**OTC HIGH ENERGY DEMAND DAY INITIATIVE**
**Clean Energy Options Best Practices:**
**Overview**
**DISCUSSION DRAFT**

## Introduction

States throughout the Ozone Transport Region (OTR) are achieving cost-effective reductions in peak energy demand and related emissions through a number of successful clean energy measures, but much more can be done. Expanding and replicating clean energy measures on a broader scale, as a complement to other efforts under the Clean Air Interstate Rule (CAIR), can help the OTR address its concerns with high energy demand days and, over the longer term, provide cost savings and additional environmental benefits beyond ozone reduction.

EPA analysis of a portfolio of enhanced energy efficiency, combined heat and power, solar energy and demand response initiatives suggests that peak day NOx emissions reductions could total up to 8% across the OTR by 2010; more than 20% by 2015. Reductions could be even greater, with appropriate provisions to address increased emissions from the use of high-emitting back-up generators associated with many demand response programs.

As a complement to its emissions modeling, and to assist the OTR states in developing a portfolio of clean energy policy options, EPA has developed a set of state "best practices" descriptions that identify leading programs and results, discuss important features and implementation issues, identify key players (including state agencies and other stakeholders) and provide an EPA point of contact and website for more information, for energy efficiency, combined heat and power, solar energy and demand response initiatives. An accompanying piece describes cross-cutting policy and financing issues.

## Best Practices for Peak Demand Reductions

The leading drivers of summer peak electricity demand are residential cooling, commercial HVAC and commercial lighting. The EPA has identified a number of "best practice" efforts to reduce peak demand associated with these drivers, listed in the table below and described in the attached set of summary pieces[1]. EPA assumed a portfolio of such best practice programs in estimating the potential for OTC-wide emissions reductions; however, each state's ideal portfolio would reflect its own clean energy context of existing programs and achievable potential.

| EPA Estimates of Potential Reductions OTC-Wide ("Medium" Level of Effort Scenarios) | Examples of Related Best Practices |
|---|---|
| Energy Efficiency<br>1.5 % reduction in total load by 2010<br>1,624 MW demand reduction at peak<br>24.7 tons NOX per day peak reduction | ▪ ENERGY STAR Qualified Homes<br>▪ Home Performance with ENERGY STAR<br>▪ ENERGY STAR HVAC Proper Installation<br>▪ Enhanced Commercial Building Energy Efficiency (retro-commissioning, enhanced lighting and comprehensive retrofit programs)<br>▪ Cool Roofs |
| Combined Heat and Power<br>1,884 MW installed capacity by 2010<br>27.5 tons NOX per day peak reduction | ▪ Standby Rates<br>▪ Interconnection Standards<br>▪ Congestion Requests for Proposals |
| Solar Energy<br>112 MW installed capacity by 2010<br>.07 tons NOX per day peak reduction | ▪ Solar PV Incentive Programs |
| Demand Response<br>4% reduction at peak hours by 2010<br>4,266 MW demand reduction at peak<br>9.6 tons NOx per day peak increase<br>(assumes emissions decreases from curtailment and load shifting offset by emissions increases from back up generators) | ▪ Demand Response -- Time Based Rates<br>▪ Demand Response – Incentive Programs |

1 Information on "quick start" approaches to energy efficiency – many of which address peak demand -- are detailed in a resource developed for a recent Arkansas PUC docket on energy efficient; see http://www.arkansas.gov/psc/EEInfo/EPAQuickstart.pdf

**Cross-Cutting Policy and Financing Issues**

Despite the benefits of clean energy and the success of programs in many states across the country, clean energy remains underutilized as an energy resource and as an emissions reduction strategy. Achieving enhanced clean energy measures across the OTR will involve a combination of policy refinements and/or changes, including efforts to address existing market and regulatory barriers and to establish new or enhanced financing mechanisms. These efforts will likely call for action on the part of the state Governors, legislatures, energy offices and/or utility regulatory agencies, in addition to efforts by the OTR Commissioners and input from a variety of stakeholders. The following table lists common barriers to energy efficiency investment:[2]

| Type of Barrier | Description | Leading Policy Responses |
|---|---|---|
| Market Barriers | Includes the well-known "split incentive" barrier, which limits home builders' and commercial developers' motivation to invest in energy efficiency for new buildings because they do not pay the energy bill. There is also a transaction cost barrier, which chronically affects individual consumer and small business decision-making | ▪ Energy Planning Provisions<br>▪ Energy Portfolio Standards<br>▪ Lead-by-Example Executive Orders<br>▪ Tax Incentives<br>▪ Public Benefit Funds<br>▪ Utility Incentives for Demand Side Resources<br>▪ Standby Rates<br>▪ Interconnection Standards |
| Customer Barriers | Includes lack of information on energy savings opportunities, lack of awareness of how energy efficiency programs make investments easier, and lack of funding to invest in energy efficiency. | |
| Public Policy Barriers | Includes prohibitive disincentives for utility support and investment in energy efficiency in many cases. | |
| Utility, State, and Regional Planning Barriers | Whereby energy efficiency is not allowed to compete with supply-side resources in energy planning. | |
| Energy Efficiency Program Barriers | Whereby investments are limited due to lack of knowledge about the most effective and cost-effective program portfolios, programs for overcoming common marketplace barriers to energy efficiency, or available technologies. | |

The following table identifies clean energy policy measures that are being used in one or more OTR states to address one or more of these barriers, and could be adapted for use across the OTR (alone or in combination). The table also notes relevant section of two recent reports (the US EPA Clean Energy-Environment Guide to Action: Policies, Best Practices and Action Steps for States[3] and in the National Action Plan for Energy Efficiency[4]) that contain more information on these policies and programs, including descriptions on the roles of key players including state Governors, legislatures, environmental officials, energy offices and/or utility regulatory agencies, and stakeholders.

- EPA Clean Energy-Environment Guide to Action: Policies, Best Practices and Action Steps for States
  - Identifies and describes 16 clean energy policies and strategies that states have used to meet their clean energy objectives.
  - See: http://www.epa.gov/cleanenergy/stateandlocal/guidetoaction.htm

- National Action Plan for Energy Efficiency (Facilitated by US EPA and US DOE)
  - A plan developed by more than 50 leading organizations in pursuit of energy savings and environmental benefits through electric and natural gas energy efficiency.
  - See: http://www.epa.gov/cleanenergy/actionplan/eeactionplan.htm

2 Combined heat and power and renewable energy face similar barriers and related policy remedies covered in the Guide to Action and the National Action Plan for Energy Efficiency.

3 http://www.epa.gov/cleanenergy/stateandlocal/guidetoaction.htm

4 http://www.epa.gov/cleanenergy/actionplan/eeactionplan.htm

| Clean Energy Policy Measure | Description | OTR State Examples | Relevant Section in *Guide to Action* or *National Action Plan for Energy Efficiency* |
|---|---|---|---|
| Energy Planning Provisions | Energy planning provisions to promote clean energy include measures that evaluate clean energy as a resource, set clean energy goals and/or establish a clean energy focused "loading order." In addition, some states extend their planning horizon to consider how long-term needs might be met and to more fully realize the costs and benefits of different energy resources. | CT, NY | *Guide to Action*: 3.2 (State and Regional Energy Planning) and 6.1 (Portfolio Management Strategies)<br>*National Action Plan*: 3 (Energy Resource Planning Processes). |
| Energy Portfolio Standards | Energy portfolio standards are used to set quantitative and enforceable state-wide goals for the use of renewable energy, energy efficiency and/or combined heat and power. Setting a target entails considering a number of factors, including: availability of economic resources; coverage; and duration (e.g. establishing an appropriate timeframe to overcome longer market cycles, funding limits and practical considerations and setting annual and cumulative goals). | CT, MA, NJ, NY, PA, RI | *Guide to Action*: 4.1 (Energy Efficiency Portfolio Standards); 5.1 (Renewable Portfolio Standards) |
| Lead-by-Example Executive Orders | States can promote clean energy in their own operations – reducing emissions and energy costs, demonstrating leadership, raising public awareness and transforming markets – via executive orders that support energy efficiency goals and performance standards for public buildings; energy efficient procurement standards and clean energy purchases. | NH, NJ, NY | *Guide to Action*: 3.1 (Lead by Example) |
| Tax Incentives | State tax incentives for clean energy can include personal or corporate income tax credits, tax reductions or exemptions and tax deductions. | MD, MA, NH, NJ, NY, RI, VT, VA | *Guide to Action*: 3.4 (Funding and Incentives) |
| Public Benefit Funds | Public benefit funds typically entail a small per kWh charge on every customer's electricity bill that support grants, loans, rebates, technical assistance and other approaches to enhancing investment in clean energy. | CT, MA, ME, NH, NJ, NY, RI, VT | *Guide to Action:* 4.2 (Public Benefit Funds for Energy Efficiency); 5.2 (Public Benefit Funds for State Clean Energy Supply) |
| Utility Incentives for Demand Side Resources | Financial incentive structures for utilities can be designed to actively promote implementation of energy efficiency and combined heat and power by providing for revenue stability, ensuring program cost recovery and providing shareholder performance incentives. | MA, NY | *Guide to Action*: 6.2 (Utility Incentives for Demand-Side Resources) and 6.3 (Emerging Approaches: Removing Unintended Utility Rate Barriers to Distributed Generation<br>*National Action Plan*: 2 (Utility Ratemaking & Revenue Requirements), 5 (Rate Design) and Appendix A (Additional Guidance on Removing the Throughput Incentive) |
| Standby Rates | The probability that any one generator will require standby service at the exact peak demand period is low and the probability that all interconnected small-scale DC will all need it at the same time is even lower. Consequently, states are exploring how to appropriately design standby rates that may more accurately reflect these conditions while providing appropriate cost recovery for utility services.. | NY | *Guide to Action*: 6.3 (Emerging Approaches: Removing Unintended Utility Rate Barriers to Distributed Generation) |
| Interconnection Standards | Standard interconnection rules encourage the connection of clean distributed generation (i.e. renewable resources and combined heat and power) to the electric grid by establishing uniform processes and technical requirements, reducing delays and uncertainty. | CT, DE, MA, NJ, NY, PA | *Guide to Action*: 5.4 (Interconnection Standards) |

