A standard energy auditing procedure is providing good results as a part of Finland's Energy Conservation Programme

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1. SYNOPSIS

This paper introduces the energy conservation potential in commercial and industrial sector buildings and the results achieved by a standard energy auditing procedure and compares them to the objectives of Finland's Energy Conservation Programme (ECP).

2. INTRODUCTION

In the autumn of 1992 the Finnish Government approved the ECP prepared by the Energy Department of the Ministry of Trade and Industry (MTI). The objectives of the ECP were defined as a 10 to 15 per cent lower specific energy consumption in 2005 compared to the reference year 1990. An Information Center for Energy Efficiency, MOTIVA, was established in the spring of 1993 to begin information and energy auditing activities as well as to promote the marketing of new energy efficient products and systems.

3. ENERGY AUDIT SERVICE DEVELOPMENT PROJECT (EASDP)

Energy auditing had previously been shown to be an efficient method of energy conservation. As a part of the ECP, the Finnish Government started supporting energy auditing in the winter of 1992. The grant is normally 50 % of the total auditing cost. During the first year only 150 projects were carried out by less than 20 auditors. Although the total volume of projects was reasonably low, the application and reporting procedures had already caused a resource problem. When it was apparent that the auditing activity should be rapidly increased, MOTIVA was given the responsibility to coordinate and develop a national energy auditing programme in May 1993. The resource problem was to be dealt with by delegating the treatment of the applications and payment transactions to 14 area offices of the MTI in August 1994.

In June 1993 MOTIVA started to develop a standard auditing procedure to be followed in all energy auditing projects receiving grants from the MTI. The EASDP was carried out by MOTIVA and three of the most experienced consulting engineering companies. The other important issues to be dealt with before the auditing programme could be controlled were the training of energy auditors and the guidelines to be followed in all phases of operation. The MOTIVA model with detailed application, working and documentation procedures was introduced in December 1993. Since then a total of 500 new energy auditors have been trained to implement the MOTIVA energy auditing procedure.

By the end of year 1994 the total number of buildings in Finland that should be audited due to their age was roughly 65.000 buildings representing a total of 600 million m3 in building volume. The volume is increased annually by 20 to 30 million m3 by the existing building stock built in the early 80's. As the first year of operation started auditing in only 150 buildings, the total number in 1994 had already increased to one thousand buildings. In 1995 the volume is expected to be 2000 to 2500 buildings representing 50 to 60 million m3 in building volume (Figure 1) and 10 million ECU in annual turnover. The continuous growth in applications give no indication that the expected total number in 1995 would not be reached (Figure 2).

4. ENERGY AUDIT FOLLOW UP SYSTEM

In order to be able to monitor the auditing work a computer based follow up system MOTICOP was developed in August 1994. Each energy audit project is filed into the MOTICOP in MOTIVA when the application is accepted. When an audit is completed, the client is obligated to submit a copy of the audit report to MOTIVA. All reports are examined in MOTIVA and filed into the MOTICOP.

The audit reports are written in a standard format and include detailed information concerning the present energy consumption of the buildings and all economically profitable energy conservation measures. All authorized auditors have been trained to use a simulation program named MOTIWATTI. The program was developed during the EASDP specially for energy conservation calculations. MOTIWATTI contains a standard format reporting table which is used when transmitting the data into MOTICOP. Manual data input will soon be impossible as the volume of completed projects is continuously increasing.

The MOTICOP is utilized in monitoring the present auditing volume and timetables and in analysis of the proposed energy conservation measures and actual savings. With MOTICOP it is also possible to control the quality of work by comparing the savings percentages of proposed measures versus average levels. In addition to project data MOTICOP contains information on all auditors and clients.

5. RESULTS OF ENERGY AUDITING PROJECTS

As a part of the EASDP 114 clients were interviewed in summer 1993. One major question was the ratio of actual implementation versus the measures proposed in the reports. The savings potentials identified by the auditors were reasonably good, 20 % in heating and 10 % in electricity. Most of the clients were satisfied with the audits but only 20 to 25 % of the proposed savings had been implemented. The two main reasons for the low level of implementation were the financing of the investments and a short period of time between the audit project and the interview. Although the interview could not prove that energy auditing is providing good results as a part of the ECP it showed that the heating target of 10 % is achievable but also that the electricity target of 15 % requires improvements in efficient technology.

In summer 1994 MOTIVA interviewed 248 clients. The implementation percentage, measures carried out or intended, had risen to 70 % (Tables 1 and 2). Although the average savings percentage in electricity has decreased by one third since summer 1993 the overall picture of the present auditing work is good. The problem with electricity is mainly due to auditors who carry out the projects without a qualified electrician. The problem will be dealt with by requiring separate authorized HVAC and electricity auditors to be named in each audit.

The annual energy consumption of the building stock to be audited in Finland is approximately 40 TWh in heating and 23 TWh in electricity. If the predicted level of auditing volume can be reached in 1995 and maintained until year 2005 the annual savings will be 5 to 6 TWh in heating and 1 TWh in electricity. In financial terms this means a total savings of 1 billion ECU in energy costs in commercial and industrial sectors during the period 1994-2005.

