



Intelligent Demand Response

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Executive Summary

Demand response has been tremendously successful for utilities and grid operators in managing an impending peak power crisis. PJM credits demand response with saving \$650 million in one season, \$230 million in a single day.

Comment [DD1]: Peter Kelly-Detwiler confirmed these numbers by phone 1/9/08, adding that PJM paid about \$6 million in incentives to get these savings. Peter cited these stats in a recent presentation that Bob Zak attended.

With growing energy demand, and in the absence of other means to continue to avoid blackouts, demand response will continue to play a key role. As demand response has been implemented thus far, there are practical limits to how much benefit it can deliver.

Manually responding to a demand response call restricts the scope and types of loads that can be shed. That limits the kW available, and thus keeps payments low, which undermines the incentive for participants to continue to take part in the utility's program.

To get beyond the manual demand-response barrier, utilities must now tap resources from the largest electric end-use sector: industrial loads. This sector remains the most energy-intensive in the United States despite the steady exodus of manufacturing to other regions. Managing energy consumption in industry will reduce operating costs in an increasingly competitive global marketplace.

The new demand response must enable or expand shedding of "fundamental loads" -- those essential functions that affect productivity, such as refrigeration, pumps and material handling systems -- if it is to reach its full potential.

The new demand response requires automation intelligence. Industrial users already install factory automation to be more efficient or trim production costs. Intelligent demand response is an extension of automation, enabling participants to:

- Connect many loads and decide which subset will make up each response
- Make decisions quickly based on preset rules
- Gather data and analytics to fine-tune responses
- Track and control the productivity impact of demand response

Implementing intelligent demand response has its challenges, not the least of which is resistance from customers to tapping fundamental loads. Equipment incentives will be needed for intelligent demand response to be most effective.

Introduction

Demand response has been tremendously successful for utilities and grid operators in managing an impending peak power crisis. How do they define success? Foremost, *financially*.

Wholesale power prices have the inconvenient habit of rising in unison with demand, just as a utility's generation reaches its capacity. By reducing overall customer loads by just one or two percent, utilities can avoid buying market power at peak prices. PJM, the regional transmission operator, credits demand response with saving its customers \$650 million in one season, \$230 million in single day.¹

Longer term, utilities must either manage peak demand, or build generating capacity to meet it. Progress Energy Florida has used demand response to manage customer loads, reducing them by as much as 2,000 megawatts, equal to four power plants.²

When the Midwest independent system operator achieved a 3,000 megawatt reduction -- six power plants -- it avoided a spike of \$200 per megawatt in its overall power cost.³

Demand response will continue to play a key role. The U.S. Department of Energy has projected electricity use to increase by 33% between now and 2030.⁴ The most rapid growth area will be the commercial sector; electricity use in the industrial sector is projected to grow by 22%.

Utilities are expanding demand response programs and launching new ones. Many have struck multi-year deals with aggregators of commercial and industrial demand response, rather than sign up individual customers or seek other ways to continue to meet peak demand.

The load commitments in those aggregator contracts escalate. Demand response service provider EnerNOC signed a five-year capacity agreement in October, 2007, with Southern California Edison. The agreement ramps up from 40 MW to 160 MW of load reduction over its term.

California is not the only state with experience in demand response. Five of the six major transmission regions in the U.S. have demand response programs in place.⁵ Utilities in New Mexico, Florida, Kentucky and California have recently implemented or expanded their use of demand response.⁶

¹ FERC Wellinghoff [deck](#) 2007

² FERC *ibid*

³ FERC *ibid*

⁴ DOE EIA Annual Energy Outlook 2008 with Projections to 2030 (Early Release December 2007) Table 2

⁵ Edison Electric Institute, "Demand Response Review" July 2007

⁶ EnerNOC announcements http://enernoc.com/press/pr_071003.htm, http://enernoc.com/press/pr_070906.htm, http://enernoc.com/press/pr_070524b.htm, http://enernoc.com/press/pr_070315.htm

Limitations of Demand Response Today

The way demand response technology typically has been implemented thus far, there are severe limits to how much benefit it can deliver.

Manually responding to a demand response call restricts the scope and types of loads that can be shed. For example, certain manufacturing equipment cannot be simply turned off. Plant managers must consider work in process -- whether molten steel or frozen vegetables -- and follow proper procedures to take complex machinery offline without causing losses.

Scaling up demand response will not be as easy as it might seem. Utilities and aggregators naturally began by skimming the cream -- enrolling the most knowledgeable, willing customers who offered the easiest loads to shed. Shedding the next, deeper layer of loads will be more challenging.

Early adopters often participate in demand response programs for reasons beyond the financial payback. The bottom-line value proposition of demand response will meet its true test as larger kW reductions are pursued. Until that time, we cannot really know whether the pure financial value proposition is compelling without the help of corporate social responsibility and public relations as motivators.

