

Designing a Customer-Focused C&I DR Program

Jason Jones, Kansas City Power & Light, Kansas City, MO

ABSTRACT

Demand Response (DR) program design often starts with the utility asking the question, “What are our capacity and operational needs?” While this is a sensible place to begin, the design process too often stops at that point. What would happen instead, if the utility began by asking customers, “What would it take for you to participate in a curtailment program?”

In 2006, KCP&L redesigned its commercial DR program to more closely align with its capacity planning and operational needs. The new program parameters afforded KCP&L increased operational flexibility in terms of when and how it could be called. The program was with limited success, with only three customers participating. By the end of the season it was clear that another redesign was required.

For 2007, KCP&L turned the traditional utility-focused design process on its head by asking customers what it would take for their business to participate. The new program was designed around this customer feedback and checked against KCP&L’s operational and planning needs. KCP&L then went back to the customers with a final plan and further refined the program based upon their input.

The end result was a unique program that provides customers the ability to dial in a customized balance between operational risk and financial reward. Because of the changes made to the program, the number of megawatts under contract and the number of customers participating increased by ten times over the previous year. It is expected that the program will grow by multiples of current participation levels over the next few years.

The Need for a New DR Program at KCP&L

KCP&L has offered some form of demand response program since at least 1993. In 1993, the company offered a Peak Load Curtailment Credit (PLCC) program (**Table 1**).

Table 1. PLCC Program Parameters

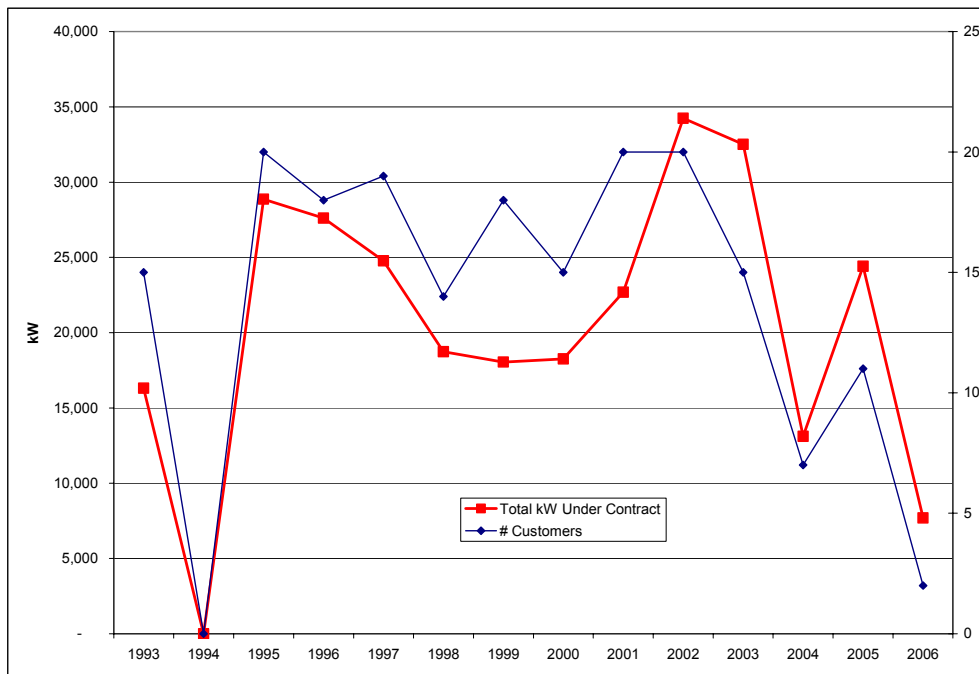
Fixed payment (\$/kW - month)	\$10.00
Variable payment	
Maximum number of curtailments	25
Contract term - years	1
Curtailment season	Jun-Sep
Hours of notice	4
Hours during which curtailments can be called	12-10 PM
Minimum curtailable load kW	200
Maximum number of curtailment hours per season	120
Curtailment days in a row	Unlimited
Opt-out per season	1
Penalty per kWh	\$1.25

The PLCC program offered program participants a fixed payment of \$10 per kW – month. The curtailment season was a four-month season (June through September), giving participants the opportunity

to earn \$40 per kW – season. Over time, the curtailment season was shortened to two months (July and August). The rationale for this centered around the fact that KCP&L’s peaks typically occur during July and August (usually during the last two weeks of July and first two weeks of August.) It was deemed unnecessary to pay for a resource to be available during the months of June and September when there was a lower probability of needing it. In doing this, customer benefits were cut in half, from \$40/kW-season to \$20/kW-season.