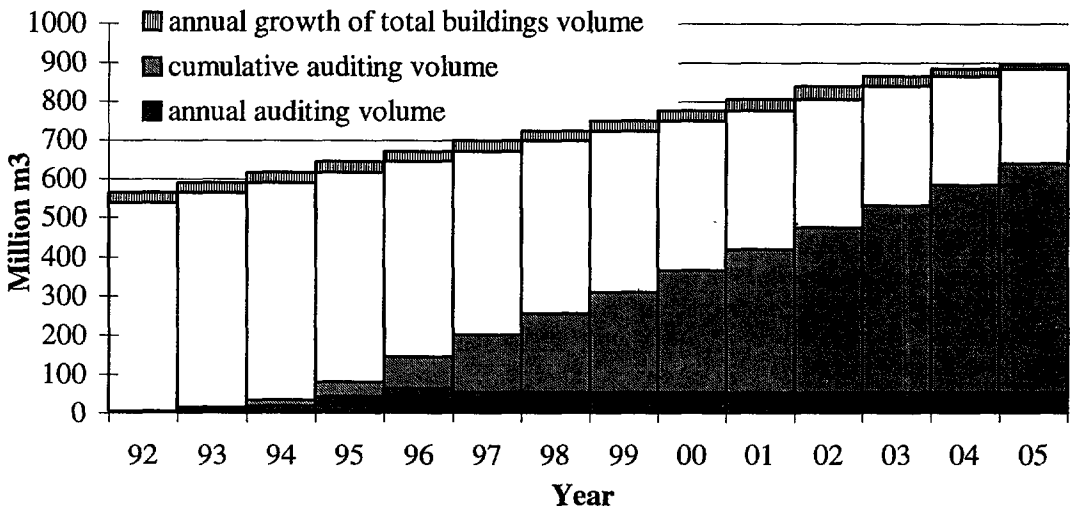

Figure 1. Auditing volume in 1992 - 1994 and required growth in 1995 - 2005

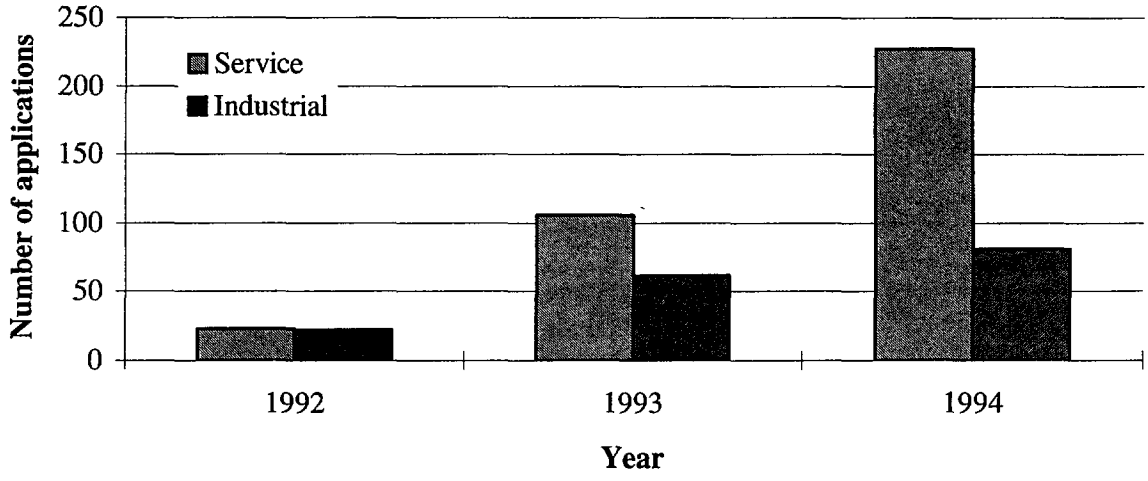

Figure 2. Energy auditing applications in service and industrial sectors

Table 1. Reported implementation of the proposed measures and total savings potential (%) in heating

Status/Sector	Private services (50 buildings)	Public services (78 buildings)	Industry (20 sites)
Implemented	8,8	5,5	4,1
Intended	4,8	11,7	5,8
Considered	2,7	4,6	7,1
Not to be implemented	1,3	0,2	2,6
Total savings potential	18,1	22,0	19,6
ECP target value	10,0	10,0	10,0

Table 2. Reported implementation of the proposed measures and total savings potential (%) in electricity

Status/Sector	Private services (50 buildings)	Public services (78 buildings)	Industry (20 sites)
Implemented	3,0	0,9	1,9
Intended	1,3	1,4	1,4
Considered	1,7	1,5	3,0
Not to be implemented	0,9	0,1	0,1
Total savings potential	6,9	3,8	6,3
ECP target value	15,0	15,0	10,0

6. CONCLUSIONS

Based on the results so far the standard energy auditing procedure has proved to be an important part of Finland's ECP. Without energy auditing and a follow up system there would be very little if any reliable information about the actual effects of ECP. In addition to good savings, the reports provide a unique opportunity for statistical analysis of a large building stock along with detailed information about the factors affecting to their energy consumption. Based on the experiences and results of the years 1992-1993, the general guidelines do not give enough guidance.