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Sustainable Energy Roadmap for Austin:
How Austin Energy Can Optimize Its Energy Efficiency

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Sustainable Energy Roadmap for Austin:
How Austin Energy Can Optimize Its Energy Efficiency

by

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Report

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Abstract

Sustainable Energy Roadmap for Austin:
How Austin Energy Can Optimize Its Energy Efficiency

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This report asks how Austin Energy can optimally operate residential energy efficiency and demand side management programs including demand response measures. Efficient energy use is the act of using less energy to provide the same level of service. Demand side management encompasses utility initiatives that modify the level and pattern of electrical use by customers, without adjusting consumer behavior. Demand side management is required when a utility must respond to increasing energy needs, or demand, by its customers. In order to achieve the 20% carbon emissions and 800 MW peak demand reductions mandate of the Generation, Resource and Climate Plan, AE must aggressively pursue an increase in customer participation by expanding education and technical services, enlist the full functionality of a smart grid and subsequently reduce energy consumption, peak demand, and greenhouse gas emissions.

Energy efficiency is in fact the cheapest source of energy that Austin Energy has at its disposal between 2010 and 2020. But this service threatens Austin Energy's revenues. With the ascent of onsite renewable energy generation and advanced demand

side management, utilities must address the ways they generate revenues. As greenhouse gas emissions regulations lurk on the horizon, the century-old business model of "spinning meters" will be fundamentally challenged nationally in the coming years. Austin Energy can develop robust analytical methods to determine its most cost-effective energy efficiency options, while creating a clear policy direction of promoting energy efficiency while addressing the three-fold challenges of peak demand, greenhouse gas emissions and total energy savings. This report concludes by providing market-transforming recommendations for Austin Energy.

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INTRODUCTION

In light of rising energy prices, growing consumption and growing concerns about climate change, the public supports moving towards more sustainable energy use more than ever before. The U.S. electrical grid is aging, strained by ever-growing energy demand and pressures to invest in more costly clean energy, and is in need of upgrading. The recent economic downturn has brought greater awareness to the importance of optimizing energy efficiency opportunities. Concurrently, carbon legislation looms on the legislative horizon. Policy, technical and market solutions combined are needed to the conserve energy, reduce greenhouse gas emissions, and reduce peak demand.

In Austin, California, and around the nation there is increased pressure to address three key priorities of energy efficiency, pollutant emissions reductions, and peak demand reductions. Austin Energy (AE), the municipal utility that serves the City of Austin and the surrounding suburbs, has a well-established residential Energy Efficiency and Demand Side Management (EE/DSM) portfolio that remains popular with the public and has saved over 800 MW of peak demand reduction to date. Theses savings from conservation and managing demand are equivalent to the scale of a coal-power plant that would power a small-city. Recently, Austin City Council adopted AE's Climate, Generation, and Resource Plan for 2020, which calls for substantial additional reductions in peak demand and carbon dioxide emissions. In order to achieve the stated goals of 800 new Megawatts (MW) of peak demand reduction and 20% carbon dioxide emissions reductions by 2020, AE must increase residential customer participation in EE/DSM programs, and increase savings coming from existing program participants.

A useful lens with which to view EE/DSM is the framework adopted by California for energy market transformation. The state of California developed The

California Long-Term Energy Efficiency Strategic Plan for 2009 to establish a synchronized statewide campaign to achieve utility market transformation by optimizing EE/DSM efforts. For AE to achieve persistently increasing energy savings the utility must better integrate EE/DSM efforts, drive more comprehensive adoption, and persuade consumers to adopt energy efficiency measures and technically assist customers so they may make energy-conscious decisions.

This report reviews the literature and research surrounding the EE/DSM field, compares AE's performance against best practices in California, evaluates the performance of AE's existing EE/DSM residential programs, and looks at the mix of technical, policy, and market-based solutions at the disposal of AE to increase customer participation and savings. It concludes with suggestions for AE to shift its policy, technical and market-based efforts to successfully transform the Austin market into a community where EE/DSM adoption is widespread and the savings help achieve the goals of the Austin Energy Climate, Generation and Resource Plan.

