

Evaluation of Swedish market transformation programmes

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1 - SYNOPSIS

Methods for the evaluation of market transformation programmes and a retrospective analysis of the evaluations of the Swedish market transformation programmes.

2 - ABSTRACT

The introduction of market transformation programmes has raised issues concerning programme evaluation and several analysts have stressed the importance of the development of new evaluation methods suited for market transformation programmes. This paper presents methods for the evaluation of market transformation programmes discussed in the literature. These methods have then been used to retrospectively analyse the evaluations of the Swedish market transformation programmes undertaken by the Department of Energy Efficiency at NUTEK. It is shown that several evaluations of the Swedish market transformation programme are based on monitoring market transformation indicators - as proposed in the literature. Furthermore, the Swedish market transformation programmes have applied indicators that describe, in accordance with suggestions in the literature, technology development, market development, and changes in market actors' behaviour. Furthermore, the results of the evaluations indicate that the Swedish market transformation programmes have succeeded in establishing changes in the market. However, the evaluations of the Swedish market transformation programmes could improve if market transformation indicators were used in a more defined way to thoroughly analyse the elimination of market barriers, the reduction of transaction costs, and achieved energy savings.

3 - INTRODUCTION

The Swedish market transformation programmes, introduced in the late 1980s, have been a precursor of market transformation programmes. These programmes, which have been co-ordinated, designed and financially supported by the Department of Energy Efficiency at NUTEK, have targeted several different market actors and been strategically planned to permanently transform the market towards more energy end-use technologies.¹ The focus of the programmes has been on the introduction and commercialisation of new energy efficient technologies. The *introduction* of new energy efficient technologies on the market has been based on technology procurement programmes (see for example NUTEK 1994a). The *commercialisation* of the procured energy efficient technologies has been stimulated by additional market activities such as demonstration programmes, information programmes, education programmes, handbooks (e.g. "The green office"), incentives, labelling systems (e.g. ELOF predominantly used for appliances), voluntary standards, etc. In total, the Department of Energy Efficiency at NUTEK has initiated about 30 technology procurement programmes and more than 1500 projects (Lund *et al.* 1996). The total cost of these completed and on-going programmes has been approximately 700 million SEK (80 million Euro) (Lund *et al.* 1996).

The introduction of the Swedish market transformation programmes, and other market transformation programmes, has raised issues of the importance of the development of new evaluation methods suited for market transformation programmes. New evaluation methods are required (1) to monitor changes in the market effected by a specific market transformation programme and (2) to provide valuable information and guidance that can be used to refine a programme in progress or to improve the planning, design and implementation of other market transformation programmes. The objective of this paper is to present methods for the evaluation of market transformation programmes discussed in the literature. These methods will then be used to retrospectively analyse the evaluations of the Swedish market transformation programmes undertaken by the Department of Energy Efficiency at NUTEK. The analysis will describe how the evaluation of Swedish programmes stands up to the evaluation methods proposed in the literature, and discuss the merits and shortcomings of the evaluations.

4 - EVALUATION METHODS SUGGESTED IN THE LITERATURE

The evaluation of market transformation has been discussed in several articles, for example by Prahl and Schlegel (1993), by Feldman (1994-1996), and by Rosenberg (1995). They all stress the importance of the development of new evaluation methods suited for market transformation. Prahl and Schlegel (1993) stress that the evaluation of market transformation programmes must analyse changes in awareness, values, and behaviour of various market actors. Prahl and Schlegel also emphasise the necessity to study a variety of variables that are assumed to be associated with savings, including sales data. Feldman (1994-1996) stresses the importance of identifying market barriers and evaluating the programmes ability to remove or overcome the market barriers considered most critical. The evaluation could include indicators of market effects, such as changes in attitudes and information, new market actors, competing products, new market rules, changes in market share and market penetration. Rosenberg (1995) presents several evaluation parameters that could be used to analyse market transformation (product improvements, price reduction, development of effective retail channels, universal stocking patterns, growth in sales and market penetration etc.) and lasting changes (increased advertising, standardisation to reduce cost etc.). Furthermore, the development of evaluation methods suited for market transformation programmes is discussed in for example IEA (1996) and Nadel and Latham (1998).

