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Environment, Nature Conservation
and Nuclear Safety

Umwelt
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for our Environment

DIN EN 16001: Energy Management Systems in Practice

A Guide for Companies and Organisations



Imprint

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Dear Readers

By 2020, Germany aims to reduce its CO₂ emissions by 40% on 1990. It won't be possible to achieve this goal without a significant increase in energy efficiency.

Energy management systems help to increase energy efficiency in companies and organisations. They are a tool to enable continuous and systematic use of added energy saving potential. The resulting cost reductions also help to strengthen the company's competitive edge on the market.

The EN 16001 standard which came into force in July 2009 defines standardised EU-wide criteria for an energy management system.

These guidelines are intended to support organisations of any type, size and sector in the implementation of an energy management system. It highlights differences and similarities with the European environmental management system EMAS in a clear and practice-oriented way, as well as ISO 14001 which forms part of EMAS. The information shows that EMAS-certified companies often already meet all the requirements of an energy management system and that an energy management system also provides an excellent basis for the implementation of EMAS.

I would like to thank all those who helped create these guidelines. I hope that they will encourage many more companies and organisations to introduce an energy management system.

A handwritten signature in black ink, reading "Norbert Röttgen". The signature is written in a cursive, flowing style.

Dr. Norbert Röttgen
German Federal Minister for the Environment,
Nature Conservation and Nuclear Safety



2 NAVIGATION

For this guide, a navigation system has been developed to make it easier for you to find important information. The following navigation support is provided:



Plan-Do-Check-Act:

This shows the stage of the Plan-Do-Check-Act cycle (Planning-Implementation-Monitoring-Action) that you are at.



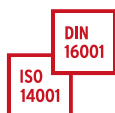
Practical examples:

Here, you will find practical examples from German and European companies who have already successfully introduced an energy management system, as well as useful tips for implementation.

To provide your organisation with information according to the awareness level and preconditions, the guide is divided into **three levels**:

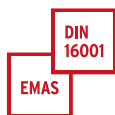
1. Common part for DIN EN 16001:

This is the complete primary text of the guide, in particular Chapter 6. Use of ISO 14001¹ or EMAS² is not required. Checklists for the actual implementation status of your EnMS can be found in Annex A.



2. Comparison with ISO 14001:

This describes additional activities that need to be undertaken for introducing DIN EN 16001 if you have already implemented ISO 14001 in your organisation. A detailed overview can be found in Annex B.



3. Comparison with EMAS:

This describes additional activities that need to be undertaken for introducing DIN EN 16001 if you have already implemented EMAS in your organisation. The effort is once again reduced in comparison to ISO 14001. A detailed overview can be found in Annex C.



Additional literature and links:

Here you will find literature tips and links to additional information.

¹ ISO 14001:2004 and DIN EN ISO 14001:2005-06 respectively.

² EMAS III – the requirements of ISO 14001 were adopted unaltered in the EMAS III regulation, which contains additional elements. For this reason, ISO 14001 (EMAS) will be referred to if there is a comparison between DIN EN 16001 and ISO 14001 or EMAS from now on. If the specific additional value of EMAS needs to be mentioned, then this will be specifically highlighted.

3 FOR WHOM IS THIS GUIDE MEANT?

A guide for all companies and organisations

EN 16001 is a classical management system standard which is not specifically sector-oriented and can be adopted by different organisations, from small and medium-sized enterprises (SME) to the Federal Authority.³ The standard lays down a framework within which individual involvement is required. The guide, as a reflection of the standard, explains in simple terms how companies and other organisations can develop a structured management system, regardless of the energy intensity of activities, size, branch etc. This guide can thus, in principle, be adopted by organisations of any kind.

The guide is not only directed towards large companies / organisations⁴ which have already introduced a management system or towards those which need to introduce an energy management system (EnMS) due to their energy intensity but also towards SMEs who want to first familiarise themselves with the subject.

Special attention is paid to companies which are already ISO 14001 or EMAS - certified or those which use a similar management system. Even companies that claim energy tax exemption are subject to emissions trading or that are committed to the subject of sustainability and corporate social responsibility, respond to these

guidelines in a targeted manner. At the same time, benefits are proposed for those companies which are already affected by the German Renewable Energy Sources Act (Erneuerbare Energien Gesetz, EEG) or for which the future development of the German Federal Government's integrated energy-climate programme is particularly relevant.

Chapter 6 provides a step-by-step guide to energy management which can be taken as a proposal and first input to introduce EnMS. Each individual step towards introducing an EnMS is explained in detail, and this helps to systematically approach the subject of energy management.

Since formal requirements in terms of functions and responsibilities naturally cover a wide spectrum, it is the task of the particular company to take what it needs from the diverse options for developing a management system, as described in DIN EN 16001, according to individual requirements.

The guide follows a systematic and less technical approach. Where relevant, however, you will still find references to sector-specific technical support from institutions and other sector-specific guides.

Integration of EnMS according to DIN EN 16001 into other management systems in the company

DIN EN 16001 can be used by companies in all of the sectors and sizes. An EnMS that is based on DIN EN 16001 can be implemented irrespective of existing management systems or can be integrated into the ones already in place.

It was designed in such a way that it can be combined with other management systems, primarily those

concerning quality and environmental management. DIN EN 16001, as well as DIN EN ISO 9001 and DIN EN ISO 14001 (EMAS), are based on the Plan-Do-Check-Act cycle (PDCA). Accordingly, the various management systems can be easily consolidated or the company has the option of conforming to the existing management system with the aim of developing a management system in accordance with DIN EN 16001.⁵

³ The guide looks at a wide spectrum of energy management aspects; it does not focus on the energy management of buildings.

⁴ To maintain simplicity, from henceforth in the document, only companies will be referred to.

⁵ It may even be based on the already existing low-threshold environment management approaches. For more information, see BMU (2005).



For integrating various management systems, see e. g.

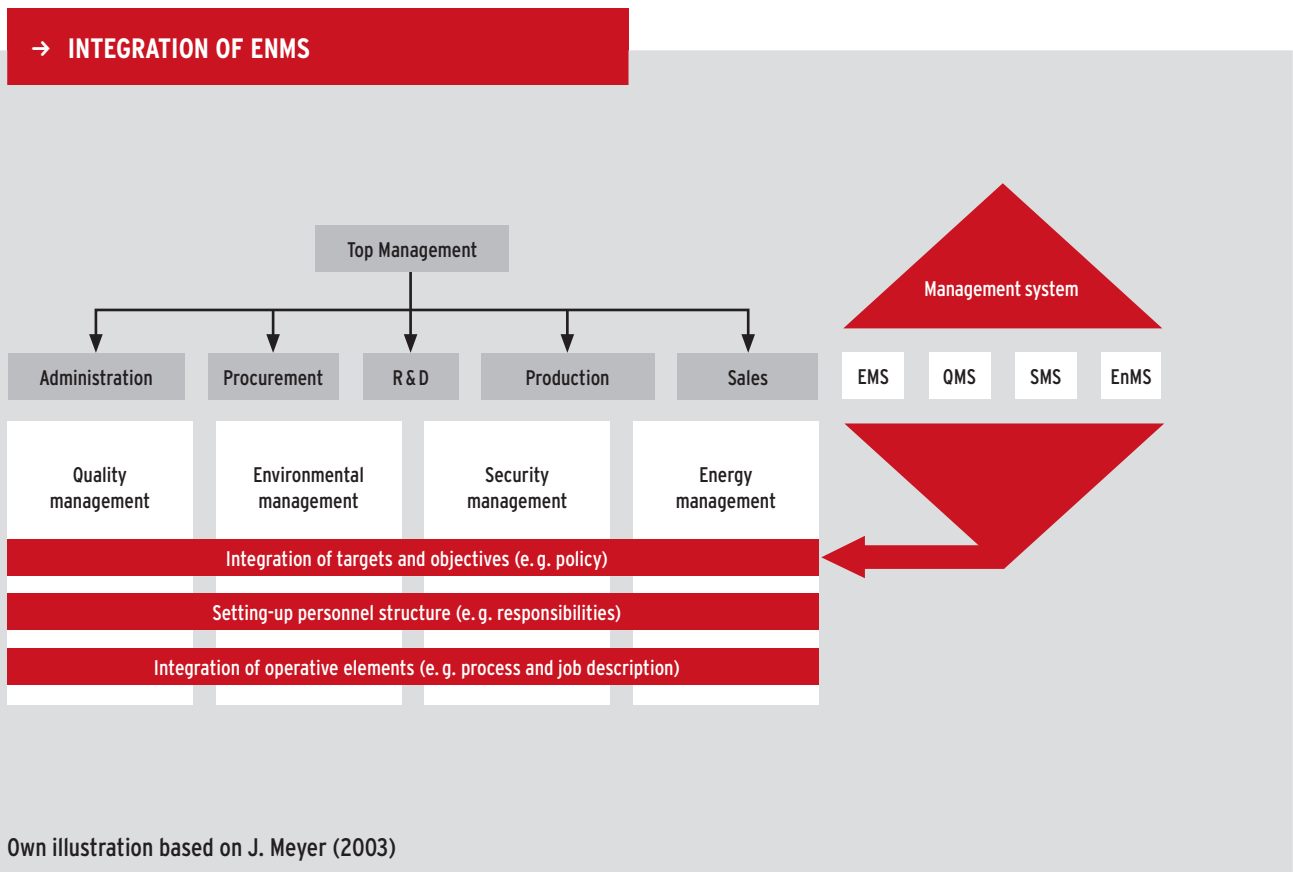


- Hessische Landesanstalt für Umwelt (1997): Leitfaden Integrierte Managementsysteme.
- Bayerisches Staatsministerium für Wirtschaft, Infrastruktur, Verkehr und Technologie (2003): Integriertes Managementsystem.

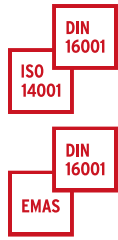
In Germany, around 45,000 companies and organisations have implemented the quality management standard DIN EN ISO 9001 and approximately 5,000 companies and organisations have implemented the requirements for environmental management according to DIN EN ISO 14001. In June 2009, 1,898 sites from 1,376 organisations were registered for EMAS. A large part of German industry is thus already familiar with the principles of DIN EN 16001 and an implementation of the standard is relatively easy.⁶

Besides the fact that implementation is easier for companies who have already put a management model into practice, it is also much more logical from the point of view of efficiency to integrate the requirements of various management systems instead of introducing them concurrently to one another.

When integrating EnMS requirements into the already existing management systems, companies profit from a reduction in personnel, as well as in temporal and financial expenditure. The successful integration of EnMS requires a company's successful consolidation of responsibilities for energy, safety, quality and environmental protection. This is not self-evident as problems always occur when bringing together system accountabilities and, if required, inherent positions also need to be changed or even eliminated. According to the size of the company, it is a good idea for one person in-charge to be made accountable for all management systems. Further clarity can be achieved if all the aspects are consolidated at a higher managerial level responsible for all management systems and corresponding department experts are made accountable for the individual technical aspects.



⁶ Data according to www.emas-register.de and <http://www.iso.org/iso/survey2006.pdf>



Since the requirements are derived from ISO 14001 (EMAS) to a standardised EnMS, Chapter 6 demonstrates the relationship between ISO 14001, EMAS and DIN EN 16001 respectively.

Energy management systems in energy-intensive companies

The introduction of an EnMS is particularly important for energy-intensive companies. On the one hand, here lies the biggest potential for cost-saving, on the other, these companies are the ones who are, at present, profiting the most from the regulations of the German government. On 1 January 2009, the amended Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz EEG) came into effect. According to this, energy-intensive companies will profit from an equalisation scheme if they have adopted EMAS, ISO 14001 or EN 16001, or if they meet the requirements of the mandatory verification process. The Federal Office of Economics and Export Control (Bundesamt für Wirtschaft und Ausfuhrkontrolle, BAFA) can partially subsidise the costs of energy-intensive companies from the manufacturing industry and railways in order to promote electricity produced

from renewable energies. The companies who wish to apply for this from the Federal Office of Economics and Export Control (BAFA) must meet, among others, the following requirements:

- The company must have drawn at least 10 gigawatt hours (GWh) of power in the last financial year from a utility company and have consumed it themselves.
- The ratio of power costs and gross value added of the company should amount to more than 15%.
- The company must obtain verification certification whereby the energy consumption and the potential to reduce the energy consumption is assessed and evaluated accordingly.

Additional literature regarding the equalisation scheme:

BAFA bulletins, e. g.:



II. A Merkblatt für Unternehmen des Produzierenden Gewerbes

II. A 1. UnterMerkblatt zur Zertifizierung des Energieverbrauchs und der Energieverbrauchsminderungspotentiale

(http://www.bafa.de/bafa/de/energie/besondere_ausgleichsregelung_eeg/merkblaetter/index.html)

4 DIN EN 16001: EMERGENCE OF A EUROPEAN STANDARD FOR ENERGY MANAGEMENT SYSTEMS

Systematic energy management is used worldwide in many companies. Good energy management identifies where the energy saving potential lies. Exploiting such a potential reduces administrative costs and increases one's own competitiveness. It was thus decided that a consensus needs to be found across sectors for the development of a standard which acts as a guide for effective energy management.

In Europe, Denmark is considered a pioneer. By 2000, a common initiative of the Confederation of Danish Industries, the Danish Federation of Small and Medium-Sized Enterprises, the Danish Energy Agency, various scientific establishments, as well as other participants, drafted the first national standard. Many other European countries soon followed suit: in 2003, a Swedish standard was launched, followed by an Irish standard in 2005 and a Spanish one in 2007.

A high level of participation was required for the development of these standards as standards require the consent and consensus of all parties concerned. The response to the standards in certain countries following their release was very high.

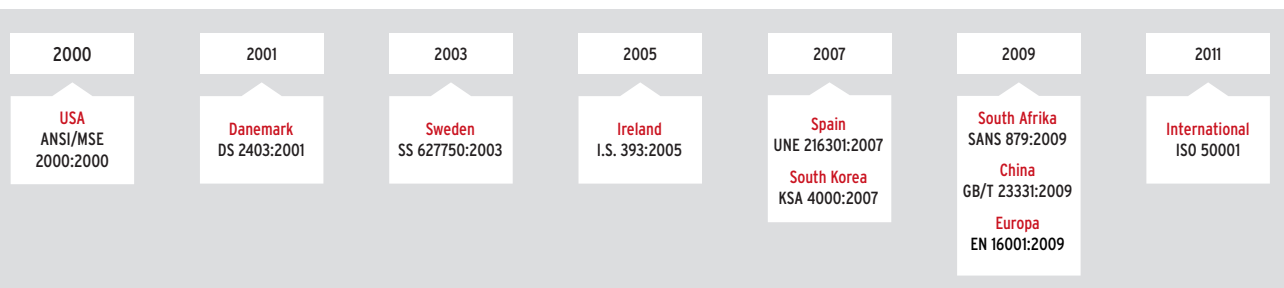
The success of national standards led to the formation of a working group of the European Committee for Standardization (CEN) in 2006 to address this topic. Supported by the European Commission, which sees the standardisation of EnMS as an important step towards increasing energy efficiency in European industry, EN 16001 was compiled within a short time period under the leadership of Sweden.

On 10 September 2009, EN 16001 was introduced to the public at an event in Brussels. Even before the official release of the new European Energy Management

Standard, the first companies conforming to this standard were certified to EN 16001:2009. In Germany, the first companies certified to the German version of EN 16001, DIN EN 16001:2009, were the Potsdamer Verkehrsbetriebe and Peine Träger GmbH (Salzgitter AG).⁷ Germany was directly involved in drafting the European standard. Thus, on 30 November 2006, a working committee for "energy management and energy efficiency" was formed by The Principles of the Environmental Protection Standards Committee (Normenausschuss Grundlagen des Umweltschutzes, NAGUS) of the German Institute of Standardization (Deutsches Institut für Normung, DIN). The working committee played a significant role in the development of the standard at a European level. It was able to rely on the experiences gained in Germany with the Energy Management Directive of the Association of German Engineers (Verein Deutscher Ingenieure-VDI) (VDI 4602 Part 1).

As already shown by the experiences at a national level, there is a wide-reaching interest in EnMS and the desire to have a respective standard, as a tool for orientation, is high. In the meantime, many other countries outside of Europe have developed similar standards. The standardisation process has since been initiated at a global level.

An international standard is currently being developed under the leadership of the USA and Brazil. This global standard ISO 50001 for EnMS is expected to be released in the year 2011. It will form the core of one of the emerging families of standards in the field of energy management in the coming years. DIN EN 16001 marks an important starting point for the formulation of ISO 50001. Every company that is certified to EN 16001 thus has a good basis for future international requirements.



⁷ The DIN EN 16001:2009 is the German version of the European standard EN 16001:2009. When a European standard is ratified, it must be adopted by all national standardisation bodies in their original form, only the preface is nationally different. The DIN EN 16001:2009 was published on July 1st, 2009. The development of the guide at hand is based on the German version of EN 16001:2009, the DIN EN 16001:2009.

5 INTRODUCTION TO ENERGY MANAGEMENT SYSTEMS

Management systems

All organisations - whether big or small, complex or simple, profit or non-profit making - have a management system. This can be formal or informal: all systematic internal regulations for responsibilities and procedures in a company are considered a management system.

