"Demand Response" – A new challenge for LonMark

"Demand Response" (DR) refers to a set of strategies which can be used in competitive electricity markets to increase the participation of the demand-side, or end-use customers, in setting the process and clearing the market. In other words, DR means that the end-user voluntarily sheds load during a limited timeframe.

Power outages in the USA, wind energy networks in Europe

Shortly after the turn of the 21st century, the US experienced huge power outages, which were largely caused by overload. As an emergency first measure, end-users were encouraged to shed loads as quickly as possible.

This has led to short-term stabilization of the power grids. As a result, universities and innovative companies (such as the Lawrence Berkeley Lab in California, Constellation Energy and EnerNOC) have developed commercial models (Economic DR). The redistribution of energy, potential savings, and financial gains achieved on the open electricity market are impressive.

This was how EnerNOC passed on their 2007 earnings of US$65 million to the "Emergency" and US$42 million to the Economic Program in Pennsylvania [1]. The proceeds will be acquired by the electricity exchanges (**see Figure 1**),

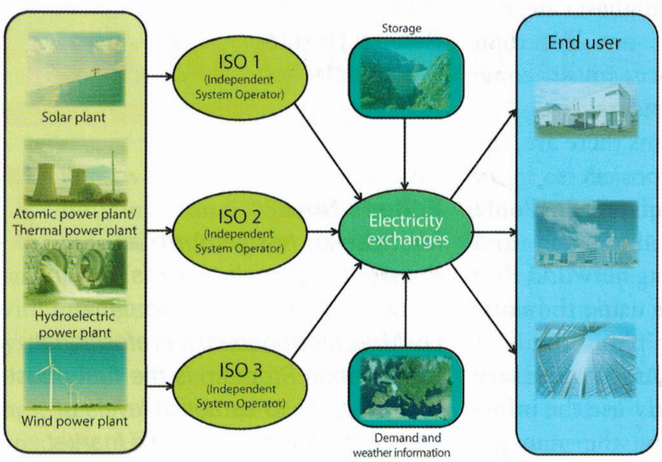

Figure 1

who will buy energy on the deregulated electricity market and then resell it to their end-users. The potential savings are comparable to the capacity of a nuclear power plant.

In Europe, the situation is somewhat different; a simplified "Demand Response" has been available for several years. Looking at the solutions for the 21st century, one must mention static "Demand Response". These are mainly fixed time profiles for storage heaters, hot water processing, and heat pumps.

The extensive use of wind energy in northern Europe means that the grid operators now face new problems [2, 3, 5]. The regular 24-hour wind energy forecast can vary up to 10% from the actual weather forecast, which can seriously disrupt the allocated reserves.

Politically, Europe has more or less decided to phase out nuclear energy and to replace it with renewable energy sources. Long-term, in Europe, we cannot get by without an excellent "Demand Response" infrastructure.

How does "Demand Response" function technically?

The Berkeley Institute is one of the leading research facilities within energy supply distribution based on renewable energy [6]. The Berkeley installations are described in the technical schematics (**Figure 2**).

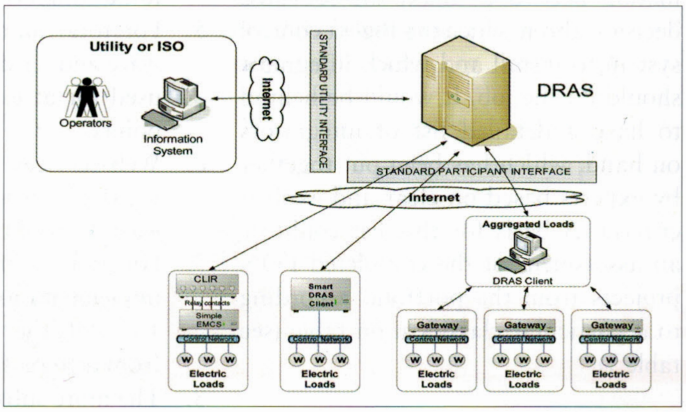

Figure 2

Via the "Standard Utility interface" (SUI), the "Demand Response Server" (DRAS) receives offers from suppliers over the Internet. Prognoses are generated on the server based on weather and wind data over the next couple of hours, and energy is bought and sold accordingly. The software works the same way as the management of a hedge fund in the financial market. On the consumer side, it communicates over the SPI with each end user installation. The data contains information relating to the amount of energy, costs, and time limitations [7].

