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Starting Point:
Europe’s Major Economic Players Need Efficiency

The typical European firm is a micro firm employing not more than 10 people. About two-third of total employment in the private sector in Europe is being found in SMEs. The strength of the European economy is therefore largely based on small businesses and the changing of our energy landscape requires this engine of the European economy to become more efficient regarding heat, electricity, water, light and other resources. But energy efficiency is not an issue these companies address easily. And here our project ENGINE – Energy Efficiency in Small and Medium Sized Enterprises – set in. According to the SME Observatory of the European Commissions Directorate General for Enterprise and Industry’s comprehensive systems for energy efficiency are much less in place in SMEs (4%) than in large enterprises (19%); the same applies for simple measures to save energy, which are used by 30% of SMEs but 46% of large enterprises. Close to two thirds of SMEs operating in the EU do not even have simple rules or devices for saving energy (63%). Less than three in 10 SMEs (29%) have instituted some measures for preserving energy and resources at their enterprise.

In October 2007 the project ENGINE started to address some key bottlenecks in this area: increasing the knowledge and information by networking and promotional activities, paving the way for experts via training and capacity building, directly addressing and assisting companies to implement measures. The key target group for ENGINE were SMEs in producing industries such as metal processing, food production, automotive and wood producing companies in Gloucestershire in the United Kingdom, Västra Götaland in Sweden, Lower-Saxony in Germany, Lombardy in Italy and Vienna in Austria.

On the whole, we are quite content with the results we achieved, although the financial crisis that caused much concern throughout Europe during the course of the project was also felt within ENGINE activities. Economic difficulties still seem to have a priority over energy related problems, although on the long run energy efficiency is a key factor for stabilising economic activity. And therefore it is also important to know that all partners in the ENGINE consortium will continue activities kick-started by the Intelligent Energy Europe program. I see it also as quite an achievement that we managed to organise specific activities to transfer knowledge to Eastern European countries even though these were not explicitly listed as required deliverables. A workshop was organised in Gdansk, Poland and a further workshop in Ceske Budejovice, Czech Republic, to disseminate ENGINE approaches and results. With this brochure we also would like to invite you to learn more about the project and use the tools, approaches and results presented to support SMEs in facing the challenges of tomorrow.

Andreas Steege
Project Coordinator, target GmbH, Hannover, Germany

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1 European Commission: Observatory of European SMEs, 2007.
Project Basics

Acronym: ENGINE
Full title: Energy Efficiency in Small and Medium Sized Enterprises
Target Group: Small and medium sized companies in the sectors of metal fabrication and processing, automotive, wood working and food processing industry

Financing: 50 % Intelligent Energy Europe
Contract number: EIE/07/104/SI2.466836
Duration: October 2007 – March 2010
Co-ordination: target GmbH, Hannover
Number of partners: 8
From/in: Gloustershire (UK), Lombardy (Italy), Lower Saxony (Germany), Västra Götaland (Sweden), Vienna and Lower Austria (Austria)
Project website: www.engine-sme.eu
Key Results Overview

WP 1 / Coordination

- Six project meetings have been held, with all partners attending regularly, supplemented by six telephone conferences, which were established as a continuous communication instrument.

WP 2 / Quality Standards and Auditor Trainings

- A Guidebook on energy management (D1) has been developed and published as a mother version in English; PDF translations exist in German, Swedish and Italian. Guidelines for the implementation of energy checks were also developed (D2).
- A comprehensive set of training materials (D3) has been developed and harmonised. Sets included 359 slides and are available in English, German, Swedish and Italian.
- 11 trainings have been implemented (D4), in Germany more than the required two seminars were carried out. In total 272 consultants were trained through courses ranging from two to ten days resulting in a total of 1,728 person days of training. In addition, a course for Pakistani auditors was carried out.
- Auditor networks (D5) have been established and implemented in Austria, Germany and Italy. In Sweden and the UK an adapted strategy had to be created to take into account existing networks. In total at least 610 auditors were involved in ENGINE networking.

WP 3 / Energy Services in SME

- A methodology for energy audits (D6) has been developed. In total 55 energy checks (D6+) have been carried out successfully in SMEs in the regions. An average of 12% of energy saving potential has been analysed in the participating companies. 47% of the checks lead to investments made.
- A comprehensive cross-country analysis (D8) has been made and translated into English, German, Swedish and Italian.

WP 4 / Awareness Campaigns for Energy Efficiency in SME

- Campaign materials (D9) have been developed for all regions.
- 25 initial consultations (D10) have been carried out.
- 15 motivational events (D11) with 505 participants have been organized.
- 10 round tables for stakeholders (D12) with 439 participants in total have been organized in all regions.
- A summary of the promotional activities (D13) is available for each partner region.
**WP 5 / EU-wide Dissemination**

- The project website (D14) went online in January 2008. The total numbers of visitors during the course can be estimated to be 3,105 (approximately 100 per month) with some 27,000 page views. The website will be maintained until March 2012.
- The high quality brochure (D15) was compiled with case studies from all regions and an English version has been published with 200 copies in print. The brochure has been translated and printed also in Austria, Germany, Sweden and Italy with 200 copies each.
- 10 national workshops (D16) were held, two in each partner country, addressing 575 participants in total at national level.
- A European workshop (D17) was organised with 25 participants on the occasion of the Hannover Fair on the 21st of April 2008.
- With regard to a specific dissemination towards Eastern Europe, a special workshop was carried out in Gdansk, Poland, on the 23rd of March 2009 with 31 participants. A second special workshop was organized in Ceske Budejovice, Czech Republic, on the 25th February 2010 attracting 43 participants.
- A publishable report in English is available for on-demand print.
Partners Statements

I have experienced that implementing results of European projects into national programmes for energy efficiency in SMEs is a very fruitful symbiosis. ENGINE has been the fifth IEE project which was implemented in and co-financed by the Austrian climate protection scheme “klima:aktiv” of the Ministry of Environment. On the one hand the EU projects profit from the experience of the national programme, on the other hand klima:aktiv can adapt already tested and well running tools from other countries of the project consortium. In this way also the follow-up activities of IEE projects are assured.

