AUDIT II

Country Report
DENMARK

Erja Reinikainen
Final version, August 2002

SUMMARY OF ENERGY AUDITING

Energy Audit Programmes

There are three energy audit programmes in Denmark

- the ELO Scheme (EnergiLedelsesOrdningen, the Energy labelling of large buildings or Energy Management in large buildings)
- the EM Scheme (Energimaerkningsordningen, the Energy labelling of small buildings)
- CO_2 Scheme in industry

The ELO and EM Schemes

The ELO and EM Schemes are energy labelling schemes and are an important element in the Danish energy policy. The labelling was implemented in January 1997, is still running and no closing is planned. The Danish energy labelling is mandatory for large buildings (ELO) and small buildings (EM).

The energy labelling is based on an energy audit made by an approved consultant. In small buildings the labelling is connected to the sale of the building, in large buildings the label must be updated yearly. The ELO scheme includes connections to Energy Management and based on continuous co-operation between the energy consultant and the client.

The labelling results in two different papers: the label itself (showing information on energy and water consumption and comparisons to other similar buildings) and an energy plan (including proposals for improvements and documentation for the labelling).

The overall administrator of the two schemes is the Danish Energy Agency, part of the Civil Service of the Danish Government. All major rules on energy labelling is given by the DEA. There is a special Council for both schemes, making decisions on training of consultants, quality control, authorisation, client complaints etc. The Secretariats of both schemes (at the Danish Technology Institute) take care of the everyday routines of the Operating Agent.

The target sectors of the schemes are residential buildings (mainly the EM Scheme), private and public service sector (mainly the large buildings in ELO). Buildings used for production are not included.

Other Programmes with Energy Audits

The CO_2 Scheme

The legislation that came into force in 1996 introduced different carbon dioxide tax rates in industry for room heating, heavy processes and light processes. The tax rates are gradually increased from 1996 to 2000. All of the revenue raised by the tax will be recycled to the industry through investment grants and through a reduction of the social security contribution paid by the employers.

Very energy intensive companies would have difficulties in operating in the competitive international market if taxes on energy use were too high. Therefore a system of voluntary agreements has been worked out. Companies can reduce taxes by entering into a binding agreement on energy efficiency with DEA. The lower tax rate is the result of companies receiving a subsidy with which to pay the tax on energy use. An agreement is valid for three years and has to be renewed after that.

In the beginning energy audits were the basis of activities in the agreements. From the beginning of 2000 the companies must establish an energy management system according to a concept formed by DEA. This system includes energy auditing as a tool to find energy saving possibilities.

Other Activities including Energy Audits

The Oil Burner Check

The OR (Olieservicebranchens Registeringsording) yearly Oil Burner Check is done by about 1400 service companies. More than 300 000 installations are examined yearly. The scheme aims at improving the energy efficiency of heating boilers.

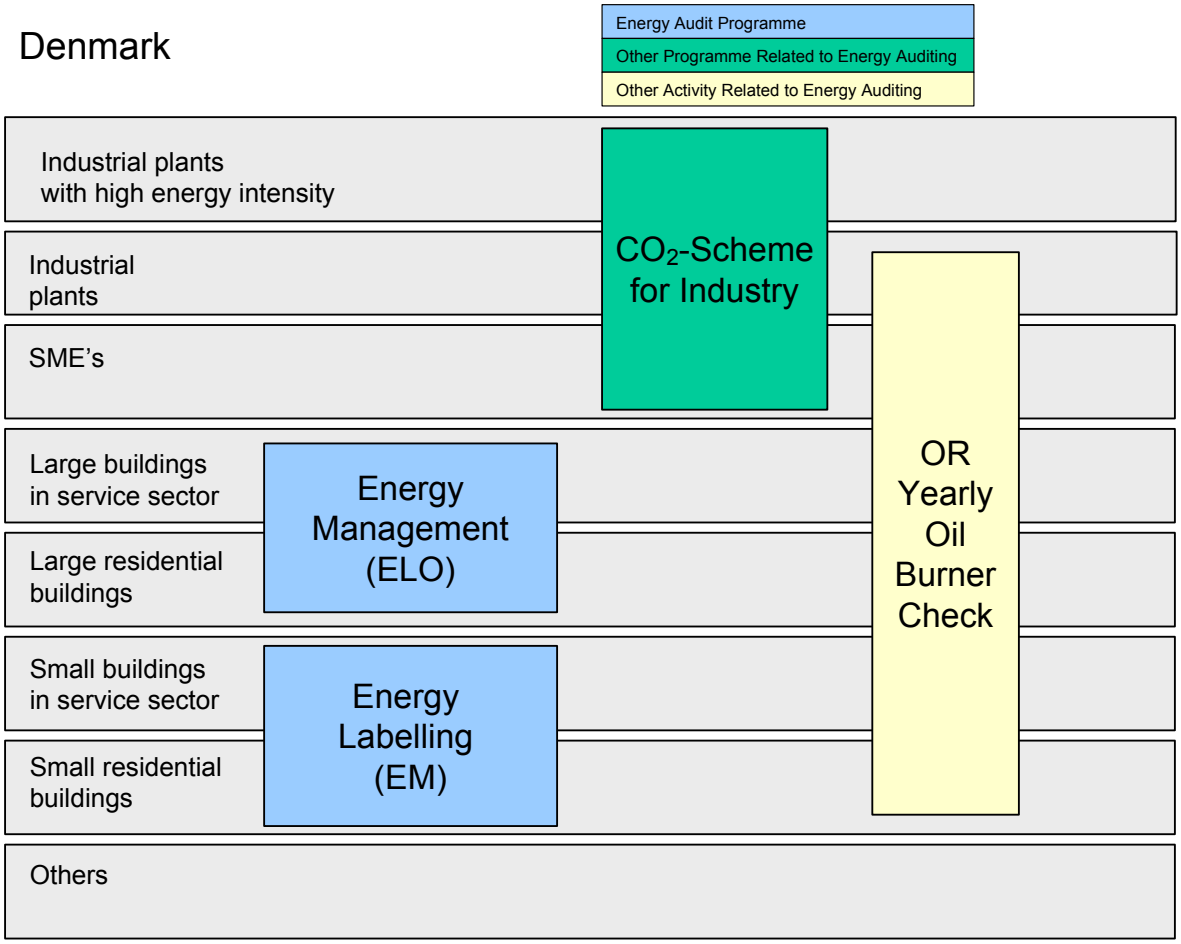

Figure 1. The Map of energy audits in Denmark

Table of EAP features coverage

	ELO-Scheme	EM-Scheme	CO_2 Scheme
Status	1996-	1996-	1997-
Administration	Danish Energy Agency	Danish Energy Agency	Danish Energy Agency
EA models	++	++	+
Auditors' tools	++	++	++
Training, authorisation	+++	+++	++
Quality control	+++	+++	+
Monitoring	+++	+++	+
Volumes, results	++	++	++
Evaluation	+++	+++	++

+++ = Detailed information available
++ = Some information available
+ = Very little information available
= No information available / does not exist

Contacts

EM-Scheme Energy labelling of small buildings	Jens Laustsen	Danish Energy Agency 44 Amaliegade DK-1256 Copenhagen K		Jhl@ens.dk Www.ens.dk www.em-sekretariat.dk
ELO-Scheme Energy labelling of large buildings	Kaj Borggren	Danish Technology Institute Gregersensvej PO Box 141 DK 2630 Taastrup	+45 72 20 2000	www.elosekretariat.dk Www.teknologisk.dk www.energiledelsesordningen.dk
Energy audits in industry	Finn Josefsen	Danish Energy Agency 44 Amaliegade DK-1256 Copenhagen K		Fj@ens.dk Www.ens.dk

Country Report

Country Report written by	Erja Reinikainen	Olof Granlund Oy
Based on the interviews of	Jens Laustsen & colleagues	Danish Energy Agency
	Finn Josefsen	Danish Energy Agency
	Henrik Poulsen & colleagues	Danish Technology Institute
	Date of interview	08.01.2002
	Comments on text	August 2002

Disclaimer

The information contained in this report has been gathered from publicly available sources and through interviews. All efforts have been made to secure the veracity of the report, however the authors cannot guarantee the content.

