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Demand Side Integration

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DEMAND SIDE INTEGRATION

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5 REVIEW OF DSI INITIATIVES

5.1 Introduction

The objectives of this section are:

- To study the current Demand-Side Integration (DSI) initiatives and the drivers behind them.
- To review actual products for DSI.
- To evaluate the advantages of DSI for the different stakeholders.
- To examine state of the evaluation practices at present.

5.2 Background: State of the art in Demand-Side Integration

To date, only limited DSI initiatives exist in developed countries. From the nineties to the present the DSI potential is continuously reducing. This is well explained when observing analyzed examples, for instance the existing USA DSI potential from 1996 to 2004 (Figure 5-1).

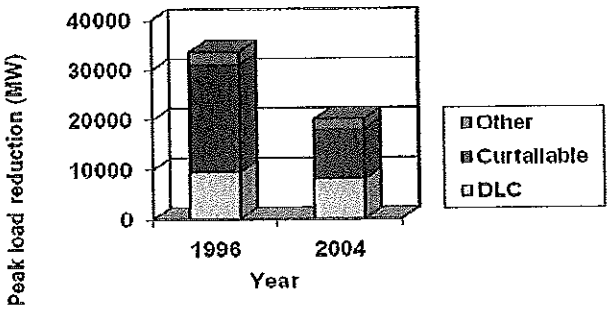

Figure 5-1 USA Demand Side Response potential ([21])

A description of the drivers for the implementation of DSI activities is included in Chapter 2.

Some barriers can become "drivers". For example, the lack of information about the meaning of DSI, appears as a serious barrier and explains some past projects or trials that have not achieved expectations amongst different DSI initiatives. Nowadays, information campaigns and specific software (for instance Dayzer, a user friendly detailed market analysis tool [23] devoted to customers) could change failure to success.

5.3 Options for Demand-Side Integration: Example of Initiatives worldwide

Table 5-1 provides some examples of DSI initiatives around the world that were available to be examined in approx 2007. As the fundamentals are illustrated by some of these examples, it was considered adequate to refer to these projects without updating the review for more recent initiatives.

A greater extent of programs in the table refers to USA past or present policies. The reason is based on the fact that USA market for DSI is amongst the most advanced in market operation with demand. Some interesting lessons have already been learned in these few years of competitive market operations.

Energy Policy Act (EPAct) 2005 (USA) also promotes energy efficiency and conservation. Some incentive and tax credits are available for customers who upgrade thermostat technologies (see Table II) smart technologies [37]) and install efficient central HVAC systems (the incentive can reach up to US$500).

5.3.7.2 The development of a comprehensive legislation

In some developed countries there is a growing consensus: insufficient levels of DSI exist in their electric power systems. An important driver for DR is to develop a comprehensive legislation in the energy sector. An example is the Energy Policy (EP) Act 2005 in the United States of America; starting from section 1252 we can extract some concerns:

"... it is the policy of the US to encourage time-based pricing and other forms of DSI, whereby electricity customers are provided with electricity price signals and the ability to benefit by responding to them".

It further states that "... deployment of such technology and devices ... shall be facilitated, and unnecessary barriers to DR participation in energy, capacity and ancillary services markets shall be eliminated".

This law requires US Department of Energy (DoE) to provide a report that "identifies and quantifies the national benefits of DSI and makes a recommendation ... by January 2007". It was not possible to perform a complete recommendation yet. DoE was not able to provide recommendations to be implemented and does not have any practical impact (benefit).

As an alternative, DOE offered a report to the USA Congress (2006) pursuant section 1252 of the Energy Policy Act (2005). Some recommendations to encourage DSI are [33]:

- Fostering Price-Based Demand Response
- Improving Incentive-Based Demand Response
- Strengthening DR Analysis and Valuation
- Integrating Demand Response into Resource Planning
- Adopting Enabling Technologies
- Enhancing Federal Demand Response Actions

5.4 Conclusions

A range of initiatives have been undertaken in the early years of DSI to seek to understand the impact of the initiatives. One the major difficulties being faced in this area is the shortage of published data of the results of the various initiatives. Although it is common to hear of new programs and the potential expenditure that the program will incur, there is a significant deficiency of published data detailing the results of such programs.

Most DSI programs require some form of subsidy Nevertheless there are positive indications from the various trials undertaken that DSI initiatives offer promising opportunities.

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6 ELASTICITY OF DEMAND AND PRICE IMPACT

6.1 Introduction

There are few studies ([50], [51]) which provide a rigorous analysis of the determinants of the elasticity of demand. Reliable estimates of the price and income from elasticity of demand are important pieces of information in formulating public policies, in our case related to DSI. Several sources in the European Union, Australia, United States and Canada (consultants, research laboratories, market regulators, utilities, etc.) have been consulted before to preparing this report, but all the sources agree with the following idea: "the price reform is a major component of electricity market reform". In this way, pricing policies and the knowledge of available elasticity in each customer segment is an essential driver for DSI Initiatives.

A simple example shows the usefulness of demand elasticity: over $215 million per year in estimated cost savings from 1GW of Price Responsive Demand were reported in New England (USA). In this way there is a need to explore customer response and thus improve pilot projects. Also, it is necessary to connect retail and wholesale markets to promote the price-responsive demand while reducing the potential to exercise market power.

What does elasticity of demand mean?

In the technical and sociological reports related to customer elasticity, several kinds of "elasticity" appear, but they do not refer exactly to the same concept. For example, some reports deal with price elasticity, others with elasticity of substitution and another group analyzes long-term price elasticity. We will explore these terms and their differences.

1. *(Own) price elasticity:* the percentage of change in demand as a result of a percentage of change in the price (the elasticity should be a negative number).

$$Elasticity = \frac{\Delta D / Di}{\Delta P / Pi} \quad (1)$$

where D is the demand (ΔDi is the change in customer demand) and P is the price (ΔPi is the change in the electricity energy price).

2. *Elasticity of substitution*: is a measure of the percentage of change in the ratio of the peak to peak-off demand as a result of a percentage of change in the ratio of the peak to the off-peak price.

3. *Long-term price elasticity:* is the annual energy consumption response to an average change in energy price. This concept should not be confused with a demand response to high instantaneous energy prices.

Two further considerations are:

- The price elasticity of demand is non-linear.
- The responsiveness to price changes is not symmetrical.

The majority of studies in this area [52] report that the customer demand for electricity is price inelastic both in the short and in the long term, but a lot of them are based on false hypothesis.

6.2 Customer Price Response

6.2.1 Can large customer demand respond to prices?

First tests of elasticity in New Electricity Markets were reported by Georgia Power [42]. In those pilot projects, large industrial and commercial customers participated in both load response and price response initiatives.

The response of large industrial customers seems easier because energy prices affect industrial benefits. This hypothesis is especially true for large and intensive energy demand segments, such as: Aluminum Industry, Glass Industry, Metal-Casting Industry, Steel Industry, etc. [43]

6.5 Conclusions

To summarize, several ideas arise from the bibliography on elasticity of demand and the experiences carried throughout the world:

- HVAC and thermal loads are a key driver for demand response.
- High demand customers have more load to shift.
- Small customers react to price (education, understanding of tariffs and technology drivers are critical to improve response).
- CPP tariffs did not have a measurable effect on annual energy use (people increase the use during off-peak periods).
- Impacts (CPP) persisted across years and especially across multi-day critical events.
- Price Responsive Demand is alive but is not prospering as well as it could be.

The most important conclusion is that a lot of work needs to be carried out in the research and measurement of elasticity through the development of DSR initiatives.

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