

EKO-Energi – Successful voluntary agreements on energy efficiency and environmental control in Swedish industry

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1. SYNOPSIS

EKO-Energi is based on a co-operative agreement between Swedish industry and NUTEK¹. ISO 14001, investments based on Life Cycle Cost and Energy calculations, LCC_e and changed behaviour are some of the results.

2. ABSTRACT

In 1994 the National Board for Industrial and Technical Development, NUTEK*, started a programme titled *EKO-Energi*. The programme's objective was long-term energy efficiency within larger energy intensive industrial companies. *EKO-Energi* will contribute to a reduction of carbon dioxide emissions to 1990 levels. The aim is also to allow companies to cut energy costs and to reduce the demand on power generation as well as to limit the use of fossil fuels. The programme runs until year 2001 and then it will be reviewed.

72 industries signed the voluntary agreement with NUTEK/STEM. The programme supports the 1992 Rio Conference's Agenda 21 and the Kyoto protocol in 1997. Therefore, the participating companies received an environmental analysis in order to speed up their application for certification according to ISO 14001 or EMAS. The analyses identified a possible reduction of CO₂ of 104 ktons per year. The results up to now show bigger savings.

In this paper we are going to present the incentives that made the industries join the programme, the tools that were offered for energy efficient purchasing and the results up to date. We have also carried out a study showing the effects of change in behaviour on the premises as a result of education and increased awareness.

3. INTRODUCTION

EKO-Energi is a programme within the Swedish National Energy Administration, STEM, for energy efficiency and reduction of CO₂ in the energy intensive industry. The program objectives are:

- Reduction of carbon dioxide emissions according to the Kyoto agreement in 1997
- Following of the EC Council Directive 93/76/EEC to limit carbon dioxide emissions by improving energy efficiency
- Pointing at energy use as one of the companies' most significant environmental impact and to implement energy efficiency work within their environmental management programs such as EMAS and / or ISO 14001.

The idea of *EKO-Energi* came up after studies of the United States Environmental Protection Agency, EPA project Green Lights: A voluntary agreement on electricity efficiency in the real estate sector. Because of this, the program was originally designed to cover electricity efficiency but shortly after extended to include other forms of energy. The programme idea took form during 1992-93 and the first agreement was signed at the end of 1994.

EKO-Energi was designed as a true Voluntary Agreement (VA) based on mutual trust. *EKO-Energi* can be regarded as a working method for implementation of the energy issues in the industries environment audits.

4. TRUE VOLUNTARY AGREEMENT

The contents of the contract with the industries were carefully chosen to secure achievement of the goals and at the same time maintaining the “voluntary” aspect. Many industries and group of industries were offered to participate. This kind of agreements between companies and authorities is unusual in Sweden and their first reaction was scepticism.

In order to secure a company-wide acceptance of the agreement, the negotiations took place with the top management, mainly the Managing Director and Plant Manager. These were accompanied by someone who was directly involved with energy/environmental matters. Because of the voluntary profile of the programme, the offered contract consisted of more carrots than sticks:

- Free energy audit by an external auditor
- Free environmental audit to speed up EMAS or ISO 14001 certification
- Education in ENEU 94² (Energy Efficient Procurement)
- Free access to information material produced by STEM for energy efficient installations and machinery
- Promotion activities such as *EKO-Energi* award and the right to use the *EKO-Energi* logotype in any promotion activity

In return the company had to:

- Establish a long term energy- and environmental policy according to EMAS or ISO 14001
- Analysis of current energy consumption as a basis for sustainable strategy
- Establish concrete efficiency goals concerning required energy, efficiency, emissions
- Conduct procurement of energy intensive equipment according to standards based on ENEU 94 /LCCe
- Report continuously planned or realised investments and measures
- Participate in activities related to the program

To avoid misinterpretation of the contract, it also included declaration of the program goals:

- reduced energy consumption
- reduced demand of power generation
- reduced consumption of fossil fuels
- reduced CO₂ emissions

and the meaning of the agreement:

- The management is responsible for the programme contents
- The company assigns a person responsible for carrying out the programme and for
- all liaison with STEM
- The company is responsible for following up the results and for reporting to STEM. The company has the right to use the *EKO-Energi* logotype when concrete and provable results have been presented

5. SELECTION OF INDUSTRIES

Some of the most energy intense industries were contacted and offered the *EKO-Energi* programme. Most of them responded positively mainly because of the offered environmental audit. An EMAS or ISO 14001 certification was well in line with the companies own plans for environmental improvement.