**Conclusion**

Enhanced clean energy measures can play an important part in helping the OTR address its concerns with high energy demand days. Maximizing their potential calls for a concerted effort on the part of various state policy makers to address implementation, policy and financing issues. Best practices in place throughout the OTR can provide useful insight into crafting a successful set of programs. US EPA supports several programs and initiatives that can provide states with relevant technical and policy assistance.

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**OTC High Energy Demand Day Initiative**
**Clean Energy Options Best Practices:**
**ENERGY STAR Qualified Homes**
**DISCUSSION DRAFT**

**Overview and Examples of Results**

Residential energy use accounts for 21% of U.S. primary energy consumption.[5] New home construction offers a cost-effective approach to lowering demand and improving comfort. Each ENERGY STAR qualified home is at least 15 to 20 % more efficient than the prevailing energy code while also reducing peak demand by approximately 1 kW. There were approximately 300,000 new homes constructed in 2005 in the OTR states.

The U.S. EPA is working with builders nationwide to adopt energy efficient technologies and "on-the-shelf" building practices that enable their homes to qualify for ENERGY STAR. EPA also works with the DOE Building America Research Program to promote new techniques and products to improve the overall energy efficiency of new homes to reach the ENERGY STAR specification or higher.

Currently, over 3,000 builder partners voluntarily label their homes including over half of the nation's top 100 largest builders. In 2005, over 160,000 homes earned the ENERGY STAR label or approximately 10 % of all new homes. Cumulatively, there are over 600,000 labeled homes and a growing number of regional and local markets with 20 to 50+ % market penetration. Together, these homes are saving American homeowners nearly a half-billion dollars on their utility bills while reducing peak demand by 600 MW.

The following programs demonstrate how effective regional solutions for implementing ENERGY STAR Qualified Homes have helped transform residential construction markets:

- **NYSERDA, New York:** Transforming the home building industry in upstate New York presented substantial challenges for NYSERDA. The industry was dominated by widely dispersed, hard to reach small and mid-size regional builders. NYSERDA responded by first developing a strong Home Energy Performance Rating System (HERS) industry across the region. NYSERDA then provided extensive training to home builders, offered substantial rebates, and implemented an effective regional marketing campaign conveying the benefits of energy efficiency. Today, market penetration is over 10 % and ENERGY STAR for homes is positioned for strong continued growth since the inception of the ENERGY STAR Qualified Homes Program five years ago.

- **Centerpointe Energy and TXU, Texas:** Joining forces in Houston and Dallas, these two utilities realized that their markets were dominated by large production builders. It was critical in their markets to expand the Home Energy Rating System (HERS) verification infrastructure and effectively market the benefits of energy efficiency to consumers. Both utilities implemented ENERGY STAR Qualified Homes with extensive efforts to recruit HERS providers in their respective markets, a minimal rebate to builders, and a strong advertising campaign educating local home buyers. As a result, during a five year period, Houston and Dallas have achieved a 35 and 45 % market penetration respectively for ENERGY STAR Qualified Homes.

- **Las Vegas ENERGY STAR Partners, Nevada:** A strong group of builders, HERS raters and local home building marketing professionals formed an alliance to promote ENERGY STAR Qualified Homes. This group effectively implemented outreach campaigns advertising the benefits of ENERGY STAR to homebuyers, and worked together to develop and disseminate on-site marketing materials. They also provided technical and marketing training, and promoted the results of their efforts at local industry conferences. As a result, after five years, nearly 60 % of all homes in Las Vegas are labeled ENERGY STAR without any monetary incentives, and home buyer ENERGY STAR awareness exceeds 95%. Other programs have succeeded without rebates in markets such as Phoenix (over 30% market penetration) and Indianapolis (nearly 20 % market penetration) where a strong champion, individual or group, effectively promoted ENERGY STAR for Homes.

**Important Features and Key Actors**

EPA recommends a number of critical program elements. First, it is essential to ensure the presence of a HERS verification infrastructure and to develop and nurture it where not fully mature. Second, sales training is extremely

5 2005 Buildings Energy Data Book, DOE/EERE

important. Lastly, investments in effective marketing are crucial for success. In addition to building consumer awareness, they help secure builder confidence in the program.

There are a number of key metrics to track to ensure key savings and peak load reduction targets are being met. These include number of ENERGY STAR builder partners and ENERGY STAR labeled homes, field evaluations of the HERS verification process, assessments of actual utility bills for labeled and control homes, and measurements of peak energy use for labeled and control homes. When planning measurement and evaluation activities, the HERS certification process includes oversight by the Residential Energy Services Network (RESNET). RESNET can be contacted to explore how to leverage their quality assurance efforts.

It is often easiest to determine net energy savings by identifying estimated savings for a typical "ENERGY STAR Qualified Home" and multiplying that savings by the number of labeled homes reported by HERS providers. Energy savings analysis inputs used by EPA based on the new ENERGY STAR Qualified Homes specifications are 1,494 kWh plus 131 therms for a home with electric cooling and gas heating, or about 3,500 kWh for an all-electric home. EPA estimates 1kW peak demand reduction per home[6].

Consistently strong cost-effectiveness performance has been documented by many of the more than 50 regional sponsors implementing ENERGY STAR for Homes. Some program administrators are implementing ENERGY STAR Homes programs in the $0.03 to $0.04/kWh range[7]. Variables that may affect cost effectiveness include incentive levels, program maturity, market maturity, geographic concentration of builders and access to established home energy rating infrastructure. Additional cost savings can come into play where there are both electricity and heating fuel savings. Non-energy benefits such as improved comfort, indoor air quality and durability also add value to homebuyers.

The 'business model' for delivering ENERGY STAR Qualified Homes leverages a number of key actors in different roles, all of which have been pivotal to the success of the labeled homes: EPA, utilities, HERS providers, state administrators, HERS raters, builders and home buyers.

**Implementation and Related Policy Issues**

Barriers to the adoption of energy efficiency technologies in the home building industry include: industry resistance to change and concerns with risk; first cost decision making which ignores utility cost savings and improved comfort, durability and indoor air quality; lack of skills selling energy efficient homes; and lack of consumer awareness. An effective ENERGY STAR Qualified Homes programs addresses these key market barriers and presents a strong business case for builders. Program design starts with an assessment of the local/regional market for new homes including the following market factors: predominant type of builder, level of housing dispersion, rigor of prevailing energy code and enforcement, availability of energy efficient technologies and construction practices; health and durability issues, relevant marketing messages.

**For More Information and Assistance**

EPA has developed a variety of proven off-the-shelf tools to help start and implement ENERGY STAR Qualified Homes. See www.energystar.gov/homes.

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6 This is a national number used by EPA for planning purposes; more climate-specific energy savings per home can be readily generated through easily available software programs.

7 Based on 2005 data from TX (calculated levelized cost of conserved energy) and 2004 data from NY (levelized cost of conserved energy, for electric portion, using total resource cost)

**OTC HIGH ENERGY DEMAND DAY INITIATIVE**
**Clean Energy Options Best Practices**
**Home Performance with ENERGY STAR**
**DISCUSSION DRAFT**

## Overview and Examples of Results

Residential energy use accounts for 21% of U.S. primary energy consumption[8] and can account for up to one-third or more of peak energy demand in the OTR. After more than 20 years of energy conservation programs in some parts of the country, there is still enormous potential to reduce energy consumption and peak demand, especially from older homes. For mature programs, cost effectiveness estimates show that Home Performance with ENERGY STAR has a levelized cost of conserved energy of about 0.05 $/kWh. The electricity demand reduction per home can be as high as 1.64 kW. Typical home performance improvements will deliver electricity savings as well as heating fuel savings. For programs with integrated gas and electric savings, the cost effectiveness will be even higher. Non-energy benefits like comfort also help as they convince homeowners to make improvements and make a lasting, positive impression.