The rest of this chapter is broken into four sections and concludes with a summary of the rest of the report. The first section briefly summarizes AE's background as a municipal utility and the details the three questions this report addresses. The section also summarizes this reports' methodology. The second section provides context to the origins of California's energy efficiency regime, followed by juxtaposition with the Texas regulatory climate that AE operates under. The third section describes AE's success and experience to date in the residential EE/DSM field, and then highlights AE's growing customer participation. That section is followed by the introduction of the concept of market transformation in energy provision. Market transformation acts as the underpinning to California's the long-term strategic plan to reach EE/DSM goals for 2030. Similar concepts, policy framework and policy tools can be applied to AE's own goals for 2020. The next section summarizes market and policy barriers that threaten AE's plan to achieve the 2020 goals. The chapter concludes with a roadmap of the report.

BACKGROUND

The City of Austin has owned and managed AE since its inception in 1893. AE is the largest department in the Austin City government, and its largest revenue source (AE Resource Guide, 2009, 4). AE provides a 9.1% distribution of revenues to the City every year, over $90 Million in the 2009 Budget. In 2009, AE provides about 45% of the total operating resources of the city budget (AE Resource Guide, 2009, 5).

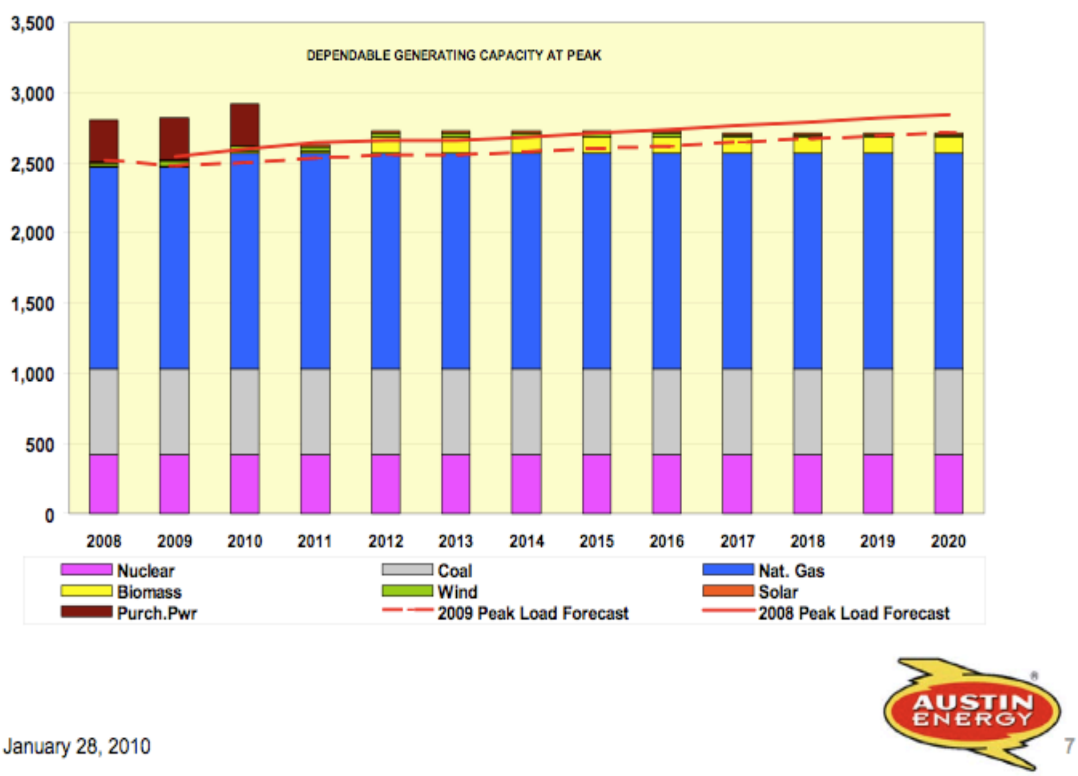
The Austin City Council is AE's governing body and is responsible for setting its rates and approving its annual budget and longer-term capital investments (Interview with Jeff Vice, Director, Local Government Relations, AE, 2010). The City of Austin is a partner in AE's efforts to move the region away from carbon-based energy sources, and in 2007 established the goal of being the most sustainable city in the country (AE DSM Presentation, 2009, 3).