Information about this VA programme was rapidly spread out to other industries by the press and by word of mouth. STEM/NUTEK were contacted by many companies that wished to participate. When 42 companies had signed 72 agreements in total, the programme had to close for more companies. The limit was set by the budget. The following trades are represented in the project: Paper mill, Saw mill, Vehicle producers, Electronic systems, Glassworks, Light fittings, Car components, Engineering industry and many more.

6. ENERGY SAVING POTENTIALS

The total energy consumption in Swedish industry amounts to approximately 150 TWh per year.

It is estimated that 75 percent of a Swedish company's consumption is related to its installations for ventilation, heating, lighting and compressed air and only 25 percent to the production process. The energy audits were limited by NUTEK/STEM to energy efficiency of the buildings (plant, office, warehouse) and surrounding equipment. Energy consumption connected to the production was excluded.

Many of the energy efficiency measures identified by the consultants' required large investments with long payoff time. Therefore many of these were not considered as viable. Some time after the education in energy efficient procurement principles with ENEU 94, consideration of life cycle cost thinking became part of the purchasing routines. Investments with long pay-off time became profitable when calculating with ENEU 94 and LCC. Today, all participating companies apply LCC/ENEU 94.

In addition to the energy efficiency measures identified by the consultants, other, more cost-effective measures have later been identified by the employees. This is most certainly a consequence of information and education in energy efficiency that was part of the project and that increased awareness among them and resulted in changed behaviour.

7. ACTIVITIES

Energy efficient purchasing

One of the incentives offered by NUTEK/STEM was education in energy efficient procurement with ENEU 94 as a tool. The Association of Swedish Engineering Industries and NUTEK have jointly developed ENEU 94, which stands in Swedish for Energy Efficient Procurement, in co-operation with energy experts. ENEU is a kind of Life Cycle Cost calculation but in ENEU 94 the LCC is calculated as the sum of the investment and energy costs during the entire lifetime of the installation, converted to the present value. If required, maintenance costs can also be included.

ENEU 94 is not just a calculation method but an entire new way of thinking when planning an energy consuming investment. The actual tool in ENEU 94 is a set of forms to be included in the purchasing process of an installation or piece of equipment, covering the tender, the offer, the evaluation and the final order, as well as performance characteristics for a take-over of the installation. ENEU 94 should serve as a practical means of assistance in:

- Planning, project design and procurement of both construction related and production equipment
- Comparison of various investment options
- Measurement and control
- Calculation of any performance bonuses or penalties during final inspection or trial operation

ENEU apply to the following categories of products and systems:

- Air treatment systems, including electric motors
- Pump systems
- Refrigeration installations including motors
- Air compressor systems
- Drying installations
- Lighting
- Frequency and power converters
- Engines

Purchasers as well as plant managers and others involved in the purchasing process attended the courses. Along with ENEU 94, STEM produced brochures with Performance Directive. Investments in Swedish industries are

possible if the pay-off time is three years or less. Thanks to the ENEU 94 calculations, energy saving investments with much longer pay-off time became possible.

National and regional network meetings

The contacts between the Administration and the companies were intense during the contract signing and audit period. After the presentation of the audit reports, it became more sporadic. In year 2000 STEM decided to start a better dialog between STEM and the companies than just claiming reports once a year. All companies were invited to regional network meetings at the Regional Energy Agencies premises. The Energy Agencies invited some of the industries in their region to attend the *EKO-Energi* network meetings.

