STATE CLEAN ENERGY -- ENVIRONMENT TECHNICAL FORUM
Call #22: Energy Efficiency as a Peak Electricity Demand Resource: Energy, Environmental and Economic Implications
April 12, 2007, 2:00 p.m. - 3:30 p.m. EST
BACKGROUND

I. Overview

There is growing interest in the role of energy efficiency in reducing peak electricity demand, in addition to its ability to lower energy demand overall, which is driving states to re-examine the focus of their efficiency programs and related measurement and verification efforts.

Historically, most electricity energy efficiency programs focused successfully on reducing overall energy use (kWh), consistent with the permanent reductions associated with energy efficiency technologies. As a result, quantifying the peak demand reductions from energy efficiency -- particularly in terms of direct, on-site measurement, versus estimates using load curves and billing data -- was not typically a priority. Meanwhile, states looked to load management efforts (including demand response programs) for achieving demand (kW) reductions or shifts. However, energy efficiency programs do and can also affect peak demand levels, although, as a recent analysis from the American Council for an Energy Efficient Economy shows, the kWH to kW relationship can vary by up to a factor of five.

Given concerns about growing demand, reliability, and the costs and siting challenges of meeting increased generation, transmission and distribution capacity needs, many states are looking at how their energy efficiency efforts can be re-prioritized, at least in part, to provide peak demand benefits. They are also considering adjusting their related measurement and verification practices to ensure they adequately capture peak demand benefits.

Some states are also looking to efficiency to help reduce emissions associated with peak demand periods. States have found that many of the units operating primarily during peak times not only have higher marginal costs, but also higher marginal emission rates, than units that operate most of the time. Future potential carbon emissions constraints are also driving increased interest in how efficiency can offset the need for new fossil-fuel capacity and minimize associated risks. These environmental drivers also have implications for measurement and verification practices.

Efforts to utilize energy efficiency explicitly to lower peak demand also have economic benefits. Programs across the country have demonstrated that meeting electricity resource needs through energy efficiency is less expensive than supply-side alternatives, and new evidence suggests that efficiency is even more cost-effective during peak periods. For example, in New England, the retail avoided cost of electricity is about 50% higher during summer peak times compared to summer off-peak (i.e., 7.23 cents/kWh peak compared to 4.77 cents/kWh off-peak).[1] Another economic implication of using efficiency to meet peak loads is that demand-side resources are increasingly eligible for financial incentives that to-date have been exclusively available to generators. For a leading example, see Call #21 on the New England ISO Forward Capacity Market. See: http://www.keystone.org/html/documents.html#forward

[1] http://www.masstech.org/renewableenergy/public_policy/DG/resources/2005-10-11_CT_CLP_ICF_AvoidedCosts13-15.pdf

II. State and Regional Efforts

Examples of leading energy efficiency efforts which include a focus on reducing peak demand are briefly described below.

A. California

Since 1975, California's investments in energy efficiency policies and programs, including utility energy efficiency programs, building codes, and appliance standards, are estimated to have reduced peak capacity needs by 12,000 MW. Building upon these results, the California Public Utilities Commission (CPUC) has adopted aggressive energy and demand saving goals for state's investor owned utilities (IOU), including 4,885 MW of peak demand savings by 2013 for the IOU energy efficiency programs.[2] The IOUs will employ a wide range of energy efficiency programs to achieve the peak demand targets, including:

- commercial and multi-family rebates for lighting, HVAC, and refrigeration;
- single-family direct install of ENERGY STAR equipment;
- standard performance contracting for large commercial and industrial customers; and,
- appliance early retirement and recycling.

These programs are described in more detail in Appendix D of ACEEE's 2007 report "Examining the Peak Demand Impacts of Energy Efficiency: A Review of Program Experience and Industry Practices". To evaluate the effectiveness of their investments, California has developed detailed measurement and evaluation approaches that include estimates for the avoided cost of energy which are area- and time - specific. The avoided costs vary significantly throughout the year, ranging from $20/MWh on an early morning in June to $222/MWh on an August afternoon, and make possible more accurate accounting of the peak benefits of energy efficiency measures. Using these hourly avoided cost figures, a report developed for the CPUC shows that an example air conditioning measure, where the majority of the energy savings occur during the peak demand period, would be valued at $133/MWh, compared to an example refrigeration or outdoor lighting initiative, at $75/MWh and $61/MWh, respectively.
http://www.energy.ca.gov/energy_action_plan/2005-09-21_EAP2_FINAL.PDF
http://www.cpuc.ca.gov/static/energy/electric/energy+efficiency/rulemaking/eeevaluation.htm

