DSM Spotlight

The Newsletter of the International Energy Agency Demand-Side Management Programme November 2003

VIII

Demand-Side Bidding in a Competitive Electricity Market

The IEA Demand-Side Management Programme Task on Demand-Side Bidding in a Competitive Electricity Market has recently come to an end, culminating in the production of a "Practical Guide to Demand-Side Bidding." This article reviews some of the Task's findings and gives a flavour of what is in the Practical Guide.

What is Demand-Side Bidding?

Demand-Side Bidding (DSB) is a mechanism that encourages consumers to offer to undertake changes to their usual pattern of consumption in return for financial reward. The financial reward can be in the form of reduced electricity prices, a direct payment for electricity they have 'not consumed', or an availability payment for the promise of being available to make a consumption change at an agreed time. DSB has become an important feature of many markets, and has the potential to grow in importance, as its operation becomes more fully understood.

Although DSB is often thought of purely as a mechanism by which consumers can earn money, it may also play an important role in terms of energy efficiency. For example, load reductions by consumers can displace the use of fossil fuel generation for maintaining the quality of electricity supply or for balancing. Alternatively, DSB can have an important role to play where demand exceeds capacity or when network constraints occur for only a very limited length of time. In such cases, it may be more appropriate to seek short-term demand reductions from consumers in place of additional generation capacity or network reinforcement.

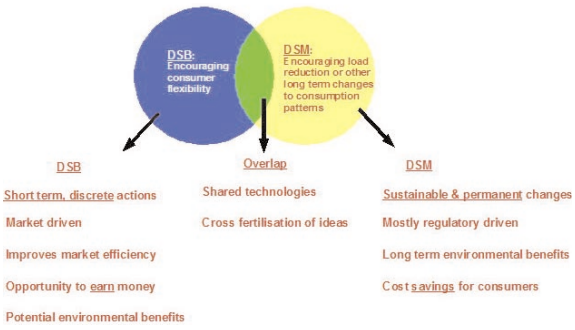
DSB is closely related to, but very different from, Demand Side Management (DSM) — the main difference arising from the impact the two have on the demand profile of consumers.

The Role of DSB in Market Mechanisms

There must be a balance between supply and demand of electricity at all times (i.e., on a second-by-second basis). However, for practical purposes electricity is not traded on a second-by-second basis, but rather trades are settled over a longer time interval—typically half hourly or hourly—depending upon the market regulations in force. Market participants, such as Suppliers and Generators, are given the responsibility of balancing supply and demand over these trading periods or otherwise face financial penalties. Thus there are two types of balancing action required, and DSB can be used for both of these purposes:

- Those undertaken to maintain balance in real-time to prevent system imbalance and ultimately network failure (Network Stability).
- Those undertaken to balance supply and demand over a trading period for the purpose of avoiding imbalance charges (Planned Balancing).

DSB vs. DSM



Network Stability

For example, a very successful area of DSB in the UK is frequency response. In an emergency, such as the loss of a large generator, the system frequency can fall dramatically from its normal value. It is the job of the Transmission

continued on page 4

COUNTRIES PARTICIPATING IN THE IEA DSM PROGRAMME

Australia
Austria
Belgium
Canada
Denmark
European Commission
Finland
France
Greece
Italy
Japan
Korea
Netherlands
Norway
Spain
Sweden
United Kingdom
United States

NEWPROGRAMMEWORK

The work of the IEA Demand-Side Management (DSM) Programme covers a wide spectrum from performance contracting and energy efficiency to demand side bidding and demand response. To focus, and where possible, to better link the Programme's work, the current IEA DSM Tasks have been divided into two clusters – load level and load shaping. These categories cover, respectively, activities that seek to reduce permanently the overall level of demand and activities that seek to cut peaks by shifting demand.

The recently initiated IEA DSM Tasks fall within the load shaping category, that is, activities that primarily address energy security and quality of supply. The new and timely DSM Tasks underway are *Demand Response Resources* (DRR), which will serve as an umbrella for the two other Tasks—*Time of Use Pricing and Energy Use for Demand Management Delivery* and *Network Driven DSM*. Below are short descriptions and contact information for the new work.

Demand Response Resources

Demand Response Resources (DRR) can be compared to the Strategic Petroleum Reserve (SPR) as both serve as a "shock absorber" for their industry. DRR provide the long-term risk management insurance that is needed if competitive electricity markets are to work. The ability to call upon thousands of megawatts contractually, on short notice and in specific locations provides a virtual storage asset that can be used for short duration demand peaks, facilitate power restoration (as seen during the August 2003 blackout in the northeastern United States), and provide a means of transition to, or possibly prevent, new power system upgrades.

