The Evaluation of an Energy Efficiency Programme for Finnish Industry

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1. SYNOPSIS

This paper presents a survey of an energy efficiency programme for Finnish industry: the agreement on industrial energy conservation.

2. INTRODUCTION

In Finland the industrial sector accounts for about one half of total primary energy consumption. Finnish industry is highly energy-intensive and energy occupies a central position among the various factors of production. Improvements in the efficiency of energy use in industry have been achieved over the past twenty years. However, in recent studies it has been shown that further improvements are possible.

3. THE AGREEMENT ON INDUSTRIAL ENERGY CONSERVATION

In 1992 the Ministry of Trade and Industry (MTI) and central industry associations, among them the Energy Federation of Finnish Industries (TELI), agreed on energy conservation targets and measures for industry. The basic principle of the agreement is to encourage the industrial sector to enhance energy efficiency voluntarily.

The agreement was one response to the requirements set in the Finnish Programme on Energy Conservation confirmed by the Government in 1992. The agreement revitalises efforts to improve energy efficiency in industry.

The agreement includes a target to reduce specific end-uses of energy (electricity, heat) by about 10 per cent by the year 2005 compared to 1990. The reduction target varies according to energy form (higher for heat) and according to the branch of industry: in small and medium-sized industries the energy savings potential and therefore, target is larger than in large process industries. The reduction targets are based on an extensive energy conservation research project led by the MTI in 1989-1991.

The agreement provides a framework for all industrial energy conservation activities in Finland. It encourages industrial enterprises to develop and implement their own energy conservation programmes and plans. From the industry's point of view the main objective for the agreement is to minimize costs and emissions by improving energy efficiency.

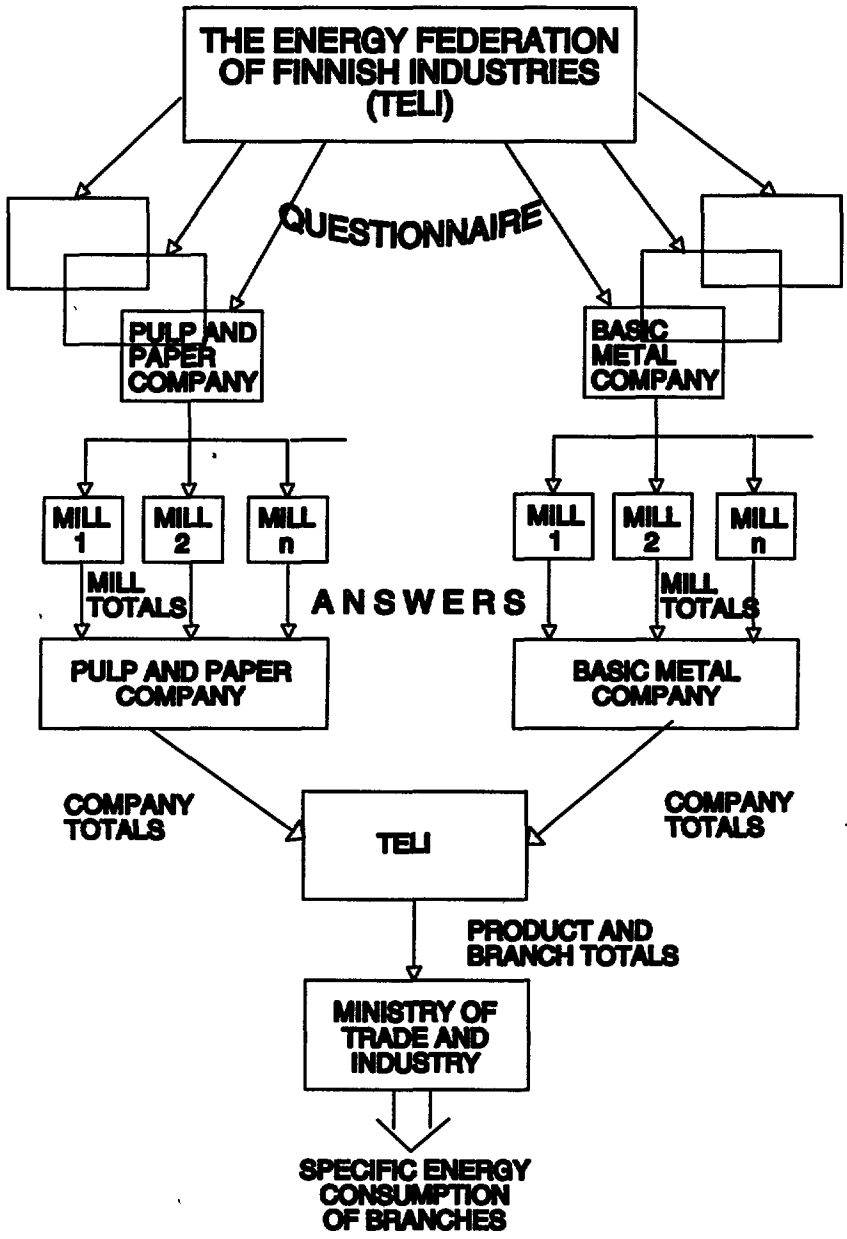
Finnish industry pays the highest CO2/energy taxes in the world. In Finland industry is not exempt from CO2/energy taxes no matter how much money it invests in energy conservation. One of the tangible benefits that industry expects to gain through the agreement is financial support from the MTI to energy conservation work.