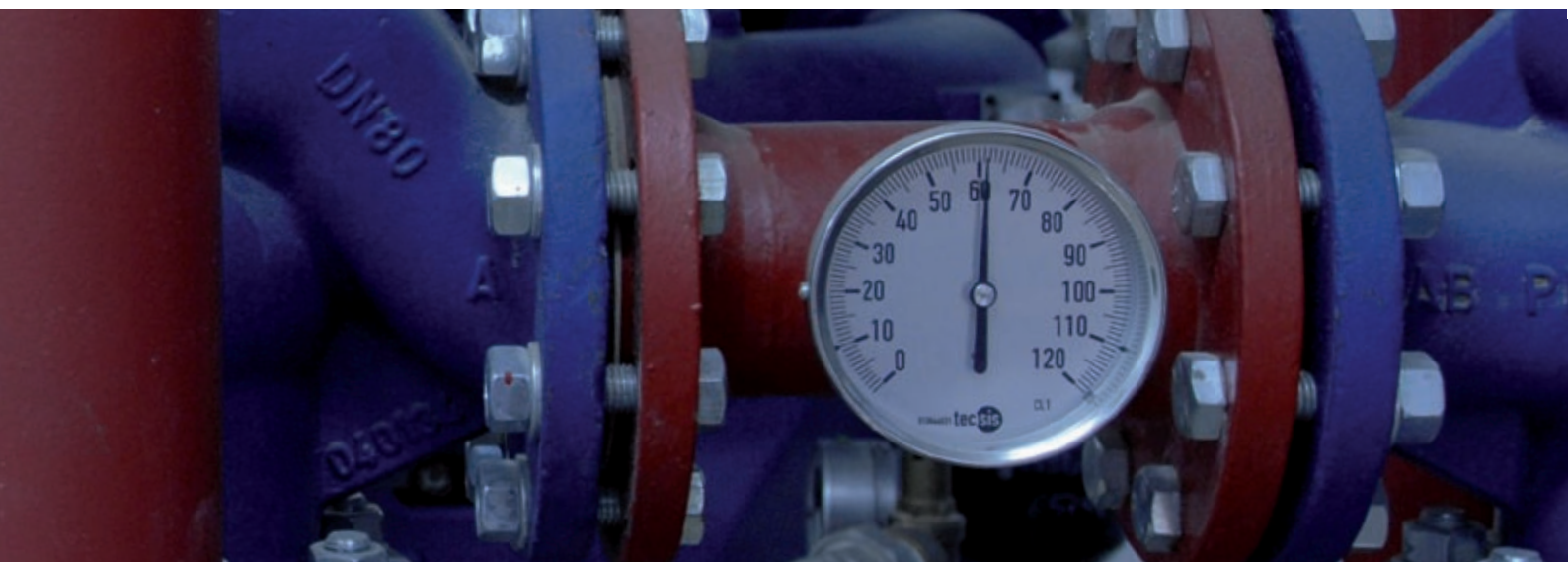
A management system should ensure that all significant objectives of the company are implemented in a systematic manner and can be assessed at every phase. Management systems which are used appropriately contribute towards the improvement of the operational and organisational structure of a company, in accordance with the requirements of the market, customers, investors, society and the country. Organisational measures like establishing responsibilities, authorities, operational procedures and monitoring systems form the basis of this system. By determining accountability in action plans (who does what, until when?) and assessing the system objectively either by internal employees or, if necessary, by external auditors, it can be monitored whether the objectives are being achieved in time or, if documented, who or what is responsible for any deviation.

The first standardised approaches for management systems were developed in the 1970s from Quality Management (QM). The first international standards for QM, the standard series ISO 9000 et. seqq., was then published in the 1980s. From the early 1990s onwards, more guidelines were introduced for specialised management systems, e.g., the British Standard BS 8800 or

the Occupational Health and Safety Assessment Series (OHSAS) 18001 as a management system for occupational safety, the Hazard Analysis and Critical Control Points-concept (HACCP) for hygiene management, EMAS and ISO 14001 for environmental management, as well as 9100 A and 9100 B for the American Petroleum Institute for Occupational Safety, Environmental Protection and Plant Safety.

The ISO 9000 et. seqq standard series is mainly a standard for Quality Management Systems (QMS). It is likewise possible to integrate an Environmental Management System (EMS) or security management system into a QMS. The ISO 14001 standard primarily concentrates on developing and upgrading a functioning EMS within an organisation. It is thus assumed that an active EMS improves the environmentally friendly character of a company. In various areas, EMAS goes much further than ISO 14001. In EMAS, the environmental management system functions to ensure, by means of organisational measures, that the environmental performance is always fully optimised.

Thus, standards for management systems should not be observed in isolation: The structure of the environment management standard ISO 14000 et. seqq complies with the structure of the quality management standard ISO 9000 et seqq. ISO 14001 served as the basis for EMAS and is a part of it. The structure of the DIN EN 16001 energy management standard eventually conforms once again to ISO 14001.



Energy management and energy management systems

Energy management includes all the measures that are planned and implemented to ensure minimum energy consumption for the current activity.⁸

Energy management influences organisational and technical procedures, as well as behaviour patterns, in order to reduce the total operational energy consumption (thus also the energy required for the production), to use basic and additional materials economically and to continuously improve the energy efficiency in the company.

An **Energy Management System** (EnMS) systematically records the energy flux and serves as a basis mainly for investments in improving energy efficiency. A functioning EnMS helps a company to continuously and systematically improve its energy performance while taking into consideration other relevant and legal requirements.

An EnMS includes the organisational and informational structures required for implementing energy management, including resources. It formulates and implements energy policies, planning, introduction / initiation and operation, monitoring and measurement, control and correction, internal audits⁹, as well as a regular management review.¹⁰

DIN EN 16001 specifies in form the requirements for an EnMS. It is thus structured towards the ISO 14001 (EMAS) environment management standard.

Literature tip



The guide, as a reflection of the standard, does not concern itself with other alternatives, such as how energy management can be operated outside the standard. It does not address technical measures either. The guide from the German Energy Agency (Deutschen Energie-Agentur Dena) is thus recommended as it illustrates a gamut of organisational and technical measures.

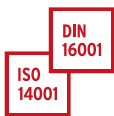
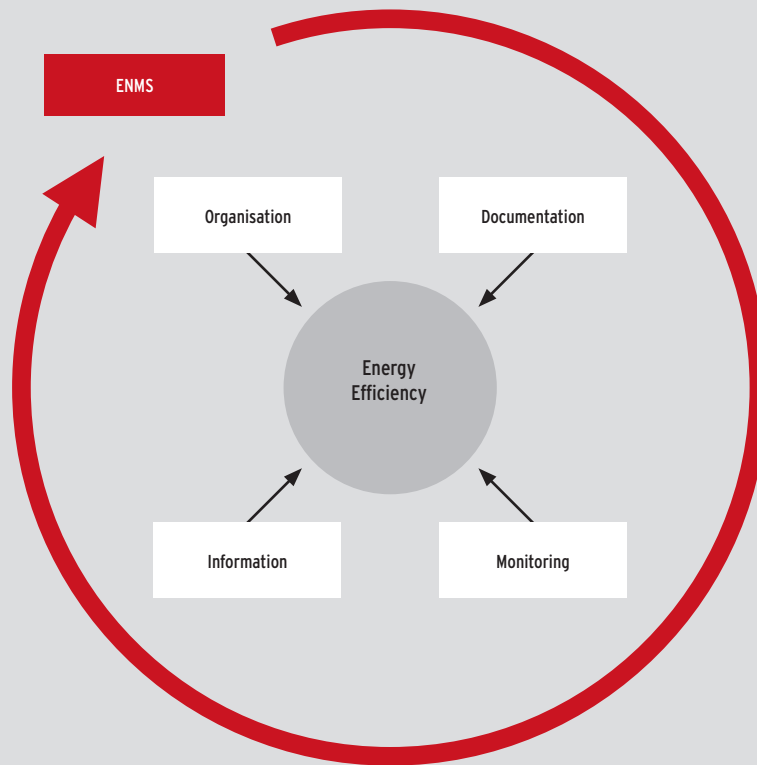
Grahl, Andrea/Zoch, Immo/Streibel, Martin/Joest, Steffen 2009: Handbuch für betriebliches Energiemanagement. Systematisch Energiekosten senken. Pub. Deutsche Energie-Agentur GmbH (dena), Berlin.

⁸ See, dena 2009b.

⁹ Internal audits should generally be conducted according to "ISO 19011 – Audits for Quality Management and / or Environment Management Systems" standard.

¹⁰ For the purpose of ISO 9001 and ISO 14001 standards.

→ THE MOST IMPORTANT ASPECTS OF AN ENMS



For readers in a hurry, this guide provides an overview of the differences between ISO 14001 and DIN EN 16001, as well as between EMAS and DIN EN 16001. DIN EN 16001 is essentially oriented towards ISO 14001. At the end of every paragraph in chapter 6, companies who have already implemented ISO 14001 will find an overview of relevant steps, which need to be additionally fulfilled to introduce DIN EN 16001. In Annex B, you will find a tabular overview.



As ISO 14001 is an important component of the EMAS regulation, the companies with an EMAS have the advantage of already fulfilling more aspects of DIN EN 16001 when compared with the companies certified according to ISO 14001. The few additional requirements that an EMAS registered company needs to additionally fulfil for DIN EN 16001 can be found in chapter 6. A tabular overview can be found in Annex C.

Advantages of an energy management system

The introduction of an EnMS essentially requires the systematisation of energy-saving methods. In the long-term, this results in measurable energy savings and cost-related improvements, as well as efficiency in processes. At the macro-level, it vastly contributes to improving the environmental situation. There are various advantages to introducing an EnMS. The main reasons are discussed below:

1. Cost reduction

Increasing energy costs reduce the overall profit – in almost every company, there is potential to reduce energy consumption. By introducing an EnMS, you can save up to 10% of your energy costs in the initial years after implementation by systematically identifying the weak points in your energy consumption and addressing them with basic measures. Also, the investment in energy-efficient technologies is worthwhile: investments in compressed air systems and pump systems, as well as in ventilation systems, refrigeration and materials handling technology, will see a 5–50% reduction in power consumption¹¹ in an average pay-back time of less than two years.

2. Environmental protection

Climate change is already one of the main causes of natural catastrophes like floods and droughts. And even today, the consequences for humans and the environment are considerable. However, the aftermath of a more rampant increase in temperature is greater, e. g. flooding of coastal regions and low-lying island nations, increasing desert areas, melting of glaciers etc. While climate change is taking place worldwide, climate protection must occur locally. Only when all households and companies are working together, the undesirable risks of climate change can be mitigated. An efficient energy management is therefore an important element as it can contribute considerably to reducing greenhouse gas emissions.

3. Sustainable management

Resource efficiency in all areas, and particularly with respect to energy, is a much discussed topic of our times. The reserves of fossil fuels are limited. Those who continue to rely on these resources are not preparing themselves for the future. Efficient energy management, new energy concepts and innovative energy technologies are key to operating successfully in the market in the coming years and decades.

4. Improvement of public image

With a DIN EN 16001:2009 certification, you can credibly show to the public that your company is operating sensibly with respect to energy-efficiency and thus protects the environment. Environmental requirements are increasingly an important factor in public proposals in Europe, including, among others, climate-friendly purchasing. Both from the perspective of the procurer and the supplier, an EnMS supports the measurement of CO₂-emissions.

5. Use of financial incentives

Since January 2009, energy-intensive companies in Germany have been able to profit from a cost-reducing equalisation scheme through the Renewable Energy Sources Act (EEG) if they have introduced an EnMS.¹² Here, legislation offers companies three different ways to gain certification. Either by a functional and certified EMS according to ISO 14001 according to EMAS, or a third method which includes certification of a comprehensible and technically-sound data collection, as well as an implementation of the review-saving potential, according to ecological and economic criteria. With the release of the DIN EN 16001 standard on 1 July 2009, there is now a certificate which exists specifically for such an EnMS.

¹¹ Compare, Austrian Energy Agency (www.energymanagement.at).

¹² Compare, Federal Office of Economic and Export Control (BAFA), 2009.

6. Projection of climate policies

According to the Integrated Energy and Climate Package (IECP), a voluntary commitment between the German economy and the German government will be signed, at the latest by 2013. This establishes EnMS as a pre-requisite for energy and electricity tax reductions. The relevant cabinet report plans a four-level introductory model:

- from 2008: promoting the introduction of EnMS
- from 2011: collecting and systematising energy data; establishing energy management structures
- from 2012: implementing management processes for continuous improvement
- from 2013: updating the EnMS

→ PRACTICAL EXAMPLES ON ENERGY CONSERVATION IN COMPANIES FROM DIFFERENT SECTORS:

Measures	Sectors	Investment in Euro	Cost reduction in Euro per year	Payback time (statistic)	Savings in Mwh and tons of CO ₂
Installation of heat exchanging device at different locations	Construction material industry / Brick production (Schlagmann)	925.000	around 450.000	around 2 years	3.225t CO ₂
Checking the lighting situation in the furniture hall buildings	Mail order selling (Baur)	0	5.500	0	48 MWh and 30t CO ₂
New circulation pumps in swimming pools	Hospitality industry (Hotel St. Georg, Bad Aibling)	4.000	3.200	1,25 years	20 MWh and 11t CO ₂
Developing a new energy-saving synthetic paint finishing system	Car component industry (sector classification code)	133.000 (additional expenditure)	255.000	0,52 years	219 MWh electrical 4080 MWh thermal 120t CO ₂ + 1.224t CO ₂
Optimising compressed air systems	Food industry (Brauerei Haus Cramer KG)	62.500	55.000	1,1 years	775 MWh 300t CO ₂

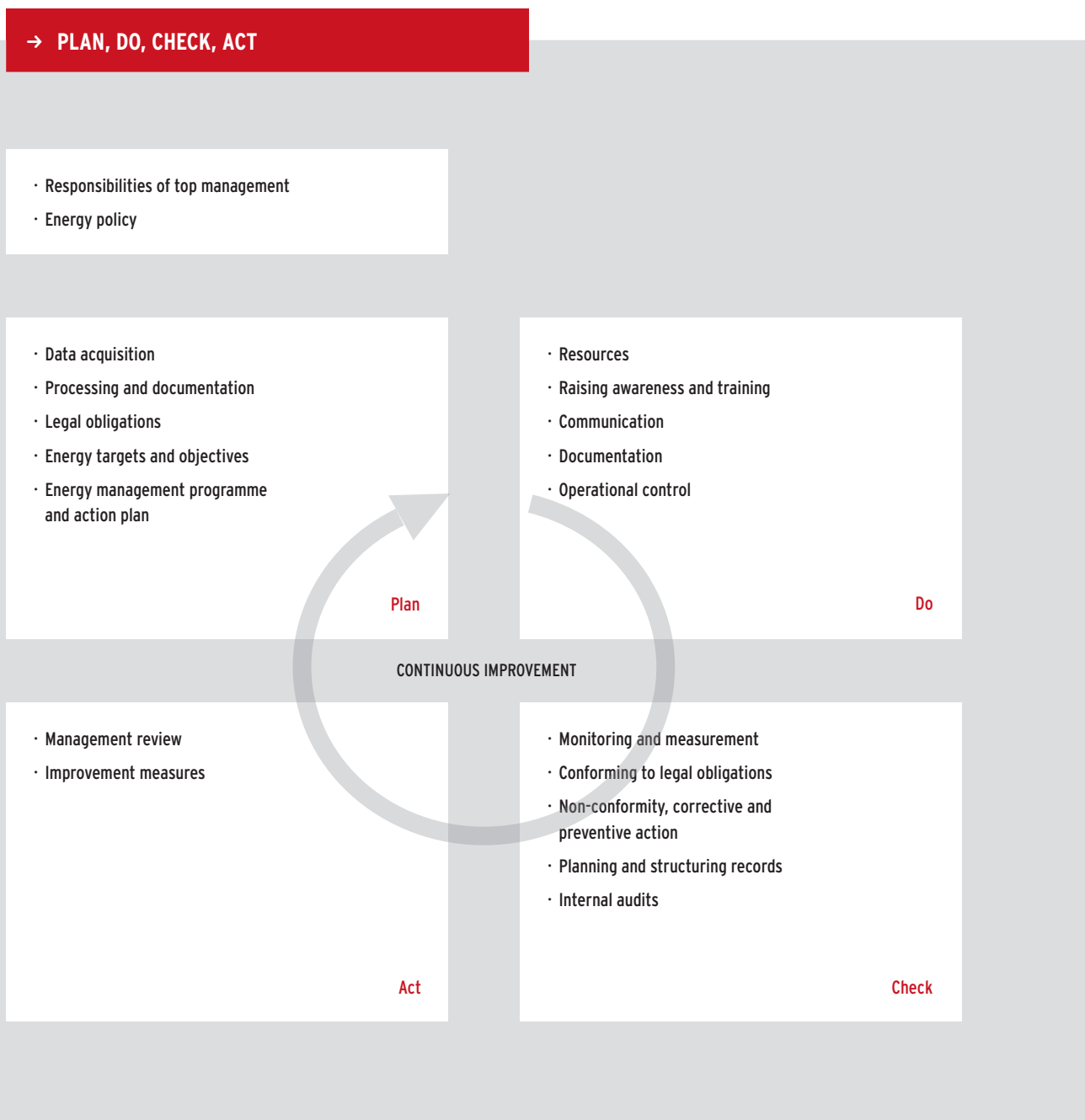
Own illustration based on Infozentrum UmweltWirtschaft Bavaria (2009).

6 STEP-BY-STEP GUIDE TOWARDS AN ENERGY MANAGEMENT SYSTEM

The PDCA cycle

Energy management according to DIN EN 16001 follows the PDCA (Plan, Do, Check, Act) cycle of other well known management systems like ISO 14001 and ISO 9001. If you have already introduced a management system into your company, then you can easily integrate energy management into the present structures.

The PDCA cycle provides a framework for the continuous improvement of processes or systems. It is a dynamic model - the results of one cycle form the basis for the next one. This structure enables you to continuously reassess and optimise the current energy consumption and to gradually reduce costs.



The individual steps of the PDCA cycle in energy management can be described as follows:

1. Plan

Establishing energy-saving targets, determining the strategy, identifying measures and responsibilities, providing the necessary resources, preparing the action plan.

2. Do

Establishing management structures for maintaining a continuous process, undertaking improvement measures (e.g. efficient technologies/procedures).

3. Check

Reviewing the level of target achievement and the effectiveness of the EnMS, collecting new ideas via energy audits, if necessary, consulting an external expert.

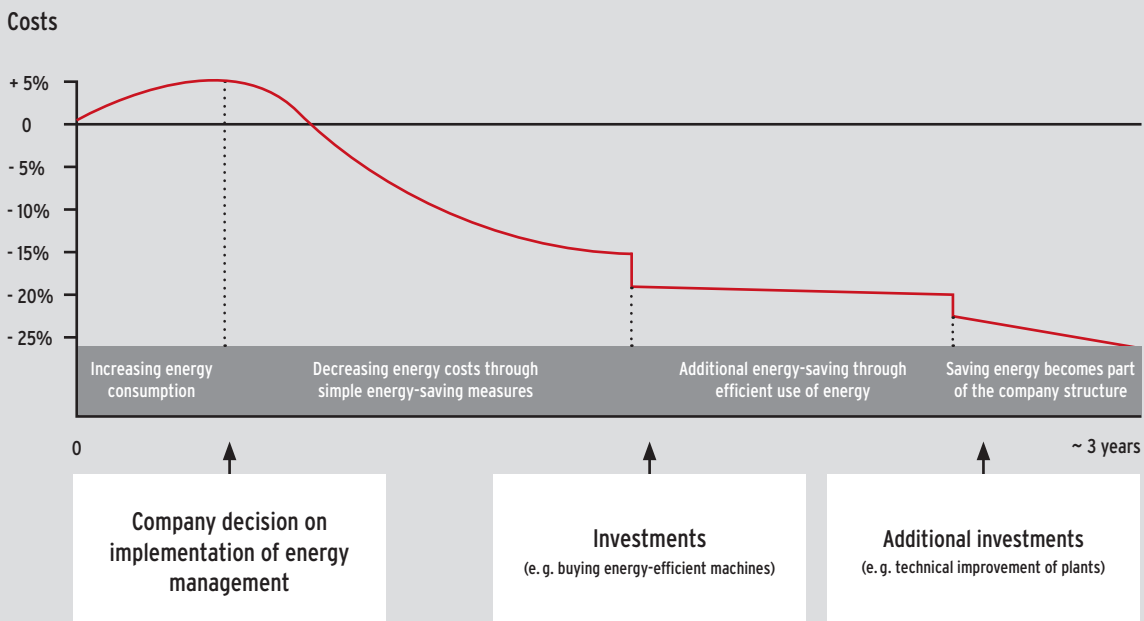
4. Act

Strategic optimisation by consolidating the current energy data, audit results and new information, evaluating the progress with the help of current energy market data, deriving new objectives.