THE COUNTRY REPORT

Table of Contents

1 Background and Present National Energy Policy 7
1.1 Previous activities 7
1.2 Present national energy policy 7
1.3 The Danish Energy Agency 8
2 Energy Audit Programmes 9
2.1 Energy labelling of large buildings, The ELO-Scheme (EnergiLedelsesOrdningen) . 9
2.1.1 Goals 9
2.1.2 Target sectors 9
2.1.3 Administration 9
2.1.4 Implementing Instruments 10
2.1.5 Energy Audit Models 11
2.1.6 Auditors' Tools 12
2.1.7 Training, authorisation and quality control 13
2.1.8 Monitoring 15
2.1.9 Auditing volumes 16
2.1.10 Results 16
2.1.11 Evaluation 17
2.1.12 Observations and Future Plans 17
2.2 Energy labelling of small buildings, the EM scheme (Energimaerkningsordningen) 17
2.2.1 Goals 18
2.2.2 Target sectors 18
2.2.3 Administration 18
2.2.4 Implementing Instruments 19
2.2.5 Energy Audit Models 19
2.2.6 Auditors' Tools 19
2.2.7 Training, authorisation and quality control 20
2.2.8 Monitoring 22
2.2.9 Auditing volumes 22
2.2.10 Results 23
2.2.11 Evaluation 23
2.2.12 Observations and Future Plans 24
3 Other Programmes including Energy Audits 25
3.1 Green Taxes for Trade and Industry 25
3.1.1 Goals 25
3.1.2 Target sectors 25
3.1.3 Administration 26
3.1.4 Implementing Instruments 26
3.1.5 Energy Audit Models 27
3.1.6 Auditors' Tools 28
3.1.7 Training, authorisation and quality control 28
3.1.8 Monitoring 29
3.1.9 Auditing volumes 29
3.1.10 Results 30
3.1.11 Evaluation 30
3.1.12 Observations and Future Plans 31
4 Other Activities including Energy Audits 31
4.2 The OR Yearly Oil Burner Check 31
5 References 31

1 Background and Present National Energy Policy

1.1 Previous activities

The Heat Inspection and VKO schemes for residential buildings

The law on the heat inspection EK (Energikonsulentordningen) was given in 1981 and had several revisions up to 1991. The objective of the heat inspection law was to limit the energy consumption for heating and making of domestic hot water in all heated buildings constructed before 1979. Buildings constructed later have had to observe the energy requirements given in the Building Regulations of 1977 and 1982.

From the beginning the Heat Inspection was combined with subsidy schemes but in 1984 the procedure was changed. When selling a building after January 1st 1985 the seller had to inform the buyer in advance of the energy economy of the building. This information on the energy use of the building was to be proven in the form of a Heat Inspection Report and a subsequent Energy Certificate if the building is in a reasonable energy economical state.

Since 1981 (up to 1994) the Heat Inspection was carried out in about 900 000 residences which is about 50% of all residential buildings in Denmark.
A subsidy was available in the beginning of the 1980's for the heat inspection as well as on the investments suggested, the amount depending on the size of the building.

VKO (Varmekonsulentordningen) is another audit scheme that was started in 1981. This scheme was based on the Act for Building and required that all large heating systems in buildings should be inspected by a Heat Consultant (Varmekonsulent).

From the beginning the scheme was mandatory for all oil-fired systems with 120 kW or more. Later the scheme became mandatory for gas-fired systems over 120 kW and also for district heated systems witch supplied more than 1.500 m².

The present Danish energy labelling schemes have been developed based on the experiences of The VKO scheme and the Heat Inspection which were running 1982-1996. The schemes ended in 1997 when they were replaced by the ELO and EM Schemes.

1.2 Present national energy policy

Goals of Danish Energy Policy

- to contribute to a sustainable development
- to meet the international challenges
- to maintain economy, employment and competitiveness
- to enhance the utilisation of renewable energy sources
- to increase efficiency in all energy services

Danish Plan of Action - Energy 21

In April 1996 the Danish Government released the fourth plan of action in the field of energy. Energy 21 included a number of new initiatives to secure the fulfilment of the

goal of reducing the national CO_2 emissions. The plan was valid until November 2001.

The new Danish Government from November 2001 has started the preparation of a new national plan for energy initiatives The basis for this plan will be the Danish targets from the Kyoto agreement, which is a reduction of the emissions on 21% in 2008-12.

1.3 The Danish Energy Agency

The Danish Energy Agency (Energiestyrelsen) is an Agency under the Ministry of Economy and Business and was established in 1976. The Agency works to encourage the general public, trade and industry and public institutions to make even more efficient use of energy in order to achieve savings.

The Agency focuses on the production, supply and consumption of energy. It ensures, on behalf of the State, the responsible development of energy in Denmark from the perspectives of society, the environment and security of supply. The Agency drafts and administers Danish energy legislation and implements analyses and assessments of development in the energy field. Initiatives targeted to private consumers include energy conservation campaigns and subsidy schemes.

The Danish Energy Agency supports
- projects leading to energy savings or more efficient use of energy in the enterprises
- projects resulting in a reduction of emissions of CO_2 and SO_2 from private enterprises
- energy audits in enterprises
- development-, test- and demonstration projects, information activities, campaigns and education

The Energy Agency administers a scheme launched in 1997 to energy-label buildings. Systematic energy management has been introduced in most public institutions and energy consultants encourage trade and industry to save energy by means of energy auditing schemes.

The energy labelling schemes have been developed by the DEA in close co-operation with some consulting companies. Representatives for consultants, consumers, real estate agents and other bodies took also a small part in the development work. The costs of the development work have been paid by DEA from the national budget.

The Energy Agency provides the consumers with all additional information on the labelling scheme and also information on the proposed energy savings. Information is given in brochures and websites.

2 Energy Audit Programmes

2.1 Energy labelling of large buildings, The ELO-Scheme (EnergiLedelsesOrdningen)

The ELO-Scheme is an energy labelling scheme that uses energy audits to investigate the energy use of the building and a set format (label) for reporting the audit results. The auditor analyses the present consumption and compares it to statistical values of similar buildings. A list of saving measures is also included in the report. As the label is updated every year, the aspect of continuous and efficient energy management is strongly involved.

2.1.1 Goals

The ELO scheme was established as one tool for reaching the national goals and international agreements and was a part of the Danish Plan of Action .

