

Advanced metering, dynamic pricing and demand response proceeding in California

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Abstract

Faced with “needle-peak” summer loads and limited connection between wholesale market prices and retail tariffs, California has initiated a regulatory proceeding on “advanced metering, dynamic pricing, and demand response.” The proceeding, jointly run by the California Public Utilities Commission (CPUC), the California Energy Commission (CEC), and the California Power Authority, has endorsed a vision to move forward with dynamic pricing tariffs and may soon decide if tariffs similar to those already in effect in the southeastern United States are appropriate for California.

Introduction

To understand California's problems during restructuring its electrical system, one must remember that, in the United States, California is often the first to innovate. We were the first to limit the growth of nuclear power, to adopt standards for buildings and appliances, to offer incentives for renewables, and to restructure. Innovators usually make mistakes along the way; some of which I will discuss.

We failed to couple retail rate to wholesale prices, and hence to introduce demand response to high prices and to shortages. To resolve this disconnect, and as the technology member of the CEC (California Energy Commission), I assumed responsibility for installing 23 000 real-time meters for all large customers (load greater than 200 kW), totalling

15 GW (30% of state peak load), and am now co-leading a joint CEC CPUC rulemaking to introduce dynamic pricing and price-responsive controls for all customers.

On a hot day, 30% of California's peak power goes to a/c (air conditioning) and 11% more to lighting commercial buildings. (Figure 1). During emergencies we showed that for a few hours on a few hot afternoons, we could set up thermostats by 2 degrees Celsius, and dim lights 30% with little discomfort to occupants. The cost of meters and controls is less than 200 Euro/kW, significantly less than the cost per kW of a new peaking power plant.

The Joint Proceeding has endorsed a Vision (Figure 2). The vision includes offering “time of use” (TOU) rates to all customers, assuming the cost of metering is economic. In addition, all classes of customers would be offered choices of how much risk to accept, with the expectation that a substantial number of large customers would choose real time pricing. Although not fully decided, we expect that the proceeding will authorise a 2 500 point experiment for residential customers and CPP pricing for larger customers, both to be in place by the summer of 2003.

Figure 3 defines the various pricing options referred to in Figure 2.

MATCHING TARIFFS TO CUSTOMERS

Although elementary economics suggests that hourly variances in wholesale prices should be passed on to retail customers, in practice an American home-owner raised on “flat”-rates, may not easily “buy” this concept. However two tariffs are of considerable interest to the California proceeding.

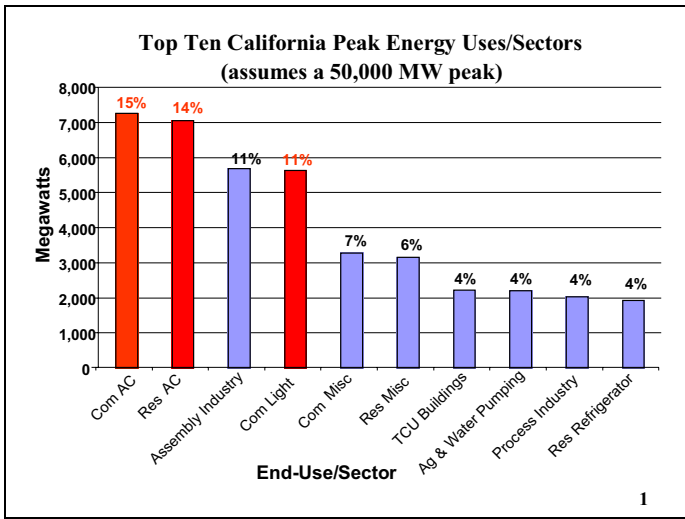


Figure 1. Top Ten California Peak Energy Uses/Sectors.

