

Guidelines for the implementation of energy audits

Target Group: Energy Auditors

Deliverable 2 Work Package 2

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Content

A.	Introduction	2
	Taking different regional conditions into account	2
B.	ENGINE Energy check methodology	3
C.	ENGINE training methodology	4
D.	Organising the energy checks	5
E.	Step-by-step guideline through the energy check	5
	Step 1: Collect data before the site visit	5
	Step 2: Analyse collected data	6
	Step 3: Visit site	7
	Step 4: Track energy flows.....	7
	Step 5: Detect areas of improvement	8
	Step 6: Produce report	8
F.	Required minimum results of all efficiency checks	8

Energy Efficiency Checks within ENGINE

A. Introduction

Energy efficiency checks should be carried out in SME's in every partner country. These checks should lead to concrete and measurable reductions in energy consumption and will build a basis for the compilation of best available energy efficient technologies in Europe for different industrial branches.

The basic structure of the checks is characterised as follows:

- Site inspection, data collection, status quo analysis
- Production of a report: Description of the company, description of energy consumption, energy flows, main energy consuming structures, benchmarking
- Determining energy saving potential, potentials for RenewableEnergy Systems (RES)
- Proposal of an implementation plan and a financing concept, including subsidy schemes

The minimum duration of those checks will be five days including the analysis of collected data. How many days will be spent on-site depends on the particular circumstances of the company.

The results of the energy checks build the basis for energy efficient investments in the participating companies in order to improve the use of energy-intelligent concepts, to extend the application of energy management tools and to implement concepts of energy services in specific industries.

Taking different regional conditions into account

The common ENGINE methodology for energy efficiency checks (see chapter B) will be the basis for conducting the checks in all partner countries. Depending on the region specific situations of the SMEs and energy audit networks the best way to conduct the energy efficiency check has to be defined by each partner. One important task of the project is the capacity building of experts by training energy auditors with the training material produced within the project.

Combining training and efficiency checks

The ENGINE training course should have a duration of 5-7 days. In some circumstances it will not be feasible to organise the training course as week-long block. In this case, the combination of training and efficiency checks is an option.

The training will be organised over a period of weeks or months (e.g. one training day at intervals of x weeks). Between the training days the efficiency check will be conducted step-by-step, beginning with the first steps of data collection and organisational measures such as setting up an energy team, etc.

In this way the training and the efficiency checks can be tailored to the individual needs of the SME.

Conducting efficiency checks following the training

When it is feasible to organise a one-week training block, the efficiency check will be conducted following the training.

B. ENGINE Energy check methodology

The energy checks will focus on both the supply and use of energy within industrial operations. The energy use of their products and raw materials before and at the end of the value chain will only be highlighted if obvious energy efficiency measures can be implemented.

To make the work cost efficient and to ensure quality throughout the process a number of dedicated tools and a methodology will be used. Areas to be covered by the energy checks are:

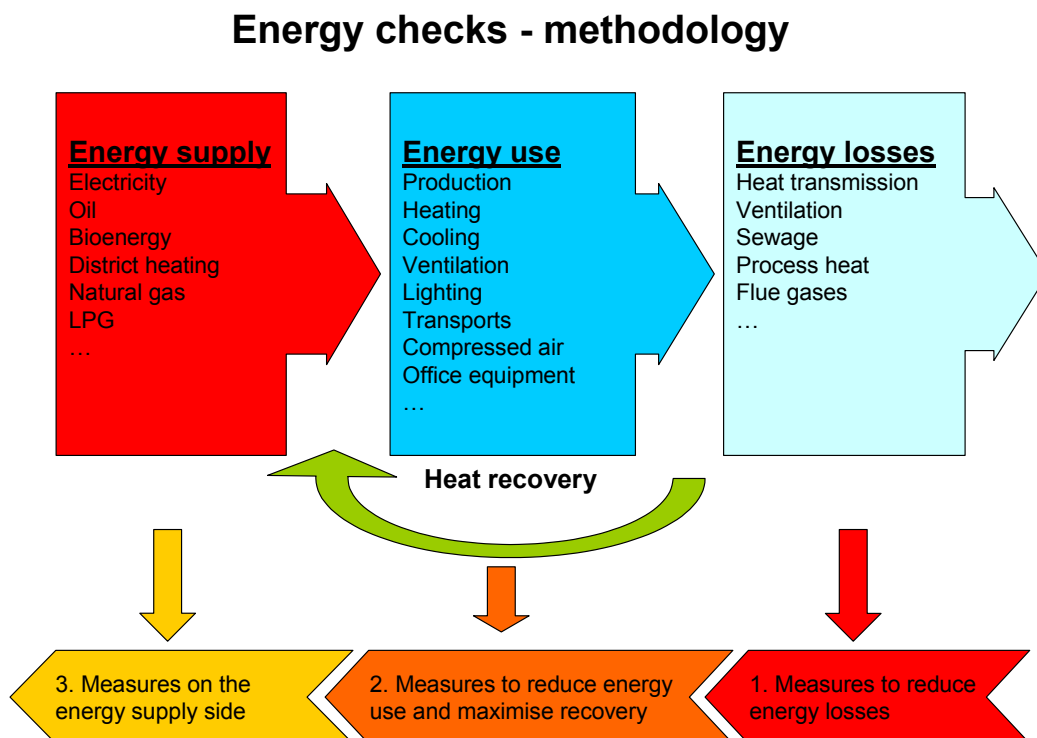
- Energy losses (heat transmission, ventilation, sewage, flue gases etc)
- Energy used (for production and support systems, administration etc)
- Energy supply (electricity, fuels etc. and the generation and distribution systems)

The energy checks will be carried out through:

- Analysis of energy bills and contracts, sketches, time schedules
- Site inspections (walk through and description of the operation/specific systems)
- Interviews with key personnel
- Calculations on energy use on specific systems and facility operations

To improve and make the work with the energy checks simpler a number of tools and instruments will be used. These tools will be presented within the training courses.

The image below illustrates the method and coverage of an ENGINE Energy Check.



The result of the energy checks will be a report containing a description of the operational energy use through an energy balance, and of specific systems which are large energy users. The energy check will also give a presentation of a list of measures to be implemented as another of measures requiring further analysis.

C. ENGINE training methodology

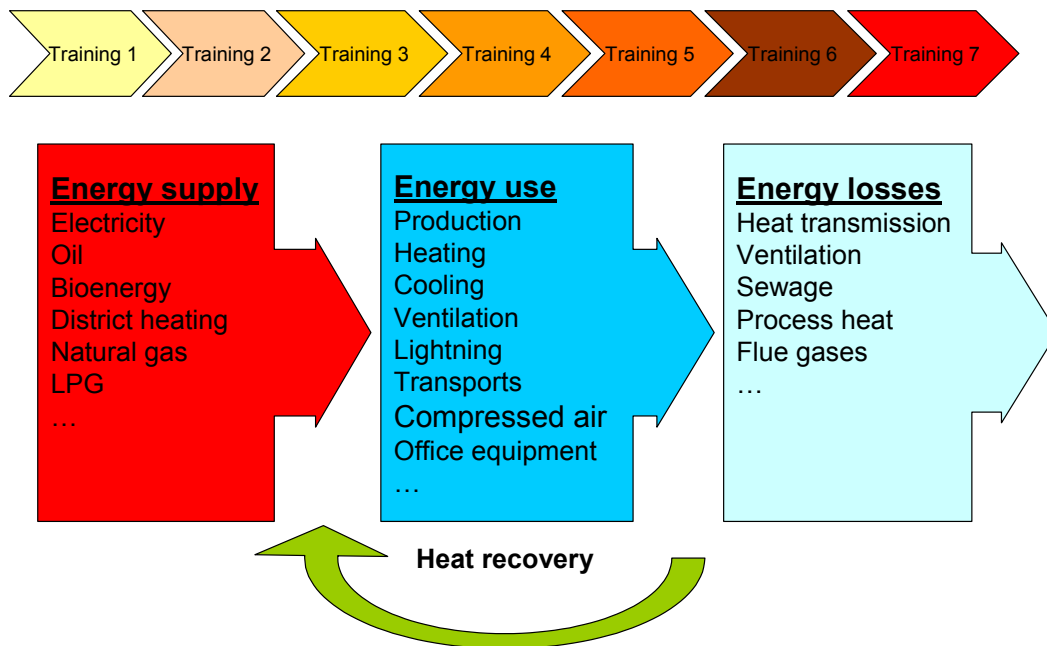
Based on the idea that the participating industrial SMEs shall be able to carry out an energy check on their own we believe that individual guidance and, if possible, integration of the energy checks with the training courses is important. In this way we can focus on specific systems/functions within the operations at the same time as strengthening the participant’s abilities to map and analyse their own energy use.