The Act to Promote Energy and Water Savings in Buildings, No 485 of 12th of June 1996 was put into force in January 1997 and it defines that all small and large buildings must be energy labelled. The aim of this law is to promote energy and water saving and increase the efficiency of energy and water use is buildings.

The building must be energy-rated and provided with an energy plan so that the owner, tenants and other similar users have knowledge of the energy conditions of the building and receive guidance as to energy-saving possibilities.

In large buildings the energy plan will develop over time into an efficient tool for planning, maintenance and energy management. The energy plan shows the development in consumption over the last three years and indicates the effect of implementing the energy saving measures suggested in the previous energy plans.

2.1.2 Target sectors

The ELO-Scheme covers residential buildings, all public buildings, commercial buildings used for trade and private service.

“Large buildings” are buildings where the total floor area of the buildings comprises 1500 m² or more, and buildings divided into large commercial tenancies where the total floor area of the buildings in which the owner-occupied flats under the same owners' association are situated, are at or over this limit.

2.1.3 Administration

Administration for the ELO and for the EM schemes is done by the Danish Energy Agency (DEA, Energistyrelsen) , a governmental institution and a part of the Ministry of Economy and Business. The DEA gives the guidelines for the scheme, does promotion work and monitors the results.

For the ELO and for the EM scheme there are separate committees of consumers and other interests (ELO Registration Committee / Registreringsudvalget for Energiledelsesordningen and EM Registration Committee / Registreringsudvalget for

Energimaerkningsordningen). Each of the Committees consists of a chairman and a number of other members. The Danish Energy Agency appoints the members. A certain number of members are appointed on the recommendation of consumers and commercial organisations concerned.

The two Registration Committees collect and process information about the function of the energy rating schemes and submit reports to the Danish Energy Agency with regard to the process, quality and quantity of the schemes. The Committee for the ELO Scheme also approves the ELO consultants and correspondingly for the EM Scheme.

The ELO and the EM Schemes have their own secretariats. The secretariats act as the Operating Agent and is responsible for quality control of reports, monitoring of results and for the training of consultants.

Both Committees and Secretariats are self-standing, self-owned, non-profit organisation getting its funding from the members.

There are 3 people full time employed by the ELO Secretariat.

2.1.4 Implementing Instruments

Legislation

The legislation connected to the ELO and EM Schemes is

- Act to Promote Energy and Water Savings in Buildings, No 485 of 12th of June 1996
- Executive Order on Energy Rating etc in Buildings, No 1169 of 16th of December 1996 and its revision from 14th of September 1999.
- Executive Order on Fees and Liability Insurance for Energy Rating of Buildings, No 1170 of 16th of December 1996 and its revision from 14th of September 1999.

New executive orders are under preparation and are expected to be published at the end of 2002.

The executive Act 485 defines the main guidelines for mandatory energy labelling of large and small buildings. The Executive order 1169 specifies these general guidelines to a practical level and it also specifies the energy consultants' knowledge and skills. The Executive order 1170 sets the criteria on energy consultants' fees.

According to Act 485 “an approved energy consultant shall conduct the energy rating and draw up or update the energy plan once every year.” Based on this Act the energy labelling of large buildings is mandatory / legally required (ELO Scheme).

According to Act 485 “the building is energy rated and an energy plan drawn up to ensure that the owner, tenants and other similar users of the building have knowledge of energy conditions in the building and receive advice about energy saving possibilities” and also “energy rating and an energy plan must be available in connection with the sale of the building”. Based on this Act the energy labelling of small buildings is mandatory / legally required (EM Scheme).

Promotion

Promotion material for the ELO and EM Schemes is published by the Danish Energy Agency.

This material includes
- brochures
- campaigns
- web-sites

Subsidies

There are no subsidies involved in the ELO or the EM Scheme.

Financing

In both schemes the building owner pays the energy consultants for preparing the energy label and the energy plan. The energy plan and the certificate have a cost that depends on the size of the building. The maximum fee for the consulting work is restricted in the Executive order 1170 about the fees and liability insurance in energy rating of buildings.

The energy consultants finance the operation of the Secretariat.

The key elements of implementing instruments for the ELO and EM Schemes are illustrated in the following table.

Mandatory / legal schemes	**Voluntary schemes**
Energy labelling is obligatory/compulsory by legislation.	No link to voluntary schemes.
Fiscal incentives (taxes)	**Fiscal incentives (subsidies)**
No link with the tax system.	No subsidies.
Marketing oriented schemes	**Policy issues**
Energy labelling is marketed to building owners by the Danish Energy Agency (brochures, web-sites, information campaign, etc).	Energy labelling is mentioned as a tool in the Action Plan to meet the targets of the National Energy Policy.

2.1.5 Energy Audit Models

An authorised ELO-consultant for large buildings inspects the building, the installations and appliances using heating, electricity and water and checks the measured consumption. Together with the person responsible for energy in the building the consultant inspects the energy use and operational condition of the installations and the state of the insulation of the building envelope.

On the basis of the site work and the energy bills using a computer tool the consultant draws up an energy rating for the building. The energy rating shows the building's consumption of heat, electricity and water and the environmental impact in relation to other buildings in the same category. In large buildings the measured and normalised (using degree-days) consumption is compared to the average.

The consultants also make an energy plan with proposals for the most profitable savings. The energy saving measures are described briefly and the estimated saving and investment cost are shown, also a note of the lifetime of the investment is made.

The energy plan contains also possibilities for immediate savings and of matters which should be inspected more closely or only can be done in combination with other measures to improve the building. The energy plan gives also the new energy rating if all the suggested measures are implemented.

The consultant may discuss the energy rating and the energy plan with the owner or management of the building and the person responsible for energy and encourages implementation of the proposed measures. The consultant also motivates the operational personnel and other personnel to energy saving behaviour.

The energy audit model used in the ELO Scheme is a walk through audit including some computer aided calculations and a short report in a set format. The audit is usually performed by one auditor. The site visit takes 3-4 hours in an average building and the whole audit is usually completed in one working day, including the energy rating and plan.

Measurements are not usually made, temperatures are checked using the existing equipment in the plant.

2.1.6 Auditors' Tools

There are tools for the ELO consultant provided by the Secretariat and by the Danish Energy Agency.

The tools include

- training material from the ELO consultant training
- handbook for ELO-consultants
- catalogue of typical savings - no-cost, low-cost, investment *(Besparelsekatalog)*
- check-list *(Huskeliste)* for energy saving in buildings (for field-work)
- calculation and reporting tool *ELO PC*
- key figures for energy consumption in different building types
- the ELO homepage www.energiledelsesordningen.dk (including good examples, how to find an ELO-consultant, key-figures, about training, etc)

The computer tool is free for the registered ELO consultants. The tool is used for data collection, calculating the savings, reporting and printing the label. The site data is sent to the Secretariat in electronic format and run into their monitoring database. The tool is mainly used for registering buildings and their annual consumption of heat, electricity and water. The program is able to calculate and print energy labels and the energy plan.

The ELO Secretariat publishes key-figure reports and summaries based on the data from the sent labels. These reports are available as pdf-files from the ELO homepage.

The pre-printed labels are available from the Secretariat for 15,80 € (120 DKK) /label.

