consumption by means of a simple plug-in meter.
→ Consumers using a 400V supply voltage can request assistance from their electricians or energy utility companies.

It is necessary to measure consumption over a period of at least one week or a typical production period which can subsequently upscaled to the annual consumption.
Processing of mapping data

→ Plot consumption curves on the basis of the energy consumption measured. The curves will provide a visual representation of the variation of consumption during and outside production hours.

→ Find key figures from the information you already have, e.g. kWh/m². You can use the information to evaluate the variation over time, set up targets for your company or compare the consumption with other similar companies – or compare your own consumption over time.

→ Create e.g. pie charts on the basis of mapping results – it is a good way to visualise the distribution of energy consumption at places of use.

→ Determine the company energy baseline or the energy baseline for equipment for which savings are possible; you need to have a point of reference to get an impression of the potential for savings and subsequently be able to see how much you have actually saved.

Fact box – Reference to ISO 50001

4.4 Energy planning
4.4.3 Energy review
4.4.4 Energy baseline
4.4.5 Energy performance indicators
4.6.1 Monitoring, measurement and analysis

Tool box, tool no. 3 – Use mapping charts (spreadsheets) for compiling and getting an overview of all your data

It is highly recommended to use spreadsheets for compiling energy data and mapping the energy consumption. This will allow sorting and computing information in many different ways and subsequent plotting of curves and figures.

Tool no. 3 is an example of a mapping chart.
Step 4 has been fulfilled when:

- You have obtained an overview of the distribution of your energy consumption
- You have identified the major places of consumption and any consumption that was not as expected
- You have determined the idle time energy consumption
- You have established the energy baseline
- You have carried out relevant measurements
- You have recorded assumptions and estimates made in connection with mapping
- You have recorded ideas for savings
- You have elaborated charts, curves and key figures on the basis of mapping results
5. Where and how can we save energy?

How is energy screening carried out?

When you have been through the process of mapping your energy consumption you will have important knowledge to be used in your search for energy savings. The results of the mapping can be used directly, whereas other suggestions from employees obtained in the process may require further investigation.

Below is a list of the places to look for savings once the energy mapping is complete:

- Places of use with the highest energy consumption.
- Consumption which is higher than expected.
- Places where the distribution of annual consumption differs from that expected (see e.g. the pie charts).
- Places where the variation of consumption differs from that expected (see e.g. key figures/consumption curves).
- Consumption outside production hours – idle time energy consumption (see e.g. your own readings/consumption curves).
- Ideas for savings recorded in connection with mapping (see e.g. the mapping chart).

Typical suggestions for savings:

- Reduce the time equipment is turned on – savings are directly proportional to the time equipment not in use is turned off.
- Adjust the plant to demand – e.g. pressure, temperature, air change.
- Adjust to suit demand – e.g. by means of movement indicators and time control.
- Use improved technology – e.g. energy-saving pumps.
- Use the free energy – e.g. let cold air cool your server room.
- Apply energy efficient purchasing and design – a bit more expensive at the start, but much cheaper in the long run.
- Select places where you wish to use energy – e.g. halogen spots.
- Make sure that regular maintenance is carried out – stop waste of energy in the bud.
- Keep your plant clean – and give your equipment optimum operating conditions.
- Improve general behaviour – employees should feel responsible for the company’s energy consumption.
- Make use of the experience of employees – they are most familiar with the plant and often have the best ideas for savings.
→ Include other savings in the project – not only energy, also water, chemicals, man hours, etc.
→ Seek professional assistance – new eyes see new opportunities.
→ Develop competencies – e.g. training in the use of new and energy efficient equipment.
→ Optimise working procedures – e.g. virtual meetings, better logistics.

**Calculation of the potential for savings:**
→ Plot new operating hours, power consumption, etc. in the mapping chart, and calculate your new consumption.
→ Remember to describe how the new consumption was calculated, e.g. in an attachment to the mapping chart.

