Energy Efficient Technologies for Industry and Best Practice
Introduction

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 metalworking, automotive component, wood, and food processing industries, although all of the energy saving measures and lessons learned other than those specifically related to a manufacturing process are applicable to the majority of SMEs.

Energy checks

The ENGINE project included 56 energy checks across the regions. The checks comprised the following stages:

- **Status quo**: Site inspection, data collection, identifying focus, interviews
- **Report preparation**: Describing company, analysing data, comparing energy use with benchmarks
- **Evaluation**: Calculating energy saving potential
- **Proposal**: drafting an implementation plan and suggesting necessary steps

ENGINE offered SMEs an analysis of their status quo by means of energy surveys and checks and worked towards regional capacity building by providing energy management training.

ENGINE has built up a knowledge pool of concepts, instruments and approaches already available and has launched informational campaigns to increase awareness on the issue.
The main driver for businesses to improve energy efficiency is usually economic: Improved energy efficiency leads to reduced costs, making a business more efficient and hence more competitive. Reducing energy bills alone is not, however, the only economic reason for improving energy efficiency.

The use of more modern process equipment, which tends to be more controllable, can also improve product quality and consistency. More controllable building services tend to improve occupant comfort and potentially productivity at the same time as reducing energy use.

SMEs are also being encouraged by their clients, especially larger companies, to improve their environmental performance including energy efficiency, since larger organisations are increasingly applying environmental management systems such as ISO 14001, which require them to manage not only their in-house production but also their supply chains. An SME with an energy management system in place therefore 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 through reduced emissions of Carbon Dioxide and water vapour.
The basic message underpinning Dr Ralf Utermöhlen’s description of barriers to effective energy management above is that you can’t manage what you don’t measure, and in energy management the more accurate the measurement, the more valuable the data. For this reason, the first step in managing energy in a structured manner is almost always to measure energy use.

There are many ways to implement an energy management system, and the most appropriate system for a cottage industry supplying food to the general public may be very different to that for an aerospace component company accustomed to documenting all aspects of production. Some companies may benefit from gaining a certification to an energy or environmental management standard, others may want to follow the guidelines without gaining accreditation, and others may benefit from following a very simple energy management system.

During the early stages of the ENGINE project, the specification of the new European energy management standard, EN16001, were finalised, and the energy management training materials were structured around this. The standard follows the same pattern as the widely used ISO 14001 Environmental management standard, using the Plan-Do –Check-Act cycle to encourage continuous improvement.

The ISO 16001 standard’s main sections concern General requirements & Policy, Identification and review of energy aspects, Legal obligations, Resources, Roles and responsibilities, Awareness raising & Communication, Energy Management system documentation, Control of documents & Operational control, Energy monitoring, Evaluation of compliance & Nonconformity, corrective action, Control of records, and Internal audit & Review.
There are several reasons why SMEs across Europe find it difficult to improve energy efficiency, even in cases where there is a clear economic argument for doing so.

In many cases, although investing in more energy efficient equipment may provide a relatively rapid payback on investment, 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.

There are hidden costs inherent in any investment, and these tend to be a significant proportion of investment costs for SMEs: A typical business may well easily identify ways to reduce energy consumption by around 15%. For a large energy user, it is worth investing considerable time and resources in saving 15% of millions of Euros, however at the other end of the scale, a micro business would be hard pressed to spare the resources to implement projects saving 15% of an energy bill of only hundreds of Euros.

Transaction costs are also proportionally higher for smaller companies, especially those with few staff and no knowledge of energy efficiency: Either valuable time needs to be taken up learning about energy and energy efficiency, or businesses must depend on advice given by salespeople who may or may not have the customers’ interests in mind.

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. In this case there is no incentive for any member for staff to improve energy use – it is just treated as a fixed cost and nobody is responsible for it. If nobody is assessed or rewarded for good energy management, it is no surprise that it is neglected.

