

Motivation for industry to increase energy efficiency

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1. SYNOPSIS

Barriers for the implementation of efforts to increase energy efficiency in the manufacturing industry and experience from attempts to overcome the barriers.

2. ABSTRACT

Every sector of society has to join the efforts of increasing energy efficiency and changing to cleaner fuels, but the instruments to ensure this development vary from sector to sector. For almost every company in the manufacturing industry, energy efficiency is a "non-strategic" problem: Investments in this area will not help these companies in their competition in the market. Furthermore, for most companies the cost of energy constitutes only a negligible part of the total costs of production. Consequently, many times the companies in the manufacturing industry seem uninterested in investing resources in increasing the energy efficiency. And to make a company decide to invest, the company usually will demand a much better profitability of investments in energy efficiency than of investments in areas of strategic interest to the company. The Confederation of Danish Industries has taken a number of initiatives in order to increase the energy efficiency in the manufacturing industry. Most of these initiatives will increase industry's attention to and the knowledge of energy savings. The most important initiative has been to establish rules for energy audits in industry. The energy audits should help the individual company to identify its own specific possibilities of energy savings. Other initiatives are related to whole lines of business. Here demonstration projects are carried out, and companies are invited to take part in working groups that would deal with the exchange of experience from energy savings and energy management within different lines of business. Some technologies for energy savings are relevant for all lines of business within the manufacturing industry, and for these technologies initiatives are taken to carry out information campaigns on these subjects.

3. AIMS FOR THE DANISH ENERGY POLICY AND FOR INDUSTRY

In 1990 the Danish Government presented a plan of action concerning energy in which it described how Denmark would lead the way towards fulfilling the target of reducing the national emission of CO₂ by 20 per cent before the year 2005.

By the year 2005 the Danish plan of action is expected to have resulted in a reduction of the gross consumption of energy by just under 15 per cent, as well as a change towards "cleaner" fuels, the most important being an increase in the consumption of natural gas by about 170 per cent.

The manufacturing industry was supposed to continue its ongoing development towards more energy efficient production. In the last 15 years energy consumption per produced unit has decreased by 22 per cent, and until 2005 this was assumed to decrease further by 22 per cent without the use of any special measures. Similarly a certain change towards "cleaner fuels" (primarily natural gas) was assumed to happen of its own accord.

To fulfil its part of the plan, the extra efforts of the manufacturing industry should be to increase its energy efficiency by an additional 8 per cent. The change towards the use of natural gas should be stepped up, and a considerable increase in the use of combined heat and power production was assumed.

Politically the Confederation of Danish Industries decided to support the objective of the plan of action,