Recognizing the urgent need for demand side participation in electricity markets to ensure energy security and mitigate price volatility in liberalized electricity markets, the IEA DSM Programme initiated Task XIII, *Demand Response Resources*. The goal of this project is to develop a process for countries to identify and evaluate the full spectrum of demand side resources, establish reasonable objectives for their realization, and determine the required infrastructure and implementation plans required for rapid deployment on a country specific basis.

The Task is organized into eight Subtasks, which are grouped into three phases. The first phase (12 months) is focused on gathering country, market, and technology specific information that will be summarized and distributed to the participating countries via a web-based Project Portal and four regional workshops. During the second phase, the Task's focus shifts to developing the methodologies, tools and products necessary to determine the best way to deploy demand response, taking into account country-specific market conditions and goals. The final phase is focused on the delivery of the tools and products created.

To facilitate the management and distribution of Task products, a Project Internet Portal will be used to categorize demand response technologies, best practices, and techniques and will act as a communication tool among the Country Experts and the Operating Agent.

For more information contact the Task XIII Operating Agent, Ross Malme of RETX, USA, e-mail:malme@retx.com, fax: +1-770-390-8501.

Time of Use Pricing and Energy Use for Demand Management Delivery

As with the other Tasks described here, this Task's overall objective is to persuade customers to respond to energy price as well as to reduce overall energy consumption and operate in more energy efficient ways. Under the new DSM Task XII, *Time of Use Pricing and Energy Use for Demand Management Delivery*, work will focus on how to motivate smaller customers to modify demand and provide mechanisms for their participation in the demand side of competitive electricity markets.

The work is divided into three areas 1) to analyze and determine what is technically and economically feasible for collecting and feeding back end use energy data to smaller customers. Results from DSM Task II, *Communications technologies for Demand Side Management*, will be used in the collection of the technical, communication and cost information; 2) to quantify the benefits of time of use pricing based on the collective experience of the participating countries; and 3) to build upon the work of DSM Task VIII, *Demand Side Bidding*, participants will quantify the pricing, control and validation requirements, and mechanisms to facilitate Demand Side Bidding for smaller customers.

For more information contact the Task XI Operating Agent, Richard Formby of EA Technology, UK, e-mail: richard.formby@eatechnology.com, fax: +44-151-347-2411.

Network Driven DSM

This is the first IEA DSM Task to work on how demand-side management can cost-effectively relieve constraints on electricity networks. The work will focus on physical events—constraints on the transmission or distribution network that may be short-term or long-term and that may or may not be driven by what is happening in real-time in the electricity market. The objective is to identify and develop a wide range of DSM measures that can be used to relieve network constraints, whether time-related constraints (e.g., occurring at network system peaks) or location-related (e.g., problems associated with particular lines or substations).

The work is divided into four areas 1) a worldwide survey of network-driven DSM projects, 2) an assessment and the further development of network-driven DSM measures, 3) the development of business models, rules and procedures to successfully implement network-driven DSM measures under different electricity market structures and regulatory regimes, and 4) the dissemination of this information to relevant audiences, including representatives of electricity network businesses, government agencies and electricity end-users. This 18-month Task will conclude with regional workshops on network-driven DSM in Europe, North America and Asia Pacific.

For more information contact the Task Organizer, David Crossley of Energy Futures Australia Pty Ltd., e-mail: crossley@efa.com.au, fax: +61-2-9477-7503

In addition to these new Tasks, Programme participants are further developing proposals on white certificates, energy efficiency lighting for DSM and energy savings performance contracting tool-kit for consideration by the Programme's Executive Committee in 2004.

IX Municipalities Face the Challenge of Liberalisation

The participants in IEA DSM Task IX, *The Role of Energy Efficiency in a Liberalised System*, have spent the last three years looking at how municipalities are promoting energy efficiency in the face of liberalised energy markets. The partners have selected 33 "best practices" which will be used to illustrate a series of guidelines, in the form of questions that municipalities should ask themselves in response to liberalisation. Below are some examples indicating how different countries have addressed specific issues.

Aggregation

Aggregation is a process by which the local authority acts as a purchaser on behalf of the consumer in order to gain market power on their behalf, and as shown below, it can lead to the development of broad programmes for local energy action.