Petra Lackner, Manager of klima:aktiv program for energy efficient enterprises, Austrian Energy Agency, Vienna, Austria

Severn Wye Energy Agency started delivering Business Energy Services shortly before the start of the ENGINE project. Working with external business support programmes helped to launch our portfolio of services. Participation in the ENGINE project has greatly assisted our ability to deliver enhanced services in this area of our work. We have been able to draw on the vast knowledge of the ENGINE consortium and in particular have made excellent use of the developed training programme, which is now integrated into many of our core business related activities. In addition to this our experience in sector specific industries has developed very well and the approach of delivering national workshops and round tables has enabled SWEA to become recognised as a delivery agent of support services to key stakeholders within industry and commerce.

Mike Brain, Head of Business Services, Severn Wye Energy Agency, Gloucestershire, UK

ENGINE has been our first IEE funded project. The AGIMUS part was mainly to carry out energy checks. The materials developed within the frame of ENGINE are sophisticated and we will continue using them in future to support SMEs. One of our biggest successes within the project was that we managed to achieve 30 % of energy savings in one of the participating companies. All involved and surveyed companies appreciated the high standard of the checks and will or have already implemented several measures to reduce energy consumption. We learned that programs like ENGINE are important to disseminate experience and knowledge.

Corinna Sonnenberg, Project Manager, AGIMUS, Braunschweig, Germany

The findings from the implementation of the energy checks with more than 25 % of energy use that could be saved through profitable measures identified gives us a strong argument and evidence to other industrial SMEs that the approaches carried out within ENGINE are both important and worth the effort.

Mats Johansson, Managing Director, KanEnergi, Skara, Sweden
The need for energy efficiency action is immense in the Swedish industry and building capacity activities to assist companies are essential. The approaches and actions carried out within ENGINE have been contributing to this core part of capacity building.

Hans Lennart Norrblom, Energy and Environment Expert, Swerea IVF AB, Gothenburg, Sweden

It is important to make the SMEs realize the full saving potentials and possibilities. However, within the ENGINE project we learned that it is very helpful to find simple low-cost measures and start implementing these first. Then, step by step, more actions can be introduced. For the success it is also essential that the energy saving expertise is passed on to in-house staff and responsibilities are created.

Antonio Siciliano, Senior Researcher, Ambiente Italia, Milano, Italy

My key task within the frame of the ENGINE project was to organise the trainings and activities for auditors in Germany, which were carried out with great success. For us it was evident, that the demand for training and capacity building is strong and seems to be an “easy seller”. The auditors and consultants see and experience the market potential. The target group of the companies still need more encouragement for which the ENGINE project also offered beneficial instruments and measures.

Roland Pätzold, Project Manager, target GmbH, Hannover, Germany

This international project offered the opportunity to experience the situation of energy efficiency in other European countries. It was interesting to see that energy efficiency does not only mean to focus on technical solutions but also to take into consideration human factors and cultures to overcome existing problems and behaviours.

Rainer Stifter, CEO of ENERGON Energie- und Umweltmanagement GmbH, Vienna, Austria
ENGINE aimed at helping the engine of the European economy – the 23 million small and medium-sized enterprises (SMEs) that provide 75 million jobs and account for 99% of all European enterprises – become more energy efficient. Smaller businesses seldom have the capacity to systematically implement energy savings. Objectives of the project implemented by eight project partners in Austria, Germany, Italy, Sweden and the UK, were to:

- Motivate SMEs to implement energy efficiency measures
- Promote innovative energy services and financing concepts
- Train energy auditors and build up expert pools
- Accelerate market introduction of energy services in SMEs
- Communicate energy efficiency to relevant decision makers and stakeholders
- Disseminate and transfer successful concepts and measures

The energy checks and surveys carried out as part of the ENGINE project addressed SMEs and experts in the metal, automotive component, wood, and food processing industries, although all of the energy saving measures and lessons learnt other than those specifically related to a manufacturing process are applicable to the majority of SMEs.
Benefits

• Energy efficiency leads to reduced costs, making a business more efficient and hence more competitive.
• Modern process equipment and building services can improve quality and consistency, occupant comfort and potentially productivity.
• An SME with an energy management system in place has a competitive advantage over one that doesn’t, which can be crucial in tendering and subcontracting situations.
• Achieving the same results while using less energy helps reduce dependence on imported energy and helps control the price of energy.
• Using less energy reduces emissions of a wide range of pollutants, which helps improve air quality locally, can reduce phenomena such as acid rain, and mitigates the effects of climate change globally.
• Energy efficiency provides benefits for both the organisation involved and the wider community at local, regional, national, and international levels.

Problems

• SMEs find it difficult to finance the investment, either due to a lack of liquidity or difficulty or reluctance to borrow for non-core business purposes.
• Micro businesses can be hard pressed to spare the resources to implement projects saving 15% of an energy bill of only hundreds of Euros.
• In SME, few staff and no knowledge of energy efficiency make it necessary to invest either valuable time or depend on external experts.
• In many companies, there is no relation between those who have control over energy use, either by specifying or using energy consuming equipment, and those who pay the energy bills.
• SMEs usually rent their premises, often on short contracts, and so have no incentive to invest in the building fabric, even if there is great potential to improve energy efficiency.

