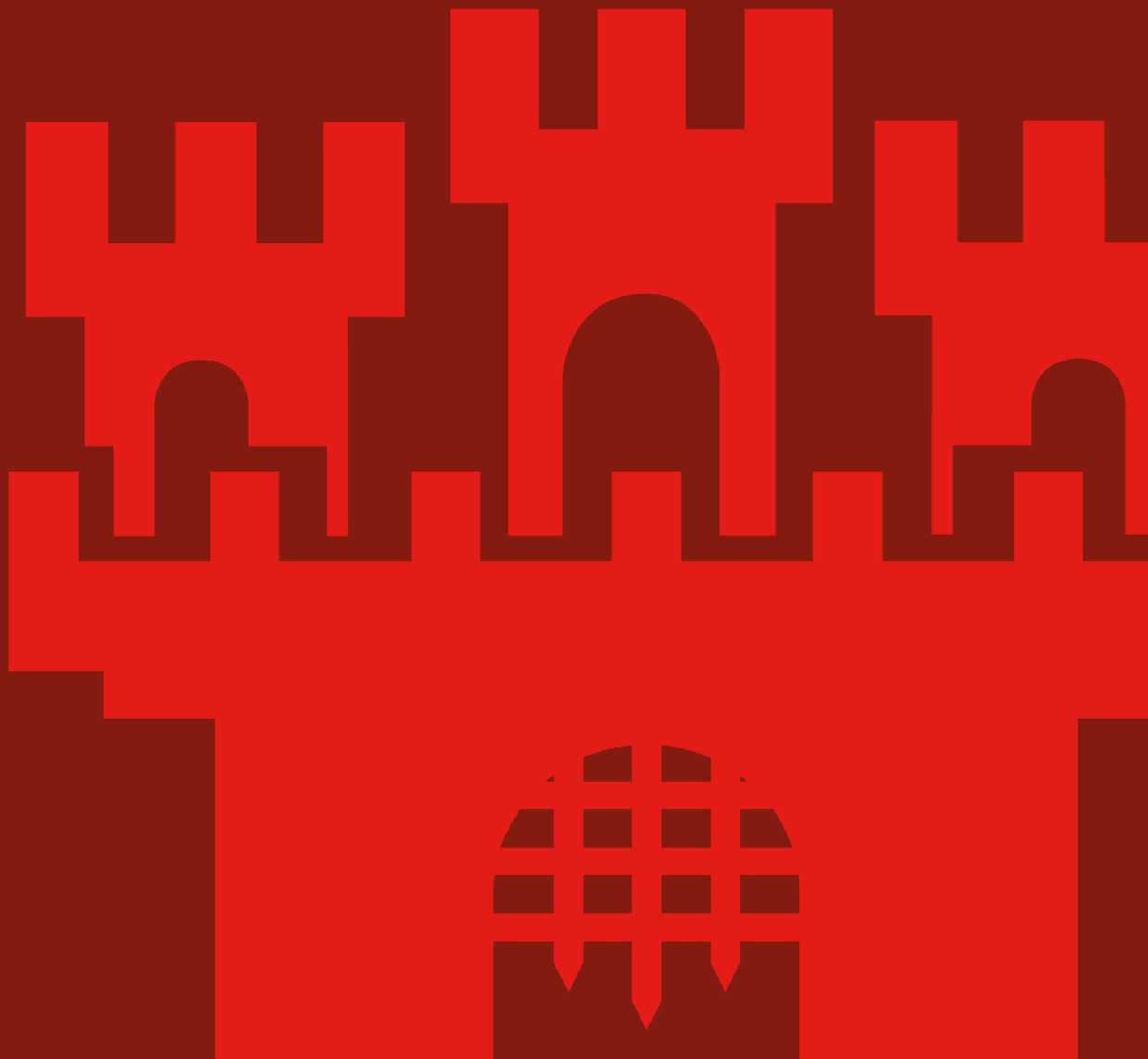




# Energy Efficiency in Industry - aimed actions leading to extended awareness all through the corporation

Regional project for energy efficiency in small and  
medium sized enterprises





- Energy Efficiency in Industry  
- aimed actions leading to  
extended awareness all  
through the corporation

Report	no. 2011:19
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ISSN	1101-9425
ISRN	LSTY-F-M—11/19--SE
Print	50 pcs.
Printed at	County Administrative Board, Jonkoping 2011
Environm. & recycl	The report is printed on certified paper and the cover consists of PET-plastic, cartons, cotton and certified glue. At recycling, the cover is removed and sorted in the combustible waste fraction, The report pages are sorted as paper material.

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## Preface

Energy efficiency and energy transition have together with climate change and climate adaptation become an issue for most companies and organizations to discuss during the last five years. The work with energy efficiency in industry in Jonkoping County took off in 2004 when the Energy Agency for Southeast Sweden began an energy audit project among companies in the highlands. During that time the County Administrative Board in Jonkoping through Miljosamverkan Sweden, began to consider energy regulators as part of the operational supervision under the environmental law. A national guidance "Energy issues in supervision" was published in October 2007 (ref 1).

The County Administrative Board of Jonkoping began its energy regulatory work during 2006 by asking companies for information about energy consumption and energy use in connection with the 2005 national environmental reporting<sup>1</sup>. The survey covered all licensed hazardous activities (enterprises) for which the County Board exercises supervision. The results of the survey (ref. 2) suggested that there is great potential and will to save electricity and reduce dependence on fossil fuels in industry, but many companies have poor knowledge of their energy consumption and can not get down to what actions are possible and profitable to implement. Consequently, the Board brought about the idea of supplementing the survey with something other than traditional supervision and monitoring of legislative compliance. An idea, that thanks to the Swedish Energy Agency's program for information, training and joint projects in energy efficiency (decision December 18, 2008), has been initiated through the successful project "Energy efficiency in industry, trade and construction industry". As well as performing energy audits at 106 SMEs and initiating energy management, the project also included establishing networks among players in the different industries.

The County Administrative Board's energy efficiency projects have in many respects been a kick-off and the beacon of the county's energy and climate strategy work. By creating a regional network among different players, a broad skill-building and increased collaboration between and within the private sector (manufacturing industry, trade and service companies), educational and public activities has emerged. Just as the recently finished project "Energy efficiency in industry, trade and construction industry" was a natural continuation of previous activities under the operational supervision, the results and experience gained in the project will be a springboard for the future. The County Board has with grants from the Energy Agency pursued a new project "Action for a more energy efficient Jonkoping County 2010-2012". This project will focus on information, guidance, seminars and training courses to create the conditions for local and regional energy network and ensure that all relevant actors, such as planners, architects, planners, construction companies, landlords, property trustees, technicians, caretakers and operators in the industry, the public sector, construction and property sector has the necessary competence to meet the demand for energy efficient and sustainable solutions.

