Appendix A: Analysis of Critical Peak Rebate Program Concept

Critical Peak Rebate Program Analysis

June 2006

Introduction

As part of its AMI filing in March 2006, SDG&E proposed to implement a "Peak Time Rebate" (PTR) Program. It amounts to a peak power buyback program for residential consumers. Similar programs for large industrial customers in the Northwest, Northeast, Mid-Atlantic, and Southeast have proven very popular and effective for reducing peak demand.[1] During the 2001 Energy Crisis, California, Washington, and Oregon reduced electricity demand by more than six percent through politically-politically popular 20/20-type buyback programs from residential customers[2] – not surprising, since residential customers are often the most responsive to price signals.[3] Due to limited metering capability – only monthly consumption data was available – the residential buyback programs were in effect 24 hours a day for the entire summer, and they would not be cost-effective on an ongoing basis. However, SDG&E concludes that a peak power buyback program operated during only the top 100, "critical peak," hours of the year can be cost-effective, even when paying residential consumers 65 cents per kWh for all electricity usage reduced below the customer's average usage for those hours.

Program Concept

The PTR program is a simple design and easy to explain to customers. Customers in the program remain on their standard electricity rate, which continues to have inverted tiers, thus avoiding any conflict with California's AB1x restrictions.

Customers will be notified a day ahead of time of critical peak days, which will occur up to 15 days per year when reserve margins are expected to be tight. Notification will be via pubic media, such as radio announcements that "Tomorrow is a Peak Power Day," along the lines of "Spare the Air" days now announced when heavy air pollution is foreseen. On critical peak days, a standard critical period – 11 a.m. to 6 p.m. – will be established. This standard period makes it easier for consumers to remember when to curtail peak load, and it makes the billing calculation simpler and cheaper to implement. During the critical period, customers reducing their load below their "baseline" load will be paid a fixed amount of 65 cents per kWh. This amount equals $650 per MWh, which is consistent with prices seen in the top 50 to 100 hours in competitive wholesale markets in the U.S.

A customer's "baseline" load will be calculated as the average load for that individual customer during the same hours for the five previous non-event similar weekdays. "Similar," means comparing weekdays to weekdays and weekends/holidays to weekends/holidays. While such a calculation for every residential customer would have been expensive and difficult a few years ago, new software, databases, and computing capability make it cost-effective today.

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[1] - Goldman, C. *et al.*

[2] - Goldman, C. *et al,* "California Customer Load Reductions during the Electricity Crisis: Did They Help to Keep the Lights On?," Lawrence Berkeley National Laboratory LBNL-49733, May 2002.

[3] - Energy Information Administration, "Issues in Midterm Analysis and Forecasting 1999," August 1999. Also, SDG&E estimates that residential customers will provide 49 percent of total demand reductions from all of its customer classes (Steve George Testimony, March 27, 2006, p. 8).

Billing of PTR customers will be done through a single line-item credit on a customer's bill. The credit calculation would be the number of kWh curtailed times 65 cents, as in this sample:

Credit = (Average Load – Actual Peak Power Load) x 50 cents

= (15 kWh – 11 kWh) x 65 cents

= 4 kWh x 65 cents

= $2.60

This calculation can be performed outside the utility's existing billing system and imported as a single data field for addition to the bill.[4] Because the PTR concept is so simple, it is probably unnecessary to produce a bill insert or detailed report. The calculation also requires a data system to keep track of each customer's "baseline" load for use in calculating the credit. Again, this system need not be part of the existing billing system.

Program Considerations

As with all demand response programs, the PTR program must resolve several questions to be successful. These include the following:

- Reasonableness of buying power back from customers
- Cost-effectiveness of the peak demand reductions
- Levels of customer acceptance and peak demand reductions
- Interaction with other demand response programs such as load control
- The concept of "free riders"
- Avoiding "gaming"
- Appropriate rate treatment to ensure utilities are kept whole

Reasonableness

Is it reasonable to pay customers for *not* doing something? SDG&E argues that it is. The reason is that customers are already paying for peaking capacity in their procurement rates. Those rates recover costs of all energy and capacity requirements for the utility for the entire year. Those costs are averaged over kWh sales, then recovered in rates. Thus, since individual customers have already paid for the peaking capacity required to serve them, SDG&E argues that it is appropriate and proper to pay them for not using that peaking capacity via the PTR program.