Solutions

• Most EU Member States have government supported programmes designed to provide advice to businesses through a variety of media including telephone advice lines, websites, publications, training, and consultancy sessions.
• Often, expert networks and support – such as have been established via ENGINE – exist at regional levels.
• Product labels help to identify efficient equipment, also for SME. Nowadays, modern heating, lighting and cooling technologies are significantly more efficient than older models.
• Finance has become increasingly difficult to obtain, however there are several sources of low cost funding available.
• The most important steps, however, are some of the simplest: In any company, regardless of size, someone should be responsible for energy use and assessment of their performance in managing energy should be made.
• One of the first tasks for whoever is responsible for energy will almost certainly be to establish a system for measuring energy.
• SME might consider establishing a dialogue with the landlord to improve the efficiency of their buildings.
• Changes and low cost upgrades of equipment are often worthwhile.
Key Result 1:  
Capacity Building, Training, Networking

- A Guidebook on energy management (D1) has been developed and published as in EN, DE, IT and SE.
- Guidelines for the implementation of energy checks were developed (D2) in EN, DE, IT and SE.
- A comprehensive set of training materials (D3) has been developed and harmonised. Sets included 359 slides and are available EN, DE, IT and SE.
- 11 trainings have been implemented (D4), in Germany more than the required two seminars were carried out. In total 272 consultants were trained through courses ranging from two to ten days training resulting in a total of 1,728 person days of training. In addition, a course for Pakistani auditors was carried out.
- Auditor networks (D5) have been established and implemented in Austria, Germany and Italy. In Sweden and England an adapted strategy had to be created to take into account already existing networks. In total at least 610 auditors were involved into ENGINE networking.

EN 16001
The work developing a new European standard one energy management systems was decided by CEN/CENLEC on 20 November 2006 and the standard EN 16001 was published by the CEN Management Centre on 1 July 2009. Throughout the start of ENGINE, this development had been anticipated by the project consortium and ENGINE materials have been drafted along the concept of EN 16001. With the new European standard for Energy Management Systems EN 16001 there is a tool for all kinds of companies to review their energy situation and improve their energy efficiency in a systematic and sustainable way.
ENGINE Guidebook:  
A Manual for Staff and Auditors

The ENGINE Guidebook allows persons responsible for energy manage-
ment and their team to learn about energy issues on their own and at
their own pace. This material can also be used to disseminate information
and know-how to other staff members and companies. The purpose of
the manual is to provide a basis for continuous improvement in all areas of
energy use within a company. The ENGINE Guidebook consists of a gen-
eral part with 65 pages structured along key issues also required by the
new European standard EN 16001. This general part is available in English,
German, Swedish and Italian from the project website.

Table of Contents of the ENGINE Guidebook

1. GENERAL REQUIREMENTS AND INTRODUCTION
   1.1 Overview energy data
   1.2 Saving potential of primary energy in the industry by 2020
   1.3 Characteristics of different industries
   1.4 Energy price trends
   1.5 Reasons to establish an energy management system
   1.6 Getting started

2. ENERGY POLICY

3. REVIEW, LEGAL OBLIGATIONS AND PROGRAMME
   3.1 Identification and review of energy aspects
   3.2 Legal obligations
   3.3 Energy programme

4. MANAGEMENT, COMMUNICATION AND CONTROLLING
   4.1 Resources, roles, responsibilities
   4.2 Awareness raising
   4.3 Communication
   4.4 Energy management system documentation
   4.5 Document control
   4.6 Operational control

5. FROM MONITORING TO REVIEW
   5.1 Energy monitoring
   5.2 Evaluation of compliance
   5.3 Non-conformity, corrective action and preventive action
   5.4 Control of records
   5.5 Internal audit
   5.6 Review of the energy management system by top management
ENGINE Training Materials:
359 Slides, 23 topics, 4 languages, 1 purpose

For the trainings planned within the scope of the ENGINE project a large pool of training material was developed by the project consortium under the leadership of WP leader Energon from Austria aiming at a harmonised body of slides ready to be used in various settings. In total, 359 slides were developed in 23 chapters and exist in an English, German, Swedish and Italian version.

1. General requirements
2. Energy policy
3. Review
4. Legal obligations
5. Energy programme
6. Resources, roles, responsibilities
7. Awareness raising
8. Communication
9. EM system documentation
10. Control of documents
11. Operational control
12. Energy monitoring
13. Evaluation of compliance
14. Non-conformity corrective
15. Control of records
16. Internal audit
17. Review by top management
18. Contents of EN 16001
19. Technical chapter: Electrical motors
20. Technical chapter: Compressed air
21. Technical chapter: Heating
22. Technical chapter: Lighting
23. Technical chapter: Ventilation

Figure 1:
Slide from ENGINE on “general requirements”
Figure 2: Slide from ENGINE on “review”

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

Figure 3: Slide from ENGINE on “communication”

The communication network

For each single group special types of communication work has to be initiated.