In the United States, the states of Massachusetts, Ohio and California have passed opt-out aggregation laws, which permit municipalities, subject to approval in a local referendum, to purchase energy in bulk on behalf of customers in their territory as a means to obtain economies of scale. The Cape Light Compact in Massachusetts has led the way, with Ohio and more recently California following. Customers can opt-out of the "aggregation" otherwise they are automatically included.

The advantage of aggregation is not limited to price. The aggregators in Massachusetts and Ohio (consortia of municipalities) have chosen energy that has a lower primary energy demand. In Ohio, power is obtained from a Texas company that generates from gas and some renewables, thus replacing the coal generated electricity provided by the former supplier. And in Massachusetts, a State law states that once an energy efficiency programme is adopted, an aggregator can control the funds from the "public benefits" levy made by the State on energy consumers and previously administered by the distribution companies. Since March 2003 the Cape Light Compact has run its own US$ 5M programme to promote energy efficiency and controls the full budget for energy efficiency programmes available from the State levy.

Aggregators also can act as a political lobby on energy issues. For example, the Cape Light Compact obtained the refund of the proceeds from the sale of a generating plant, and is pressing for the transfer of ownership of the street lighting equipment from the incumbent electricity distributor to their member municipalities, a far more satisfactory management arrangement for promoting efficiency. Furthermore, in 2001 the Compact obtained funds from a local Trust to prepare a policy plan for renewable energy for their region.

Allowing such opt-out aggregation has many advantages in a liberalised market. At present it is only allowed in some US states. Other liberalised countries might do well to consider laws permitting aggregation.

Acting as Market Players

In Finland, Jyvaskyla Municipality took over the ownership of street lighting from their energy company upon liberalisation, and following this made extensive investments in an energy saving plant. In Stockholm, the municipal electricity company used to supply electricity for traffic signals free of charge as a public service. Upon liberalisation, it became a chargeable client and thus provided the incentive for them to change all their signals to super-efficient LEDs.

Benefits also can be obtained for local authorities themselves when they purchase energy in a consortium. This is common in the United Kingdom and is starting in other countries (e.g., The Netherlands). Energy purchasing through consortia has proved successful in promoting the consumption of electricity with a lower CO_2 emissions content. However, these consortia are generally purchasing organisations, and therefore, they have not promoted sustainable energy policies or demanded energy efficiency services as a complement to the energy supply to a significant degree.

A local energy agency such as Graz can be an ideal intermediary for promoting such energy efficiency services. Indeed one can concentrate all energy-related activity (including purchasing) in such an energy unit or agency as Leicester in the UK has done.

Local Energy Planning

The arrival of liberalisation does not mean that cooperation with the local utility is lost, or that it is impossible to plan for ambitious targets in energy efficiency and renewables. Trollhättan in Sweden has maintained and deepened its energy planning since liberalisation in 1996 through an action programme designed to reduce emissions by 50% and fossil energy use by 90% by 2010. The programme was devised in cooperation with municipal energy, housing and property management companies and updated in 1998 and 2003. It makes use of both investments and soft measures (advice).

In many European countries the idea has been that liberalisation, often misleadingly called deregulation, means that the market will solve all if it is just left alone. However, a liberalised market needs far more regulation than a monopoly, at the national, state and local levels.

The example of Trollhättan demonstrates that liberalisation does not mean the end to the role of the municipality or municipal action, but rather puts more pressure on the municipality to deliver. To deliver an effective programme of investment in energy efficiency and renewables, a framework is needed to guide action and to enable the local authority to bid for resources. No longer can the municipality just say, "That is the municipal energy company's business." It has to plan and search for resources, and in effect, become more business-like in delivering public services and meeting public objectives. Trollhättan demonstrates this in an exemplary manner, showing that there should be a smooth transition through liberalisation with energy planning continuing with even more urgency. It is only local level actors, such as the local authority that can deliver many of these objectives.

For more information or copies of the reports, please contact the Operating Agent, Martin Cahn of Energie-Cités, e:mail: martin@tf.com.pl or see www.energie-cites.org.

Demand-Side Bidding *from page 1*

System Operator to correct this and return the system frequency to normal within a specified period. Normally this is achieved by having reserve generators in a state of readiness. However, consumers capable of instantaneous shutdown can also provide the same frequency correction. In the UK, a Demand-Side aggregator (Gaz de France) is currently offering an instantaneous load reduction of 110MW, aggregated across 13 cement production sites. The crushing and milling processes at cement works are ideal for frequency response as they consume large, predictable and steady loads which can be easily interrupted and restarted.