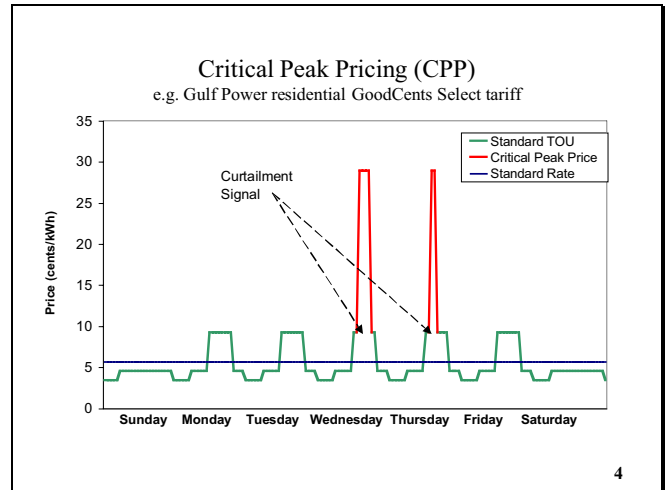


Figure 4. Critical Peak Pricing (CPP).

Proposed CEC/CPUC Vision

- ◆ Always TOU or Better if digital meters available and if economic
- ◆ “CPP” is an extension of TOU
- ◆ Residential and Small Commercial
 - Default = CPP
 - Hedge = TOU
- ◆ Intermediate Size Customers (perhaps 200 kw to 1 MW)
 - Default = CPP
 - Hedge = TOU
 - Option = RTP (voluntary)
- ◆ Large (perhaps > 1 MW)
 - Default = RTP
 - Hedges to CPP or perhaps TOU

Figure 2. Proposed CEC/CPUC Vision. The abbreviations (TOU, CPP, ...) are explained in Figure 3.

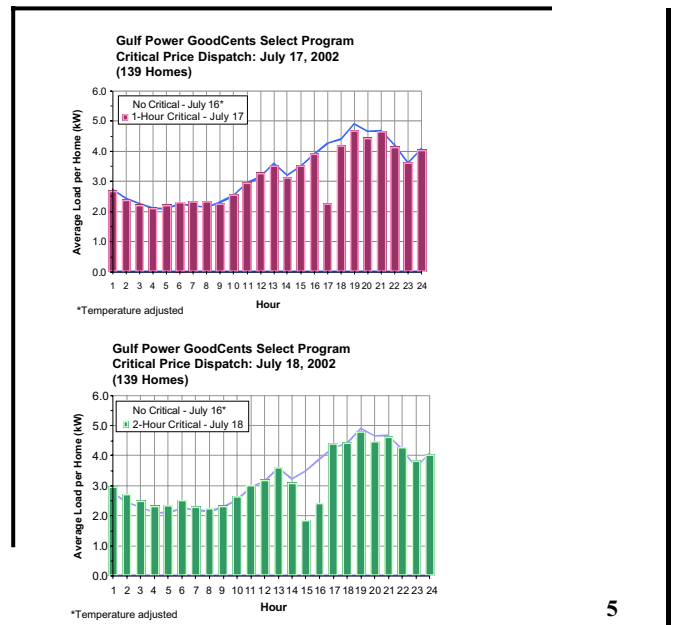


Figure 5. Gulf Power GoodCents Select Program.

TOU Pricing vs. Dynamic Pricing (CPP & RTP)

- ◆ **Time-of-Use (TOU)** is typically 3 time blocks published in advance for entire season
 - Peak, Shoulder, Off-Peak
 - Cannot address unforeseen weather or equipment failures
- ◆ **Critical Peak Pricing (CPP)** is a high price imposed on a few days a year when energy is expensive or system conditions are critical or near critical
 - Non-CPP hours are less expensive as a result
 - Customer pays the critical price when invoked by the utility
 - day-ahead forecast of CPP offers added time for response
- ◆ **Real-Time Pricing (RTP)** is the hourly marginal cost of a kWh
 - Reflects hot weather, scarcity, or equipment failure
 - day-ahead forecast of RTP offers added time for response

Figure 3. TOU Pricing vs. Dynamic Pricing (CPP & RTP).