In many states, 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. Landlords typically have little interest in energy efficiency, since they do not usually pay energy bills of the tenants, and those costs they do pay, such as for communal services on shared sites, are paid by the tenants through service charges.
The lack of knowledge of energy efficiency is helped by the availability of independent advisers and consultants, and most EU member states have government supported programmes designed to provide advice to businesses through a variety of media including telephone advice lines, web sites, publications, training, and consultancy sessions.

Product labelling, especially for domestic scale appliances, can help SMEs identify efficient equipment. Many pieces of modern equipment are significantly more efficient than older models due to changes in technology, sometimes spurred by tightening energy efficiency standards: Heating, lighting, and cooling technology have all evolved significantly in the last decade.

Finance has become increasingly difficult to obtain during the course of the project; however there are several sources of low cost funding for the acquisition of energy efficient equipment, such as the Carbon Trust in the UK.

Fiscal policies that provide incentives for the acquisition of efficient equipment and taxes on fossil fuels also make energy efficient equipment and practice more attractive.

Public sector leadership, through the specification, procurement, and use of energy efficient equipment not only help to encourage the market and supply chain for emerging technologies, but can also act as showcases for less familiar technology.

The most important steps, however, are some of the simplest: In any company, regardless of size, someone should be responsible for energy use, and their work assessment should include assessment of their performance in managing energy. One of the first tasks for whoever is responsible for energy will almost certainly be to establish a system for measuring energy. Once this is established it is possible to evaluate year on year energy use, assess the economic viability of any potential improvements, and evaluate whether energy consumption is acceptable. Those responsible for energy use should be assessed on their management of energy in the same way they would for other aspects of their jobs.

Businesses that have little control or influence over the buildings they use have a more limited scope for improvements, although much may be achieved by establishing dialogue with the landlord. Even if this is not possible, changes in how equipment is used, and low cost upgrades, especially to control systems and lighting, can still be worthwhile.
The Business
The business is an automotive supplier. However, this particular business is not a typical organisation found within the automotive industry. They are a supplier of automotive products, mainly chemical products for use in core production and mould fabrication processes.

Energy Performance
The business uses electricity and gas. Last year the business used approximately 817MWh of electricity and 2,153MWh of natural gas. In 2007 the factory’s total energy consumption equated to €212,560 (5.2% of the business’s revenue). The biggest consumer of electricity is compressed air production (307.9MWh/annum). The biggest consumer of natural gas is the various thermal processes (1,697MWh/annum), which require temperatures of up 700°C.

Energy saving potential
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 608MWh per annum or €36,450 per annum. The business has committed itself to implementing several measures.

<table>
<thead>
<tr>
<th>Scope</th>
<th>Measure</th>
<th>Investment</th>
<th>Saving Potential</th>
<th>Payback Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy procurement</td>
<td>Invitation of new tenders of energy procurement</td>
<td>None</td>
<td>Price deduction electricity from 10.75ct/kWh to 10ct/kWh: saving potential approx.</td>
<td>0 years</td>
</tr>
<tr>
<td>Compressor</td>
<td>Maintenance of the compressed air pressure grid. Regular analysis of leaks</td>
<td>None</td>
<td>€6,000/annum</td>
<td>0 years</td>
</tr>
<tr>
<td></td>
<td>Cut-off of two compressors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>Adaption to the requirements. Disassembly of lamps with no impact</td>
<td>None</td>
<td>€560/annum</td>
<td>0 years</td>
</tr>
<tr>
<td>Regeneration of sand</td>
<td>Pre-heating of the heater supply air by using waste heat</td>
<td>€330,000</td>
<td>Reduction in natural gas 54.8m³/h</td>
<td>7 years</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Cost saving potential approx €47,000/annum</td>
<td></td>
</tr>
<tr>
<td>Sand covering</td>
<td>Insulate sand heater (10cm insulation layer)</td>
<td>€1,000</td>
<td>Reduction in natural gas 16.6MWh/annum</td>
<td>1.3 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cost saving potential approx. €800/annum</td>
<td></td>
</tr>
<tr>
<td>Compressor operation</td>
<td>Use of waste heat for warm water and heating (social rooms)</td>
<td>€20,000</td>
<td>Reduction of natural gas and electricity 8MWh/annum</td>
<td>2.5 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cost saving potential approx €7,700/annum</td>
<td></td>
</tr>
<tr>
<td>Lightning</td>
<td>Change of lighting system (replacement of conventional ballasts)</td>
<td>€2,520</td>
<td>Cost saving potential approx. €490</td>
<td>5 years</td>
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</tbody>
</table>
Sector Specific Case Studies
Laser Welding