Top management

Energy report
Environmental report
Telelctsphone

Energy Manager

Energy report

Workshops

Intranet

Environmental report

Letters

Environmental report

Others

Neighbors

and interested groups

Figure 4: Slide from ENGINE on “Technical chapter: Electrical motors”

Main components

The following components belong to a motor system:
1. power supply
2. the motor-drive package
3. the process system

Generic applications include pumps, fans, and compressors. The other major categories are materials handling and processing systems.
ENGINE Trainings: Different Settings and Approaches

Austria
In Austria ENGINE trainings are carried out in cooperation with the campaign “klima:aktiv” where a networking and training infrastructure is already well established guaranteeing the continuity of the ENGINE training. Trainees receive theory as well as practical training. The check is an integral part of training and EN 16001 will be taught. The first course started in autumn 2008, the second one was organised together with an Austrian regional energy efficiency programme in May 2009. In total 68 participants were trained and feedback was very positive. Currently the Energy Agency of the Austrian Chamber of Commerce shows real interest to copy the training and offer it to new target groups.

United Kingdom
The training course has been publicised at presentations to local business networks, at networking events hosted by local chambers of commerce and industry, and to the coordinators of Business Link, a regional network of business advisors to SMEs. It is sometimes difficult for SMEs to release staff for a whole week of training, especially in the current economic climate, so the first ENGINE training course was run with a session every other week from January to March 2009. There were 19 participants from a wide range of local businesses, and bodies offering energy and environmental advice. The next was delivered between November 2009 and February 2010 in a similar format with 27 participants in attendance. The skills gained from one module were applied in the workplace after training and then experiences were shared in the following modules.

Germany
Three training courses have been organised in Germany. The first one took place between August and December 2008; the second one started in February and ended in May 2009, the third course started in August 2009 and ended in December 2009. These courses have been developed enhancing an already existing element for architects, electrical and mechanical engineers, facility managers. The actual ENGINE course has been further developed considering the inputs from the consortium and targeting especially at energy auditors, a target group not previously addressed. The well established networks of the predecessor course were used to promote ENGINE. As regional partner, the Chamber of Engineers assured that all its members were informed about the courses. In total 78 participants were trained.

Italy
In Italy the auditor training was carried out in two rounds, the first from September to November 2009 and the second from October to December 2010. Trainings was publicised in an earlier step among the regional part of the national network AICQ (Associazione Italiana Cultura Qualità – Italian association for quality) with no success. Therefore the training courses were held together with an adult training provider called AFOR, in Milano. In total 28 participants were trained.

Sweden
The Swedish strategy was to train management and technical staff at SMEs to be “energy managers” within the company. The intention was to perform the training in cooperation with already existing networks in the Southwest region of Sweden. A few energy auditors, not connected to any special company, also participated. The checks have been integrated into the trainings. The aim was to focus on specific systems/functions within the operations as well as strengthening the participant’s capabilities to map and analyse the energy use. The first training was held in cooperation with “networking companies” on seven days with 26 participants. The second set of training sessions was held in cooperation with “IDC West Sweden” also with 26 participants. The number of days was reduced to four based on the experience from the first training. In conjunction with these training sessions 14 energy checks were implemented. The strategy to integrate trainings and checks has been very fruitful and appreciated by the participating companies.
**Key Result 2:**
**Energy Checks, Energy Services, Cross-country Analysis**

**Methodology for Energy Efficiency Checks**

**Focus of the Checks**

The ENGINE Energy Efficiency Checks will be focusing on both supply and use of energy within the industrial operations. The energy use of their products and raw materials before and after in the value chain will only be highlighted if obvious energy efficiency measures can be implemented therein.

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 supply through electricity, all kind of fuels and the generation and distribution systems
- Energy used for production and support systems, office and all other activities
- Energy losses through heat transmission, ventilation, sewage, flue gases and so forth.

**Means Used**

The ENGINE Energy Efficiency Checks will be carried out through:

- Site inspections (walk through and description of the operation/specific systems)
- Interviews with key personnel
- Analyses of energy bills and contracts, sketches, time schedules
- Calculations on energy use on specific systems and facility operations.
To improve and make the work with the energy checks easier a number of tools and instruments will be used. These tools will also be used within the trainings. The result of the energy checks will be a report containing a description of the operations energy use through an energy balance and specific systems which are large energy users. The energy check will also give a presentation of a list of measures to be implemented as well as further analysed within in an Action Plan.

Combination of Check and Training

Based on the criteria that the participating industrial SMEs shall be able to carry out an ENGINE Energy Efficiency Check on their own we believe that individual guidance and, if possible, integration of the checks with the trainings are important. In this way we can focus on specific systems/functions within the operations at the same time as strengthening the participant’s capabilities to mapping and analysing their own energy use.

The checks should be carried out step by step and be coordinated with the training sessions. For example the participants can get “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 trainings will bring about the participants having a better knowledge of the energy use and potential for improvements in industrial SMEs. The participants shall be able to carry out a check on their own company or other industries. They shall be able to map and analyse an industrial SMEs energy use as well as carry out a range of analyses on measures for energy efficiency.
Small and medium-sized enterprises (SMEs) are the engine of the European economy. In the EU 25, 23 million SMEs provide around 75 million jobs and represent 99% of all enterprises. However they seldom have the capacity to systematically exploit energy savings. ENGINE aimed at helping the engine of European economy become more energy efficient. One of its measures was to implement energy efficiency checks (energy survey/mapping) in SMEs with the focus on metal and automotive production and processing, wood and food industries. In total 55 checks could be implemented successfully and the results of 52 were analysed and summarised. ENGINE was implemented by the project consortium within regional networks and existing structures and activities reached out to the following regions:

- Gloucestershire in the UK
- Västra Götaland in Sweden
- Lower-Saxony in Germany
- Lombardy in Italy
- Vienna in Austria