By shedding just the very easiest loads, early adopters are receiving lower payments than they could be, because limiting the kilowatts available means limiting the financial potential. The resulting low payments undermine the value proposition of the programs over the longer term and certainly make cost-justification more difficult for the participant using a real cost-benefit analysis.

Industrial Sector

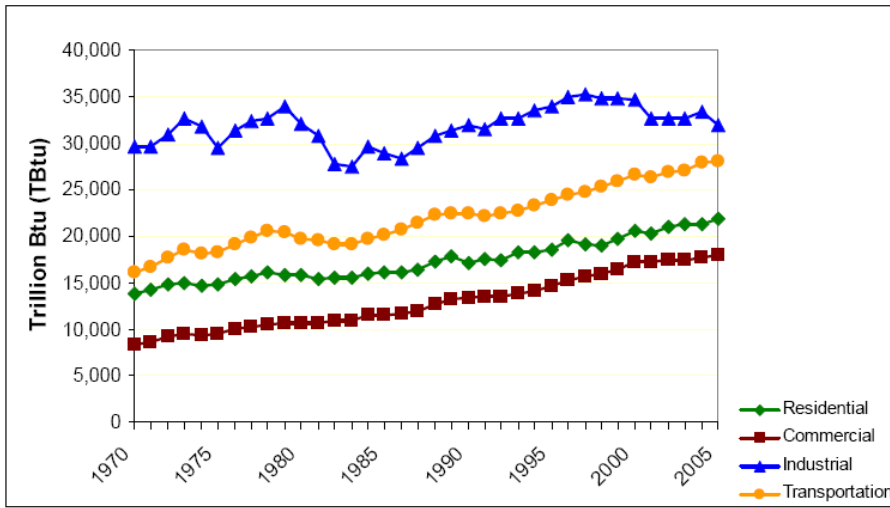
To reach the true potential of demand response, utilities must tap into resources from the largest electric end-use sector: *industrial loads*. Industry today consumes 26% of the electricity sold in the United States, and the Department of Energy projects for that to remain constant through 2030.⁷

Managing energy consumption in industry will reduce operating costs in an increasingly competitive global marketplace. In energy-intensive industries such as food and metals, the cost of energy averages 4.8% of annual operating expenses.⁸

⁷ IEA AEO 2007 p. 109: 1,103 / 4,251 = 25.9% (billions of kWh)

⁸ EIA Annual Energy Outlook 2007 p. 47 c.1; also see p.69 c.1

**Figure 1: U.S. energy consumption trends 1970-2005:
comparison of industrial, transportation, residential, and commercial end uses²**



Yet, only about one in eight manufacturers uses any form of load control,⁹ and the adoption rates for demand response in the industrial sector remain very low. A major reason for the low adoption rate is that the largest manufacturing loads are fundamental to operations: productivity may be jeopardized when plant managers shed loads such as refrigeration and freezing systems, foundry equipment, forklift chargers and material handling systems. Manufacturers, being understandably cautious, either limit or forbid shedding of these fundamental loads.

The next level of demand response must expand participation of fundamental loads if it is to reach its full potential. What utilities need is a way to break the fundamental load barrier.

Intelligent Demand Response Reaches Fundamental Loads

The next level of demand response requires intelligence. *Intelligent demand response* uses state-of-the-art demand management automation with specific functionality to overcome the limitations of manual methods or generic system control. It increases the potential reward of expanded curtailment, while controlling risk to industrial customers.

Automated, intelligent demand response enables participants to:

⁹ DOE Manufacturing Energy Consumption Survey, "Table 8.1 - Number of Establishments Participating in Energy Management Activities" [link](#) (2002, latest data available; 14% use load control and 4% take advantage of equipment rebates or variable-rate tariffs)

- Connect many loads, then orchestrate which subset will make up each response
- Make response decisions quickly based on preset rules
- Protect processes with strict load shedding rules
- Respond to a call dynamically with rolling reductions
- Give utilities direct control over certain loads
- Gather data and analytics to fine-tune response and verify performance
- Track and control the productivity impact of demand response

Intelligent demand response is the logical evolution for managing peak demand. And it is possible with systems available today.

Industrial users already apply dedicated controls systems and application-specific products in key processes, to be more efficient or trim production costs. Now it is possible to apply dedicated demand management systems to coordinating and controlling the use of power in a manufacturing plant.

CASE STUDY

Trojan Battery, a manufacturer of deep-cycle batteries, wanted to participate in a demand response program with Southern California Edison. The revenue from the program could offset part of Trojan's multi-million-dollar energy bill.

The process of charging new batteries for the first time represents 60% of Trojan's four-megawatt load. But interrupting it could ruin hundreds of new batteries.

Trojan implemented intelligent demand response with centralized control of the process. That allows Trojan to shed as much as 3,400 kilowatts -- 85% of their average total load -- on short notice and without damaging new batteries.