2.1.7 Training, authorisation and quality control

The main idea is that the ELO-consultant should be "a generalist" knowing about all the different fields of energy usage and saving. Usually the audit work connected to the energy label is done by one consultant but sometimes a team of two auditors may be used.

Pre-qualification

The pre-qualification is very strict in order to have the right kind of people attending the training. The right kind of experience is very important.

The applicant sends a form to the Secretariat to qualify for training. The requirements are evaluated from a detailed CV. The Secretariat may ask for further information ans specifications. The DTI rejects 10-20 applicants in the pre-qualification phase every year.

The ELO-consultant must fulfil the following requirements in order to be approved as an energy consultant and to perform energy rating of small or large buildings (the qualifications are a little different for consultants for small buildings and consultants for large buildings - the main idea however is the same):

1. Have a Danish M.Sc.Eng., B.Sc.Eng., M.Arch., or a degree as a building technician, or corresponding, recognised qualifications from Denmark or abroad;
2. Have at least 5 years documented commercial practice within the previous 10 years with relevant building technology consulting or combined building technology and energy consulting, including contact with clients;
3. Have successfully completed an admission course with satisfactory results as specified by the Danish Energy Agency.

ELO-training

The training consists of nine days of education and is followed by an examination. The cost of the training (2 527 € / 19 200 DKK) is paid by the consultant or his company.

The training covers the following topics
- Module 1
  - introduction, legislation
  - heating systems
  - water supply installations
- Module 2
  - building envelope
- Module 3
  - lighting
- Module 4
  - ventilation systems
- Module 5
  - electric appliances

- Module 6
  - checklists
  - responsibilities of consultant
  - motivation
  - short introduction to ELO PC auditor's tool
  - ELO consultant's handbook
  - practical tasks in building inspection and energy plan in ordinary and special buildings

There is an additional 4-hour course for the ELO PC tool. The participants should be approved ELO consultants. The fee for the training is 158 € / 1200 DKK.

The participants must study the given material before the training. The training is carried out as theory with practical exercises. Some homework is included. Energy saving possibilities will by illustrated by means of examples.

Most of the lessons in the ELO consultant work -module are completed with a written test. In order to qualify as an ELO consultant the participant must pass all tests with a certain degree. If he doesn't pass the test, he can do the lesson again and participate in a new test. The whole course can be repeated too.

Each year there has been an additional training day for active ELO consultants. The training is given by specialised consultants.

Authorisation

In their work as approved consultants the consultants must also follow certain rules set in the Executive Order. The Registration Committee for the ELO Scheme (large buildings) approves the qualified energy consultants.

The authorised consultants agree to obey certain rules that are specified in the updated revision of the Executive order 1169. These rules include e.g. taking part in compulsory training events, paying yearly fees, using official labels on the market, following advice from quality control, etc.

The energy management consultant must be employed in a firm registered by the Committee. In order to be registered the firm must meet certain requirements listed in the regulations.

The company of the ELO consultant must
- have at least one authorised auditor as employee
- be registered for VAT
- have an responsibility insurance as defined by the Danish Energy Agency

The company that the ELO consultant works for pays a membership fee to the corresponding secretariat to cover the costs of administration of the scheme.
The active ELO consultant pays an yearly registration fee (197 € / 1500 DKK) to the Secretariat. Also the consulting company must pay an yearly fee (461 € / 3 500 DKK).

At the moment there are about 350 ELO-consulting companies in Denmark with about 640 authorised consultants. More auditors are being trained. The Committee keeps lists of all consultants who have been approved. The ELO Secretariat publishes the names of all authorised ELO consultants on their homepage. The lists are sent to

consultants, municipalities, authorised estate agents etc. and may also be ordered by interested parties.

Quality control

The quality control of the ELO reports is done at the DTI. There is a group of 5-6 ELO consultants doing the control.

The controller contacts the client and the consultant, reads the report and visits the site. The controller analyses the case and checks if the consultant has suggested appropriate saving measures and that the report meets a reference level. The controller gives feedback to the auditor. The feedback is usually guiding and encouraging.

If the report is poor and rejected in the control procedure, the issue is dealt in the Committee. Owners of buildings etc. who have had an energy rating and energy plan drawn up, can make complaints to the Committees concerning professional matters and quality with regard to the work of the consultants. In connection with a complaints case, the Committees may order the consultant to correct mistakes and omissions in the energy rating and energy plan or, under the circumstances, have another consultant draw up a new energy rating and energy plan. The Committees may deprive a consultant of his authorisation.

The quality control also gives feedback to the training of ELO consultants on issues that should be dealt with more thoroughly.

From the beginning of 2002 more work will be put into the quality control. So far only about 0,5 % of the reports have been checked and the target is 2 % in 2002.

2.1.8 Monitoring

The ELO Secretariat situated in DTI is responsible for the monitoring of results. The information from the energy rating and plan report files (produced using the ELO PC tool) are automatically fed into databases. The computerised registration is pooled with the Building and Dwelling Register (BBR) so that the BBR register contains information about the most recent energy rating. The database also includes the dates of the latest energy rating - it is possible to monitor if the yearly rating has been made or not.

The BBR has collected data from the residential sector and all other sectors for a period of more than 20 years. This information is available to the public, e.g. on the key-figure report on the Secretariat home page www.energiledelsesordningen.dk.

Results of the scheme are also introduced in the ELO consultants' newsletter.

The implementation of the suggested measures in the energy plan is not monitored directly. The results show in the repeated energy ratings. There is no obligation to the building owner to do the improvements.

2.1.9 Auditing volumes

There are about 28 000 buildings within the ELO scheme according to the Building and Dwelling Register (BBR). About 15 000 of these have been labelled by the year 2000. The coverage of the labelling is 52 % measured by building area and 42 % by number of buildings.

It is expected that in the following 2-3 years the coverage will be about 75 %. An information campaign has been started to increase the number of labelled buildings.

There are great regional differences in the coverage. In the Copenhagen area about 55 % of the buildings have been labelled, but the lowest regional coverage is about 30 % (Storstroms amt, Viborg amt).

There are also differences in the coverage when looking at building types. The highest coverage is reached in schools, hospitals, apartments, etc. Culture buildings, day care homes, military buildings and prisons have a coverage of about 30%. The coverage is lowest in industry, transport buildings, warehouses buildings, etc.

2.1.10 Results

The average energy saving potential shown in the energy plans connected to the energy labels is 7 % in heating energy, 5 % in electricity and 7 % in water. The saving potential varies according to building type and use, but this is the overall average.

The total potential is
- 3,6 PJ in heating
- 0,173 TWh in electricity
- 5 million m^3

To reach these savings an investment of 711 million € / 5,4 billion DKK is required.

The cost of saved energy is estimated to be
- 2,9-7,2 € / 22-55 DKK / GJ in heating
- 24-38,6 € / 183-293 DKK / MWh in electricity
- 0,9-1,6 € / 7-12 DKK / 1000 m^3 in water

The actual implemented savings are difficult to estimate. From an interview of building owners it can be seen, that more energy saving measures have been implemented in buildings with an energy label than in buildings without a label.

An assumption is that about 36-55% of the potential will be implemented.