Figure 4 illustrates a CPP rate currently in effect for residential customers in Gulf Power (Pensacola, Florida).

Figure 5 provides depictions of how customers responded to CPP prices during the summer 2002. Savings were in the range of 1.5 kW, mainly from raising air-conditioning thermostats by 2 degrees C, for both the one-hour and two-hour CPP periods.

Figure 6 provides an overview of Georgia Power Company’s (Atlanta, Georgia) Real Time Pricing program. Figure 7 illustrates how large customers on an hour-ahead RTP respond to price. These customers exhibit the best response to real time prices, reducing loads as seen on the grid by more than 20% when faced with high prices.

Georgia Power's Voluntary 2-part RTP Program

- ◆ Customer bill = Part 1 + Part 2
 - Part 1 based on historical load profile (customer baseline load – CBL). CBL is a list of hourly loads for entire year
 - Part 2 based on price responsive **departures** from load profile
- ◆ Part 1 is the CBL x TOU tariff
 - What you expect to pay if you don't respond to real-time price
- ◆ Part 2 is the hourly departures from CBL
 - Enables customer to buy additional kWh when prices are low
 - And sell back kWh when prices are high
- ◆ **Saves 17% of participant's load at ~\$1/kWh on hot afternoons**

Figure 6. Georgia Power's Voluntary 2-part RTP Program.

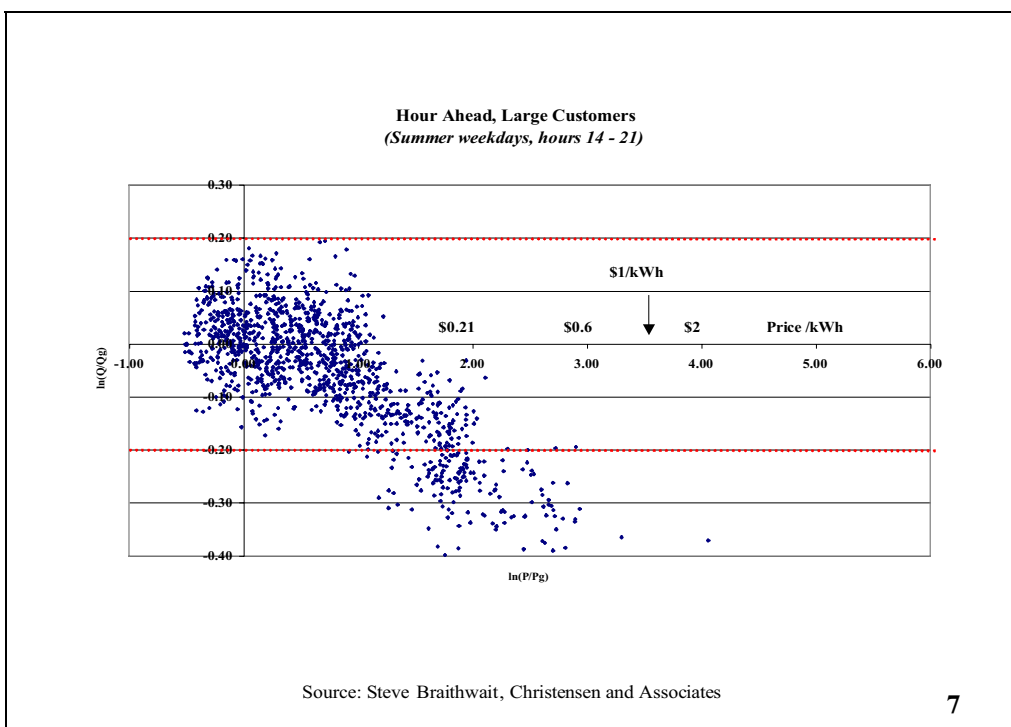


Figure 7. Response of Georgia Powers "Hour Ahead," Large Customers.

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