

Evaluation of DSM-Programmes

Evald Brønd, NES A/S, Denmark

1. SYNOPSIS

Description of a first screening procedure and the assessment parameters for evaluation of lots of DSM options. Discussion on results obtained from practical application.

2. ABSTRACT

Many Danish electric utilities launched about 6 years ago some DSM-activities in order to promote the most efficient and economic use of electricity. The programmes were offered to the various groups of customers partly as support to the governmental policy concerning energy conservation and partly to enhance customer related services performed by the utilities. At first the activities were designed without thorough market analyses, cost/benefit calculations etc. The possible effect on the electricity consumption could only be assumed based on approximate appraisements. This practice was, of course, unsatisfactory in the long run. As part of a comprehensive project--supported by the EEC's SAVE-programme--concerning integrated resource planning (IRP), some of the Danish DSM-activities have been analysed in detail. The result of the analyses shows a great deviation in the cost/benefit ratio for the activities accomplished. In order to compare different options of DSM-programmes a practical tool is necessary for a judgmental evaluation of DSM-programmes. As part of the IRP-project a screening procedure useful for such an evaluation has therefore been developed, based on experiences in the U.S. The paper describes this procedure, the assessment parameters used and the result obtained from screening of the DSM-activities mentioned.

3. INTRODUCTION

3.1. Background

The majority of Danish electric utilities has a long tradition concerning customer-orientated programmes for using electric appliances in the household as effective (i.e. most energy efficient) as possible. The means used in such programmes are information, exhibitions, campaigns, demonstrations, instructions etc. Common for these means (and the programmes) are that the customers more or less of their own accord make use of the appropriate means (or programme), and that it is normally not possible to measure or evaluate the results of the utility's contribution. When customer-orientated programmes (demand side management (DSM) activities) are being more consultative and individual with special reference to make the customers implement measures to reduce the energy consumption, it will be necessary to have a "tool" to evaluate the expected result and to compare this to the costs. Such a tool is of interest especially for electric utilities offering various types and lots of DSM activities.

3.2. Scope

A few of the bigger Danish electric utilities launched about 6 years ago consultancy programmes as DSM activities for non-residential customers. Shortly after such programmes were offered by most of the Danish electric utilities. The means in the programmes consisted of visits, mapping of electricity consumption, rough estimates of saving possibilities. The programmes were mostly offered free of charge to the customers.

The scope with these DSM activities was in the beginning partly to support the intentions in the energy policy concerning electricity conservation and partly to get some experiences concerning DSM activities compared to extension of production capacity.

The consultancy programmes were started up as pilot projects, i.e. some differences between the details in the programmes offered by the individual utilities, without much knowledge of the need for such activities and to which extent the programmes would be accepted and implemented by the customer.

These DSM activities have after a running-in period of 3-4 years to a high degree nowadays been "standardized", i.e. consisting of more levels and steps, so it is possible to tailor the most efficient version for the individual customer depending on his conditions and needs. Some parts of this range of programmes (partly including financing) have to be paid by the customers and are offered in competition with private consultants. The standardized programmes are now offered by all Danish electric utilities.

The utilities had until recently no general evaluation procedure for the programmes, but as part of a big and ambitious project concerning Integrated Resource Planning (IRP) to which a majority of power producers and distribution utilities in Denmark are contributing, it has been logical to develop a tool suitable for preliminary evaluation of DSM programmes.

4. METHODOLOGY

4.1. Conditions

A tool for the assessment of different DSM activities has to fulfil the following conditions:

- estimate results compared to contribution seen from various points of view such as:
 - economy
 - energy saving
 - market penetration
 - image
- be easy to use (operational)
- be methodical

An assessment of DSM programmes (options) will always be influenced by parameters that are difficult to quantify; it is therefore not possible to develop a tool which gives an exact valuation of neither accomplished nor planned DSM programmes. *The aim of the tool is to have an easy and operational method useful for screening of many different DSM options in order to find out which options could be suitable for more detailed economic evaluation, market testing, and implementation.*

4.2. Assessment parameters

Based on experiences obtained from a screening procedure used by a US consultancy firm for several DSM programmes offered by electric utilities in the U.S. we have in Denmark decided to use the following parameters for an assessment of DSM options:

- a. Potential for energy saving measured in GWh
- b. Market share measured in GWh. (This criterion is the most realistic estimate of the market impact as result of the option in question)
- c. Socio-economics, measured as a ratio between benefits and costs (values of energy savings and load reductions include an external benefit of 0,012 ECU/kWh (0,10 DKK/kWh) as an expression of the CO₂ impact)
- d. Utility resource requirements, measured as total expenditures per calculated saved kWh
- e. Technological development (maturity for practical use)
- f. Load shape objective

The proportion between parameter b and a is the same as the expected market penetration. The parameter

Brønd

"socio-economics" is to understand as technology economy. The costs do therefore not include utility costs, but only society and customer costs. The benefit has been calculated on the basis of the societal price for saved energy.

Other parameters could have been taken into account such as impact on utility image, useful lifetime, easy to install/operate etc. But as it was the aim to find a tool which could give a rough valuation of new or planned DSM options and as some of the parameters mentioned are difficult to estimate in advance we decided to use only the 6 parameters for the screening exercises of the IRP-project. It has been considered to make the parameters as quantitative as possible, and they are evaluated to be the most influential by assessment of DSM options in Denmark.

4.3. Screening process

For each parameter a classification numeral in the interval 1-5 has been defined. The value of the numeral is a graduation of the result or value of the individual parameter with "5" as the most satisfactory.

