Four Experiments with Electricity Conservation in Denmark and National Implications

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This paper deals with measures or policy instruments, which, properly implemented, could reduce the expected 19% growth until 2005 in the Danish electricity consumption to zero. Compared with national policy (e.g., the Danish Energy 2000) and traditional utility campaigns for increased energy efficiency, we have focused more on the manufacturing sector and we propose larger savings in this sector. Energy 2000 is the latest comprehensive plan for the development of the Danish energy sector. (The Scandinavian word: "virkemidler" has many different and probably inaccurate English/American translations: Political measures, policy instruments, steering mechanism, steering instrument. We will use the word "measure").

The measures consist of economic measures (e.g., an electricity tax of 2.3 cent/kWh in the until 1993 untaxed sectors), pedagogic measures (e.g., information and electricity audits) and normative measures (e.g., minimum efficiency standards).

The assessment of the impact of various policy instruments is based on four large experiments (with electricity savings between 2% and 15%), which have been carried out in the housing sector, the public sector, the industry and private retail and service. The experiments have been implemented by our research unit and 14 Danish utilities.

The impact of an electricity tax (price elasticities) is based on time series data from 1966 to 1988. We have found smaller long-run elasticities (0.3 for Danish prices) than in other studies.

Introduction

Our estimates concerning electricity savings due to use of different measures are mainly based on four experiments with electricity savings carried out within the domestic sector (Nielsen et al. 1992; Nielsen 1993) industry (Hansen and Togeby 1993 a and b; Togeby 1993), the retail and service sector (Oksbjerg and Rieper 1993) and the public sector (Gjelstrup 1991). In the evaluation we have tried to take care of free-riders and information costs and internal costs by the consumers in the four sectors. Concerning control groups we only succeeded in establishing a control group in the domestic sector.

There is a wide variance in the resultant savings among the four experiments and among different sub-sectors within the experiments. The experiments are illustrated in Table 1. The experiments took place in the period 1988-1992. The final report from the experiments was published in 1993 (Larsen et al. 1993). The saving percentages achieved are shown in Table 2.

In industry and the retail and service sector the primary measure was intensive electricity audits. (In the industry experiment 1½ months engineer time was used per site. In the other sectors the audits were minor but still rather intensive). In the public sector, apart from an electricity audit, a campaign to influence people's attitude and a short instructional course were carried out.

In the experiment in the domestic sector, five measures were tried in three sets. One group was subjected to all the measures, one group was subjected to all the measures bar the visit from a consultant, and one group was subjected to all the measures bar the tariff increase. No households with electric heating were included in the field experiments. The figures in Table 2 are for single family houses due to a large withdrawal rate in one of the group of flats.

Table 1. Measures and Target Groups in the AKF Field Experiments

Sector	Measures Tested	Target Groups
Industry	Electricity audits Financing	Management in 37 companies
Retail and service	Electricity audits Financing	Management in 46 companies
Domestic	Information Consumer meter reading Electricity audits Financing Tariff increase	Approx. 1,500 households
Public sector	Electricity audits Instruction courses Influencing attitudes	Politicians and consumers 1,800 persons at 6 test locations

Table 2. Savings Achieved in the Experiments

	Realised Savings From Field Experiments	
Sector	**kWh/per Annum**	**Per cent**
Industry		
Annual electricity consumption		
1-2 mill. kWh/year	55,000	4.1
2-5 mill. kWh/year	219,000	7.1
5-50 mill. kWh/year	277,000	2.0
Retail and service		
Supermarkets	27,000	10.0
Offices	1,300	4.0
Other shops	12,000	15.0
Domestic		
Single family houses		
All measures	520	9.9
No consultant visit	460	8.3
No tariff increase	380	7.4
Apartments (all groups)	63	3.0
Public sector	14,500	6.0

The largest saving percentage has been achieved in "other shops" (clothes, shoes, furniture, hardware etc.): Here a 15% saving on electricity consumption has been achieved.

The smallest percentage effect was obtained in industrial companies with an annual electricity consumption of between 5 and 50 million kWh. The savings achieved here were 2%. However, due to the large electricity consumption per company, the small percentage represents substantial savings (277,000 kWh per year) when measured in kWh.

In the field experiment in the domestic sector the group subjected to all measures saved approx. 10%. The group that did not receive a visit from a consultant saved 8.3% and the group that was not subjected to a tariff increase saved 7.4%. A general lesson learnt from the field experiment in the domestic sector is that it is difficult to obtain economic coherence from measures, like the consultancy scheme, which have to be adapted to fit the individual household with a relative limited use of electricity (cfr. Table 3).