When the Act on energy labelling was being prepared, it was estimated that it is possible to reach an yearly saving of 0,5% of the net heating consumption of the buildings within the scheme. The total consumption of the buildings within the scheme is about 87 PJ, 0,5% of this is 0,435 PJ as an yearly saving. When the scheme has been running three and half years, the expected saving at this rate would be just below 2 PJ. The shown potential is about 3,6 PJ so in this area the expectations have been met - the actual implementation rate of the measures, however, is not known. An assumption is that about 36-55% of the potential will be implemented.

2.1.11 Evaluation

The ELO scheme has been evaluated in 2001. The complete evaluation report can be downloaded from the DEA home page (in Danish).
Summary and conclusions http://www.ens.dk/spar/store_bygninger/ELO_resume.pdf
The complete evaluation report
http://www.ens.dk/spar/store_bygninger/ELO_slutrapport.pdf

The evaluation has been made by parallel for the two energy labelling schemes by COWI Rådgivende Ingeniorer AS in co-operation with Advice Analyse. The evaluation was made in late 2000 and the reports were published in February 2001. The DEA, the ELO Secretariat and the Registration Committee have also been involved in the evaluation work.

The main conclusions from the evaluation are

- there was no target for the coverage of the ELO, but the present coverage of about 50 % can not be seen as satisfactory
- the ELO scheme is well known and accepted among consultants but building owners don't know it so well and are not familiar with its advantages - an information campaign is suggested to make the ELO Scheme better known among clients
- there are some improvements to be seen in the administrative set-up, mainly in the roles of the Secretariat, the Registration Committee and the DEA

The evaluation also looks at some technical details of the ELO (set limit of 1500 m^2 for large buildings, suitability for certain building types, ELO Consultants' fees, exceptions for the yearly updating of the energy label, etc) and brings forward some improvements and ideas in these areas.

2.1.12 Observations and Future Plans

The ELO Scheme will be developed and improved, it will go on running.

Changes are planned for implementing in the last part of 2002, and a new Executive Order is under preparation.

2.2 Energy labelling of small buildings, the EM scheme (Energimaerkningsordningen)

The building is energy rated and an energy plan drawn up to ensure that the owner, tenants and other similar users of the building have knowledge of energy conditions in the building and receive advice about energy saving possibilities.

Energy rating and an energy plan must be available in connection with the sale of the building. Energy rating and the energy plan may not be more than 3 years old when the agreement about a sale has been reached.

2.2.1 Goals

The EM Scheme was established as one tool for reaching the national goals set in the Danish Plan of Action - Energy 21. See also 2.1.1.

The goals of the energy labelling scheme were set for 2005 when the scheme was established. The goals by 2005 were

- saving of 4-6 PJ in heating energy
- saving of 300-600 GWh in electricity
- saving of 5-10 million m^3 of water
- saving of 0,6-0,8 million tons of CO_2

Nearly half of these reductions are expected to come from the labelling of small buildings.

In addition to the energy saving and reduced environmental impact the energy labelling has a positive impact on local employment because energy saving measures in buildings in general requires a large amount of local work.

2.2.2 Target sectors

The energy label for small buildings is connected to the sale of property and it concerns residential buildings, owner-occupied flats, public buildings, buildings used for trade and private service. In this context “Small buildings” are buildings with a total floor area under 1,500 m^2.

In practice the labelling involves mainly buildings and apartments from the residential sector. The majority of the labelled buildings are one-family houses, semi-detached houses and terraced houses.

2.2.3 Administration

The key players are

- the Danish Energy Agency (Energistyrelsen) as the Administrator
- the EM Registration Committee (Registreringsudvalget for Energiemaerkningsordningen) as a part of the Administrator
- the EM Secretariat at the DTI as the Operating Agent

The administration is described in 2.1.3 for the EM and the ELO Schemes.

There are 8 persons employed full time by the EM Secretariat. Their main tasks are monitoring, data collection and quality control. The EM Secretariat also provides a telephone service “Energy information” for clients.

In the DEA there is one person part time involved in the budgeting, development, promotion, etc of the EM Scheme.

Real estate agents are also involved in the labelling scheme. When houses and apartments are being sold it is the responsibility of the seller to ensure that the purchaser is made aware of the building's energy rating and energy plan before

agreement is reached concerning the sale. Real estate agents have a key role in encouraging the sellers to have the label made.

2.2.4 Implementing Instruments

The implementing instruments are described in 2.1.4 for the EM and the ELO Schemes.

2.2.5 Energy Audit Models

The EM Scheme includes a walk-through audit with some measurements, computer-aided calculations and a short report in a set format. One person makes the energy rating and the energy plan. The site visit is quite detailed and the whole audit takes 3-4 hours.

The EM consultant calculates the consumption of heating, electricity and water in the building for a standard family with a typical user behaviour profile. The work is based on finding the individual properties of the building, including the registration of all building parts, installations and appliances (depending on the size of the building). The calculated value is compared to the average consumption for all similar buildings. Especially for one-family buildings the energy rating is comparable in all buildings.

In small buildings the energy plan is combined with a description of the present state of the different building parts, installations, heating supply system and appliances.

The field work includes measurements on the u-values of building parts, boiler efficiency, room temperatures, etc.

There are maximum prices for the energy labelling (set by DEA) but the consultants are in a free competition for lower prices. The typical price for the labelling of a one-family house is 300-500 € / 2000-3500 DKK.

2.2.6 Auditors' Tools

Two software companies provide computer tools for the auditors. The tools are called EK-PRO and TM-Energy. The software cost is 526-658 € / 4000-5000 DKK per licence. The programme calculates the energy use of a small building and produces the energy certificate and the energy plan. The software has been developed by architects, engineers and energy consultants. The tools and the updated versions are tested by DTI.

The tools help the auditor to prepare the energy label and print it on the pre-printed form they have purchased from the EM Secretariat. The price of a form is 22,5 € / 175 DKK.

The tool also forms "a database" of each labelled site and this data is sent to the EM Secretariat database for monitoring.

A new web-based tool is being developed. This would help the consultants in having the latest data available (e.g. energy prices, statistical specific consumption, etc). The new tool would make the reporting and data-management of the labels more efficient.

The other tools for EM Consultants are
- Handbook (from training)
- brochures and other material from the DEA
- "Energikonsulent nyt" information paper, appearing four times a year, introducing new rules, clarifications, frequently asked questions, general information, etc
- home page for the EM scheme: www.emsekretariat.dk (statistics , how to find an EM Consultant, about training, prices of labelling, energy prices, building type identification codes, consultants' pages, etc)

Other tools on energy labelling
- www.sparenergi.dk , the web pages of DEA for building owners (energy labelling, what to do when buying or selling a house, principles of energy monitoring, typical saving measures and saving tips, list of publications, links, etc)
- www.energioplysningen.dk , the web pages of DEA on energy information and energy saving (energy use, energy saving, renewables, research and statistics, energy grants etc for households, buildings, industry, etc)

2.2.7 Training, authorisation and quality control

The EM Consultant usually works alone and must know about building structures and heating system and also be aware of the problem areas typical in small buildings.

Pre-qualification

The pre-qualification is very strict in order to have the right kind of people attending the training. The right kind of experience is very important. The consultants should be construction engineers or architects and have an experience of 5 years with existing buildings.

The applicant sends a form to the EM Secretariat to qualify for training.