Jonkoping 2010-12-22

Annelie Johansson, Jönköping County Administrative Board. Head of Dep. of Environmental and Spatial Planning

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<sup>1</sup> Every licenced activity considered to environmental hazardous, is set to come in with an environmental report each year, stating the condition for ex. energy management.

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## Abstract

The County Administrative Board of Jonkoping, Sweden, has for a number of years been working decisively with small and medium sized enterprises (SME) in order to improve energy efficiency. Since February 2009 a project has been running with the objective to inspire mainly manufacturing industries to adopt energy policies and to do energy audits. The project included benchmarking of similar projects in order to identify and avoid common mistakes and obstacles. At the end of 2009, more than 100 SMEs had shown interest in, together with qualified energy consultants, performing individual energy audits. Up until June 2010 over 100 audits had been done of which 85 were performed at manufacturing industries. The audits resulted in a battery of measures related to the building, water, space heat and cooling, ventilation, lighting, load management, compressed air and buying and management strategies. The measures will, if fully implemented, lead to 10-30 % more efficient energy management per year and company.

## Introduction

In 2009 the County Administrative Board, together with the local municipality energy advisors, started a project in order to take on enterprise's problems on energy management and poor compliance to national environmental legislation. The basic idea of the project was directly linked to earlier experiences in the region. The project was funded for a period of two years by the National Energy Agency together with municipalities.

## Background

Energy and climate issues have in recent years come increasingly into focus. The Swedish national environmental objectives, "Limited Climate Impact" and "Good Built Environment" indicate the long-and short-term goals to be achieved if we are able to offer future generations a sustainable development. According to the regionalized environmental objectives, revised in November 2006, the greenhouse gas emissions (GHG) emissions, as an average for 2008-2012, was at least 10% lower than in 1990. By 2020, the emissions of Jonkoping should be at least 25% lower than in 1990. The environmental impact of energy use in homes and indoor premises should also decrease and be lower in 2010 than in 1995. Energy efficiency as well as the renewable energy should be the primary means to achieve these goals.

The Swedish government has requested that The County Administrative Board in Jonkoping coordinate and drive the state's climate and energy strategy in consultation with municipalities, Energy Agencies, Swedish EPA as well as regional and local actors. In addition, the County Board is mandated to promote conversion to alternative energy sources in the relevant sectors at regional level and, in particular, to increase the proportion of renewable energy and contribute to efforts to achieve the national goal for wind energy and promote energy efficiency. The boards should also promote the energy management in buildings and the reduction of electricity and fossil fuels use heating homes and offices.

Municipalities in Jonkoping County have identified energy as a major environmental issue that should be a priority for local planning and regulatory work. Supervision work has yet to take off, partly because the environmental and public health inspectors need more training. There is also an uncertainty about the ability to set requirements for energy efficiency and conversion to renewable energy source under the general rules of the Environmental Code.

## Regional potential

In Sweden and Jonkoping County there are large energy savings potentials in companies. This is largely attributable to the fact that Sweden has had relatively low energy prices. Comparative studies show that Sweden has relatively high power consumption per unit of output compared to similar industries in other European countries. Compared to 2700 companies in 31 countries in Europe, North America and Asia, Swedish companies do not identify and implement energy saving measures. Apart from lower energy prices, there are good opportunities for economic savings by implementing energy efficiency measures. Examples show that one can make energy savings of 30-50% depending on the investment.



Many steps can be made without bringing great cost, often through simple measures in the supporting systems.

In Jonkoping there are five facilities included in the Programme for Energy Efficiency (PFE). PFE is a voluntary programme for energy efficiency in energy intensive industries i.e. pulp and paper, iron and steel industry, mining and chemical industry. Industries can join if the cost of energy (purchased and internally-generated) in the company amounts to at least 3 percent of the value of the company's production or if the company's energy, carbon dioxide and sulphur taxes amount to at least 0.5 percent of the company's added value.

The companies which join the programme are granted tax relief on their electricity costs. When the companies join PFE, the tax is reduced from SEK 0.005 per kWh to SEK 0 per kWh. Participating companies are after a two-year period required to submit a report on performed energy audit, energy management system and a list of measures. The participating companies have, through improved procedures for energy-efficient purchasing and project-planning, achieved great electricity rationalisation. Collectively, the 87 companies involved with the PFE programme undertook 1066 measures and invested a total of SEK 636 million.

The final results from the Swedish Energy Agency's five-year PFE-programme show that 87 Swedish energy-intensive industrial companies have achieved energy rationalisations totalling 1.4 TWh. This corresponds to an annual electricity consumption of approx. 80,000 electrically heated houses or, correspondingly, the City of Uppsala. The result is twice as good as the expectation of 0.6 TWh that Sweden had when the programme was commenced.

The majority of enterprises are after all not eligible for PFE. The number of enterprises in the county within the manufacturing industry is estimated at 3000, of which nearly 1000 use more than 300 MWh per year.

The regional energy agencies, especially "Energy Agency for Southeast Sweden" have been successful in managing EU-funded projects. Jonkoping County lack direct access to a regional energy agency funded which is why the number of local and regional energy projects in Jonkoping County is low compared to surrounding counties. The county has in the recent years had assistance of Energy agency of southeast Sweden, not least in the Highland project<sup>2</sup>, 2003-2005. Together with ALMI several hundreds of energy audits were performed in small and medium sized enterprises. Driving forces for companies participating was expected higher energy prices, climate issues, environmental certification and competitive reasons.

The Highland project has shown that there is great potential and will to save electricity and reduce dependence on fossil fuels. However, many enterprises have poor knowledge of energy management and do not know how to identify EE opportunities. They also lack knowledge on which investments are profitable.

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<sup>2</sup> Highland-project. Between 2004 and 2006 the highland municipalities provided free energy advice to all businesses in the municipalities. This was done with support from ALMI and the EC Objective 2 and the work was carried out in collaboration with the Energy Agency of Southeast Sweden. Municipalities wanted with this project support the local industry as energy prices began to increase the impact on businesses.

Similar projects carried out in southern Sweden show that SMEs (small-and medium-sized enterprises) need assistance to reduce their energy consumption. 70% have an increasing interest in energy efficiency after completing energy audits or surveys that provided relevant information and advice. Performed audits show that there is potential to save up to 35% energy, but that enterprises are poor at implementing the identified actions. Therefore, SMEs need help to find routines for a continuous energy management process and long-term support. The administrative board can through project funding and the regional block grant budget for energy, provide administrative resources including information and training, such as the project at hand.