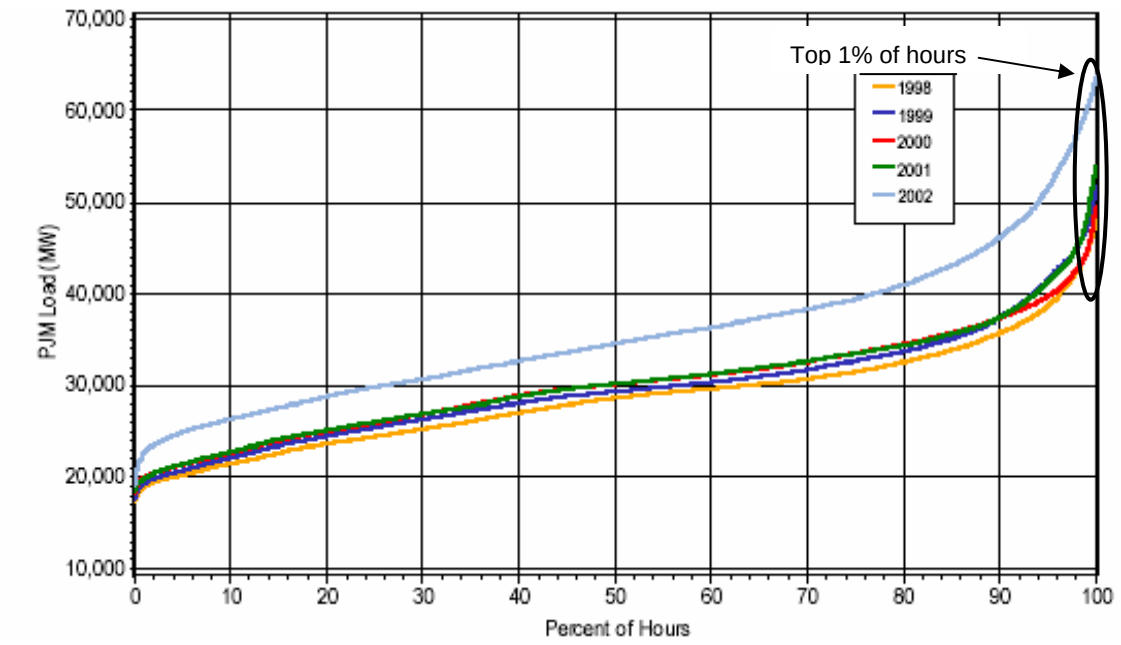
[4] - It is not known whether SDG&E will show the number of curtailed kWh on the bill so the customer could perform a verification calculation independently.

Cost-Effectiveness

SDG&E's application provides testimony to the effect that the PTR program is cost-effective, based on assumed capacity value of $85 per kW year (somewhat higher than the value used by PG&E in its AMI application analysis). SDG&E assumes that it will have good coincidence between the times that PTR is dispatched and the times when SDG&E would have had to purchase marginal capacity.

A significant factor in this analysis is the number of hours per year when marginal capacity is needed. As Figure 1 shows for PG&E, there is a sharp spike in load during these hours; the situation for California is similar.