The EM Consultant must fulfil the general requirements described in 2.1.7 (according to the Executive Order on Energy Rating etc in Buildings, No 1169 of 16 December 1996), and the revision from September 1999.

A consultant can be qualified as an EM Consultant and as an ELO Consultant. Some of the basic requirements and the required training background of the two consultants are different and not many consultants qualify for both.

There is also a house quality and condition assessment scheme running in Denmark. The main purpose of the assessment is to foresee the large and small problems which the building owner will face in the future. This assessment does not include energy issues. The assessments are usually made by architects and construction engineers who also qualify for EM Consultants.

EM Consultant training

The training is arranged by the DTI and it consists of four days of education and is followed by an examination. The training is divided into two sections (2x2 days) with

a month in between. The cost of the training (1579 € / 12 000 DKK) is paid by the consultant or his company.

The training covers the rules and guidelines of energy labelling, the procedure of work, field work and measurements, use of calculation tools, reporting. The training material has been collected into a Handbook for EM Consultants.

The test following the training includes 50 questions on the building, its properties, mechanical and electrical systems, rules of energy labelling, how to advise house owners, etc. In order to qualify as an EM Consultant the participant must pass the test with a certain degree.

Before working independently an EM Consultant must assist in 3 energy labelling projects. The first labels he has prepared alone will be checked carefully at the Secretariat quality control.

The consultants have to follow an yearly additional training course of one day.

Authorisation

In their work as approved consultants the consultants must also follow certain rules set in the Executive Order. The rules and requirements described in 2.1.7 also apply to EM Consultants. The Registration Committee for the EM Scheme approves the qualified energy consultants.

The active EM Consultant pays an yearly registration fee (300 DKK) to the Secretariat. Also the consulting company must pay an yearly fee (395 € / 3 000 DKK).

About 50 consultants are authorised every year. At the moment there are about 700-800 active EM Consultants in Denmark.

The Committee keeps lists of all consultants who have been approved. The EM Secretariat publishes the names of all authorised EM consultants on their homepage.

Quality control

The quality control of the energy labelling reports is done at the EM Secretariat. There is a group of 8-15 experienced consultants (working part time for the Secretariat) doing the quality control.

The quality control procedure involves several steps
- data check: the data sent by the consultant is checked (using key figures) for rough mistakes before feeding it into the EM database at DTI
- a quick report check: the appearance of the label and energy plan is checked, the saving measures are analysed and the saving potential is checked on a rough level
- a check audit: a new report is prepared by another consultant (based on a visit to the site and measurements) and compared to the original, reasons for differences are analysed

All labels go through the data check. 1% of reports are checked by the quick report checking. About 100 check audits are made each year. The budget for quality control is about 131 600 € / 1 million DKK.

If the report is poor and rejected in the control procedure, the issue is dealt in the Committee. The Committees may deprive a consultant of his authorisation. 2-3 consultants have been rejected, several have withdrawn from business.

The work of new consultants is checked very carefully. More attention is paid to consultants whose reports produce "odd results".

2.2.8 Monitoring

The EM Secretariat is operated by a private company DEM, Danish Energy Management, and it is responsible for the monitoring of results. The information from the energy rating and plan report are automatically fed into databases by EM Consultants. The consultants send the data electronically from the labelling tool they use.

The computerised registration is pooled with the Building and Dwelling Register (BBR) so that the BBR register contains information about the most recent energy rating.

Results of the scheme are also introduced in the EM consultants' newsletter "Energikonsulent nyt".

2.2.9 Auditing volumes

From the beginning of the scheme in 1997 until the end of 2001 there were about 217 000 buildings registered in the EM Secretariat's database.
Yearly labelling volumes are shown in the following table. This table includes all the buildings in the database.

Programme year	Number of labelled buildings
1997	42 500
1998	52 500
1999	47 500
2000	37 000
2001	38 000
Total	217 500

Due to some technical problems in the first year of this scheme some of the buildings were only registered partly in this database or some data had to be left out because of possibility of errors. The buildings with insufficient information could not be used in the evaluation of the scheme in 2000.

Studies from the evaluation in 2000 (based on 129 000 labelled buildings from January 1997 – June 2000) shows that 58 % of the labelled buildings are one-family houses, 10 % semi-detached or terraced houses, 8 % apartments.

The overall coverage of labelling is about 60 % when calculated from the number of sold one-family houses and labelled buildings of the same type. The total amount of one-family houses in Denmark is about 1,4 billion buildings. In this respect the coverage of energy labelling July 2002 is around 15 % of all one family houses.

There are differences in the geographical coverage in energy labelling - the Copenhagen area has the highest coverage and the North, Middle and South Jylland have the lowest coverage.

2.2.10 Results

The average energy saving potential shown in the energy plans connected to the energy labels is 18 % in heating energy, 6 % in electricity and 16 % in water. The saving potential varies according to building type and use, but this is the overall average.

This potential can be seen from a sample of buildings where enough data is available and where saving measures have been listed. The saving measures are most commonly found in heating systems and very few energy plans show possibilities in saving electricity. In 71 % of the energy plans there are saving measures for heating, in 5 % of plans there are measures for saving electricity and in 22 % measures for saving water.

Most of the suggested saving measures have a very long lifetime time and will give a reduction in energy consumption for many years. 80 % all suggested measures have a life time of 20 years or more. Typically the payback time of these measures will be 2–20 years (8 years in average). The actual implemented savings are difficult to estimate. It is estimated that 40 % of building owners with an energy label have done some improvements. From an interview of building owners it can be seen, that more energy saving measures have been implemented in buildings with an energy label than in buildings without a label.

Based on the calculations in 2000 the total estimated saving potential in 156 628 buildings within the EM scheme is 2,6 PJ / 745 GWh in heating

Based on the present results it is not possible to say if the targets (introduced in chapter 2.2.1) will be met or not.

2.2.11 Evaluation

The EM Scheme has been evaluated in 2001. The complete evaluation report can be downloaded from the DEA home page (in Danish).
Summary and conclusions
The complete evaluation report

The evaluation has been made by parallel for the two energy labelling schemes by COWI Rådgivende Ingeniorer AS in co-operation with Advice Analyse. The evaluation was made in late 2000 and the reports were published in February 2001. The DEA, the EM Secretariat and the EM Registration Committee have also been involved in the evaluation work.

The main conclusions from the evaluation are

- the coverage of 50-60 % is hardly satisfactory, bearing in mind that energy labelling of small buildings is mandatory
- the scheme is mainly well known and accepted among consultants
- the scheme is not very well known among building owners (only 12 % of interviewed house owners know the scheme well, 57 % have do not know about it)
- real estate agents do not see the advantages of the energy label and don't have an interest in promoting the labelling scheme among building owners
- more information about the labelling scheme should be given, the main target groups being building owners, buyers of property and real estate agents
- the quality of the labelling information of buildings varies a lot and the database includes a large amount of buildings with only basic data - the quality of the labelling data should be improved
- the actual achieved savings can not be directly seen or estimated from the saving potential indicated in the energy plans - follow-up should be improved
- there are some improvements to be seen in the administrative set-up, mainly in the roles of the Secretariat, the Registration Committee and the DEA

The evaluation also looks at some technical details of the EM Scheme (set limit of 1500 m2 for large buildings, suitability for certain building types, EM Consultants' fees, how to encourage building owners to implement the suggested saving measures, etc) and brings forward some improvements and ideas in these areas.

