LOAD ACTING AS A RESOURCE—OPPORTUNITIES AND CHALLENGES

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"LaaR is potentially very rewarding but rather difficult to accomplish, like most things worth doing in life."

WHAT IS LaaR?

Beginning with the opening of the Texas retail electricity market on January 1, 2002, customers that met certain requirements have had the ability to provide services essential to the stability and reliability of the electricity grid by offering their interruptible loads as "resources" to the Electric Reliability Council of Texas, or ERCOT, the operator of the Texas electric grid. The generic term for this arrangement is Load Acting as a Resource, or "LaaR".

LaaR is very similar in nature to the Instantaneous Interruptible, or "IIL" tariff, to which many oil & gas loads subscribed prior to January 1, 2002. However, there are a few distinctions between the IIL tariff and LaaR. First, the "utility" as such no longer exists to provide one-stop management of LaaR. In reality, the customer bears much greater responsibility for LaaR coordination and management than was required under IIL. The complexity of requirements and the number of different parties now involved in LaaR can be overwhelming. Second, rather than receiving a substantially discounted electricity rate, a LaaR customer bids into a reverse auction and, if selected, receives cash payments each month. Third, participation in LaaR is essentially voluntary; customers can opt into and out of LaaR as frequently as every day unless the customer is contractually committed to a fixed unit payment arrangement under which opting out is forbidden.

Any load in ERCOT greater than 1 MW (or, in theory, multiple loads combining to exceed 1 MW) that can withstand "instantaneous" interruption is a candidate for LaaR. Loads previously equipped for the interruptible rate are obvious LaaR candidates; some of the old equipment can usually be re-used, although it is cheaper and faster to replace certain components. Some electricity suppliers (i.e., Retail Electric Providers or "REPs") also include a clause in their supply contract that precludes a load from acting as a resource. In such a case the supplying REP could hold that customer captive by only agreeing to waive the LaaR prohibition for its own benefit.

LaaR interrupts loads in two instances: The first is when the grid frequency drops below the ERCOT-mandated 59.7 Hz for 20 cycles (i.e. 1/3 second) or longer. All LaaR sites are equipped with an under-frequency relay that detects this drop and trips off the load instantly. This is most likely to occur when a large source of generation unexpectedly leaves the grid. For example, if a nuclear plant is struck by lightning, it may instantly shut down. This causes an instantaneous drop in supply with no change in demand. As a result, grid frequency falls past the ERCOT mandated threshold and LaaR loads trip off. This provides instant increases in grid frequency, and allows precious minutes for alternate sources of generation to come on line. Once they do, LaaR loads can return; in fact, they are required to return within three hours, in case they are needed again.

If logistically possible, it is advisable for the LaaR customer to disarm the under-frequency relay for any of the customer's LaaR loads that are not bidding into the auction system; otherwise, the loads are subject to instantaneous interruption with no compensating payments. Effectively, disarming the under-frequency relay removes it from the control circuitry, precluding an instantaneous interruption.

The second instance of LaaR interruptions is via manual deployment by ERCOT. This occurs primarily around urban areas and is used to relieve acute congestion. Regardless, being able to respond to a manual deployment from ERCOT is part of the requirement to participate in LaaR and is part of the LaaR testing process. An ERCOT-mandated LaaR event does not include every LaaR load bidding into the reverse auction at the time of the interruption, but only involves the loads in the proximity of the grid instability identified by ERCOT. Manual deployment of LaaR must be accomplished within 10 minutes of customer notification, and is therefore technically not instantaneous. Some LaaR providers will trip the load from their

control centers, whereas others require the customer or their agent(s) to do so; if the load is remote, this mandates a need for remote capability on the customer's part.

Regardless of the nature of the interruption event, LaaR loads must be back on line within 3 hours of the issuance of an "all clear" notification by ERCOT.

Any time a LaaR load is not available for interruption when that load is participating in the reverse auction system, the LaaR customer may be required to bear the cost of replacing that capability, generally at a higher cost than the LaaR payments. Since LaaR bids are "next-day", there is no way to re-bid loads into the bid system "same-day".

Two points are worth noting for oil & gas operators. First, in oil & gas producing areas, "under-frequency events" have been the exclusive cause of LaaR interruptions to date. Second, LaaR deployments are actually less likely in times of peak demand. In fact, LaaR is most likely to be deployed during moderate temperatures and generally low times of electricity usage. This is because the loss of a single source of generation is less likely to affect the grid when more sources of generation are engaged.

Since inception, LaaR has tripped four times due to an under-frequency event. Each outage has lasted between 7 and 22 minutes. LaaR has not tripped since the spring of 2003. Nevertheless, LaaR must be approached from the point of view that it can and will trip at any time with little or no notice. Finally, LaaR resources may be called on by ERCOT in system emergencies which, by their nature, are difficult to define beforehand.