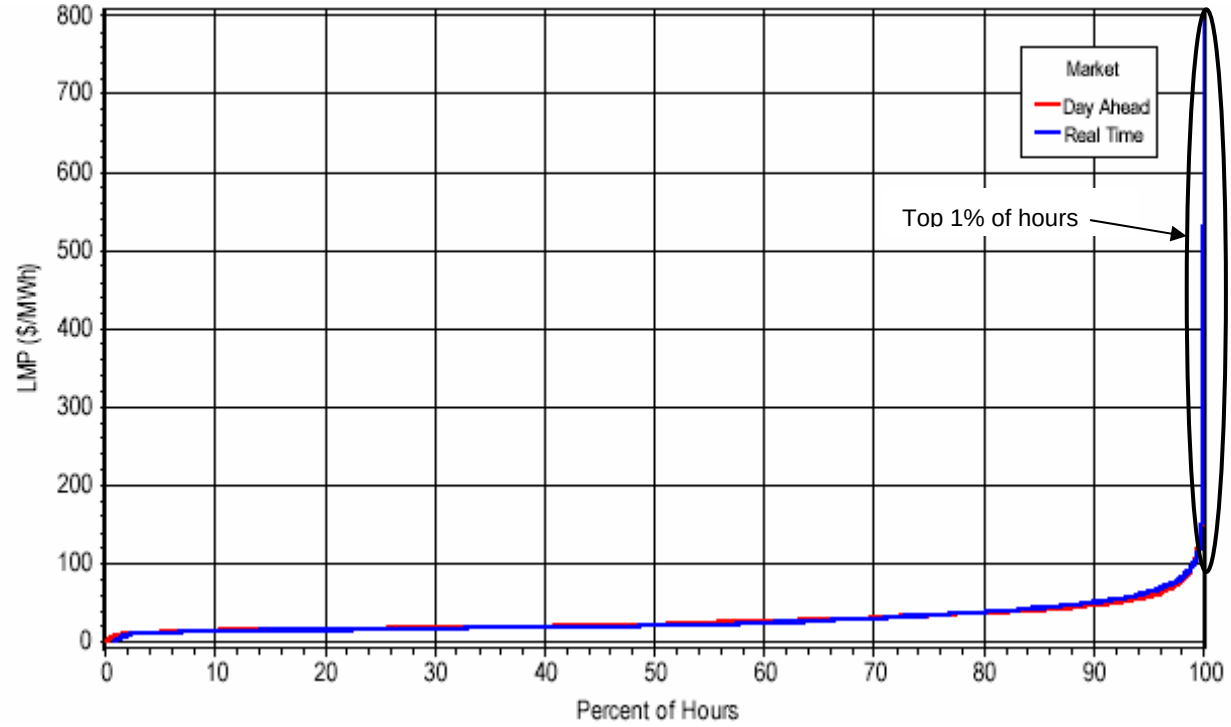
Figure 1 – Load Duration Curves for PJM for Recent Years



Since electricity cannot be stored, the costs of peaking plants must be recovered in the few hours each year in which the plants are operated. With regulated rates the costs are spread over the year. In competitive wholesale markets, this short window for cost recovery results in prices that parallel electricity demand, as seen in Figure 2 for PJM.

The goal of the PTR program is to avoid the construction of new peaking plants as customer load continues to grow overall. Thus, the savings associated with the demand reductions, *over the long term*, will equal the costs avoided by not building and maintaining those peaking plants. SDG&E determined this amount is $85 per kilowatt per year.

Figure 2 – Price Duration Curves for PJM for 2002



A quick review of the program economics suggests SDG&E's analysis, if one agrees with the $85 figure, yields reasonable results. To begin, since line losses at the consumer level add up to approximately 10 percent during peak hours, a 1.0 kilowatt load reduction translates into 1.1 kilowatts fewer peaking plant needed, and a corresponding savings of 1.1 times $85, or $93.50. Customers are actually receiving a savings of 80 cents per kWh (65 cent rebate plus avoiding electricity purchases at an average rate of approximately 15 cents per kWh). If the PTR program operates 105 hours per year, the cost of the demand reductions would be 80 cents times 100 hours, or $84.00, yielding net gross savings of $9.50 per kilowatt year – for the maximum number of operations.