All ideas for savings are compiled in a combined screening list and action plan.

The screening list will become a kind of log of proposed savings which can subsequently be considered in the light of new conditions, e.g. new technology, changed energy prices etc. The screening list is a living document which is updated as required and must be used from the very start when you map your consumption.

**How is an energy action plan prepared?**

The energy action plan contains the projects for savings to be completed. The projects are the suggestions from the screening list that meet the requirements of the company regarding e.g. payback time or size of savings. The selected projects are calculated in detail to ensure that they provide a reliable picture of the savings which the company may expect in terms of return on investment, etc.

For each suggestion for savings, the combined screening list/energy action (tool no. 4) may be used to make an overview and to form the basis for prioritising the actions. For each savings project, detailed information, assumptions and calculations are given in a separate attachment.

**How are energy savings documented?**

The mapping has given you a number of tools which can be used to verify the savings achieved. Bear in mind that identical assumptions must be applied when comparing consumption before and after introducing savings – e.g. identical production patterns, identical pressure and temperature requirements for equipment, etc. Otherwise the comparison will give a misleading picture.
Tools for documentation of the energy savings may include:

- Consumption curves for the company.
- Measurements of selected equipment.
- Key figures.
- Charts.
- Establishing the energy baseline of savings implemented and comparison with the original baseline to identify how much has been saved.

**Tool box, tool no. 4 – Screening list/action plan (combined list)**

Use this tool for inspiration when making a combined screening list/action plan for proposed savings and specific projects for savings to maintain an overview of your actions and as a basis for prioritisation.

**Fact box – Reference to ISO 50001**

- 4.4.3 Energy review
- 4.4.6 Energy objectives, energy targets and energy management action plans
- 4.5.4 Documentation
- 4.5.6 Design
- 4.5.7 Procurement of energy services, products, equipment and energy

**Step 5 has been fulfilled when:**

- You have reviewed the areas where opportunities for savings exist
- The ideas have been recorded in a combined screening list and action plan
- Detailed calculations have been made of the most interesting ideas
- An action plan has been made for the projects to be completed
- You have documented the savings made
6. What is the day-to-day approach to energy management?

How do we maintain focus on energy management in our daily work?

When you have been working with steps 1 to 5 leading to an energy management system in the company, it is necessary to consider how energy management becomes part of the daily work routine in order to ensure that continuous attention is paid to reducing energy consumption. This is why step 6 is so important: at this point the company has to pursue the efforts to maintain focus on the day-to-day approach to the system and the savings.

It is essential that the actual consumption is compared with the expected consumption on a regular basis.

Establish a measuring plan to identify:
- where are measurements to be made?
- how often are measurements to be made?
- what equipment is to be used for measurements?

Calculate and assess key figures:
- which are relevant in terms of what is measured, e.g. kWh/m³ air, kWh heat/m²;
- as compared to previous consumption;
- as compared to that of similar companies;
- which are continuously revised and updated.

Ensure when recording major nonconformities that:
- the cause of the nonconformity is identified;
- remedial action is taken to bring consumption back to normal;
- a means to prevent nonconformities from occurring is found.

It is furthermore important that the day-to-day operations focus on the energy consumption and that deviations from the energy policy are prevented:

by setting criteria for efficient operation and maintenance:
- where are criteria to be set – e.g. for compressed air plants;
- frequency – e.g. examine the plant for leakage;
- extent – e.g. number of leakages accepted.
by maintaining focus on continuous maintenance that will reduce:

→ waste of energy – e.g. slack V-belts in ventilation systems;
→ repair expenses – night rates;
→ production stop – loss of production;
→ discarded items – low-quality production that cannot be sold at the normal price.

by maintaining focus on energy efficient purchasing:

→ inform suppliers that energy consumption is an essential parameter;
→ reduce energy consumption during the entire life of equipment, e.g. energy-saving fans;
→ accept higher purchasing costs as the additional expense will be worthwhile in the long run.

by maintaining focus on energy efficient design:

→ accept higher costs as the additional expense will be worthwhile in the long run;
→ seek external assessment of major projects to secure the most energy efficient solution.