The energy checks should be carried out step by step and be coordinated with the training sessions where possible. For example, the participants can carry out work based practical tasks as “homework” between the sessions. The homework should contain tasks within the area that has been highlighted on the session before, i.e. inventory of lighting systems, as well as initial mapping for upcoming areas. On the following session a short follow-up and discussion of the area and tasks will be carried out.

For guidance the participants will be provided with tools such as checklists and templates which will be introduced and described during the training sessions. The tools will cover the mapping and analysis of areas such as lighting, ventilation, heating, the building envelope and energy use of engines/motors etc

The image below displays the interaction between the training and the methodology for energy checks.

Energy checks and trainings - methodology



The training will result in improving participants’ knowledge of the energy use and potential for improvements in industrial SMEs. The participants shall be able to carry out an energy check in their own company or other industries. They shall be able to map and analyse an industrial SME’s energy use as well as carry out a range of analysis on measures for energy efficiency.

D. Organising the energy checks

Regardless of the organisation of the training course, the efficiency checks will be carried out in logical steps detailed in chapter E. The intervals between the steps will vary on a case by case basis, (dependent on the training, size of client SME, cooperation of the SME with the energy auditor, etc.).

A kick-off meeting will be organised by the ENGINE partners to bring the SMEs and auditors together. The companies will get detailed information on the project and efficiency checks. A list of necessary information which they have to collect within their companies will be handed out. The energy auditors will have the opportunity to meet the companies they will work with.

After analysing the collected data the auditors will visit the sites and track the energy flows. The efficiency check tool will give a first rough estimation of saving potential in different areas of the companies and the necessary steps for implementing energy management.

At the end of each efficiency check a standardised report which contains the required minimum results will be produced by the energy auditors with support from the project partners.

E. Step-by-step guide to the energy check

This chapter explains the individual steps for conducting the energy efficiency checks.

Step 1: Collect data before the site visit

In preparation for the efficiency checks data from the companies will be collected. A considerable amount of energy information is readily available in an organisation, but it often requires collecting and interpreting. By simply gathering appropriate information, a clearer picture of energy use and costs will begin to emerge.

Invoices provide the primary source of energy information. However, data may be available from other areas of the business which, if appropriate, should also be integrated. For example, cost data derived from invoices will in some cases be required from the accounting department.

The energy auditor will use the data for a first evaluation of the energy situation (energy sources, main energy consumers, production capacity, first benchmarks, etc.). By analysing the collected data the auditor will get the information needed to know where to look in more detail when he visits the site.

Following list of necessary information will be handed out to the companies:

- Invoices of all energy sources of the last two years (electricity, oil, natural gas, LPG, district heat etc.). The invoice must contain the information on energy consumed (kWh, m³, kg ...)
- Energy supply contracts
- Plan of site (for better preparation and orientation)
- Indicators: Typical figures which show the capacity load of the company (turnover, production, material input, etc.) on a monthly basis
- List of main energy consuming machinery and equipment.
- Technical instructions for the main energy consumers
- Existing energy audit reports

With the information gathered the auditor is able to start filling in the energy check tool and get a first basic overview of the energy situation, for example:

Basic information about the company

Guidelines for the implementation of energy checks

- Company data (branch code, address, field of operation etc.)
- Contact data
- Key figures (number of employees, m² of production area, turnover, production, input raw material, hours of operation)

Soft facts: questions regarding the awareness of the SME for energy matters

- Is there a person responsible for energy?
- Is energy consumption monitored?
- Is energy efficiency considered when purchasing new equipment?
- Is the company aware of sustainable use of energy?
- Has the company consulted an expert regarding energy efficiency improvement?