Instead, in the domestic sector use should be made of the fact that the ways in which appliances are utilized are more uniform than in other sectors. This can be done by employing, e.g., minimum efficiency standards.

The results for the public sector are based on very few observations, but indicate, that there are still many profitable (lighting) projects within the public sector. At the six experimental sites, savings totalling approximately half of the electricity consumption for lighting were feasible. Only half of the possible savings (about 108,000 kWh per year) were realized. This result embodies, however, very wide variations. One site showing savings of 32%, whereas at three others hardly any of the possible savings' options were realized. The reason for success was clearly designated responsibility and a favorable atmosphere for decision making.

The Cost of the Savings

The cost of the savings due to different measures consists of cost by the user (e.g., investment in new appliances) and cost by the "sender" of the measure (e.g., wage to consultants and printing of information). We have (subject to some uncertainty) been able to calculate the cost of most of the savings as shown in Table 3.

These costs of the savings calculated in cents/kWh are compared with a rough estimate for the social cost of electricity. We have assumed this to be 7.2 cents/kWh. The 7.2 cents/kWh include a 2 cents/kWh valuation of external effects by power production (cfr. Olsen and Mortensen 1992), If we accept 7.2 cent as the social cost per kWh, it will be seen that many (but not all) of the measures are inefficient in the form they were carried out in the experiments. It was cheaper to produce the electricity than to save it.

Table 3. The Cost of the Savings

Measure	Cost Cent/kWh_{saved}
Electricity audit in industry with consumption between 2-5 mill. kWh/year	3.5
Electricity audit in industry with consumption between 5-50 mill./year	3.8
Electricity audit in "other shops"	6.2
Electricity audit in supermarkets	6.2
Written information to households	7.2
Electricity audit in industry with consumption 1-2 mill. kWh	8.8
Third-party financing in households	14.5
Monthly consumer meter reading with feed-back	21.5
Free electricity audits in offices	29.5
Free electricity audit in single family houses	45.5

Remark: We have not been able to calculate the cost per kWh saved in the public-sector experiment. As we did not enter into a third-party financing contract within the experiment in the industrial, the retail and the service sector there is no figures for this measure in these sectors either.

Electricity Audits

Free electricity audits have been tried out in all sectors.

In industry the audits have resulted in a large number of suggested projects for saving electricity in the individual companies. The companies, however, attach (naturally enough) more importance to operational reliability than to efficiency in their use of electricity. The primary goal is to produce. For this reason, when describing a project for economizing on electricity, it is important that the company is made confident that the project will not disrupt normal production. A similar mechanism operates in the public sector, where each individual institution (for example a school) has its own main activity or goal.

It turns out, as for instance in the case of the industrial experiment that there have been problems as regards the reliability of the expected savings of the proposed projects. This is due to, among other things, the fact that a number of operational conditions, like for example the total utilization time per year, has to be estimated using data for a short period. Results show that one can easily overestimate savings by 50% (Togeby 1993). It is, therefore, recommended that more attention is paid to check-up measurements.

A considerable number of projects are rejected because management does not believe that they will function well in practice. Therefore, it is recommended to pay more attention to the dialogue with the management, and to alternative projects or the most profitable part of a proposed project which management itself finds realistic.

The reason for the high saving (15 %) in “other shops” due to the electricity audit is the fact that shops with particularly good opportunities for economizing were chosen. Choosing businesses with good opportunities for economizing is thus a way of making the utilization of certain types of measures, for example electricity audits, more effective.

Third-Party Financing

The principle of third-party financing is that electricity saving investments can be financed through the electricity bill. Financing schemes have been tested within the domestic sector, the industry, and the retail and service sector, but with very little success. In industry and the retail and service sector, nobody has availed themselves of the offer, except one company, that turned out to be bankrupt. The third-party financing offer was given to the 83 managements in the target group (cfr Table 1) when the results of the energy audits were presented. The interest rate was low (in 1992), 9-10% in industry and 12% in the domestic sector and in the retail and service sector.

In the domestic sector the scheme has been used, but with a very limited effect. Participating households could change their appliances (maximum two per household) and get the change financed over 5 years. Downpayment was not necessary and the interest rate was 12%, which in 1992 was a really good offer for a household. Only 5% of the households took advantage of the lending scheme. Later we asked those households that did change large appliances, why they did not use the lending offer. 75% answered that they preferred to pay cash.

