“Peak Sharing” — A Win-Win Solution to Reliably and Cost-Effectively Reduce System Peak Demands

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Abstract

Through a cooperative effort known as “peak sharing”, utilities can defer or displace the need for new power plants and lines by “leasing” customer-owned standby gensets for as few as 50 to 250 hours per year. Peak sharing offers reliable, dispatchable, measurable, and cost-effective peak demand reductions that can “generate” huge savings in utility capital requirements through more efficient use of existing resources. Customers benefit by turning otherwise idle resources, standby gensets requiring costly testing and maintenance, into revenue-producing assets without compromising emergency use priorities. When utilities work together with customers who own standby gensets, both sides win.

Overview of Peak Sharing

Ever-expanding deregulation has inspired a new theme for the electric utility industry in the 90’s... Competition, open access, and new technology will dramatically change the way utilities conduct business as we move into the 21st century. Rising energy costs and growing environmental concerns have created tremendous challenges for utilities to provide more competitive electric services. These challenges have inspired a wide variety of demand-side management (DSM) programs intended to defer or displace the need for new power plants and transmission/distribution upgrades. Unfortunately the promises of DSM to improve operating efficiency, reduce capital requirements, and enhance customer service have not always been clearly evident. Program assessment often proves both difficult and expensive. In fact, “many industry experts have wondered aloud whether DSM programs could ever deliver measurable and reliable supplies of electricity. In response to these doubts, utilities may spend as much to “evaluate” and measure DSM programs as is expended to design and implement them.”[1] However, a truly unique DSM solution exists because many commercial and industrial sites already own substantial standby (emergency) generating capacity to maintain continuous power even during utility interruptions. These standby generator sets (gensets) represent a huge capital investment and yet sit idle most of the time.

Through a cooperative effort known as “peak sharing”, utilities can tap into this extensive capacity resource to defer or displace the need for new power plants and lines by “leasing” customer-owned standby gensets for as few as 50 to 250 hours per year. Customers benefit by turning otherwise idle resources into revenue-producing assets without compromising emergency use priorities whatsoever. Providing electric power, especially for critical operations, is a capital intensive effort regardless of who makes the initial investment. Thus, it only makes sense to use all power generation resources in the most efficient and cost-effective manner, even if this requires cooperation between utilities and their large energy-consuming customers (who have traditionally been at odds with each other for economic reasons). Utilities simply cannot afford to have more than 15% of their total generating resources sitting idle during 95% of the year (see *Figure 1: Platte River Power Authority Load Duration Curve*)[2]. From the customer's perspective, standby power equipment is nothing more than a "necessary evil" to account for unpredictable power service, which can fail at any time for a variety of reasons. Standby gensets are used even more sparingly than peaking resources owned by the utilities and, to make matters even worse, they require expensive testing and maintenance so they will always be ready when needed.