In conclusion, the evaluation of market transformation is suggested to monitor changes in indicators of market transformation, i.e. parameters describing

- (1) *changes in market actors' behaviour*: changes in manufacturers' commitment in the market (e.g. entry of new firms, the development of new models, changes in product lines, research and development, pricing, standardisation etc.), changes in trade allies' commitment in the market (e.g. the number of dealers, changes of dealers stocking patterns, and development of effective retail channels, pricing, promotion etc.), and changes in customer acceptance and behaviour (awareness of the product and willingness to pay).
- (2) *market development*: changes in the mix of products and actors on the market, changes in market share (the mix of products available and the sale of these products), changes in product performance and price, formal and informal standards, changes in infrastructure associated with the product, roles of exchange, changes in stocking practices.
- (3) *technology development*: changes in innovations, performance, non-energy benefits, product prices, operating cost etc.

The indicators will describe, in the short and medium term, market transformation effects and, in the long term, a permanent market transformation. Furthermore, the indicators could be used to analyse the elimination of market barriers, the reduction of transaction costs, and achieved energy savings. The specific indicators chosen to evaluate a programme will depend on the type of programme and the commercialisation status of the product or service being promoted. However, for all programmes a time series of market transformation indicators will be necessary in order to capture market transformation.

Moreover, the analysis of each market transformation indicator will call for an individual method (IEA 1996). Methods for analysis of changes in market actors' behaviour may include interviews, consumer billing records, consumer surveys, end-use metering, short-term monitoring etc. Methods for analysis of market and technology

development may include interviews, market surveys, site visits, manufacturers sales reports, product catalogues, price lists, product reports etc.

5 - EVALUATION METHODS USED IN SWEDEN

Since the early 1990s, several evaluations of the Swedish market transformation programmes have been accomplished by NUTEK itself and by external evaluators. However, the evaluations of the Swedish market transformation programmes have had different focuses and structures, and only a few of the evaluations have been directed towards market transformation. The first evaluations of the Swedish market transformation programmes focused only on the direction and procedure of the programmes (STEV 1990; RRV 1992). Subsequent evaluations also focus on the direction and procedure of the programmes, but included more precise and directed analysis of specific programmes (NUTEK 1993a; NUTEK 1993b; NUTEK 1994a; The ministry of industry 1995; RRV 1995; Lund *et al.* 1996). The market transformation as a result of the programmes has only been evaluated by the Department of Energy Efficiency at NUTEK (NUTEK 1993a; NUTEK 1993b; NUTEK 1994a) and by a Finnish research group (Lund *et al.* 1996). The internal evaluation reports were supplemented by reports from external evaluators, contracted by the Department of Energy Efficiency at NUTEK, to evaluate the changes in market actors' behaviour and competence (NUTEK 1993c; NUTEK 1993d; NUTEK 1994b).²

The evaluation reports that analyse market transformation as a result of the programmes have used indicators to monitor changes in market transformation. In the early 1990s, the indicators used were few and described only improved technology performance and cost reduction. Over the years, the indicators were to describe sales data, market share, and change in knowledge, attitudes and behaviour of important market actors. The evaluation from 1996 (Lund *et al.* 1996) included additional indicators describing the introduction of informal standards and spin-off effects. These evaluators also discussed the significance of external effects (recession, learning processes in organisations etc.) and international effects (effects on technology change in other countries, export markets, price reduction, etc.). The indicators developed to evaluate the Swedish market transformation programmes describe, in line with suggestions in the literature, technology development, market development, and changes in market actors' behaviour.

6 - ACHIEVED MARKET TRANSFORMATION IN SWEDEN

As described, indicators have been used to evaluate market transformation effects; indicators that describe technology development, market development, and changes in market actors' behaviour. By using these indicators it has been possible to evaluate the achieved market transformation.

Technology development has been analysed through indicators that describe technology performance, improved energy efficiency, increased lifetime, and spin-off effects. The evaluations show improved energy efficiency for all technologies, but also additional technology development for many technologies. Improved performance has been shown, for example, for the winning refrigerator/freezer which provided reduced CFCs, for the energy efficient windows which reduced noise and provided a flexibility of the placement of radiators (eliminated cold draught from windows), and for the winning heat-pumps which were more reliable than the standard heat-pumps. The procurement of HF electronic ballasts was shown to provide, apart from improved energy efficiency, essential technology improvements, such as non-flickering lighting systems, operational reliability, and a built-in intelligence for occupancy control. Moreover, the evaluation analyses illustrated that the NUTEK procurement programmes resulted in spin-off effects. For example, the market transformation programme for energy efficient windows not only led to the introduction of a "best" energy efficient window (with a U-value of 1.0 W/m²K or less) but also to the introduction of an improved standard window (with a U-value of 1.2-1.5 W/m²K). Moreover, the market transformation programme for HF electronic ballasts allowed for the introduction of improved control systems of lighting to occupancy and to daylight.