The total amount of energy used by all the industries was 1,373 GWh/year with an identified profitable saving potential of about 49 GWh/year, which represents an annual saving of 4%. However, to get a balanced picture of the companies examined, it was decided to exclude the figures of saw mills and wood working companies, because they have large energy use and comparable very low share of identified energy saving potential. Thus a comparison excluding them is more appropriate for a EU synthesis:

- The total energy saving potential is 12% of all used energy.
- The mean profitable energy saving potential amongst the companies participating in the ENGINE Energy Efficiency Checks is 19%.
- The saving potential for the industries differ from 1 to 42%.
Means of energy saving potential according to industry sector and area

<table>
<thead>
<tr>
<th>Branch</th>
<th>Automotive</th>
<th>Metal</th>
<th>Wood working</th>
<th>Food Processing</th>
<th>Other Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saving Potential</td>
<td>16 %</td>
<td>8 %</td>
<td>1 %</td>
<td>21 %</td>
<td>18 %</td>
</tr>
<tr>
<td>Lighting</td>
<td>10 %</td>
<td>4 %</td>
<td>0 %</td>
<td>4 %</td>
<td>14 %</td>
</tr>
<tr>
<td>HVAC</td>
<td>58 %</td>
<td>59 %</td>
<td>1 %</td>
<td>2 %</td>
<td>50 %</td>
</tr>
<tr>
<td>Building Envelope</td>
<td>1 %</td>
<td>11 %</td>
<td>0 %</td>
<td>2 %</td>
<td>15 %</td>
</tr>
<tr>
<td>Compressed Air</td>
<td>4 %</td>
<td>7 %</td>
<td>11 %</td>
<td>0 %</td>
<td>4 %</td>
</tr>
<tr>
<td>Industrial Process</td>
<td>27 %</td>
<td>18 %</td>
<td>6 %</td>
<td>56 %</td>
<td>6 %</td>
</tr>
<tr>
<td>Non-Tech Measures</td>
<td>1 %</td>
<td>0 %</td>
<td>39 %</td>
<td>0 %</td>
<td>7 %</td>
</tr>
<tr>
<td>Other Measures</td>
<td>0 %</td>
<td>1 %</td>
<td>43 %</td>
<td>36 %</td>
<td>5 %</td>
</tr>
</tbody>
</table>

Key conclusions from the analysis of the ENGINE Energy Checks:

- Measures within facility systems such as lighting as well as heating, ventilating and air conditioning (HVAC) represent a large share of the potential except in wood working and food processing. This is most probable due to the fact that latter branches have significant higher specific energy use as well as a limited space heating demand. Thus the share is lower. In both this branches the focus within the energy checks (which were made with limited resources) was on processes and other areas.

- In the automotive, metal processing and “other industries” measures within HVAC, lighting, building envelope and compressed air has a substantial energy saving potential. These areas can all be considered as quite similar in all industries which indicates that there is similar potential in most of the industries in Europe.

- Significant energy saving potentials within the industrial processes have also been identified. Most probably much more profitable energy savings can be identified if the energy use and processes are analysed more in detail. The energy saving potential is also higher in long term when investments in new process equipment, systems and better methods can be implemented.

One aspect of energy saving, that was not included in the potential energy saving figures, is the changed mentality and general awareness of energy use within the enterprises. While having the correct technical equipment is important for energy saving, the right mentality and user routines are also very important. Through the training activities the key personnel has a better understanding of their energy use and their technical equipment. Hopefully this person will spread relevant information through out the enterprise and motivate energy saving behaviour.
Overall statistics of companies having undergone an ENGINE Energy Efficiency Check:

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Average</th>
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<tbody>
<tr>
<td>Employees</td>
<td>5,286</td>
<td>102</td>
</tr>
<tr>
<td>Turnover (M€)</td>
<td>5,879</td>
<td>163</td>
</tr>
<tr>
<td>Area (m²)</td>
<td>831,199</td>
<td>22,465</td>
</tr>
<tr>
<td>Energy use (MWh/year)</td>
<td>1,373,436</td>
<td>25,720</td>
</tr>
<tr>
<td>Electricity (MWh/year)</td>
<td>384,224</td>
<td>7,389</td>
</tr>
<tr>
<td>District heating (MWh/year)</td>
<td>41,376</td>
<td>796</td>
</tr>
<tr>
<td>Oil (MWh/year)</td>
<td>17,150</td>
<td>330</td>
</tr>
<tr>
<td>Gas (MWh/year)</td>
<td>430,224</td>
<td>8,274</td>
</tr>
<tr>
<td>Bio fuels (MWh/year)</td>
<td>500,361</td>
<td>9,622</td>
</tr>
<tr>
<td>Others (MWh/year)</td>
<td>100</td>
<td>2</td>
</tr>
</tbody>
</table>

Key Figures
The key figures for the different industry sectors varied considerably, so that it makes more sense to look into the different sectors individually. The average saving potential and three different key figures for all the industries, except the wood working industries is presented here:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average saving potential</td>
<td>19 %</td>
</tr>
<tr>
<td>Energy/turnover ratio</td>
<td>250 MWh/M€</td>
</tr>
<tr>
<td>Energy/employee ratio</td>
<td>75 MWh/employee</td>
</tr>
<tr>
<td>Energy/area ratio</td>
<td>360 kWh/m²</td>
</tr>
</tbody>
</table>

HVAC stands for heating, ventilation and air conditioning.
Key figures are broken down within each sector.