AE has been an early adopter of many best-practices associated with utilities, including a green building code, a city-wide climate protection plan, and the Austin City Council has implemented many planning guidelines aimed at improving energy performance of building codes, residential and commercial properties (Pecan Street Project Final Report, 2010, 1). AE's status as a public utility allows customers to influence AE policies, through specific actions such as adoption of a Tree Cutting Service near utility lines, or broad actions such as reduced Greenhouse Gas (GHG) emissions through the Austin Climate Protection Plan. AE has not built or expanded a fossil fuel power plant in nearly 30 years, and recently declined to expand its supply of nuclear power from 1982 to 2010. AE has reduced its overall carbon output and other air pollutants beyond targeted goals. AE hopes to never invest in fossil fuel-based energy resources in the future as well.

AE expects to request a revision and significant increase in billing rates in 2012 to keep up with the demand (Martin Toohey, *Austin American Statesman*, 2010). This brings up the critical question of how to achieve even greater customer participation in EE/DSM that works against AE's current business model, because the utility's revenues remain tied to how much energy is consumed. This model is called volumetric pricing, or in laymen's terms, the "spinning meter" model. DSM programs reduce potential revenue. According to an Itron National Energy Efficiency Best Practices Study, demand-side resources are the most cost-effective and least carbon intensive choice for achieving new load growth (Itron DSM Potential Study, 2008). The California Public Utility Commission (CPUC) requires that energy efficiency be the first priority in load order and calls for Demand Response (DR) programs that reduce demand at peak demand periods be the second highest priority (California Long-Term Energy Efficiency Strategic Plan, 2008, 1). The American Council for Energy-Efficient Economy (ACEEE) ranks California the top state for energy efficiency because of its advanced statewide commitment to best practices. (Texas ranks in the middle of the rankings nationally (ACEEE State Efficiency Scorecard, 2009).) Since 1982 AE's EE/DSM programs have reduced the need for additional generation by more than 800 MW, which is equivalent to the capacity of AE's entire coal-based electricity generation (AE Climate, Generation and Resource Plan, 2010). In 1999 Austin City Council mandated that energy conservation measures be the first priority in generation for AE (AE Energy Efficiency Fact Sheet, 2009).

Austin's population is expected to grow by as much as 750,000 new residents over the next 30 years (City of Austin Demographer, 2009). AE faces the challenge of continuing to provide energy to ever more people, and places. As Figure 1.1 shows, there is a significant gap in 2020 between AE's existing generation capacity and the amount needed to meet demand. AE hopes to shave purchased power-based demand from its generation portfolio, as this energy is bought at the most expensive time critical peak periods. These hourly loads occur for a total of 43 hours of the year in 2009. AE seeks to replace that energy purchased on the energy wholesale market with renewables and EE/DSM initiatives in the future.

Figure 1.1 Current Resources vs. Load Forecasts for AE, 2010–2020



Source: Austin Energy Resource & Climate Protection Plan to 2020 Presentation by Roger Duncan, AE General Manager, 2010, 7.

In order to bridge this gap, AE must adopt significant new capital improvements in new generation and DSM initiatives. This will require a careful mix of expanding the generation portfolio, conserving existing energy sources, utilizing new generation resources efficiently, and end-users consuming energy more efficiently as well. These concerns and the directives of City Council lead to a series of questions that will be addressed in this report.

1. What is the potential for Energy Efficiency and Demand Side Management in meeting future energy needs in more sustainable ways?
2. How have AE's conservation/DSM programs evolved and how does its performance compare to other utilities?
3. Drawing from examples of other utilities and programs, what policies and programs would accelerate energy savings and meet the ambitious goals of AE's conservation/DSM initiatives over the next decade?

As part of the recommendations set forth by City Council in the new AE Resource, Generation and Climate Plan, AE will undergo an Energy Efficiency Potential Analysis in the near future so that AE and City Council can map out its conservation and DSM strategy. This report provides some initial guidance on key issues affecting that analysis. Since energy efficiency and conservation in the United States operate on a scale much larger than green building, distributed energy generation, energy storage, or renewables, the framework of this report will concentrate on the lowest hanging fruit for achieving the greatest energy conservation: existing residential households.