LaaR QUALIFICATION

In order to qualify for LaaR, customers must perform or contract for the following tasks: 1) Purchase and installation of a Remote Terminal Unit ("RTU") or Programmable Logic Controller ("PLC") and a communication system at the LaaR site that is acceptable to the LaaR provider and ERCOT; 2) execution of a contract(s) with the appropriate communications service provider(s); 3) testing and, if needed, refurbishment of the under-frequency relay located at the field site and submittal of the required test documentation to ERCOT; 4) execution of a LaaR contract with the chosen Qualified Scheduling Entity ("QSE"); 5) completion and submittal of numerous ERCOT LaaR registration forms and related documents; 6) coordination and completion of all initial telemetry testing with the QSE and ERCOT; and 7) successful completion of an actual or simulated manual deployment with ERCOT and the QSE.

IMPORTANT LaaR CONSIDERATIONS

Participation in LaaR requires considerable investment in field equipment and imposes a modest monthly cost for maintaining field systems. A typical LaaR site includes a breaker (generally a device caller a recloser), under-frequency relay, PLC or RTU, substantial communications equipment, backup power, instantaneous metering equipment and a certain degree of redundancy. Because sensitive electronics are involved, good grounding is also important. Once a site is participating in LaaR, ongoing obligations include 1) management of bids to optimize returns, 2) predicting and reconciling LaaR revenues, 3) allocating LaaR expenses and income, 4) maintaining and troubleshooting continuous telemetry streams and 5) responding to the inevitable LaaR event.

Although not strictly required, before bidding a LaaR load into the ERCOT auction system, it is advisable to remove the breaker and send it to a shop for servicing to ensure reliability. Most breakers require periodic maintenance, the frequency of which depends upon the type of breaker, the total number of load-breaking operations incurred, and the amount of current being interrupted. If LaaR payments for a given load are significant, it may be justified to purchase and maintain a spare breaker to avoid cessation of bidding when a breaker is being serviced.

Turnkey LaaR services can be acquired, or customers can place these burdens on in-house personnel, if available. Most experienced oil field automation contractors and in-house automation personnel have the capability of designing and installing the required field equipment once they are familiar with the nuances of the specific requirements imposed by ERCOT and the designated QSE, but that is no small task.

Since many oil field loads are located in remote areas, it is essential that personnel designated to perform support, maintenance and repair functions for these sites be locally based, and that they have the capability of rapid deployment to the sites with access to critical replacement components. Some components of LaaR field installations have long lead times between ordering and delivery, so it is important that the customer maintain a stock of such items or require the field service contractor to maintain an inventory of replacement parts. To avoid the stocking of a large variety of replacement components,

it is advisable to standardize the field installations as much as possible. It is important to understand that the design of LaaR systems and LaaR field equipment in oil & gas environments has been implemented from scratch through a team effort involving operators and service providers, i.e. complete LaaR solutions are not available off the shelf, and one should not expect either ERCOT or the QSE to provide specific solutions to customers.

Communications for LaaR are particularly tricky. Every 2-10 seconds, the entire system must be able to transmit the MW currently flowing through the LaaR site, the status of the under-frequency relay and status of the breaker. Oil & gas loads are often in rugged, remote environments where the traditional communication models and paths used by utility SCADA systems do not fit. ERCOT requirements for data collection are based on these traditional models. When dedicated land-lines are not possible and networks, servers and satellites are used, meeting ERCOT requirements is challenging. In the absence of dedicated communication paths and with the involvement of IP networks, a resource provider must consider its customer's Information Technology policies when choosing communication paths. Different QSEs require different communications protocols, and the customer's compatibility with these must be assured.

Rarely do LaaR requirements fit smoothly into an existing SCADA infrastructure. On the other hand, once deployed, LaaR capabilities provide value beyond LaaR at little added expense. To begin with, the PLC required for LaaR generally has additional inputs and outputs that can be used for more traditional SCADA functions. Or, in cases where SCADA doesn't exist, the LaaR requirements can actually enable SCADA at little added cost. In addition, via either proprietary or Web-based SCADA systems, oil & gas operators can monitor and control a LaaR site remotely, accomplishing such tasks as monitoring electrical consumption in real-time, bringing the load down, bringing the load back up, disarming and re-arming the underfrequency relay, and substantially increasing profitability by responding to the volatility of electricity prices. On-site annunciator panels can also simplify the job of field personnel when responding to LaaR or non-LaaR electrical outages.

HOW LaaR WORKS

As previously noted, LaaR participants receive cash payments. This is accomplished via a market mechanism and involves several parties. Once qualified, LaaR participants can either sign a fixed price contract or bid into the LaaR market via a reverse auction.