Based on these results, we conclude that financing (without subsidy) of electricity savings is of little relevance in the private sector in Denmark. This conclusion is perhaps too quick, but it is supported by some U.S. experiences (e.g., Nadel 1990).

We know that this negative result for third-party financing may be surprising for others (e.g., Brown 1986). For industry and the retail and service sector the result can be explained by the fact that large investments were split into several sections, thereby reducing the need for raising loans. Furthermore, the companies have chosen mainly to realize the projects with the shortest pay-back period (less than a couple of years). This reduces the financing problems. All in all; when the management was convinced about the conservation project there was in general no special financing problem left. Another explanation is that our third-party financing schemes (perhaps more correct: “financing schemes”) were without any significant element of subsidy. We have experienced that even minor elements of subsidy will increase the interest of the consumers (Larsen 1993).

Experience from Danish utilities shows on the other hand that financing schemes can be of relevance to electricity savings in the public sector, because of the time-restricted budgets and lack of loan capacity in this sector. Furthermore, in the public sector many projects are rather simple lighting projects with a long life time. Time restricted budgets and favorable lighting projects with a long life create a good background for third-party financing. Furthermore, tax-based public institutions do not go bankrupt.

The Paradox of Attitudes

Unlike the experiments in industry, the retail and service sectors measures in the domestic field experiment have primarily been directed towards influencing people’s everyday habits. One way of doing this was by attempting to influence people’s attitudes through written material.

Results based on questionnaires before and after the experiment in the domestic sector show that no noticeable change in attitudes can be detected during the course of the project. And it was impossible to find clear relationships between the participants' attitude, and their electricity consumption or savings achieved in connection with the experiment.

Despite the fact that a change of attitudes is absent, there have been savings in electricity consumption of between 5 and 10% in the domestic experiment anyway. This is presumably due to the fact that attitudes before the experiment were very much in favour of electricity savings, but people have lacked concrete advice about how they could carry out the savings in practice.

Price Elasticity

We have tried to explain (Kristensen and Oksbjerg 1993) the electricity consumption of the Danish industry by developments in:

- value added (gross-domestic product at factor cost)
- a real-term electricity price
- a real-term aggregated expression of other energy prices and
- a trend development to allow independent technological shifts, etc.

Various dynamic models with different lags (so-called Almon lags and Koyck lags) and different data sets are tested. The models indicate a short term price elasticity in the order of -0.1, and long term elasticities in the order of only -0.3. But it is possible that the long term price elasticity is higher than the estimated -0.3. Firstly, it is hardly possible in practice to "catch" the effect of price changes over more than maximum 5-10 years. And it might take much longer before the effects of a given price change stop. Secondly, we have in our analyses of the electricity consumption used the Danish electricity prices. However, the development of manufacturing equipment is highly international. That is why German electricity prices could well have the same significance for manufacturing equipment used in Danish industry as Danish electricity prices. (Remark for North-American readers: Denmark is a very small, very open economy, with import and export ratios close to 50% of GDP and a population of about 5 million. Which is close to the population in Maryland). Thirdly, the majority of various foreign—mainly American-studies estimates long term price elasticities much higher than -0.3 (many above -1) (Bohi 1991; Longva et al. 1988). This applies in particular to estimates based on cross-sectional analyses where the price-elasticity may reflect a location effect. Our "guestimate" concerning the electricity-price sensitivity of Danish industry is a short run elasticity of approximately -0.1. In the long run there may be considerable differences with regard to the effect of local Danish electricity prices and international electricity prices respectively. Interviews with Danish industrial leaders confirm this reasonable theory. A long term price elasticity of -0.3 is probably a fair guess for local Danish prices. For international price increases the long-term effect may well be double that size, i.e., -0.5 to -0.6.

As we want to be on the safe side and because we propose a high (33% in the previously not taxed sector) increase in the electricity price we use in our projections -0.25 as the long-term elasticity for a Danish electricity tax and -0.5 for an international tax,

Sets of Measures

Based on the experiments and the elasticity studies we conclude that it is possible to increase the efficiency of electricity consumption substantially and realize an unchanged level of electricity consumption in the year 2005 is not unrealistic.

We have put together two sets of measures: a so-called national set and a so-called international set. It is essential for the discussion in a small open economy to realize the dependency on the international market. We have therefore distinguished between a national set of measures (what Denmark can do alone) and an international set of measures (what Denmark can do in cooperation with other countries). The goal of an unchanged level of electricity consumption can only be achieved for the international set. The reason for the greater reduction using the international measures is primarily due to the presumption that the effect of the proposed electricity tax will be twice as large when adopted by a great number of countries. Furthermore, we believe that minimum efficiency standards have to be carried out in an EU-context.