The PLCC program reached its highest participation level in 2002 with 20 participants (**Table 2**) and a total contracted capacity of 34 MW. Participation declined over subsequent years as the season was shortened, reaching a low of 2 customers and a total contracted capacity of 8 MW by 2006. The decline in participation levels was largely due to rising diesel fuel prices, the shortening of the curtailment season and the potential to be curtailed up to 25 times. Customers who participated in the program through the use of backup generation found that the financial benefits of participating in the program (a maximum of \$20 per kW season) did not sufficiently offset the cost and risk of curtailing.

Table 2. PLCC Historic Participation Levels



In 1999, as participation levels in PLCC were nearing their peak (but still falling short of desired levels) KCP&L launched a Voluntary Load Reduction (VLR) program in order to grow its total DR portfolio. VLR did not pay a fixed payment, but instead paid a variable, event-based payment. Participation in curtailment events under the VLR tariff was voluntary. Prices offered to customers during curtailment events typically ranged from \$.20/kWh to \$.35/kWh. Because the program was voluntary and did not produce reliable results in terms of customer participation during curtailment events, the VLR program was not highly valued by KCP&L’s resource planning and power sales personnel. It was determined that VLR would not be counted during the capacity planning process.

By 2005 KCP&L had determined that the PLCC program was not delivering acceptable results. It had fallen out of favor with customers due to the low financial benefit and operational parameters that made customer participation difficult. As such, neither program was performing at an acceptable level. In 2005,

KCP&L was also in the midst of filing an Integrated Resource Plan that was to include a heavy commitment to DR. Given these circumstances, it was clear that a new DR program had to be created.

Determined to develop a program that would overcome the shortcomings of PLCC and VLR, KCP&L set out to design a product that would *first* pass scrutiny within KCP&L’s resource management and power sales departments. To do that, the program would have to be designed to ensure that when it was called upon, the contracted capacity would be delivered. Incentives would also have to be structured such that, from a KCP&L power marketer’s perspective, a kW of curtailable load did not cost significantly more than a kW of load purchased in a one or two-year purchased power contract. In short, the program would have to perform like a power plant and cost no more than a near-term market capacity agreement.

The product that was developed, MPower 2006, and which ultimately made it through company internal approvals and regulatory commission approval, had the following operational parameters (**Table 3**).

Table 3. MPower 2006 Program Parameters

	1-Year	3-Year	5-Year
Fixed payment (\$/kW - season)	\$ 16.00	\$ 24.00	\$ 34.00
Variable payment (per kW of <i>curtailable</i> load)	\$ 0.36	\$ 0.36	\$ 0.36
Maximum number of curtailments	25	25	30
Contract term - years	1	3	5
Curtailment season	May-Sept	May-Sept	Jan-Dec
Hours of notice	4	2	1
Hours during which curtailments can be called	12-10 PM	12-10 PM	12-10 PM
Minimum curtailable load kW	200	200	200
Maximum number of curtailment hours per season	120	120	120
Curtailment days in a row	3	3	3
Economic purchase (buy KCP&L energy at a market based price plus delivery and admin fees)	Yes	Yes	Yes
Opt-out per season	1	1	1
Penalty per kWh	\$ 1.25	\$ 1.25	\$ 1.25

MPower 2006 was launched in March of 2006 in Missouri, with Kansas following several months later. Customer interest was extremely limited. The MPower DR portfolio at its maximum consisted of two customers with a total contracted load of 7.6 MW.