Basic electricity data on a monthly basis

- electricity consumption and electricity costs (energy and grid)
- electricity production

Basic heat data on a yearly basis

- kWh/year and costs of different fossil fuels
- CO₂ emissions of fossil fuels (can be calculated according to the national calculation methods)
- kWh/year and costs of renewable energy sources
- m² heated area

Step 2: Analyse collected data

In the training courses the energy auditors will be provided with a tool for data collection. The ENGINE consortium agreed on using the Swedish “EnSAM Tool” and the Austrian “ProTool”. Both tools have been tested and lead to comparable results. The partner countries can choose which tool they will use.

To be able to find energy saving and efficiency opportunities it is necessary to allocate the energy supplied or produced to energy consuming machinery and equipment.

By entering the collected data into the tool, quite a clear picture of the **input of energy** will be generated. The information on the energy input and its change from one year to the next can be taken from the energy invoices, such as invoices for:

- electricity
- oil
- natural gas
- biomass
- LPG
- etc.

To analyse the **on-site energy production** (e.g. in CHP-plants or steam boilers etc.) more detailed information will be collected at the site visit.

Especially for analysis of the **use of energy (energy output)** from different processes, further investigations during the site visit will be made for the following processes:

- heating
- cooling
- compressed air

Guidelines for the implementation of energy checks

- lighting
- air conditioning
- electric motors
- etc.

Step 3: Visit site

After studying and analysing the collected information the energy auditor is well prepared for visiting the site and conducting the energy check. The most important part of the site visit is to track the energy flows within the company and the production processes.

The energy auditors will receive tools for the site visit including detailed information on:

- metering
- Power factor
- load management
- lighting
- compressed air
- ventilation
- pumps
- electric motors
- chillers
- heating systems
- process heat
- heat recovery
- etc.

Step 4: Track energy flows

With the data collected so far, the energy system should be visualised with an energy flow chart (or Sankey diagram). This is a graphical representation of all relevant energy flows in the company.

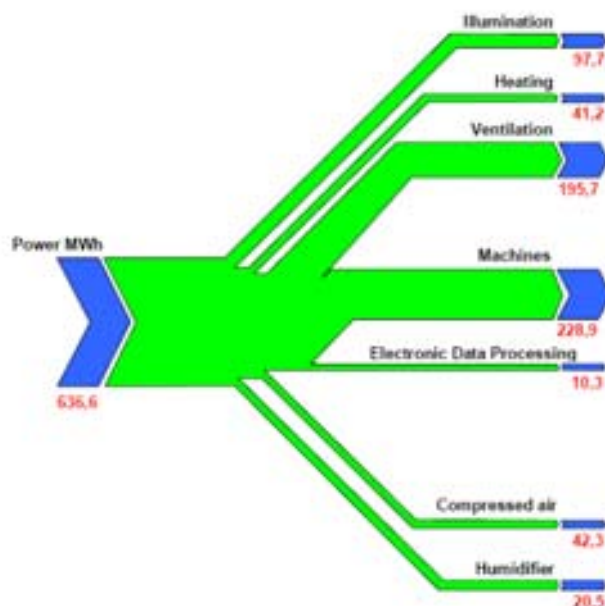


Figure 3: Sankey diagram of the energy system in a joinery

Step 5: Identify areas of improvement

As a result of the data collection and site visit the energy auditor will identify areas of improvement. A comprehensive set of information will support the auditor in identifying savings potential. According to the circumstances of the pilot company the auditor will use suitable parts of the set of information, such as:

- Checklists
- General measures lists
- Branch specific measures lists
- Best available technologies
- Best practice examples
- Benchmarks
- etc.

The set of information will be presented and handed out during the training courses.

Step 6: Produce report

For reporting the results of the 56 efficiency checks the ENGINE Energy Report Template must be used. This guarantees that a minimum standard of the efficiency check is met and makes the checks comparable.

One part of the report (e.g. the executive summary) must be publishable. Therefore the SMEs will have to sign a declaration that certain information will be used for illustrating best practice examples and collecting the total savings resulting by all efficiency checks.

F. Required minimum results of all efficiency checks

- Description of the company and its energy situation with general basis data for benchmarks and information about soft facts for first implementation steps of energy management
- Overview on energy consumption of main energy carriers (electricity, gas, oil, water, biomass...)
- Detailed analysis of electricity and heat consumption
- Estimation of savings potential in different areas
- List of suggested energy efficiency measures
- List of implementation steps for efficiency measures and energy management