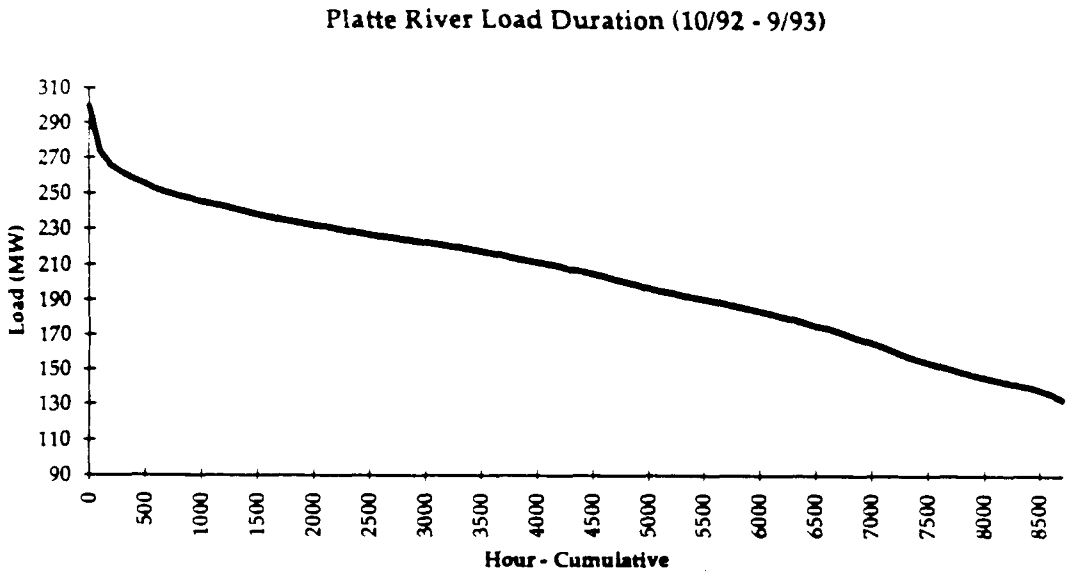

Figure 1: Platte River Power Authority Load Duration Curve

Fortunately for companies who own standby gensets in today's competitive energy environment, substantial incentives are becoming more commonly available for reducing electric power consumption during system peak demand periods. Various utility strategies attempt to achieve this goal including "peak sharing", real-time pricing, time-of-use pricing, and interruptible rates. The bottom line for companies who own expensive standby power equipment is that on-site generation becomes attractive whenever the cost to purchase power exceeds the overall cost to generate equivalent power. By integrating standby capacity into an intelligent building automation or energy management system, decision making options are expanded significantly. Such a system can maximize profits from day to day by weighing the trade-offs between load shedding, higher electricity costs, and self-generation.

Based on the incentive rates now offered by many utilities for various DSM programs, genset upgrades required to take advantage of these tremendous opportunities can pay for themselves very quickly, sometimes in less than a year. These upgrades simultaneously improve genset performance and reliability without increasing maintenance costs (provided operation does not exceed 500 hours per year). In fact, maintenance, service, and regularly scheduled testing can be simplified and improved if the genset is upgraded in such a way as to allow greater automation and diagnostic feedback from the standby power system as a whole. Although deregulation may be perceived as a burden to electric utilities, large energy consumers will certainly benefit because their standby gensets can now earn a substantial return-on-investment while continuing to serve emergency power needs.

In summary, peak sharing offers more efficient use of existing resources by replacing a sizable portion of total generating capacity needed just 50 to 250 hours per year. This promotes long-term rate stability without any significant revenue loss through reliable peak demand reduction. Furthermore, peak sharing incentives improve relations with large customers who are becoming more and more selective in choosing their energy providers. When utilities share their peak reduction savings with customers who share their standby gensets, both sides win. As a result of this win-win solution, society as a whole benefits from improved electric supply efficiencies with a minimal investment in new equipment.

Utility Industry Changes that Make Peak Sharing an Attractive Alternative

In order to remain competitive in today's fast-paced world economy, utilities, like many other companies, are finding themselves in the precarious situation of having to provide better service, at a lower cost, with fewer resources to accomplish this challenging task. Recent articles from utility trade publications paint a vivid picture of the impact that deregulation and new technology are having on traditional operating procedures:

> As an estimated 3000 utility executives assemble in Silicon Valley this month for the *DA/DSM '95* show, an observation by baseball's immortal sage of confusion, Yogi Berra, seems particularly apt. Berra advised: "When you come to a fork in the road, take it." The utility industry faces many forks in the road today. Like Berra, industry leaders know they have to take some of them. The problem as leaders in other deregulated industries — such as airlines, trucking, and telecommunications — have learned, is that some of those forks lead into swamps.[3]

> The electric power industry around the world is experiencing radical structural changes — either for economic or ideological reasons. Whereas traditionally the sector has been dominated by government involvement and control and monopoly structures, a wave of deregulation, liberalization, and privatization is opening the industry to private-sector participation.[4]