Customer-Focused Redesign

At the conclusion of the 2006 curtailment season, KCP&L began studying successful DR programs across the country and compiling data on these programs, with a heavy focus on those programs offered by the New York ISO and ISO New England. The company also held meetings with multiple demand response service providers to further its understanding of DR best practices.

In January of 2007, KCP&L held a DR focus group to learn first-hand from customers what type of DR program design would appeal to them. Approximately 40 customers, representing 20 companies attended the meeting. The meeting audience was comprised of both prior DR participants and non-participants. Customers were lead through discussions that centered on program operational parameters and pricing structures. Several key themes emerged from this discussion related to how customers viewed KCP&L’s previous DR program offerings:

- Enrollment and event payments were too low to cover a customer’s variable cost of curtailing.

- Customers wanted more of the financial reward in “real time.” Fixed payments were often forgotten about by the time actual curtailments occurred, making it difficult for facility managers to explain to upper management what they’d received in return for shutting down or rescheduling operations for a curtailment.
- Penalties were too high to justify the risk of participating.
- Customers viewed the potential of being called on to curtail up to 25-30 times in a year as very risky, regardless of the actual historic number of curtailments called per year (seven).
- Customers felt that their performance baseline, or estimated peak demand (EPD), was set artificially low due to the fact that it was based on the average peak demand for the months of May through September, when curtailments were historically called almost exclusively during the months of July and August. The net effect of this, as viewed by customers, was that it would be more difficult for them to hit their target demand level (firm power level (FPL)) during a curtailment.
- Many customers who might otherwise participate, could not do so due to the 200 kW minimum curtailable load requirement.
- Because of low incentives and the potential to be called on to curtail up to 25 or 30 times, customers felt there was too much risk involved in committing to a multi-year contract.

This customer feedback was translated into the potential program changes shown below (**Table 4**).

Table 4. Customer Needs Translate to Possible Program Changes

Focus Group Feedback	Potential Program Enhancement
• Payments too low	• Share more of benefit with customer • Shift more benefit to event payment • Base event payment on kWh rather than kW
• Penalty risk too great	• Reduced enrollment payments vs. kWh penalty
• Risk of 30 potential curtailments too great	• Let customer choose # curtailments for which they will commit
• New participants unwilling to commit to multi-year contract	• Let customer “earn” way into multi-year contract
• EPD months don’t match curtailment months	• Don’t use shoulder month(s)
• 200 kW minimum too great	• Drop minimum to 25 kW

These general changes were then translated into a revised MPower program with the following operational and economic parameters (**Table 5**).

Table 5. MPower 2007 Program Parameters

Contract Term	2007 MPower		
	One Year	Three Year	Five Year
Fixed Payment	\$2.50/kW x # Events Chosen	\$3.25/kW x # Events Chosen	\$4.50/kW x # Events Chosen
Event Payment	\$.35/kWh		
Penalty	150% of enrollment payment pro-rated for event		
Curtailment Season	Jun - Sep		
Estimated Peak Demand	Based on Jun - Sep noon - 10 p.m. peaks.		
Minimum Curtailable Load	25 kW		
Max # Curtailments per Season	10		
Max # Consecutive Curtailment Days	3		
Hours of Notice	4 (with day-ahead courtesy notice)		
Hours During Which Curtailment Can Occur	noon - 10 p.m.		
Max Length of Curtailment	8 hours		
Days Excluded from Curtailments	Weekends and holidays		
Max Number Curtailment Hours per Season	80		

Several of the operational parameters shown above bear further explanation:

Maximum Number of Curtailments

Perhaps the single largest complaint about prior programs was that even if KCP&L had historically called an average of only seven curtailment events a year, the tariff allowed for up to 25 events in the case of a one- or three-year contract and 30 events in the case of a five-year contract. Customers thought that the tariff must be written that way for a reason, and that there would eventually be a year that saw 20+ events called.