How do we ensure in-house checking of our energy management system and the day-to-day activities?

It is important that internal audits of energy management are carried out as a kind of mock exam to ascertain whether the system works before the management review takes place.

The internal audit is to ensure that:

→ the energy policy, targets, objectives and other requirements of the system are fulfilled;
→ the system is effective and is maintained;
→ documents and records are subject to control;
→ follow-up activities are documented.

The outcome is to be presented to top management.

How is the management review – the annual examination – performed?

The purpose of the management review is to assess the following:

→ is the system worth the cost?
→ do we get what we expect?
→ is adjustment required?
→ what resources are to be allocated?
Input to the management review is a status regarding:

- what has happened since the previous review;
- savings achieved – have targets and objectives been fulfilled?
- internal audit results;
- expected energy consumption for the coming period;
- recommendations to improve energy management.

It is subsequently the task of top management to communicate information on:

- how the system is doing;
- how improvement of energy efficiency is progressing;
- any changes of the energy policy, objectives or targets;
- the future guidelines for energy management;
- allocation of resources.

Fact box – Reference to ISO 50001

4.5 Implementation and operation
4.5.5 Operation control
4.6 Checking
4.6.1 Monitoring, measurement and analysis
4.6.3 Internal audit of the EnMS
4.6.4 Nonconformities, correction, corrective action and preventive action
4.6.5 Control of records
4.7 Management review

You have a well-established energy management system when:

- The energy consumption is monitored on a regular basis
- Day-to-day operations focus on energy consumption
- Internal audits are carried out
- A management review has been performed or planned
Energy management – step by step

Figure 2. Energy management step by step. The figure shows the steps described in the guide and their relation to the Plan-Do-Check-Act approach, which is a fundamental principle in all management standards, including the energy management standard.
Congratulations!

You have now been through all the steps to energy management – but the work doesn’t stop here!

When you have completed all six steps towards energy management as described in this guide, you have established all the elements belonging to an energy management system.

You focus on energy consumption, you have made an overview, and the division of responsibilities has been clarified with respect to continuous improvement and development.

As a result of the process you have probably introduced a number of changes, and new, fixed routines have been implemented in your company. The process has left a lasting imprint on your behaviour.

By reducing the energy consumption of your company, you have lowered your CO₂ emissions and you now contribute to fulfilling the political climate objectives.

But working with energy management is an ongoing process with continuous cycles to ensure continuous attention on reducing energy consumption.

Compare on a regular basis the actual consumption with that expected, maintain focus on energy efficient design, maintain focus on energy efficient purchasing, maintain focus on continuous maintenance that will reduce any waste of energy, production stops, discarded items, etc., as described in step 6, and perform internal audits to ascertain that your system works.

You may also consider whether you wish to take a further step: to apply for certification of your energy management system!

Certification implies that, in cooperation with you, an external party will review your energy management system. If you conform to the requirements of the energy management standard, ISO 50001, *Energy management systems – Requirements with guidance for use*, you will be granted a certificate.

A certificate offers several advantages. It may contribute to ensuring that you maintain focus. Asking external parties to review your system and routines can be an inspiration for and form the basis of further progress. A certified energy management system can also be used to boost your company profile.
Tool box (supporting tools)

Tool no. 1 – Make a simple business case
Tool no. 2 – How do we develop our energy policy, energy objectives and energy targets?
Tool no. 3 – Mapping chart for compiling and getting an overview of energy data
Tool no. 4 – Screening list/action plan (combined list)