## Project description and layout

During 2009-2010, the County Administrative Board of Jonkoping was the principal actor that implemented the project "Energy Efficiency in Industry, Trade and Construction Industry". The project was marketed under the name "Invest with profit in mind – to become energy efficient", and was performed in close cooperation with municipal energy advisors, ALMI, the local business community and environmental inspectors. The project had three sub-divisions: Energy efficiency in SME, Energy efficiency in trade and commerce and Energy efficiency in construction industry. This report deals with Energy efficiency in SME.

The project aims was to:

- inspire manufacturing enterprises (mainly SMEs) and trade facilities to audit their energy consumption and develop energy plans
- support the ongoing energy work in SME through networking, training and information on energy efficient technologies, methodologies and tools to reduce energy use in manufacturing processes, operations and maintenance systems (heating, water, ventilation, lighting, compressed air etc.).
- protect existing good practice that can serve as a guide for others who engaged in similar activities
- support efforts to introduce EMS or energy management as a supplement to QMS
- develop the dialogue between companies and governments on energy issues by network building activities, seminars and workshops, etc.

The project was directed primarily at SME with less than 250 employees, moderate power consumption and few staff focused on energy and environmental resources. The entire county was covered by the project but this objective was after consideration narrowed down to the municipalities that had not previously participated in similar efforts. The main focus was on Jonkoping, Habo, Mullsjo, Varnamo, Gnosjo and Gislaved. For the highland municipalities, i.e. Nassjo, Eksjo, Aneby, Tranas, Vetlanda and Savsjo, the project chose to cooperate with energy advisers to follow up the Highland Project (described earlier), to see if suggested actions from energy audits had been carried out.

The project was funded by the Swedish Energy Agency (88%) and other (12%). Other financiers included the County Council and the different municipalities. Private financing in the form of contributions included a budgeted amount of SEK100.000. The private financing was approximately 7 % of the total budget.

Target group for the project has primarily been what in Sweden is called “environmentally hazardous activities”. The target group included enterprises in mechanical industry, paper and pulp industry, surface coating industry, casting industry, etc.

## Objectives

The main objective of the project was to

- Decrease energy consumption in the industrial sector by at least 10% at the end of 2012 compared to 2005/06 levels. To achieve this target,
- At least 150 companies in industry and commerce must survey their energy use and prepare energy plans to reduce energy use
- at least 600 people in industry, trade, construction industry must participate in seminars and training efforts on energy-efficient technologies, methodologies and tools to reduce energy use in manufacturing processes, operations and maintenance systems, etc.
- At least 75 businesses must adopt energy management or have energy introduced into existing EMS
- A network comprised of the county's enterprises is created.
- Two seminars were to be held in order to present the results of the project.

## Results

### INTERACTION AND INFORMATION

In order to achieve more effect of the project a broad collaboration with local governments, especially public energy advisers, were established. The public energy advisers work at the municipalities to meet the inhabitants need for information about energy, but also to influence enterprises to be more energy efficient. They are organised by the Energy Agency for Southeast Sweden, but have no natural forums to discuss project-oriented activities with other advisers. The project therefore gathered energy advisers in the surrounding municipalities for organizing information meetings for SMEs within the project. Collaboration also involved environmental offices and municipal environmental inspectors who helped to contact enterprises. The local business office or appropriate industry association was also contacted and engaged in the project. Due to the fact that energy advisors historically mainly worked with private homes and conversion of heating source, a key issue discussed with energy advisers is how the energy issue should be addressed towards the "new" target group "enterprises" and how it should be designed to simultaneously take into account the environmental supervision perspective. County Administration Board coordinated an activity for energy advisors in the municipalities of Jonkoping, Nassjo, Vaggeryd, Habo, Mullsjo and Savsjo which led to a better understanding of business conditions and how to work with SMEs.

In connection with the planning of each information session, a working group was formed consisting of the local energy adviser, ALMI Business Partner Corp<sup>3</sup>., the project manager, business offices/companies and environmental agencies. The group planned every activity and was active in the implementation. Public energy advisor, business organisations and The Regional Council also participated in project work groups to plan for the final seminars (see above).

The local authorities in the highlands i.e. Nassjo, Eksjo, Aneby, Tranas, Vetlanda and Savsjo municipalities, was also given a chance to participate in the project. A survey on energy management was designed to evaluate earlier efforts in the region, i.e. the Highland project. The survey was sent to approximately 600 enterprises and the results are to be used in projects running from 2011-2013.

### ALMI

In March 2009, collaboration with ALMI Business Partner AB and the County Administrative Board began. Among other things ALMI administer structural funds and, within their existing project "Vaga-Vaxa-Vinn", ALMI was able to partially finance energy audits for 100 enterprises. After public procurement, six consultants were hired to conduct the energy audits. In spring 2009, several meetings were held with the ALMI to discuss the specifications for energy audits and procurement offers from consulting firms. At the end, a total of nine bids were examined. An agreement was signed by the following energy audit consul-

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<sup>3</sup> ALMI is a state owned organisation with the main objective to promote the development of competitive small and medium-sized businesses as well as to stimulate new enterprise with the aim of creating growth and innovation in Swedish business life.

tancies; E.MIL Energy & Environment, EVU, FLK, Industrial Laststyrning AB, Sweco Environmental and Ömangruppen. Later also Browik in Tranås were hired. The energy audit specifications were discussed together with the consultants. In September 2009, The County Administrative Board was contacted by ALMI Business Partner in Vaxjo and a meeting with the County Boards of Kronoberg and Jonkoping, ALMI and Energy Agency for Southeast Sweden was held. The aim was to initiate a similar project in Kronoberg.

## **MEDIA**

The project was continuously in contacts with the press, e.g. press conference in collaboration with Arla Foods (SME), press releases regularly sent out to media to inform about the project and its progress and a press conference in conjunction with DB Schenker (SME) who participated in the project. The purpose was to generally highlight energy efficiency and primarily to inform the public of energy efficiency measures implemented by the participating SMEs.

The press contacts resulted in local media (TV4 Jonkoping, Folkbladet, Smalands tidning, Jonkopingsposten and Sveriges radio) coverage of the project. Two news reports in the local television news, one radio report and five articles in the local press.

## **CONTRIBUTIONS TO NATIONAL ENERGY AUDIT VOUCHERS**

The project was acknowledged nationally in connection the National Energy Agency's commission to introduce energy audit vouchers nationally. The national government expert and later also juridical expert contacted the author of this paper for more detail about forming an energy audit proposal to SMEs and the costs of a minimum effort to do so. The project design of the energy audits has in this way contributed to the final design of the national energy audit checks.

## **INFORMATION MEETINGS**

During 2009, the SMEs of Jonkoping County were offered to attend information meetings where information and advice in areas such as energy efficiency and use of energy audits were presented. Nine information sessions were conducted and a total of 148 entrepreneurs in the seven municipalities participated in the project. The meetings were organised with the help of the local energy advisors, business companies and ALMI Business Partner AB. Their purpose was to highlight energy efficiency opportunities in the manufacturing systems and processes and to introduce the use of energy audits.