SDG&E argues that an advantage of PTR is that events can be called only when needed, as opposed to a critical peak price that must be called for the designed number of events each year to be revenue neutral. On the other hand, a few operations are needed every year to validate demand response levels and remind customers of the program features. A minimum of five operations per year is desirable to fulfill these requirements. With at least five and at most 15 operations per year, a likely average will be around 10 per year. Ten operations at seven hours each (11 a.m. to 6 p.m.) would yield a cost for demand reductions of 70 times 80 cents, or $56.00 per kilowatt per year. This is a savings of $37.50 per kilowatt-year, based on SDG&E's assumed avoided capacity cost.

A further consideration is the effect of the b aseline, which reduces the cost per kilowatt-hour reduced. There are tow reasons. First, the baseline undersates the average load on a critical peak day; by definition, these days normally have higher loads than non-critical peak days. Second, some customers will reduce loads but not earn any rebates, by not going below their baselines (an effect offset by those

customers who earn rebates but reduce load as a result of coincidence rather than response to the PTR rebate incentive.

Customer Acceptance

SDG&E notes that the PTR program promotes strong customer acceptance in five key ways and, like the 2001 residential buyback programs in the West and industrial buyback programs around the U.S., can be expected to be very popular.

The program begins by being meaningful: it asks consumers to respond only a few days per year, only when their demand reduction is needed the most, and only when their demand reduction is valuable enough – at 65 cents per kWh – to be worth taking action to reduce load.[5] In addition, the concept is simplicity itself: if I reduce usage on peak days, I can earn a credit on my bill; if I do nothing, I will pay my regular bill.

Moreover, consumers need not think about the program. They would be reminded by media announcements of "Peak Time Rebate" days, and the peak hours will be fixed at the same hours on each critical peak day. Also, the incentive amount will be fixed, eliminating any need for participants to adjust their load responses to changing levels of incentives.

Finally, a universal program that works the same way for all residential consumers greatly magnifies understanding, acceptance, and load response. The universality results in reinforcement or program awareness and features in the media and in the community by family, friends, colleagues, and neighbors. This reinforcement was extremely effective in promoting conservation behavior by consumers in the 2001 buyback programs.[6] Last and not least, the concept of a residential rebate program has already proved to be immensely and broadly popular with consumers, based on the response to the 2001 programs.

Peak Demand Reductions

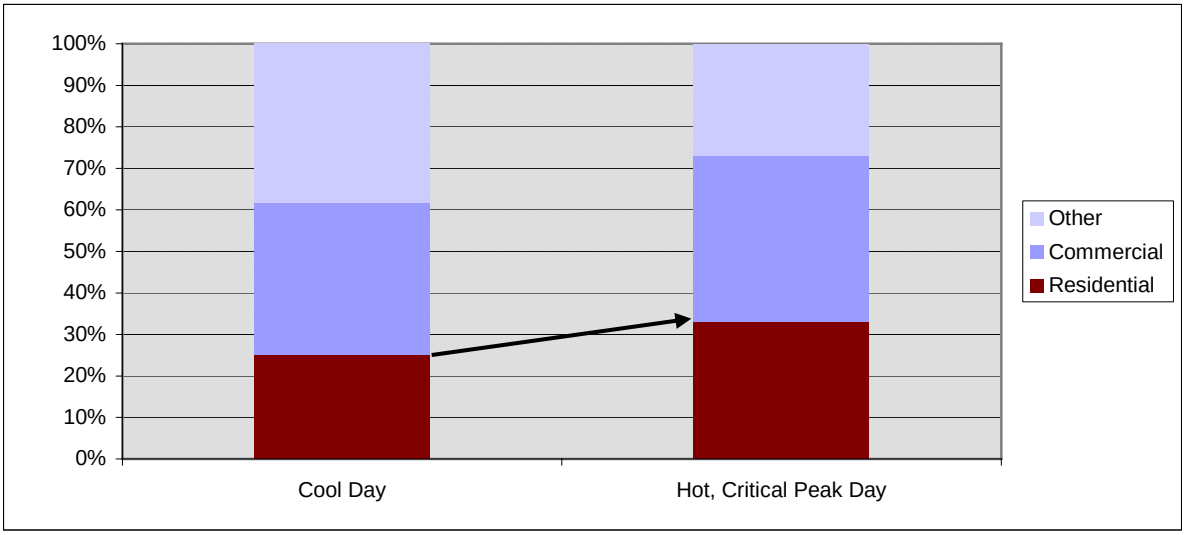
Residential consumers are well suited to reduce peak demand via the buyback program. First, residential consumers are major contributors to the peaking problem, as seen in Figure 3 below.