The Business
The business is involved in the metal fabrication sector, more specifically laser welding. The business employs 70 staff and an annual revenue of €341.8 Million.

Energy Performance
The business uses electricity and district heating. In 2008 the business used approximately 5,480 MWh of electricity and 1,500 MWh of heat from the district heating network.

Energy saving potential
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 €38,250 per annum. The business has committed itself to implementing several measures.

Other recommendations
- Staff awareness
- Lighting: changing 200 lamps to LED-technology, new lighting concept, less lamps, installation of lamp groups which can be switched off together
- Replacement of the old pumping station
- Implementation of an energy management system
- Measuring air-pressure leakage, optimisation air pressure

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<th>Area</th>
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<th>Saving Potential (€)</th>
<th>Payback Ratio</th>
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</thead>
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<tr>
<td>De-dusting plant</td>
<td>Use of Waste heat to heat workplaces in winter</td>
<td>To determine</td>
<td>181 MWh</td>
<td>€12,700/annum</td>
<td>to check</td>
</tr>
<tr>
<td>Laser system</td>
<td>heat pump for social rooms</td>
<td>To determine</td>
<td>216 MWh</td>
<td>€10,800/annum</td>
<td>to check</td>
</tr>
<tr>
<td>Compressed air</td>
<td>Use of Waste heat</td>
<td>€2,000</td>
<td>170 MWh</td>
<td>€12,000/annum</td>
<td>&lt; 1 year</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>assumption: cost of district heat: €70/MWh</td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>Replacing of Radium lamps by surface emitting diode with mirror optics</td>
<td>€3,200</td>
<td>16 MWh</td>
<td>€950/annum</td>
<td>3.3 years</td>
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<tr>
<td>Laser system</td>
<td>Use of waste heat: Preheating process water</td>
<td>€1,000</td>
<td>26 MWh</td>
<td>€1,800/annum</td>
<td>1.6 years</td>
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Sector Specific Case Studies
"Caseifici Zani F.Iii” Dairy Factory

The Business

The dairy factory “Caseifici Zani F.Iii”, founded at the beginning of the last century, is located in Cigole, a small town about 30km south of Brescia. In 2008 the production reached 1,170t (tonnes) of cheese starting from about 70,000t of milk. Every year the factory is responsible of the emission of 3,200t of CO2, the equivalent of about 500 homes.

Energy Performance

The factory uses electric and thermal energy as well as water. Last year the business used approximately 2,600MWh of electricity and 915,000m3 of natural gas. The most important part of electric consumption is for refrigeration and air conditioning. The refrigeration plant provides cooling for the production cycle (like milk refrigeration or cold storage for cheese) and for the air conditioning of the entire factory. The heat requirements consist of 9 bar steam, which is used for the production cycle. Only 4% of the steam is used for space heating. Every day the factory uses about 200m3 of water, with 20m3 of the water needing a special depuration process.

The main aspect of the energy consumption is the simultaneous and intensive uses of heating and cooling (i.e. electricity) throughout the year. This suggests the potential to improve actions such as cogeneration of power and heat recovery, but there is also potential for thermal and photovoltaic solar energy applications. The business is taking in consideration these actions and producing feasibility studies both for technical and economical aspects.