The tools are available at www.ds.dk/energiguide

Tool no. 1

Make a simple business case

<table>
<thead>
<tr>
<th>Energy consumption</th>
<th>Expense/year</th>
<th>Estimated savings in %</th>
<th>Total/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption</td>
<td>25,000</td>
<td>3</td>
<td>750</td>
</tr>
<tr>
<td>Gas consumption</td>
<td>20,000</td>
<td>5</td>
<td>1,000</td>
</tr>
<tr>
<td>Oil consumption</td>
<td>5,000</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Fuel consumption</td>
<td>10,000</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Related consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>5,000</td>
<td>7</td>
<td>350</td>
</tr>
<tr>
<td>Chemicals</td>
<td>20,000</td>
<td>15</td>
<td>3,000</td>
</tr>
<tr>
<td>Repairs/loss of production</td>
<td>15,000</td>
<td>75</td>
<td>11,250</td>
</tr>
<tr>
<td>Total savings</td>
<td></td>
<td></td>
<td>16,500</td>
</tr>
</tbody>
</table>

Consumption to operate energy management

<table>
<thead>
<tr>
<th></th>
<th>Expense/year</th>
<th>Estimated savings in %</th>
<th>Total/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Man hours</td>
<td>10,000</td>
<td>-</td>
<td>10,000</td>
</tr>
<tr>
<td>Investments</td>
<td>5,000</td>
<td>-</td>
<td>5,000</td>
</tr>
<tr>
<td>Total expenses</td>
<td></td>
<td></td>
<td>15,000</td>
</tr>
<tr>
<td>Total savings</td>
<td></td>
<td></td>
<td>1,500</td>
</tr>
</tbody>
</table>
Tool no. 2

How do we develop our energy policy, energy objectives and energy targets?

Suggestions for the formulation of an energy policy, energy objectives and energy targets are given below.

There are no restrictions on how detailed the energy policy, energy objectives and energy targets have to be, but there has to be an increasing degree of detail from the energy policy through energy objectives to energy targets.

**Energy policy (some suggestions may be applied in their present form, others will require further elaboration)**

- Throughout the entire company, employees are to be aware of using energy sparingly.
- Efficient use and reuse of energy, natural resources and materials throughout the entire company.
- We will make an active effort to reduce the consumption of energy and thereby contribute to reducing the consumption of scarce resources such as coal, oil, natural gas and to reducing the emission of greenhouse gases (CO$_2$).
- We will be a pioneer company in the field of energy.

**Objectives**

- We purchase energy efficient products from now on.
- We apply energy efficient design of new buildings.
- We will choose the most energy efficient equipment from our suppliers whenever possible.
- We will make sure that all employees are conscious of saving energy.
- We will make sure that all employees are conscious of the energy consumption of the company – and that new devices purchased are among the least energy consuming devices on the market.
- Energy management is to become a natural part of the daily work of all employees.
- We will go through all installations with the purpose of identifying opportunities for reducing the energy consumption.
- Every year we are to launch a communication campaign focusing on behaviour to ensure that employees are updated on energy issues.
 Targets

→ We wish to number among the 10 most energy efficient municipalities/ministries/universities/companies.

→ We will reduce our CO₂ emission by an annual 3% over 10 years.

→ We will be certified to ISO 50001 in 2017.

→ We will reduce the relative electricity consumption of our administration by 10% in 201X.

→ By the end of 20XX, 80% of our ventilation systems are to be heat recovery systems.

→ All offices are to be provided with energy-saving power strips by the end of 201X.

→ Reduce electricity consumption in 20XX by 1% compared with 2010.

→ By 1 July 20XX, mapping of opportunities for savings are to be carried out in consultation with an energy consultant, and a prioritised action plan for completing relevant actions has been made.