Figure 5: Distribution of the proposed measures for all the industries involved in the ENGINE project
Energy Efficient Technologies for Industry and Best Practice
**Metal Fabrication**

The 17 companies analysed by ENGINE within the metal fabrication industry use 233 GWh/year and the proposed potential energy saving is 18.3 GWh/year. Metal fabrication means processes like welding, lathing, milling, machined steel components and sheet metal bending. It’s clear that in the metal fabrication industry the area with the highest energy saving potential are the HVAC systems, while there is almost no recommended saving potential in the industrial process area. Results also show that the industries in Germany had higher energy consumption than the other countries in this group.

Key figures for: Metal fabrication industry. No. of checks: 17

<table>
<thead>
<tr>
<th></th>
<th>Lowest figure in energy checks</th>
<th>Highest figure in energy checks</th>
<th>To be used for comparison with other industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>MWh/M€, year</td>
<td>17.7</td>
<td>721</td>
<td>200</td>
</tr>
<tr>
<td>MWh/employee, year</td>
<td>2.9</td>
<td>227</td>
<td>45</td>
</tr>
<tr>
<td>kWh/m², year</td>
<td>96</td>
<td>4,985</td>
<td>372</td>
</tr>
<tr>
<td>% saving potential</td>
<td>1</td>
<td>42</td>
<td>19</td>
</tr>
</tbody>
</table>

![Figure 6: Distribution of the proposed measures in the metal fabrication industry](image)

In the bar charts below the x-axis represents what country the energy check was performed in.

![Figure 7: Energy used compared to annual turnover within the metal fabrication industries](image)
Figure 8: Yearly energy use compared to the amount of employees in the metal fabrication industries

Figure 9: Energy use compared to the size of the plant within the metal fabrication industries
Automotive

The energy use is 42 GWh/year and the proposed energy saving potential is 6.6 GWh/year by the 6 ENGINE Energy Efficiency Checks carried out in automotive supply industry. Here, the highest energy saving potential are the HVAC systems.

Key figures for: Automotive supply industry. No. of checks: 6

<table>
<thead>
<tr>
<th></th>
<th>Lowest figure in energy checks</th>
<th>Highest figure in energy checks</th>
<th>To be used for comparison with other industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>MWh/€, year</td>
<td>197</td>
<td>743</td>
<td>404</td>
</tr>
<tr>
<td>MWh/employee, year</td>
<td>38</td>
<td>229</td>
<td>62</td>
</tr>
<tr>
<td>kWh/m², year</td>
<td>338</td>
<td>1,061</td>
<td>571</td>
</tr>
<tr>
<td>% saving potential</td>
<td>0</td>
<td>42</td>
<td>25</td>
</tr>
</tbody>
</table>

Figure 10: Distribution of the proposed measures in the automotive supply industry

Figure 11: Energy use compared to annual turnover within the automotive supply industry
MWh/employees
Figure 12: Yearly energy use compared to the amount of employees in the automotive supply industry

kWh/m² plant surface area
Figure 13: Energy use compared to the size of the plant within the automotive supply industries
Food Processing
The energy use is 21.6 GWh/year and the proposed potential energy saving is 4.5 GWh/year for all the 8 companies in this area analysed within the ENGINE Energy Efficiency Check. Winery and dairy farmers are a few examples of what kind of industries are included in this group. In the food processing industry the highest saving potential lies within the industrial processes.

Key figures for: Food processing industry. No. of checks: 8

<table>
<thead>
<tr>
<th></th>
<th>Lowest figure in energy checks</th>
<th>Highest figure in energy checks</th>
<th>To be used for comparison with other industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>MWh/employee, year</td>
<td>13</td>
<td>385</td>
<td>90</td>
</tr>
<tr>
<td>kWh/m², year</td>
<td>6</td>
<td>431</td>
<td>175</td>
</tr>
<tr>
<td>% saving potential</td>
<td>3</td>
<td>25</td>
<td>18</td>
</tr>
</tbody>
</table>
Industrial process 36%
HVAC 4%
Building envelope 2%
Lighting 2%
Compressed air 2%
Non-tech measures 56%
Others

Figure 14: Distribution of the proposed measures in the food processing industry

MWh/employees
Figure 15: Yearly energy use compared to the amount of employees in the food processing industries

kWh/m² plant surface area
Figure 16: Energy use compared to the size of the plant within the food processing industries
**Wood Working**

The energy use is 1,050 GWh/year and the proposed potential energy saving is 15 GWh/year for the 14 companies analysed. All these companies were located in Austria. The companies from the wood industry are all located in Austria. These companies in Austria had experienced high energy costs in the past and because of this they have been active with saving energy in the past. Therefore there were not as many possible energy saving solutions compared with other branches. This means that the key figures do not necessarily reflect the whole wood industry. The areas with largest saving potential in the wood working area are the non-tech measures and other measures.

Key figures for: Wood working industry. No. of checks: 14

<table>
<thead>
<tr>
<th></th>
<th>Lowest figure in energy checks</th>
<th>Highest figure in energy checks</th>
<th>To be used for comparison with other industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>MWh/ME(), year</td>
<td>108</td>
<td>2170</td>
<td>750</td>
</tr>
<tr>
<td>MWh/employee, year</td>
<td>13</td>
<td>1204</td>
<td>160</td>
</tr>
<tr>
<td>kWh/m(^2), year</td>
<td>54</td>
<td>832</td>
<td>200</td>
</tr>
<tr>
<td>% saving potential</td>
<td>0</td>
<td>29</td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 17: Distribution of the proposed measures in the wood working industry.
MWh/€ revenue
Figure 18: Energy use compared to annual turnover within the wood working industries.