2.2.12 Observations and Future Plans

Some problem areas

A problem in the scheme is that the person who sells a house has to have the energy labelling done and has to pay for it, and sometimes he gets a negative impact by the label. If the labelling produces a low rating for the building (high consumption) and the energy plan suggests many proposals for improvements, the label can reduce the price of the house.

It would be problematic to make the buyer of the house pay for the energy labelling. Often there are several buyers in competition for a house and they would have to make a common agreement or have several energy labels made for the same house.

Many real estate agents feel that energy labelling gives additional work to selling a house. In some cases the labelling even has to be paid by the agent out of the total fee for selling the house.

From this can be seen that it is a problem for the labelling scheme that two of the key players (seller and real estate agent) in some cases have a very small or even a negative value of the energy label.

Future plans

However, an overall conclusion is that the EM scheme has been successful, it has been modified during the years and it will continue. The labelling scheme has

identified a large energy saving potential in existing buildings - energy savings which would have been difficult to identify in other ways.

The energy labelling scheme is a very large source of information on the present building stock in Denmark. It receives data of more than 40 000 one-family houses every year. This information can be used in monitoring and evaluating of other initiatives and also in identifying possible savings and saving measures.

The Danish energy labelling of buildings in connection of property sale is being used as the model when an European level energy certification scheme is being developed.

3 Other Programmes including Energy Audits

3.1 Green Taxes for Trade and Industry

In 1990 the Danish Parliament passed legislation establishing a target for reduction of CO_2-emissions. In 1994 the government appointed an interministerial committee which found that the CO_2-target would not be met without additional measures being taken and that the most effective way of achieving further reductions would be to increase taxes on energy consumption in trades and industries. The parliament passed the current Energy Package in 1995, effective from the beginning of 1996.

3.1.1 Goals

Different CO_2-tax rates in industry have been introduced since 1996, meaning different rates for room heating, heavy processes and light processes. The tax rates have gradually increased from 1996 to 2001. All the revenue raised by the CO_2-tax has to be recycled to the industry through the lowering of non-wage labour costs, subsidies to energy-efficiency investments and by granting tax subsidies to energy intensive companies on condition that they enter into an agreement on energy efficiency with the Danish Energy Agency.

The balance will be shifted from tax on labour towards tax on pollution and the depletion of scarce resources. During the intermediate period between 1996 and 2000 when the tax rate is increasing, part of the revenue was recycled through subsidies on energy efficiency investments.

The annual revenues from taxes on energy use were about 461 million € / 3,5 billion DKK in 2000, approximately 1% of total government revenues.

The CO2-scheme aims at promoting more efficient use of energy in industrial enterprises. It should encourage to more energy efficient technologies and production methods.

3.1.2 Target sectors

The CO_2-tax-Programme is targeted to the industrial sector. The scope covers both building and process. It concentrates on energy use, environmental issues are not included.

3.1.3 Administration

The administration of the subsidies and agreement scheme is organised in accordance with the regulations of the Ministry of Finance and recommendations from the Office of the Auditor General of Denmark regarding administration of subsidies, etc.

In 2001 a Committee (Det Rådgivende Energiudvalg for Industrien REI) was established. The Committee is a discussion forum for the experiences from the energy taxes and subsidies and to advise Danish Energy Agency on the future development of the schemes. In the future the committee will be replaced by a contact committee with members from the main organisations.

Auditors are trained by the Danish Technology Institute.

3.1.4 Implementing Instruments

The scheme defines heavy processes, light processes and room heating and three different taxes have been defined on these three items: CO_2-taxes, energy taxes and sulphur taxes.

The sulphur tax is applied to all energy uses at the same rate. The CO_2-tax is applied to energy uses at different rates - the tax rate for room heating is high, the rate for light processes is lower and the rate for heavy processes is the lowest. The energy tax is only applied to room heating.

On an average, the tax on industrial companies is lower per unit of energy than the tax on service sector companies - the taxes on energy use decrease with energy intensity.

The revenue from increased taxes is recycled. Most of the revenues are recycled through lower labour-market contributions, etc.

Subsidies are an other means of recycling the revenue. When the taxes were introduced, a pool totalling 237 million €/ DKK 1,8 billion was set aside for subsidies to investment. In general subsidies are granted up to 30 % of investments in energy efficiency projects with a pay back period of 2-9 years. If the company has entered the agreement with DEA the required pay back time for projects is 3-9 years. Only projects with a high CO_2-reduction relative to the investment are subsidised.

Subsidies can also be used for energy audits, demonstration and development projects, information projects, etc.

Very energy intensive companies would have difficulties in operating in the competitive international market if taxes on energy use were too high. Therefore a system of voluntary agreements has been worked out. Companies can reduce taxes by entering into a binding agreement on energy efficiency with DEA. The lower tax rate is the result of companies receiving a subsidy with which to pay the tax on energy use.

When joining the agreement a company agrees to carry out a number of energy saving measures and introduce energy management. An agreement is valid for three years and has to be renewed after that.

Agreements can be made for both light and heavy processes. All companies with heavy processes are defined as energy intensive and have the right to enter the agreement. Companies with light processes are defined as energy intensive only if the yearly tax on their energy use amounts to at least 3% of their value added.

Two kinds of agreements can be made: individual and group agreements. The group agreements are made with groups of companies from a sub-sector with similar production processes.

Energy audits are the basis of activities in the agreements. The companies must also establish an energy management system.

Agreement-companies:
Heavy process enterprises are required to undertake all projects with a payback period of less than 4 years. Light-process enterprises must implement all investment projects showing a pay-back-time of 6 years or less.

Non-agreement -companies:
Investment grants up to 30% of the initial expense are offered to large companies for energy saving projects that have a payback time of more than 2 years and less than 9 years.

Subsidies are not returned if the DEA concludes that an agreement is not being fulfilled. In cases of non-compliance the CO_2-tax will be imposed in full.

The key elements of implementing instruments for the CO_2 Scheme are illustrated in the following table.

Mandatory / legal schemes	**Voluntary schemes**
Energy audits in industry are not linked to mandatory schemes.	Energy audits in industry are integrated part to fulfil the requirements of voluntary agreements in the CO2 Scheme.
Fiscal incentives (taxes)	**Fiscal incentives (subsidies)**
There is a link with the tax system, audits are an requirement to the agreement companies to get a tax reduction or rebate within the CO2 Scheme.	Subsidies for energy audits or for investments are related to the implementation of the measures identified by audits.
Marketing oriented schemes	**Policy issues**
No special promotional instruments which can be linked to energy audits.	CO2-tax scheme has been introduced by the Danish Parliament as a tool to meet the national CO2-targets.

3.1.5 Energy Audit Models

Energy audits are carried out by an energy consultant or a member of the company that has signed the agreement. In the energy audit all energy saving projects and the pay back times must be described. Energy audits are to recommend special investigations if these would be likely to result in the identification of possible energy savings. This is typically done when complicated processes are concerned.

The subsidies for the investments and audits are not paid out before a full report of the implementation is received from the company. The company must also present an account for the project signed by a certified accountant.

The cost of the audit varies depending on the size and branch of the enterprise. The time on site varies from 8 hours to 100 hours depending on the size of the enterprise.