Under a fixed price contract, customers are generally guaranteed a set return for participating in LaaR. In return, the customer is usually required to remain as a LaaR participant for one or more years, and the load must be available for interruption during all hours of the contract term, which can impose significant hardships on customers. In a market-oriented contract, customers are able to "opt out" of participation in LaaR by simply refraining from submitting a next–day bid.

QSEs generally allow the submission of a bid template that is "good until cancelled or modified", precluding the need for manual submission of a bid schedule by the customer each day. Bids must be submitted for each hour of the following day.

Either way, the money for LaaR comes from re-distribution of a cost borne by all electric ratepayers. ERCOT disburses this money to QSEs, and QSEs disburse it to their customers participating in LaaR. Hence, a customer contracts with a QSE in a bilateral deal. The QSE submits next-day bids to ERCOT for the contracted load(s) in exchange for a commission on the LaaR payments that are rendered to the customer. Different QSEs offer differing degrees of flexibility, levels of service and commissions for LaaR. Larger LaaR loads generally command lower percentage commissions.

The LaaR market is not particularly complex, but its details are beyond the scope of this paper. One point should be stressed, however: LaaR payments are made for being AVAILABLE to be interrupted, not for the actual interruption itself. Hence, LaaR revenues are not any different whether an interruption occurs or not.

Prices in the LaaR market do fluctuate, generally seasonally. However, they do so somewhat counter-intuitively: LaaR is generally LESS valuable in the summer and winter months when more generation is available, and more valuable in the shoulder months when less generation is online. LaaR prices are actually set for every hour of every day. Average monthly LaaR prices for 2002-2004 are included in Table 1.

HOW VALUABLE IS LaaR?

Based on historical LaaR prices, a conservative estimate for LaaR revenues can be based on $7 per MW per hour. Hence, a hypothetical oil & gas load with a minimum (not average or peak) demand of 1 MW available 24x7 will generate gross revenue as follows:

1 MW * $7/MW-hour * 24 hours/day * 30 days/month = $5,040/month.

A two MW load would generate twice this much gross revenue, a ten MW load ten times as much, etc.

Against LaaR revenues, one must consider the costs. The one-time cost of enabling a site for LaaR depends on many factors. Most oil & gas sites with equipment remaining from the old interruptible rate have experienced one-time capital costs between $10,000 and $20,000. Sites without any existing equipment are likely to cost two or three times this much. LaaR payout ranges anywhere from less than 1 month on a large load with existing equipment to around 18 months on a 1 MW load with no existing equipment.

Ongoing costs also depend on a number of factors. These include the QSE's commission, communication costs, costs for periodic maintenance of breakers, and troubleshooting and management burdens. It should be pointed out that the cost of managing a ten MW load is not substantially greater than the cost of managing a one MW load. Hence, depending mostly on the size of the load, total LaaR costs for oil & gas operators typically average as low as 20% or as much as 60% of the gross revenues. As a good rule of thumb, LaaR net revenues tend to offset between 4% and 10% of the site's electric bill after payout.

IS LaaR FOR ME?

LaaR is not for everybody. Your load must be able to withstand instantaneous interruptions, and the cost of deferred production must be considered.

Capable management, both logistical and technical, is critical. To begin with, LaaR ties together hardware and software from many separate sources. Most of these products are off-the-shelf and cannot be readily modified for the specific communication environment. On an ongoing basis, many competing requirements must be coordinated including those of the customer, ERCOT, the QSE, the electrical equipment services provider, the field services contractor, the electrical transmission and distribution provider, communications providers and equipment suppliers. Both maintenance of communication systems integrity and management of LaaR within the context of greater priorities are no small task for oil & gas operators. Finally, when a LaaR event occurs, support and response are critical.

These tasks can be managed in-house or outsourced. Either way, despite the difficulties, LaaR can provide a significant increase to the operator's bottom line in a time of increasing electricity costs.

Table 1
Average Monthly Clearing Price for LaaR, 2002-2004

	Avg.	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2002	$ 6.56	$ 3.22	$ 4.22	$ 5.39	$ 8.47	$ 3.89	$ 4.32	$ 7.16	$ 5.57	$ 7.33	$ 9.02	$ 8.66	$ 11.50
2003	$ 11.23	$ 9.68	$ 46.60	$ 12.89	$ 8.20	$ 8.90	$ 4.96	$ 5.12	$ 7.10	$ 7.51	$ 10.16	$ 7.02	$ 6.68
2004	$ 8.33	$ 9.26	$ 8.51	$ 9.01	$ 8.89	$ 6.65	$ 6.09	$ 4.00	$ 4.76	$ 8.00	$ 10.48	$ 11.96	$ 12.34