MWh/employees
Figure 19: Yearly energy use compared to the amount of employees in the wood working industries.

kWh/m² plant surface area
Figure 20: Energy use compared to the size of the plant within the wood working industries.
Other Industries

Other industries include companies that do not belong to any of the previous industry sectors. Plastic casting, stone crushing and powdering, assembly of machines or various products are a few examples of the type of industries that are in this group. In total 7 ENGINE Energy Efficiency Checks were carried out establishing an energy use total of 25.5 GWh/year and a proposed potential energy saving of 4.7 GWh/year. Like the metal and automobile supply industries the “other industries” have the biggest saving potential within the HVAC systems. This shows that the industries within this group are similar to the metal and automobile supply industries in their possible energy saving measures.

Key figures for: Other industries. No. of checks: 7

<table>
<thead>
<tr>
<th></th>
<th>Lowest figure in energy checks</th>
<th>Highest figure in energy checks</th>
<th>To be used for comparison with other industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>MWh/M€, year</td>
<td>38</td>
<td>250</td>
<td>110</td>
</tr>
<tr>
<td>MWh/employee, year</td>
<td>6</td>
<td>196</td>
<td>40</td>
</tr>
<tr>
<td>kWh/m², year</td>
<td>114</td>
<td>1156</td>
<td>380</td>
</tr>
<tr>
<td>% saving potential</td>
<td>5</td>
<td>37</td>
<td>24</td>
</tr>
</tbody>
</table>

Figure 21: Distribution of the proposed measures in other industries
Figure 22: Energy use compared to annual turnover within the other industries

MWh/M€ revenue

Figure 23: Yearly energy use compared to the amount of employees in the other industries

MWh/employees

Figure 24: Energy use compared to the size of the plant within the other industries

kWh/m² plant surface area
Automotive Supplier, Germany

Energy saving potential of 20 %
A supplier for chemical products used for core production and fabrication in the automotive industry participated in the ENGINE Energy Efficiency Check. In 2007, the total energy consumption of the company equated to some 5.2 % of the business’ revenue, the biggest consumer being compressed air for electricity and natural gas for the thermal processes. Following the energy survey a report, complete with a range of recommendations to reduce consumption and cost of energy, was presented to the business. Identified savings totalled 608 MWh per annum or € 36,450 per annum. The business has committed itself to implementing several measures.

Saw Mill, Austria

14 % of heat and 12 % of electricity could be saved
An Austrian saw mill with 90 employees and an annual production of 115,000 cubic meters of processed wood was analysed according to the ENGINE Energy Efficiency Check. Even though some measures had already been made, additional areas for improvements were identified in lighting, electric motors, ventilation, compressed air and heating. Low cost measures like improved maintenance, installing thermostatic valves and cleaning of windows have already been installed. In total, the Check described a potential savings of 14 % in the area of heating and 12 % in the area of electricity.

Wine Factory, Italy

Streamlining processes could result in 20 % of energy savings
An Italian wine factory providing final working, bottling and shipping of wines from the province of Verona received a thorough analysis within the ENGINE Energy Efficiency Check. Every year the factory treats 80,000 to 100,000 hectolitres of wine and emits some 460 tons of carbon dioxide. Saving potential is seen in lighting and improving efficiency of motors and pumps. A larger share can be achieved in addressing the heat and steam generation, making refrigeration and air conditioning more energy efficient and insulating the office buildings.
Dairy Farm, United Kingdom

Up to 16% of cost savings possible due to improved equipment

The dairy farm has some 200 cattle and an energy bill of £ 4,000 per year. A third of energy is used for heating, a third for cooling milk and a further third is used for electrical equipment and lighting. The principal recommendations made from the ENGINE Energy Efficiency Check are to improve technical equipment rather than use of energy, which is already well managed. Variable speed drives, heat recovery, improved coolers and compressors can result in reducing costs by £ 650 per year.

Plastic Products, Sweden

Potential of 20 to 25% energy savings

A manufacturer of plastic products used in offices with 33 employees and a turnover of 3.5 million Euros underwent an ENGINE Energy Efficiency Check. In addition to the analysis, the company organised an additional training. Several actions with almost no investments necessary were implemented shortly after including shut down of equipment when not needed or use of waste heat. In total the potential for savings is estimated to be between 20 and 25%. But even more, enthusiasm for energy saving has been established in the company.
Key Result 3:
Activation, Communication, Transfer

- Promotional materials have been developed for all regions.
- 25 initial consultations have been carried out.
- 15 motivational events with some 400 participants have been organized.
- 10 round tables for stakeholders with 439 participants in total have been organized in all regions.
- The project website has gone online end of January 2008 and will be maintained until March 2012.
- The high quality brochure was compiled with case studies from all regions and is available in two different versions for Germany and Austria in German, in English, Italian and Swedish.
- 10 national workshops were held, two in each partner country, addressing 600 participants in total at national level.
- A European workshop was organized with 25 participants on the occasion of the Hannover Fair April 2008.
- With regard to a specific dissemination towards Eastern Europe, a special workshop was carried out in Gdansk, Poland in March 2009 with 31 participants. A second special workshop was organized in Ceske Budejovice, Czech Republic, in February 2010 attracting 43 participants.