If AE cannot substantiate that 1000 MW of demand reduction is achievable in a cost effective manner, doubts may be raised about the feasibility of AE's own recommended goals, how it plans to account for future savings and what information it is relying on to make these predictions.

Methodology

This report will review literature on conservation and DSM from national research institutes such as the Electric Power Research Institute (EPRI), American Council for Energy Efficient Economy (ACEEE), the Edison Electric Institute (EEI), and the Rocky Mountain Institute (RMI). This report also includes verified data from the performance of DSM programs for AE and California three largest and most-successful IOU EE/DSM programs. The report utilizes anecdotal and statistical research on best practices in EE/DSM policies, program development and implementation, and then evaluates the performance through the lens of market transformation. Interviews with City Council, AE staff and academics offer insight into the context and precedent of AE, and the challenges it faces in its business model, rate structure and EE/DSM initiatives as they relate to the rest of the generation portfolio. The topics of dynamic pricing, price signals and demand response programs are reviewed through a meta-analysis of the literature and existing programs. Also, the topic of customer behavior is reviewed in a social science framework. The challenge that all utilities face is finding a way to breakthrough the wall of cognitive dissonance in regard to energy efficient consumer behavior, and consumer decision-making. The report will seek to interpret AE's current Climate Generation and Resource Plan for 2020 through a review of these reports, documents, journal publications and other mediums to determine where process improvements, program synchronization, and deeper customer participation can enhance AE's EE/DSM Portfolio.

POLICY AND MARKET-BASED CONTEXT TO EE/DSM

AE's Distributed Energy Services is currently in the third year of a five-year plan to ramp up energy efficiency programs to achieve the peak demand reduction of 800 MW mandate made in the Generation, Resource and Climate Plan for 2020. California's

Public Utility Commission (CPUC) is currently halfway through a ten-year plan to increase energy efficiency dramatically, and it has established energy efficiency goals that are unmatched in the US at the state-level. The CPUC goal is to avoid nearly 5,000 MW of peak demand and cumulative energy savings goals of more than 23,000 GWh by 2013 (CPUC Energy Efficiency 2010-2012 Portfolio Fact Sheet, 2010). These savings are projected to meet 55-59% of the utilities' incremental electric energy needs between 2004-2013 (CPUC Energy Efficiency 2010-2012 Portfolio Fact Sheet, 2010).

In order to benchmark AE's progress and potential, this report will look at the best practices in California (Sacramento Municipal Utility District, Pacific Gas & Electric, Southern California Edison) and other utility programs. In order to better understand the market forces and assumptions that AE and California utilities operate under, this report summarizes relative market and regulatory conditions associated with operating a utility in Texas and in California and the impact that decoupling and deregulation have in an energy marketplace and the utility industry in general. Drawing from examples of other utilities and programs, this report will look at policies, education and marketing approaches, and program designs that would accelerate energy savings and meet ambitious goals for AE's conservation/DSM initiatives over the next decade.

Strengths and Limitations of the Texas and California Energy Markets

Weighing the relative merits of the California and Texas energy regimes is important because it provides context for how utilities set energy efficiency programs in motion and how much savings utilities try to accrue through those programs. As a historical leader in energy efficiency efforts, California initially established codes and standards for heating, ventilation and air conditioning (HVAC) standards of efficiency, and codes for refrigerators. Since 1978 when this policy was established, California has the race toward achieving market transformation, while Texas has a long way to go. However, Texas can take more aggressive steps to establish statewide policies and initiatives since it operates with virtually no federal oversight. If the Texas Public Utility Commission, working with the Texas State Energy Conservation Office and State Government, can bring utilities within the state to agree on end-user efficiency guidelines it can shape energy policy in a meaningful way, just as the CPUC has done.