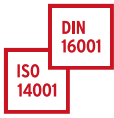
Activities can take place in parallel; even the decision on which to begin an activity depends on the conditions in the respective company.

When compared to selective measures (ad-hoc energy management), continuous application of this process clearly reduces the energy-related costs of a company.

→ CONTINUOUS COST REDUCTION WITH ENMS



Own illustration based on Lackner, Petra/Holanek, Nicole (2007)



The management of energy use and consumption is an essential part of environmental management. ISO 14001 is based on the Plan-Do-Check-Act cycle and the process of continuous improvement, as well as the formal and structural requirements already present in the existing ISO 14001 in your company.



As an EMAS-company, you have the Plan-Do-Check-Act cycle, the process of continuous improvement, as well as all formal and structural requirements, already firmly rooted in your company.

Practical example (adapted):

A medium-sized company called “Altpapieraufbereitung Oswald” decided to introduce an EnMS for tax-related purposes. To implement the EnMS, a continuous, objectively assessable improvement process should be present in the structures of the company.

The Head of the company initiated the process by including the objective of energy efficient management in the company philosophy, appointed an Energy Manager and provided him with the corresponding resources and responsibilities (**Plan**). The manager coordinates the documentation of all energy-related processes in the company.



The company “Altpapieraufbereitung Oswald” has already taken other approaches for an environmental management system. However, it is not applied in a systemic manner because only certain processes in the company are controlled and directed by the system. To reflect the continuous improvement process, a structure is established for the introduction of an energy management which will make it possible to record and assess all energy flows and conduct improvement measures (**Do**).

The results of the measures are regularly assessed by the Energy Manager, new targets are set and the resultant reports are compiled (**Check**).

The newly defined targets and measures are implemented by the Energy Manager with the support of employees and an external energy advisor (**Act**).

Determine responsibilities of the top management

For the long-term success of an EnMS, the motivation of the employees and the commitment shown for an EnMS are of major importance.

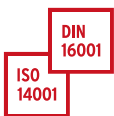
This includes all levels and functions of an organisation and begins at the highest management level of a company, the top management.

Within the framework of an EnMS, the **functions of top management** include:

- Determining, introducing, and maintaining an energy policy for the organisation.
- Ensuring the availability of required resources for introducing, attaining, maintaining, and improving the EnMS (personnel, special capacities, technical and financial resources).
- Appointing a management representative (“Energy Manager”) with established responsibilities and powers for implementing an EnMS. This person should also be responsible for submitting the report on performance and the results of the system to the top management.
- Deciding on further strategic energy management measures on the basis of documented results regarding the subject of energy in the internal audits.
- Reviewing the EnMS of the organisation at regular intervals to test it for results. This review should be recorded and maintained as part of management reviews.

→ A FEW REASONS WHY MANAGEMENT DOESN'T INTRODUCE AN ENMS

- No one is responsible for energy matters
- Energy costs are seen as fixed costs
- Sub-systems within changing company structures are not transcendental
- Employees regard “their processes” as optimised and greet further analysis with scepticism



Clear responsibility of the top management is an important characteristic of DIN EN 16001. If you have already implemented ISO 14001 and your top management is familiar with energy-related problems, then the introduction of DIN EN 16001 should pose no additional costs for your top management.



EMAS requirements are in accordance with ISO 14001.



Tip

By transferring the Energy Manager to the upper-most management level of the company, you are setting the best example for a successful implementation. For example, the Plant Manager can simultaneously lead the energy management team in the company.

Define your energy policy

According to DIN EN 16001, the starting point for a functioning EnMS is the formulation of an energy policy for your company. The energy policy that needs to be documented in hard copy is a statement in which your top management outlines the objectives of effective energy management. The document is the first step in a structured energy management process.

The energy policy sets out energy-related guidelines, operating principles and long-term overall objectives for your company. It is used, over time, as a measurement for the effectiveness of energy management.

According to DIN EN 16001, the statement expressing the energy policy of a company must contain the following points:

- The commitment of management to continuously increase the energy efficiency of your company, as well as to carefully handle energy, should be expressed.
- It should determine the scope and boundaries of your EnMS.
- It should state the obligation of your management to provide information and resources required for realising energy objectives and targets.
- It should include the obligation to adhere to all legal obligations that affect the energy aspects of your company.

After developing and introducing your energy policy, it should be communicated to all people working directly or indirectly for the company. Your energy policy should also be regularly assessed and, if required, adapted to changing circumstances.

If there are already other policies in your company, like an environment or quality policy, then you can integrate your energy policy into this document. If your company is working in several locations, then your energy policy can refer to either all activities or only the ones of specific locations. Pay attention to defining system boundaries in such a way that your objectives can be implemented within these.

While formulating your energy policy, ensure that it can be easily understood inside and outside of the company.



Literature tip

According to DIN EN 16001, the energy policy should be made accessible to the public. Use this for the presentation of your company to the public. Additional information on this is available in Chapter 7 of this guide.

→ EXAMPLE OF AN ENERGY POLICY *

Our Energy Policy

We, the company Samplename GmbH, hereby commit ourselves to the long-term reduction of our energy consumption and to the improvement of our energy efficiency in a continuous improvement process. To fulfill these objectives, we are implementing an energy management system according to DIN EN 16001:2009 standard. We thereby ensure that all the requirements of this standard are correctly implemented and that there is a continuous improvement of all processes within this energy management system.

In addition, we will regularly review that

- the required financial and structural preconditions are met;
- all employees are integrated into the implementation and operation of the energy management system and responsibilities are established;
- relevant legal obligations and other requirements are taken into consideration;
- energy aspects/energy data are regularly determined and assessed;
- programmes promoting energy-efficiency are correctly introduced and conducted;
- the results are measured and evaluated by means of a regular audit;
- etc.

Date: _____ Place: _____

Name: _____

Position: _____

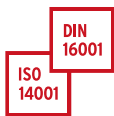
* A few more points can be added to this rough example of an energy policy.



Literature tip

Take inspiration from guides for other management systems when formulating your energy policy, e. g.:

- Lackner, Petra/Holanek, Nicole (2007): BESS-Handbook
- Engel, Heinz Werner (2009): EMAS “easy” for Small and Medium Enterprises



The energy policy can easily be integrated into the environmental policy in accordance with ISO 14001. In order to meet the requirements of DIN EN 16001, the following aspects should be taken into consideration:

- Include an article in your energy policy that alludes to improved energy use, as well as improvement in energy efficiency.
- Add information about the scope and boundaries of the EnMS.
- Include a paragraph on ensuring the availability of information, as well as all the resources that are necessary for attaining the objectives.
- Include a paragraph on regular reviews and updating of the EnMS.



For formulating an energy policy, EMAS-companies must add the term energy efficiency to their environmental policy and, where missing, include a paragraph on ensuring the availability of information, as well as all resources that are necessary for achieving the objectives.

A PLAN

When introducing an EnMS, all energy-relevant aspects should be reviewed and illustrated in a specific structure that was defined by the organisation.

From the clear and understandable illustration of the consolidated data, the savings potential can be deter-

mined. This helps in defining short- and long-term objectives. Additionally, the consolidated information can be used for certification of the EnMS, as well as in communicating results inside and outside the company.

Energy consumption – Energy conversion

In a physical sense, energy cannot be consumed; despite this, the following colloquial term of energy consumption is used instead of energy conversion.

The following steps should be followed during the planning stages:

1. Identifying responsibilities
2. Review the consumption, costs and production figures of energy
3. Processing and documenting the collected data
4. Including legal obligations
5. Defining energy objectives and targets
6. Formulating an energy management programme and an action plan



1. Identify responsibilities and form an energy-efficient team

The Energy Manager

As a first step in the planning process, a management representative (Energy Manager) is appointed by the top management in your company for the implementation of the EnMS. His role and authority should be documented and communicated to the other employees. To be able to carry out his/her tasks, he/she needs the necessary competence, motivation and support of the top management.

The energy efficiency team

The first task of the Energy Manager is to put together an energy efficiency team and coordinate it. As energy

efficiency affects almost all areas of your company, it is important that the Energy Manager works together with the officers in-charge of all relevant departments. During selection procedures, technical knowledge and motivation play a decisive role. For success, motivation is more important than technical knowledge as such knowledge, if required, can always be obtained by an external adviser.

Most medium and large companies have a “quality and environment” department (that usually is responsible for implementing ISO 9001 und ISO 14001). This department should be integrated into the process as it is already working with the existing management systems in the company.

Furthermore, the employees that have an indirect, yet important, influence on the energy consumption (e. g. developers, trainers) are an asset for the energy efficiency team.

In large enterprises, it makes particular sense to further train a few members for this role. This holds true particularly for departments whose personnel are not trained technically but make an important contribution towards energy consumption.

Another effective option is to consult external advisors at the time of introducing the EnMS. Due to their experience and an independent point of view on the procedures of the company, these experts are in a position to support and motivate the team in various areas. External funding can be requested under certain circumstances for the employment of external advisors.

→ **EXAMPLE OF AN INTERNAL JOB DESCRIPTION FOR AN ENERGY MANAGER**

Tasks	Qualities
<ul style="list-style-type: none"> • Setting up and leading the energy team in the company • Planning and implementing the projects (according to budget, time and quality) • Acquisition, processing and communication of energy-related information • Delegating tasks and setting time limits • Supporting the involvement and recognition of the top management • Attaining staff support beyond individual areas and functions • Regularly reporting to the top management 	<ul style="list-style-type: none"> • Good knowledge of the operating procedures • Excellent capabilities in project management, in organisation and communication • Sound knowledge of DIN EN 16001 • Basic technical understanding • Trust and respect of co-workers • Involvement and enthusiasm for the subject of energy management • Ability to listen to others who, in some cases, have a different opinion and other ideas

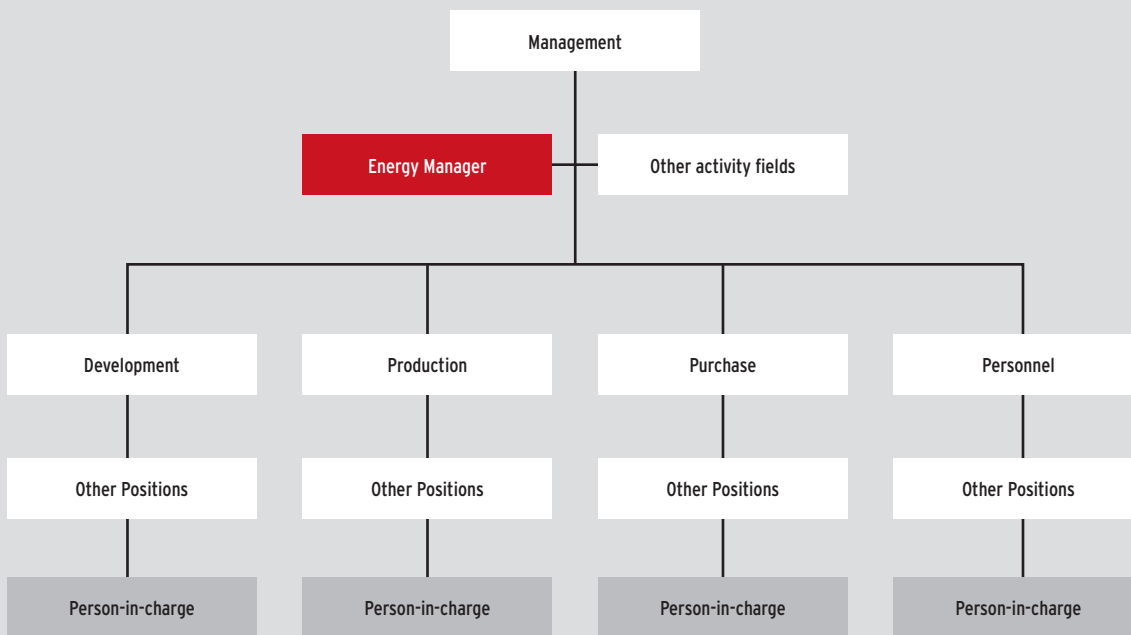
The Energy Manager shares responsibilities and tasks with the members of the team. Regular meetings should take place for coordination. The frequency of the meeting is based on demand; it must, however, take place once every quarter. The top management should be included at least once a year.

The task of an energy efficiency team lies essentially in implementing and maintaining an EnMS. This includes:

- Developing an effective organisational structure to integrate the EnMS into the operational organisation
- Establishing and maintaining an energy information system for internal and external communication

- Developing an energy management programme using a comprehensive data assessment and evaluation, as well as the development and implementation of measures to increase energy efficiency
- Purchase and selling of energy, consultation at the time of purchasing new inventory
- Training and awareness building among employees
- Contact point for employees and the public for enquiries relating to energy

→ EXAMPLE OF AN ORGANISATIONAL CHART FOR AN ENERGY EFFICIENCY TEAM



It is recommended that the scope of application and the position of each person involved is recorded in hard copy.

→ **EXAMPLARY POSITIONS AND RESPONSIBILITIES**

Position	Person-in-Charge incl. phone, e-mail	Description of tasks and authoring
Energy Manager	Uta Schmitz	Coordinating the energy efficiency team and officers in-charge of the EnMS, external contact person, training
Contact person from company management	Hans Kloß	Facilitator between management interests and those interested in the implementation of EnMS
In-charge for the departments	Development – Annemarie Hausmeier Production – Dr. Ulf Hauelsen ...	Supporting and communicating tasks between the team and the departments, contact person for the employees Assigning tasks like measuring or documenting
In-charge within the departments	Production – Klaus Bender; Ella von Berghausen ...	Responsible for data collection and documentation for electrical energy Responsible for data collection and documentation for heating and cooling
External Advisors	Engineering company Wagenpfahl	Supporting introduction and implementation of the EnMS, training

In order for the energy efficiency team to be able to implement measures, it will need its own budget and should be able to utilize a fixed part of the savings for further activities.

Select employees with energy competence from the individual operation areas for the energy efficiency team. The individual employee can carry out his / her role in the energy efficiency team in addition to his / her normal duties. However, do remember that during the introductory phase of an EnMS significantly more time is required for the initial data collection.



Tip

After the initial euphoria, it can happen that your employees find it difficult to continuously prioritise the EnMS. It is therefore important that the subject of EnMS is continuously emphasised by the Energy Manager and top management over the long term.

2. Review consumption, costs and production of energy

You can't manage what you don't measure!

A systematic review and analysis of energy consumption forms the basis for an increase in energy efficiency. The higher the consumption the more detailed the measurement should be and, consequently, the easier it is to ascertain the savings potential.

These measurements are restricted by measurement costs, which should naturally not exceed the benefits. If you have localised big consumers, you can tighten the system boundaries of the analysis in order to obtain detailed information.

In addition to consumption data, there are other relevant factors which should be included in order for a comprehensive assessment of data to be possible. In order to maintain clarity, it makes sense to take into account the entire company, as well as individual areas. However, system boundaries and operational conditions should always be determined in this case.

These can be, for example,

- Measurement interval (time, duration) and measurement accuracy
- Production stages, type of product, locations or even areas of building equipment and appliances (lighting, ventilation etc.)

You should be able to explain irregularities. It is therefore recommended that you record data for production figures, turnover and breakdowns alongside energy consumption and use. During the review, age and visible defects of equipment and resources should also be identified.

In order to determine the savings potential and to identify changes, the complete energy flow of the company should be recorded and documented.

→ ENERGY FLOW WITHIN THE COMPANY

- Electricity
- gas
- heat
- own sources
- ...

- Production sites
- halls
- machines
- heating/ventilation
- offices
- lighting
- process heat / process cooling
- controls
- transportation
- ...

- Feed-in EEG
- sale of district heat
- sale of other energy carriers
- production figures
- turnover
- ...

Documentation should be easy to maintain and follow. Therefore, it is recommended that duration and areas of assessment, as well as type of data sources, are

recorded. Error estimation and system boundaries also play a part here.

To be able to achieve this, you require at least the following figures:

- Type, quantity and costs of energy sources

→ INPUTS

Measurement duration		Area	Energy source	Quantity	Consumption	Costs	Data sources		Measurement errors
from	to								
					MWh	Euro			
01.01.2008	31.12.2008	Hall 2	Electricity				Invoice Meter reading	15.02.09 05.01.09	4%
01.01.2008	31.12.2008	Hall 2	Gas				Invoice	15.02.09	

- Share of energy and cost of individual consumers in total consumption, the energy sources or the costs (areas, machines, production areas, departments, storeys, ...)

→ CONSUMPTION

Measurement duration		Area	Energy source	Quantity	Consumption	Costs	Data sources		Measurement errors
from	to								
					MWh	Euro			
01.03.2008	01.04.2008	Drainage area	Electricity				Electricity meter		
01.03.2008	01.04.2008		Oil				Estimation on tank filling level		20%
05.01.2008	31.06.2008	Office building	Electricity				Electricity meter		
01.07.2008	22.12.2008	Office building	Electricity				Electricity meter		

- Possible time differentiation (production step-, level-, daily-, weekly and yearly load profiles)
- Data on production (quantity, turnover ...)

→ PRODUCTION FIGURES

Measurement duration		Area	Product	Quantity	Turnover	Data source
from	to			Unit	Euro	

- Apart from that, information on waste heat temperature levels, charges on district heating, supply of electricity from Combined Heat and Power (CHP)¹³ or regenerative sources etc.

→ OUTPUTS

Measurement duration		Area	Energy source	Quantity	Consumption	Revenue	Data Sources	Measurement errors
from	to					Euro		
		Production	Waste heat 120 °C	Not known	None	None	In-charge Area Manager	
01.01.2008	31.12.2008	Production	Waste wood for producing pellets or wood briquette	200 t, 0,8 MWh	Sales	20.000	Administration	
01.01.2008	31.12.2008	Office building	Electricity from photovoltaic	13,2 MWh	Supply acc. to the Renewable Energies Act	6.336	Administration	

¹³ Combined Heat and Power (CHP) refers to generating power and heat from one fuel source during a single process.

You can use various sources for recording, such as energy bills, meter readings, energy reports from building management or information from administration.

If you have little or no data for a separate illustration, you can make assumptions with the help of type / name tags, measuring devices, through operational hours, tank level etc. However, extreme caution should be exercised here as error estimation must be traceable.