EPA and DOE offer Home Performance with ENERGY STAR as a strategy for encouraging comprehensive home energy improvements to help capture the significant savings potential of improving whole-house performance in existing homes. The program, which helps capture savings through improved heating and cooling systems, windows, insulation and air flow, is especially timely as increasing product standards mean less savings potential from single-product (e.g., HVAC) strategies.

Over the past five years, EPA and DOE have worked with states, utilities, and others to develop and pilot Home Performance with ENERGY STAR in a dozen markets with good results. Program pioneers noted below have collectively improved the efficiency of nearly 20,000 existing homes and saved their customers an estimated $400 per year in energy costs.

- Since 2001, over 100 contractors in ***NYSERDA's*** Home Performance with ENERGY STAR program have improved the energy efficiency of more than 11,000 homes, saved New Yorkers over 8 million kWh of electricity and a net annual on-peak demand savings of 1 MW. http://www.getenergysmart.org/WhereYouLive/HomePerformance/overview.asp

- In 2005, ***Austin Energy*** had over 70 contractors participating in its Home Performance with ENERGY STAR program, completing 1400 projects with a peak demand savings of over 3000 kW. http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Residential/Home%20Performance%20with%20Energy%20Star/index.htm

- ***Wisconsin Focus on Energy*** estimates that their home performance program is saving on average 1100 kWh of electricity and 500 therms of natural gas per home. http://www.focusonenergy.com/page.jsp?pageId=25

## Important Features and Key Actors

A whole-house energy audit is a good first step, but recommendations are seldom implemented if the homeowner does not know who to trust to complete the work or is unable to easily finance improvements. With Home Performance with ENERGY STAR, the contractor who completes the home assessment is also prepared to complete the needed renovations or work closely with participating contractors who can. Programs that offer homeowners a quick and easy way to finance improvements see even better results.

A local or regional program administrator is crucial to the implementation and operation of Home Performance with ENERGY STAR. Organizations such as a utility, state energy agency or non-profit energy efficiency organization are typical program administrators who understand local market conditions and can provide third-party oversight to home improvement contractors and verify homeowner satisfaction.

## Implementation and Related Policy Issues

8 2005 Buildings Energy Data Book, DOE/EERE

Program implementers need to take into account local market conditions, and there are several common barriers to address in program design and implementation, including: contractor participation, consumer financing and/or incentives, marketing, and quality assurance. Designing a Home Performance with ENERGY STAR program starts with identifying market barriers to improving the energy efficiency of existing homes and developing solutions to overcome them.

Measurement and verification of results is another important element of a successful program. Program administrators typically track the number of contractors participating, projects completed, and average energy saved per project based on information submitted by the contractor as a condition of program participation, rebates processed, and/or financing information. Making program benefits to contractors contingent upon the submission of documentation is an early program design consideration.

**For More Information and Technical Assistance**

ENERGY STAR provides program sponsors with assistance in program planning, promotion and contractor participation. To do this, EPA and DOE have established a national network of experienced program implementers, building scientists, marketing and ad firms, and contractors that can serve to advise and assist in program start-up, as well as program direction. For more information, visit www.energystar.gov/homeperformance.

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**OTC High Energy Demand Day Initiative**
**Clean Energy Options Best Practices:**
**ENERGY STAR HVAC Proper Installation**
**DISCUSSION DRAFT**

## Overview and Examples of Results

Air conditioning (AC) accounts for about 14 percent residential electricity use in the United States[9].

Residential HVAC Quality Installation and Maintenance programs focus on proper installation of central air conditioners and heat pumps to address common problems that reduce efficiency, including: improper sizing, improper refrigerant charge, improper airflow over the indoor coil, and air duct leakage. These common problems can reduce the efficiency of AC equipment 30%. Because about 5% of air conditioners are replaced each year, getting the installation right presents a good opportunity to reduce electricity demand. Programs that offered financial incentives for the purchase of ENERGY STAR qualified heating and cooling equipment have begun to require that systems meet installation standards in order to ensure that their investment will deliver as expected as well as achieve additional savings.

New Jersey's Residential HVAC Program, funded by a systems benefit charge, is one example of an HVAC Quality Installation and Maintenance program in the Northeast. Financial incentives have been offered for the installation of high efficiency HVAC equipment when installed correctly. In 2005 over 600 HVAC technicians received sales and technical training, over 17,000 central air conditioning units or heat pumps were installed achieving an estimated savings of 15,012 MWh of electricity and 12.7 MW of demand[10].

The Long Island Power Authority (LIPA) has offered financial incentives for installation of high efficiency HVAC equipment with documentation of proper installation for several years. In 2006 third-party verification of charge and air flow was instituted into the program. Similar programs in Massachusetts and Rhode Island are also using third-party verification of air flow and refrigerant charge. LIPA estimates a per unit savings of 1364 kWh/year and peak demand savings of 1.75 kW when an old 10.2 SEER unit is replaced with a new 15 SEER unit that is installed correctly.

## Important Features and Key Actors

Many programs have focused on promoting high efficiency AC equipment to reduce peak demand in the past. This approach continues, but is less effective since the minimum energy efficiency standard for residential central air conditioners increased to 13 SEER. Programs have started to focus on quality installation to ensure that high efficiency equipment delivers the expected savings and to achieve additional savings. It is expected that this program approach will become common as standards and protocols are established.

Successful programs typically adopt best practice standards for installation and train contractors to meet them. Working with a trade association, like the Air Conditioning Contractors of America (ACCA), can help to identify contractors interested in participating. Contractors are typically required to document the installation on forms that must be submitted to the program before an incentive is issued to the consumer or contractor. Some form of verification procedure or quality assurance inspection is used to ensure compliance with program standards. Some programs contract with a third party verification service that works with contractors and verifies installation criteria, like air flow and refrigerant charge, remotely. The most successful programs to date are operated by utilities or state energy agencies. For example, utilities in NJ, MA, NY and RI have offered programs with incentives for high efficiency residential central air conditioners or heat pumps with incentives for quality installation.

On a regional level, the Northeast Energy Efficiency Partnership (NEEP), a non-profit organization that facilitates programs in the Northeast, estimates the achievable lifetime savings from Northeast HVAC program efforts are 130,000 MWh through 2009[11]. NEEP facilitates information exchange to increase sales of high efficiency AC systems using quality installation practices. NEEP is working to change the northeast residential HVAC market to one in which most consumers choose efficient equipment and systems, and most service providers use quality installation practices when installing and servicing HVAC equipment and systems. NEEP is also managing a research project on behalf of the NJ Board of Public Utilities and the New York State Energy Research and Development Authority with STAC funding from DOE to inform the development of common regional quality installation protocols for program implementation.

9 2001 Residential Energy Consumption Survey

10 New Jersey's Clean Energy Program 2005 Annual Report

11 NEEP Strategic Initiative Review Quantitative Analysis Report

**Implementation and Related Policy Issues**

Implementing a quality installation and maintenance program requires a commitment to work with HVAC trade contractors and play a role in technician training and mentoring. The best time to engage contractors is during the Fall or Spring when business is slower and they are more receptive to new opportunities. Training is essential to explain program incentives, standards and expectations.

To maintain the credibility of the program it is essential to verify that contractors are meeting program standards. When standards are not enforced not only does the program not achieve the expected savings, but it hurts the business of contractors that are following program standards. Some programs use an independent organization, called a verification service provider, to verify that air flow and refrigerant charge are correct. Programs have also used on-site inspections to verify program standards are met.

In addition to a quality installation there are other home improvements that can reduce cooling demand. Improvements to a home's thermal envelope, such as air sealing, adding insulation, and installing ENERGY STAR qualified windows will also reduce the amount of time the air conditioner runs to keep the home comfortable. ENERGY STAR's DIY Guide to Home Sealing is an excellent resource to encourage homeonwers to make improvements to their home's thermal envelope.

**For More Information and Assistance**

This is a new ENERGY STAR program. EPA is developing an ENERGY STAR HVAC Quality Installation program that will build on the efforts of Air Conditioning Contractors of America and stakeholders from the Northeast to develop a quality installation specification. As a new program, EPA is dedicating resources to develop the right tools and consumer messages to grow the program. EPA would work closely with local sponsors and develop customized materials for the promotion of proper installation of HVAC equipment

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**OTC HIGH ENERGY DEMAND DAY INITIATIVE**
**Clean Energy Options Best Practices:**
**Commercial Buildings: Enhanced Approaches for Energy Efficiency Programs**
**DISCUSSION DRAFT**

**Overview and Example Results**

Commercial building energy use is a leading component of peak energy demand. Typical commercial building energy efficiency programs provide rebates to upgrade specific equipment. While these technology-specific incentives have an important role in building markets for energy efficiency, taking a more comprehensive approach -- looking at interactions of energy end-uses and overall building performance – allows for energy efficiency programs to capture much greater savings. Over the past 25 years, the energy efficiency of building components such as windows and chillers has improved by more than 30 percent; yet building energy use has not improved by nearly as much. This result reflects the significant role that proper sizing of heating and cooling equipment, integrating individual technical components and controlling, operating and maintaining equipment can have in determining the energy performance of a building.