During the meetings, the participating companies had to make a presentation of their company and also of the energy efficiency work they carried out and present one success story. Other activities during these meetings were presentations by guest speakers and workshops. The minutes of the network meeting were sent out to all *EKO-Energi* contact persons so those who did not participate could benefit of the ideas and experiences presented during the meeting.

The network meetings have been a success and are very appreciated. These low budget activities have linked the companies together and stimulated to more energy efficient thinking. During year 2000 STEM arranged four regional meetings. All companies were also invited to the *EKO-Energi award* ceremony during which three companies were awarded in the presence of governmental officials, politicians, energy experts and the press.

8. GOOD EXAMPLES

All participating companies have identified several good solutions with low pay-off time. Some of them are presented below:

Södra

Södra is a co-operative for processing of forestry products with 32 000 forest owners as members. Södra's industrial operations are carried out at 12 plants, which belong to three different divisions: Södra Timber (saw mills), Södra Wood Fuel (bio energy of wood chips, pellets and wood powder) and Södra Cell (pulp mills). Only Södra Timber and Södra Cell signed the *EKO-Energi* agreement. Since the agreement, Södra has invested in many energy saving measures. Some of them are:

Changing of the heating system in head-office from electricity to central heating. Investment costs approximately 0.7 M Euro and savings approximately 33% of heating costs.

Värö Saw mill installed load-measuring and frequency controlled fans in their air pumps for bark and chips.

In Kinda Saw Mill frequency controlled fans were installed in the drying plant. Around 40 per cent of the energy use has been saved. Kinda installed also a kind of belt conveyor instead of air blow system for chips. The energy demand declined from 1400 MWh per year to 700 MWh.

Mörå Mill sells 120 GWh process energy to the Municipality of Karlshamn who uses it in their district heating. 120 GWh are equivalent to 95 per cent of the municipality's total demand.

The 1999 *EKO-Energi award* was given to Södra Timber Värö Saw Mill. The motivation was: "The company had identified a saving potential of 1707 MWh/year to be saved before year 2002 of which 1400 MWh have already been saved."

Thorn Lighting

Thorn Lighting AB is a subsidiary to Thorn Lighting Group with head office in London. Their production is mainly light fittings for professional use (street lighting, offices and factories). In 1996 they joined the *EKO-Energi* programme. Since then their oil consumption has been reduced by 43 %, the purchased energy from

district heating by 29 % and electricity by 4 %. The decline is based on kWh per produced unit and most of the decline is due to energy efficiency.

All purchasing procurement for equipment and machinery in their own production is according to ENEU. In addition, ENEU is used by their sales force, which provides their customers with better decision tools. This means that they, indirectly, have impact on the energy conservation at the end user level. Also their production designers were introduced to ENEU 94 and the result of that is reduction of raw material use.

Thorn Lighting has introduced a computer soft ware for LCC calculations for lighting. The programme, Bereco, can be downloaded from their web site and is accessible to all: www.thornlight.se.

Volvo Cars

The Volvo production plant in Skövde has initiated a project called Energy 2000 that consists of an information campaign called "Stop Needless" and other energy saving activities in the production process. The campaign that runs from October 1, 2000 until December 2001 involves all employees.

A study carried out by the company calculated that unnecessary energy use costs 190.000 Euros annually. This energy can be saved if "Stop Needless" runs successfully. Other energy saving areas are losses from machines and robots in standby position equivalent to approximately 405.000 Euros and approximately 70.000 Euros from compressed air. Volvo Skövde produced a leaflet called "Stop Needless". The leaflet shows by examples how the employees can save energy in their daily working life but it also shows how big the saving is in monetary terms. Example for leaking compressed air:

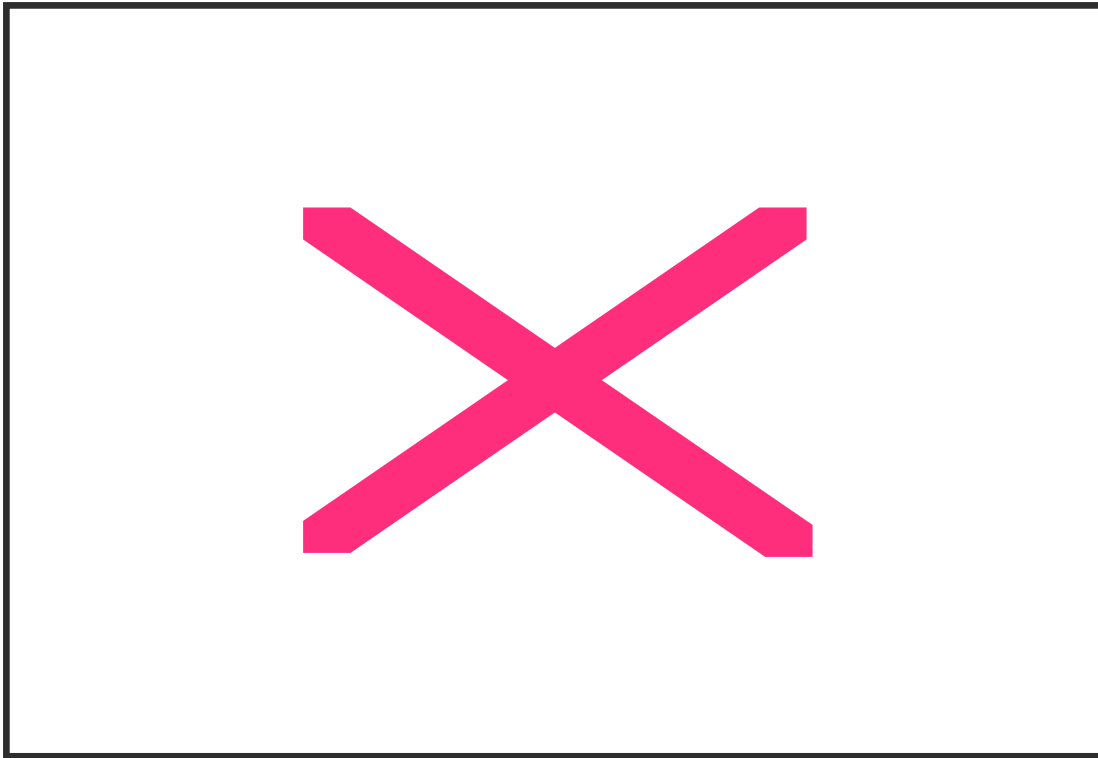
"Do you know that one single hole with five millimetres diameter in a compression-pipeline costs 1200 Euro per year! Our energy costs from leaking compression amount to 30000 Euro annually in unnecessary leakage. We can Stop Needless by: ...". Several solutions are presented together with an "emergency call" phone number so detected leakage quickly can be reported to responsible person. Other energy saving areas mentioned in the leaflet are lighting, open doors, standby losses both in the office and in the process and water consumption. There is also a presentation of how the energy issues are treated in the company, energy saving goals and on going projects.

All employees received a presentation of the campaign and of the *EKO-Energi* programme. The leaflet has a coupon on which the employees can write ideas on how to save energy and send it to the project office. The good ideas are awarded monthly with free lunches or energy efficient bulbs. Twenty per cent of the energy savings will go back to the employees in some kind of award.

The "Needless" site on Intranet, <http://violin.vccce.vcc.volvo.se> can be visited by all employees. They can find information about who the winner of the month is, proposed solutions and other interesting issues. The aim of this project is to increase the employees' energy awareness and change their behaviour.

Volvo Cars in Skövde joined the *EKO-Energi* programme in 1998. Since then their energy production per produced engine has been reduced by 9 per cent. Their goal is to reduce the energy consumption per produced engine by another 8 per cent by year 2003 compared to year 1999.