To help utilities stay ahead of the competition, *EN*CORP is developing our new *en*power™ controls that lead the way in creating reliable, dispatchable, and cost-effective peaking resources out of customer-owned standby gensets. These revolutionary new controls break through the technical barriers of peak sharing program implementation by providing safe parallel operation of standby gensets using a single integrated package (paralleling switchgear is also required). Parallel operation allows maximum use of standby capacity versus typical isolated emergency circuits that use less than half the available capacity (due to considerations for the "starting inrush current" of electric motors powered by the isolated circuit). Additionally, paralleling with "soft" power transfer eliminates power disruptions at the customer's facility, which cannot be tolerated by loads such as sensitive electronic equipment and synchronous motors. *EN*CORP's *en*power controls are high-quality, utility-grade products that offer a complete solution for paralleling standby gensets together and/or with the utility grid by providing real and reactive power control, remote monitoring/metering, protective relaying, and synchronizing. Peak sharing programs that use *en*power controls offer:

- Dispatchable peak demand reduction;
- Cost-effective solution consistent with least cost planning emphasis;
- Improved system load factor;
- Simple program evaluation with measurable results;
- Enhanced voltage stability and avoided transmission/distribution line losses during heavy-load conditions;
- Maximum use of standby capacity through safe parallel operation; and
- Improved customer relations with large energy consumers.

One of the highlights of *en*power controls is the open LONWORKS™ communication interface, which several Fortune 500 companies have adopted for their facility automation needs. As far as utilities are concerned, Detroit Edison has adopted LONWORKS as "the basis for future control and communications" throughout their entire transmission and distribution network. Several other large utilities are also evaluating LONWORKS for demand-side management (DSM), distribution automation (DA), and automatic meter reading (AMR) applications. This built-in communication capability allows utilities to capitalize on the "information superhighway" by enabling remote control, monitoring, and diagnostic feedback from standby gensets, which can be used to create highly available and reliable capacity. The LONWORKS interface also allows *en*power controls to bridge the electronic communications gap between utilities and their customers who own standby gensets.

Typical Structure of Existing Peak Sharing Programs

Existing "peak sharing" programs explicitly state that if a customer needs the standby genset for emergency power at the same time the utility is requesting the genset for peak sharing, emergency needs always have priority. Beyond this basic feature, peak sharing programs differ significantly in standby genset requirements and incentives offered to customers for participation.

To participate in a peak sharing program, customers are usually required to transfer at least a minimum portion of their load from the utility to their standby genset(s) without exporting power onto the grid. This means that the customer must be using the minimum load when called upon, and the standby genset(s) must be large enough to carry this load. Most programs require a load reduction between 200 and 400 kW, but load reduction values range anywhere from 30 to 500 kW. Peak sharing incentives are typically tied to the dispatchability level chosen (i.e., the response time period for reducing load after notification has been issued) and the availability factor achieved (i.e., the actual capacity available during requests). Response times vary from 1 minute to 12 hours, but most programs have a response time between 15 minutes and 1 hour.

Another common feature of existing programs is a limitation on the amount of time the utility is allowed to operate customer-owned standby gensets during the year. Some utilities have only a total time limit, while others also provide a limit on the maximum number of starts and/or a time limit for any single use. Total time limits are based on a number of factors such as anticipated utility peaking resource needs, local environmental concerns, local ordinances regarding the maximum number of operating hours for standby gensets, and typical genset manufacturer recommendations. Time limits for existing programs range from 120 to 800 hours/year, with most programs using a value between 200 and 300 hours/year.

Standby gensets typically require additional equipment to measure the actual load reduction achieved. Ordinarily the utility pays for (within limits) and owns all extra metering and monitoring equipment, which allows the customer to participate without paying up front costs and motivates the customer to continue purchasing power from the utility rather than switching to a different energy provider. Many peak sharing programs allow approved standby gensets to operate in parallel with the utility grid, or to at least use a closed-transition (make before break) transfer switch. Some utilities will even pay for additional paralleling equipment as part of the peak sharing program. Parallel operation allows genset testing *under load* without causing any noticeable effects or power disruptions at the customer's facility, even if the genset fails. The benefits of testing gensets under load include simultaneous testing of distribution equipment, closer simulation of actual emergency use, and burning of rust-producing moisture gathered inside the engine during idle speed operation. Consequently, using standby gensets for peak sharing will make most emergency power systems more reliable, not less reliable.