In early 2009, a meeting was held with the SWEREA-SWecast, an applied research group specialized in casting processes. The purpose was to discuss the operation of energy audits in the casting industry in Jonkoping County. Several casting enterprises are currently working with the Swerea Swecast and the Energy Agency of Southeast Sweden in the energy indicator project ENIG<sup>4</sup>. The meeting resulted in an agreement that extended energy audits were to be performed at the participating casting enterprises. This would give the SMEs as well as the Board a more detailed report and thus, a better basis for future actions.

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<sup>4</sup> ENIG -is a network created to promote energy efficiency in Swedish industry. The organizations behind ENIG are Swerea SWecast, Swerea IVF and FSEK (Association of Swedish Regional Energy Agencies). Energy Agency is a key partner and one of the financiers behind the building of ENIG.

## **SURVEY – THE PROGRESS OF PAST PROJECTS**

An important part of the project was also to retrieve information about the energy management status of SMEs in the region. In the summer and fall of 2009, two questionnaires were sent to all SMEs and retail businesses in Tranås, Nassjö, Eksjö, Vetlanda and Sävjsjö municipalities to follow up on previous participation in the Highland project (see above). The purpose was to check the status on energy management, i.e. how many of the suggested measures had been carried out and if further support for the implementation of measures were needed. It was also important to see what obstacles and problems the SMEs had with establishing energy management. 114 companies answered the questionnaire and of those, 45 had completed energy-efficiency measures and 67 were in the process of implementing these measures. Measures implemented include: lighting replacements, review of ventilation and air systems and replacement of electric heating in favour of district heating. The result of the survey is to be used to build networks between companies with similar problems and to design and run training courses for these enterprises (Project 2011-2013)

In addition, a follow-up was made by Linköping University for the project "Developing Highland" which ran 2004-2006 and involved companies in Aneby, Eksjö, Nassjö, Sävjsjö, Tranås and Vetlanda (ref 3). The Follow-up questionnaire was sent out to 107 companies part of "Developing Highland" of which 71% responded. The results showed that out of the energy measures proposed in the energy surveys, 20% had been completed and 19% was to be implemented.

## **Energy Audits in the Project**

Within "Energy efficiency in industry, retail and construction sector", a total of 106 energy audits were conducted, of which 97 in the industry sector and 9 in the retail sector. Energy consultants contracted by the County Council, carried out the audits. Each audit was documented in a written report containing a full list of all energy consuming operations, a description of each operation and proposed actions such as heating, ventilation and production, etc and a summary of proposed energy savings in kWh and in SEK. The specification also included a key figure to be able to compare enterprises. The key figure chosen was kWh/m<sup>2</sup>. In Sweden this is the most common key figure and is also in compliance with how the Swedish National Board of Housing, Building and Planning regulate energy. For casting industry there would be more interesting to calculate energy efficiency by unit of product. However the diversity of enterprises in this project makes calculation by unit of product extremely complicated. For a complete specification of included parts, see Appendix 4. For an example of an energy audit report, see Appendix 5.

During the project, the project manager, participating enterprises and consultants were in regular contact to ensure the quality of the energy audit. The result of this was higher accuracy in proposed actions but also better competency in the consultant organisation.

## **ENERGY USE**

The total energy use for the companies involved in the project was 256 GWh / year. Electricity consumption is 174 GWh / year and energy consumption for heating is 81.2 GWh /

year. Figure 1 shows the distribution of the average energy use by industry.<sup>5</sup> The category “other industries” includes various manufacturing industries as well as logistics and warehousing companies. Sector wise conclusions are difficult to draw in this category since the number companies per industry sector are low.

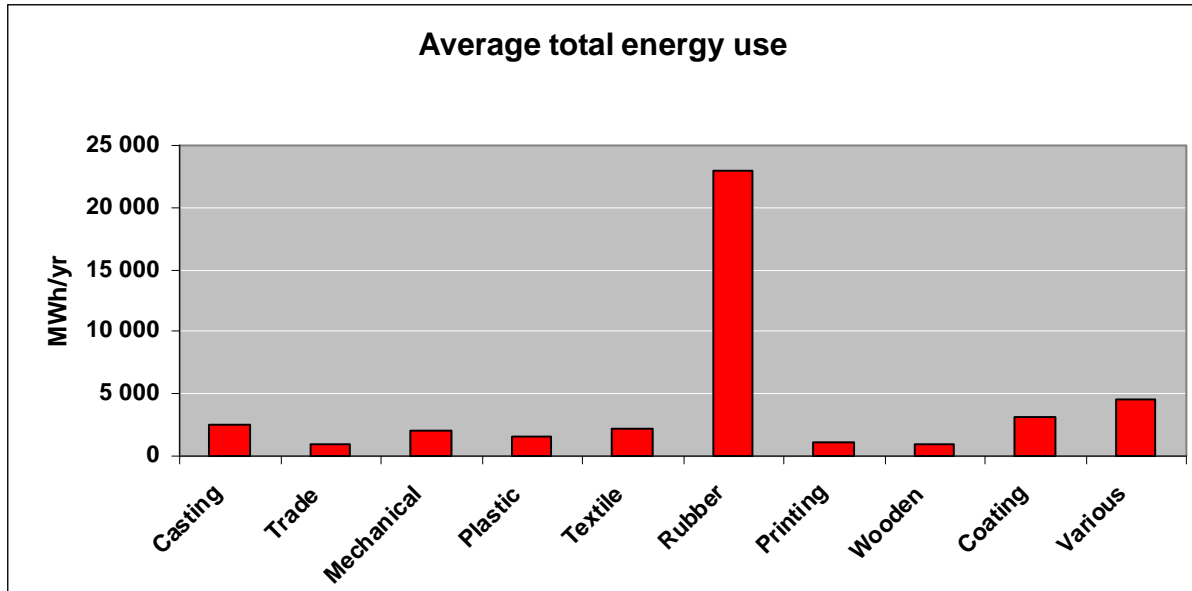


Figure 1. Average energy use per enterprise for the participating industries in the project.

The average energy consumption is clearly the highest in the rubber industry. Processing of rubber initially heated and then cooled is a very energy consuming process, which also explains the high electricity consumption for the rubber industry in Figure 2 below.