The simple solution to this problem was to let the customer tell KCP&L (up-front, at the contract signing) the maximum number of times he was willing to curtail, from one to ten. By allowing the customer to choose just one event if desired, any new customer who was risk averse and had little or no demand response experience, had a low-risk way to get into the program, see how it worked and gain some confidence in their ability to curtail. The thought behind this was that after they tried it one year, they'd sign up again the next year, choosing the ten-event option.

This solved a KCP&L internal problem as well. KCP&L planners discounted previous DR programs because both PLCC and MPower 2006 allowed the customer to opt out of one event per year with no penalty. This opt-out could occur during any given event assuming it hadn't yet been used up. The new program had no opt-out provision, so planners knew what to expect.

Fixed Payment

The fixed payment under the old program scenario was dependent upon the customer's curtailable load and the term of the contract -- the larger these variables, the larger the fixed payment. The same held true for the new program except that one more variable was added to the equation: the maximum number of curtailment events to which the customer was willing to commit. This new fixed-payment formula is shown in **Table 6**.

Table 6. MPower Fixed Payment Formula

Contract Term	One Year	Three Year	Five Year
Annual Fixed Payment	$\$2.50/\text{kW} \times \# \text{ Events Chosen} \times \text{Curtailable Load}$	$\$3.25/\text{kW} \times \# \text{ Events Chosen} \times \text{Curtailable Load}$	$\$4.50/\text{kW} \times \# \text{ Events Chosen} \times \text{Curtailable Load}$

A customer with a 200 kW curtailable load signing a five-year contract and committing to up to 10 annual curtailments would receive an annual fixed payment of \$9,000 ($\$4.50/\text{kW} \times 10 \text{ events} \times 200 \text{ kW}$). These payments are paid in four equal monthly installments during the course of the curtailment season.

Variable Payment

Under the old MPower tariff, event payments were not tied to the actual number of hours of curtailment. The payment was simply calculated as $\$.36/\text{kW} \times \text{kW}$ of curtailable load. A customer with a 200 kW curtailable load would be paid \$72 for participating in a curtailment event whether that event lasted six or eight hours.

Based on the focus group results, it was clear that customers wanted a larger overall financial incentive and they wanted more of the overall incentive to be associated with the actual curtailment event. This was accomplished by setting the event payments to be \$.35 per kWh, so that (using the example

above), a customer with a 200 kW curtailable load would receive \$420 for a six-hour event ($\$.35 \times 200 \text{ kW} \times 6 \text{ hours}$), and \$560 for an eight-hour event ($\$.35 \times 200 \text{ kW} \times 8 \text{ hours}$). KCP&L's cost of providing these incentives would, in most cases, be partially offset by high market energy prices during curtailment hours.

Determining Price Points

The fixed and variable payments discussed above were determined based on previous experience with PLCC and MPower, and customer feedback obtained in the focus group. The goal in setting the price points was to set the total customer benefit at the lowest possible level that would still garner the desired level of participation.

The range of possible price points was bounded on the upper end by the avoided cost of a combustion turbine (CT). There was a lot of internal discussion among program designers and energy resource management and power sales personnel as to whether the upper bound should in fact be the avoided cost of a CT or near-term market capacity prices, which are generally significantly lower than the cost of a combustion turbine. In the end, any such discussion ultimately boils down to whether or not a DR portfolio is viewed as a short-term or long-term resource.

KCP&L views a DR portfolio as a long-term resource. Operationally, it does not have the exact same characteristics of a CT, but from a planning standpoint, the capacity of a DR portfolio is accounted for very much like the capacity offered by a CT. A DR portfolio has more value when it is assumed by all parties up front that it will be grown and maintained over decades. To accomplish this, and to ensure continued long-term participation by customers, incentives have to be of a level high enough to make a customer's ongoing commitment worthwhile.

One additional point that must be agreed upon by all parties up front is that a DR program cannot be turned off and on to match near-term capacity needs. A DR program must be promoted and maintained year after year or customers will lose confidence and become less likely to participate in future years. This is not to say that events must be called every year, but customer participation levels should, if not grown, at the very least be maintained.