The majority of peak sharing programs use two types of incentives to encourage customer participation. The first incentive, a capacity credit, is based solely on the total load reduction that the customer agrees to provide with their genset(s). This incentive, which ranges from $2 to $21 per month per kW, is given simply for the customer's generating capacity commitment and it is paid even if the genset is never needed for peak sharing during the year. The second incentive is intended to compensate genset owners for actual fuel and maintenance costs incurred due to program participation. This incentive usually consists of a "fuel" credit based on the number of kWh's produced (a typical value is $.07/kWh). A less common, but very innovative, incentive is the assumption of all major maintenance and testing of gensets by the utility. This saves the customer labor and operating costs while increasing genset reliability for both the customer and the utility.

Since the utility is using standby gensets to replace additional peaking power plants and/or transmission and distribution upgrades, most programs have long contractual periods. Some utilities offer programs with a contractual period of only 1 year, but most require 3 to 5 years (or a continuous contract having a five year termination provision), while the longest is 15 years. Because of the long lead times needed to build additional peaking power plants and/or upgrade transmission and distribution systems, there is normally a significant penalty for early termination of the contract by the customer. Non-performance of the contract (not being able to provide the contracted amount of load reduction when needed) also carries a stiff penalty since the utility is depending on this peak demand reduction as part of its resource planning process.

As can be seen by the wide variety of programs in existence today, there are very few rules when it comes to setting up a peak sharing program. Thus, the "best" structure for a peak sharing program depends only on the imagination and specific needs of the utility and its customers.

Capitalizing on DSM Opportunities By "Empowering" Standby Gensets

To help companies who own standby gensets take advantage of DSM programs such as "peak sharing", real-time pricing, time-of-use pricing, and interruptible rates, *EN*CORP's new *en*power controls allow seamless integration of standby power equipment into intelligent building automation and energy management systems. By combining full-featured paralleling capabilities with a LONWORKS interface, *en*power controls offer:

- "Blipless" transfer of power to and from the utility;
- Dramatically simplified genset exercising *under load* without transfer switch power disruptions;
- Rapid return-on-investment for genset upgrades that also improve performance and reliability;
- Remote operating mode and load reference inputs, as well as status and metering outputs for connecting to intelligent building automation or energy management systems and/or directly to utility dispatchers; and
- Flexible, low-cost LONWORKS interface for sharing information with interoperable products made by different manufacturers (including energy management, HVAC, lighting, and security systems).

It is very important to note that a formal "peak sharing" program is not necessary for owners of standby gensets to take advantage of utility-sponsored DSM efforts. As far as the customer is concerned, peak sharing, real-time pricing, time-of-use pricing, and interruptible rates are all just different forms of rate curtailment similar to traditional peak shaving. The difference is that these forms of rate curtailment are driven by the utility in direct response to system-wide needs for peaking capacity, rather than having customers make decisions to use self-generation based strictly on peak demands at their own facilities (which usually are not coincident with system peak demands). Consequently, these rate mechanisms serve to minimize utility revenue losses because customers use self-generation only when the utility's cost of producing electricity is very high. These new DSM rate curtailment options do, however, require an essential ingredient not necessary for traditional peak shaving: a direct communication link between utilities and their customers who own standby gensets.

Major Obstacles Confronting Peak Sharing Program Implementation

At this point, two major obstacles stand in the way of implementing peak sharing on a large-scale basis: 1) An advanced communication link is needed for connecting utilities with their customers to create dispatchable, reliable, measurable, high-quality, high-availability peaking capacity; and 2) Emissions issues must be adequately addressed. Several large utilities are actively pursuing solutions to overcome the first obstacle by participating in the construction of the "information superhighway", and it appears LONWORKS technology will have a major influence in the final outcome of these activities.

Answers to the question of emissions impact are much more uncertain. To date, it appears that a formal study has not been conducted to determine whether emissions produced as part of a peak sharing program would pose any greater threat to air quality than routine operation of gensets for testing and emergency use. The problem is not that emissions are produced, because emissions would be produced with utility-owned peaking resources as well — the problem is that emissions are produced within urban areas rather than more remotely. Using hydro power as a peaking resource would seem ideal with regard to air pollution, but large fluctuations in the river flow below dams have adverse environmental impacts of a different kind. In fact, the Western Area Power Administration (WAPA) is now trying to decide how to manage their hydro power in an environmentally sensitive manner to minimize the impact on plants, wildlife, and recreational activities downstream of major dams along the Colorado River. The effect of this environmental study will be to reduce the peaking capacity of WAPA's hydro power while simultaneously increasing its cost as a limited peaking resource.

