DSM in the 2010 Connecticut Integrated Resource Plan (IRP)

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ABSTRACT

While demand-side management (DSM) has always been a conceptual part of integrated resource planning (IRP), in practice it has not always been an important focus. The current uncertainties facing supply resources and, in some cases, regulatory pressure (such as in Connecticut) are causing a resurgence of interest in demand-side alternatives. The key questions regarding DSM resources include: What will they actually cost? How quickly can they be deployed? and What will be the ultimate customer penetration rates and program effectiveness? IRP lays the groundwork for greatly increased levels of spending for energy efficiency (EE), load management, and load response in Connecticut. Three scenarios were studied: (1) reference-level DSM (business as usual), (2) targeted DSM (intermediate scenario), and (3) all cost effective DSM. By 2020, the DSM savings in the all cost effective case presented in the plan would reduce peak load growth by 1,095 MW and provide electric savings of 5,910 GWh, due to aggressive implementation of both EE and load response programs. The development of the DSM portion of the plan presented the electric utilities with several key challenges. As more states consider similar legislation, there are many important lessons that other states can learn through Connecticut's experience.

INTRODUCTION

There are two main types of utility DSM programs: load response, also known as demand response (DR), and energy efficiency (EE) programs. The 2010 IRP focuses on energy efficiency. The primary benefits of EE are from energy savings and reduced emissions, which have significant value under all market conditions. In resource planning, energy efficiency must be recognized for its energy, capacity, and emissions

value, comparable to generation resources. Also, there are some obstacles that must be considered in constructing a resource strategy. Utility EE programs depend heavily on skilled and experienced engineers and technicians to identify savings opportunities, recommend savings strategies, and then implement those strategies. [1, 2]

REFERENCE-LEVEL DSM STRATEGY

The reference-level of energy efficiency reflects business as usual DSM, with continuation of the program structures and designs currently deployed in Connecticut within state approved program budgets. The 2010 Electric and Natural Gas Conservation and Load Management Plan provided the foundation on which the ten-year forecast was based. In addition to the EE achieved through the utility programs, there are other parties that implement EE programs, but in a much smaller scope. [3, 4]

The utilities' reference-level EE projections shown in Table 1 represent what is achievable through the following existing funding sources:

- Funding received through the $3 mil charge on customer electric bills
- Revenues received from ISO-New England (ISO-NE) for EE capacity entered into ISO-NE's transition period and the Forward Capacity Market (FCM)
- Revenues resulting form the sale of class III renewable energy credits (RECs)
- Revenues from the Regional Greenhouse Gas Initiative (RGGI)
- Funding provided to the companies from the American Recovery and Reinvestment Act (ARRA)

Table 1. Reference-level DSM

Reference-Level DSM Strategy	Year 5	Year 10
Cumulative annual peak load reduction acheived (MW)	255	431
Cumulative annual energy savings achived (GWh)	1,749	2,894
Lifetime energy savings from all measures installed (GWh)	19,216	32,595
Program Costs ($ mil)	619	1,121
Total Electric Benefit ($ mil)	1,984	3,503
Cost per Annual kWh	0.354	0.388
Cost per Lifetime kWh	0.032	0.034
Cost per Annual kW	2,430	2,601
BC Ratio	3.2	3.1

TARGETED DSM STRATEGY

This IRP evaluates additional EE in a targeted DSM expansion resource strategy, which is constructed as an intermediate step between the reference level and the all achievable cost effective DSM level. The targeted DSM expansion strategy produces significant energy savings while also eliminating growth in peak demand in five years, and a slight reduction thereafter. The targeted DSM expansion strategy is comprised of four high-potential initiatives addressing residential new construction zero energy homes, residential cooling, various commercial and industrial (C&I) applications, and C&I chiller retirement, as described in more detail below.

Zero Energy Homes (ZEHs) Initiative

The ZEHs initiative would build on a zero energy home pilot started in 2009 and would greatly expand the number of ZEHs in Connecticut to approximately 600 units per year. In the next ten years the residential new construction market would be transformed to the point where incentives and support can be reduced or eliminated altogether.

Table 2 shows the costs and cumulative savings this initiative would achieve. [5]

Residential Cooling

The residential cooling initiative is a set of measures offering savings above and beyond the business as usual residential reference-level EE. These measures and savings potential were identified in the 2009 study "Potential for Energy Efficiency in Connecticut, KEMA, Inc." [6]

Table 2. Targeted DSM—Zero Energy Homes

Targeted DSM -- Zero Energy Homes	
Cumulative Annual peak load reduction achieved by year 10 (MW)	32
Cumulative Annual energy savings achieved by year 10 (GWh)	67
Lifetime energy savings from all measures installed in 10 years (GWh)	1,664
NPV of program costs over 10 years (2010 $)	$34,293,139
NPV of participant out-of-pocket costs over 10 years (2010 $)	$34,293,139
Customer benefits measured in 2020 IRP analysis (2010 $/MWh saved)	$202
NPV of customer benefits from all measures installed in 10 years, assuming the benefits are always $202/MWh (2010 $)	$140,720,409
Benefit to Program Cost ratio	4.1
Benefit to Total Cost ratio	2.1