The Survey

The following points will bring the greatest improvement to efficiency and a reduction of energy consumption:

- Refrigeration and air conditioning
- Steam and heat generation for process and conditioning
- Thermal and electric production from solar energy
- Improving efficiency of motors and pumps
- Compressed air
- Improved lighting efficiency

These actions have been detailed in a report presented to the proprietors. The report contains suggestions for reducing the energy needs. Another aspect is the management of energy that can be improved with a correct monitoring activity and contract analysis.

Key Points

- Hot water storage system (about 20 m3) that can be linked with thermal solar energy. This can increase the efficiency of the boilers.
- Pre-heating of water from refrigeration plant exhaust air.
- Replacing the traditional neon lamps with LED equivalents could save approximately 70MWh of electricity per annum.
The Business

The wine factory “Gerardo Cesari”, founded in 1936, is located in Quinzano d’Oglio, a small town about 40km south of Brescia. The wine factory provides final working, bottling and shipping of many wines from the province of Verona. Every year the factory treats 80,000 – 100,000 hectolitres of wine in about 3,200 hours. Every year the factory is responsible for emitting 460t of CO2, the equivalent of about 90 homes.

Energy Performance

The factory uses electric and thermal energy as well as water. Last year the business used approximately 600MWh of electricity and 80,000m3 of natural gas. The most important part of the electrical consumption is connected to the bottling process, in particular the filtering and packaging. The lighting in the factory uses over 8% of the total electricity consumption. The main portion of gas is used for steam production for the sterilisation of the equipment. Only 10% of gas is used for space heating. Every year the factory uses about 30,000m3 of water.

The Survey

The following points will bring the greatest improvement to efficiency and a reduction of energy consumption:

- Steam and heat generation
- Refrigeration and air conditioning
- Thermal and electric production from solar energy
- Improving efficiency of motors and pumps
- Compressed air
- Improve lighting efficiency

These actions have been detailed in a report presented to the proprietors. The report contains suggestions for reducing the energy needs. Another aspect is the management of energy that can be improved with a correct monitoring activity and contract analysis.

Key Points

- Replace the steam generator that has a very low efficiency with an instantaneous unit.
- Hot water storage system (4 – 6m3) that can be linked with thermal solar energy. This can increase the efficiency of the boilers.
- Replacing the traditional neon lamps with LED equivalents could save approximately 25MWh of electricity per annum.
The Business
An analysis was undertaken for an Austrian saw mill with 90 employees and an annual production of 115,000m3 processed wood.

Energy Performance
The annual electricity consumption is approximately 7,440MWh and for the majority of electricity that has to be purchased a small percentage comes from their own small hydropower station. Heat consumption is approximately 50,000MWh and is generated with two biomass boilers and a gas boiler. Around 2/3 of this energy comes from biomass and 1/3 from gas.

The Survey
Charts 1 & 2 underline electricity and heat consumption.
During the analysis all areas of the company were covered and although the energy manager had already taken steps to improve efficiency, energy savings could still be identified in all areas:

- **Lighting** – Use of daylight; installing reflectors and movement sensors in outside areas and exchange of old lamps with new efficient lamps.
- **Electronic Motors** – Linking the process and supply so to stop supplying the equipment further when the process is complete; continuous exchange of old with high efficiency motors is required.
- **Ventilation** – Linking the process with the exhaust to stop ventilation when the process is complete; reuse waste heat and decrease speed of ventilators.
- **Compressed Air** – Use of waste heat; continuous cleaning and maintenance; shut-down the compressor when it is not in use.
- **Heating** – Improved insulation of the drying chambers; continuous cleaning of equipment; use of solar power for drying; and use of waste heat to pre-heat drying chambers.

Key Points
- The total potential savings in the area of heating is over 7,000MWh (14%) and in the area of electricity it is over 900MWh (12%).
- Most of the low-cost measures like improved maintenance, installing thermostatic valves, cleaning of windows have already been implemented.
- Investments in a new compressor have been made: Resulting from this audit the company redesigned the compressed air net and replaced one of the 70kW compressors with a 30kW compressor.
The Business

This saw mill has 30 employees and an annual production quantity of 70,000 solid m3 wood. The company had not appointed a person to be responsible for energy efficiency activities and the purchase of energy efficient devices.