The figures in Table 4 are more to be considered as a qualified guess than an exact projection, The following few words can be mentioned about the background for the figures. The pedagogic measures are mentioned in details below. But we actually realized savings of the magnitude of 6% in our experiments (cfr Table 2). Concerning the impact of the electricity tax it is a simple elasticity calculation bearing in mind that 55% of the Danish electricity consumption until 1993 has been untaxed. The effect of the minimum efficiency standards on refrigerators and freezers is estimated by the Nordnorm-Commission (1992). A good, general description of the energy situation in Denmark can be found in: Energy Use in Denmark. An International Perspective (Shipper et al. 1992).

Table 4. Savings Broken Down According to Type of Measure

Savings in 2005 in Relation to Energy 2000's Base Projection	Internationally Coordinated Effort	National Effort
	Per cent	
Pedagogic measures	6	6
Electricity tax	10	5
Standards	3	0
Total	19	11

Pedagogic Measures

We suggest more informative electricity bills for all sectors. On an informative electricity bill the consumers are able to see their electricity consumption immediately in terms of kWh and amount due, and the consumption is compared with earlier periods.

Many utilities already send out information about opportunities for economizing on electricity consumption. It is, however, important that all consumers regularly receive concrete and goal-oriented information about opportunities for economizing on electricity consumption. Results from our research in the domestic sector indicate that the need for information about *how* electricity can be saved is greater than the need for information about *why* it ought to be saved.

Information can be a relatively cheap measure; it has, among other things, the advantage of preserving the consumer's full freedom of choice. Nobody is compelled to employ uneconomic initiatives. In many cases information is necessary in order to enable other measures (e.g., taxes) to function as expected. The effect of information, on the other hand, will be very limited in some cases.

For industry, the retail and service sector, and agriculture (based on Projekt Elgård, Gudbjerg and Guul-Simonsen 1993) we suggest energy audits. Audits are well suited to give advice which has been adapted to fit local conditions. Consultants are, however, expensive. Therefore, it must be emphasized that new consultancy schemes must be meticulously integrated into already existing schemes and be kept under observation with a view to ensuring that reasonably cost-effective savings in electricity are in fact achieved. For industry, moreover, we suggest special information aimed at cooling and compressed air, and for the retail and service sector, lighting in "main street shops," because in these consumer areas, particularly good opportunities for making profitable savings have been revealed.

For retail, service and industry we suggest a clearing house as Electric Ideas Clearinghouse (Bonneville 1991), which, in particular, will focus on making energy consumption more efficient in connection with the purchase of equipment. This will be of aid to the individual companies and increase pressure on manufacturers of electrical equipment and appliances to increase the efficiency of their products.

For the public sector the Danish Energy Agency has established a campaign, "Energy under control." This campaign contains energy management and the possibility of third party financing. The campaign is (to some extent) based on experiences from AKF's public sector experiment.

Economic Measures

We suggest an electricity tax of about 2.3 cent/kWh (DKK 0.15/kWh). The size of the tax is based on abatement cost concerning NOx and SO_2 and discussions in the Danish Parliament concerning CO_2. This is comparable to the CO_2-tax of 0.9 cents/kWh which has just been introduced for certain companies. It is important that fair warning of the tax is given, in order to enable the necessary adjustments to be made in capital structure, and between capital investment and the workforce. It is equally important that the increase takes place within an OECD or at least an EU framework. In this way, the effects of the tax will be greater, also in Denmark. In addition to this, difficulties relating to competitiveness creating political complications when energy taxes are introduced will be reduced if the tax is internationally coordinated.

The employment of taxes is, in many ways, an attractive measure in terms of promoting energy savings. Market prices for energy (in sectors where little or no tax is levied) do not reflect the environmental burden on the community. The consequence of this is that energy consumption exceeds a level which, for the community, is economically efficient. A tax leaves the individual free to introduce concrete savings. Opportunities are thus created for utilizing local know-how and inventiveness in introducing savings in areas that are most cost-effective.

Normative Measures

The normative measures we suggest are efficiency standards first for refrigerators and freezers in the domestic area. We hereby support current initiatives within the Nordic Council of Ministers (Nordnorm-Commission 1992), the Danish and the Dutch governments and part of the European Union. In 1992, the Dutch government has announced minimum efficiency standards for freezers and refrigerators and the Danish government is for the time being announcing minimum efficiency standards for dishwashers and washing machines. In theory it is possible for an EU member state to introduce minimum efficiency standards alone. But in practice it is unrealistic to introduce this measure on a national basis. EU will probably consider minimum efficiency standards as a technical barrier for free trade in the inner market and not as a measure to increase energy efficiency; minimum efficiency standards would also be much more effective as an international measure.