B. Connecticut

In southwest Connecticut, energy efficiency is being used to help meet transmission and distribution system resource needs. To avoid service disruptions in the highly congested area, ISO-New England (ISO-NE) issued a "gap RFP" for emergency supplemental capacity. A unique feature of the solicitation is that it specifically called-out energy efficiency as an allowable resource on par with generation. One of ISO-NE's awards was a contract to Conservation Services Group to deliver 4 MW of on-peak energy efficiency over four years.

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[2] California Energy Commission and California Public Utilities Commission. Energy Action Plan II, Implementation Roadmap for Energy Policies, October, 2005

The effort will entail locationally targeted energy efficiency lighting retrofits in a range of mid to large sized buildings (including multi-family housing, schools, warehouses and commercial facilities)[3]. While this represented only a small fraction of the total 300 MW of awards, it was precedent setting. In addition, the state's Energy Independence Act (EIA) of 2005 further advances energy efficiency in southwest Connecticut towns by stipulating that a greater percentage of the state's public benefits funding be targeted to the 54 capacity constrained towns. Now, Connecticut allocates approximately 50% (or $35 million in 2006) of the total Connecticut Energy Efficiency Fund (CEEF) to targeted programs that lower peak demand, improve reliability, and mitigate congestion concerns. Key strategies include efficient lighting and A/C for C&I and A/C for residential consumers.
http://www.cga.ct.gov/2005/ba/2005HB-07501-R00SS1-BA.htm
http://www.iso-ne.com/genrtion_resrcs/rfps/SWCT_GAP_RFP_2003-12-01.pdf

C. Ozone Transport Commission – High Electricity Demand Days

Concerned with persistent ozone non-attainment in many parts of the northeast, in 2006, the Ozone Transport Commission initiated an effort targeted at lowering NOx emissions on high electricity demand days. Their work has included detailed analysis, supported by the US EPA, of the potential emissions reductions associated with increased energy efficiency. Modeling conducted by the US EPA indicated that cost-effective energy efficiency efforts could yield as much as a 23 percent reduction from electric generators in NOx emissions across the region by 2015. The OTC states have developed a Memorandum of Understanding whereby states will be pursuing strategies to achieve proposed targeted reductions in NOx emissions on high ozone days; this MOU has specifically noted the value of energy efficiency and states are now working to incorporate energy efficiency into their air quality strategies under this initiative.
http://www.otcair.org/document.asp?fview=meeting#

D. New York

The New York State Energy Research and Development Authority (NYSERDA) estimates that efficiency programs have reduced summer peak demand by almost 1,700 MW from 1990-2001. Similarly, a recent evaluation of New York's Energy $mart programs indicates that a permanent demand reduction of 365 MW has been achieved through energy efficiency improvements. For its site-level energy efficiency improvements, NYSERDA measures savings using its "Program Measurement and Verification Guideline." On the utility side, Long Island Power Authority (LIPA) is using energy efficiency to meet a portion of its energy resource requirement of 1000 MW over the next 8-10 years. Thus far, LIPA has identified 73 MW that will come from building retrofits, energy efficient lighting, and similar measures.
http://nyserda.org/Energy_Information/SBC/sbcsept2004.pdf
http://www.lipower.org/newscenter/pr/2003/may30.rfp.html

[3] http://www.csgrp.com/images/pdf_press_releases/CSGCT.pdf

E. Texas

Texas' restructuring law requires the electric utilities to meet 10% of demand growth through energy efficiency programs starting in 2003. The utilities have so far exceeded the goals of the program in 2003 (135 MW), 2004 (147 MW), and 2005 (142 MW), achieving savings of 151MW, 192 MW, and 181 MW respectively.[4] Utilities estimate energy and demand savings in accordance with the International Performance Measurement and Verification Protocol (IPMVP)[5] or the Public Utility Commission of Texas (PUCT) approved deemed savings estimates.