Southern California Edison paid most of the cost of the technology through a Technical Assistance and Technology Incentives Program, and pays Trojan Battery around \$10,000 per demand response call to use it.

Trojan expects a financial payback in six to twelve months, not including utility payments from a demand response call. That's because the same system qualifies Trojan for lower electric rates. Trojan pays less per kWh, a savings of about \$90,000 a year, with the understanding that its power can be interrupted on short notice.

Challenges and Solutions

Implementing intelligent demand response will have its challenges, not the least of which are the up-front investments and customer resistance to tapping fundamental loads.

The solution is to create a quantifiable value proposition with manageable risk. Eager industrial participants are those who see the financial benefit from demand response and feel that they can keep risk under close control.

Risk management-- The key to keeping risk under control is intelligent demand response technology. It gives plant managers control over which loads are shed, and it removes the risk of damage to essential equipment by correctly managing the shutdown and restart procedures for each demand response event.

The right technology also eliminates the fear of the unknown. It provides the information and analytics needed for plant managers to understand and control the productivity impact of demand response.

Equipment incentives-- A major tool for increasing the adoption of automated demand response is to provide incentives to industrial customers for the purchase of the necessary equipment. When the proper equipment is in place, it is easier for the customer to make the commitment to participate.

Demand response solves what is primarily viewed as a utility problem. By providing incentives for equipment and systems, utilities invest in the solution. Incentives give companies the tools for providing predictable capacity and streamlined implementation -- and that removes barriers to participation.

Utilities are aware that more participation would help to postpone the building of new power plants and reduce their purchases of high-priced wholesale power to meet peak demand. They can achieve this by investing in equipment for relatively few, but significant, industrial customers.

If it is left to the value of curtailment payments alone, then intelligent demand response will progress, but at a slower pace. Incentives are simply the catalyst to get customers to take action sooner. Speed of adoption is exactly what the emerging demand-response trend needs, to meet expectations.

Payoffs

Utilities-- The reward to load-serving entities for investing in intelligent demand response is already clear. A comparatively modest investment in equipment for energy-intensive customers can produce a clear return by reducing energy costs and decelerating capital expenditures.

There is a deep well of energy resources waiting to be tapped, and with it utilities can postpone plans for new power plants and lines. Add to that the reduced purchases of wholesale power at its highest price point. A 3% reduction during peak hours would reduce energy market prices by \$8 to \$25 per megawatt-hour, according to a study conducted in 2007 encompassing five utility territories.¹⁰

Customers-- The same study concluded that demand response in the PJM region, for example, could save participants an estimated \$9 million to \$26 million on energy annually and avoid another \$73 million in capacity charges. This is in addition to the revenue stream from participating in demand response.

Utility customers get two additional benefits. First, ongoing efficiencies are achieved when intelligent demand response technologies are deployed, reducing operating costs throughout the year. Second, the avoided cost of purchasing high-priced wholesale power creates a savings that is passed on in tariffs to all utility customers, not only to those who participate in demand response.

Aggregators-- With accelerating commitments to their utility customers, aggregators need to unlock the potential of demand response. Intelligent demand response is the key. It enables aggregators to enroll reluctant customers, sign up larger controllable loads, and expand existing agreements.

About Bob Zak

As President of Powerit Solutions, Bob brings deep familiarity with key industry vertical markets, applications, and underlying technology as well as strong sales expertise through years in the Industrial Automation sector. Bob formerly spent 12 years at a large regional factory automation firm, culminating as VP Sales and Marketing, selling and building sales channels into Industrial, Utility, and Commercial markets including verticals such as Metals, Food Products, Wood Products, Plastics/Petroleum, and Water/Wastewater. Bob also held positions as a Software Specialist and built the firm's Systems Integrator business, delivering customer-focused turn-key solutions. Bob holds a B.S. in Industrial Distribution.

¹⁰ Mid-Atlantic Distributed Resources Initiative press release Jan 2007, "Study Finds Up To \$182 Million Annual Savings From Electricity Demand Response In Mid-Atlantic Region" [PDF](#)

About Powerit Solutions, LLC.

Powerit Solutions, LLC. is a leading technology provider of Intelligent Energy Management solutions specifically designed to enable demand response, reduce ongoing peak energy demand and generate significant cost savings and energy conservation for industrial customers. Powerit has developed innovative predictive controls that allow the servicing of complex industrial environments, enabling the user to reduce charges while protecting production dynamics and facility comfort.

Powerit's technology is installed in over 600 installations globally in sectors including metal/foundries, fabrication/ manufacturing, food/beverage, petrochemical/plastics, wood/paper, agriculture, water/wastewater, printing/publishing, and commercial/retail among others. Customers include Gallo and Paul Masson Wines, Pacific Steel Castings, Frito Lay, P&O Cold Logistics, *San Jose Mercury News*, California Steel, Patterson Frozen Foods and many others.

More information at: www.poweritsolutions.com .

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