Energy Performance

The company does not regularly dry wood but operates its own transportation system. This explains the relatively high fuel consumption and the relatively low heat consumption. The total energy consumption is approximately 4,800MWh and electricity consumption is approximately 1,300MWh. Charts 5 & 6 highlight the areas of use.

In the area of electricity, the main energy consumers are electrical motors and compressed air and ventilation systems.

The Survey

During the analysis of the energy systems the following saving areas could be identified:

- **Compressed air** – Maintaining a compressed air net to avoid leakages; reduce pressure; and switch off individual compressors to avoid the continuous running of all compressors.
- **Electrical Motors** – Operate the motors in intervals and exchange flat belts with tooth belts.
- In the area of heating, the company uses two boilers: the large 575kW boiler is operated by oil and the smaller 20kW boiler is operated by biomass. The total heat consumption is approximately 2.17GWh. Losses occur mainly through leakage and old equipment. The actions required to create the most savings are:
  - Improving insulation of drying chambers and heating tubes.
  - Heating tubes have already been insulated.
  - Reuse waste heat in drying chambers and compressor stations
  - This measure is already partly implemented.

Key Points

- The compressed air measures have all been implemented.
- The business has made progress with reducing the heating consumption.
- The total potential energy savings in the area of heating is approximately 560MWh and in the area of electricity it is 65MWh.
Sector Specific Case Studies

Processkontroll

The Business

Processkontroll consist of three different companies which all work with industrial auto motion within process industries. The customers are energy utilities, nuclear power plants and chemistry, pulp and paper and steel industries. The production is mostly assembling but also some manufacturing. A lot of components are procured and large parts of the facilities are used as storage. The group has a revenue of about €24 Million and approximately 160 employees.

Energy Performance

All energy used is electricity and the total annual energy use is 920MWh.

The Survey

Through mapping and calculations the energy use was divided in several categories as shown in chart 9.

Key Points

• In most of the buildings heat pump technologies are the most favourable solution for heating based on investment and technical implementation.

• There is also a potential for energy savings from adjustments to operational hours and schedule for ventilation and lighting systems.

• An investment in modern light fittings is also a profitable measure.

• By recovering hot air from the air compressor the use of electricity in the nearby building can be reduced.

• Total profitable energy saving measures gives a 37% reduction of the energy use or annually 340MWh less electricity used.
Sector Specific Case Studies

Plast Petter

The Business

PLAST PETTER AB is a manufacturer of products in plastics mainly for use in offices. The plastic products are cut, welded and glued together. Plast Petter is situated in the southwest of Sweden and has 33 employees and a turnover of about 3.5 million Euros.

Energy Performance

Plast Petter is using energy from oil and from electricity, around 320MWh and 550MWh every year respectively.

The Survey

An energy check was conducted and Plast Petter participated in a ENGINE training session.

Several actions were implemented shortly after this, for example:

• Disconnecting of transformers
• Shut down of cooler for drying of compressed air
• Shut down of fan for ventilation during nights and weekends.
• Air from cooling of compressor is lead to the production area for heating.

These actions, with almost no investment costs are now giving a reduction of energy use of 10-12%.

The possibility to use plastic spill for heating instead of oil is now being investigated. The plastic spill from the in-house production process will eliminate all the use of oil for heating.

Key Points

• An enthusiasm for energy saving is now established within the company.
• Already performed actions are now giving a reduction of energy use of 10-12%.
• These savings are achieved with almost no investment costs at all.
• Total potential for energy savings is estimated at 20-25%. If the use of plastic spill is counted the figures will be significantly higher.
**Sector Specific Case Studies**

**Håkanssons Sawblades**

**The Business**

Håkanssons Sawblades is a world leading manufacturer of saw blades. Their band saw blades are widely recognized as technically the most advanced band saw blade available. The saw blades produced are mainly for sawing metal but also in the wood industry as well as within food production. 90% of the production is exported. The company works constantly to bring about improvements by developing operations with regard to environmental impact in respect of emissions, waste and the utilisation of resources.