In short, once it is agreed that a DR portfolio ought to be modeled more after a CT than a short-term purchased power agreement, pricing becomes a matter of finding out what it takes to get a customer to participate and then checking that price point against the cost of an avoided kW of CT capacity. Once all parties agree to this fundamental starting point, one cannot argue that a DR program should be "turned off" for a year or two because current one- or two-year market capacity prices are lower than the cost of a DR kW. If this weren't the case, then the argument could be made that a CT should never be built, simply because near-term market capacity prices are, on average, less than the cost of a CT.

In setting the price points for the new MPower program, KCP&L relied heavily on data gathered from the customer focus group. That data indicated that the benefits of the one-year contract would have to be more than doubled, and that the three- and five-year contract total benefits would have to be increased by more than 60% to obtain significant levels of customer participation.

As previously stated, customers also desired to have more of the total benefit paid out on an event (variable) basis. Therefore, in modeling the new program, KCP&L had to consider pricing in terms of an average case and a high case. The average case would be a summer when the number of event hours equaled the historical average number of event hours, which happened at the time to be 42 hours (seven, six-hour events per season.) The high case would be a summer during which the maximum allowable number of event hours occurred, which under the parameters being considered for the new program would be ten, eight-hour events, for a total of 80 curtailment hours. A summary comparison of annual incentives for these scenarios is shown in **Table 7** for both the new and old MPower programs.

Table 7. MPower Pricing Scenarios

Average Case			New Program			Old Program		
Contract Term	# Events Signed Up For	# Event Hours	Fixed Payment	Variable Payment	Total Payment (\$/kW)	Fixed Payment	Variable Payment	Total Payment (\$/kW)
1 Year	10	42	\$ 25.00	\$ 14.70	\$ 39.70	\$ 16.00	\$ 2.52	\$ 18.52
3 Year	10	42	\$ 32.50	\$ 14.70	\$ 47.20	\$ 24.00	\$ 2.52	\$ 26.52
5 Year	10	42	\$ 45.00	\$ 14.70	\$ 59.70	\$ 34.00	\$ 2.52	\$ 36.52

High Case			New Program			Old Program		
Contract Term	# Events Signed Up For	# Event Hours	Fixed Payment	Variable Payment	Total Payment (\$/kW)	Fixed Payment	Variable Payment	Total Payment (\$/kW)
1 Year	10	80	\$ 25.00	\$ 28.00	\$ 53.00	\$ 16.00	\$ 3.60	\$ 19.60
3 Year	10	80	\$ 32.50	\$ 28.00	\$ 60.50	\$ 24.00	\$ 3.60	\$ 27.60
5 Year	10	80	\$ 45.00	\$ 28.00	\$ 73.00	\$ 34.00	\$ 3.60	\$ 37.60