One of the programs providing peak savings (36 MW in 2005) is Texas' Commercial and Industrial Standard Offer Program, which provides incentives for energy savings and summer peak demand savings from energy efficient retrofits or renovations. Eligible participant must have a peak demand of at least 100 kW. Conservation measures must provide at least 10 or 20 kW (depending on the utility) of summer peak demand savings per project and incentive payments range from $150 to $200/kW.[6]

Other programs providing peak demand savings include:

- a residential and small commercial program (25 MW);
- an ENERGY STAR New Homes program (51 MW); and,
- an air conditioner distributor program (15 MW).

For information on utility-by-utility energy efficiency offerings, see the Texas Energy Efficiency website. http://www.texasefficiency.com/index.shtml

III. Resources (listed alphabetically)

A. Database for Energy Efficient Resources (DEER)

DEER is a CEC and CPUC sponsored database of estimates for energy and peak demand savings values, measures, costs, and effective useful life.
http://eega.cpuc.ca.gov/deer/

B. Energy Action Plan II: Implementation Roadmap for Energy Policies

The September 2005 California Energy Commission and California Public Utilities Commission Energy Plan II details California's approach to saving both peak and base-load power while satisfying utility concerns over lost sales.
http://www.energy.ca.gov/energy_action_plan/2005-09-21_EAP2_FINAL.PDF

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[4] Nadel, Steve. Energy Efficiency Resource Standards: Experience and Recommendations, March 2006.
[5] Http://www.ipmvp.org
[6] http://www1.eere.energy.gov/femp/program/utility/utilityman_em_tx.html

C. Energy Efficiency Policy Toolkit

The Regulatory Assistance Project's Energy Efficiency Policy Toolkit summarizes state regulatory policies for energy efficiency, renewable energy, distributed resources, and rate design, in many cases including details about peak electricity provisions. http://www.raponline.org/Feature.asp?select=47

D. Examining the Peak Demand Impacts of Energy Efficiency: A Review of Program Experience and Industry Practices

In this February, 2007 report, the ACEEE looks at both techniques for evaluating energy efficiency programs and estimates of costs and benefits for several specific programs. www.aceee.org/pubs/u071.htm

E. Exploring the Relationship Between Demand Response and Energy Efficiency: A Review of Experience and Discussion of Key Issues.

ACEEE's 2005 review of demand response and energy efficiency programs points out that all energy efficiency has some demand impact -- although not necessarily at peak demand, and demand response programs are about reducing peak demand -- and are not necessarily about energy efficiency. http://www.aceee.org/conf/mt06/cc2-york.pdf

F. High Electric Demand Day Strategy, Ozone Transport Commission Presentation

This March 2007 presentation by Anne Gobin of the CT DEP and Chris Salmi of the NJ DEP outlines the OTC's strategy to reduce NO_x emissions during high electricity demand days that often coincide with days with high ozone levels; it includes energy efficiency efforts targeted at reducing peak demand. http://www.otcair.org/document.asp?fview=meeting#

G. Memorandum of Understanding Among the States of the Ozone Transport Commission Concerning the Incorporation of High Electrical Demand Day Emission Reduction Strategies into Ozone Attainment State Implementation Planning

This MOU, agreed to in March, 2007, lays out a framework for helping the northeast states achieve a targeted 20 to 32 percent reduction in emissions from "high electricity demand day" (HEDD) units on high electricity demand days beginning in 2009 and no later than 2012. It includes the recognition that energy efficiency can cost-effectively provide a portion of the necessary reductions. States are now working to pursue inclusion of energy efficiency and other measures in their air quality strategies.
http://www.otcair.org/document.asp?fview=meeting#

H. National Action Plan for Energy Efficiency, Chapter Six, Energy Efficiency Program Best Practices

This chapter of the National Action Plan for Energy Efficiency, developed by leading organizations and facilitated by the US EPA and US DOE, describes leading approaches for designing and operating efficiency programs. It includes data on demand reduction benefits of energy efficiency from various programs across the country and potential study estimates. http://www.epa.gov/cleanenergy/actionplan/eeactionplan.htm

I. Potential for Energy Efficiency, Demand Response, and Onsite Renewable Energy to Meet Texas's Growing Electricity Needs

A growing population and economy in Texas have led to increased electricity needs and particularly rapid growth in peak demand. The Electric Reliability Council of Texas (ERCOT) reported an increased of about 2.5% per year between 1990 and 2006. A report by the American Council for an Energy Efficient Economy points out opportunities to meet increased demand with demand-side and renewable resources. ACEEE, March 2007. http://aceee.org/pubs/e073.htm