**Energy Performance**

The energy used is all electricity which is supplied for industrial processes, facilities and heating. The total annual electricity use is 2,200MWh. The largest users are the hardening process, ventilation including heating battery, pressurized air and milling machines.

**The Survey**

Through mapping and calculations the energy use was divided in several categories as shown in the image.

**Key Points**

- The largest potentials for energy saving lies within better adjustment of operation hours and schedule for ventilation and lighting which fits the actual use and need.
- An investment in modern lighting fittings is also a profitable measure.
- There is a large potential for energy saving by heat recovery from the hardening process as well as the pressurised air system.
- By retracting waste heat from the hardening process via filtering to an accumulator tank this heat can be utilized for hot water and preheating of the inlet air in the ventilation system. Heat recovery exchangers from the cooling system of the two air compressors can also be connected to the accumulator tank.
- This solution also implies the need of extra ventilation by opening a large gate when hardening due to high overload of heat to the facilities.
- Total profitable energy saving measures gives a 25% reduction of the energy use.
Sector Specific Case Studies

Blomdahls

The Business

Blomdahls Mekaniska AB is a family owned company situated in the southwest of Sweden. The business is manufacturing of sheet metal parts for industry and the main processes are cutting, bending and surface treatment of these. Blomdahls has 28 employees and a turnover of about 2.3 million Euros.

Energy Performance

Energy consumed is only from electricity and about 800MWh per annum.

The Survey

An energy check combined with training has been a key part of the work for energy efficiency. A big enthusiasm for energy savings has been established. Several actions have been completed or are planned for the near future. Adjusted settings of ventilation system, improved lighting, and improvements to the compressed air system are some of the actions which already saved around 10% electricity.

Key Points

• Great enthusiasm is achieved through a combination of the energy check and training.
• Savings of around 10% is already achieved almost without any investment costs during the first five months of energy work.
• Most important for reduction of the total energy use is a change to more energy efficient production equipment, primarily a new oven, for surface treatment. The total potential for energy savings is roughly estimated at 30%.
Sector Specific Case Studies
Maschinen und Formenbau Leinetal (MFL GmbH), Germany

The Business
MFL is a well established company in the outskirts of Hanover whose main production areas are tool making and mould construction. They have 70 employees and in 2007 the energy consumption was 581MWh in total.

Energy Performance
Electricity is needed for warm water preparation and lighting as well as for the production of compressed air. As for the heating the company has a separate oil-fired boiler.

Most of the oil-based energy consumption of about 44% was due to the heating with the old boiler combined with the inefficient and old circulating pumps. Another 11% of the whole electricity usage was needed for the lighting and nearly 28% was required to produce compressed air.

Besides the obvious energy wastage at the compressed air production another reason gave a strong push towards energy efficiency. A competition was held by the regional climate protection agency and others. To take part it was necessary to have a professional energy concept developed by a consultant.

The Survey
The energy check covered nearly every part of the company but laid emphasis on the following areas:
- Heating and hot water system
- Lighting
- Compressed air
- Heat recovery

The report shows that there were more potentials than even the auditors had expected and not only in the energy sector but also in the water consumption. Although heat recovery is the most important step to reduce the energy consumption, many other smaller and bigger measures contribute to help saving costs.

After the company had realised that it is very easy to save energy and money the machines and processes were optimised. For example they installed a completely new regulation for the heating system. Now the office and the production building have got different time-controlled regulations which perfectly cover the real needs.

The energy-concept won a prize of 6,000 Euros. And while there was a follow up competition in the region which focuses on implemented measures and achieved CO2 reductions the company undertook great efforts to put the recommendations into practice. Such commitments were rewarded with the first prize and this was worth 20,000 Euros.