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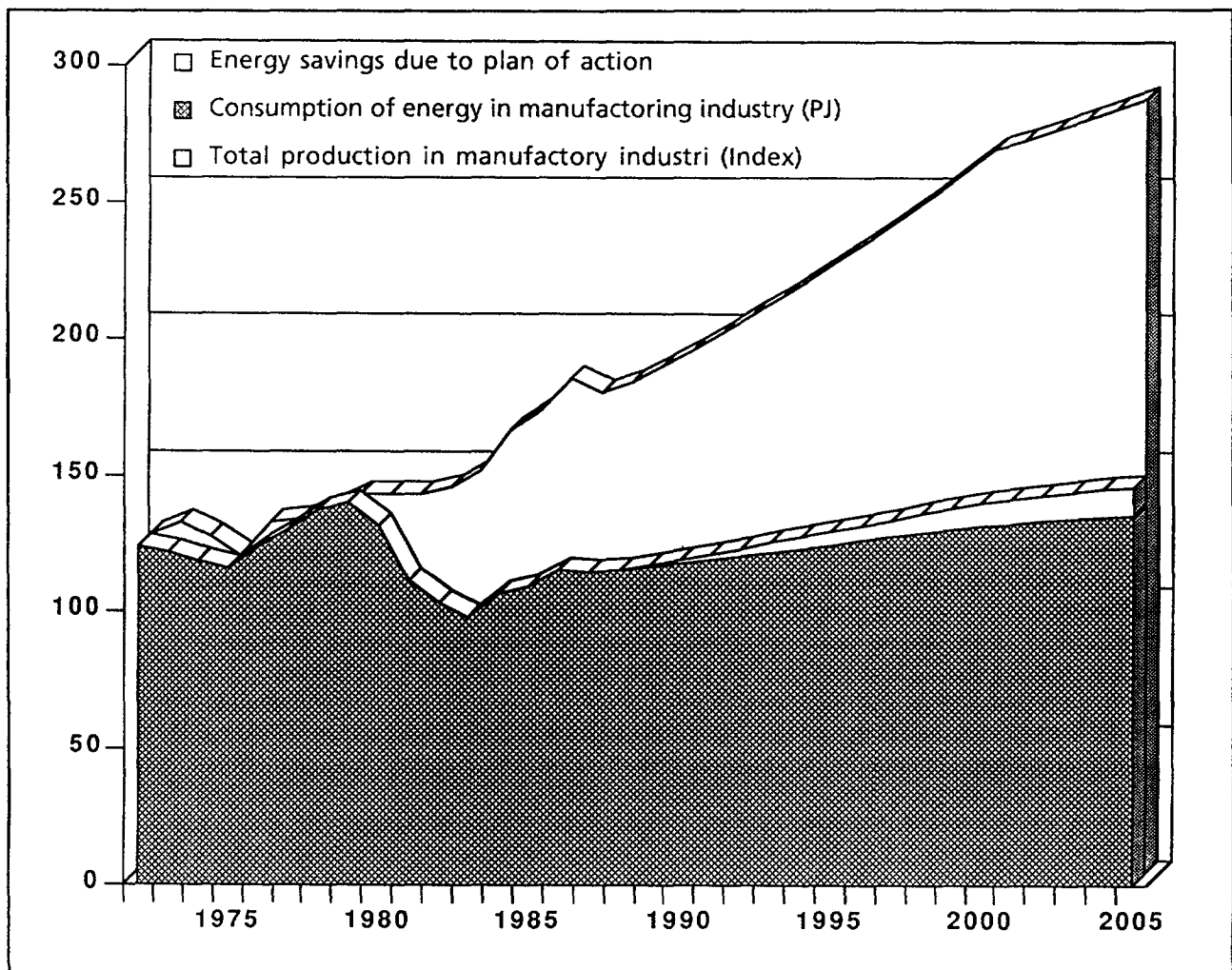


Figure 1. *Production and energy consumption of the manufacturing industry*

though without lending its support to some of the major measures proposed by the Government. One of these measures was environmental taxes on CO₂-emission. Industry did not believe that environmental taxes would encourage the companies to further investments in energy efficiency. On the other hand a unilateral Danish CO₂-tax would reduce the Danish competitiveness considerably.

The challenge was thus to find measures, which would ensure that industry reached its goals without harming its competitiveness.

4. LARGE POTENTIAL FOR PROFITABLE ENERGY SAVING

Different research projects in Denmark have indicated that considerable parts of the energy consumption in the industry could be reduced if the companies carried out profitable investments in energy efficiency.

One example is a survey carried out by the research institute AKF (Togebj & Hansen 1992) covering on all the 37 major manufacturing companies in a limited part of Denmark. In each company in principle all the profitable possibilities of saving electricity were explored. On the background of this survey the consultants recommended the companies to carry out a total of 286 energy savings projects, which all resulted in a cumulated saving greater than ECU 650 (DKK 5,000) and had a simple pay back time of less than 4 years. If all the recommended projects were realized, they would reduce the consumption of electricity with

approximately 10 per cent.

A Swedish project for efficient use of electricity (Vattenfall, 1992) has similarly come to the conclusion that 8 to 14 per cent of the electricity consumption can be saved in the non-electricity-intensive industry. The potential for the electricity-intensive industry is approximately 5 per cent.