→ By the end of 20XX, we have elaborated energy-saving procedures and manuals for all fields of activity and ensured that they are known and are applied by all.
Tool no. 3 – Mapping chart (example)  The active spreadsheet is available at www.ds.dk/energiguide

<table>
<thead>
<tr>
<th>Appliance</th>
<th>No.</th>
<th>Location</th>
<th>Power (W)</th>
<th>Load (%)</th>
<th>Typical annual consumption (kWh/year)</th>
<th>Occupancy</th>
<th>Annual power consumption</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorescent lamp</td>
<td>17</td>
<td>Workshop</td>
<td>36</td>
<td>80</td>
<td>8 5 12</td>
<td></td>
<td>235 364</td>
<td>Light regulator (dimmer)</td>
</tr>
<tr>
<td>Filament bulb / energy-saving bulb</td>
<td>4</td>
<td>Office</td>
<td>40</td>
<td>100</td>
<td>8 5 12</td>
<td></td>
<td>77 119</td>
<td></td>
</tr>
<tr>
<td>Saving bulb</td>
<td>4</td>
<td>Office</td>
<td>9</td>
<td>100</td>
<td>8 5 12</td>
<td></td>
<td>17 27</td>
<td></td>
</tr>
<tr>
<td>Spots</td>
<td>3</td>
<td>Office</td>
<td>20</td>
<td>100</td>
<td>8 5 12</td>
<td></td>
<td>29 45</td>
<td></td>
</tr>
<tr>
<td>Desk lamps</td>
<td>10</td>
<td>Office</td>
<td>10</td>
<td>100</td>
<td>8 5 12</td>
<td></td>
<td>48 74</td>
<td></td>
</tr>
</tbody>
</table>

**LIGHTING, TOTAL**

<table>
<thead>
<tr>
<th>Appliance</th>
<th>No.</th>
<th>Location</th>
<th>Power (W)</th>
<th>Load (%)</th>
<th>Typical annual consumption (kWh/year)</th>
<th>Occupancy</th>
<th>Annual power consumption</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC + screen</td>
<td>5</td>
<td>Office</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
<td>600 930</td>
<td>Standard consumption used</td>
</tr>
<tr>
<td>Printers</td>
<td>4</td>
<td>Office</td>
<td>1000</td>
<td></td>
<td></td>
<td></td>
<td>4.000 6.200</td>
<td>Standard consumption used</td>
</tr>
</tbody>
</table>

**IT EQUIPMENT, TOTAL**

<table>
<thead>
<tr>
<th>Appliance</th>
<th>No.</th>
<th>Location</th>
<th>Power (W)</th>
<th>Load (%)</th>
<th>Typical annual consumption (kWh/year)</th>
<th>Occupancy</th>
<th>Annual power consumption</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dishwasher</td>
<td>1</td>
<td>Kitchen</td>
<td>400</td>
<td></td>
<td></td>
<td></td>
<td>400 620</td>
<td>Standard consumption used</td>
</tr>
<tr>
<td>Coffee machine</td>
<td>2</td>
<td>Kitchen</td>
<td>350</td>
<td></td>
<td></td>
<td></td>
<td>700 1.085</td>
<td>Standard consumption used</td>
</tr>
<tr>
<td>Electric kettle</td>
<td>2</td>
<td>Kitchen</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td>140 217</td>
<td>Standard consumption used</td>
</tr>
<tr>
<td>Range hood</td>
<td>1</td>
<td>Kitchen</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td>70 109</td>
<td>Standard consumption used</td>
</tr>
<tr>
<td>Refrigerator</td>
<td>1</td>
<td>Kitchen</td>
<td>400</td>
<td></td>
<td></td>
<td></td>
<td>400 620</td>
<td>Standard consumption used</td>
</tr>
<tr>
<td>Freezer</td>
<td>1</td>
<td>Kitchen</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
<td>300 465</td>
<td>Standard consumption used</td>
</tr>
</tbody>
</table>

