State Clean Energy-Environment Technical Forum
Energy Efficiency and Peak Electricity Demand:
Energy, Environmental, and Economic Implications
April 15, 2007
Call Summary

Participants: 45 participants from 22 states and a number of national organizations (see the participants list at http://www.keystone.org/html/documents.html#peak.

Key Issues Discussed

- Challenges in, and approaches to, measuring the impacts of energy efficiency on high electricity demand days (HEDD)
- Policy drivers -- growth in demand, reliability and emissions on there's a lot more
- Advanced hourly time-of-use (TOU) communicating meters will provide the data needed to better understand the EE impacts on HEDD
- Better load shape data on customer classes and end uses will help fill the gap now.
- Stakeholder process in Ozone Transport Commission (OTC) states to develop agreement on short-term ozone target and EE goals.

Summary of Presentations

Note: All of the presentations from this call are available for download at http://www.keystone.org/html/documents.html#peak. Please refer to these documents for additional detail on the presentations.

A. Welcome and Introduction – Catherine Morris, The Keystone Center

On behalf of the U.S. Environmental Protection Agency (EPA), The Keystone Center would like to welcome everyone to the call. We appreciate the strong interest in the impact that energy efficiency can have on peak energy demand.

B. Examining Peak Demand Impacts of Energy Efficiency – Dan York, American Council for an Energy Efficient Economy (ACEEE)

- ACEEE researchers prepared and issued a **report entitled "Examining the Peak Demand Impacts of Energy Efficiency: A Review of Program Experience and Industry Practices,"** which is available for free download on the ACEEE website at www.aceee.org.
- ACEEE was interested in looking at peak demand impacts of energy efficiency (EE). They were curious to assess the impacts of EE as a load management tool, looking specifically at the impact on peak demand.
- **As electricity supply has been stretched, utility planners have been looking at EE programs to enhance reliability.** There are overlaps with demand management programs, but if you implement load management alone, you will not reduce overall energy use much. You need both EE and load management.
- **The primary focus of the report is measuring EE impacts.** Peak demand impacts have not been estimated, but the load shape curve has been applied to estimate peak demand savings. Barriers to estimating peak demand impacts include limitations of existing meter data (which does not indicate time of use). As a proxy for peak demand, ACEEE relied on a

few studies reporting efforts to and results from measuring peak demand impacts using something other than load curve estimations.

- Researchers found **good program examples of direct measures of peak demand impacts with time-of-use (TOU) meters.** Because there were more funds available for evaluations of this kind in the 1990s, much of the research that is based on older data.
- **Measuring EE is a matter of aggregating a lot of separate actions.** Researchers looked at a range of EE measures that different states and utilities are using. Then they compared selected measures to see what kind of consistency there was in the measures. The lesson from this exercise is that there are different EE measures that impact demand, but they vary greatly based on the technology being used. However, impacts on peak demand are still in question (e.g. efficient residential lighting might not affect peak demand, but efficient commercial lighting, heating, cooling might).
- **The findings of the report include:**
  - EE has achieved some peak demand reductions; good examples are few but provide some guidance for measurement of impacts.
  - There is a growing need for these kinds of programs—the multiple benefits of EE (for the environment and for load reliability) are becoming more evident.
  - The evaluation community has a lot of experience and protocols for doing this work well, and with advances in technology and metering there is a new opportunity to collect differentiated data to really estimate peak demand impacts.
  - We can collect the necessary data, but we need to figure out where, how, and what to do with it.

Questions/Answers

Have you seen any evaluations of the impacts to the EE-peak demand relationship of different peak times in different regions? For example, in the Pacific Northwest, peak demand occurs at 2 p.m. but in Hawaii it occurs from 5 p.m. to 9 p.m.

California just completed a comprehensive study in the commercial sector and identified when peaks are occurring. It seems to be changing over time. I think there has been less work on correlating that to EE.

In Massachusetts, NStar and National Grid have looked at the coincidence of EE with peaks. In the Pacific Northwest they don't have peak demand constraints. We know that EE works well. The key is to translate that knowledge into changing behavior at the residential, commercial, and industrial levels. Californians have not increased their average per capita energy consumption since 1994. To make further gains, we first need to translate information on the peak demand impacts of EE into something that can be understood by legislators. Then we need to get residential, commercial, and industrial customers to adopt these practices.

What are some best practices for making this happen?

There are clearly some technologies that have obvious impacts on peak energy demand—e.g. commercial lighting and air conditioning. The biggest load growth is driven by air conditioning. Prioritizing programs and targets is easy. In California, they are working on developing more critical peak pricing to provide consumers with the motivation to consume less. We need to encourage price response first and then see what additional demand we can curtail.