There are a number of emerging and / or under-utilized energy efficiency program designs that could be more broadly implemented in the OTR states in order to achieve additional peak demand and energy savings. Examples of such programs can already be found in specific OTR states. Administrators of energy efficiency programs in the OTR could draw on the experience of these innovative programs, as well as lessons learned throughout the U.S.

The magnitude of potential savings throughout the OTR would be determined by the extent to which emerging or enhanced program approaches would provide savings above and beyond current energy efficiency programs being implemented by utilities, states or other program administrators. The additional savings from the commercial buildings sector expected to be significant, given that more comprehensive approaches are not widely in place. The proposed program designs also align well with the comprehensive approach to commercial building energy management which is the cornerstone of the U.S. EPA's ENERGY STAR program in this sector. Previously, in a preliminary analysis of potential in the commercial buildings sector, EPA estimated that 1% of total annual commercial energy consumption, or 34 trillion BTUs, could be saved through implementation of whole-building energy performance programs leveraging the ENERGY STAR program in the OTR states. This preliminary analysis would need to be updated as part of the HEDD initiative.

EPA estimates that the energy consumption of commercial and industrial buildings can be reduced by up to 30% through whole-building strategies that address improved operations, maintenance practices, and upgrades in building equipment. EPA estimates that early programs to improve whole-building energy performance by leveraging the ENERGY STAR program have achieved energy savings at a levelized cost of conserved energy of between $0.03-04 / kwh.

**Important Features and Key Actors**

There are two specific best-practice areas through which the additional commercial building energy saving opportunities could be captured. Individually or together these enhanced program designs can produce additional energy and electricity demand savings in OTC states depending on the market conditions and current programs. Each best practice is designed to take a comprehensive approach to assessing energy savings opportunities buildings, although they each have a different primary focus. One best practice focuses on building operations, maintenance and low cost equipment improvements (retrocommissioning). The other best practice is focused on improving the delivery of programs targeting capital, retrofit improvements to buildings. These best practices both represent attempts by program administrators to better screen buildings so that an appropriate, comprehensive sets of measures to improve energy efficiency can be identified and implemented. Although emerging in the market as separate, program best practices, they have much in common. The two best practices are:

- Retrocommissioning (RCx) Programs: Demand and energy savings are realized through the systematic evaluation of building systems and the implementation of low-cost, low capital investment measures designed to improve system operations and, in many cases, improve occupant comfort. RCx is a strategy for buildings that do not require immediate capital improvements to replace or repair equipment. Retrocommissioning is an emerging utility program design in the U.S. The New York State Energy Research and Development Authority (NYSERDA) estimates that retrocommissioning projects can be expected to deliver 5 to 7 % kW demand savings in a building, with typical energy consumption saving ranging from 5 to 20%, without investment in major capital equipment improvements. NYSERDA has been a leader among organizations in the OTR states in this emerging program area. NYSERDA completed a pilot program in 2005 through which it provided incentives for studies to investigate

RCx opportunities. The agency is now implementing building performance (i.e., retrocommissioning) programs statewide through which it will provide incentives for both analysis and implementation of measures. Northeast Utilities (Connecticut Light & Power and United Illuminating) is also expanding initial pilot program activities by providing incentives for opportunity investigations and implementation, providing another important example of innovation within the OTR.

- Comprehensive Retrofit Programs: Program administrators are implementing comprehensive approaches to better guide capital investments in commercial buildings. Program designs have typically included incentives, standard offer contracts and whole build performance programs. A number of program administrators in the OTR have run customized incentive programs, through which more comprehensive packages of building improvements are encouraged, including: Efficiency Vermont, National Grid (MA and RI), New Jersey SmartStart Buildings, Northeast Utilities (CT and MA). An on-going challenge for such programs is ensuring that a broad set of technology measures is pursued. To address this issue, there are currently two innovative efforts underway in the region to encourage more comprehensive assessment and implementation of efficiency measures. NSTAR Electric in Massachusetts is using whole-building energy performance benchmarking (i.e., the US EPA energy performance rating system) to help its customers identify and prioritize energy efficiency upgrades. Additional support is provided through walk-through energy audits and assistance in applying for a full range of NSTAR financial incentive programs so that measures are implemented comprehensively. National Grid in Massachusetts and Rhode Island is also providing innovative support through its Project Expeditor program so that its customers pursue energy efficiency investments comprehensively.

Apart from fully, comprehensive approaches, the guiding principles of these programs can also be applied to enhance the design and delivery of more traditional, equipment incentives by better accounting for the role of individual energy end uses in the overall building system. For example, commercial lighting is a key end-use for both energy and peak demand savings. Of the major, end uses in buildings, lighting systems can improved directly through careful program design without causing significant lost opportunities. Best practice lighting program designs can be promoted which consider how a lighting system is designed and operated. This minimizes opportunities that can be lost when one-for-one technology replacements are promoted. In a similar manner, some targeted HVAC incentives could be promoted, although these opportunities are best addressed through comprehensive approaches. Nonetheless, options for best practice HVAC programs should be investigated further as part of the HEDD process.

There are several key actors involved in the successful implementation of more comprehensive commercial program implementation. This description assumes that programs would either be implemented by regulated utility companies or by state entities that have been designated to run statewide programs, e.g., NYSERDA.

- *Utility Program Mangers:* Administer the programs and provide incentives and must be convinced of the efficacy of new program designs.
- *State Public Utility Commissions:* Commissions provide oversight of programs.
- *Service and Products Providers:* Program administrators often rely on third-party vendors to deliver energy efficient products and services to their program participants.
- *Building Owners and Managers:* Motivated building owners and operators are key to program success. Program administrators can adopt market segmentation strategies for engaging key market sectors.

**Implementation and Related Policy Issues**

Public utility commissions play a key role in establishing a supportive regulatory climate to encourage the design and implementation of enhanced, best practice programs for reducing energy consumption through comprehensive program strategies for commercial buildings. The PUCs in OTR states will need to encourage innovative program designs and sufficiently flexible procedures for program evaluation, monitoring and verification. Many PUCs have questioned the persistence of savings that result from programs that include significant elements of operations and management improvements. Balancing this concern with the need to encourage innovative program approaches will be required for program success.

Implementation of RCx and comprehensive retrofit incentive programs would require program administrator staffs who are experienced in implementation. A number of the OTR states have a long track record in energy efficiency program implementation and would have personnel qualified to manage more comprehensive programs. As noted, examples of more comprehensive designs can already be found within the region. For states with more limited program experience, pilot-scale activities would likely be required. In addition, a consideration of enhanced, traditional incentive program, such as lighting programs, may also be an appropriate initial focus.

The availability of qualified vendors is another key implementation issue. Some states in the region have worked to create a network of qualified providers. In New York, NYSERDA has invested over a span of several years to screen and identify qualified service providers as an element of its technical services programs. The Massachusetts-based utility, National Grid has sought to develop qualified providers and have them directly participate in the delivery of their commercial energy efficiency programs through their Project Expeditor offering.

**For More Information and Assistance**

In the commercial and industrial sector, lack of knowledge about overall building energy performance is a key barrier to motivating building owners and operators to improve the energy efficiency of their buildings in a more comprehensive approach. To address this obstacle, EPA created an energy performance rating system that compares the energy use of an individual building against the national stock of similar building using a 1 to 100 point rating system. This rating enables building owners and managers to measure how well building systems are integrated, operated and maintained. The EPA rating has a clear role to play in any comprehensive program design by providing a standardized metric for whole-building performance. Program administrators implementing RCx programs and programs to comprehensively package retrofit opportunities are increasingly integrating the EPA rating in their programs to measure building performance before and after customer participation in a program. To support use of the building rating, EPA has developed a full set of customer service, technical support and training tools. EPA can work with states to ensure that the full extent of ENERGY STAR program resources are used to support these comprehensive program designs.

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**OTC HIGH ENERGY DEMAND DAY INITIATIVE**
**Clean Energy Options Best Practices:**
**Cool Roofs**
**DISCUSSION DRAFT**

**Overview and Examples of Results**

Energy-efficient roofing systems – also called "cool roofs" – can reduce roof temperature by as much as 100°F on hot summer afternoons, thereby lowering cooling energy requirements and peak energy demand. A leading example in this area, California recently incorporated cool roofs into its "Title 24" Building Energy Efficiency Standards. These requirements apply to conditioned (heated or cooled) non-residential buildings that have low-sloped roofs. This includes newly constructed buildings and re-roofing of existing buildings. Title 24 does not require that building owners replace or recover existing roofs that are not in need of re-roofing.

DOE building energy simulations indicate that use of a cool roofing material on a prototypical California non-residential building with a low-sloped roof yields significant electricity and gas savings on a unit-area basis, as seen in the table below. The typical cost premium for a cool roof is 0.00 to 0.20 $/ft2.