The electricity supplier can normally provide a 15-minute load profile on demand. This can help you maintain the time series.

Above all, for big consumers you should consider installing more measurement devices.

If there are no, or only a small number of specialists in your company who can take on these tasks, consult external consultants or provide your personnel with advanced training.



An overview of energy management software available on the market can be found at:

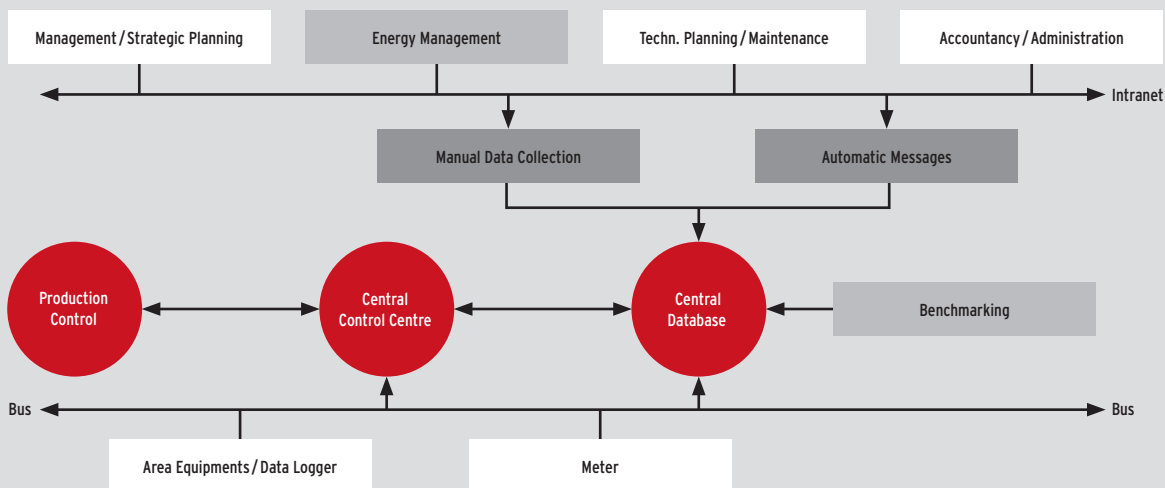
http://www.energieagentur.nrw.de/_database/_data/datainfopool/Marktspiegel_2005.pdf

<http://www.perpendo.de/files/tga-1-2005.pdf>

The illustration depicted below is only a representative structure for recording data with the help of software. If you already have a computerised infrastructure for

regulating and monitoring the plant technology, then it is worthwhile searching for relevant IT-supported solutions.

→ DATA ACQUISITION WITH HELP OF SOFTWARE



Own illustration based on <http://www.perpendo.de/files/tga-1-2005.pdf>

3. Process and evaluate all data

Documentation plays a central role in an EnMS. Therefore, during the introduction of documentation it is very important that a clear and traceable structure is developed from the beginning on. The objective of this step is the clear depiction of the energy flow and its documentation over a long period of time. The prepared data form the basis for the energy management programme and the energy targets.

Therefore, attention should be paid to recording all data as described above (system boundaries) and that they are up to date, complete, easy to maintain, as well as accessible to those responsible.

Review of the data through illustration and generation of comparative key indicators has been proven of value.

When introducing an EnMS into your company, various key indicators should be generated which are representative of what you hope to achieve with your energy policy. Examples can be found in the table given overleaf. While determining these values, it is important to always establish system boundaries and operational conditions in order to avoid misrepresentation.



Tip

In the EMAS internet portal (www.emas.de) under the heading Participation/ Environmental Statement, you will find numerous examples of energy performance indicator indexes from the different branches as a first benchmark.¹⁴ A few examples from this are depicted in the following table.

However, it is important that each company determines its own individual targets and measures its own progress.

Key data indicators for industry-specific unions and syndicates, which provide the individual branches with customised material, can serve as comparative values.

Industry	Company	Energy Performance / Consumption Index
Food industry	Erfurter Teigwaren (Pasta) (2005)	0,174 kWh electricity / kg pasta 0,246 kWh gas / kg pasta
Paper industry	Kartonagen Schwarzenberg (2004)	428 kWh/t cardboard production net 1.923 kWh/t cardboard production gross
Publishing/Printing industry	Axel Springer Druckhaus Spandau (2006)	5,1 Wh / m ² printed paper area (electricity and gas)

¹⁴ Appendix IV to EMAS III also contains statements on key figures of companies (including energy efficiency).

→ OPERATIONAL ENVIRONMENT PERFORMANCE INDICATORS

Key Data	Description	Unit
Total energy consumption	Absolute	kWh, MWh, Euro
Specific energy consumption	$\frac{\text{Total energy consumption [kWh]}}{\text{Production quantity / Units}}$	kWh / PM, kWh / PE
Percentage of energy source	$\frac{\text{Consumption per energy source [kWh]}}{\text{Total energy consumption [kWh]}}$	%
Energy intensity	$\frac{\text{Energy of a process (field) [kWh]}}{\text{Total energy consumption [kWh]}}$	%
Percentage of energy from internal circuit	$\frac{\text{Energy from internal heat recovery [kWh]}}{\text{Total energy consumption [kWh]}}$	%
Percentage of renewable energy sources	$\frac{\text{Use of renewable energy [kWh]}}{\text{Total energy consumption [kWh]}}$	%
Total energy costs	Absolute	Euro
Specific energy costs	$\frac{\text{Energy costs [kWh]}}{\text{Production costs [Euro]}}$	%
Industry-specific energy performance indicator	$\frac{\text{Total energy consumption [kWh]}}{\text{Turnover [kEuro]}}$	kWh / kEuro
Specific costs per energy source	$\frac{\text{Costs per energy source [Euro]}}{\text{Consumption per energy source [kWh]}}$	Euro / kWh
Cost savings	Absolute	Euro

Own illustration based on: BMU / UBA (1997)

→ ENERGY CONVERSION FACTORS

	Net Calorific Value	Gross Calorific Value
Natural gas	10 kWh / m ³	12,66 kWh / kg
Fuel oil light	9,93 kWh / l	11,68 kWh / kg
Fuel oil heavy	10,27 kWh / l	11,17 kWh / kg
Hard coal		approx. 8,14 kWh / kg
Brown coal		approx. 5,35 kWh / kg

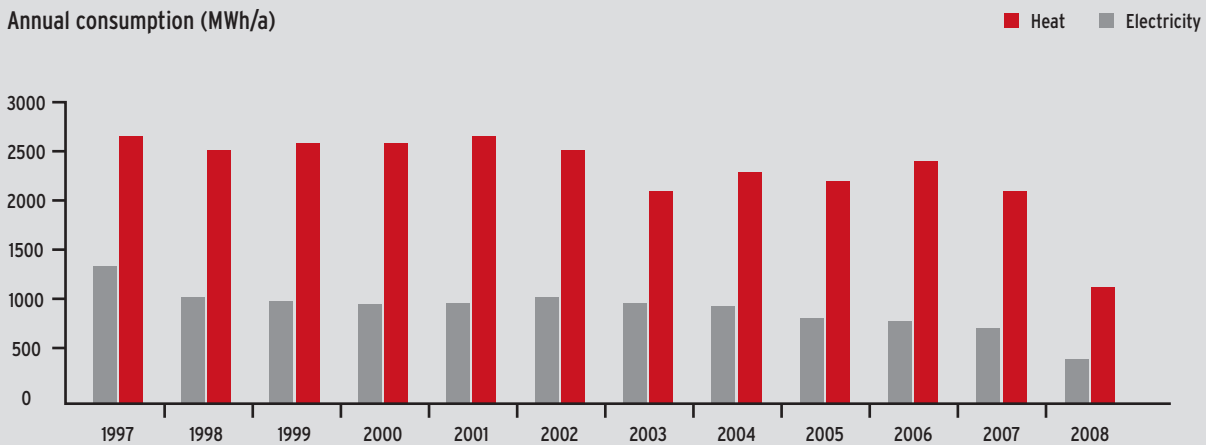
Author's own compilation

Using the spreadsheet calculation programmes available on the market, the data can be illustrated clearly in diagrams.

One way of illustrating volume flows is to use a Sankey diagram. In this diagram, energy flows are illustrated in proportion to quantity using different widths and the direction of arrows making it easier to detect losses and “hidden” consumers.

Other illustrations include, for example, cost/energy consumption distribution, time series, load profiles, energy flow diagrams, asset analysis, process analysis, long-term developments or tables.

→ EXAMPLE ILLUSTRATING DEVELOPMENT IN HEAT AND POWER CONSUMPTION



Tip

Regularly announce energy consumption index developments and consumption values to the individual departments to motivate your employees. Celebrate success together!



Examples of software for creating Sankey diagrams:

<http://www.iwa.tuwien.ac.at/iwa226/stan.html>

<http://www.doka.ch/sankey.htm>

<http://www.e-sankey.com/de/>

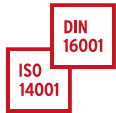
An important objective of your EnMS is to save costs. This requires interface management: Outdated distribution formulae for energy costs often exist in the controlling of companies, something which should be regularly updated. Therefore, the Controller and the

Energy Manager should schedule regular meetings over a fixed time-period. In the long run, an updated distribution formula provides better incentives for those people in charge of the cost centres.



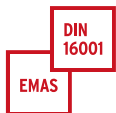
Tip

Overall, it is important that the current figures (consumption, costs) are stored in the ERP (Enterprise Resource Planning) system (e.g. SAP) of your company. This data should be retrievable from Controlling & Accounting, as well as the technical departments.



The following aspects should be considered in the existing ISO 14001 while determining and reviewing energy aspects:

- Establish and review the past and current energy consumption.
- Identify the areas with significant energy consumption, and those in which maximum changes in energy consumption have taken place. The latter represent important areas for energy savings.
- Analyse the expected energy consumption for a comparison with the current energy consumption.
- Identify all the persons whose activities have a significant impact and influence on energy consumption.
- Identify and prioritise opportunities to improve energy efficiency and those for energy savings. Maintain a list.



With the current EMAS III, the review of past and present energy consumption has generally already been realised when taking into consideration the data from the environmental audit. If required, you must add the energy factors here.

Even the identification of areas with increased energy consumption has already been completed. If required, add the changes from the last period.

Additionally, you should estimate the expected energy consumption in accordance with ISO 14001 and identify all the persons whose actions have an influence on it.

4. Include legal obligations

The EU DIRECTIVE 2006/32/EC “End-Use Efficiency and Energy Services” from 5th April 2006 intends to tap into the potential of energy efficiency by enacting an energy efficiency law. Here, the EU aims to increase energy efficiency in industry by 20% by 2020.

For this, the government is providing supporting financial measures in the form of credit programmes for the introduction of EnMS, as well as for concrete projects. (Please refer to the box: Support Programmes).

A trend-setting document for the coming year is the national Energy Efficiency Action Plan (EEAP) based on the European guidelines.

While implementing DIN EN 16001, all currently applicable and relevant laws, regulations and ordinances should be adhered to. Particularly the following:

- Energy Saving Regulation (EnEV)
- Renewable Energy Sources Act (EEG)
- Draft for an Energy Efficiency Law (EnEfG)

- Energy Saving Act (EnEG)
- Federal Immission Control Act (BImSchV)
- Energy-using Products Act (EuPA)
- Best Available Techniques (BAT) – Energy Efficiency Information Leaflet¹⁵

Also to be taken into account are other environmental laws, as well as the Operational Safety and Protective Labour Legislation.¹⁶

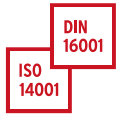
Companies maintain a register of legal obligations so that specific provisions are not forgotten. This contains all relevant laws and regulations which are necessary for operations. The individual legal provisions within this register are updated, as are the measures which must be undertaken for their compliance. A documentation of the process for identifying and implementing legal provisions in the company is important for the final certification.

→ SUPPORT PROGRAMMES - EXAMPLES

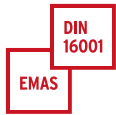
- Energy efficiency advice for SMEs (KfW Bank Group)
- Various support programmes of the Jülich research centre
- Supporting emission-free heavy-duty commercial vehicles (KfW Bank Group)
- KfW Bank Group – environment programme
- Supporting measures for commercial refrigerating plants (BAFA)

¹⁵ Compare, Best Available Techniques (BAT) at <http://www.bvt.umweltbundesamt.de/sevilla/kurzue.htm>

¹⁶ Compare, e. g. www.gesetze-im-internet.de or www.umwelt-online.de, as well as (especially for EMAS) “EMAS in Rechts- und Verwaltungsvorschriften (as at: November 2009)” from the office of the German EMAS Advisory Board.



With an existing ISO 14001, ensure that you are complying with all relevant laws and legal obligations for the introduction of DIN EN 16001. Review once again if it actually complies with all the energy-relevant laws.



As an EMAS company, you are on the safe side here. You not only comply with all the relevant laws and legal obligations but have proven that already. Review once again if you have actually integrated all the energy-relevant laws in your EMAS.

5. Energy objectives and targets

After stocktaking, you can develop global, long-term objectives consistent with your energy policy, which can then be achieved with short-term targets according to the PDCA principle.

The targets should be based on all influencing parameters that decisively impact the energy consumption. During their selection, ensure that the respective parameters are measurable. On the one hand, the targets should be ambitious, while on the other hand, they should be realistic enough to be achievable in the planned time period.

Here are a few starting points:

- Production processes (e.g. efficient use of compressed air, condensate, as well as switches and valves, use of automatic integrated systems, economic mode);

- Motors and engines (e.g. increased usage of electronic controls, variable speed drive, integrated application programme, frequency converter, highly-efficient electric motors);
- Ventilator, variable speed drive and ventilation (e.g. new devices/systems, using natural ventilation);
- Demand management (e.g. load management, servo-mechanism for peak load dismounting);
- Highly efficient Combined Heat and Power (e.g. CHP plants)

→ FORMULATING ENERGY OBJECTIVES



The energy targets should generally be formulated as “S.M.A.R.T.”, e.g.:

S	- specific
M	- measurable
A	- appropriate
R	- realistic
T	- time-bound

Also, include the following while formulating your energy targets:

- The energy aspect to which the targets correspond (e.g. pumps, lighting,...).
- The quantitative reduction target. Use the ratio here (kWh/PE, kWh/k€,...) as the review is independent of production activity and other interfering factors.
- The time period by when the target should be achieved.
- The financial and ecological value (pay-back time, CO₂eq¹⁷, ...).
- The measures and persons-in-charge necessary for implementation.
- Estimated expenditure and costs (investment costs, production accidents, personnel costs, ...).

Publications on energy efficiency in industry are available at:

- “Rationelle Energienutzung” (English “Rational Energy Use”) series by Vieweg Publishers (Vieweg Verlag)
- <http://www.industrie-energieeffizienz.de>
- <http://www.lfu.bayern.de/luft/fachinformationen/>



For proposals on technical measures, you can refer to, for example, your state Energy Agency, 3,000 newly appointed energy coaches from the Chamber of Industry and Commerce (IHK), as well as the NRW (North Rhine-Westphalia) energy project:

- An overview of the local energy agencies is provided by:
<http://www.dena.de/infos/service/links/kategorie/energieagenturen/>
- For energy coaches, you can contact the project office of the German Chamber of Industry and Commerce (DIHK) at <http://www.dihk.de/klimaeffizient/> or your local Chamber of Industry and Commerce (IHK) respectively
- The company pages of the Energy Agency NRW (North Rhine-Westphalia)
<http://www.energieagentur.nrw.de/unternehmen>

The “Modular Energy Efficiency Model“ (Mod.EEM) pilot project with around 100 companies for introducing EnMS in NRW provides further ideas.

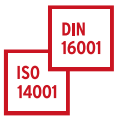
¹⁷ CO₂eq means “CO₂ equivalent” and stands for the climate impact of all the greenhouse gases combined, whereby carbon dioxide serves as a benchmark; the other greenhouse gases are correspondingly calculated per specific impact in ppm CO₂.

→ EXAMPLE FOR AN ENERGY OBJECTIVE TAKEN FROM AN EMAS ENVIRONMENTAL DECLARATION

Objectives, Individual Objective	Implementation Status of Specified Measures
Considerate Use of Resources	
Reduction of energy consumption in administration until 31.12.2010 by 5 % in comparison to the previous year.	Replacing conventional lamps by energy saving lamps is continuously pursued.
	The energy balance for the transparent building of the main administration was compiled. Measures were undertaken to reduce the energy consumption.

www.emas.de/teilnahme/umwelterklaerungen/sammlung

While formulating energy objectives, you can turn to the environmental objectives of ISO 14001. In order to meet the requirements of DIN EN 16001, the following aspects should also be considered:



- Ensure that your objectives are based on the improvement of energy efficiency and energy performance.
- Define measurable targets for all parameters that have an important influence on your energy efficiency and your energy savings.
- Regularly document and update your energy objectives, targets and programmes.



With an existing EMAS, some of these requirements have already been covered by you with the environmental statement. If required, you can extend these in order to ensure that the targets are measurable, documented and have a time frame.



6. Develop an energy management programme and an action plan

All the steps described so far should be consolidated and regularly updated in an energy management programme so that implementation is guaranteed and the internal and external control of EnMS is possible.

In the energy management programme, the established targets, the planned measures, responsibilities and durations are prioritised and consolidated.

Analysing energy targets

An initial classification of the targets takes place within the framework of a rough cost-benefit-estimation. If a selection is made, then you can determine some targets with the help of a weighted point system. The following factors should be included here: legal obligations, industry standards, expenditure of implementation, investment costs, pay-back time, as well as environmental advantages.

Establish action plans

After you have evaluated the targets, an action plan can be prepared which includes concrete measures on how the targets can be achieved. For each target and the relating work packages, responsibilities must be defined, a deadline established and resources for implementation provided.

Measures should be developed parallel to energy targets with the help of various factors such as the expenditure for implementation, investment costs and pay-back time. Develop measures jointly with your energy-efficiency team, as well as with the employees responsible, in order to get an overview of the feasibility of the various measures in your company.

Documentation of the energy management programme

Objectives, targets and action plans can be documented in the energy management programme in order to simplify the implementation and to monitor effectiveness. A synopsis of the programme should also be part of the energy report.