Second, residential consumers have shown in programs over the past three decades that they reduce loads significantly in response to peak price signals. The programs most like the PTR program are critical peak pricing programs without automated response. In three programs, in Illinois, California, and France, residential customers reduced peak load by an average of 22% on critical peak days.[7] Over time, for customers who implement automated response, those

[5] - At Puget Sound Energy, in the residential time-of-use program, many consumers were upset that they had taken extensive actions to reduce peak loads for savings of only 0.9 cents per kWh.
[6] - *Op cit*.
[7] - Budd, C. "Making Electricity Markets Work: Hourly Prices for the Home," EUCI Load Management Conference, October 2003; Pacific Gas & Electric *et al.* "Monthly Report on Statewide Pricing Pilot to California Public Utilities Commission and California Energy Commission," December 15, 2003; and Aubin, Christophe *et al*. "Real-Time Pricing of Electricity for Residential Customers: Econometric Analysis of an Experiment." Journal of Applied Econometrics. Dec. 1995.

reductions can be expected to average approximately 45%, the result of six such integrated pricing and automated control programs operated in nine states around the U.S.[8]

Figure 3 – Contribution to System Demand by End Use, California 2003[9]



Interaction with Other Demand Response Programs

The PTR program could work well with other demand response programs. PTR may be considered an alternative to supply-side resources at times of system peaks. As such, a customer could participate in any other tariff – be it inverted tier rates, flat pricing, a flat bill, time-of-use rates, or critical peak prices – and still participate in the PTR program. Provided the other tariff is designed to recover costs from its participating customers, there is no double counting; with PTR, the utility is simply buying peaking power from its customers rather than from wholesale power marketers. However, to reduce potential confusion, it may be preferable to exclude from the buyback program customers participating in other dynamic pricing tariffs in which special rates are dispatched on critical peak days.

Passive Credit Earners or "Free Riders"

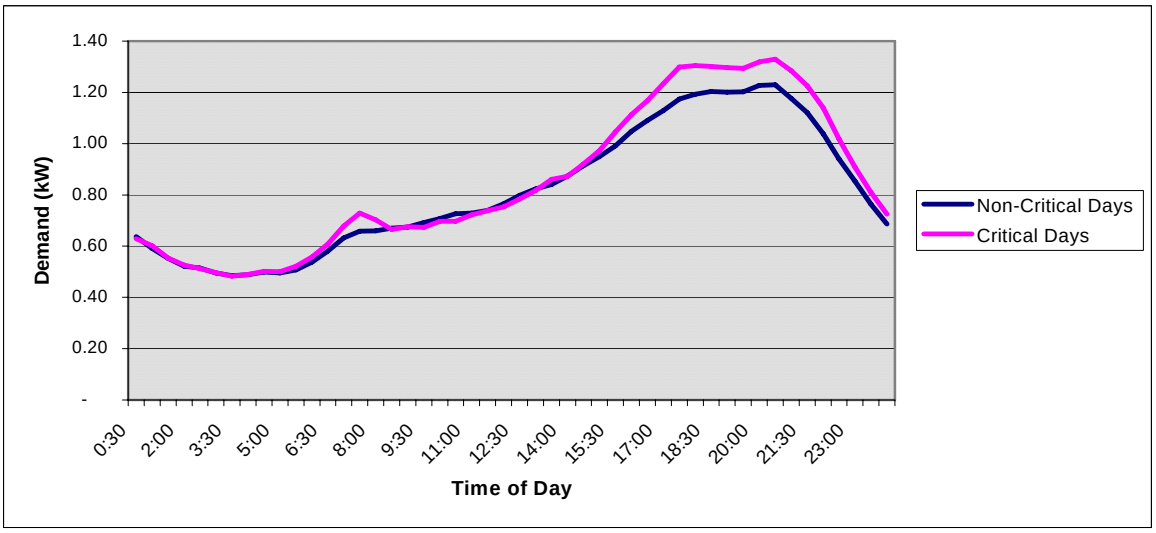
A potential concern regarding the PTR program is passive customers who receive incentive payments for actions they would have taken in the absence of the program. While the term "free rider" is often used to describe such customers, a more neutral term is "passive." "Passive" is defined to be a customer who reduced load on a critical peak day not because of the buyback program incentive, but because he went on a vacation or took some other action he would have taken without the program.