Typical peak sharing programs limit the operation of standby gensets to less than 250 hours per year, while actual operating hours in existing pilot programs have been considerably less. This limited operation usually does not require any special emissions certifications or permits beyond those required for use as an emergency genset. Ultimately, regulatory compliance for emissions is the responsibility of the customer, although most utilities have an "environmentally conscious" public image to uphold, which involves a very real responsibility to promote better air quality for the public they serve.

Although a comprehensive analysis has not been undertaken, preliminary results indicate that peak sharing programs will lead to tremendous "avoided cost" savings versus other DSM and supply-side options. These savings should be large enough to include advanced emission control systems and exhaust-gas aftertreatment equipment within the list of genset upgrades required to participate in a peak sharing program. This strategy allows utilities to take a proactive role in "cleaning up" older gensets, which produce considerably more emissions than new gensets. Cleaning up older units is particularly important because many standby gensets have a useful life of 30 to 40 years due to their relatively infrequent use. To bolster public image, peak sharing contracts could also specify mandatory compliance with EPA, state, and local emissions regulations, while controlling genset testing to avoid emissions on days with poor regional air quality.

LONWORKS Opportunities for OEM's and System Integrators

With technological displacement occurring at an astonishing rate, companies both small and large must develop synergistic allies whenever possible if they wish to remain competitive in the fast-paced world economy of today and tomorrow. This holds true in the area of commercial and industrial DSM, where opportunities for LONWORKS OEM's and system integrators are enormous. From the utilities' perspective, peak sharing is the most desirable way to use customer-owned standby gensets since utility dispatchers can control these resources directly, simplifying resource planning and scheduling. However, peak sharing programs are really only an interim solution to encourage companies who own standby gensets to cooperate with their utilities so everyone can reap the benefits of peak demand reduction. According to Matt Oja, vice president of marketing at Scientific Atlanta, "Rates are going to be the ultimate DSM... Eventually, rate-based DSM will evolve into a competitive strategy for tomorrow."[5]

In this type of business environment, companies will require sophisticated energy management systems to maximize their profits on a real-time basis by constantly evaluating the many alternatives for energy use, load shedding, load shifting, fuel switching, self generation, etc.

Utilities will require advanced communication and planning systems to provide real-time price indicators, accurate forecasting of demand levels and availability of on-site capacity, etc. Attaining this level of integration for the supply and demand of electricity will be impossible without interoperability between many diverse kinds of equipment made by many different manufacturers. System integrators are likely to be responsible for bringing the various elements together to create a practical and workable solution for everyone involved. Michael Chesser, executive vice president and chief operating officer for Atlantic Electric Co., summed up the need for integrated systems and technologies made by many different manufacturers: “In the optimal system, all the [technology] elements support one another and enable us to create partnerships with customers to avoid having to build new substations. Such integrated systems also will allow us to better use existing generating capacity through dispersed generation, remote load control, and other strategies.”[6]

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1 *The Official Guide to Demand-Side Management Programs and Research*, UDI/McGraw-Hill, Washington, DC, 1993, p. 3.

2 Example of a typical utility’s load profile characteristics from “Resource Integration Study,” Platte River Power Authority, Fort Collins, Colorado, 1994, p. 4.4.

3 Dunklin, Philip I. and Causey, Warren B., “DA/DSM: An Industry Report,” *Electrical World*, January 1995, p. 72.

4 Silvia Pariente-David, “Globalization of the electric power industry: Risks and Opportunities,” *Electrical World*, January 1995, pp. 25 - 36.

5 Dunklin, Philip I. and Causey, Warren B., “DA/DSM: An Industry Report,” *Electrical World*, January 1995, p. 76.

6 Dunklin, Philip I. and Causey, Warren B., “DA/DSM: An Industry Report,” *Electrical World*, January 1995, p. 72.