C. California's Peak Efficiency Efforts and Evaluation Approaches - David Hungerford (California Energy Commission) and Peter Lai (California Public Utilities Commission)

- In California, there are separate budgets and policies for EE and demand response, although there is talk of reintegrating them. This means that examining the impacts of energy efficiency on peak demand must occur on two fronts.
- **After the 2001 energy crisis, the California legislature required installation of 24,000 additional advanced communicating meters** for all the customers with more than 200 kilowatt-hours (kWh) of demand. Most customers with 500 kWh of demand or more already had TOU meters, but some were not communicating and needed to be replaced. Recently, the approvals have been given for California's largest utility to install meters for all the rest of its customers. California's other utilities are also considering or actively pursuing installation of advanced communicating meters.
- Once these meters are installed, we will have the data about demand reductions in the peak period. **We are laying the groundwork for moving forward and encouraging active demand response on peak days** and encouraging EE investments that reflect the time-varying cost of power.
- California is currently in the midst of its 2006-2008 EE program cycle. For these 3 years, the **California Public Utilities Commission (PUC) has authorized $2 billion for four investor-owned utilities (IOUs) to invest in energy efficiency.** The IOUs are serving as the program administrators, and the PUC has evaluative responsibility. The evaluation budget for the 3-year period is about $75 million. In 2005, in anticipation of this program, the state developed protocols for EE programs. We need to be able to demonstrate to rate-payers that utilities have been spending the $2 billion wisely and effectively to capture savings.
- **The state adopted a practice manual to define how energy savings calculations are done.**
    - **The Total Resource Cost test measures the net costs of the EE program** as a resource option based on the total costs of the program and both the utilities' and the rate-payers' avoided costs. The cost/benefits ratio indicates the total avoided supply-side costs of the utility. For the four California utilities, we are anticipating a benefit of $5.4 billion and a cost of $2.7 billion. We are hoping to realize a cost effective ratio of 2.
    - The avoided costs calculator has also been developed. Information about the company, the calculator, and how the avoided costs methodology was developed are available at www.ethree.com.
- **A lot was learned from developing this methodology.** We need to develop better load shapes so we can better evaluate demand reduction and avoided costs. The PUC has developed a load shape update initiative. **The Database for Energy Efficient Resources (DEER) team will work with contractors to develop better load shape data so our next round of programming (from 2009 to 2011) will be better and we will be able to calculate load cost savings.**. After that, we hope we will have real-time metering data from most customers.
        - This is very important because between 2006 and 2008 utilities will be applying for shareholder cost sharing based on net resource benefits. There are minimum performance requirements for utilities to get these benefits.

Questions/Answers

Developing load shape data is expensive and with California's diverse population, it will likely be even more difficult. What do you expect this effort to cost?

We are hoping to do it as part of our Measurement and Verification (M&V) contract. We have budgeted $1 million in our DEER budget, but that does not include the M&V contract piece. It could exceed $1 million.

Have you gone back to look at data from the mid-1990s on lighting impacts?

I am familiar with the work that the Electric Power Research Institute (EPRI) has done on this in the past. One problem of using those studies is that there have been substantial investments in EE upgrades since they were done, especially since 2001. The assumptions in those studies might not be accurate now. There have been substantial changes in California in the last 5 years—lighting is more efficient, plug loads are changing, etc. Utilities will be reinvigorating their own load research areas to contribute to this effort.

California is embarking on development of demand response protocols in addition to the existing EE protocols and standard practices protocols. This will help us understand demand response better. We will look at peak impact reductions, cost effective inputs, and other factors. In demand response, there are costs for customers. This makes standard models less useful because they are based on annual numbers. We are now trying to look at the time value of different load reductions. Some of the particulars of the avoided costs include capacity value and the ability to substitute demand response for generation response in the resource planning process, as well as other programs that might more accurately measure demand response calls on certain days.

We had previously separated EE from conservation, so it was okay to have a really big house as long as it was efficient. As we look at demand response in our rates and factor it into our thinking, conservation activities and demand response will become more integrated issues.

D. Ozone Transport Commission (OTC) High Electricity Demand Day Initiative – Doug Austin, Ozone Transport Commission

- The Ozone Transport Commission is comprised of the northeastern states (although not all of Virginia). In the inner corridor of the northeastern states from northern Virginia to Maine and out to Pennsylvania, there are large populations and several areas with severe ozone problems.
- **The High Energy Demand Day Initiative (HEDD) came from the State of New Jersey**, where they started looking at air quality on high energy demand days and tried to model it. Early results indicated that addressing high energy demand days was another strategy for meeting ozone targets.
- **There is a new 8-hour ozone standard that many of the states in the Northeast have to meet.** Previously, there was only a 1-hour standard. The new 8-hour standard is a stricter standard, and it tends to pull more areas into non-attainment (including some areas in the Midwest and elsewhere).
- **State Implementation Plans (SIPs) have to show attainment** of the 8-hour ozone standards. All Northeastern states are moderate non-attainment areas, which means that we have to show attainment in our SIP plans by June of 2010. To reach attainment of 85 parts per billion (ppb), the average from 2007-09 needs to be 85 ppb or below.