Tip

As examples, three environmental programmes from the environmental statements of different organisations are given below:

→ NEW OBJECTIVES IN THE AREA OF GROUP-WIDE ENVIRONMENTAL PROTECTION OF BMW GROUP

Strategic objectives	Measures	Deadline
Management of Resources and Environmental Protection		
Breakthrough goal of a 30 % reduction in energy consumption, VOC, water, process waste water and solid waste per manufactured vehicle between 2006 and 2012 (5 % per year)	- More measures to raise employer awareness of energy saving potential	2010
	- Integration of pilot project findings on consumption structures and energy flows in Munich in 2008 into all German locations	2009 / 2010
	- Full implementation of "odour-free foundry" at the Landshut plant by 2010 and the subsequent continued reduction of VOC-emissions.	2010
	- Decrease in drinking water consumption as a result of recycling in production and the use of other water categories such as near-surface ground water	Ongoing
Increased application of renewable energies	Evaluate and promote the option of using wind and geothermal energy at various locations	2010
Waste management	Integrate the locations Goodwood and Rayong into the waste information system of the BMW group	2011
Nature conservation and biodiversity	Develop a biodiversity indicator for the entire network of the BMW group	2011
Efficient transport logistics		
Increase percentage of low-emission transport modes	Development of supply concepts from global procurement sources to the BMW group's production sites by taking into consideration sustainable, environmentally friendly transport modes	2009
Optimisation of transport volumes	Development of concepts on traffic reduction (load factor) and traffic relocation to more environmentally friendly carriers.	2009

Environmental programme from the Environmental Statement 2008 of the BMW Group¹⁸

¹⁸ Bayrische Motoren Werke (BMW) (ed.) (2008): Sustainable Value Report 2008. Munich. Available at http://www.upj.de/fileadmin/user_upload/MAIN-dateien/Aktuelles/Nachrichten/bmw_svr_2008.pdf

Measures	Outcome	Completed on	Locations	Responsible	Details on Completion Status
Establishing regular information for employees on environmental performance of the locations (including review) at regular interval through an environmental statement (March) and report of UB (Sept.)	First-time publication of environmental statement and report	30.09.08	DE, BP, MF, MN, CO, BE, LA	UB / ÖUB	(Environmental Programme MF 1.1) According to the compiled environmental statement, e-mail the employees on the basis of location.
Formulating a motivational leaflet for workers with advices concerning environmentally - friendly behavior (switching-off monitors, light, heat controls etc.)	Allocation	30.10.08	DE, BP, MF, MN, CO, BE, LA	UB / Z5	Coordination is taking place between technical responsible OEs. In order to comply with the location specification, location versions should be compiled. These are then distributed via post to all the employees.
Clear and prompt demonstration of appropriate energy performance index in office buildings through information board in the entrance areas	Implementation (according to concept under 1.4.5)	01.09.08	DE, BP, MF, MN, CO, BE, LA	Z5	There was an unsatisfactory attempt. A technical-optical acceptable solution is found, the transfer of data is following
Developing an action-based measurement concept for recording the consumption of heat, electricity, cold and water mediums	1.) Determining the measuring points 2.) Implementation	1.) 20.06.08 2.) 13.12.08	MF	Z5	(Environment programme MF 3.0.1) 1.) completed 2.) open
Decommissioning water heater in the toil. of FLC	Implementing Standard DG DE	04.09.08	DE	Z5 / UB	Measures were agreed upon between Z5 and UB after an inspection (refer to annotation UB)
Installation of a photovoltaic plant on the roof of FSA-hall	Approval of resources from 120 million programme of BR	30.09.08	MF	Z5	(Environment programme MF 3.1.2); measures requested within the framework of 120-Mio-programme.
Assessing the improvement possibilities of structural heat insulation, particularly of the windows	Decision on concrete measures	30.09.08	BP, MF	Z5	BP: Decision on measures will be taken during the course of ES construction. MF: IR-Thermograph was conducted, small problems were resolved by the manufacturer, more thermograph planned for winter 08/09
Assessing the improvement possibilities in heat distribution	Decision on concrete measures	30.09.08	BP	Z5	Refer to 3.4.4 (Z5: new deadline at the end of 3.Q. '08 realised due to delay ES construction etc.) A complete renovation/reformation of the heat distribution network.
Installation of a plant for waste heat recovery from the discharged air of RLT-plant in new buildings.	Energy saving	31.12.08	MF	Z5	Z5: Implementation from 120 Mio.-building refurbishment programme

¹⁹ Federal Environmental Agency (UBA) (Ed.) (2008): EMAS-Environmental Statement of the Federal Environmental Agency for the locations Dessau-Rosslau, Berlin-Bismarckplatz, Berlin-Marienfelde, Langen and House 23 in Berlin-Dahlem. Available at <http://www.umweltdaten.de/publikationen/fpdf-l/3671.pdf>

Environmental Objectives	Environmental Programme 2006 to 2008	Responsibilities Deadline	Status of Completion as at 31. 12. 08
Further development of the EM-system for IFA-AT and IFA-MB	Optimising recycling of old cars by including EMS in the project planning for all new products and processes	EM-officer F & E ongoing	Implemented for 2007
	Cooperation of the IFA group in the Saxony-Anhalt environment alliance	EM-officer ongoing	Implemented for 2007
Reduction of atmospheric pollution	While purchasing new company vehicles, it should be taken into consideration that they meet the requirements for low-emission E4 and that diesel vehicles are fitted with a particulate filter.	UMB / Procurement / Commercial areas 12/2008	Implemented for 2007
	In IFA-drive technology, the atmospheric pollution is further reduced by natural gas combustion for heating the office space using compressor heat.	Plant management IFA-AT 01/06	Implemented
Reduction of oil consumption	In investment activities, (machines and equipment) increased attention is paid to low oil consumption / dry processing, if technically possible.	Engineering 01/01/06 to 31/12/08	Implemented for 2008
Water conservation	Reduction of water consumption in the entire plant as compared to 2006 per production ton of turnover, for e. g. by increasing the length of replacement cycles of the washing machine in the wheel flange production (based on turnover)	Engineering u. F u. E 12/2008	Implemented for 2008
Reduction of paper consumption	By introducing digital archiving, paper consumption should significantly reduce from an average 46,000 pages / month. (MB and AT)	Department manager 12/2008	Implemented for 2008
Reduction of waste accumulation / person	Reduction of household waste / residual waste by 10 % in comparison to 2006 by training of the employees.	Department manager Annual balance sheet	Not implemented
Reduction of emissions in particular the VOC (Volatile Organic Compounds) emissions below the legally stipulated limits (31 of Federal Immission Control Act - BImSchv)	Use of water soluble paints only	Engineering 2004	Implemented
	· Developing a concept	2005	Implemented
	· Developing a technical solution · Implementing the solution	2006	Implemented for 2008
Trainings	Conducting continuous internal environment information events for IFA-employees in group discussions and employment services	Department manager Min. 1 x annually	Implemented for 2006
Preventing soil pollution	At IFA-Maschinenbau GmbH, the interim storage of emulsion-affected processed shavings should be improved (model comparison)	Management Waste Management Officer Ltr. production 2008	Implemented for 2008

²⁰ IFA-Maschinenbau GmbH / IFA-Antriebstechnik GmbH (Ed.) (2009): Environmental Statement 2009 according to the Ordinance (EC) No.: 761 (EMAS). Available at http://www.ifa-gruppe.de/pdf/qualitaet/Umwelterklaerung_2009.pdf

→ PRACTICAL EXAMPLE FOR DEVELOPING AN ACTION PLAN

Concerns / Subject	Lighting in office building
Target	To reduce the energy consumption for lighting by 10 % next year
Parameters	Energy consumption for lighting per employee in [kWh/employee]
Reference parameter	Yearly consumption
Required investment	500 Euro
Value of savings	Approx. 300 Euro/Year
Pay-back time	Approx. 1,5 years
Avoided CO ₂ -emission	3.243 kg / year
Measures	<ol style="list-style-type: none"> 1. Building awareness of the user 2. Stocktaking - review of lighting power at work places 3. Using energy saving lamps and/or ballasts 4. Optimised positioning of lamps
Time frame	<ol style="list-style-type: none"> 1. Until October 2010 2. Until October 2010 3. Until November 2010 4. Until November 2010
Person responsible, amount of work	<ol style="list-style-type: none"> 1. Energy Manager - 0.5 day 2. Company Technician - 1.5 days 3. Company Technician - 1 day 4. Energy Manager - 0.5 days
Provision of expenditures	By energy efficiency team budget
Loss of work / production	None
Others	<p>Reworking the lighting affects the working atmosphere positively</p> <p>The durability of energy lamps is higher than the traditional lighting devices</p>

B DO

In order to achieve the maximum possible savings potential, the measures determined in the action plan should be prioritised and translated into a detailed work plan.

As well as including the responsibilities and time-frame for various activities, the work plan should always take into account the necessary resources. The stipulated energy objectives and targets can thus only be achieved if sufficient financial and technical resources are available. Furthermore, the Energy Manager should systematically record the success of

measures and activities in order to make it easier for energy objectives and targets to be realised and a cost-benefit analysis of the implemented measures to be conducted. Success indicators are cost savings and a reduction in environmental pollution, as well as a positive review by the press or positive feedback from the employees.

Maintain an energy savings register that records all the implemented measures with their savings potential.

After you have successfully planned your EnMS in step 4, it is now time for the actual implementation. During the implementation phase, the activities which were determined in the energy management programme and in the action plan are implemented.

The following steps must be considered to ensure an effective implementation of the EnMS:

1. Securing the necessary resources for implementing the EnMS and establishing an action plan
2. Raising and building awareness
3. Training the employees
4. Communication of the EnMS
5. Documentation of the EnMS and monitoring the documentation
6. Operational control of all the relevant processes, including acquisition, purchase and maintenance



→ EXAMPLE OF AN ENERGY-SAVING REGISTER ²¹

Electricity consumption in the reference year (kWh)	
Gas consumption in the reference year (m ³)	
Primary sources of energy in the reference year (GJ)	

Energy-Saving Measures (Number and Description)	Implementation year of the measure	Actual savings in the 1 st year	Actual savings in the 2 nd year	Actual savings in the 3 rd year	Actual savings in the 4 th year	Actual savings in the 5 th year	Investment costs / employees / material	Pay-off time period in years	Savings in kwh per year	Savings in m ³ natural gas per year	Energy-saving (GJ / Year)	Improvement in energy efficiency in %	Eliminated CO ₂ emissions per year
Energy management and good business management													
1) ...													
2) ...													
...													
Energy-saving projects in processes													
1) ...													
2) ...													
...													
Energy-saving projects in plants and buildings													
1) ...													
2) ...													
...													
Strategic projects													
1) ...													
2) ...													
...													
Total energy efficiency													

²¹ According to Austrian Energy Agency (2007).



Tip

Begin with the implementation of those measures that guarantee quick success and require very little or no investment. This leads to a distinct sense of achievement which makes it easy to communicate the advantages of energy management and to systematically tie the EnMS to the organisation.

Formulate the implementation of individual measures like a project in your company. This will simplify the implementation procedure for your employees.

Measures without investment mostly refer to organisational changes, for example, establishing responsibilities, a systematic data acquisition, the switching-off of machines and devices when they are not being used etc. Even adjusting energy supply contracts falls under this category.

Often, simple changes in the behaviour of the employees towards energy can lead to energy and cost savings

of up to 50%²². However, the problems during the implementation process should not be underestimated and well-defined responsibilities should be determined.

When undertaking measures that require investment, it is important to include suppliers and sub-contractors in order to realise the greatest possible savings potential.

→ SUCCESS CAN BE ACHIEVED DURING THE IMPLEMENTATION PHASE AS FOLLOWS

- Build on what you have while simultaneously encouraging creative thought and new approaches.
- Develop appropriate measures to be able to review and communicate progress.
- Communicate what you do, what you need, and what the outcome is.
- Use an improvement in your energy situation to motivate and encourage participation

²² Compare SenterNovem (2004).



1. Ensure the availability of required resources for the implementation of the EnMS

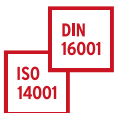
As already shown in chapter 6.A, it is necessary to form an energy efficiency team that is responsible for introducing, maintaining and improving the EnMS. Here, it is not sufficient to just appoint an Energy Manager and other personnel who are part of the energy team. Top management must guarantee the availability of

required technical and financial resources which will ensure a smooth implementation of measures from the action plan. Additional human resources are of particular importance during the introduction phase of your EnMS.



PLAN

For more tips on forming an energy efficiency team, refer also to chapter 6A. Identify the responsibilities and form an energy efficiency team.



The resources required for the implementation of DIN EN 16001 are also required for ISO 14001. Depending on the size of the company and sector, the Environment and Energy Manager can be the same person or be in the same team.



EMAS requirements are in accordance with ISO 14001.

2. For a successful EnMS, focus on raising and building awareness

For a long-term successful implementation of the EnMS, all employees should be in a position to fulfil the role intended for them. After you have established which projects should be implemented, it is now important that you raise the awareness of your employees.

Raising and building awareness are important prerequisites for the success of the EnMS in your company.

Raising awareness can take place through a variety of different channels. Appropriate channels include, for example, information campaigns, flyers, info screen, articles in employee newsletters or the Intranet.

In any case, it is important to motivate the employees to participate. Provide tips on how one can easily and simply save energy and communicate achievements which include environmental and the financial aspects.

Furthermore, it is important that top management sets a good example. Simple changes in attitude can be adopted much more easily if top management is committed and communicates this emphatically.

→ EMPLOYEES SHOULD BE AWARE OF:

- The advantages of energy efficiency for the environment and for the company
- The energy policy and the energy management programme
- The requirements of the EnMS and also how you can improve energy efficiency and the use of energy
- The potential impact of their activities on energy consumption and achieving the energy objectives and targets
- Their tasks and responsibilities in implementing the energy management according to DIN EN 16001.

Tip



Involve the intermediary management in identifying all the employees who you regard as important.

Simple steps for reducing energy consumption are a good introduction towards motivating the employees to save energy. This includes, e.g. switching-off lights and all electrical devices as soon as they are not being used, regulating air conditioners etc. Here, the management has the function of a role model!

3. Facilitate employee trainings and professional development

After having defined responsibilities, it is necessary to find out whether the relevant people have the skills and competence required to conduct their tasks in the field of energy management.

Appropriate training leads to the establishment of the relevant and necessary competence in the company, as well as to creating awareness of the importance of energy management among individual employees.

Training features direct technical aspects, like introductory training for using a new technology. At the same time, it can also include training measures which are indirectly related to energy, e. g. professional development for the Energy Manager in the field of communication or project management.

Apart from concrete professional training measures for individual employees, you should prepare training programmes for the conscious use of energy in your company. The training material should thus be maintained on a regular basis.

Training and creating awareness of the topic of energy management should not only be limited to your own company but should also include suppliers/contractors. You can expect that all persons working on behalf of the company are well-informed regarding the implementation of a successful energy management.

Tip

Include your company's personnel development department so that energy management training becomes part of the development plan for the respective employees.



Various German states offer courses in energy management on their website. An example of this is the Ministry for School and Vocational Education in North Rhine-Westphalia (<http://nrw.sophia24.com/>)

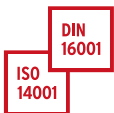
Even the local Chamber of Trade and Commerce offers certification courses for operational energy experts.

Furthermore, various certifiers and EMAS-environmental consultants conduct workshops and seminars on energy management in accordance with DIN EN 16001, as well as for operational energy experts.

Practical example



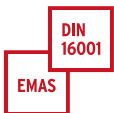
The Volkswagen Group conducts a training programme for energy representatives in various departments. This training includes providing information on the most conventional energy sources to demonstrate energy saving potential in various areas. The training provides basic knowledge on the specific energy-saving options in the field of electricity (lighting and electrical machines), compressed air (6 bar and 12 bar), space heating/technical heating, water, incoming air/exhaust air, office, building envelope and organisation.



ISO 14001 does not make a statement on the qualification of the energy management representative. Ensure that your energy management representative possesses the necessary expertise and skills.

Expand your spectrum of training measures with energy-relevant training:

All employees should be informed about the advantages of energy efficiency and energy management.



By involving all employees, EMAS-companies ensure that the employees are well-informed when it comes to the various aspects of energy management.

Even in EMAS, no statements are made regarding the qualifications of the energy management representative. Review if he/she possesses the required expertise and qualifications. Expand your spectrum of training measures with energy-relevant training.

4. Communicate your EnMS in the company

While communicating your EnMS, you should differentiate between internal and external communication. According to DIN EN 16001, internal communication is obligatory and is closely related to raising the awareness of employees when it comes to implementing the EnMS. The external communication of your EnMS results is not mandatory; however, it helps to portray a positive profile of your company and positively affects your corporate image.

Effective internal communication is an important prerequisite for the successful implementation of your EnMS. Informing your employees about the EnMS on a regular basis increases their motivation to actively participate.

In order to continuously improve the EnMS, it is not only important to raise awareness among employees about the importance of energy management but also a company culture needs to be established, one that enables your colleagues to actively put forward suggestions for improvement and which motivates them on all levels.

All comments collected and suggestions for improvement should be reviewed and answered. Appoint a person-in-charge and draft a plan for internal communication within the framework of energy management – this simplifies the information flow.

→ ACCORDING TO DIN EN 16001, THE FOLLOWING ASPECTS OF THE ENMS SHOULD BE COMMUNICATED

- The energy policy and the energy objectives and targets
- The possibility of each individual to contribute towards energy management
- Information on energy consumption and trends within the company
- The conformance to legal and other requirements
- Room for improvement
- Financial and environmental advantages of energy management
- Contact person for further details.



Tip

Build on established communication channels while preparing your communications plan. Develop the communications plan together with the department for internal communications and gain from their experience.

Apart from communicating to raise the general awareness of your employees, it is important to regularly communicate the most important aspects of the EnMS. Integrate the results of measurements and the energy indicators and aspects collected for the energy management into your internal controlling. This ensures regular internal communication of the EnMS results up to the top management.

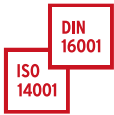
Even if it is not compulsory communicate your activities externally, it remains important. If you decide in favour of external communication, then you must determine who will be responsible for it, what kind of information will be communicated and which communication media are to be considered. You should be able to communicate distinctly and clearly all possible measures and even the continuous improvement thereof according to the philosophy of DIN EN 16001.

Tip



Internal communication of your EnMS, its objectives and targets, as well as responsibilities, on a regular basis forms one of the most important aspects of a successful implementation. Especially in the initial phase, regular communication of the measures to be implemented is very important. This helps achieving a change of attitude amongst your colleagues.

External communication is not an obligation but you can take it as an opportunity to portray your company in public as being energy-conscious and environmentally friendly. It is becoming increasingly relevant in the face of the climate protection debate to portray individual efforts and to be placed positively on the market. A possibility for external communication is the integration of energy management into your sustainability report. Learn more about this aspect in Chapter 7 of this guide.



The requirements for internal communication are similar in ISO 14001 and DIN EN 16001. Focus your communication on energy aspects. Ensure that all employees are informed about energy management and can actively take part. When you decide to communicate your energy management externally, prepare a communication plan, just as you do for internal communication.



EMAS users are already well-positioned with respect to communication. External communication and the involvement of employees is mandatory in EMAS. Additional requirements for internal communication are in accordance with ISO 14001.