Modeled savings from Title 24 Cool Roof requirements:

| | |
|---|---|
| • *Annual electricity savings: average 297 kWh/1000 ft2*<br>• *Annual natural gas deficits: average 4.9 therm/1000 ft2*<br>• *Annual source energy savings: average 2.6 MBTU/1000 ft2*<br>• *Peak power demand savings: average 0.19 kW/1000 ft2* | • *Yields cooling equipment cost savings: average $94/1000 ft2*<br>• *Fifteen-year net present value energy savings: average $451/1000 ft2*<br>• *Total savings (cooling equipment cost savings + 15-year NPV energy savings): average $545/1000 ft2).*<br>***(note: only modeled data are currently available)*** |

**Important Features and Key Actors**

Title 24 offers builders the option of following either a prescriptive or performance approach to complying with their energy budget. The CEC also maintains a Title 24 Hotline, offers training at meetings of local building officials, and provides onsite training upon request. To lower costs for builders, some local utilities offer rebates (an additional incentive to energy and life cycle savings from cool roofs).

The Title 24 standards are developed and promulgated by California Energy Commission (CEC), but local building departments are responsible for enforcing the cool roof requirements. California's electric and gas utilities hold training sessions for local building departments on compliance options. For a cool roof product to be eligible to qualify under the Title 24 standards, it must be tested and rated through the Cool Roof Rating Council (CRRC). Cool roof manufacturers offer products for both low-slope and sloped roofs.

**Implementation and Related Policy Issues**

California has a long history of advancing cool roofs as a peak demand reduction measure. Related education and outreach programs are effective at reaching customers, retailers, and suppliers. The CEC's Consumer Energy Center offers a database of cool roof products, FAQs, print material, videos, and a comprehensive Web site. Experts from the Lawrence Berkeley Lab (LBNL) and CEC frequently participate in peer exchange forums. Research by LBNL's Heat Island Program demonstrates that reductions in building cooling electricity use, peak power demand, and ambient air temperature are all possible from cool roofs in California. However, much of this research is location-specific, and other states may prefer to have their own results.

**For More Information and Assistance**

Details on the California Title 24 program are at:http://www.consumerenergycenter.org/coolroof/
Information on ENERGY STAR Roof Products is at: http://www.energystar.gov/index.cfm?c=roof_prods.pr_roof_products
EPA can offer assistance with: program design; best-practice peer exchange; displaced emissions estimates; marketing and recognition.

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**OTC High Energy Demand Day Initiative**
**Clean Energy Options Best Practices:**
**Standby Rates**
**DISCUSSION DRAFT**

## Overview and Examples of Results

Facilities that use renewables or Combined Heat and Power (CHP) usually need to provide for standby power when the system is unavailable during periods of maintenance, due to equipment failure, or other planned outages. Electric utilities often assess standby charges on onsite generation to cover the costs they may incur to provide adequate generation, transmission, or distribution capacity (depending on the structure of the utility) to supply onsite generators when requested (sometimes on short notice). The utility's concern is that the facility will require power at a time when electricity is scarce or at a premium cost and that it must be prepared to serve load during such extreme conditions. The probability that any one generator will require standby service at the exact peak demand period is low and the probability that all interconnected small-scale DG will all need it at the same time is even lower. Consequently, as of 2006, several states have evaluated or have begun to evaluate utility rate structures and have made changes in standby rates to promote CHP and renewables as part of their larger efforts to support cost effective clean energy supply as an alternative to expansion of the electric grid. Several notable examples of states with well-designed standby rates in place are CA, NY and OR.

## Important Features and Key Actors

New York, Oregon and California have developed beneficial strategies to ensure that standby rates allow CHP to compete on a level playing field and that recognize their benefits while providing a reliable electric system for consumers and adequate cost recovery for utilities.

### New York

In July 2003, the New York PSC voted to approve new standby rates for utilities' standby electric delivery service to DG customers and standby service to independent wholesale electric generating plants that import electricity as "station power" to support their operations (NYPSC Case 99-E-1470). A key consideration was for the rates to result in onsite generation running when it is less expensive than purchasing power from the grid.

Under the guidelines previously adopted by the New York PSC, standby rates are expected to reflect a more cost-based rate design that avoids relying on the amount of energy consumed per-kilowatt-hour, to determine the charges for delivery service. Instead, the new rates recognize that the costs of providing delivery service to standby customers should more accurately reflect the size of the facilities needed to meet a customer's maximum demand for delivery service at any given time. This varies not with the volume of electricity delivered, but primarily with the peak load (per-kilowatt) that must be delivered at any particular moment.

For certain categories of standby customers, the New York PSC voted to approve a series of options for the transition to the new rate structure. Specifically, preexisting DG customers are offered two options. They can either shift immediately to the new standby rate or continue under the existing rate for four years and then phase into the standby rate over the next four years. Because the new rates align the customer cost with the potential benefit of onsite power to the grid, there are some cases in which it is more favorable for customers to opt in to the new rates, which also provide greater reliability to the grid.

Recognizing the environmental benefits of certain energy sources, customers that begin DG operations between August 1, 2003, and May 31, 2006, and use certain environmentally beneficial technologies or small CHP applications of less than 1 MW, can choose among three options. They can elect to remain on the current standard rate indefinitely, shift immediately to the new standby rate, or opt for a five-year phase-in period beginning on the effective date of the new standby rates. The deadline for the standby rate exemption was originally May 31, 2006. However, the PSC issued an order on May 23, 2006 to extend the standby rate exemption until May 31, 2009.

**Oregon**

In 2004, the Oregon Public Utilities Commission approved a settlement regarding Portland General Electric Company's (PGE) tariffs for partial requirements customers. The load served by the on-site generation is treated in the same manner as any other load on the system, which under Oregon rules is obligated to have (or contract for) its share of contingency reserves. The onsite generation is, in effect, both contributing to and deriving benefits from the system's overall reserve margin. Under the new rates, the partial requirements customer must pay or contract for contingency reserves equal to 7.0 percent (3.5 percent each for spinning and supplemental reserves) of the "reserve capacity" (i.e., either the nameplate capacity of the on-site unit or the amount of load it does not want to lose in case of an unscheduled outage; if the customer is able to shed load at the time its unit goes down, then it will be able to reduce the amount of contingency reserves it must carry). A similar pricing package has been adopted by PacifiCorp.

The Commission has outlined the following guidelines that should be used to implement standby rates:

- Utilities should offer both firm and interruptible standby service. Rates should be unbundled.
- There should be no inherent incentive for standby customers to idle their generators when natural gas and wholesale power prices are high. Customers that have reliable control equipment to reduce loads instantly when their generator trips off-line or reduces output should not have to pay for utility distribution and transmission facilities, or reserves charges, based simply on the nameplate capacity of the generator.
- Interruptible service should enable a customer to buy backup power on a short-term basis, optimizing the economic operation of the generator. Energy rates for the interruptible option should be market-based.
- Standby charges should not apply to customers with generating systems less than 1 MW. Variations in demand resulting from such small systems going off-line at different times are not noticeable to the system.

**California**

California Senate Bill 28 1X (passed in April 2001) requires utilities to provide DG customers with an exemption from standby reservation charges. The exemptions apply for the following time periods:

- Through June 2011 for customers installing CHP-related generation May 2001 to June 2004.
- Through June 2006 for customers installing non-CHP applications May 2001 to September 2002.
- Through June 2011 for "ultra-clean" and low-emission DG customers 5 MW and less installed January 2003 to December 2005.

California utilities submitted DG rate design applications in September 2001. A docket was opened to allow parties to file comments on the utility's proposals in October and November 2001. After a year, the CPUC decided to incorporate the rate design proposals into utility rate design proceedings. Each utility's rate case is different, but in general, the rate design includes a contracted demand with high fixed charges.

**Implementation and Related Policy Issues**

The following best practices, based on state experiences, can help states implement rates that support CHP and renewable energy.

1. Ensure that state PUC commissioners and staff have current and accurate information regarding the rate issues for CHP and renewables and their potential benefits for the generation system. These new technologies may not have been considered for rates that were developed before the more widespread application of renewable energy and CHP.
2. Open a generic PUC docket to explore the actual costs and system benefits of onsite clean energy supply and rate reasonableness, if these issues cannot be addressed under an existing open docket.
3. Coordinate with other state agencies that can lend support. State energy offices, energy research and development offices, and economic development offices can be important sources of objective data on actual costs and benefits of onsite generation.

**For More Information and Assistance**

New York Public Service Commission: http://www.dps.state.ny.us/
Oregon Public Utility Commission: http://www.oregon.gov/PUC/meetings/pmemos/2005/030805/reg3.pdf
California Public Utilities Commission: http://www.cpuc.ca.gov/

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**OTC High Energy Demand Day Initiative**
**Clean Energy Options Best Practices:**
**Interconnection Standards**
**DISCUSSION DRAFT**

## Overview and Examples of Results

Standard interconnection rules encourage the connection of clean distributed generation (DG) systems (i.e., renewable resources and combined heat and power (CHP)) to the electric grid by establishing uniform processes and technical requirements that apply to utilities within a state. These rules reduce the uncertainty and prevent long delays and costs that clean DG systems may encounter when obtaining approval for grid connection.