Table 3. Targeted DSM—Residential Cooling

Targeted DSM -- Residential Cooling	
Cumulative Annual peak load reduction achieved by year 10 (MW)	28
Cumulative Annual energy savings achieved by year 10 (GWh)	35
Lifetime energy savings from all measures installed in 10 years (GWh)	624
NPV of program costs over 10 years (2010 $)	$34,292,654
NPV of participant out-of-pocket costs over 10 years (2010 $)	$17,146,327
Customer benefits measured in 2020 IRP analysis (2010 $/MWh saved)	$202
NPV of customer benefits from all measures installed in 10 years, assuming the benefits are always $202/MWh (2010 $)	$71,525,790
Benefit to Program Cost ratio	2.1
Benefit to Total Cost ratio	1.4

The measures included in this initiative represent measures with a high level of cost effective savings potential that may not be fully realized under the base funding scenario. [5]

High Potential C&I Measures

This initiative is comprised of a set of measures selected from the 2009 study "Potential for Energy Efficiency in Connecticut, KEMA, Inc." They were selected from the top twenty demand savings measures listed in the potential study and consist of new or enhanced measures. The measures include DX tune-up or advanced diagnostics, fluorescent fixtures continuous dimming, compressed air-system optimization, and efficient refrigeration operations. These measures would be new offerings or those having been only recently explored.

C&I Chiller Retirement Initiative

The 2007 & 2008 Energy Opportunities (EO) Accelerated Chiller Retirement Initiative—to impact summer peak demand by identifying and removing old, inefficient chillers from the system—was successful in achieving its goal of reducing summer peak demand. Not all identi-

Table 4. Targeted DSM—C&I Measures

Targeted DSM -- High Potential C&I Measures	
Cumulative Annual peak load reduction achieved by year 10 (MW)	76
Cumulative Annual energy savings achieved by year 10 (GWh)	317
Lifetime energy savings from all measures installed in 10 years (GWh)	3,174
NPV of program costs over 10 years (2010 $)	$82,923,018
NPV of participant out-of-pocket costs over 10 years (2010 $)	$41,461,509
Customer benefits measured in 2020 IRP analysis (2010 $/MWh saved)	$202
NPV of customer benefits from all measures installed in 10 years, assuming the benefits are always $202/MWh (2010 $)	$398,567,603
Benefit to Program Cost ratio	4.8
Benefit to Total Cost ratio	3.2

fied projects proceeded forward at that time, and the initiative was subsequently suspended due to funding constraints.

Chiller loads are one of the largest contributors to the summer peak demand. Reinstating and expanding this initiative would target this market opportunity. Old, inefficient chillers could be replaced with high efficient, air-cooled or water-cooled equipment. This effort would further enhance the companies' C&I programs to assist Connecticut businesses in mitigating energy and demand cost increases.

Based on the Brattle Group simulations, the targeted DSM expansion strategy would reduce generation service costs by $109 million in 2020 in the current trends scenario, a savings that far exceeds the $19 million annual program cost (net of $10 million FCM funding). The generation cost savings is approximately half from the value of energy not consumed, and about half from a slight reduction in market energy prices. Although average costs (per kWh consumed) are not good measures of overall program performance when the quantity consumed is changing, average costs do decrease under this strategy due to the market energy price effect. Hence, overall rates would likely decrease even for non-participants in the additional DSM programs, in spite of a $ 0.7 mil increase in the system benefit charge (SBC) to fund the programs. The

Table 5. Targeted DSM—Chillers

Targeted DSM -- C&I Chillers	
Cumulative Annual peak load reduction achieved by year 10 (MW)	55
Cumulative Annual energy savings achieved by year 10 (GWh)	194
Lifetime energy savings from all measures installed in 10 years (GWh)	3,874
NPV of program costs over 10 years (2010 $)	$84,050,606
NPV of participant out-of-pocket costs over 10 years (2010 $)	$84,050,606
Customer benefits measured in 2020 IRP analysis (2010 $/MWh saved)	$202
NPV of customer benefits from all measures installed in 10 years, assuming the benefits are always $202/MWh (2010 $)	$397,531,571
Benefit to Program Cost ratio	4.7
Benefit to Total Cost ratio	2.4

Table 6. Targeted DSM—Total

Targeted DSM -- All Initiatives	TOTAL
Cumulative Annual peak load reduction achieved by year 10 (MW)	191
Cumulative Annual energy savings achieved by year 10 (GWh)	612
Lifetime energy savings from all measures installed in 10 years (GWh)	9,336
NPV of program costs over 10 years (2010 $)	$235,559,417
NPV of participant out-of-pocket costs over 10 years (2010 $)	$176,951,581
Customer benefits measured in 2020 IRP analysis (2010 $/MWh saved)	$202
NPV of customer benefits from all measures installed in 10 years, assuming the benefits are always $202/MWh (2010 $)	$1,008,345,373
Benefit to Program Cost ratio	4.3
Benefit to Total Cost ratio	2.4

Targeted DSM resource strategy would not only reduce customer costs but also reduce CO_2, NO_x, and SO_x emissions.