An interesting conclusion of the research project carried out by AKF was that in many cases it was more

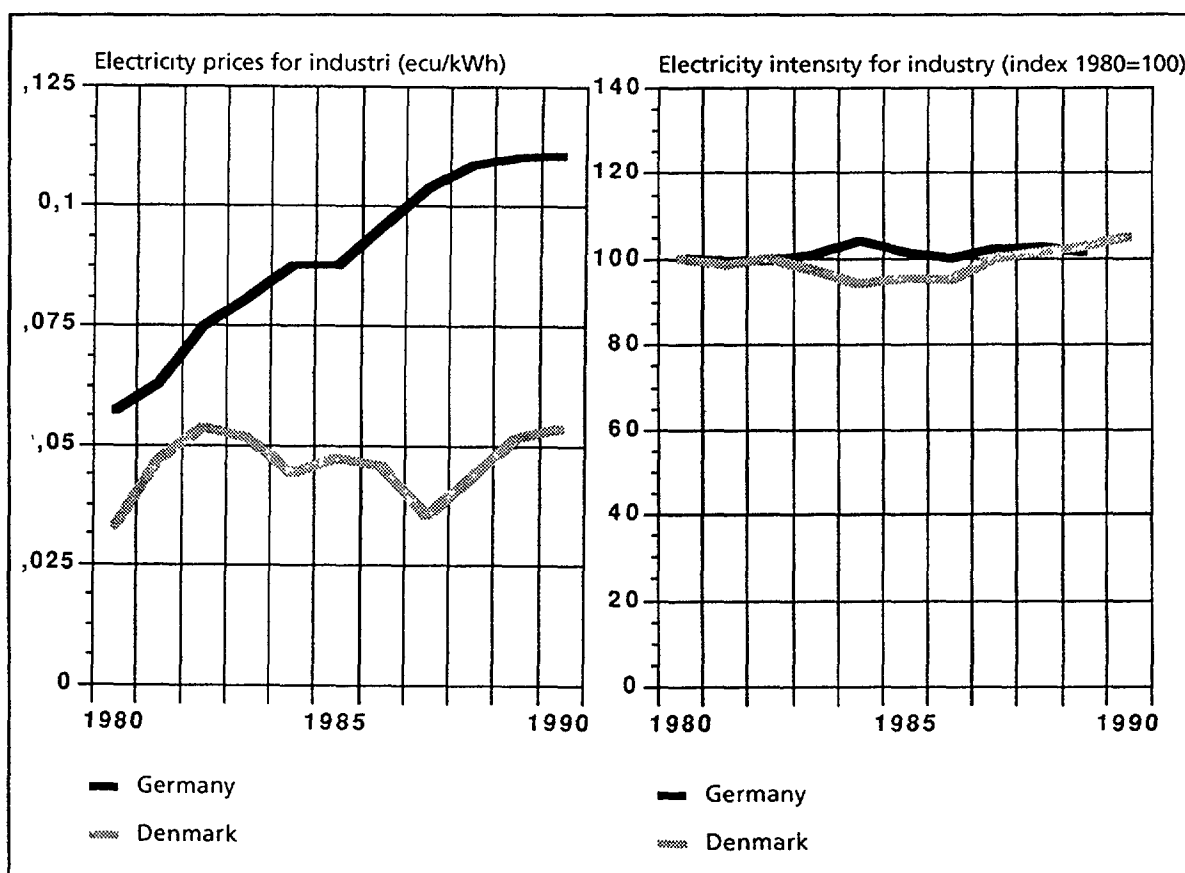


Figure 2. Electricity prices and electricity intensity of Danish and German industry (Eurostat: Energy proces 1978-1990 and European Economy, No 51)

expensive to identify the potential savings than to implement them.

5. FISCAL MEASURES DO NOT WORK

The use of fiscal measures to promote energy savings in industry is based on the assumption that the companies always react rationally to the price signal. The fact that industry already has a large potential for profitable energy savings which has not been realized indicates in itself that higher prices will not automatically bring a significant rise in the investments in energy savings.

A simple comparison between the development in the electricity prices in Denmark and Germany indicates this lack of a clear tendency. In the period from 1980 to 1990 the German electricity prices rose constantly resulting in a 100 per cent increase from 0,06 ECU/kWh to 0,12 ECU/kWh. During the same period the Danish electricity prices varied in the interval from 0,04 to 0,05 ECU/kWh.

If the consumption of electricity unambiguously was a function of the price, the electricity intensity should have developed significantly different in the two countries, but it did not. In both countries the tendency was a constant intensity, and as a matter of fact the intensity did increase a little in Germany compared with Denmark in the mid-eighties, while the prices in Denmark had a downward tendency.

