Managing the load

A state-of-the-art system for managing demand response

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- DEMAND RESPONSE
- GRID RELIABILITY & EFFICIENCY
- NETWORK MANAGEMENT

***E-terra**DRBizNet, allows utilities to efficiently use consumer loads as a controllable grid resource. Demand response (DR) is a relatively simple concept: utilities provide incentives to electricity customers to reduce their consumption during periods of high prices or peak demand. DR is another method for utilities to manage grid reliability and the energy supply/demand balance. As DR Product Manager Travis Rouillard notes, "it's a greener and more economical alternative to building new power plants or adding new grid capacity."*

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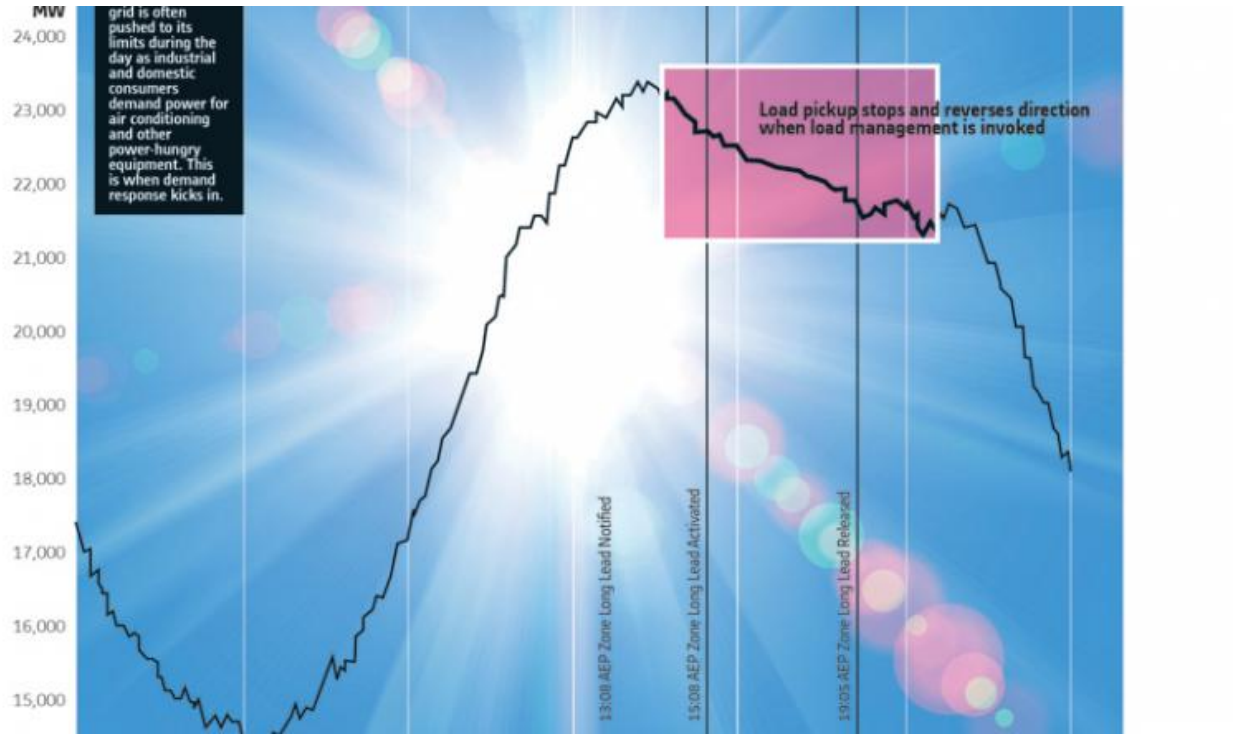


1 __ Demande response: how does it work?

Demand response works in 5 basic steps:

- **Enrol:** customers willing to participate in demand response enrol into incentive programmes offered by their local utilities.
- **Automate:** the utility usually provides the customer with a smart-grid device, such as a smart meter or programmable thermostat, which is capable of receiving a signal from the utility and automatically reducing power consumption.
- **Notify:** when grid operators observe a shortage of power in part of the grid, they send a notification signal to the specific smart-grid devices that will help ease the situation.

- **Curtail:** the smart-grid devices automatically turn off non-critical electric loads or change thermostat set points for a few minutes or hours.
- **Settle:** the utility verifies that the customers actually reduced their consumption and calculates the amount of credit to appear on their next bill.

e-terra*DRBizNet* helps utilities efficiently perform these steps thousands of times, for each of the small customer load changes it takes to be cumulatively equivalent to the output of a traditional generator. In addition, it provides operators with the tools to forecast how much customer load is available at any time and which specific customers they should dispatch for how long. Rouillard points out that, "although the principle is simple, execution is complex. That's because of the scale involved to make lots of small distributed resources perform as if they were a single power plant."

2 __ When is demand response used?

Demand response is most often used as a way for utilities to reduce their peak system needs. Since the top 5 % of transmission or generation capacity may only be used a few hours a year, it is often cheaper to reduce customer load for those few hours than to build new lines or plants. In the summer, this usually means curtailing air conditioners during the hottest afternoons – or electric heaters during cold winter mornings – which can be a huge share of the peak system demand. But it can also include approaches such as dimming lights in commercial buildings or interrupting machines in factories. DR can either curtail the load entirely or simply shift it a few hours earlier or later when capacity is less constrained. When electricity supply systems were

deregulated in many areas, and retail suppliers started to buy power for their customers in the open market, demand response became an alternative to paying high spot prices. In some markets, hourly megawatt prices can easily jump 1,000 % in the course of a few hours. Instead of paying those high prices, retailers can actually sell DR energy back to the market, earning a healthy return.