Tip



According to DIN EN 16001, energy management should be a cross-sectoral theme. Staff members from different departments such as procurement, controlling, technology, and operations should regularly discuss this topic with each other. For example, organise a “round table” that brings together responsibilities concerning quality management, environmental management, energy management, controlling and maintenance for the exchange of experiences and views.

5. Document and monitor your EnMS

All key elements of your EnMS should be captured either on paper or electronically and then be recorded. The documents should be easily accessible and therefore, preferably filed in a systematic manner. If you have already introduced a documentation system into your company, it is recommended that you use it for your EnMS also in order to save on effort and costs.

These key questions make it easier for you to prepare an easily understandable documentation system:

- What is the subject of the documents?
- Which part of the company is affected?
- Which activities should be documented?
- For whom is the documentation meant and who must work with it?

In the following, you will find a list of documents that are normally included in the documentation of an EnMS:

- Regulations concerning policy, energy objectives and energy targets
- Information on significant energy aspects and processes
- Job instructions
- Process information
- Organisational plans, internal and external regulations
- Records
- Technical documentation, e.g. installation and equipment records, record on energy flow and utilities, maintenance plans, user manuals etc.
- Results of the review of energy aspects
- Action plans with references to additional activities²³

Ensure that anyone who is responsible for the documentation of one or more working areas has access to the documents. Ensure that the documentation system is monitored regularly and always kept up-to-date.

All processes related to energy must be documented. It is necessary to document the reasons for implementing a certain measure, as well as which energy aspects (technology, organisation or behaviour) and activities in the daily work routine are affected by a certain procedure.

The simpler the documents are maintained, the easier it is to implement the EnMS. Also, keeping your documents up to date enables you to monitor and measure your EnMS more easily.

To what extent and detail documentation takes place depends not only on the size of your company but also on a series of other factors. A decision should be made based on the following aspects:

- What are the consequences if the process is not documented?
- Is it necessary to maintain a record due to legal or other requirements?
- Is documentation necessary to ensure that the activity can be traced?
- Does documentation bring with it advantages, e.g. by making it easier to carry out communication and training?
- Is documentation necessary for easier maintenance and reviewing of the EnMS? Is the risk of ambiguity and deviation reduced due to the documentation?
- Does DIN EN 16001 require processes to be documented?

²³ According to DIN EN 16001.



Tip

Combine the responsibility for documents of the QMS and EMS with the EnMS. The general rule of thumb is that an integrated management system reduces expenditure by up to 30%!



Documentation obligations in ISO 14001 (EMAS) and DIN EN 16001 differ only marginally. You already fulfil all the important prerequisites; however, ensure that all energy-relevant documents are available.



EMAS companies have already presented an externally validated document. No other requirements need to be met. Ensure that all the energy-relevant documents are available.

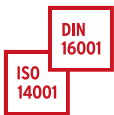
Monitoring documentation

Documents should regularly be monitored for being up-to-date and being accurate. Therefore, ensure that all relevant locations have the current version of the documents and that obsolete and old versions are retained to avoid confusion.

For legal reasons, a few obsolete documents need to be kept. However, ensure that these documents are clearly separated from the current versions.

Also, ensure that the latest documents are well-preserved from damage, loss or destruction.

All documents can be kept in electronic form, as well as in hard copy.



There is no considerable difference in the monitoring of documentation between ISO 14001 and DIN EN 16001. Ensure that all important documents of the EnMS are integrated and make sure that all the documents are maintained in a manner sufficient to implement the energy management system.



EMAS requirements in accordance with ISO 14001.

6. Include energy efficiency in processes, design and procurement

Within the framework of your EnMS, you need to consider all the internal and also, to some extent, external processes of the company.

This includes the planning of procedures and processes, maintenance of facilities, installations and equipment, buildings, purchasing, procurement, as well as the

energy consumption of all the commodities and assets used in your company.

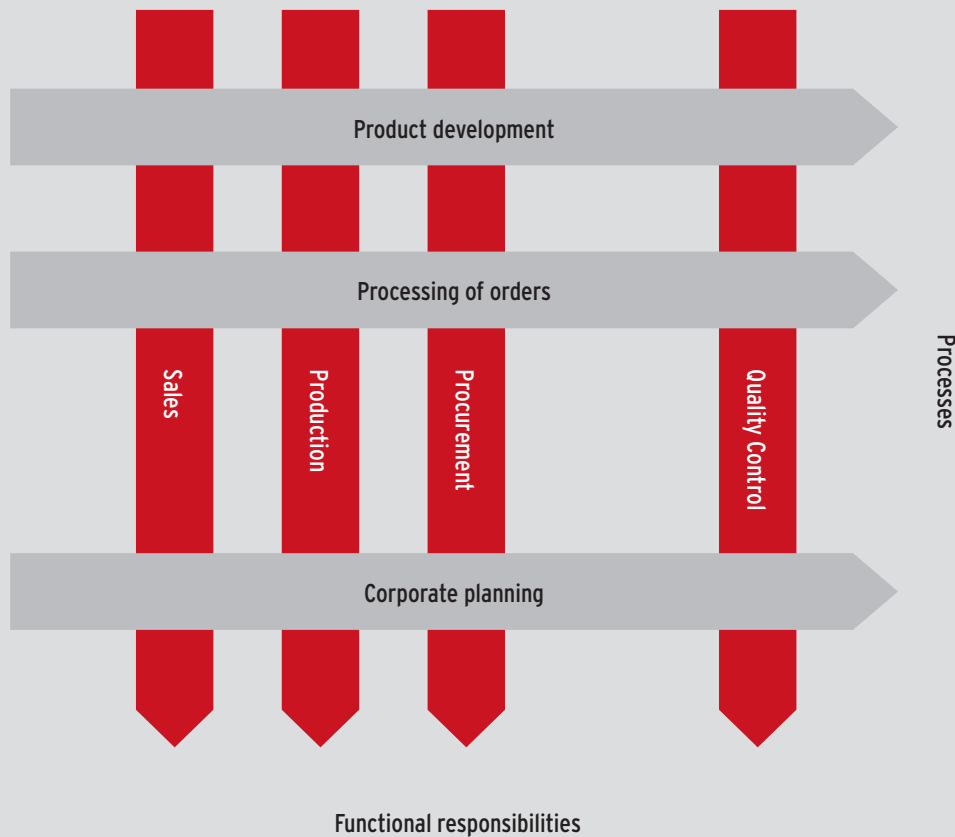
Examine all processes to determine, for example, how much energy can be saved by switching off machines when they are not in use or by changing processes or working procedures.



Tip

Do not only concentrate on the main processes. Studies have shown that a major amount of the energy in industrial establishments (up to 2/3) is consumed by ancillary activities!²⁴

→ TYPICAL PROCESSES IN A COMPANY



Own illustration based on B. Ebel (2003)

²⁴ See also, e.g. Fraunhofer Institute for System- and Innovation Research (Fraunhofer ISI) (2008).

Furthermore, the regular maintenance and upkeep of machines, equipment and facilities often leads to

energy savings, e.g. because air conditioners are cleaned or failures are noticed more easily.

→ TO ENSURE THAT MAINTENANCE AND REPAIR TAKE PLACE AT REGULAR INTERVALS, YOU MUST:

- Carry out operational and repair plans for machinery, equipment and plants.
- Specify maintenance intervals for relevant facilities. This includes mentioning the type of maintenance.
- Identify the departments and personnel who are responsible for the operation and repair of the equipment.
- Have ready the time plans for reviewing the relevant facilities and the description on how the assessment should be conducted.

According to DIN EN 16001

Energy-conscious design:

Attention must be paid to energy-efficient design, when designing, modifying or renovating plants, facilities and buildings. Those who ensure that energy-efficient alternatives, low energy standards or alternative energy sources are used within new facilities and utilities as well as new production lines will consequently save energy and costs.

When introducing energy-efficient designs, collaboration with an external consultant is recommended. External consultants have the experience needed for estimating the cost-benefit effect of energy-conscious design.

Energy-conscious procurement:

Even when purchasing machinery, equipment, raw materials and services, a lot of energy can be saved. Make energy efficiency a criterion for evaluation in your procurement processes.

This means basically that you:

- Make energy efficiency a criterion in your procurement policy;
- Establish procurement guidelines for products that currently consume more energy than necessary;

- Conduct a thorough energy review;
- Determine the criteria and calculation methods for the pay-back period;
- Conduct a lifecycle analysis.

The cost-benefit aspect should generally be taken into account. Most importantly, these criteria need to be taken into consideration for large purchases and for areas in which energy consumption plays an important role.

It should be determined exactly when an energy-efficiency review must be undertaken. According to DIN EN 16001, the following preconditions should be clear in this regard:

- Responsibilities for carrying out the review;
- Resources available;
- Examining economic and energy-efficient alternatives;
- Responsibilities for evaluating and approving the review;
- Responsibilities for decision-making with regard to deciding which option is the most reasonable.



→ **ENERGY-CONSCIOUS DESIGN SHOULD ENSURE THAT:**

- an in-depth analysis of energy consumption is carried out in the very first phase of the development project;
- an energy review is conducted in all relevant development steps (proposals, first detailed design, final design, selecting the equipment, delivery, commissioning etc.);
- the responsibilities of the persons-in-charge concerning an energy-conscious design are established clearly.

According to DIN EN 16001

Literature tip

On the website of the Federal Environment Agency (UBA), you will find many helpful tips on environmentally friendly procurement.

<http://www.umweltbundesamt.de/produkte/beschaffung/>



The Federal Ministry of Economics and Technology (BMWi) has published various links for practical procurement help on their website, e. g. guides on how energy efficiency aspects can be integrated when awarding a contract, important energy consumption data and environmental key data, as well as online information systems

(<http://www.bmwi.de/BMWi/Navigation/Energie/energieeffiziente-beschaffung,did=232288.html?view=renderPrint>)

In the BMU publication “Fördergeld für Energieeffizienz und Erneuerbare Energien”, you will find an overview of the relevant support programmes. The brochures are available from BMU or online at:

http://www.bmu.de/files/pdfs/allgemein/application/pdf/geld_energiesparen.pdf

In principle, the guidelines for energy-conscious procurement and design should not only be applicable to your company but also to your suppliers. Make energy efficiency a feature when selecting suppliers and consultants/subcontractors.

Training and raising employee awareness are the most important prerequisites for an energy-conscious design and procurement.

In the current ISO 14001, the control of your processes and procedures should be expanded by energy efficiency. This includes the following aspects:

- Determining criteria for the operation and maintenance of equipment, facilities and buildings.
- Adding energy efficiency and energy consumption as an additional criterion for procurement. Inform your suppliers that energy is an important criterion of your procurement policy. Pay heed to energy efficiency even during the maintenance of plants and property.
- Expanding communication channels to your personnel and all others who work on behalf of your company and whose activities have an impact on energy consumption.



As an EMAS company, you have much fewer additional aspects to consider. You have already integrated environmental impacts into your procurement. In addition, you only have to ensure that the energy aspect remains a relevant theme. Your employees are informed already.

If required, add criteria for operating and maintaining facilities, equipment and buildings, as well as the review of energy consumption in design, modification or maintenance of goods and buildings.



C CHECK & ACT



According to DIN EN 16001, an important aspect of energy management is the process of continuous improvement. In order to ensure this, you need to regularly check if you have achieved all energy objectives and targets and if the EnMS is functioning optimally.



If necessary, you may need to undertake corrective measures.

The following aspects must be considered during a regular review:

1. Monitoring and measurement
2. Reviewing compliance with legal obligations
3. Nonconformity, corrective and preventive action
4. Planning and structuring records
5. Internal audits
6. Review by top management

1. Monitor and measure the results of your EnMS regularly

It is possible to detect inefficient energy consumption promptly if there is a frequent and regular comparison between the expected and actual energy consumption.

Apart from that, it allows you to analyse energy consumption and to measure the extent to which you have achieved energy targets and objectives.



By frequently and regularly comparing the expected and actual energy consumption, it is possible to quickly detect inefficient use of energy. Also, it provides the opportunity to analyse the energy consumption and to measure the achievement of objectives and targets.



Tip

Use energy reports, meter readings, information from administration and accounts for monitoring and measuring. For this, your ERP system (e.g. SAP) should contain the most current data!

The purchase of measurement equipment and meters is often expensive and does not necessarily remain in proportion to the potential savings. Therefore, adjust the number of the required measurement devices to the type of your company and to the requirements of your EnMS. A comprehensive introduction of measurement devices is not necessary; a plan should be prepared to optimise the use of measurement devices and, if necessary, to procure new devices over a long period of time.

Generate key indicators to measure energy consumption. This will help you compare the consumption of various plants or production lines. Examples of key figures are, for example, the energy consumption per production unit or m² of floor area.



Tip

For further information on data collection, refer to the chapter PLAN (recording consumption, costs and production of energy).

In accordance with DIN EN 16001, the following activities should be carried out regularly:

- Continuous monitoring and recording of fundamental energy consumption and the energy factors related to it
 - Consolidating main energy consumption in the form of key values
 - Comparing actual and expected energy consumption
 - In the case of major deviation from the expected energy consumption, the reason for deviations and the corrective measures should be documented.²⁵
- Create benchmarks with other divisions of your company or other similar companies in order to discover optimisation potential and to define energy targets.



Important

The relation between energy factors and energy consumption must be assessed on a regular basis to ensure that consumption is assessed with the help of current best-possible performance.

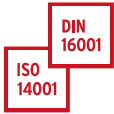
→ THE FOLLOWING ASPECTS OF THE MEASUREMENT SHOULD BE RECORDED IN WRITING

- How is energy consumption measured
- The scope of measurement (includes measuring intervals, as well as information on measurement devices)
- The tasks and responsibilities for measurements
- How is the expected energy consumption determined

According to DIN EN 16001

²⁵ According to DIN EN 16001.

The requirements for monitoring and measurement are similar in ISO 14001 and DIN EN 16001. In order to meet the requirements of DIN EN 16001, you should additionally consider the following aspects:



- Ensure that the review also includes the monitoring of energy consumption.
- Ensure that the measurement equipment can also measure the specific energy consumption.
- Compare and assess the expected vs. actual energy consumption in fixed time periods.
- Compare your energy indicators with those of similar companies.



EMAS requirements are in accordance with ISO 14001.

2. Monitor and assess compliancy with legal obligations

You should regularly assess to what extent the legal obligations of the company described in chapter 6A have been complied with. A written review is required

here. You can use the review to keep your legal register up-to-date.



With regard to monitoring and reviewing the compliance of legal obligations, no additional measures need to be taken in the current ISO 14001. In ISO 14001, the obligations are explained in greater detail than in DIN EN 16001.



For companies with EMAS, the same requirements apply as those for ISO 14001. However, their legal compliance has, unlike within ISO 14001 certification requirements, been cross-checked by the responsible authorities, and can be proven by appropriate documentation (known as a clearance certificate of an environmental verifier).

3. Take action if the energy policy cannot be implemented:



If the requirements that DIN EN 16001 sets for EnMS are not fulfilled, then you must take corrective action.

This is applicable, for instance, when the behaviour of employees or the development of the company are not conforming to the energy policy, the energy objectives and targets or to the energy programme.

You must find out what made deviations take place and ensure that the problem does not repeat itself.

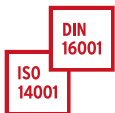
Deviations should be documented but there are no guidelines on how you have to respond to them.

4. Make a plan for your records

You must keep records of your energy-related activities. With these records, document the realisation of energy objectives and targets, energy programmes and action plans. The records depend on the company and must conform to the requirements of your EnMS. They should be traceable, legible and accessible and should be directly assigned to the relevant processes, activities or persons.

In the following, you will find a list of documents which are normally included in the records:

- Information on relevant laws and formalities
- Records on trainings
- Communication media for all interest groups, such as press releases, campaigns for raising awareness, presentations, websites etc.
- Essential energy consumption and indicators on energy performance
- Records on installation, review, maintenance and calibration of measuring equipment and devices
- Communication of the energy policy to suppliers and other contractors
- Due dates for monitoring and maintenance of energy consuming facilities
- Purchase of energy-efficient goods and equipment
- Results of audits and management reviews²⁶



In comparison to ISO 14001, no substantial changes are necessary to the procedures for managing records.

Ensure that all the records necessary for an effective management of your EnMS are maintained. Make certain that it is clear to which activity, product or service a record relates.



As an EMAS user, you already fulfil all the prerequisites as you must regularly collect all information on your environmental performance for updated environmental statements.

²⁶ According to DIN EN 16001.

5. Internal audits

You must regularly carry out internal audits,²⁷ which includes a systematic review of your EnMS. Internal audits are an important step for continuous improvement.

In the run-up to an internal audit, it is advisable to clarify what it actually contains. For instance, it should **not** be taken as a:

- Cost-benefit-calculation of individual measures
- Calculation of economic efficiency for future projects
- Analysis of technical aspects of the equipment purchased according to the action plan

The aim of the internal audit is to further improve the functionality of your EnMS, your energy management

programmes, objectives and targets etc. and to help develop new measures for optimising your energy management.²⁸ An audit is a systematic element of the internal review of your EnMS and thus an important step for continuous improvement. Therefore, you should not see the internal audit as merely a control measure but as an opportunity to further improve yourself and the company.

The internal audit should take place at least once a year. It can either be conducted by employees of your company who have the required skills and knowledge about your EnMS, the standard DIN EN 16001, as well as the aspects to be analysed but remain outside the direct management of the EnMS. Otherwise, you can consult an external auditor and have him/her carry it out. In this case, it is advisable to use the same auditor that is used for certification as it saves on effort and costs. In either case, the auditor should be qualified, experienced, impartial and independent of the area to be assessed in the organisation.



Tip

When conducting internal audits through an employee, it is recommended to first consult the other management officers of your company to exchange advice.

Once you have decided on the auditor, you should then carefully plan the actual implementation of the audit. Think beforehand about which information sources you will use. These can be persons, documents or already existing energy reports. It is a good idea to collect the essential data for the internal audit before the audit itself. This will help to save time and cost and will give you a good opportunity to get more deeply involved in the analysis of possible causes. Inform the relevant persons in time and gather background information in the run-up to the audit.

Prepare audit checklists for guidance during the audit. In Appendix A, you will find examples of checklists that will help you analyse the current status quo of your EnMS. If required, note the type of resources used, place and time of the audit taken, as well as the name of the persons responsible.

At the beginning of the audit, explain the objective of the internal audit to all employees directly connected to the EnMS elements which are to be audited. It is important that it is not about the performance of the individual employee but about the effectiveness of the EnMS.

²⁷ Definition according to DIN EN 16001: "The purpose of an internal audit is to carry out a systematic review of the energy management system and assess whether the system operates in accordance with the organization's own requirements together with those of the energy management system standard."

²⁸ ISO 19011, which at the moment is in the process of being amended, is the international audit standard. It functions as a guide for auditing quality and environment management systems and lists the qualifications of auditors.