As of September 2006, 18 states have adopted standard interconnect rules for DG. Ten additional states are in the process of developing their rules. The OTC states with standard interconnect rules are CT, DE, MA, NJ, NY, and PA. MD, VA, and VT have proposed interconnection rules.

## Important Features and Key Actors

Standardized interconnection rules, generally developed and administered by a Public Utility Commission, establish clear and uniform processes and technical requirements for connecting DG systems to the electric utility grid. These rules are an important mechanism for improving the market conditions for clean DG.

Standardized interconnection standards can support the development of clean DG by providing clear and reasonable rules for connecting clean energy systems to the electric utility grid. By developing standard interconnection requirements, states make progress toward leveling the playing field for clean DG relative to traditional central power generation. Standard interconnection rules can help reduce uncertainty and prevent excessive time delays and costs that small DG systems sometimes encounter when obtaining approval for grid connection. These uniform interconnection requirements ensure that the costs of interconnection are the same throughout the state and are commensurate with the nature, size, and scope of the DG project. They also help DG project developers accurately predict the time and costs involved in the application process and the technical requirements for interconnection. Finally, standard rules ensure that the project interconnection meets the safety and reliability needs of both the energy end-user and the utility.

Successful interconnection standards address the application process and technical requirements for interconnecting DG projects of a specified type and size with the electric grid. The application process for a well-designed interconnection rule will contain standard application forms, timelines, fees, dispute resolution processes, insurance requirements and interconnection agreements. Another key element of interconnection rules is technical interconnect requirements. Rules generally specify the type of generation technology that may be interconnected, the required attributes of the electrical grids where the system will be connected, the types of equipment and protocols required for the physical interconnection, and the maximum system size that is eligible for the interconnection process. These requirements may specify that DG must conform to industry or national standards (such as IEEE 1547 and UL 1741), and may include protection systems designed to minimize degradation of grid reliability and performance as well to maintain worker and public safety.

New Jersey and Texas have adopted successful interconnection rules. The New Jersey Board of Public Utilities developed interconnection standards for Class I renewable energy systems in 2004. These rules are separated into three levels based on system size and technical certification. Each level has specific interconnection review procedures and timelines for each step in the review process and covers systems up to 2 MW in size. In November 1999, the Texas PUC adopted substantive rules that apply to interconnecting generation facilities of 10 MW or less. The rules require that Texas utilities evaluate applications based on pre-specified screening criteria, including equipment size and the relative size of the DG system to feeder load.

## Implementation and Related Policy Issues

Implementing successful interconnection standards requires collaboration between interested stakeholders to develop clear, concise interconnection rules that are applicable to all potential DG technologies. The stakeholder process should include entities such as electric utilities, state public utility commissions, developers of clean energy systems, third-party technical organizations (e.g., the Institute of Electrical and Electronic Engineers [IEEE 1547][12] and Underwriters

12 http://grouper.ieee.org/groups/scc21/dr_shared/

Laboratory, Inc. [UL Standard 1741])[13] Regional transmission organizations (RTOs), other agencies or state environmental and public policy agencies[14].

Additionally, there are many areas to consider when developing interconnection rules:

- Work collaboratively with interested parties to develop interconnection rules that are clear, concise, and applicable to all DG technologies. This will streamline the process and avoid untimely and costly re-working.
- Develop standards that cover the scope of the desired DG technologies, generator types, sizes, and distribution system types.
- Address all components of the interconnection process, including issues related to both the application process and technical requirements.
- Develop an application process that is streamlined with reasonable requirements and fees. Consider making the process and related fees commensurate with generator size. For example, develop a straightforward process for smaller or inverter-based systems and more detailed procedures for larger systems or those utilizing rotating devices (such as synchronous or induction motors) to fully assess their potential impact on the electrical system.
- Create a streamlined process for generators that are certified compliant to certain IEEE and UL standards. UL Standard 1741 provides design standards for inverter-based systems under 10 kW. IEEE Standard 1547, establishes design specifications and provides technical and test specifications for systems rated up to 10 MW. These standards can be used to certify electrical protection capability.
- Consider adopting portions of national models (such as those developed by the National Association of Regulatory Utility Commissioners (NARUC), MidAtlantic Distributed Resources Initiative (MADRI), and FERC and successful programs in other states, or consider using these models as a template in developing a state-based standard. Consistency within a region increases the effectiveness of these standards.
- Try to maximize consistency between the RTO and the state standards for large generators.
- Developing consistency among states is important in reducing compliance costs for the industry based on common practices.

Below is a list of key implementation issues:

- Consider working as a collaborative to establish monitoring activities to evaluate the effectiveness of interconnection standards and application processes.
- Periodically review and update standards based on monitoring activities, including feedback from utilities and applicants.
- Consider working with groups such as IEEE to monitor industry activities and to stay up-to-date on standards developed and enacted by these organizations.

**For More Information and Assistance**

**EPA resources**
http://www.epa.gov/chp/state_resources/interconnection.htm
http://www.epa.gov/cleanenergy/stateandlocal/guidetoaction.htm
**IREC resources**
http://www.irecusa.org/connect/index.html

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13 http://ulstandardsinfonet.ul.com/scopes/1741.html

14 The Institute of Electrical and Electronic Engineers (IEEE) has developed IEEE 1547, which is a guide for Interconnection System Certification. Section 1254 of the Energy Policy Act of 2005 (EPAct 2005) states that interconnection standards will be based upon the standards developed by IEEE. Underwriters Laboratories (UL) is revising its existing standard, UL 1741, to include distributed generation (DG). UL 1547 will provide a streamlined approach to interconnect DG with the grid.

**OTC High Energy Demand Day Initiative**
**Clean Energy Options Best Practices:**
**Congestion Requests for Proposals (RFPs) – Combined Heat and Power**
**DISCUSSION DRAFT**

**Overview and Examples of Results**

Although states may be able to meet current peak demand conditions, they may have the need for qualified capacity to meet forward peak demand requirements. In order to promote new investment in generation capacity in appropriate locations, regional organizations such as ISO-New England, have been working with the Federal Energy Regulatory Commission (FERC) to implement locational capacity and locational forward reserve markets as one way to encourage the development of required new capacity. However, such markets, would expose state ratepayers to higher rates partially due to Federally Mandated Congestion Charges (FMCC) and other charges. As an alternative to creating these higher rates, some states have launched procurement processes for clean energy, including CHP, to meet the capacity needs. Requests for Proposals (RFPs) were issued to encourage new supply-side and demand-side resources. Connecticut and New York utility Consolidated Edison (Con Ed) have both created procurement processes to combat rising energy prices.

**Important Features and Key Actors**

Connecticut and Con Edison have issued RFPs in the past few years to solicit the development of long-term projects to reduce FMCCs. Both RFPs encourage the development of new DG by establishing long-term contracts and other financial incentives.

**Connecticut**
Connecticut's Public Act 05-01, An Act Concerning Energy Independence (EIA) authorized the Connecticut Department of Public Utility Control (DPUC) to launch a competitive procurement process focused on creating new supply-side and demand-side resources to reduce FMCCs. The DPUC issued a RFP on September 13, 2006, which may include but shall not be limited to "(1) customer-side distributed resources; (2) grid-side distributed resources; (3) new generation facilities, including expanded or re-powered generation; and (4) contracts for a term of no more than fifteen years between a person and an electric distribution company for the purchase of electric capacity rights." The targeted timeframe for FMCC reduction from new projects is for the period beginning May 1, 2006, and ending on December 31, 2010. Projects will be evaluated based on their contribution towards lowering Connecticut ratepayer's cost.

The DPUC will consider as eligible: new generation facilities; additional investments to existing generation facilities that increase the total capacity that can be considered electrically located in Connecticut; conservation; other demand-side resources; and energy efficiency projects. Distributed Generation (DG) projects are considered eligible to participate in this RFP. However, since DG has other opportunities under EIA, projects can choose to participate in this process or can participate in other programs, but not both.

Local distribution companies, Connecticut Light and Power (CL&P) and United Illuminating (UI) will serve as the counterparty to contracts. Costs for the contracts entered into under this procurement process will be allocated equally on a load ratio basis to CL&P and UI resulting in a consistent $/kWh charge. There are three possible contract options under the RFP: one for generation, one for demand response, and one for other demand resources (includes energy efficiency).

**New York**
There are a number of financial incentives available to reduce electricity demand in the Con Edison service territory (consisting of the five boroughs of New York City and a portion of Westchester County). These incentives are provided for under the Con Edison Demand Side Management (DSM) programs. The New York State Pubic Service Commission's (PSC) *Order Adopting Three-Year Rate Plan*, established Demand Side Management (DSM) goals to be obtained for the Con Edison territory through a System-Wide Demand Reduction Program (SWP) administered by NYSERDA and a Targeted Program (TP) administered by Con Edison.

Con Edison issued a Request for Proposal (RFP) in April 2006 for its Targeted Program (TP), which solicits applications from qualified parties to supply the company with new demand side management (DSM) resources. The RFP calls for a savings of 123 MW over a multi-year period beginning in 2008. Eligible customer changes include energy efficient air conditioning, lighting, refrigeration, motors, clean distributed generation (DG), and steam air conditioning.