The requirements for the audit reports are:
- description of the enterprise and its production processes
- description of previous energy saving activities
- analysis of energy use
- analysis and assessment of energy use in different parts of the enterprise, costs and savings achieved by best available technologies
- analysis of the energy supply and possibilities to change energy source
- description of the energy saving improvements found in the audit
- economic calculation over investment and payback-time

3.1.6 Auditors' Tools

No information about the tools used by auditors.

3.1.7 Training, authorisation and quality control

Training and authorisation

The auditors are approved and authorised by DEA. There are about 70 authorised auditors.

The general requirements to the consultants are:
- the ability to quickly get an overview of the enterprise and its processes
- possession of technical expertise within one or more relevant energy related areas
- ability to carry out economic analyses based on the knowledge of the economy of the enterprise
- ability to motivate the company to energy savings

The consultants are divided into A- and B-level consultants.

The auditors at A-level may perform audits with government grants but not energy audits as part of an agreement on energy efficiency or government grants covering expenses on the CO_2-duty. Only B-level consultants are allowed to carry out energy audits for the Agreement-companies and in connection with government grants covering expenses of the CO_2-duty.

The audits for Non-Agreement -companies can be carried out by energy consultants of A- or B-level. There are different detailed requirements for the A- and B-level consultants, concerning the basic education and occupational experience.

At A-level
- basic education of an engineer (MSc or BSc) or trained machinist or similar qualifications
- three years' experience with energy efficiency in the manufacturing industry

- knowledge on energy consumption and supply, both heating and electricity
- experience should include financial and technical evaluation of energy efficiency possibilities, presentation of these, energy control, management of tasks
- the experience must be documented and must have been gained during the past 6 months

At B-level
- the criteria is basically the same as for A-level, but the experience must be from five years
- the consultant must also have knowledge about energy/environmental management systems
- he must also an experienced project manager

Quality control

All energy audits must be verified by an independent certifying organisation. The DEA has made verification of the audit reports obligatory for all companies in 1997. Verification is carried out by agencies that are accredited to carry out certification according to the EMAS-system. Thus the energy audits are reviewed independently. The verification checks primarily, that audit reports meet documentation requirements.

To check the technical quality of the audit report, a technical expert (a consultant who specialises in certain production processes) is chosen by the verification authority from a list of experts recognised by the DEA. The verification process typically lasts for one month.

3.1.8 Monitoring

All companies with an agreement are obligated to report to the Danish Energy Agency to ensure compliance. Companies must submit yearly progress reports documenting the fulfilment of the projects specified by agreements and the status of energy management systems.

The Danish Energy Agency maintains a database showing the expected energy savings due to concrete projects described in the agreements.

3.1.9 Auditing volumes

Number of agreements

	1996	1997	1998	1999	2000	2001
Total number of agreements	81	176	236	287	329	337

The agreements included in 2001 about 50% of the total energy consumption of the VAT-registered companies. Nearly all companies with high energy consumption which were expected to enter into agreements have done so.

3.1.10 Results

Estimation of CO_2 reductions in 2005 from the two rounds of agreements (1996-97) and the first five rounds (1996-2000)

Agreement entered	1996-1997	1996-2000
Estimated impact in	1999	2005
Concrete projects	1,2%	1,5%
Special investigations	0,8%	1,0%
Energy management	0,8%	3,8%
Total impact	2,7%	6,3%

It is estimated that the continuation of the agreement system by 2005 can lead to a decrease in CO_2 emissions corresponding to 6 % of total emissions in trade, industry and services.

Of this reduction the highest amount is due to energy management.

3.1.11 Evaluation

As a part of the evaluation of the CO_2-tax system the Danish Energy Agency initiated an independent evaluation of the agreement system in 1998. The evaluation was carried out by research institutes and consultants.

The taxation of energy use for trade and industry was evaluated in 1998 by an interministerial committee and published in the report "Evaluering af gronne afgifter og erhvervene" (in Danish only). There is a summary report on the evaluation in English "Green Taxes for Trade and Industry, description and evaluation" published by the Danish Energy Agency in June 2000.

As the agreement system was implemented in 1996 and changed both in 1997 and 1998, the system was evaluated before it was fully established. It has not been possible to make an ex post analysis based on statistical elements but a method of analysis of behaviour has been used. The evaluations used case studies and a survey.

The main results from the evaluation are

- it has been possible to establish an energy tax system that has lead to a decrease in CO_2 emissions without causing a decrease in the competitiveness of trade, industry and services
- in general companies are satisfied in the quality of the energy audits
- the audits sum up existing knowledge rather than identify new saving possibilities
- companies see the audits as a useful tool for improving energy efficiency
- the DEA finds that the quality of audits has improved since verification was introduced in 1997
- the special investigations that are implemented in addition to the audits open areas of new knowledge
- the energy management system is seen as a positive element in the agreement system, however the implementation of the systems appears to progress slowly
- the rating for energy efficiency activities is 27 % higher in agreement companies than in companies without an agreement

- the agreement has caused an increase in activity of 6 % compared to companies without an agreement
- the companies expect an energy saving of 1,4% within a three-year period, in addition further savings are expected as a result of improved energy management and special investigations
- the administrative costs of entering into an agreement are between 10 and 20 % of the tax subsidy, these are mainly costs due to energy audits and verification

3.1.12 Observations and Future Plans

The CO_2-tax and agreement scheme are valid and running in 2002.

4 Other Activities including Energy Audits

4.2 The OR Yearly Oil Burner Check

The OR (Olieservicebranchens Registeringsording) yearly Oil Burner Check is done by service companies. The scheme is administrated by DTI (Danish Technical Institute) which provides education and training for the companies and is also responsible for the development of the scheme. About 1400 service companies do these check-ups. More than 300 000 installations are examined yearly.

5 References

Reference material:

- Energy Policy Report 2000
- The Danish Agreements on Energy Efficiency, May 1999
- Act to Promote Energy and Water Savings in Buildings, No 485 of 12th of June 1996
- Executive Order on Energy Rating etc in Buildings, No 1169 of 16th of December 1996 and its revision from 14th of September 1999.
- Executive Order on Fees and Liability Insurance for Energy Rating of Buildings, No 1170 of 16th of December 1996
- Bekendtgoerelse om energimaerkning i bygninger (nr 717 af 14 september 1999)
- Evaluering af Energimaerkningsordningen, resume, februar 2001
- Evaluering af Energiledelsesordningen, sammenfatning og konklusion, februar 2001
- Training of energy auditors in Denmark, paper by Henrik Poulsen, DTI
- Beskrivelse ad Kursus til ELO-konsulent, januar 2001
- Energy labelling in Denmark, paper to IEA conference in sept 2000 by Jens Laustsen, DEA
- Country report Denmark, Heat energy rating and Energy rating benchmark, BELAS-project report in the SAVE-programme by Henrik Poulsen, DTI, July 2000
- Green Taxes for Trade and Industry, description and evaluation, DEA, July 2000

Web-sites

- www.ens.dk
- www.teknologisk.dk
- www.energiledelsesordningen.dk
- www.emsekretariat.dk
- www.sparenergi.dk
- www.energioplysningen.dk
- www.elsparefonden.dk

Currency

1 DKK = 0,1316 €
1 € = 7,599 DKK
(March 2002)