To each parameter is also defined a weighting factor which made it possible to give the assessment parameters different weights by a mutual weighting.

The determination of the weighting factors has been considered thoroughly. As one of the aims with the DSM programmes offered by Danish utilities was to support the governments energy policy it is natural that the economic parameters have the highest values. The real market share has a more predominant influence than a more or less calculated saving potential. Finally it is so that Denmark for the time being does not have big capacity problems concerning power supply; hence the weighting factor is rather low for load shape impact.

The three most dominating parameters can therefore--by maximum classification numerals--give about 2/3 of the maximum score of 175 points.

Table 1 shows the parameters and weighting factors to be used in the Danish IRP-project.

Table 1. Assessment parameters and weighting factors

Parameter	Energy saving potential	Market share	Socio-economy	Resource application	Technological development	Load shape impact
Weighting factor	3	6	10	7	5	4

The screening process is then easy to effect by multiplying the classification numeral with the weighting factor for the parameter and sum up for all the parameters for each option. Affected in this way the screening process gives an overall assessment for lots of DSM options.

For some specific DSM programmes other assessment parameters may have a dominating influence on judgement of a programme. As examples can be mentioned programmes which have to promote new services offered by a utility, the general impression of the utility and its image etc. as well as campaigns with special goals.

It is necessary to notice that a screening process carried through as here described is qualitative of nature even if it results in a scoring list which could be ranked.

To conclude: A screening process as described may be very useful as a judgmental valuation, and comparison of a broad spectrum and lots of DSM options, as elements in programmes directed to one or more market segments (groups of customers).

5. RESULTS

5.1. Test of the screening process

Some of the DSM programmes which have been offered by the Danish electric utilities in recent years have been analyzed as preliminary tasks in the IRP-project, totalling about 40 programmes covering various groups of customers. The screening process described has been tested on these programmes.

Table 2. Screening of DSM options offered to residential customers

Parameter	Energy saving potential	Market share	Socio-economy	Resource application	Technological development	Load shape impact	Total score
Weighting factor	3	6	10	7	5	4	
ELSAM energy saving campaign, winter 90/91	5	5	4	5	5	2	153
EFFO and EASV's campaign for change of freezers	5	5	1	3	5	2	109
EFFO's experiment with CFLs 1988 (distributed)	5	5	3	1	5	2	115
SEAS's distribution of CFLs in the autumn 1989	5	5	5	2	5	2	142
AKF's experiment "energy savings in the housing sector"	5	5	1	1	3	2	91
NESA's campaign for CFL	5	5	3	4	5	2	136

The test detected that a provisional definition of the assessment parameters as well as the classification numerals and the weighting factors, had to be adjusted considerably in order to give a meaningful result, i.e. a succession which corresponds satisfactorily with the results obtained by carrying through the

programmes. The final definition to be used in the IRP-project, the classification numerals and the weighting factors are those stated in chapter 4.2 and table 1.

To illustrate the screening process the figures for some DSM options offered to residential customers have been reproduced in the following table.

It might seem curious that the classification numeral for the first two parameters is the same for all options, but that is due to the fact that all options shown in the table have been directed to the same group of customers and mostly aimed at the same type of electricity end use; they may therefore overlap each other. In practice the users of the procedure will have to secure that the individual programmes do not overlap inexpediently. One aim in developing the screening procedure has been to make it as simple as possible.

5.2. Applicability

Based on practical use in the Danish IRP-project, it is the impression that the screening process described may be a useful tool in designing new DSM options maybe, especially when more technical versions of a DSM option are available or more means--such as economic subsidy, free consultancy--can be taken into use.

Even if the principle and the way of carrying through the screening process may be transferred from one country to another we have learned that it is necessary with a "national" definition and adjustment of assessment parameters, classification numerals, weighting factors etc. On the other hand it is our impression that it should--for the general use of the screening process--be possible to use the same process for all utilities in Denmark.

6. CONCLUSIONS

Nowadays where it for various reasons has become more and more widespread for electric utilities to offer their customers a wide range of DSM options partly to contribute to as efficient a use of electricity consumption as possible and partly as an element in the optimization of capital investment, i.e. integrated resource planning, it is necessary to be able to compare and give a rough estimation of new DSM options. The screening process described has shown its suitability for these purposes in the Danish IRP-project.

Even though the described screening procedure has been developed for project purposes and has until now only been used as an element in the IRP-project, it is today evident that the procedure in the future will be used by evaluation of new DSM options, maybe after some adjustments. Some new assessment parameters may be added. As examples can be mentioned the impact on CO₂ emission which is a factor of great importance in the coming years in Danish energy policy. Some new compulsory schemes concerning electricity use have been established in 1992. As these schemes influence the design of DSM options--and also the market penetrations for some DSM activities--it will be necessary to adjust the screening procedure.

The conditions for all the Danish electric utilities by offering DSM programmes to their customers are in general uniform. It is therefore to expect that in Denmark there are very good conditions for using a general screening procedure--equal to all utilities--as a useful tool by designing new DSM activities. If new definitions of assessment parameters are necessary or adjustment of weighting factors is appropriate, it will end up with the same result for all utilities. Due to these circumstances it is to expect that a screening procedure similar to the one described in this paper will be widely used by the utilities.

Due to information from the US consultant for the Danish IRP-project we in the Danish screening procedure have a much higher content of qualitative assessment parameters than normally used in the US. This fact gives the screening process a new "dimension" and thereby a more practical applicability.

ACKNOWLEDGEMENTS

The preparation of this paper has been supported by Henning Parbo, ELSAM. Information concerning screening procedures used by electric utilities in the U.S. has been given by SRC International.