attitude makes the difference

IEA-DSM Task XXI: Standardisation of Energy Savings Calculations

Task I: State-of-the-art

Demand Response

Madrid, April 2010

Index

1. Main Demand Response related Tasks in IEA-DSM
2. Demand Response definitions and examples
3. Proposals for measuring energy savings caused by DR initiatives

1. Main Demand Response related Tasks in IEA-DSM

Completed and current tasks

Within the IEA-DSM tasks, some of them are related to Demand Response understood as policies aimed to manage customer consumption of electricity in response to supply conditions:

- **Task VIII - Demand-Side Bidding in a Competitive Electricity Market:** The objective of this Task is to **evaluate and promote Demand Side Bidding (DSB)** as a means of improving the efficiency of the operation of the electricity supply chain. This aim is fulfilled by evaluating the characteristics, strengths and weaknesses of existing DSB schemes and creating guidelines for the development and enhancement of new schemes.

- **Task XI - Time of Use Pricing and Energy Use for Demand Management Delivery:** The objective of this Task is to **increase the motivation of smaller customers to save energy** through energy end use presentation, modify their **energy demand profile** through time of use pricing and provide mechanisms for their bidding demand into competitive energy markets

- **Task XIII - Demand Response Resources:** The objective of this Task is to deliver the necessary methodology, business processes, infrastructure, tools and implementation plans for the **rapid deployment of a demand response program** into participating country electricity markets to meet the specific goals and policy objectives of that market

- **Task XV - Network Driven DSM:** 'Network-driven' demand-side management (DSM) is concerned with **reducing demand on electricity networks** (grids) in specific ways which maintain system reliability in the immediate term and over the longer term defer the need for network augmentation. This task investigates DSM measures which can be used to relieve constraints on electricity networks (grids), whether these constraints are time-related or location-related

- **Task XIX - Micro Demand Response and Energy Saving:** The aim of this Task is to **investigate the implementation of TOU pricing, remote/automatic demand switching and energy end use monitoring for SME and residential customers** so as to quantify the costs, benefits and business viability of such measures from the System Operator, Demand Balancing and energy saving perspectives

Source: International Energy Agency - Demand Side Management Programme

Index

1. Main Demand Response related Tasks in IEA-DSM
2. Demand Response definitions and examples
3. Proposals for measuring energy savings caused by DR initiatives

2. Demand Response definitions and examples

Some DR products

Demand response is defined by the U.S Department of Energy (DOE) as changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at time of high wholesale market prices or when system reliability is jeopardized. Some of the most common DR products are:

- **Feedback to customers with In Home Displays (IHDs):** the installation of small household devices provide real-time energy consumption and costs information to customers, who become more aware about it, minimizing their electricity bill
- **Dynamic Pricing:** utility companies dynamically change energy pricings in order to encourage customers to reduce energy consumption on peaks. Consumers can adapt their consumption moving non critical loads from expensive (peak) hours to cheaper (valley) hours (load shifting), so that the daily load curve becomes more flat
- **Demand bidding/buyback programs:** close to dynamic pricing, customers can offer bids to reduce loads when wholesale market prices are high
- **Direct load control (DLC) and Automation:** allows the utility some degree of control over certain equipment, for example switching-off non critical loads or modifying devices' parameters (i.e. increasing the temperature in centralized AC generators) in order to reduce electric load in the net
- **Emergency demand response programs:** customers receive incentive payments for load reductions when needed to ensure reliability
- **Interruptible/curtailable:** customers receive a discounted rate for agreeing to reduce load on request
- **Ancillary services market programs:** customers receive payments from a grid operator for committing to restrict load when needed to support operation of the electric grid (i.e., auxiliry services)

DR products are oriented to change consumers' habits, either promoting their active participation or allowing the utility to control some of their energy consumption

Source: Coordination of Energy Efficiency and Demand Response, A Resource Of The National Action Plan For Energy Efficiency. U.S. Department of Energy
Source: IEA-DSM Tasks

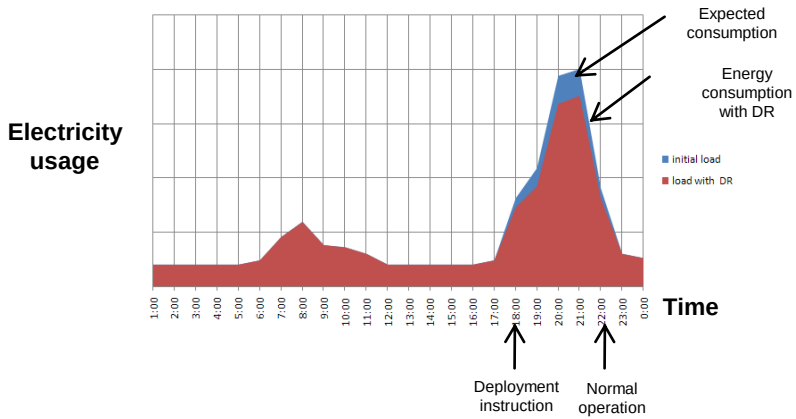
Index

1. Main Demand Response related Tasks in IEA-DSM
2. Demand Response definitions and examples
3. Proposals for measuring energy savings caused by DR initiatives