- **Higher emissions come on the worst air quality days and from dirtier units.**
- **HEDD deals mostly with the ozone problem, but we are also getting ancillary benefits for PM2.5 and haze.**
- The New Jersey effort showed that there were a lot of potential benefits from addressing HEDD, so OTC staff starting thinking about how to apply this lesson. We learned that emissions from electric generating units (EGUs) are higher on high energy demand days, resulting in poor air quality on days when we can least afford it. **We needed to determine which EGUs contribute the most emissions.**
- **The source of HEDD emissions is different throughout the Northeast.**
  - In New England, the source is primarily residual oil-fired, load-following boilers.
  - In the New York City and New Jersey area, the source is mostly gas- and diesel-fired combustion turbines.
- **Effect of these sources on air quality:** As demand increases, ozone also increases. Under sunlight, NOx and volatile organic compounds (VOCs) "cook" to create ground-level ozone. If we can decrease the NOx, then we can decrease the ozone (especially on our worst non-attainment days).
- **The northeastern states have been dealing with ozone for more than 15 years; the "low-hanging" fruit is already gone**. We are now getting into controls that cost between $5,000 and $10,000 per ton.
- **OTC formed a stakeholder process with representatives from all the states** in the Northeast corridor, people from EPA, academics, and other stakeholders. In the last year, we have defined what a HEDD unit is.
  - We want to try to establish short-term reduction goals in 2007-2009.
  - At the last OTC meeting, the states signed a memorandum of agreement (MOU) to engage utilities to meet actual tonnage reduction targets.
  - The overall HEDD strategy includes this short-term strategy and a long-term strategy to replace dirtier units over time with clean units.
- **New Jersey is ready to release the HEDD trigger.**
  - First, utilities must anticipate HEDD which can be difficult. They are trying to identify a parameter for triggering an HEDD response that is acceptable.
  - In creating a HEDD trigger, we are constrained by the Clean Air Act. We cannot use temperature as an indicator of HEDD, so we are trying to look instead at demand cutoff in the inner corridor load pockets—when they reach a certain level, then a day is categorized as a HEDD.
- **Each state has identified a goal so that they can negotiate with individual utilities** to come up with NOx reductions in tons per day as required under the MOU. If these targets are met, this would be a 135 ton per day reduction in NOx.
- **EPA has been helping states with quantification of EE projects**.
  - EPA has done some work on modeling scenarios of load reduction to assess how much of the SIP targets could be met by EE. RSG, a private corporation, is trying to simulate 7.7 tons per day of reductions through a more sophisticated and targeted EE study.
- States can also implement rules to try to get an estimate on the amount and emissions from distributed generation (DG) -- a hidden problem that contributes to air quality problems but is not well-documented. We can control new DG units coming on, but if they are dirty diesel, air quality benefits are lost.

Questions/Answers

What are the incentives or tools that states are using to obtain agreements? What is the incentive for utilities to participate?

That is still being negotiated at the state level. If states put EE peak demand reductions in their SIPs, they must also have enforcement mechanisms. Perhaps these can be developed in the contracts with utilities, but we are not close to knowing how that will come out.

The magnitude of the HEDD effect is increasing over time. Has anyone looked at the effect of Clean Air Interstate Rule (CAIR) state reductions on HEDD?

CAIR focuses on base load generating units. We are trying to address peak units that come on during just the worst demand and ozone days. One issue that might come up on the individual state level is whether the state would allow further reductions beyond what they would do for CAIR to count toward their HEED target. If you are going to allow for base load units to count, one would assume they would have to be located in areas that impact ozone levels.

General Discussion

How many utilities are involved in OTC?

10-12 are involved in the stakeholder process. Some utilities are multi-state.

You talked about the need to develop load curves for specific measures or specific types of appliances. How detailed do you hope load curves to be?

We are modeling certain types of end-users, like grocery stores and restaurants, at an aggregate level. We are also targeting key end uses so we have those technologies modeled as well, like heating, cooling, and lighting loads.

The DEER database that we use to standardize impacts for EE measures depends on the idea that we can take a measure and understand how much impact we will get from it—applying individual load shape to individual measures is the general idea. However, largest end uses are certainly our biggest target.

What are the drivers for shifts in the peak demand profile?

Heating and cooling use is increasing. In California, new development is going on in hotter areas, creating more air conditioning use. We are also seeing more air conditioning going in when coastal homes are being remodeled. We need to understand this increased use so we can impact the peak in a beneficial and cost-effective way.

In the OTC stakeholder process, did utilities accept the SIP targets in addition to their responsibilities under CAIR?

The utility response was mixed. It was not a perfect stakeholder process. Utility and environmental representatives in the process often had to sell the process to others up their respective chains of command. And utilities are already raising concerns about their CAIR responsibilities. We are still unclear about their role in the process; it is very fluid.

NEXT TECHNICAL FORUM CALL: May 10th, from 2:00 p.m. to 3:30 p.m. ET
TOPIC: Urban Heat Islands