**KITCHEN, TOTAL**

<table>
<thead>
<tr>
<th>Appliance</th>
<th>No.</th>
<th>Location</th>
<th>Power (W)</th>
<th>Load (%)</th>
<th>Typical annual consumption (kWh/year)</th>
<th>Occupancy</th>
<th>Annual power consumption</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server room – number of servers</td>
<td>5</td>
<td>Server room</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td>500 775</td>
<td>Standard consumption used</td>
</tr>
<tr>
<td>Cooling</td>
<td>1</td>
<td>Server room</td>
<td>200</td>
<td>50</td>
<td>0 24 7 12</td>
<td></td>
<td>202 312</td>
<td>Standard consumption used</td>
</tr>
</tbody>
</table>

**SERVER ROOM, TOTAL**

<table>
<thead>
<tr>
<th>Appliance</th>
<th>No.</th>
<th>Location</th>
<th>Power (W)</th>
<th>Load (%)</th>
<th>Typical annual consumption (kWh/year)</th>
<th>Occupancy</th>
<th>Annual power consumption</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation plant</td>
<td>1</td>
<td>Workshop</td>
<td>2000</td>
<td>70</td>
<td>0 12 7 12</td>
<td></td>
<td>1.411 2.187</td>
<td>Standard consumption used</td>
</tr>
<tr>
<td>Cooling / airconditioning</td>
<td>2</td>
<td>Workshop</td>
<td>500</td>
<td>50</td>
<td>0 12 5 6</td>
<td></td>
<td>180 279</td>
<td></td>
</tr>
<tr>
<td>Compressed air</td>
<td>1</td>
<td>Workshop</td>
<td>200</td>
<td>70</td>
<td>0 1 2 12</td>
<td></td>
<td>34 52</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>Workshop</td>
<td>500</td>
<td>70</td>
<td>6 5 12</td>
<td></td>
<td>126 195</td>
<td></td>
</tr>
</tbody>
</table>

**OTHER CONSUMPTION, TOTAL**

<table>
<thead>
<tr>
<th>Appliance</th>
<th>No.</th>
<th>Location</th>
<th>Power (W)</th>
<th>Load (%)</th>
<th>Typical annual consumption (kWh/year)</th>
<th>Occupancy</th>
<th>Annual power consumption</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL COMBINED**

<table>
<thead>
<tr>
<th>Appliance</th>
<th>No.</th>
<th>Location</th>
<th>Power (W)</th>
<th>Load (%)</th>
<th>Typical annual consumption (kWh/year)</th>
<th>Occupancy</th>
<th>Annual power consumption</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9.468 17.720</td>
<td></td>
</tr>
</tbody>
</table>
## Tool no. 4 – Screening list/action plan (combined list)

The table is available at [www.ds.dk/energiguide](http://www.ds.dk/energiguide)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Potential for savings kWh/ year</th>
<th>Investment (Price)</th>
<th>Pay-back time Years</th>
<th>Time schedule</th>
<th>Person in charge</th>
<th>Detailed calculations in attachment</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Replace high pressure air compressor in workshop</td>
<td>3,000</td>
<td>5,000</td>
<td>20,000</td>
<td>Autumn 2012</td>
<td>PJ</td>
<td>T.1</td>
<td>Project late!</td>
</tr>
<tr>
<td>2</td>
<td>Turn off lighting on 1st floor evenings and weekends</td>
<td>2,500</td>
<td>3,500</td>
<td>0</td>
<td>Winter 2013</td>
<td>HN</td>
<td>B.1</td>
<td>Project accepted</td>
</tr>
<tr>
<td>3</td>
<td>Replace bulbs with energy saving light bulbs in offices</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>Less than 1</td>
<td>HN</td>
<td>B.2</td>
<td>Project accepted</td>
</tr>
<tr>
<td>4</td>
<td>Put copying machines on a time switch</td>
<td>250</td>
<td>300</td>
<td>250</td>
<td>Autumn 2013</td>
<td>HN</td>
<td>K.1</td>
<td>To be reconsidered</td>
</tr>
</tbody>
</table>

5
6