In conclusion, the evaluations of technology development show that the Swedish market transformation programmes have resulted in an introduction of several energy efficient products with improved performance to the market. The introduction of most technologies must, however, be considered as a pre-introduction since the technologies most likely would have been introduced to the market even without the programme, but in this case several years later. As an example, the pre-introduction has been calculated to 5-7 years for HF electronic ballasts and 3-4 years for refrigerators/freezers (Lund *et al.* 1996).

Market development has been analysed by using indicators that describe sales data, price reduction, the introduction of formal and informal standards etc. The sales data shows that market penetration growth differs considerably between technologies. Some technologies have reached a smaller market share; in 1995, 3 year after the technology procurement programme, the market share of energy efficient combined refrigerators/freezers was 8.5% (Lund *et al.* 1996). Other technologies have reached a larger market share; already in 1995, 3 year after the technology procurement programme, the market share of HF electronic ballasts was 60-70 % (Lund *et al.* 1996). Some, technologies, such as energy efficient ventilation equipment, have not reached any significant market penetration.³

Price reduction is an important issue for the diffusion and adoption of new technologies. Lower prices will increase market demand, which, in turn, will lead to increased production volumes and decreased production costs, which, in turn, will lead to increased market demand etc. However, the development of improved products will in most cases initially increase technology prices. This has been the case for most technologies procured by NUTEK. However, for some technologies, e.g. heat pumps, cost reductions have been included in the procurement programme. Some price increase may be acceptable for the buyers if it corresponds to a requested improvement of performance (e.g., the extra cost of HF electronic ballasts is approximately 200-300 SEK (Dovelius, 1996)). The outcome of the technology programmes shows that price reduction may be slow, this even in cases when competition is hardened between producers. For some technologies, such as heat pumps and HF electronic ballasts, prices have been reduced. For other technologies prices have not been reduced, the reason may be a recession (as for windows) or split incentives (as for refrigerators/freezers in rental apartments).

The changes in market actors' behaviour have been illustrated indirectly through the increase in market development and increase in market penetration. Moreover, the analysis of indicators of awareness show that the Swedish market transformation programmes have increased the *awareness* of energy efficient technologies among several different parties, from producers to users (NUTEK 1993c; NUTEK 1994b; NUTEK 1997; NUTEK 1998).

7 - CONCLUDING REMARKS

The analyses of the evaluations of the Swedish market transformation programmes show that not all of the evaluations have been focused on the evaluation of market transformation. The evaluations that do evaluate market transformation have been based on the use of market transformation indicators. The applied indicators describe, in accordance with suggestions in the literature, technology development, market development, and changes in market actors' behaviour. These evaluations have proven to be successful to illustrate market transformation effects and the results of the evaluations indicate that the Swedish market transformation programmes have succeeded in establishing changes in the market. However, the measured market transformation effects are short and medium term market transformation effects only since the evaluation of a sustainable market transformation must take into account a timelag of *several* years.

To improve the evaluation of market transformation programmes market transformation indicators should be used in a more defined way to thoroughly analyse the elimination of market barriers, the reduction of transaction costs, and achieved energy savings. This, in turn will require the identification and use of indicators specified to different programmes, methods to develop a baseline, directions on how to adjust for external parameters etc..

8 - ENDNOTES

(1) As of January 1, 1998, the activities of the Department of Energy Efficiency were taken over by the Swedish National Energy Administration. In the text below only NUTEK will be referred to.

(2) The Department of Energy Efficiency at NUTEK has also in recent years contracted external evaluators for the evaluation of changes in market actors' behaviour (NUTEK 1997; NUTEK 1998).

(3) The reason for the failure has been described by Suviletho and Överholm to be caused by the limited use of the procured technology (only one size of air-handling units was chosen) and a too limited number of market support programmes.

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