When conducting the internal audit, the auditor shall:

- Determine the current energy performance
- Assess the effectiveness of the EnMS, as well as its processes and systems
- Compare the results with the energy objectives and targets
- Provide information for benchmarking
- Analyse problems and identify their sources and weaknesses
- Identify possibilities for continuous improvement

The result of an internal audit should be an energy report in which all current energy data is present. Apart from the status quo of the energy management, the report should also contain a description of follow-up activities, monitoring and measurement of results, as well as a description of responsibilities.

The report not only focuses on the improvement of the EnMS but also refers directly to energy efficiency. It compares the results of the activities with plans and energy targets of the energy management programme and determines by how much energy consumption and energy efficiency have actually improved.

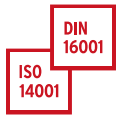


Tip

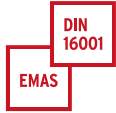
It is advisable to present the final report to the top management, as well as to the employees whose job area is affected by the internal audit. You thus get the opportunity to present outcomes, to explain deviations and non-conformity and to plan possible improvement measures.

→ EXAMPLE FOR PREPARING AN ENERGY REPORT (KEY POINTS)

Energy Report, Second Half-Year 2009		
1	Short company profile (incl. company processes & products)	
2	Energy sources & energy consumption (Jul - Dec / 2009)	
3	Energy targets as of 31.12.2009 Achievement of targets as of 31.12.2009	
4	Identified measures for 2009 Achieved measures in 2009	
5	Synopsis of energy management programme	
6	Required corrective measures	
7	Next steps	



The requirements of the internal audit of DIN EN 16001 widely conform to the requirements of ISO 14001. Ensure that your internal auditor has sufficient knowledge of energy management and energy efficiency. Furthermore, deviations from expected energy consumption are to be dealt with immediately.



EMAS companies already fulfil all the prerequisites through the additional regulations on internal company auditing. However, ensure that your auditor has sufficient knowledge regarding energy management and energy efficiency.

6. Get your EnMS reviewed by the top management (Management Board)

A review of the EnMS should be undertaken by top management at regular intervals to evaluate the suitability and effectiveness of the energy policy, the objectives and targets, the indicators, as well as the general state of your energy management.

The management review is not only an assessment of the EnMS status quo but also an important tool for the identification of possibilities for improving energy efficiency in your company.

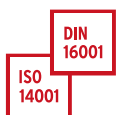
In order to ensure that the suggestions given by top management are also taken into consideration, the review shall be documented, for instance, in the form of a protocol or action plan. Furthermore, follow-up measures and responsibilities for implementing the suggestions must be identified. Based on the results of the internal audit, an intensive review by the top management should take place at least once a year.



Tip

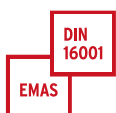
Integrate the energy management obligations into your internal financial controlling in order for top management to be kept informed about the status quo of the energy indicators.

In order to organise the respective meeting of the top management for the review of your EnMS as effectively as possible, preparations should be made well in advance (e.g. preparation of a comprehensible consolidation of all important data and results of the EnMS).



The requirements for a review by the top management are almost identical in ISO 14001 and DIN EN 16001. Make sure that the management pays special attention to assessing energy aspects. Regarding the requirements of the DIN EN 16001, the planned energy consumption should also be taken into consideration.

The suggestions resulting from the review undertaken by top management must be completed with improvements achieved since the last review.



EMAS requirements are identical to those of ISO 14001.

7 CERTIFICATION, ASSESSMENT & EXTERNAL COMMUNICATION

Certification

If you have fully introduced an EnMS into your company, you have the option of getting it certified by an independent external certifier. By doing so, you increase the relevance of your management system and can simultaneously improve your company's image. When receiving the certificate, the company has officially demonstrated that it has fulfilled the requirements of DIN EN 16001. Certifications are carried out by an independent third party and after

a successful assessment the companies are awarded a certificate.

Certificates should be renewed on a regular basis. That includes conducting an audit in order to check if you are continuously improving your management system. Therefore, select your certification body very carefully as this business relationship is to last for a long time to come.



Tip

If you have already introduced another management system, you should bear in mind that your certification body cannot only certify your EnMS but also other management systems (e.g. ISO 9001 or ISO 14001). Here, the effort required for an audit can be reduced and costs can be saved.

Initial certification

Once you have decided on a certifier, a first pre-audit is usually carried out. Depending on the particular certifier, the pre-audit looks at the company's location, business strategies, requirements of the standard that your company has already fulfilled etc. Based on these early assessments, the core points of the measures to be undertaken can be established. In a second step, the documentation of your management system is reviewed to determine the extent to which you already comply with the requirements of the DIN EN 16001 standard.

During the actual certification audit (DIN EN 17021), the certifying auditors look at the extent to which the functionality of the management system implemented fulfils the conditions of the standard in practice. It thus primarily deals with the agreement between the defined targets and the performance against these. The expenditure for this certification audit is dependent on the certification body you employ. Thus, apart from assessing the documents and the (energy) performance, effectiveness can be evaluated through additional appraisal interviews or by observing company processes.

If the auditors approve the compliance of your management system with the requirements of DIN EN 16001, then your company is awarded the certificate.



Tip

Before starting the certification process, the EnMS should have run for at least three months so that the relevant data is available.



Re-certification

To ensure continuous improvement of your management system, annual audits are conducted by the certifier. Performance is thus assessed systematically, enhanced and, if required, optimised. In this way, non-conformities can be detected at an early stage and relevant corrective measures are taken.

With a regular review audit by the certifier, you can re-certify your management system. Remember to conduct the re-certification in time and before the validity of your certificate expires.



Literature tip

Additional information on certification can be found, for example, on the websites of the following organisations:

- Deutsche Akkreditierungs- und Zulassungsgesellschaft für Umweltgutachter GmbH (DAU)
<http://www.dau-bonn-gmbh.de>
- Deutsche Akkreditierungsstelle
http://www.dakks.de/akkreditierte_stellen

External communication

Receiving the certificate signifies to your employees, business partners, clients and the wider public that you have successfully implemented an EnMS. To communicate this, you have various options of internal and external communication tools available. Thus, you can, for example, include your EnMS in the annual or

sustainability reports. It is further recommended to define target groups, discuss communication media (like newsletters, professional journals, events, company website etc.) and to develop corresponding marketing strategies.



Tip

A separate menu item on “energy” or “energy management” on your homepage can contribute towards underlining the importance of the topic for your company.

It is important to follow the DIN/ISO/CEN standardisations for any kind of external communication to prevent false statements.

In the past, there have been instances in which companies have used logos of standardisation organisations like DIN, CEN or ISO. These logos are, however, registered as trademarks and are thus protected. Therefore, be careful not to use any such logos.



Pay particular attention to describing your certification correctly. If you have implemented an EnMS in your company and received the relevant certification, then you are certified according to DIN EN 16001:2009. Expressions like “certified according to DIN EN” or “DIN EN 16001 certified” are not precise. You should also be careful about the use of the terms certified, registered

and accredited. “DIN EN 16001:2009 certified” and “DIN EN 16001 registered” can be used as synonyms. However, the use of “DIN EN 16001:2009 accredited” is false.

The misconception that DIN EN 16001:2009 is a product standard should be prevented. The standard does not refer to a product of your company but to processes that affect the energy efficiency and energy consumption of your company.

According to DIN EN 16001:2009, external communication is not obligatory following a certification but remains the decision of each company. If a company decides against external communication, it should be able to give reasons for this decision. It is generally recommended that you use external communication as an opportunity to highlight the credibility of your company’s energy policy.



Literature tip

References to “Good Practice“ in the communication of the certification can be found in the guidebook from ISO, Genf:

ISO 2005: Publicising your ISO 9001:2000 or ISO 14001:2004 certification.

Free download at <http://www.iso.org/iso/publicizing2005-en.pdf>

DIN EN ISO 9001:2008 and DIN EN ISO 14001:2004 can easily be ordered online from the Beuth-Verlag website (<http://www.beuth.de>).

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ANNEX A: ENERGY MANAGEMENT CHECKLIST

The energy management checklist is an important instrument for you to review, either when initiating the EnMS or when close to completing the implementation process, whether you have optimally introduced the EnMS according to the DIN EN 16001:2009 standard.

The checklist includes a series of checkpoints which are formulated as questions. If you have implemented the EnMS correctly, you will be in a position to answer the questions with “YES”. The checklist consists of 86 ques-

tions. On the hand right side of the table, you will also find a column for comments on every individual point. Comments can, for example, be measures or references to some specific areas which require further attention. At the end of the checklist, you will find the summarised analysis of all the sub-questions. In this, note the number of questions answered with YES and NO per section. This will help you to quickly identify the areas that show an optimal implementation or, if necessary, those that need further improvement.



Tip

Use the comments column during the review process. After auditing and certification, it serves as a good guideline for improvement and optimisation measures.

→ COMPANY DATA

This checklist has been prepared for the following company / organisation:

Address:

Zip Code and City (of Registration):

Telephone Number:

Fax:

E-mail:

Contact:

Telephone Number:

1.

2.

3.

Date of Review:

→ ENERGY MANAGEMENT SYSTEM CHECKLIST

* No. analogical to the progression with regard to contents of DIN EN 16001

No.*	Required Elements	Implementation Yes / No	Comments
A	Energy policy		
1	Has the energy policy been established by the top management of your company?		
2	Have the scope and boundaries of the EnMS been defined?		
3	Does it include an obligation to constantly improve the EnMS?		
4	Does it include the obligation to comply with all the applicable requirements concerning energy aspects?		
5	Has the energy policy been documented and made accessible to all internal and external employees?		
6	Is the energy policy open to the public?		
B	Planning		
B.1	Identifying and reviewing energy aspects		
7	Were significant energy aspects identified and reviewed at regular intervals by the company?		
8	Has a list of options been prepared for improving energy efficiency?		
9	Were reviews of energy aspects documented?		
	Were the following aspects considered by you in this process?		
10	Previous and actual energy consumption, as well as previous and actual energy factors (data)		
11	Identification of areas with increased energy consumption		
12	Identification of areas which have seen important changes with regard to energy use in the last period		
13	Estimation of the expected energy consumption for the following defined periods		

No.*	Required Elements	Implementation Yes / No	Comments
14	Identification of all persons working for the organisation whose activities have a significant impact on energy consumption		
15	Identification of possibilities for improving energy efficiency		
B.2	Legal obligations and other requirements		
16	Were all legal obligations concerning energy aspects determined?		
17	Was the relevancy of other requirements for your energy aspects determined?		
B.3	Energy objectives, targets and programmes		
18	Were energy objectives and targets established for all relevant functions and levels of the organisation?		
19	Were these documented?		
20	Were these implemented?		
	Were the following aspects of the energy objectives and targets taken into consideration?		
21	Compliance with the energy policy of the company / organisation		
22	Consistent with the obligation to improve energy efficiency of the company / organisation		
23	Consistent with conforming to applicable legal obligations and other requirements		
24	Were specific targets determined for all the important parameters influencing energy efficiency?		
25	Are all energy targets measurable and were they documented?		
26	Has a time period been determined for achieving the appointed targets?		
27	Were technological options, financial, operational and social framework conditions taken into consideration?		

→ ENERGY MANAGEMENT SYSTEM CHECKLIST

* No. analogical to the progression with regard to contents of DIN EN 16001

No.*	Required Elements	Implementation Yes / No	Comments
28	Were legal obligations and the point of view of stakeholders taken into consideration?		
29	Were EnMS programmes developed?		
30	Were responsibilities defined in the programmes?		
31	Does the programme include resources and a deadline for achievements?		
32	Were all energy targets and objectives, as well as energy programmes, documented?		
33	Were all energy objectives and targets, as well as energy programmes, updated in the intervals prescribed?		
C	Implementation and operation		
C.1	Resources, tasks, responsibilities and authorities		
34	Has the top management made available the required experienced personnel, as well as technical and financial resources?		
35	Were tasks, responsibilities and authorities determined, documented and communicated?		
36	Was a management representative appointed and his tasks, responsibilities and authorities defined?		
37	Does this management representative have the authority to ensure conformity of the EnMS with the standard?		
38	Does he have the authority to report on the performance of the EnMS and suggestions for improvements?		
C.2	Awareness, training and competence		
	Do all employees have knowledge of the following areas?		
39	Energy policy and energy management programme of the organisation		
40	Requirements of the EnMS (activities of the organisation to control energy use and improvement of energy performance)		

No.*	Required Elements	Implementa- tion Yes / No	Comments
41	The own potential impact on energy consumption or energy efficiency.		
42	Individual tasks and responsibilities within the framework of the EnMS		
43	Do all persons in-charge possess adequate education, training and experience?		
44	Were relevant training measures introduced?		
C.3	Communication		
45	Was the energy performance, as well as the EnMS, communicated internally?		
46	Do all employees actively take part in improving the energy performance?		
47	Are the energy performance and the EnMS communicated externally?		
48	If so, was a plan established for the implementation and documentation of external communication?		
C.4	Documentation of the EnMS		
	Was documentation initiated, implemented and maintained for the following aspects?		
49	Description and explanation of the core elements (main points 3.2. to 3.6. of the standard) of EnMS and their interaction		
50	Determining the location for relevant documentation, including technical documentation		
C.5	Control of documents		
	Do your documents fulfil the following aspects?		
51	Can be located and traced		
52	Regular review and, if required, revision		

→ ENERGY MANAGEMENT SYSTEM CHECKLIST

* No. analogical to the progression with regard to contents of DIN EN 16001

No.*	Required Elements	Implementation Yes / No	Comments
53	Availability of current versions at all relevant locations		
54	Easy accessibility and protection from damage, loss and destruction		
55	Establishment and documentation of the retention time		
56	Removing obsolete documents due to legal reasons or for security purposes		
C.6	Operational control		
	Were the following aspects taken into consideration when determining and planning the processes?		
57	Determining criteria for operation and maintenance of equipment, facilities and buildings		
58	Considering energy performance for purchasing, procurement and installations		
59	Considering energy consumption of all commodities		
60	Information about all people working on behalf of the organisation		
D	Review		
D.1	Monitoring and measurement		
61	Was a plan drawn up to measure energy and to monitor this process?		
62	Were energy consumptions and energy factors measured, monitored and recorded on a regular basis?		
63	Was the relationship between energy consumption and the related energy factors established in all cases?		
64	Was the actual energy consumption measured against the expected energy consumption at regular intervals?		
65	Were records of all significant unplanned deviations from the expected energy consumption identified?		
66	Were indicators of energy performance compared with similar internal or external organisations?		

No.*	Required Elements	Implementa- tion Yes / No	Comments
D.2	Assessing the compliance with legal obligations		
67	Was the compliance with legal provisions and regulations assessed regularly and its result recorded?		
D.3	Nonconformity, corrective and preventive actions		
68	Was a plan drawn up to deal with nonconformity?		
D.4	Managing records		
69	Was proof regarding the conformity of the EnMS with the requirements of the standard established?		
70	Were records established concerning the effectiveness of the EnMS and the performance achieved?		
71	Were there required control mechanisms established for managing records?		
72	Can the records be traced for a certain time period?		
D.5	Internal auditing of the EnMS		
	Do the implemented internal audits fulfil the following requirements:		
73	The EnMS is in accordance with the energy policy, all the established objectives and targets, the energy management programme and the remaining requirements of the standard		
74	All legal obligations and other requirements are taken into consideration		
75	The EnMS was introduced and maintained effectively		
76	Was an operational plan compiled for the audit containing the results of previous audits?		
77	Were objectivity and impartiality taken into consideration in the audit process?		

→ ENERGY MANAGEMENT SYSTEM CHECKLIST

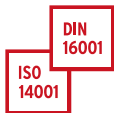
* No. analogical to the progression with regard to contents of DIN EN 16001

No.*	Required Elements	Implementation Yes / No	Comments
78	Were measures formulated to prevent non-compliance?		
79	Were these measures reviewed and their outcome documented?		
80	Were results of the audit documented and reported to the management?		
E.	Management review of the EnMS		
E.1	General		
81	Was the EnMS reviewed in planned intervals?		
82	Was the effectiveness of EnMS, as well as the energy policy, taken into consideration in this case?		
83	Were all the introductory parameters mentioned in 3.6.2 of the standard taken into consideration for the management review?		
E.2	Output of the management review		
84	Were measures for improving the energy performance since the last review taken into consideration?		
85	Were measures for changing energy policy, as well as other aspects of the EnMS, considered?		
86	Was the provision of resources taken into consideration?		

No.	Required Elements	Implementation Yes / No	Comments
A	Energy policy		
B	Planning		
B.1	Identifying and reviewing energy aspects		
B.2	Legal obligations and other requirements		
B.3	Energy objectives, targets and programmes		
C	Implementation and operation		
C.1	Resources, tasks, responsibilities and authorities		
C.2	Awareness, training and competency		
C.3	Communication		
C.4	Documentation of the EnMS		
C.5	Control of documents		
C.6	Operational control		
D	Review		
D.1	Monitoring and measurement		
D.2	Assessing the compliance with legal obligations		
D.3	Non-compliance, corrective and preventive measures		
D.4	Managing records		
D.5	Internal auditing of EnMS		
E	Management review of the EnMS		
E.1	General		
E.2	Output of the management review		



ANNEX B: COMPARATIVE TABLE DIN EN 16001 AND ISO 14001



Since the requirements for an EnMS were substantially developed from ISO 14001 and ISO 14001 forms an important basis for DIN EN 16001, the following table illustrates the relationship between ISO 14001 and DIN EN 16001, respectively. A corresponding overview has already been developed within the framework of the ISO/PC 242 committee and will be published on the homepage of the European Committee for Standardization in the course of 2010. The following annex is essentially based on this overview, which at present is only available in English.

As energy manager and energy experts of your organisation, the table serves as an overview and orientation to review your operational situation with regards to the introduction of DIN EN 16001. Even the parts of the EnMS, which are in principle already fulfilled under ISO 14001, should once again be reviewed with reference to the special situation of each company.

The first table consists of three main columns:²⁹

- 1) The requirements of DIN EN 16001
- 2) A comparison of these requirements with the relevant chapters of ISO 14001
- 3) Differences and necessary additions to ISO 14001



Literature tip

EnMS can also be integrated into ISO 9001. Detailed information on this can be found on the website of the Austrian Energy Agency:
http://www.energymanagement.at/fileadmin/elearning/Tools_Startaktivitaeten/Uebereinstimmungslisten.pdf

²⁹ No legal guarantee is taken for the table. It is only a rough draft; the review of individual prerequisites is imperative.