The goal of the NYSERDA DSM programs is to supplant a portion of the load growth expected to occur in the Con Edison area over the term of the rate plan. The overall target for the SWP is stated as 150 MW of demand reduction in the Con Edison territory through Energy Efficiency (EE), Load Management (LM), and distributed generation projects (DG). Specific programs in the SWP administered by NYSERDA include:

- Peak/Aggregated Load Reduction
- Commercial and Industrial Performance
- Residential A/C Load Management
- New Construction
- Building Performance and Financing
- Flex/Tech Technical Assistance
- CHP Performance Program

Funding opportunities for NYSERDA are listed as Program Opportunity Notices (PON). Remaining funds for several of the above mentioned programs are as follows:

- As of June 30, 2006 there was $1,220,000 still available in the Con Edison SWP Smart Equipment Choices Program (PON 968).
- Additionally, as of August 1, 2006 there was $7.9 million worth of funding remaining for the Con Edison SWP Commercial and Industrial Performance Program (Demand Reduction and $12.5 million is still available for the installation of CHP systems in the Con Edison service territory (PON 984).

**Implementation and Related Policy Issues**

To reduce rates, states or utilities can follow these practices:

1. Collaboration between state agencies, utilities and regional organizations, such as ISO-NE, to implement policies to encourage development of new clean energy resources, including CHP.
2. Develop long-term financial incentives or contracts so potential project developers are assured of a revenue stream.
3. Ensure that state PUC commissioners and staff have current and accurate information regarding the relevant rate issues (such as FMCC) and the potential benefits of DG.
4. Open a generic PUC docket to explore reducing rates through targeted clean energy solutions to grid congestion and utility proposed grid upgrades and/or new power plants.

**For More Information and Assistance**

Connecticut Department of Public Utilities (DPUC), RFP 2006
Website: http://www.connecticut2006rfp.com/context.php

Con Edison, RFP 2006
Website: http://www.connecticut2006rfp.com/context.php

New York State Research and Development Authority (NYSERDA), Funding Opportunities
Website: http://text.nyserda.org/Funding/funding.asp?i=2

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**Overview and Examples of Results**

Solar energy is an appealing renewable energy option for the OTC to consider for addressing high energy demand given that the resource is greatest when summer demand is highest. In addition to lowering peak demand and related emissions, solar energy systems can reduce strains on the electric transmission and distribution system. A leading example in the OTC described below, New Jersey operates three integrated programs that encourage residents, building owners, and others to install solar technology. On an OTC-wide basis, EPA has estimated that new state solar PV incentive programs could yield, under a "medium level of effort" scenario, 112 MW of installed capacity by 2010, yielding peak ozone day NOx emissions reductions of .07 tons-per-day.[15]

**New Jersey's Solar Energy Initiative**

New Jersey has an overall state-wide goal of 90 MW of solar capacity by 2008. New Jersey operates three integrated programs to help achieve that goal:

- Customer On-Site Renewable Energy (CORE) Program: Under CORE, consumer rebates are available to residential and business customers to help reduce the up-front cost of PV systems.
- Solar Renewable Energy Rebates (SRECs): The New Jersey SREC Program provides an additional source of financing for clean, emission-free solar electricity. The SREC program is an emerging market-based financing option for solar PV. Owners of solar arrays obtain an SREC each time they generate 1 mWh. The credits can then be sold to help offset the upfront costs of PV systems. The program is capitalized by funds generated from utility Alternative Compliance Payments (ACP).
- Clean Energy Financing Program: Low-interest loans and grants to customers are designed to help businesses, schools, and municipalities finance clean energy.

Since the inception of the CORE program in 2001, 1,665 New Jersey residential, commercial, public, and non-profit entities have installed solar PV. This includes 1,375 homes and small businesses, and nearly 300 commercial and public entities. In total, CORE has paid out almost $56M to 800 projects, resulting in over 12.5 MW of program-induced solar capacity. A joint state-federal analysis estimates that CORE reduced $NO_x$ emissions by 1.1 tons during the 2005 ozone season.[16]

Combined with non-program installations, New Jersey has over 21 MW of total installed solar systems. These systems are generating 26,000 MWh of electricity and reducing CO2 emissions by over 31 million pounds.

**Important Features and Key Actors**

New Jersey's solar programs have benefited from state support of over one-half billion dollars. This level of investment is unprecedented, serving to bring solar industry and government officials together while grabbing the attention of project financiers. They are currently transitioning from rebates to SRECs. Access to funding via a system benefit charge, tax rebates/exemptions or other sources are important features of a successful program.

Several actors are part of the New Jersey program:

- New Jersey's solar programs are administered by the Board of Public Utilities' (BPU) Office of Clean Energy (OCE). The BPU also determines rebate levels and coordinates the payment process.
- Eligible customers include New Jersey homes, businesses, institutions, and non-profit facilities.
- The BPU maintains a list of active solar photovoltaic installers on their Web site.

15 NOx emissions analysis using ICF Technology Retrofit and Updating Model (TRUM) for U.S. EPA.

16 DOE's final report on the DOE/EPA Clean Energy-Air Quality Integration Pilot Project: http://www.eere.energy.gov/wip/clean_energy_initiative.html

**Implementation and Related Policy Issues**

New Jersey is the fastest growing solar market in the country. In 2005 alone, solar capacity increased by 157%. Growth to-date in 2006 has been even faster, with 789 solar systems installed by August. The state credits this growth to the *combination* of rebates, financial incentives, and technical support offered by the BPU. NJ officials say that the programs have been so successful that the state has had problems meeting demand. Currently, compliance with the solar requirements in New Jersey is transitioning from rebates to an SREC-based financing program. The BPU's next step is to expand the current program by initiating a 17 MW pilot starting in June 2007.

**For More Information and Assistance**

Details on the New Jersey program can be found at: http://www.njcep.com/

EPA can offer assistance with: program design; best-practice peer exchange; displaced emissions estimates; and marketing and recognition.

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**OTC HIGH ENERGY DEMAND DAY INITIATIVE**
**Clean Energy Options Best Practices**
**Demand Response – Time Based Rates**
**DISCUSSION DRAFT**

## Overview and Examples of Results

Time based rates encompass several rate structures where the price paid for electricity varies throughout the day. Time based rates promote demand response through price signals, which allow customers to decide whether or not it is worth it to reduce consumption at a particular time. Time based rates also have the potential to improve the efficiency of supply side investments and reduce the harm from market power in restructured markets. Customers in some states can voluntarily participate; in other states, large customers face time-based rates as the default rate structure. Participating customers can reduce loads during times of high prices by shifting loads to other time periods, foregoing electricity use without making it up at another time, or switching to backup generation. Which option is utilized can have a significant impact on the resulting net emissions impact.

Demand Response Time Based Rates programs are in place across the northeast, including in New York and Pennsylvania, and the US. Below are two examples of successful programs:

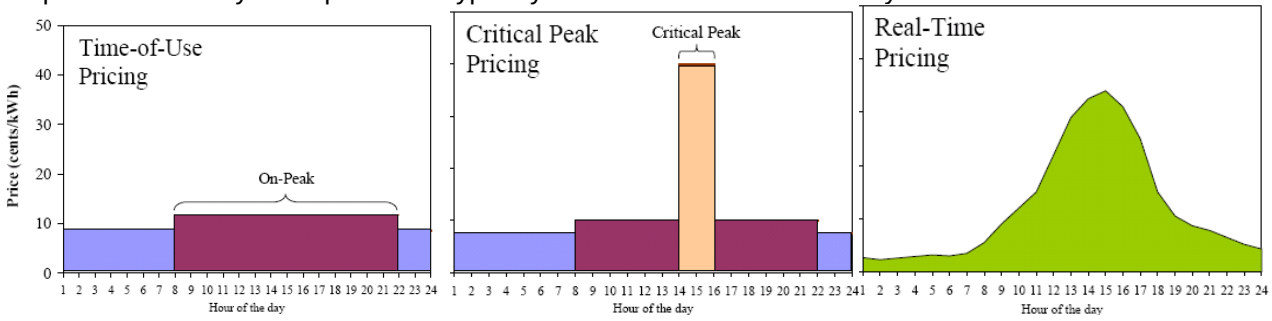
- Niagara Mohawk (NY) has utilized a mandatory Real Time Pricing (RTP) (see below for definitions) tariff for large customers (i.e., greater than 2 MW) since 1998. Although 1/2 of the customers were unable to adjust load, almost 1/3 curtailed load without shifting it to other periods and 1/10 both curtailed load and shifted it to other time periods. The most common reduction strategies were shutting off equipment despite the fact that over half of the customers had demand response enabling technologies that should have allowed for more sophisticated responses. Government and educational facilities were found have the highest price responsiveness, followed by industrial, while commercial customers were not responsive to price. Overall, the customers represent about 50 MW in peak demand reductions when the peak price is five times the off-peak price.