Generally, appliance standards must be laid down according to the actual use of the appliance. If appliances are utilized in a widely varying manner then a particular appliance might be very economical in one situation and very uneconomical in another. Minimum efficiency standards for freezers and refrigerators generally used 24 hours will be an advantage for nearly all consumers. But for use in two months in a summer house, a cheap inefficient appliance will be the best purchase for the consumer. For appliances with different time of use some consumers will lose welfare if cheap inefficient appliances are removed from the market. One advantage of standards is that they are effective in the important situation where equipment is being replaced. It is more cost-effective to initiate savings in electricity when a worn-out appliance (or installation) is being replaced anyway, than if the appliance (or installation) is being replaced purely for the purpose of saving electricity.

We made a study (Hansen and Henneberg 1992) where we discussed other possibilities for minimum efficiency standards for lighting, refrigerators and in the commercial sector. Our conclusion was that the simple win-win situation concerning freezers and refrigerators is an exception. For freezers and refrigerators minimum efficiency standards will be of benefit to nearly all consumers. These standards are relatively easy to control and give predictable savings of a reasonable size.

Uncertainties and Extrapolation Problems

There is of course a lot of uncertainty problems in social experiments with electricity savings. One major problem is the free-rider problem (Lui and Fang 1990 and Mehlbye et al. 1993). Is the outcome (electricity savings) due to our measures or would it appear anyway, perhaps a little later. We have tried to solve the problem by questioning, but the question is hypothetical and great caution is needed when you analyze hypothetic questions. This problem and more traditional and “simple” problems as missing sub-sectors in the experiment within the retail and service sector, and on average smaller houses and more flats in Denmark than in the household experiment are mainly dealt with in the reports describing the experiments (Nielsen 1992; Hansen and Togeby 1993; Oksbjerg and Rieper 1993). The method for correcting biases has been standardization. Furthermore, we used a lot of data from the very large Swedish experiment Uppdrag 2000 (e.g., Vattenfall 1987; Vattenfall 1991). In this material we could confirm and substantiate our studies and fill the gaps for sub-sectors (e.g., within retail and commerce).

Another very serious problem, not for the experiments, but for the use of the results from our social experiments, (in contrary to physical experiments) is whether the effect of a permanent measure will be the same as the effect of the same measure tested in an experiment. You could argue that the effect of a permanent measure would be greater because you have learnt through the experiment (e.g., new consultants could learn from our experiences), but you could also argue that lack of the experimental enthusiasm in a permanent used measure (e.g., electricity audit) would reduce the savings radically. In new evaluations of Danish energy audits (Christensen 1994) there are clear examples of the last problems. The audits were not carried out as expected neither qualitatively nor quantitatively.

The Environmental Consequences of Electricity Consumption

The interest in economizing on electricity is due to the environmental consequences of the sharp increase in electricity consumption. These environmental problems are local and regional as well as global. Fuel consumption for generating electricity has trebled since 1960 (calculated per head of population) both in Denmark and in the European OECD countries. Total energy consumption for the same period has only doubled. There are innumerable scenarios that demonstrate the need for radical savings in energy consumption in the rich parts of the world. All forecasts, however, predict a continued growth in electricity and energy consumption.

In this connection, Danish electricity and energy consumption are minimal. Furthermore, the environmental problems that really make savings imperative are global. For this reason it is of the utmost importance that Danish efforts are not made in isolation, but are an integral part of a binding international collaboration.

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References

Bohi, D. R. 1991. *Analyzing Demand Behaviour. A Study in Energy Elasticities.* Baltimore, Maryland.

Brown, I. 1986. *Third Party Financing Opportunities for Energy Efficiency in the European Communities.* Association for the Conservation of Energy, London, England.

Christensen I.-M. 1994. "Developing the Supply Side of Existing State Controlled Energy Consultancy." *Proceedings from ACEEE 1994 Summer Study on Energy Efficiency in Buildings.* American Council for Energy-Efficient Economy, Washington, D.C.

Electric Ideas Clearinghouse. 1991. *In Touch with Efficiency.* Bonneville, Washington.