The Swedish research project Uppdrag 2000 (Vattenfall, 1992) has confirmed that electricity price alone is not a sufficient incentive to implement conservation measures. Only 15 per cent of the customers considered in the survey can be regarded as price-sensitive, to the extent that a substantial rise in price would result in them attempting to improve their efficiency of energy use.

6. ENERGY PRICES NOT UNESSENTIAL FOR INDUSTRY

Although industry does not react unambiguously to the changes in energy prices, it can not be assumed that energy prices are unessential for industry.

The energy intensive part of the Danish manufacturing industry accounts for only 6 per cent of the employment (Dahlin et al., 1990), but accounts for more than 50 per cent of industry's consumption of energy. In those companies where the energy cost constitutes 3 to more than 15 per cent of the production value energy prices are certainly not unimportant for their competitiveness. This is especially the case in sectors where the product's price (rather than design et al.) is the main competitive parameter, which is the case in most of the energy intensive sectors, e.g. cement, iron foundries, oil mills, and the production of fish meal.

The situation is rather that the primary focus in the companies has to be on their strategic issues: the purchasing of raw materials, product development, production, sales activities, etc.

Know-how and awareness are limited resources in the companies in the same manner as is, for example, money. In the competitive situation in which the companies are living they will usually have to concentrate on solving the problems of keeping production going and to ensure that the necessary expertise and working resources are continuously available for the central parts of company activities.

For almost any manufacturing company energy is just the kind of cost which has to be paid. Of course energy savings are carried out when someone becomes aware of the possibilities, but for most companies it is not "rational" to spend considerable resources in finding energy savings. And finding all profitable energy savings just requires the use of considerable resources.

7. NECESSARY MEASURES: INFORMATION AND CHANGE OF ATTITUDE

Future energy conservation does not only depend on technical and economic conservation potentials. To start with, there must be a demand for the particular technology involved.

The decisive factors in determining the conservation result that a particular technical or economical potential will finally deliver can be summarized in the concepts of Acceptance and Take-Up as described in Uppdrag 2000 (Vattenfall, 1992).

The various factors that together influence the acceptance and take-up of the various measures, and thus of the resulting actual conservation performance, are illustrated in Figure 3.

The initiatives launched by the Confederation of Danish Industries are primarily in terms of increased acceptance of the energy conservation. The focus has been on increasing industry's attention to and knowledge of energy conservation.