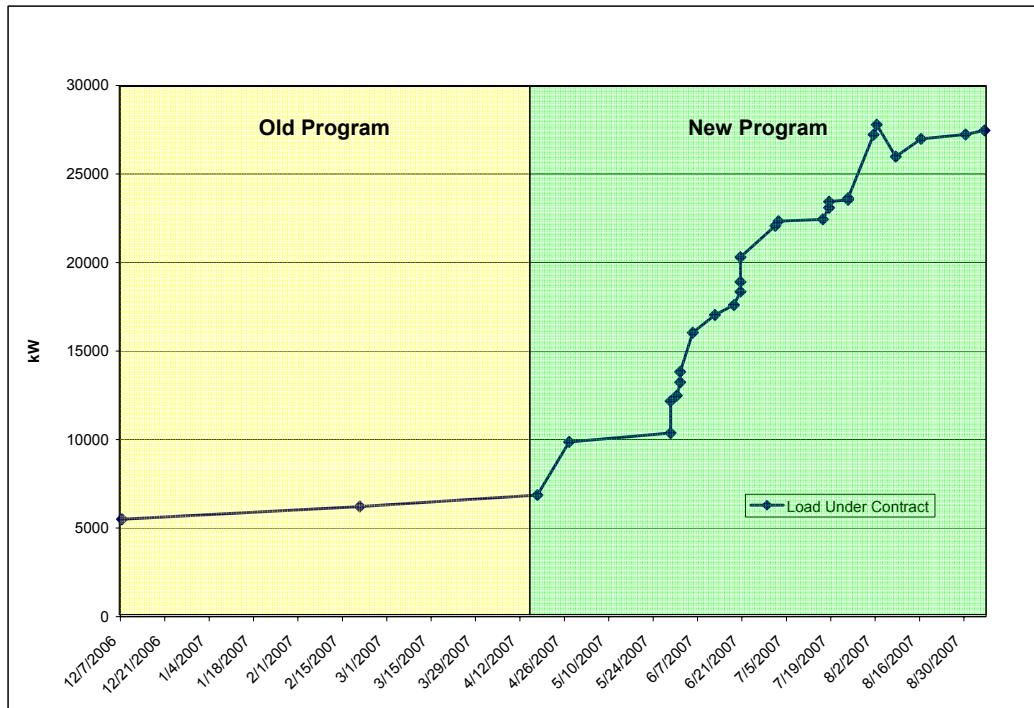
Penalty

The penalty under the old MPower tariff was \$1.25 per kWh. The customer focus group revealed that the penalty presented a significant hurdle to participation. With the program redesign, the penalty was reduced and restructured. With the new design, the per kWh mechanism was completely eliminated. Customers who failed to perform during any given event hour would simply not receive an event payment for that hour. They would also incur a proportional reduction in a future enrollment payment according to the following formula: $1.5 \times [(\text{Annual Participation Payment} / (\text{Max \# Events per Year})) \times [1 - (\text{Delivered kWh} / \text{Expected kWh})]$.

Results

The Missouri and Kansas tariffs for the new MPower program were approved in April of 2007. This left little time to educate the market and sign customers up for the program before the start of the curtailment season. However, customer interest in the new program proved to be greater than expected. By the start of the curtailment season on June 1st, the portfolio had over 13 MW under contract. By the time of the first curtailment on August 9, the portfolio had grown to 26 MW (**Table 8**). By year end, there were 27 MW under contract.

Table 8. MPower Portfolio Growth



KCP&L factors its DR portfolio into its capacity planning process and exercises the program every summer to help manage its peak electrical requirements. The summer of 2007 was cooler than normal in KCP&L's service territory but nevertheless, the program was still exercised four times in early August. On a portfolio basis, customers delivered as promised. An analysis of individual customer load reductions reveals that on average, customers delivered 7% more than their contracted load during curtailment events. It is critical to maintain and track portfolio performance so that capacity planners will have confidence in the program and make use of it as a real capacity resource.

Conclusions and Next Steps

The key lesson learned by KCP&L in designing the MPower program is that a program has little chance of succeeding if it is not built around customer needs. Because the January 2007 focus group was so successful and led to a successful program redesign, KCP&L held another focus group in November 2007 and intends to hold multiple such meetings in 2008. The November 2007 focus group led to several potential product enhancements, which may find their way into the program for 2008. These include:

- Shortening the intra-day timeframe within which a curtailment can occur.
- Shortening the curtailment season to more closely match historical reality.
- Given the two changes mentioned above, increase the maximum number of consecutive curtailment days from three to five.
- Formulating an alternate, more accurate way of establishing a customer baseline/estimated peak demand.

Having established a successful, customer-focused program, KCP&L can now focus more intensely on entering new markets with its DR program. Toward that end, and building on the momentum established in 2007, KCP&L has partnered with Energy Curtailment Specialists to enter the small commercial market in 2008. As the MPower program is extended to the smaller commercial market, KCP&L will look to equip customers with enabling technologies that automate the execution of curtailment strategies, reduce the potential for human error, and allow the maximum demand contribution and financial benefit. These enabling technologies include direct control of lighting and HVAC, installation of energy management systems and the use of displays or computer interfaces that can deliver price signals and automate the end user response to price signals. As was done with the design of the MPower 2007 program, the evolution of KCP&L's DR program will be driven by changing customer needs.