- California conducted a statewide pilot of Critical Peak Pricing (CPP) (see below for definitions) from 2003-04 which included 2,500 customers from industrial, commercial, and residential sectors. The pilot found that residential customers were more price responsive (12.5% average peak reductions) than commercial and industrial customers, and that the enabling technologies (e.g., smart thermostats) led to significantly higher demand response. In 2005, the IOU's voluntary CPP tariff reduced peak demand by an average of 11 MW across events; load reductions were primarily achieved through process reductions and curtailing discretionary uses rather than through backup generation.

## Important Features and Key Actors

Time based rates include three general categories:

- *Time of Use* (TOU) Pricing: A rate with different unit prices for usage during different blocks of time throughout a day (e.g., peak, shoulder, off-peak). TOU rates reflect the average cost of generating and delivering power during those time periods;
- *Critical Peak Pricing* (CPP): CPP is an overlay on TOU or flat rates where customers can face a critical peak price that is much higher than the normal peak price (e.g., 3-5 times higher) for a limited number of hours throughout the year;
- *Real Time Pricing* (RTP): A rate in which the price for electricity fluctuates hourly, reflecting changes in the wholesale price of electricity. RTP prices are typically known to customers on a day-ahead or hour-ahead basis.



In order for time based rates to function effectively, customers need access to the time based rates in a timely manner, be capable of responding (e.g., automated load control systems), and have an advanced meter installed. Current estimates suggest that the market penetration of advanced meters is low nationally – almost 6%; however, this varies significantly by state, with some OTC member states like Pennsylvania (52.5%) and Connecticut (21.4%) having much higher market penetration rates.

There are typically a number of key actors associated with effective time based rate programs, including utility commissions, utilities and load serving entities, energy agencies, air quality agencies, and electricity customers.

**Implementation and Related Policy Issues**

The use of time-based rates, particularly CPP and RTP, is a relatively new development. Most studies have found modest demand response to high peak prices (e.g., 5-15%), but this varies significantly both within and between sectors. Preliminary results suggest that government and education customers are most likely to forgo use, while industrial customers are more likely to shift loads to off peak periods or utilize on-site generation; commercial customers have been largely unresponsive to price. The type of customer response (e.g., shifting, foregoing, generating on site) to high peak prices is likely to impact the environmental benefits of time-based rates and is a key consideration for design.

Time base rates programs require advanced meters and are enhanced by facilitating devices that provide information (e.g., electricity prices) to customers in a timely manner and automate demand response (e.g., smart thermostats). Allowing utility cost recovery for these investments and providing incentives to encourage such investments can be another important issue. However, disseminating technology is often not sufficient to generate significant demand response; technical assistance to develop response strategies is also important. Time based rates programs are best viewed as an important part of a portfolio approach to demand side management that also includes energy efficiency, incentive-based demand response, and technical assistance; there are likely important synergies between programs (e.g., time based rates can encourage investments in peak-targeted efficiency).

Section 1252 of EPAct (Smart Metering) creates several requirements of utilities and utility regulators with regard to time based rates. By January 2008, each utility must offer time based rates to each of its customer classes, provide time based rates to individual customers upon request, and provide an advanced meter to each customer that requests time based rates. Also by January 2008, in states that have not considered implementation and adoption of a smart metering standard, the state PUC is required to issue a decision on whether to implement a standard for time-based rate schedules.

For Additional Information and Assistance

Two recent reports contain detailed information on demand response programs:

- FERC Staff Report, 2006. Assessment of Demand Response & Advanced Metering. http://www.ferc.gov/legal/staff-reports/demand-response.pdf
- Hopper, Nicole et al 2006. Customer Response to Day-Ahead Market Hourly Pricing: Choices and Performance. LBNL. http://eetd.lbl.gov/ea/EMS/reports/58114.pdf

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# OTC HIGH ENEGY DEMAND DAY INITIATIVE
## Clean Energy Options Best Practices
## Demand Response – Incentive Programs
## DISCUSSION DRAFT

**Overview and Examples of Results**

Incentive-based demand response programs provide incentives to electricity users for reducing consumption during system emergencies (i.e., emergency demand response) or times of high wholesale prices (i.e., economic demand response). Participating customers typically reduce loads by switching to backup generation or flexing facility loads (e.g., adjusting HVAC or lighting set points) manually or through automated controls. Which of these options, or combinations of options, is employed can have a significant impact on resulting net emissions.

FERC estimates that the potential peak reductions from existing demand response incentive programs are roughly 37,500 MW nationally and range from 3 to 7 percent of peak demand in most regions. Demand response incentive programs are in place across the OTC, including Connecticut and New York. Examples of programs include:

- New York ISO's incentive-based demand response programs, including a capacity market program (SCR), a demand bidding program (DADRP), and an emergency demand response program (EDR), have resulted in significant reductions in peak demand, including:
    - In the summer of 2003, 1400 commercial, industrial, and multi-family residential customers reduced their peak consumption by 700 MW;
    - In the summer of 2006 NYISO called on its EDR and SCR programs, which reduced peak demand by 1100 MW.
    - With the exception of the demand bidding program (DADRP), participants are allowed to transfer loads onto on-site generation to meet load reduction requirements.

- ISO New England's incentive programs include its real time demand response and capacity market (ICAP) programs. In 2005, ISO-NE had 472.5 MW ready to respond, 290 MW of which was in Connecticut. The program was called only once in 2005 and yielded 1100 MWh, 870 MWh of which was met with backup generation. In order to participate, customers must have installed an approved internet-based communication system.

- Other states with effective demand response programs include California (e.g., the California Power Authority's Demand Reserves Partnership, several reliability programs) and Florida (e.g., Florida Power & Light's direct load control programs, as well as interruptible and curtailable load control programs).

**Important Features and Key Actors**

There are several different types of demand response programs, which differ by the end use sector they target (e.g., industrial, commercial, residential) and the type of event that triggers their utilization (e.g., a system emergency, high wholesale prices), among other things; common types include:

- *Direct load control*: targeted towards residential customers, it is a program where a utility or system operator remotely shuts down or cycles a customer's electrical equipment on short notice in exchange for an incentive payment;
- *Interruptible/curtailable rates*: targeted towards large commercial and industrial customers, it is a program where customers receive a rate discount or bill credit in exchange for agreeing to reduce load during system contingencies;
- *Demand bidding/buyback programs*: large customers offer to provide load reductions at a price at which they are willing to be curtailed, or identify how much load they would be willing to curtail at posted prices;
- *Emergency demand response programs*: provide incentive payments to customers for reducing their loads during reliability-triggered events, but curtailment is voluntary; and
- *Capacity market programs*: customers commit to providing pre-specified load reductions when system contingencies arise, and are subject to penalties if they do not curtail when directed.

Incentive based demand response programs are offered at both the utility/load serving entity (LSE) and wholesale level.

There are typically a number of key actors associated with effective demand response programs, including independent system operators, energy agencies, utility commissions, air quality agencies, utilities and LSEs, and electricity customers.

**Implementation and Related Policy Issues**

According to an ISO New England report[17], a significant fraction of incentive based demand response came from the use of backup generation rather than curtailment. Demand response programs that allow the use of backup generators to meet demand response obligations are likely to compromise the environmental benefits of the programs. Some states have addressed this by including requirements for the types of load reductions that are eligible for certain DR programs (e.g., NYISO's Day Ahead Demand Response Program prohibits the use of back up generation) and/or selecting programs that tend to elicit load flexing rather than the use of backup generation (e.g., California's Critical Peak Pricing program). Among incentive-based demand response, economic programs (e.g., demand bidding) would be the most appropriate candidate for inclusion in any HEDD strategy as economic programs are more likely to encourage load flexing rather than back-up generation.

Addressing utility disincentives to providing demand response programs is another important issue leading states have addressed; in similar ways to which they have addressed disincentives for other demand side programs (i.e., decoupling, cost recovery, performance based incentives), states can work to ensure that utility incentives are aligned with well functioning programs. Furthermore, many demand response programs either require or are significantly enhanced by advanced meters and/or facilitating devices that automate demand response (e.g., smart thermostats). Allowing utility cost recovery for these investments and providing incentives to encourage such investments can be another important issue. Demand response also faces some state-level specific barriers (e.g., New York prohibits RTP for residential customers) that would need to be addressed by individual states.

As estimates of demand response and subsequent payments are typically based on deviations from an established baseline, rigorous evaluation, measurement, and verification protocols are important to ensuring program effectiveness. Finally, demand response is best viewed as an important part of a portfolio approach to demand side management that also includes energy efficiency and technical assistance; there are likely to be important synergies between the programs (e.g., technical assistance can help customers identify appropriate load flexing opportunities).

**For Additional Information and Assistance**

A recent report of the FERC contains detailed information on demand response programs:

- FERC Staff Report, 2006. Assessment of Demand Response & Advanced Metering. http://www.ferc.gov/legal/staff-reports/demand-response.pdf

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17 RLW Analytics and Neenan Associates (2005, December). An Evaluation of the Performance of the Demand Response Programs Implemented by ISO-NE in 2005.