DIN EN 16001		Requirements ISO 14001	
Chapter		Chapter	
3	Requirements for an Energy Management System	4	Requirements for an Environmental Management System
3.1	General requirements	4.1	General requirements
	Establish, document, implement and maintain the EnMS		Establish, document, implement, maintain and continually improve the environmental management system
	Defining scope and boundaries of the EnMS and documenting it		Definition and documentation of the scope of the environmental management system
	Continually improving energy efficiency		Continual improvement of environmental management system but not of environmental performance
3.2	Energy policy	4.2	Environmental policy
	Top management shall ensure availability of resources for establishing, implementing, maintaining the EnMS and improving energy performance		Top management must define environmental policy of organisation
	Scope and boundaries		
	Nature and scale of energy use and impact on energy use		Appropriate to nature, scale and environmental impacts of its activities, products and services
	Commitment to continually improve energy efficiency		Improvement of environmental management system and prevention of environmental impact
	Ensure availability of information and resources for achievement of objectives and targets		Not included in environmental policy but with 4.4.1 "documentation" it becomes apparent that information needs to be available
	Framework to set and review energy objectives and targets		Framework to set and review environmental objectives and individual targets
	Commitment to comply with all requirements that are applicable		Commitment to comply with legal and other requirements
	Documented, implemented and maintained, as well as communicated		Documented, implemented and maintained, as well as communicated to persons who are working for the organisation and on behalf of it
	Regular reviewing and updating		Not included in environmental policy but in 4.5.2. "evaluation of compliancy"
	Availability to public		Availability to public

	What should additionally be done with an existing ISO 14001?
	Energy should basically be defined as an important factor under ISO 14001.
	Generally included
	Define the boundaries of your EnMS.
	In ISO 14001, an improvement of the environmental management system is expected, however it is not expected of environmental performance. Define energy efficiency and the improvement of your energy performance as an important aspect and focus your activities on continuous improvement of your energy efficiency.
	The energy policy can easily be integrated into the environmental policy. In order to meet the requirements of DIN EN 16001 here, you should consider the following aspects:
	Include a paragraph in your environmental policy that refers to an improved energy use.
	Scope and boundaries of energy policy should be incorporated into the environmental policy.
	Generally included
	An improvement of the environmental performance (energy efficiency) should be included in the environmental policy.
	Must be included additionally in the environmental policy.
	Generally included
	Generally included
	Generally included
	Must be included additionally in the environmental policy.
	Generally included

DIN EN 16001		Requirements ISO 14001	
Chapter		Chapter	
3.3	Planning	4.3	Planning
3.3.1	Identification and review of energy aspects	4.3.1	Environmental aspects
	Initial identification, review and update of energy aspects, prioritisation of significant energy aspects for further analysis		Identifying environmental aspects, determining aspects with significant impact on the environment
	Past and present energy consumption and energy factors		No method on how to present environmental aspects (including energy) is provided
	Identification of areas of significant energy consumption and significant changes in energy use during last period		No method on how to present environmental aspects (including energy) is provided
	Estimation of expected energy consumption		No method on how to present environmental aspects (including energy) is provided
	Identification of all relevant persons with regard to energy consumption		No method on how to present environmental aspects (including energy) is provided
	Identification and prioritisation of opportunities for improving energy efficiency		A register of possibilities for improvement is not expected
3.3.2	Legal obligations / other requirements	4.3.2	Legal / other environmental requirements
	Identification and access to effective legal and other requirements		Identification and access to applicable legal and other requirements
	Determination of how legal requirements apply to energy aspects		Determination of how legal and other requirements apply to environmental aspects
3.3.3	Energy objectives / targets / programme	4.3.3	Objectives / targets / programme
	Establishing, implementing and maintaining energy objectives and targets; objectives and targets need to be consistent with energy policy, which includes commitment to improve energy efficiency and comply with legal obligations; targets need to be measurable, documented and set with a time frame		Establishing, implementing and maintaining environmental objectives and targets; targets need to be measurable, where practicable, consistent with environmental policy; includes commitment to prevent pollution and compliance with legal requirements
	Designation of responsibility for energy management programme		Designation of responsibility in order to achieve objectives and targets
	Designation of means and time frame for achievement of targets		Designation of means / time-frame for achievement of targets
	Documentation of energy objectives, targets and programme, update at planned intervals		No requirements

What should additionally be done with an existing ISO 14001?
Generally included. Add the following aspects for energy management when ISO 14001 is existing:
Determine and review your previous and current energy consumption.
Identify the areas in which the most energy is consumed and those in which most changes have happened. The latter can form important factors for energy savings.
Estimate the energy consumption that you expect, in order to be able to compare it with the actual energy consumption.
Identify all persons whose activities can influence the energy consumption of your company.
Identify and prioritise the possibilities to improve energy efficiency and to save energy. Make a list.
Generally included. Ensure that all energy-relevant laws are complied with.
Generally included
Generally included
Generally included. Ensure that all your objectives and targets are aimed at improving the energy efficiency and energy performance.
Define measurable energy targets / objectives for all parameters that have an important impact on your energy efficiency and your energy savings.
Generally included
Generally included
Regularly document and update your energy objectives / targets and programmes.

DIN EN 16001		Requirements ISO 14001	
Chapter		Chapter	
3.4	Implementation / operation	4.4	Implementation / operation
3.4.1	Resources, roles, responsibility, authority	4.4.1	Resources, roles, responsibility and authority
	Top management has to ensure availability of essential resources for establishing, implementing, maintaining and improving the EnMS		Management has to ensure availability of essential resources for establishing, implementing, maintaining and improving environmental management system
	Management representative ensures that EnMS is established, implemented and maintained		Ensure establishing, implementing and maintaining of environmental management system
	Management representative reports on performance to top management for review, which includes recommendations		Management representative reports on performance of environmental management system for review, that includes recommendations for improvement
3.4.2	Awareness, training, competence	4.4.2	Competence, training, awareness
	Qualification and competence of energy manager		No requirements for qualification and competence of environmental manager defined
	Employees are aware of energy policy, EnMS requirements, impact of their activities with respect to energy consumption, their roles and responsibilities, benefits of improved energy efficiency		Organisation shall implement procedures to raise personnel awareness; requirements are formulated less strictly
	Personnel need to be sufficiently competent; training needs shall be identified		Personnel need to be aware of environmental management system; training needs must be identified and training provided
	Management is informed and trained in an appropriate manner		Any person whose work has a potential impact on the environment shall be made aware of it
3.4.3	Communication	4.4.3	Communication
	Internal communication to ensure active participation of all personnel in energy management; organisation decides whether to communicate externally; in case of external communication organisation shall establish external communication plan		Internal communication among different levels and functions of organisation; receiving, documenting and responding to relevant communication from external parties

What should additionally be done with an existing ISO 14001?
Generally included. Ensure that the resources for monitoring all energy-relevant aspects are available.
Generally included
Generally included
Generally included. Depending on the size of the company, the energy manager and the in-charge officer for environmental management can be one and the same person.
Generally included, but in ISO 14001 the various aspects are not formulated as detailed. Therefore, while implementing the DIN EN 16001 it should be ensured that all the aspects under ISO 14001 are actually implemented.
It should be ensured that the energy representative/environment representative has the required competencies and qualifications.
Ensure that your employees possess knowledge on the various aspects of energy management. Ascertain that your scope of training is increased by energy-relevant trainings and that all employees are informed about the advantages of energy efficiency.
Normally included. However, if required, add special energy-related topics.
Generally included
The requirements for internal communication are similar in ISO 14001 and DIN EN 16001. Focus your communication on energy aspects. Ensure that all employees are informed about energy management and can actively take part in this. When you decide to communicate your energy management externally, prepare a communication plan.

DIN EN 16001		Requirements ISO 14001	
Chapter		Chapter	
3.4.4	Documentation	4.4.4	Documentation
	Description of core elements of EnMS		Documentation of environmental management systems must include environmental policy, objectives and targets, scope of environmental management system, description of main elements of environmental management system and their interactions, documents and records required by the standard and additionally those defined as necessary and required
	Identification of location of relevant documentation		Implicitly fulfilled
3.4.5	Control of documents	4.4.5	Control of documents
	Records and documents are traceable and can be located		Ensuring that changes and current revision status of documents are identified and relevant versions of applicable documents are available on location
	Periodically reviewed and revised as needed		Review and when necessary update and re-approve
	Availability of current versions at all locations		Ensuring of availability of applicable versions of documents on location
	Maintaining documents so they are easily accessible and to be protected against damage and loss		Not defined how documents need to be maintained
	Retaining obsolete documents for legal purposes or removal as appropriate		Unintended use of obsolete documents shall be prevented, they need to be suitably identified when retained
3.4.6	Operational control	4.4.6	Operational control
	Prevention of situations that can lead to deviation from energy policy		Implementing procedure(s) to prevent deviation
	Determination of criteria for operation and maintenance		Definition of criteria but not specifically for each individual area
	Consideration of energy efficiency in procurement		Inclusion of suppliers but no specific requirements for purchasing.
	Consideration of energy efficiency in change / refurbishment of assets affecting energy consumption		No requirements
	Communication to personnel		No requirements

	What should additionally be done with an existing ISO 14001?
	Generally included, ensure that all energy-relevant documents are available.
	Generally included
	Generally included
	Generally included. Ensure that all relevant documents for EnMS are integrated.
	Generally included
	Generally included
	Generally included
	Ensure that documents are securely stored.
	Generally included
	Broaden the control of your processes and procedures with energy efficiency.
	Generally included
	Determine the criteria for operating and maintaining machinery, facilities and buildings.
	Integrate energy efficiency and energy consumption as an additional criterion for procurement. Ensure that your suppliers are informed that energy is an important criterion of your procurement policy.
	Take energy efficiency into consideration when changing and maintaining commodities.
	Expand communication to your personnel and all others working on behalf of your company and whose action have an impact on energy consumption.

DIN EN 16001		Requirements ISO 14001	
Chapter		Chapter	
3.5	Checking	4.5	Checking
3.5.1	Monitoring / measurement	4.5.1	Monitoring / measurement
	Requirements for monitoring, measuring and targeting shall be described (specifically for energy consumption)		Fulfilled by monitoring and measurement of processes with significant impact on environmental aspects
	Accuracy and reuse of monitoring and measuring equipment		Ensuring use of calibrated and /or verified monitoring and measurement equipment
	Relationship between energy consumption and associated energy factors shall be established; assessment of actual vs. expected energy consumption at defined intervals		Not explicitly required
	Maintenance of records of significant accidental deviations from energy consumption that is expected		Not explicitly required
	Reviewing of relationship between energy consumption and energy factors at defined intervals		Not explicitly required
	Comparison of energy indicators against those of similar organisations		Not explicitly required
3.5.2	Evaluation of compliance	4.5.2	Evaluation of compliance
3.5.3	Nonconformity, corrective action and preventive action	4.5.3	Nonconformity, corrective action and preventive action
3.5.4	Control of records	4.5.4	Control of records
	Records need to demonstrate performance achieved and effectiveness of EnMS, as well as define necessary controls		Procedure(s) for identification, storage, protection, retrieval, retention and disposal of records shall be established, implemented and maintained
3.5.5	Internal audit	4.5.5	Internal audit
	EnMS conforms to all requirements of standard		Audit to check conformance of environmental management system with arrangements for environmental management including requirements of standard, to determine whether environmental management system is properly implemented and maintained
	Check legal obligations		Not explicitly mentioned, but fulfilled through a)
	Effectiveness of implementation and maintenance of EnMS		Fulfilled through a)
	Establishment of audit schedule and selection of auditors that ensure objectivity of audit		Auditor selection and conduct of audits need to ensure objectivity and impartiality of audit process
	Securing that actions are taken for elimination of nonconformities without hesitation		Not explicitly mentioned

What should additionally be done with an existing ISO 14001?
Generally included. Ensure that control also includes the monitoring of your energy consumption.
Generally included. Ensure that the measurement equipment can also measure the specific energy consumption.
Compare and assess the expected and actually measured energy consumption in planned time periods.
Make available the records on significant unplanned deviations.
Review the relationship between energy consumption and energy factors at regular intervals.
Compare energy indicators with similar organisations.
Generally included
Generally included, in ISO 14001 it is examined more in detail than in DIN EN 16001.
No substantial changes necessary. It should be ensured that all energy aspects are controlled effectively.
Included; it should be ensured that the internal auditor has the knowledge required for energy management and energy efficiency.
Generally included
Generally included
Generally included
Generally included
Ensure that measures to deal with nonconformity are immediately taken.

DIN EN 16001		Requirements ISO 14001	
Chapter		Chapter	
	Internal audits are conducted by organisation itself or for internal purposes		Fulfilled
	Informing top management		Informing Management of audit results
3.6	Review of energy management system by top management	4.6.	Management review
3.6.1	General		
	Review of EnMS by top management in planned intervals		Review by top management at planned intervals
3.6.2	Input to management review		Fulfilled but not specific sub item
	Follow-up actions		Follow-up actions from previous management reviews
	Checking of energy aspects and energy policy		Checking of environmental performance of organisation
	Compliance with legal obligations		Changing circumstances, including legal and other requirements
	Extent to which energy objectives and targets are achieved		Extent to which objectives and individual targets are achieved
	Audit results		Internal audit results
	Status of corrective and preventive actions		Status of corrective and preventive actions
	Overall energy performance of organisation		Fulfilled
	Projected energy consumption		Projected developments are not explicitly mentioned
	Recommendations		Recommendations for improvement
3.6.3	Output from management review		No specific sub-item but results arise from input parameters

	What should additionally be done with an existing ISO 14001?
	Generally included
	Generally included
	Generally included
	Generally included
	Generally included but does not describe any explicit sub-item
	Generally included
	Generally included, with special focus on energy aspects
	Generally included
	Generally included
	Generally included
	Generally included
	Integrate planned energy consumption in your management review.
	Generally included
	Generally included. Add the improvements made since the last management review to the results / output.



ANNEX C: COMPARATIVE TABLE DIN EN 16001 AND EMAS



ISO 14001 is an essential part of the EMAS-regulation, but as the EMAS regulation goes beyond the regulations of ISO 14001, fewer additional requirements are necessary with an already existing EMAS-validation when introducing DIN EN 16001.

In most cases, necessary changes are more about the adaptation of special terms on energy consumption and energy efficiency.

The German EMAS Advisory Board (Umweltgutachter-ausschuss- UGA) has compiled a table which clearly depicts the differences between EMAS and DIN EN 16001. This table is available at the office of the German EMAS Advisory Board (Umweltgutachter-

ausschuss- UGA) under the title – “Fulfilling the requirements of DIN EN 16001 ‘Energy Management Systems’ through EMAS III” (German: “Erfüllung der Anforderungen der DIN EN 16001 ‘Energiemanagementsysteme’ durch EMAS III”). In the following, you will find a summary of changes that still need to be carried out when EMAS exists and DIN EN 16001 is implemented.³⁰

³⁰ According to the office of the German EMAS-Advisory Board, fulfilling the requirements of DIN EN 16001 “energy management systems” through EMAS III, October 2009. No legal guarantee has been taken up for the correctness of the following table. It is only a rough draft; the review of individual prerequisites is, however, imperative.

DIN EN 16001		Requirements EMAS	
Chapter		Chapter	
3	Requirements for an Energy Management System	4	Requirements for an Environmental Management System
3.2	Energy policy	4.2	Environmental policy
	Commitment to continually improving energy efficiency		Commitment to continual improvement and prevention of environmental impact, also: Commitment to improve environmental performance (Appendix II B3)
	Ensure availability of information and resources for achievement of objectives and targets		Not part of environmental policy, but content covered by 4.4.1 "Implementation and operation"
3.3	Planning	4.3	Planning
3.3.1	Identification and review of energy aspects	4.3.1	Environmental aspects
	Past and present energy consumption and energy factors		Consider existing data
	Identifying areas of significant energy consumption and significant changes in energy use during last period		Evaluate significance of aspects according to scale, number etc.
	Estimation of expected energy consumption		
	Identification of all persons whose tasks can potentially cause significant change to energy consumption		
	Identification and prioritisation of opportunities to improve energy efficiency		Covered contents-wise by environmental review, environmental programme, management review
	Register of possibilities for energy savings		Covered content-wise by environmental programme
3.3.3	Energy objectives / targets / programme	4.3.3	Objectives, targets and programme
	Designation of means and time frame for achievement of targets		Measurable, where practicable ... Also: Performance shall be evaluated. Obligation to improve environmental performance. Core indicators and other relevant indicators.
3.4	Implementation / operation	4.4	Implementation / operation
3.4.2	Awareness, training, competence	4.4.2	Awareness, training, competence
	Qualification and competence of energy manager		Management representative is not specifically mentioned
	Organisations needs to identify training needs		Identify training needs and provide training
	Management at all levels are informed and trained in an appropriate manner		Any person from organisation whose work tasks have a significant environmental impact ... Also: feedback from management to employees (B.4.2)

What should additionally be done in the existing EMAS?
Add the concept of energy efficiency
To be added
Generally fulfilled. If required, add energy factors
Generally fulfilled, if required, add review
Add if required
Add if required
Generally fulfilled
Generally fulfilled
Add if required
If required, provide proof
If required, add the theme of energy
Generally fulfilled

DIN EN 16001		Requirements EMAS	
Chapter		Chapter	
3.4.5	Control of documents	4.4.5	Control of documents
	Here formulation differs: traceable; periodically reviewed; easily accessible; available at all relevant locations; protected against damage; loss or destruction; retention time established, obsolete documents retained or removed		Here, formulated as following: made public; review; update; identify change and status; current document available at all relevant locations; legible; easy to identify; identify obsolete documents. Content is basically the same.
3.4.6	Operational control	4.4.6	Operational control
	Criteria for operation/maintenance		Establish organisational requirements in procedures
	Consider energy efficiency with regard to procurement		Procedures concerning environmental aspects and requirements for suppliers. Also: environmental impact of procurement procedures as obligation (Appendix 1)
	Energy efficiency with regard to design, change or refurishment of assets		Environmental review also for planning of substantial changes (Art 8)
3.5	Checking	4.5	Checking
3.5.1	Monitoring/measurement	4.5.1	Monitoring/measurement
	Determination of energy consumption and associated energy factors; assessment of actual vs. expected energy consumption at pre-defined intervals		
	Maintain records of significant unplanned deviations from expected energy consumption		
	Reviewing and revision of relationship between energy consumption and energy factors at defined intervals		
	Comparison of energy performance indicators with those of similar organisation		
3.6	Review of EnMS by top management	4.6.	Management review
3.6.2	Input to management review		
	Review energy aspects and energy policy		Input for review almost identical
3.6.3	Output from management review		
	Similar requirements to those of EMAS, differing wording		

What should additionally be done in the existing EMAS?
Generally fulfilled If required, determine storage time
Add if required
Generally fulfilled, if required, add special criteria
Add if required
Add if required
Add if required
Add if required
Add if required
Add special statements on energy
Add special statements on energy

NOTES

A series of horizontal dotted lines for writing notes.

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