The content and goals of the agreement shall be subject to review during 1996.

3.1. Monitoring and evaluation of the agreement

Monitoring and evaluation are essential for the realisation of the agreement. As part of the agreement, TELI, MTI and industrial energy users have designed a system to monitor the progress of specific energy consumption in the Finnish pulp and paper and basic metals industries. The system was demonstrated in 1994-1995. Empirical data on energy consumption and other relevant factors (processes, products) was collected in 1994 and analyzed at the beginning of 1995.

Figure 1 provides an overview of how the data acquisition is organized in two branches of Finnish industry.



The result of the work will be a standardized, annual follow-up programme of specific energy consumption of pulp and paper and basic metal products.

In this first phase about 60 % of the total Finnish industrial energy demand is reported. For other branches of Finnish industry, co-operation will be established and the follow-up will be carried out later. The ultimate goal would be an international, standardized comparison of energy efficiency of various branches of industry.

Our motto is: "Monitoring of energy efficiency contributes to energy conservation". The aim is to motivate industry to look more critically at its energy consumption and ultimately to introduce more energy-efficient measures.

3.2. Problems in evaluation of energy efficiency by using specific energy consumption

In the agreement the energy efficiency is evaluated by using specific energy consumption. This causes problems because changes in specific energy consumption does not always imply energy efficiency.

We encountered some special problems in pulp and paper industries, e.g. (1) There are not two papermills of the same kind with identical products having identical ingredients: comparisons are not valid. (2) There is no uniform knowledge of the energy included in bleaching chemicals, fillers and coating pigments because these are not manufactured in pulp and paper mill. (3) Shutdowns and the amount of defective products increase strongly specific energy consumption, because specific energy consumption is calculated using saleble production.

We found out that in addition to a single number representing specific energy consumption, supplementary meters are needed to evaluate energy efficiency. For this reason empirical data on other relevant factors (processes, products) were collected.

3.2.1. A method for follow-up of specific energy consumption of Finnish pulp and paper industries

To improve the time series comparison a special method was developed for pulp and paper industries. Typical "average" Finnish paper and board products were created (Figure 2) whose specific energy consumption serves as follow-up value.

Pulp	**Paper and Board**
GW, PGW x_1	Newsprint
TMP, CTMP x_2	Wood based printing &
Kraft pulp x_3	Woodfree printing &
Recycled fiber x_4	Board

$$SEC_{product} = k * \sum_{i=1}^{n} (x_i * SEC_{pulp,i}) + SEC_{papermachine}$$

where

$SEC_{product}$ = Specific energy consumption of typical "average" Finnish paper or board product.

k = Share of pulp in paper or board product.

x_i = Share of pulp component i in pulp composition.

$SEC_{pulp,i}$ = Specific energy consumption of the pulp component i.

$SEC_{papermachine}$ = Specific energy consumption of the papermachine.

4. REFERENCES

Rämö, J. 1993. "Problems in and Proposals for Monitoring of Energy Efficiency in Finnish Industry." The Energy Federation of Finnish Industries. Not published.

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