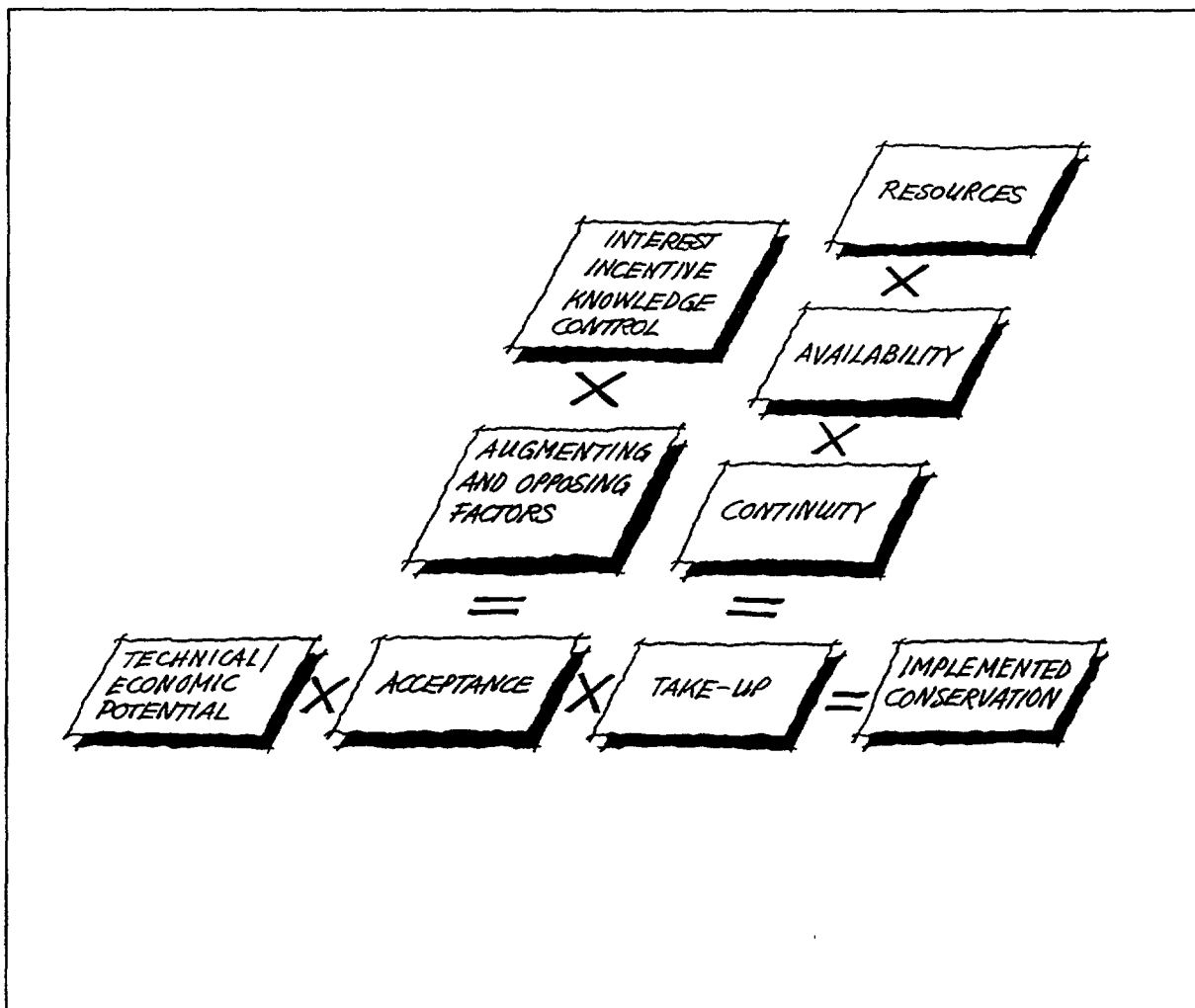


Figure 3. Factors that influence conservation results (Vattenfall 1992)

The most important initiative was an arrangement for energy audits in industry. The energy audits should help the individual company to identify its own specific possibilities of energy savings.

Parallel to the work on energy audits in the Confederation of Danish Industries, the Danish Parliament has passed two laws on the same subject. One law makes it possible for the most energy intensive companies to avoid paying CO₂-tax if they, among other conditions, have an energy audit conducted. The other law makes it possible to obtain subsidies from the state to conduct energy audits.

Other initiatives from the Confederation of Danish Industries were related to whole lines of business. Here demonstration projects were to be carried out, and companies were to be invited to take part in working groups that would deal with the exchange of experience from energy savings and energy management within different lines of business.

Some technologies for energy savings would be relevant for all different lines of business within the manufacturing industry, and it was suggested to carry out information campaigns on these subjects.

8. ENERGY AUDITS

Energy audits are an important instrument to give the companies a specific basis for decisions on the implementation of initiatives to increase energy efficiency. As described in the Danish legislation, an energy audit should also be an effective help to the individual company in its implementation of energy management, and in its awareness of energy efficiency when new equipment is purchased.

We still do not have any experience on the effect of energy audits conducted according to the Danish legislation. More than 500 companies, of which a large part was green house gardening, were submitted to an energy audit in the last months of 1992 as a part of the conditions to avoid paying the CO₂-tax. The law on subsidies to energy audits did not come into force until January 1, 1993.

For the time being the experience on energy audits in Denmark is restricted to a number of audits carried out as a part of a large research project undertaken by the research institute AKF (Togeby & Hansen, 1992), covering all the 37 major manufacturing companies in a limited part of Denmark. The audits only focused at electricity.

In each company a thorough audit was conducted by consultants spending an average of 250 to 300 hours on each audit. The aim was to identify in principle all possible initiatives to reduce the consumption of electricity with a pay back time of less than 4 years and over a certain value. All kinds of electricity consumption including the manufacturing processes were examined.