Example from the Intranet page “Stop Needless”



9. ENERGY EFFICIENCY AS A RESULT OF CHANGED ATTITUDES AND BEHAVIOUR

The University of Lund, under the leadership of professor Anna-Lisa Lindén, has carried out a study evaluating the *EKO-Energi* programme. The study is based on interviews with 13 representatives from 9 participating industries, with consultants involved in this project and with the NUTEK/STEM staff responsible for the project. The outcome of this study is:

- The energy- and environment audits have been very useful in the companies' future work. The *EKO-Energi* programme as a whole but particularly the audits have given increased priority to energy efficiency and environmental issues.
- The proposed energy efficiency measures have gradually been implemented, starting with those with no or very little pay-off time and with a schedule for those measures that require substantial investment costs.
- In many cases the proposed purchasing rules in ENEU have been easy to incorporate in the companies existing routines.
- *EKO-Energi* speeded up the companies' certification process.
- The network meetings are very appreciated and are regarded as very important in the learning process.
- In the past years, the Swedish industrial era with few big, often very old companies with solid records changed. Companies with few Swedish owners suddenly were introduced to the stock market, consolidated with foreign companies or split up. Management changed and employees made redundant. This scenario was not foreseen when designing the contract for voluntary agreements. Therefore, during the programs running period, many of those who signed the contract have left the company and the new ones did not feel responsible. Maybe, because of the Swedish politeness, all of the new management has accepted to continue the programme.
- The external factors that affected the results are the declining electricity prices that made some suggested investments too expensive so they had to be removed from the budget because of too long pay-off times.
- There was an uncertainty among the companies about the reporting of energy consumption and energy efficient measures. Especially when the companies changed management or owners, it was not very clear to

them if the contract was still valid and if they still had to report to the Authority or not. The Authority should take the responsibility for the interpretation of the contracts. Even though they are called Voluntary Agreements, it should have been made very clear right from the beginning that the companies committed themselves to send in a report once a year.

Our comment to this last point is that almost all participating companies report the energy savings achieved every year. The amount that apply for the EKO-Energi award is 50 per cent. One reason for this low rate is the budget seasonality. Our call for tender is mid January every year. Some of the companies have other budget periods than calendar year and have not the required information in time. Another reason can be that they have not saved much energy a particular year and find it needless to send application. They still have to report but these reports are sent after their budget period is closed.

10. RESULTS

A more creative thinking has been noticed among the participating companies. They appreciate the benefits of reduced energy consumption and they keep finding new financial solutions to cover new investments in energy efficient equipment or installations. Some of the industries have started or increased their co-operation with utilities, local governments and other industries in the area. They supply bio-energy, hot water or steam and replace oil with district heating or gas.

All those involved in the purchasing of energy requiring equipment in the participating companies adopt LCC and LCCe as a tool instead of payoff calculation.

All companies are EMAS/ISO 14001 certified or in process of certification.

Despite change of management and staff in most of the companies, the companies stayed in the project and continue to report their activities and energy savings.

11. CONCLUSIONS

Those who work with energy efficiency and environmental issues and identify areas that can be improved, have difficulty in convincing the decision makers to allocate money for this type of investments. It is therefore important to ensure that the management supports the Voluntary Agreement and that the agreement includes an instrument of pressure to achieve agreed results.

Because of the rapidly changing market, new constellations, new management and new organisation, Voluntary Agreements should be signed for shorter periods. In the *EKO-Energi* case, it was very difficult to motivate the new management and the new staff to continue the agreement.

Large industries have well functioning departments for maintenance and control of the process, monitoring of energy and water consumption and very often an environmental control system. Those who really need a VA are the smaller industries. An energy efficiency programme for small and medium size industries should be considered.

The importance of the psychological climate in the companies and change of behaviour along with increased energy awareness must not be neglected.

Education and communication are two key words in Voluntary Agreements between authorities and industries.

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13. END NOTES

¹ Since 1998 the Energy efficiency unit within NUTEK has been reorganised to a new energy authority, Swedish National Energy Administration, STEM.

² ENEU 94 has been revised and the new version introduced in 2001 is renamed to Kalkylera med LCC_{energi}