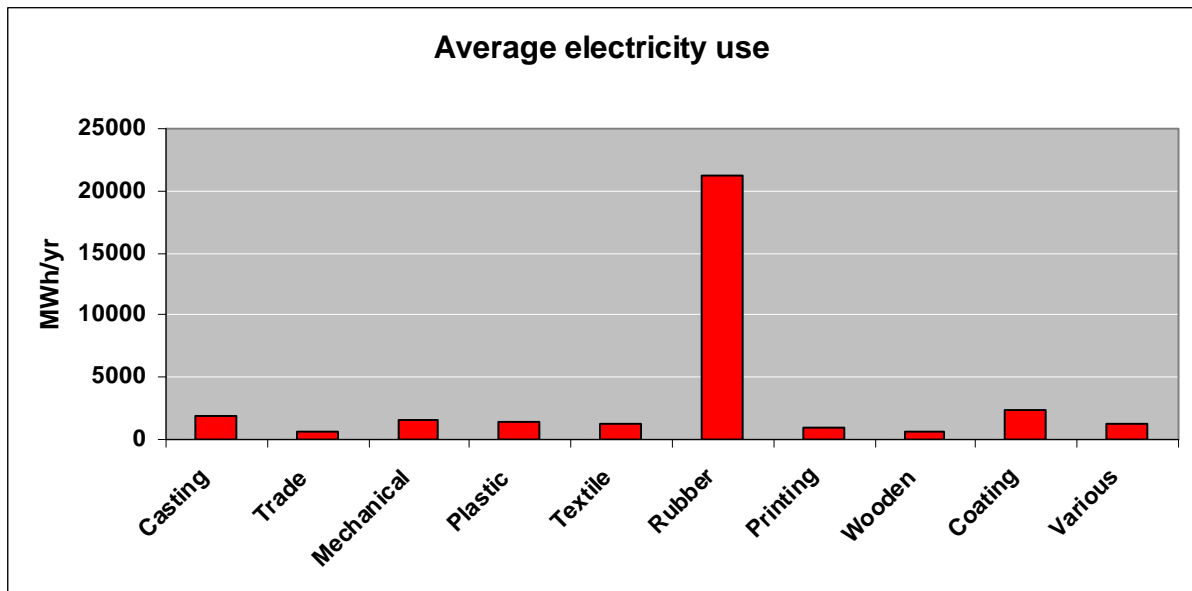


Figure 2. Average electricity use per company for the various industries.

<sup>5</sup> Number of companies participating in each sector: casting (7), retail (9), mechanical engineering (46), plastic industry (6), textile industry (2), rubber industry (2); printing (2), timber (5), finishing (11) and other (14).

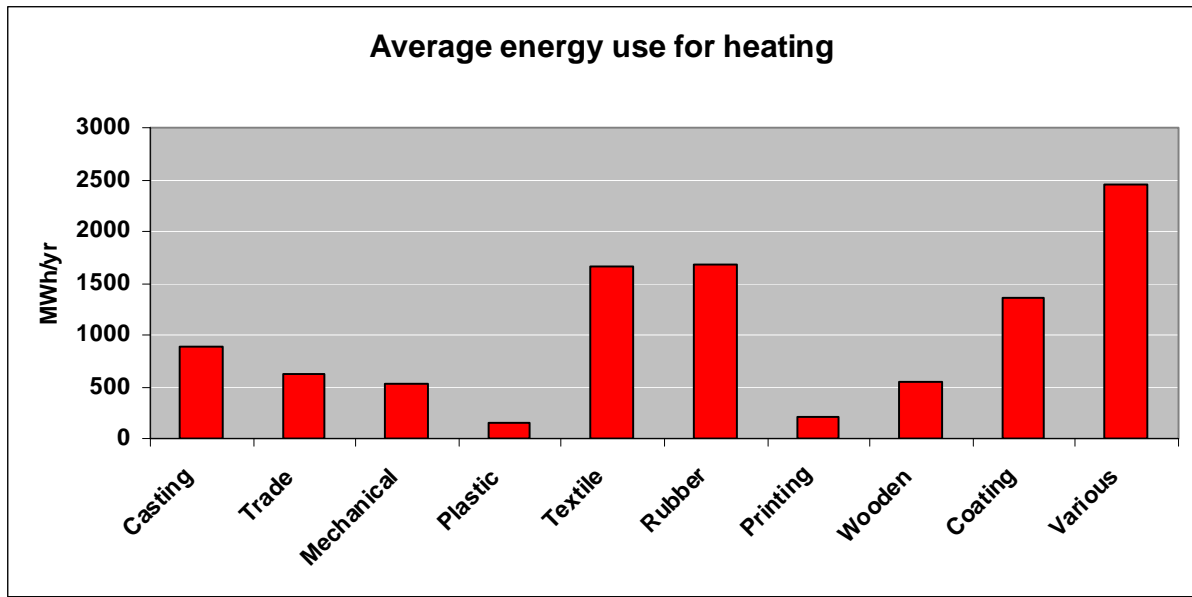


Figure 3. Average energy consumption for heating per company for the various industries.

Figure 3 shows that the average energy use for heating is greatest in the category “other, rubber, textile and coating industry.

### Fuel usage

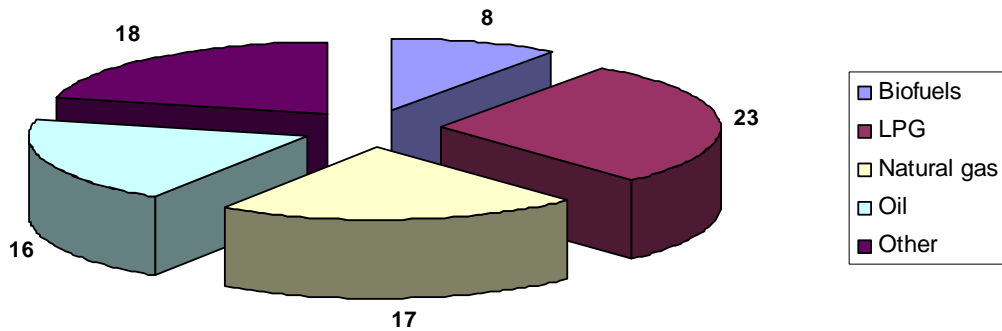


Figure 4. Distribution of fuel usage for all participating companies in the project.

Figure 4 shows the share between different fuels the companies were using. Nearly half of companies consume oil. A look at consumed GWh/year, LPG is the greatest turnaround



with 23.2 GWh / year compared with for example oil with 15.9 GWh / year. “Other” represents for the most part of district heating.