[8] - King, C. "Integrating Residential Dynamic Pricing and Load Control: The Literature," January 2004.
[9] - California Energy Commission, "1998 Baseline Energy Outlook," August 1998.

Three reasons have been given that passive customers should not be a problem for a program such as PTR. First, this problem was not identified as a problem in the 2001 buyback programs, large programs with total incentive payments exceeding $250 million.[10] Importantly, these buyback incentive payments are discounts back to ratepayers and, thus reduce rates, as opposed to payments to third parties, such as power producers, which increase rates.

Second, the calculation of the incentive requires that consumers reduce peak demand even before beginning to earn a credit. Figure 4 shows that the average customer must reduce peak demand by about 10% on critical peak days to get down to the level of peak demand on non-critical days and beginning to earn a rebate.

Figure 4 – Average Residential Demand in Northern California, September 2003 [11]



Third, PTR rebates are not a significant proportion of annual bill amounts, so the amount that a passive customer could receive is quite limited. Residential usage during the critical peak hours, for the maximum dispatch of 15 days, totals an average of 2.5% of annual electricity use.[12] In California, for an average user of 6,000 kWh, reducing the 2.5% amount by an extreme of 50% would mean a reduction of 68 kWh, including factoring in the 10% start-up amount from Figure 4 above. At 65 cents per kWh, the credit would be $44.20. This compares to annual bills averaging approximately $780. Thus, in this extreme case, the customer's annual savings is still only 5%.[13]

Avoiding "Gaming"

The PTR program is very difficult to "game," which is usually defined as manipulating usage to generate artificially high bill credits. First, because critical peak days are not known until the evening before the event, customers do not

[10] - *Op. cit.*
[11] - Pacific Gas & Electric Company dynamic load profiles for residential customers.
[12] - Working Group 3 Report to the California Public Utilities Commission, January 2003.
[13] - EIA, "State Electricity Profiles 2001 – Pennsylvania," May 2003.

know which days will be used to determine their "baseline" usage for calculating the credit. Second, even if a customer could predict critical peak days precisely, gaming would actually backfire. For example, a customer might use excess energy during the peak period on expected averaging days so he could realize excess reductions on the critical peak day. Since five days are used in the averaging, the customer must use five extra kWh during the averaging for every one kWh in excess load reduction. At rates of 15 cents per kWh and a rebate of 65 cents per kWh, the net gaming benefit is 65 cents minus five times 15 cents, or *negative* 10 cents per kWh. And this assumes perfect knowledge; a customer guessing wrong – and incorrect guesses are far more likely than correct guesses – will pay even higher bills by trying to game.

Rate Treatment

SDG&E has proposed that the PTR rebates be accounted for in procurement coss. Since these are pass through, SDG&E would ensure that it is neither helped nor harmed by calling events. California's policy "decouples" utility kWh sales from utility profits.

Final Observations

SDG&E's goal with PTR is to obtain significantly higher demand response benefits, and its testimony supports achievement of this goal. It remains to be seen how the California PUC and intervenors will respond.