ALL ACHIEVABLE COST EFFECTIVE DSM RESOURCE STRATEGY (A-ACE)

The Energy Conservation Management Board (ECMB) completed a new potential study in 2009 which estimated the maximum achievable cost effective energy efficiency potential based on several conservation program funding scenarios.

The Integrated Resource Plan funding scenario in the 2009 potential study is the basis for the A-ACE DSM resource strategy evaluated in this IRP. It is based on the maximum funding levels that the conservation program would expect to receive as a result of the IRP and would produce approximately 20% less peak demand and 10% less energy savings than programs with unlimited funding.

This IRP includes a different approach to estimating benefits, by comparing customer costs between the A-ACE DSM, the targeted resource strategy, and the reference resource strategy. Relative to the reference resource strategy, the IRP estimates that the A-ACE DSM resource strategy produces an incremental 561 MW and 3,439 GWh in cumulative annual savings by 2018. This reduces customer costs by $402 million annually after accounting for the $90 million in incremental annual program costs. Most of the benefit is due to reduced energy and associated RPS needs, with approximately a quarter from market price impacts.

Although average costs (per kWh consumed) are not a good measure of overall program performance when the quantity consumed is changing, average costs increase under this strategy because a slight reduction in GSC rates would not fully offset the SBC rate increase to $5.6 mil from $3 mil in the reference strategy. Hence, costs for non-participants could increase, while costs for participants would decrease (by a larger total amount).

FUNDING OPTIONS

The funding for the program costs has changed over the last few years, shifting from almost complete reliance on the charge on customer electric bills to include other sources of revenues. These additional

sources of revenues include:

- ISO-NE Forward Capacity Market
- Class III REC program
- Regional Greenhouse Gas Initiative (RGGI)
- American Recovery and Reinvestment Act (ARRA)

Identifying new sources of funding could include strategies such as increasing the conservation charge on customers' bills, allowing the EDCs to include funding for energy efficiency in distribution rates, or finding other new sources of funding. All of these options would help customers to save money, while also reducing emissions. DSM program costs could be included in the rate base and could also be recovered through rates using other recovery mechanisms such as a conservation adjustment mechanism (CAM).

DSM CORE PROGRAMS

Residential

The core residential programs are:

- Retail products
- Home energy solutions (HES)
- New homes
- Water heating
- HES—income eligible

Commercial & Industrial

The core commercial and industrial DSM programs, which are high-performance core Connecticut Energy Efficiency Fund (CEEF) programs, are:

- Energy Conscious Blueprint
- Energy Opportunities
- Small Business Energy Advantage
- O&M services and RCx

IMPLEMENTATION CHALLENGES

The targeted DSM plan (in the IRP report) represents a significant increase in program funding. This level of DSM spending would require

a significant ramp-up of infrastructure, including engineers, architects, evaluation contractors, and other energy conservation professionals.

Even though some of the funding required to implement these energy efficiency programs is not yet identified, some new sources of funding identified by the utilities and the Connecticut Energy Advisory Board (CEAB) recommendations may reduce the gap between current and future funding levels.

The aggressive energy and load savings projected under the IRP would rely extensively on Connecticut utilities' participation in regional and national market transformation initiatives over the next ten years. Such market impacts require broader strategic alliances with other utilities, governmental agencies, and industry players to effect broad market changes by manufacturers, national/regional accounts, chains and franchises, and other players. In addition, the energy efficiency programs will be aligned with relevant national, state, and local energy initiatives and plans.

CEAB RECOMMENDATIONS

Based on the findings in the 2010 IRP, the CEAB recommended that the utilities use best efforts to maximize the utilization of energy efficiency resources by expanding financing options, market mechanisms, and codes and standards, as well as by refocusing the ratepayer-funded programs to complement these expanded initiatives. The CEAB recommends that Connecticut identify and develop ways to help reach A-ACE, seeking to avoid increasing the rate on electric customers. A strategy to implement A-ACE targets for the state must consider a broader portfolio of financing mechanisms and implementation approaches. [7]

The utilities and the Energy Efficiency Fund have developed a robust energy efficiency infrastructure in Connecticut and are poised to ramp up to the IRP level, but there are still a lot of issues and challenges that need to be addressed in order to reach high DSM levels. Environmental groups, non-profit organizations, and the general public have overwhelmingly supported DSM.

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