As a result of the audits the consultants recommended that saving initiatives be conducted which could reduce the consumption of electricity by an average of 11 per cent.

One year after the audit had been carried through, the researchers interviewed the companies in order to evaluate the consequences of the audits. This showed that the result of the audits was a 2,5 per cent decrease in the electricity consumption and an expectation of further savings within a short time 0.5 per cent more.

A conclusion could be that energy audits give significant results and that the savings conducted are able to pay back the costs of the audit as well as the necessary investments.

But energy audits as the only instrument is not sufficient to reach the political goals. Other measures are necessary as supplements to the audits.

In the future the Confederation of Danish Industries hopes a large number of companies will conduct energy audits voluntarily and not only as a part of the conditions for avoiding CO₂-taxes. In such voluntary cases when the companies pay a larger part of the costs of the audit themselves, the companies will have a better motivation for implementing the recommendations, because doing so is the only way to get back some of the costs of the energy audit.

8.1 Standard Energy Audits for Specific Lines of Business

Thorough energy audits can be very expensive. In order to reduce the costs it will be tried to set up standards for energy audits for companies in lines of business with homogeneous energy conditions. The expected cost reduction is especially necessary if energy audits are to be conducted in companies with relative small consumptions of energy - a situation which applies to the largest number of companies in Denmark.

The establishing of these standards has just started, so the only experience in this area is the difficulties in defining a homogeneous group of companies. It has become apparent that the companies regard themselves as part of one line of business which do not have any homogeneous conditions on energy. As an example, the professional association for the Danish Packaging Industry has initiated the establishing of a standard. The early stages of this work has shown that the only thing the members have in common is that they

produce different kinds of packaging: Some of plastic, some of paper, and others of wood.

9. ENERGY MANAGEMENT

The continuous attention to energy consumption is important, because it enables the companies to appreciate why changes take place in the pattern of consumption. It also makes it more probable for possible savings to be identified and implemented.

Continuous energy management demands a certain awareness in the company. And although most companies have unexploited resources in this field, for example among the blue-collar workers, awareness is a limited resource in every company. Consequently, energy management should be easily practised and be result-oriented in order to be successful.

To help the companies practise effective energy management effectively, energy audits conducted according to the Danish legislation require of the consultants that during an energy audit they tell the companies how to handle energy management as well as possible.

Many methods of energy management will be the same in whole sectors. At the same time companies in a given sector will often have the advantage of being able to exchange key figures to evaluate their relative position.

The Confederation of Danish Industries has, therefore, invited companies in some sectors to take part in working groups to deal with the exchange of experience from energy savings and energy management within whole lines of business. The preliminary experience from this work is that it is very difficult to involve the staff of the companies actively in the working groups. Even if the work has taken place in an energy-intensive sector, we have not yet succeeded in giving these people the impression that their work in energy