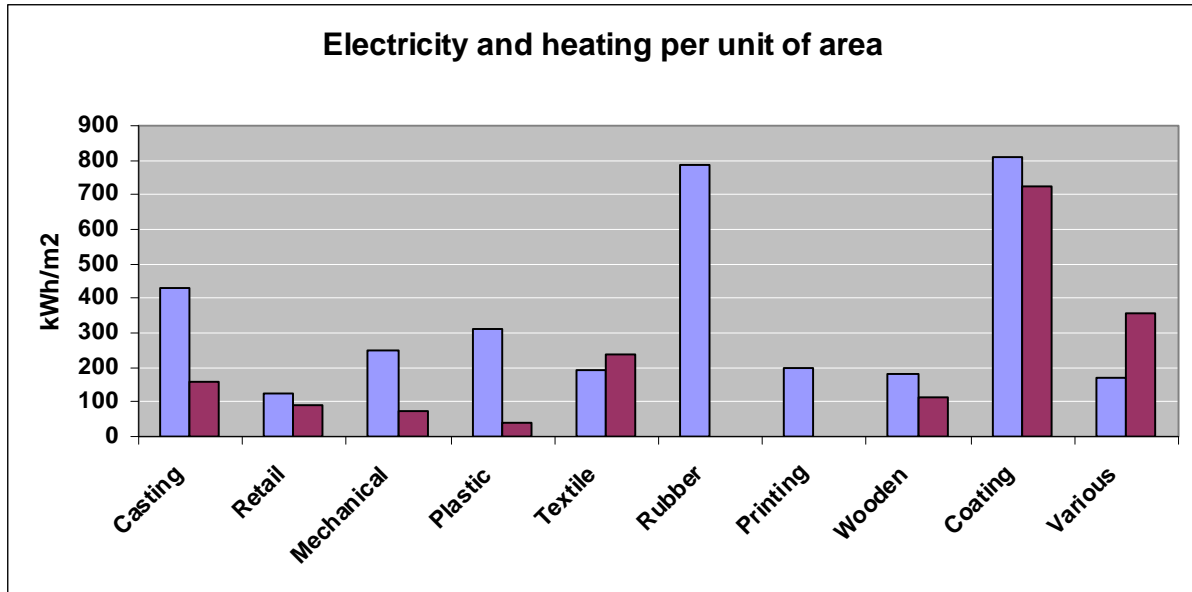


Figure 5. Electricity and heating usage per unit area for the various industries. Blue bar shows the electricity use per unit area and the purple bar shows the heat consumption per unit area.

Figure 5 shows the electricity and heat consumption per square meter in the various industries. Coating, rubber industry and casting have the highest electricity consumption per square meter.

### SAVINGS

The total savings potential for enterprise’s energy use was estimated 26.2 GWh / year, i.e. 10 % of total energy use. The savings potential represents a reduction of 7.855 tCO<sub>2</sub>/year. The total CO<sub>2</sub>-load of each company is not calculated here.

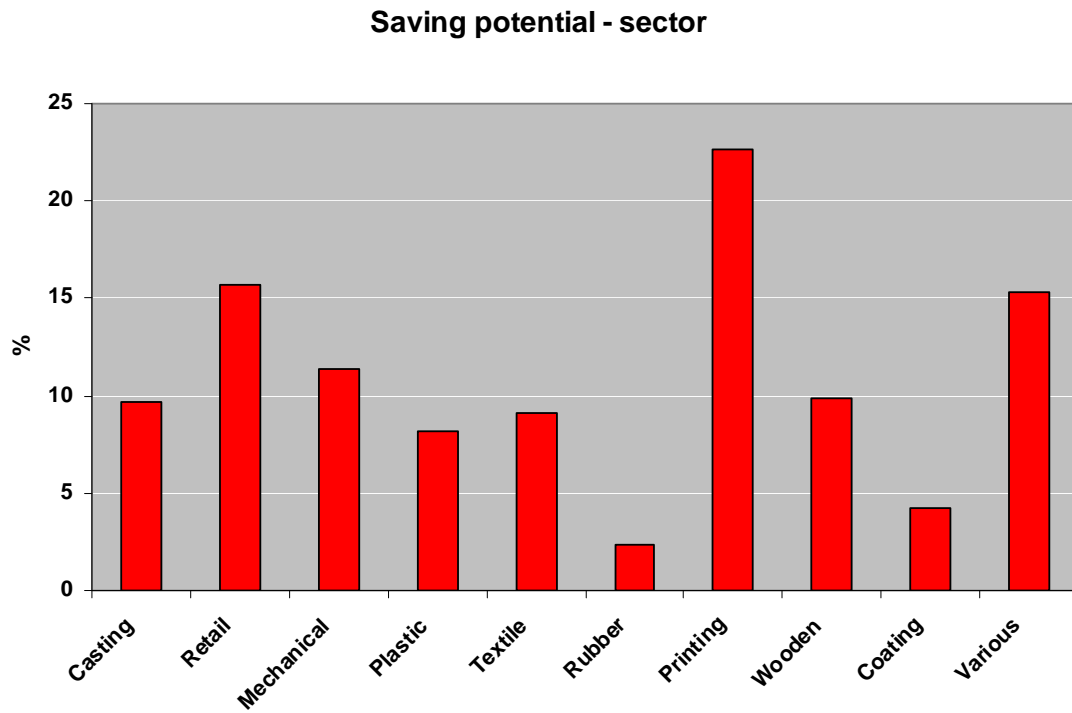


Figure 6. Savings as a percentage per year for the various sectors.

The saving potential is greatest in printers, retail and other industry (Figure 6). It is worth noting that the potential savings in the coating industry only reach 4%, while this sector has the highest average electricity and heat consumption per square meter. Measures with a approx. 5-year payback period represent 11.1 GWh of energy savings per year. Furthermore, measures requiring no investment costs equate to 5.6 GWh of savings per year.