« Reduce energy cost and improve grid reliability. »

Many retailers share the savings with their customers as a way to encourage them to participate. With the advances in smart-grid technology and Internet communications penetrating almost every customer group, DR is gaining attention as a new way to provide emergency grid reliability services. Rouillard provides an example: “If the grid is subject to a problem such as a generator fault or transmission outage, it needs to drop system load quickly. Using **e-terra***DRBizNet*, it can automatically dispatch DR to drop hundreds or even thousands of megawatts within minutes. This gives operators some breathing space to deal with the issue.”

3 __ Major challenges to face

Despite decades of success in North America, utilities in other parts of the world have been slow to adopt DR. The business case for DR is certainly more difficult in regions with historically low energy costs or low per-capita consumption. In many areas, regulations simply do not allow utilities to offer the incentives necessary to attract participants. But this is changing rapidly, for several reasons:

- the worldwide increase in the demand for power;

- the challenge of building new plants or transmission assets near population centres where demand growth is fastest;
- more interest in phasing out nuclear- and coal-based power;
- increased deployment of intermittent resources such as wind and solar power;
- advances in battery storage, which can act as a generator or a load;
- growth of smart-grid technologies and Internet access everywhere.

These factors are improving the business case and obliging regulators to review their positions on DR. Rouillard explains: "Utilities everywhere are struggling with how to deal with an increasing mix of intermittent generation, while also supporting large new loads, from electric vehicles, for example. You can't provide a stable, balanced grid without having some control over the demand side."

4 __ The future is now

Demand response is allowing utilities to fundamentally rethink how they view the customer side of their business. **e-terra***DRBizNet* gives utilities the ability either to reduce load temporarily, or to shift it to another time when supply is plentiful. In some cases, it completely changes the traditional relationship utilities have with customers, who can now be paid incentives for being flexible about when they use power.

Alstom is deploying **e-terra***DRBizNet* at utilities to enable large-scale demand response programmes that reduce energy costs and improve grid reliability. It supports the continued growth of renewable energy resources by giving utilities more control over

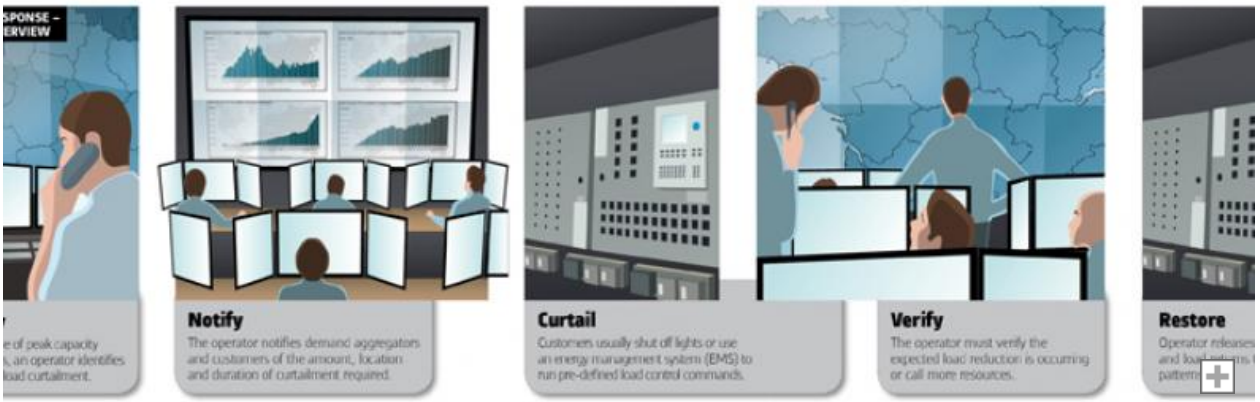
load to better match the avail-ability of supply. DR is a key component of Alstom's smart grid solutions.

PJM INTERCONNECTION

The US regional transmission organisation PJM Interconnection is the largest grid operator and electricity market in the world (after China), with a system load of over 150,000 MW during summer peaks.

It was an early adopter of demand response as an alternative way to manage seasonal capacity and emergency reserve needs. Since it started working with **e-terra**DRBizNet in 2008, its demand response portfolio has grown to over 15,000 MW, or roughly 10 % of its system load. **e-terra***DRBizNet* helps PJM manage its 6 different programmes – each with different participation rules and incentive structures. During a heat wave in July 2012, it had an unusually high system load of 155,000 MW, with 6,000 MW of generation offline. Demand response helped PJM in 2 ways. First, a large number of customers voluntarily participated in demand response in exchange for being paid the spot price for the energy, just like generators. This reduced system load by over 1,000 MW, which was enough to suppress skyrocketing energy spot prices. Second, operators called on their emergency reserve demand response customers to deliver another 1,500 MW in one of their highly congested transmission areas. This allowed them to avoid more serious frequency problems or involuntary customer interruptions. Demand response is now a $500 million market at PJM. There are over 1 million end-customers participating directly and indirectly – everything from industrial manufacturers to shopping malls to

homeowners. But all customers in the PJM service territory benefit in the form of lower electricity prices, more reliable supply, and reduced environmental impact compared with building new fossil fuel generators or transmission lines.



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