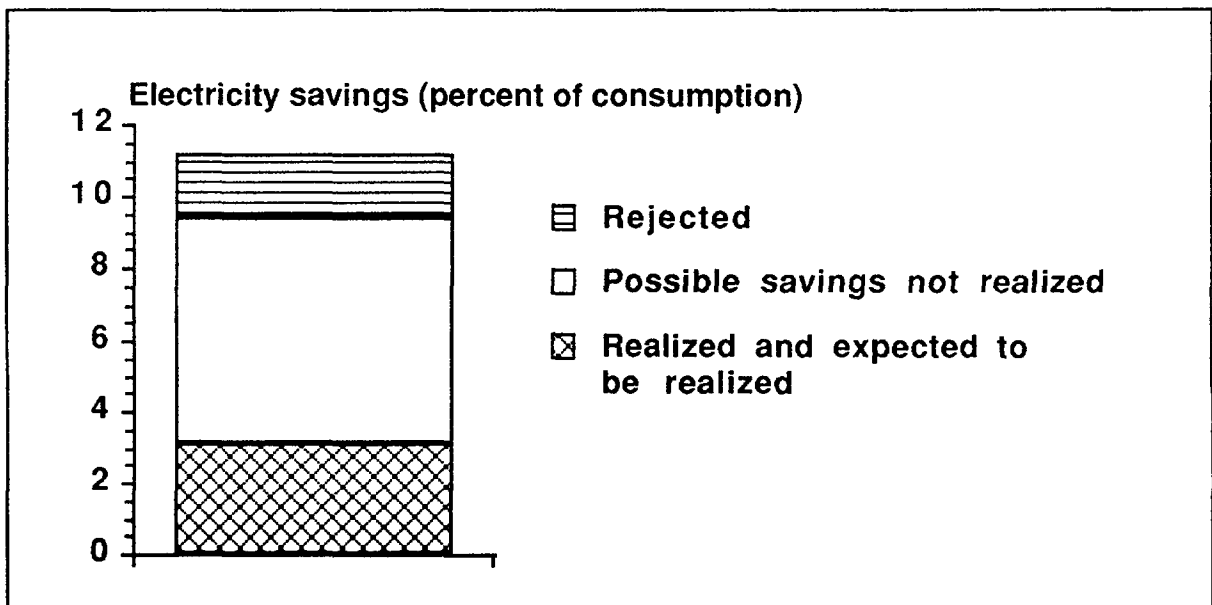


Figure 4. Results of recommendations one year after energy audits (Togebj and Hansen, 1992)

management gives a surplus in both time and money. They tell us that they would be interested in energy management "if they just had the time!". They did not feel that energy management was a way to release resources for themselves, which it might be, if they succeeded in involving the blue collar workers in the process.

The Federation of Swedish Industries has been more successful in building up similar working groups in the energy-intensive sectors. Since the first "oil-crisis" in 1973/74 representatives from the companies have met regularly in working groups within different lines of business to exchange experiences on energy matters. In the beginning focus was on security of supply, later on prices were in focus, and now energy and environment are treated together.

10. MODEL COMPANIES

For the manufacturing industry energy audits are something new, and the companies do not have experiences of their own to tell them that energy audits can identify enough energy savings to make it worthwhile - and they are not sure that the recommended initiatives give the expected results.

Under normal circumstances energy audits and their consequences will be a matter of confidence between the consultant and the company. This makes it difficult to increase trust in the usefulness of energy audits.

To reduce the uncertainty the Confederation of Danish Industries has proposed a number of model company projects in which the companies, after an energy audit, carry out all the profitable energy savings. The idea is to publish the report on the energy audit, and that the company should be willing to share its experience and to have visitors from other companies - also from their competitors.

Six plants have until now been chosen as model companies, and the plan is to realize a total of ten projects. In each case an energy audit is carried out, paid by the state. In return for this the company promises to realize all the profitable energy saving, recommended by the consultant during the audit.

During the whole process the company and the consultant in cooperation inform other companies of the experiences gathered - both positive and negative. This is done in articles, public meetings, and during site visits.

We hope the projects will be effective in terms of dissemination, and the first projects have shown positive results. For example, one plant, known as being very energy conscious, was able to save 13 per cent of its consumption of electricity. This was not only the sum total of the recommended initiatives but the measured effect of the realized changes in the plant.

11. INFORMATION CAMPAIGNS

None of the different measures provided by the Confederation of Danish Industries is able to stand alone. The companies which have conducted energy audits will for instance need continuously to be influenced to retain their awareness of energy efficiency. To this purpose information campaigns are an effective measure, with the added benefit of being able to reach companies that have not conducted energy audits yet.

Information campaigns are useful on subjects that are relevant for all lines of business, i.e. lighting, compressed air, cooling and ventilation.

In the beginning of 1992 an information campaign on energy efficient lighting was carried out. It was carried out in co-operation with the public authorities, the utilities, the commercial interests involved, and with the trade organizations covering the target group.

The purpose of the campaign was to raise the level of knowledge of efficient lighting among the relevant decision makers in the manufacturing industry. This was achieved, despite the fact that the campaign had not found its ideal form. In future campaigns it will be realistic to expect better results.

One single campaign does not give sufficient results. The target group has to be influenced again and again if it is to become more knowledgeable about this "marginal subject". The fact is that this is still the way that

most people in the manufacturing industry think of energy efficiency.

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