Key Points
- Compressor heat recovery as well as waste heat usage of the machines reduced the energy consumption by around 170MWh.
- Another 32MWh were saved by the replacement of luminescent tubes and optimisation of the lighting.
- The implementation of high efficiency circulating pumps and a hydraulic adjustment contributes to the improvement with 30MWh.

Extract from an interview:
“We now know that an important success criterion for an investment in energy efficiency is the use of professional energy advisors who work together with our management and find economical and implementable solutions. Another one is the involvement and training of the employees. Eventually competition shows us that there is no contradiction in the investment in energy efficiency and business returns.”
The Business
Bartelheimer was founded in 1984 and is today well established in the metalworking and metal processing sector and has specialised in powder coating processes. The company employs 10 people and the yearly energy usage is about 522 MWh, emitting 148 t CO2. The total annual energy spend is around 34,000 Euros.

Energy Performance
Electricity is needed for many processes such as powder coating and compressed air production. Together with the lighting it covers nearly 20% of the total energy consumption. Besides the electricity the powder coating process needs enormous amounts of gas. In total 211 MWh are used for that production area. That is 40% of the whole usage and is worth 13,500 Euros. And another 159 MWh are used for the heating of the office and production buildings.

Nevertheless compared to the metal and coating sector the consumption structure lies in a normal range.

So the main targets the energy check should have covered were:
- Analysis of the energy consumption and identification of the main users
- Recommendations for improvements especially regarding economical aspects

The Survey
Following the agreement between the company and the auditors the survey reveals saving potentials in this areas:
- Heat recovery
- Lighting
- Heating system
- Employee motivation
- Compressed air

The survey shows that there is more potential to discover and to solve than the company originally expected or hoped for. Yet the main barrier to implementing the measures is cost. Like many other companies, they are concerned about the financial crisis and won’t invest when the return on investment schedules are quite uncertain. However, low cost and easy to handle measures were implemented immediately, e.g. the leakages in the air pressure system have been repaired and the starting level of the compressor was reduced to 8 bars.

The intention for the future is to have a closer look at the energy usage and to act step by step. The replacement of the old tubes with high efficient luminescent tubes or the isolation of the pipe-system and the restoring of the regulation could be the next measures. Additionally, the employees should be more involved in the process to save energy and money.

Key Points
- Heat recovery at the end of the powder coating process could save energy of about 137 MWh.
- Optimisation and regulation of the heating system will cut energy costs by 8,800 Euros.
- Another 20 MWh could be saved by the replacement of luminescent tubes and optimisation of the lightning.
The Business

U Godsell and Sons run a 200 head dairy farm near Gloucester. The annual energy spend is approximately £4,000, emitting 28t CO2.

Energy Performance

The farm uses mains electricity for hot water heating, lighting, milking, and refrigeration. Energy consumption on the farm is typical for a dairy farm: about a third of the energy is used heating hot water, a third for cooling milk, and a third for milking, lighting, and auxiliary equipment. The farm had already taken steps to consider using energy cost effectively, and extensive use was made of off peak rate electricity for milk cooling and hot water heating.

The Survey

The survey provided an assessment of the energy situation covering two main themes. The first covers technical opportunities for reducing energy consumption/cost assessing the following areas:

- Heating and hot water
- Milking equipment
- Lighting
- Milk cooling equipment
- Renewable energy opportunities

The second looks at management of energy use (monitoring consumption, and understanding how staff use energy). Energy use at the farm was found to be well managed. Unusually for a small business, the principal recommendations were only for technical improvements related to equipment, rather than user practice. These were:

- Increasing capacity of the spring water milk chiller
- Installing a variable speed drive (VSD) on milking equipment
- Installing heat recovery equipment on milk chillers.

Key Points

- Improving cooler will reduce annual electricity demand for milk cooling by £300.
- Variable speed milking pumps will cut annual milking pump energy use by £250.
- Compressor heat recovery will cut annual hot water heating costs by £100.