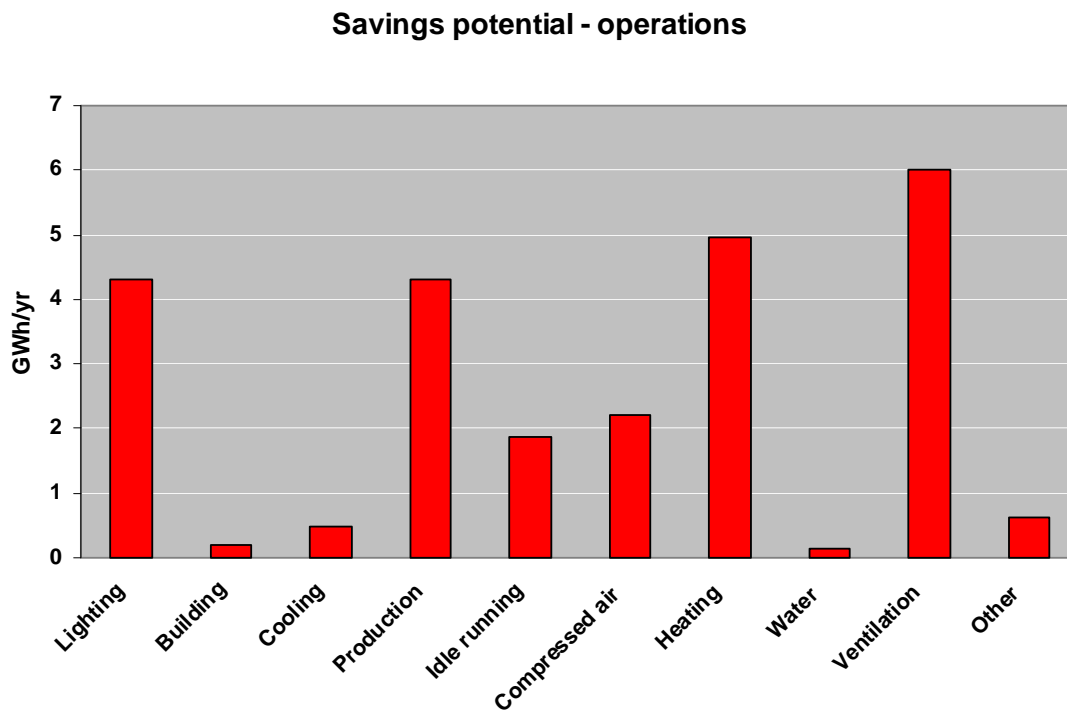


Figure 7. The total savings potential divided into different areas of internal operations for participating companies.

Saving opportunities are available in all stages of production, see Figure 7. Other represents mainly the installation of systems to supervise and monitor the energy consumption. Energy audits show that the biggest savings are in the supporting systems, such as ventilation, heating and lighting as well as in production. It is worth noting that the compressed air system and idle consumption<sup>6</sup> together account for 4 GWh / year, i.e. 16% of the total savings potential.

## Energy efficiency measures

Completed energy audits have resulted in numerous proposals to improve energy efficiency within the various fields. Below are some examples: Results in profitability are not presented here as the technology progress is fast and prices fluctuate. A statement concerning profitability would therefore only state the current situation while a statement concerning savings in energy consumption is useful during a longer period of time.

<sup>6</sup> Idle consumption is the energy consumed while the production is down, i.e. at night time, during holidays, etc.

**Table 1. Energy efficiency measures within various fields**

Lighting	Production	Cooling	Idle consumption	Compressed air	Heating	Ventilation
Replacement of light fittings	Shutdown of equipment / machines during evenings and weekends	Heat recovery from chillers	Reduce idle running power to maximum 10% of the peak	Seal leaks in the compressed air system	Heat recovery from air compressors and machinery	Need to adjust air flow
Presence control	Continuous measurement of electricity consumption at each major machine	Improved runtime settings	Walking tour when production comes to rest in order to identify the equipment that can be turned off	A switch to modern speed controlled compressors	Replacement of heat source for example heat pump	Adjust the ventilation run times for operations
Daylight control	Reduce the time and lowering the temperature in warm keeping	Better use of "free cooling"		Energy recovery	Replacement of thermostats and water heaters, etc.	Recover heat from exhausted air
Reduce the output in artificial lighting		Reducing simultaneous heating and cooling		Installation of the overall controlling system	Lowering the room temperature	Efficient air exchange with properly placed ventilation
					Need for control of peak heating	Better control of settings and smoother service intervals

## Energy seminars

Two follow-up seminars were held at the end of 2010 to track implementation progress based on the energy efficiency opportunities identified, best practice and good examples. During the workshops, various energy efficiency measures in ventilation, light and air were presented. Furthermore, enterprises shared what efficiency measures they had invested in and the savings these measures brought about see Annex 5 for the program.

Entrepreneurs participated in the workshops were very satisfied. In total, the seminars attracted 51 entrepreneurs. Enterprises received practical energy efficiency tips and were inspired to start working or continue working on energy issues in their activities.

## **SURVEY – FOLLOWING UP PROGRESS**

At the end of the project and following after the two energy seminars, a questionnaire was sent out to all 106 participating companies. The purpose of this survey was to obtain a follow-up on the energy efficiency measures planned or already implemented in order to see how well the project objectives of reduced energy consumption was fulfilled up until then.

74 companies responded to the survey, giving a response rate of 70%. Of these, 38 were preparing an energy plan for reducing energy use in its operations. 38 companies had adopted energy management or energy targets. 43 companies had carried out energy efficiency measures in their operations. Some examples of measures include: more energy efficient lighting, occupancy controls and reduction of the output of artificial lighting, measures on the ventilation systems, replacement or shutdown of energy-intensive machinery, insulation of buildings, etc.

By implementing energy efficiency measures, energy savings reached 9.4 GWh / year. Provided the implemented measures are those identified during the energy audits, 36% of the total savings potential according to the audits are made within a year. Moreover, the survey showed that 42 companies plan to bring energy efficiency measures in their operations, adding about 2.6 GWh of savings per year.

### **NETWORK BUILDING ACTIVITIES**

Throughout the project, various activities were carried out in order to create opportunities for networking between the participating companies, industry associations, consultants in the energy field, the business community, university, county municipalities, energy consultants and environmental agencies, etc. The networks have been a contributing factor to both well-attended seminars, press conferences, surveys and information dissemination as a good achievement in the sub-projects. The networks are also important to reconcile and establish a base of knowledge and facilitate the use of key persons. When starting projects these resources comes well in hand to identify and avoid common obstacles and mistakes. The project has also been involved in starting the project ENIG with Swerea Swecast and Swerea IVF.

## Discussion and conclusions

During project implementation, the County Board developed a regional climate and energy strategy (ref 5). The strategy foresees that by 2050 Jonkoping County will be a plus-energy county (i.e. renewable energy will generate a surplus. of energy). The vision is accompanied by eight global goals and 13 milestones based on each field of measures. The project has greatly influenced the energy efficiency field of measures. By 2020, energy use in Jonkoping by 2020 will be 30 percent lower than in 2008. The project has had inputs and activities including the establishment of energy networks, energy audits and seminars. The activities have led to knowledge sharing among the county's entrepreneurs and will contribute to the above milestones for reduced energy consumption.

A feasibility study on the creation of a regional energy office in Jonkoping was conducted during the project's implementation. The pilot study has investigated the possibility of creating a regional energy agency to promote energy efficiency, increased share of renewable energy as well as provide for a reduced use of energy for homes, buildings, agriculture, industry and retail. The network formed by the project and the increased interest and need to educate and assist the energy sector, contributed to the need to introduce a regional energy agency.

The project has delivered a favourable outcome, including good effectiveness and an ensured implementation of identified energy efficiency measures. The project has created wide networks that continue to grow. The increasing awareness among companies has demonstrated continued good will to learn and do more. The project was timely, both globally and locally with the running climate change and rising energy prices, which have strengthened the project and its message, and given it greater impact.

The effectiveness is sufficient although the individual objectives on energy audits and implementation of energy plans and energy management systems have not been met in full. Out of 150 energy audits initially predicted the project landed at 107. The effect of the initiated energy management work at the different enterprises is difficult to estimate. Hopefully the project has been helpful in raising the energy efficiency issue and getting to the next stage of action. Hopefully through the networks comes information and experience to be spread, which means that good examples and best practice are spread.