Gjelstrup, G. 1991. *Offentlige elbesparelser—teknik, organisation og politik (Public Electricity Savings)* . AKF Forlaget, Copenhagen, Denmark.

Gudbjerg, E. and F. Guul-Simonsen 1993. *Projekt Elgård (Project "Electric Farm")* (no English summary), Randers, Denmark.

Hansen and Henneberg. 1992. *Normer for elforbrug til belysning (Minimum Efficiency Standards for Lighting)* (no English summary). AKF Forlaget, Copenhagen, Denmark.

Kristensen, K. and K. Oksbjerg. 1992. *Elforbrugets prisfølsomhed i industries (Price Elasticities in Industry).* AKF Forlaget, Copenhagen, Denmark.

Larsen, A. 1993. "Replacement of old Freezers: Economic Evaluation of a Campaign." *Proceedings from ECEEE 1993 Summer Study on the Energy Efficiency Challenge for Europe*, Volume 2, pp. 63-73. European Council for an Energy-Efficient Economy, Oslo, Norway.

Larsen, A., J. Jordal-Jørgensen, K. Jørgensen, L. Nielsen, M. Pedersen, and M. Togeby. 1993. *Virkemidler og elbesparelser (Measures and Electricity Savings* . AKF Forlaget, Copenhagen, Denmark.

Longva, S, Ø. Olsen and S. Strøm. 1988. "Total Elasticities of Energy Demand Analyses within a General Equilibrium Model." *Energy Economics* Vol 10 (4):298-308.

Lui, D. W. and J. M. Fang. 1990. "Issue in Free Rider Ratio Estimation." *Proceedings from ACEEE 1990 Summer Study on Energy Efficiency in Buildings* Volume 6, pp. 6.91-6.97. American Council for Energy-Efficient Economy, Washington, D.C.

Mehlbye, J., O. Rieper, and M. Togeby. *Håindbog i evaluering (Handbook in Evaluation).* AKF Forlaget, Copenhagen, Denmark.

Nadel, S. 1990. "Conservation Programs: A Review of the Lessons Taught by a Decade of Program Experience." *Proceedings from ACEEE 1990 Summer Study on Energy Efficiency in Buildings,* Volume 8, pp. 8.179-8.205. American Council for Energy-Efficient Economy, Washington, D.C.

Nielsen, L. 1993. "How to get the Birds in the Bush into Your Hand." *Energy Policy* November 1993:1133-1143.

Nielsen, L., K. Jørgensen, and J. Jordal-Jørgensen. 1992. *Elbesparelser i boligsektoren—afsluttende rapport (Electricity savings in the domestic sector).* AKF Forlaget, Copenhagen, Denmark.

Nordnorm-Commission. 1992. *Principles for Efficiency Standards for Electricity Consumption of Household Appliances.* Joint Nordic Proposal. The Nordic Council of Ministers.

Oksbjerg, K. and O. Rieper. 1993. *Elbesparelser inden for handel og privat service—forsøgserfaringer med elrådgivning. (Electricity Savings within Private Retail and Service)* AKF Forlaget, Copenhagen, Denmark.

Olsen, O. J. and J. B. Mortensen. 1992. *Elproduktionens samfundsøkonomiske omkostninger (Social Cost of Electricity Production).* AKF Forlaget, Copenhagen, Denmark.

Schipper, L., R. Howarth and B. Andersson. 1992. *Energy Use in Denmark an International Perspective.* Berkeley, California.

Togeby, M. 1993. "The Control Problem in Relation to Electricity Conservation" *Proceedings from ECEEE 1993 Summer Study on the Energy Efficiency Challenge for Europe,* Volume 1 pp. 171-177. European Council for an Energy-Efficient Economy, Oslo, Norway.

Togeby, M. and H. Hansen. 1993a. *Hvad kommer der ud af et elsyn – afsluttende rapport fra forsøg med elbesparelser i industries (What comes out of an Electricity Audit).* AKF Forlaget, Copenhagen, Denmark.

Togeby, M. and H. Hansen. 1993b. "Electricity audits in large industrial companies." *Proceedings from ECEEE 1993 Summer Study on the Energy Efficiency Challenge for Europe,* Volume 2, pp. 45-55. European Council for an Energy-Efficient Economy, Oslo, Norway.

Vattenfall. 1987. *Elhushållningsåtgårder - Åtgärdsförslag framtagne vid energikartläggninger i 10 industries i Våirgårda kommun,* Sweden.

Vattenfall. 1991. *Från krog till kontor.* Råcksta, Sweden.

Remark: All AKF Reports contain an English Summary.