A key approach of ENGINE was to address companies and stakeholders at regional, national and European level by directly approaching companies via consultations, implementing workshops, round tables and other communication events.
Swedish Energy Conference held in spring 2010 connected to energy efficiency networking supported by ENGINE, photo Swerea

Motivational event at the Chamber of Commerce in Braunschweig, Germany in June 2008 with 20 regional stakeholders, photo AGIMUS
National workshop in Hannover, Germany organised in cooperation with the regional Chamber of Industry and Commerce in June 2008 with 86 participants, photo target
EU level

Workshop presenting approaches from ENGINE at the Pomeranian Marshall’s Office, 23rd of March 2009 at Gdansk, Poland to 43 interested regional stakeholders, photo AMBIENTE

A European workshop organized with 25 participants on the occasion of the Hannover Fair on the 21st of April 2008, photo target
Lessons Learnt

Energy checks valuable, but subject to economic frame conditions
The implementation of energy checks was a valuable support for the companies involved. However, getting the companies to agree to the checks has been more difficult than expected, mainly due to unfavourable economic conditions for the key target group of SMEs. A common experience in all countries was that SME claimed on grounds of economic pressure that they did not have enough resources to carry out the checks. Also some, who did participate, were afterwards reluctant to carry out measures due to restraints in investment potential.

There is a significant demand for training
In contrast to the difficulty to get enough SME carrying out checks, the implementation of trainings was exceptionally successful and met a true demand – be it either for auditors, consultants, but also for staff within the SME. A common experience in all countries was that the capacity building for experts or training for in-house personnel is needed and welcome despite the difficult financial conditions.

Communication and networking are a necessity
It is fundamental to create exchange platforms for the involved actors dealing with energy efficiency issues in SMEs. This allows the creation of a dynamic area where constructive discussions and exchange are fostered. It has been noticed that participants consider word-of-mouth recommendations much more trustworthy than the only advice of a consultant. Moreover, such exchange arenas, like the events organised within the campaign activities, have proved to be helpful for the realisation of economies of scale. From the partner side it definitely made sense to co-operate with existing initiatives and networks to facilitate communication to target groups and raise level of awareness.

Success Stories

Austria (Energon/AEA): New impulse for industry
In Austria the energy efficiency checks have been conducted within the wood processing industry. Within the checks in sawmills and carpentries benchmarks for specific energy consumption have been elaborated. These benchmarks have been compared with existing benchmarks from 1997. The comparison showed that the specific energy consumption has been increased considerably within 13 years. Because of these results a special support project for energy consultancy in sawmills by the regional programme of Salzburg is in discussion.

United Kingdom (SWEA): Trainings
SWEA have found the delivery of the training courses to be one of the most successful aspects of the programme as these have generated a lot of interest from local businesses. In addition to this we have found that local business support organisations have been particularly interested in attending these events so that they are able to promote the benefits of sustainable energy to their clients which will have a good impact in terms of spreading the message to many SMEs. In addition to this, the delivery of the half day workshops has also been very successful. Not only have the events been very well attended, but SWEA have also identified a number of new and important contacts to help promote the broad range of services offered by SWEA. This, is hoped, will lead to an increase in the level of SME related work that we deliver, not only in Gloucestershire, but also in surrounding areas.
Germany (AGIMUS/target): Trainings and checks

The division of work between target and AGIMUS resulted also in a different perception of successful developments. For target, the implementation of the trainings was exceptionally successful. Within the frame of the project, 3 courses with a total of 78 participants were implemented instead of the planned 50. For AGIMUS, the direct contact and carrying out of energy checks were beneficial – both for increasing the capacity of the consulting abilities as well as the companies itself. In one case, 30% of the total energy consumption could be reduced after the ENGINE check and the implementation of the recommended measures. The companies had different expectations concerning the results of the checks. So the auditors tried to conduct the energy surveys in a really company-specific way. After the check all companies were impressed by the work of the ENGINE auditors and the results. Customer specific approaches to the checks lead to specific recommendations, content customers and high chances for implementations.

Italy (AMBIENTE): Individual check

The best results obtained from the project are energy checks for the dairy factory “Fratelli Zani” and the wine factory “Cesari Vini”. In both cases they gave a lot of attention to the checks and to our suggestions although, in this period, the economic crisis does not allow for big investments. The factories have understood that their energy efficiency could be improved not only with technological actions, but also with a better management of the energy system. The factories did not have yet an Energy Manager, but after the energy checks they appointed an energy dedicated figure. Concerning specific technological possibilities coming out during the checks, the main aspect of the energy consumption is the simultaneous and intensive use of heating and cooling (so electric energy) during all over the year. This suggests the possibility to improve actions like cogeneration and heat recover, but also like thermal and photovoltaic solar energy applications. For both factories in particular installing an important hot water storage system that can be interfaced with thermal solar energy was proposed. This can provide an improvement of the efficiency of the boilers.

Sweden (Swerea/KanEnergi): Concept of trainings and regional programmes

Our approach of integrating the trainings with the implementation of the energy checks has been mostly appreciated by the participating SMEs and energy advisors. By being more involved in the auditing and identification of measures throughout the capacity building process the companies have gained improved awareness of the energy use and energy management. The 18 participating companies have identified profitable energy measures corresponding to 26% of total energy use. Almost all of them have already implemented measures and are currently working with identifying more. Based on our two WP4 round tables a regional information and education programme has been initiated. Currently the structure and organization is being developed and in the end of March 2010 an application to the Swedish Energy Agency will be submitted. The programme is already endorsed by the Regional administration and authorities as well as key stakeholders such as the Technical University of Chalmers and Swedish Testing and Research Institute and the Regional Energy Agency.
Contacts

A range of information, including reports and training material, is available from the ENGINE website, www.engine-sme.eu.

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