The installation of a variable speed drive has already cut electricity consumption by 20% and will pay for itself in less than 5 years. The improvements to the chiller, costing around £1,000 will lead to annual savings of approximately £300. Heat recovery equipment to preheat hot water using waste heat form the milk chillers costs approximately £1,000 and provides annual savings of £100. The savings may appear modest as they are based on 2007 electricity prices. It is expected that actual savings in the medium term, and returns on investment, will be better than those quoted.
The Business
Severn Wye Energy Agency conducted an energy check of a Gloucestershire engineering company from April to August 2009. The Engineering Company is a well established manufacturer of roller and ball bearings, based in the South Midlands area of the UK. The premises houses offices, production, and storage areas for materials and finished products.

Energy Performance
The business has annual energy consumption of approximately 340MWh of gas and 490MWh of electricity. Electricity consumption accounts for over 80% of the energy bill in a typical year. The majority of energy used at the business is for lighting, production (metalworking), and heating. Staff at the business were aware of the significance of energy consumption, and were keen to find practical ways to reduce energy consumption without affecting the core business.

The Survey
It was clear that although the production processes were significant users of energy, it would be difficult to reduce production energy use since most was from packaged machines such as CNC equipment. The compressed air system was checked thoroughly, as leaks are costly and can be repaired cheaply and easily. No leaks were found, indicating that the system was well maintained.

The largest potential for energy saving was found in the workshop lighting, since most of the workshop were lit by fluorescent tubes operated by electromagnetic control gear. Assessment showed that replacing the existing lighting with modern metal halide lighting (such as that already fitted on one area) or modern fluorescent tubes with high frequency electronic control gear would reduce electricity demand by approximately 72MWh per annum – approximately 15% of the electricity consumption. Changing the lighting would also reduce maintenance requirements.

The other significant saving identified was to duct warm air from the compressor house into the main building during the winter to reduce heating demand by 8MWh per annum. Smaller measures identified included improving insulation levels in the office accommodation and installing more efficient gas heaters and boilers.

Key Points
- Improving lighting efficiency to save 15% of total electricity consumption (72MWh) per annum.
- Heat recovery from the compressor to reduce heating demand by 8MWh per annum.
The ENGINE project was not about reinventing the wheel or encouraging SMEs to experiment with untested technology, but about enabling smaller companies to take advantage of the technologies and management tools already used by more energy intensive industry.

The ENGINE programme has clearly demonstrated that it is possible for smaller companies to reduce their energy consumption through the implementation of an appropriate energy management system. The main barriers to doing so are the lack of resources (mainly time and money) and the large numbers of companies who rent premises on short term leases.

The market for energy efficient equipment is constantly evolving, driven by market demand and regulation of energy efficiency, although it tends to be larger companies that have the resources to prioritise and evaluate quality, reliability, and energy efficiency when acquiring new equipment, whereas smaller companies frequently acquire equipment based on cost and ease of availability.

The demand for energy management in small businesses is increasing, driven both by the general trend of ever rising fuel prices, and that of larger companies demanding better environmental standards from their suppliers.

During the course of the ENGINE programme, the international economic situation has changed considerably, with global supply of credit and demand for products, services, and energy falling, reversing at least temporarily the trend of ever increasing fuel prices, and leading to a situation where many businesses are unable to invest in non essential investment. Even under these conditions there is still potential for most businesses to save energy through better use of existing equipment or through low cost investments, for example in better control equipment. Although the ENGINE programme looked at specific industry sectors, the examples are applicable to most SMEs.

There is market potential for almost all SMEs to cost effectively reduce their energy consumption. The availability of ever more efficient technology and impartial business advice services will aid the adoption of technical solutions. The move toward automated metering among ever smaller energy consumers will make the collection of energy data simpler and cheaper, and this will make the implementation of a more formal monitoring and targeting or energy management system.
A range of information, including reports and training material, is available from the ENGINE website, www.engine-sm.eu.

The website also has contact details of each of the project partners:

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KanEnergi AB, Skara, Sweden
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For information on other Intelligent Energy Europe funded projects, an on line searchable database is available at http://ieea.erba.hu/ieea/page/Page.jsp