On the consumer side the summarized information of the DR telegram is transferred to a device or an entire building. After determining the energy needs, the consumers can then accept or reject the offer. In case of "Emergency Demand Response" the consumer has to follow the command.

Figure 3 shows an example of a tariff increase of two levels, which motivates the consumer to reduce their consumption by 1.3 MW. The graphic shows the power consump-

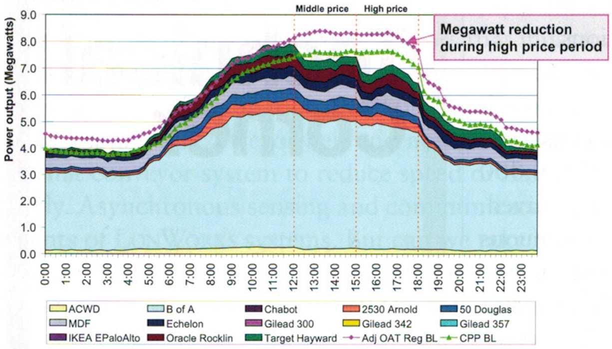

Figure 3

tion of 13 consumers during the course of one day. Around noon time, the tariff increases by two steps (12:00, 15:00). The line "OAT BL" shows the average regional temperature gradient. The energy consumption caused by air conditioners tends to follow this temperature curve. The line "CPP BL" (Critical Peak Pricing) shows the price history of critical peak loads. The graphic clearly shows how the energy consumption can be controlled through pricing. In a further automated attempt in 2007 [8] the Berkeley Institute compared more pricing options.

Importance for LonMark

The American network operators require building operators to expand their automation systems to support "Demand Response". Such building management systems must be enabled to reduce the energy consumption to, for example, 80% upon command. This requirement may look different depending on the building zone and may have to be accordingly configured by the facility managers.

The family home also offers an enormous potential for temporary reduction of energy consumption. At present one counts a time window for refrigerators of +/- 4 hours, for washing machines also +/- 24 hours. This means ultimately that individual devices have to react upon the "Demand Response" requirements. LonMark is the technology which is spread worldwide in buildings as well as in utilities and metering companies. This is why LON technology is predestined to define a scalable interoperable solution for consumers.

The DR application is also interesting for the rapidly growing market of LON based streetlighting. On the energy production side the solutions are IP based (SOAP XML, IEC 61850), as the utilities already have an efficient infrastructure. An open communication solution on the scale required cannot be limited to individual standards. This also applies to LonMark in that joint solutions with similar standards should be sought in order to have a widespread impact.

Implementation by LonMark

The technical committee of the LonMark International Board has launched a program together with the Utility Task Group which will systematically lead to a targeted solution. The group is working with the team from the Lawrence Berkeley Institute in California as well as manufacturers, network operators and end users. At a European level, they are seeking cooperation with universities, technical schools and local LonMark Affiliates to define a solution which can be implemented worldwide. Members and interested institutions are invited to actively participate in this process.

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Building Automation – Saving more than construction costs!

Intensive use of technical building equipment systems in modern buildings, a steep rise in the price of energy sources, increased demand for quality in new properties and modern living environments have meant that the use of automated control systems for the control and regulation of technical building equipment have become a must.

According to data from several large consulting firms the use of automation systems, whose price only constitutes on average 4% of the construction costs, makes it possible to substantially reduce operating costs. During the whole building's life cycle (on average 50 years) the amount saved can be higher than the total construction costs.

Comfort level requirements have in the meantime also become higher. For example it is hard to imagine a modern building without services such as heating, ventilation and air conditioning. The result is that the total energy consumption of a property exceeds today's standard on average by around one and a half to two times.

Supply of additional electric power capacity costs approx. 3000 to 4000 Euros per kW of electricity. With an average property consuming 1500 kW above the standard amount, even the most expensive automation system which reduces energy consump-