The companies that undertook an energy audit mostly belongs to the casting-, coating-, mechanical engineering- and plastic industries. Other industries are the wood, textile, printing, laundry and other industries. Participating companies have 2-250 employees and annual energy consumption of about 100 MWh - 23 GWh. As expected, the casting and coating enterprises have high energy consumption because of the energy-consuming processes involved. Thus, and with economy as driving force, many enterprises have worked hard to reduce their energy consumption and therefore have relatively lower energy potentials than the category of other industries. The category other industry includes companies in which the energy issue is secondary and companies therefore are less prone to act on measures and to control their consumption. The retail category includes, among others, grocery stores, which typically have a higher energy than regular retail stores, meaning that energy consumption for the category as a whole will be higher. For example, a grocery store in

Jonkoping had an electricity use of nearly 700 kWh / m<sup>2</sup>. This should be compared with the average in Sweden for the type of stores at 450 kWh / m<sup>2</sup>.

Companies use an average of 286 kWh/m<sup>2</sup> for electricity and 186 kWh/m<sup>2</sup> for heating energy, giving a total installed energy of 459 kWh per m<sup>2</sup>. 186 kWh heat energy/ m<sup>2</sup> in spite of the fact that 25% of companies not use any additional energy for heating, only excess heat from processes. Enterprises in the coating and casting industry that use much electricity in a limited area have difficulties streamlining different operations without substantial investments. Given that there are heat-generating activities and that there are people on the premises, one can at least conclude that there should be opportunities to reduce these values.

The audits clearly demonstrate the deficiencies and the measures identified energy efficiency opportunities. Industries that often have air quality problems and excess heat are in comparison, less inclined to save energy even though there are many indications telling them to do so. This supports the assumption that these industries are aware of the difficulties in managing excess heat and thus consider a solution to be a larger investment. The enterprises that need to do more according to the study include the mechanical engineering industry, textile industry and other industries.

A study of food stores shows that the stores are medium sized and similar in character. The audits show that there are potential savings in terms of both heating and cooling at these facilities. It demonstrates the difficulty in facilities that are simultaneously cooled and heated. The effect is more pronounced in the larger stores where the area for refrigerated food is reduced in proportion to the total retail store area. Different energy efficiency measures have been discussed during the visits, such as separating the refrigerated sections, either by having cold rooms or by sliding door systems on the shelf sections. Savings can also be made in the lighting section but are hampered by the high quality preferences of the exposure light.

The measures suggested in the audits have been grouped based on which area they concern, such as measures to reduce energy consumption of ventilation, etc. The exceptions are the measures that are difficult to assess or the measures that have longer than five years of repayment period. It can be observed that the average energy savings is 11% per year for the companies involved in the project. In terms of money for energy saving that is 121.000 SEK/year before depreciation. Given that many of the measures do not require any investment at all or very little investment without the need for depreciation, it may be concluded that many energy efficiency measures are both micro economically as well as macro economically profitable. Simple things like changing running hours on machines and other equipment, keeping recommended service intervals and adjusting installed effect are measures that are instantly useful both for business and for the regional energy and climate work.

As for the lighting measures, there are still considerable quantities of older lighting remaining on many industries, it is often poorly adapted to the activities available on the premises and the use of accessible controls is bad. There seems to be a public perception that things should be consumed before it is time for change and that it is better to wait with investment in the lighting field. The latter teaches a basic lack of knowledge of the extensive technical developments in this area and experiences show that it is costly to wait. Results

from an average major enterprise shows that it is possible to save 480 MWh / year alone to replace older lighting, directing it in accordance with the natural light and to adjust to the needs better.

The potential for heat savings from the proposed measures is great. The average value per enterprise is only calculated on those companies that use additional heating, a large proportion (25%) use existing process heat and recycled air heat for heating. Despite this, a lot of heat in casting, some probably used as basic heat, but nonetheless there is a large potential savings per year. The project has been supplied with information showing that many companies have worked hard to bring down electricity consumption, but there are also measures for heat energy.

## In conclusion

Based on the results from this project, the County Board will continue to work with energy issues in various projects:

- Networking for industry
- Sustainable construction and management
- Skills training in the planning, construction, management and operation
- Energy Regulators in the C-activities

The first three efforts are part of the county administrative upcoming project "Steps to an energy efficient Jonkoping county 2010-2012" , inter alia financed by the Energy Authority. The fourth effort will be carried out within the County Administrative Board's annual regulatory guidance under the Environmental Code. All the measures are deemed necessary to achieve the goal of energy use. The objective for Jonkoping is that in 2020 the county will be 30 percent more efficient than in 2008.

## FUTURE EFFORTS AT THE COUNTY ADMINISTRATIVE BOARD

The County Board will, in cooperation with Enterprise Europe Network, during 2011-2012 offer companies an opportunity to participate in the project "Energy Eff - Networking for SME. The networks will focus on corporate energy use and follow-up of energy audits will be addressed to operators in SMEs as well as management. The purpose of the networks is to further enhance knowledge on energy issues in enterprises. The principle is to share experience and learn from each other with the active support of experts. One aim is also to be taught how to take advantage of existing networks and other channels of knowledge accumulation. Another part is about getting companies to use interactive tool to clearly demonstrate connection of "cause-effect" to a larger staff group. The network project will educate key personnel through customized training sessions. These will focus on organization and management, finance, purchasing procedures and tools, behaviour and attitudes, as well as various technical aspects such as lighting, heating / cooling, ventilation, compressed air and production specific processes and machines. The offer of training activities will be aimed at all businesses in the county but companies that implemented energy audits in energy efficiency project with priority. The courses will be implemented on site locally at companies which provides valuable experience exchange and concrete examples. The project was presented at the national industry fair "Elmia Subcontractor", November 10 and 12, 2010.



## References

1. ”Energifrågor vid tillsyn”, Naturvårdsverket och Länsstyrelserna, 2007.
2. Rapport 2008:07 ”Energikartläggning gällande tillståndspliktig miljöfarlig verksamhet i Jönköpings län”, Länsstyrelsen i Jönköpings län
3. ”Energirådgivning ett vinnande koncept för svensk industri”, Carl-Johan Bondesson och Björn Andersson, Linköpings universitet, 2006.
4. Rapport 2009:35 ”Undersökning av ISO14000-certifierade och EMAS registrerade företag i Jönköpings län”, Jonathan Alvekrans och Mohamed Majed.
5. Rapport 2010:17 ”Klimat- och energistrategi för Jönköpings län”, Länsstyrelsen i Jönköpings län.
6. ”Förstudie om regionalt energikontor i Jönköpings län”, Owe Andersson, Ekangruppen, april 2010.