The Role of Aggregator and Service Providers

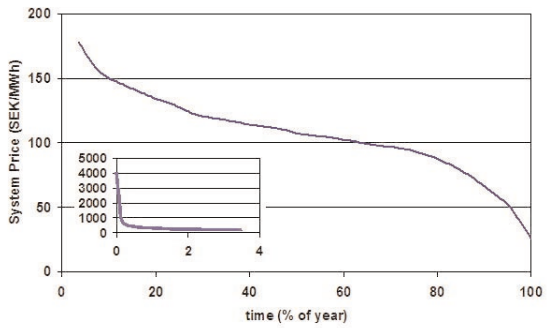
Usually DSB is far removed from the day-to-day priorities of consumers, the very people that DSB is aimed at. Consequently, DSB can easily be seen as an unwanted distraction. Often, as in the case of the cement industry discussed above, the role of an Aggregator or Service Provider is crucial in providing the necessary impetus to make DSB happen. The Aggregator may be an independent company or an Electricity Supply Company. In either case, it is they who bring together knowledge of electricity markets, an understanding of the processes of the end consumers of electricity, and the expertise to implement the necessary control, monitoring and communications technologies.

Planned Balancing

To date, the most successful DSB schemes have been used to cope with abnormal or unusual situations, as in the Network Stability example described above. Similarly, the successful Planned Balancing examples have tended to be where price spikes occur just occasionally, for example, in generation limited networks. Here very high prices can occur for a few hours per year and demand response is desirable to reduce prices and ensure a secure system.

This Nordic example shows a typical annual System Price distribution curve (i.e., the percentage number of hours per year that the price exceeds the plotted value). The inset shows how the price can rise dramatically for less than 1% of the time. Investigation is currently under way as to whether it is feasible to group together a large number of small consumers to provide a cost effective solution to these occasional price spikes. From a market perspective, the problem is one for the suppliers. However, in practical terms the Network Operator may be better able to solve the metering and settlement issues that arise. Sweden has initially turned to the Network Operator to provide

Annual Variation in System Price in Sweden



Demand-Side reductions, but has set a target date of 2008 to put the market mechanisms in place for this to be undertaken by the suppliers.

A Step-by-Step Guide to DSB

The final output from DSM Task VIII is a "Practical Guide to DSB." The Guide is divided into two sections. The first section provides background information about the concept of DSB and why it is important in the operation of competitive electricity markets. This includes a number of important definitions and a discussion of the drivers for DSB. The second section presents a step-by-step guide to the implementation of DSB, covering such issues as: understanding the needs of the DSB buyer; the suitability of consumers to meet these needs; the control, monitoring and communication technologies required; and how to make a business case for each participant. Each step is illustrated by examples. Further examples are included at the end of the Guide to provide a wide coverage of DSB applications. Examples cover both Network Stability and Planned Balancing.

The Future

DSM Task VIII, *Demand-Side Bidding in a Competitive Electricity Market* has provided both an overview of the current status of Demand-Side Bidding and practical advice on how to implement DSB. However, DSB, like competitive electricity markets themselves, is an area that is constantly evolving, and many changes can be expected over the coming years.

DSM Task VIII has shown that a wide range of DSB schemes are available, but with the vast majority targeted at large consumers. The challenge for the long-term success of DSB is to build on this initial success and to extend its applicability to encompass smaller consumers (particularly those who, within the context of liberalised markets, do not currently require time of use metering). A number of practical issues to do with verifying Demand-Side Bids (e.g., will metering be too expensive?, can consumption profiles be used as a lower cost alternative?, is aggregator validation sufficient?) require addressing. As do the questions of who will drive DSB forward—will it be aggregators and service providers, or will it require active intervention from system operators? These and other questions will be addressed by the new IEA DSM Task XI, *Time of Use Pricing and Energy Use for Demand Management Delivery* as described on page 2.

For more information on DSM Task VIII visit the IEA DSM web site at dsm.iea.org.

The DSM Spotlight is published three times a year to keep readers abreast of recent results of the IEA Demand-Side Management Programme and of related DSM issues. The viewpoints or policies expressed in this newsletter do not necessarily reflect those of the International Energy Agency, the IEA Demand-Side Management Programme member countries, or the participating researchers.

For more information on the Programme, its work and contact addresses, please visit our website at ***http://dsm.iea.org***

No. 20, November 2003

Prepared for the IEA Demand-Side Management Executive Committee
by
Morse Associates, Inc.
1808 Corcoran Street, NW
Washington, DC 20009
U.S.A.

Editor: Pamela Murphy