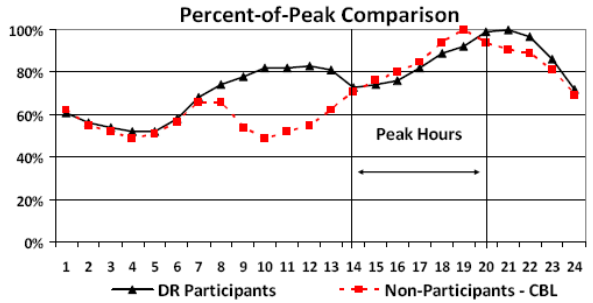
3. Proposals for measuring energy savings caused by DR initiatives

Measurement and Verification (M&V) refers to the application of appropriate statistical and load research techniques to measure and verify the load reduction impact resulting from the utilization of a Demand Response program. Basically there are two ways of measuring impact estimation of DR products on the network:

1. **Individual Measurement:** load reduction of a single consumer comparing its actual energy use during the DR event period with the amount of energy the customer would have consumed absent a signal to reduce, and translating this single impact to the net



2. **Mass Market Measurement:** where individual measurement of customer impact is too expensive or time consuming. Impact estimation is achieved by aggregating all participating customers and comparing the resultant load shapes against similar non-participating customers. However, as mass market programs are constantly evolving with customers frequently entering and exiting programs, determining who is being measured and its status in every DR event must be carefully considered



Additionally to load reduction, other energy efficiency and DR benefits can also be measured considering their impact on different aspects

Source: everis

3. Proposals for measuring energy savings caused by DR initiatives

In addition to the avoided energy consumption on peaks, every different benefit derived from DR must be measured in a different appropriate way, considering its impact on:

a) **Electrical distribution networks:** buildings and equipment that use less energy (fewer kilowatt-hours) impose smaller power loads (lower kilowatts of demand) on the system, not being necessary to oversize them

b) **Power plants:** less energy loads also avoid power plants to operate at maximum power, taking into account that the amount of energy generated is bigger than the consumed due to losses in the transmission system

c) **System operator control:** customers participating in demand response can reduce electricity consumption, shift it to another time, or displace grid power with self-generation, giving more control of peak loads to system operation

d) **Environmental Impacts:** for every unit of electricity not generated, the nation reduces its consumption of energy resources, air pollutant emissions, water use, and associated land uses.

e) **Renewable energies:** matching between renewable energy production and energy demanded becomes easier, switching load peaks to peaks of renewable generation and so increasing the percentage of renewable on the system

There are currently some initial projects(1) about how to measure the DR impact on the electrical network. However there is the need of a comprehensive study in order to develop specific standards to assess the impact of DR in the transport system

[1] US department of energy has conducted some research about DR evaluation and its relationship with Energy Efficiency wthin the national action plan for energy efficiency

3. Proposals for measuring energy savings caused by DR initiatives

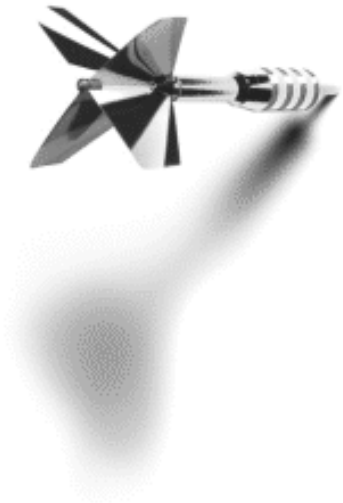
The possible next steps in order to consider demand response impact into energy savings calculation standard procedures are focused to:

1. **Analyze the main Demand Response products in each country,** including products in usage, experiments and pilot programmes conducted

2. **Analyze the different mechanisms applied to measure DR savings in each country,** if applicable, also analyzing the hypothesis that are considered to evaluate these savings and if there are some standards, existing or under development, to measure these energy savings

3. **Standardize the procedures to measure DR benefits**, based on the previous analysis conducted

4. **Apply those standards** to some existing DR products or experiments, evaluating the results obtained



everis

attitude makes the difference

RED ELÉCTRICA DE ESPAÑA