One byproduct of California's EE growth is the deep level of research done in the public, private regulatory, and academic spheres that led to ever-improving frameworks to meet the challenges of continuously improving energy efficiency. The regulatory climate in California is significantly different from that in Texas. One key element that California has that is not available in Texas is decoupling. Decoupling is the concept of separating an energy utility's profits from its sales of the electricity, and instead aligns a rate of return with meeting revenue targets. The result is that utilities are rendered essentially disinterested by the market force to produce more energy (Ronald Brownstein, *Atlantic Monthly*, 2009). Shifting focus away from spinning meters resulted in California's energy regime and market players focusing more on the efficient delivery of energy rather than finding means to generate more energy.

California's plans have been informed by this incentive to conserve energy in many ways and this has been supported by a well-funded mandate to ensure that this result has achieved. For instance, the three-year EE/DSM budget for California IOUs from 2010 to 2012 is expected to exceed $3.6 Billion – the largest expenditure of its type in US history. Oregon, Maryland and other states also operate in a decoupled market, but Texas has no such requirement and thus utilities do not benefit from this incentive. After decoupling of the grid the second major milestone in California occurred in 1998, when the CPUC corrected course from simply extending existing energy consumption levels at the same rate for the next 40 years to significant reductions in energy consumption.

Today, it is important to recognize that Texas is starting its statewide EE/DSM efforts. The average Texan consumes almost double the national average of energy in a year, and almost double that of California (ACEEE, 2009). As such, while Texas has recently been successful in reaching its ratcheting goals over the last couple years, reduce energy consumption through its energy efficiency improvement programs (EEIP), which direct transmission and distribution utilities to serve 10% of load growth through energy efficiency. The Public Utility Commission of Texas (PUCT) has announced in 2009 that this goal – set for 2010 – has already been reached, and the ACEEE has produced a report that asserts that there is still more efficiency that can be achieved from EE (ACEEE, Texas Energy Efficiency Potential Study, 2009). In particular, the level of savings that utilities can achieve through the EEIP can be cost-effectively increased to produce more savings and greater load growth. The utilities have easily met the efficiency target, so the state is on track to reach even greater levels of savings in the EEIP through expanding the utility-sector EEIP, increased adoption of Demand Response (DR) programs in retail markets. Perhaps new state-level appliance/equipment standards and short-term public education programs and rate structures that more accurately reflect a daily load curve and the costs AE must pay on the energy wholesale market will be developed in the near-term future. (Rate structures, standards and public education and outreach are reviewed in Chapter 2.) In addition, the EEIP does not apply to cooperative and municipal utilities in the state. Some of municipally owned utilities (MOUs) such as AE and City Power Service (CPS) of San Antonio are already active in the area of EE/DSM (ACEEE, Potential for EE, DR and Onsite Renewable Energy to Meet Texas's Growing Electricity Needs, 2009).

All utilities have a range of generation resources that include fossil fuels, nuclear, renewables, and energy efficiency. When demand exceeds supply Texas utilities purchase power from the deregulated Electric Reliability Council of Texas wholesale energy market (ERCOT). ERCOT is one of five independent service operators (ISOs) in the United States and the only one that is limited to a single state, allowing for minimal federal oversight since there is no interstate trading. The most critical piece to the California energy regime is its decoupled market that has worked with utilities, appliance manufacturers, and industry standards associations for years to incentivize both carbon emission reductions and energy efficiency simultaneously in an interdependent manner.

Starting in 2011 ERCOT will phase in day-ahead pricing for the wholesale market and establish many new protocols that enhance the efficacy of the Texas transmission system. Today all utilities in ERCOT pay a flat-rate transmission congestion cost—essentially an insurance fee to ensure receipt of electricity. According to market analysts, the effect that a nodal market will have is that it will shift the transmission=level cost of congestion down to individual distribution utilities based on how much congestion they produce on transmission lines. Since EE/DSM is the most effective means of reducing congestion, many utilities in ERCOT are expected to add the avoided cost of transmission congestion to the list of benefits In ERCOT's nodal market, 4,000 measurement devices across the market will determine congestion costs based on the amount of congestion that is produced by each distinct utility—thereby more accurately linking the cost of transmission congestion to the utility responsible for that congestion (Interview with Jacob Steubing, Horizon Wind Energy, 2010). Day-ahead markets may significantly improve information available to consumers on when to reduce their energy consumption, but any incentive to do so will rely on the rate structure and whether pricing signals are used by the utility.

AE Success to Date in EE/DSM

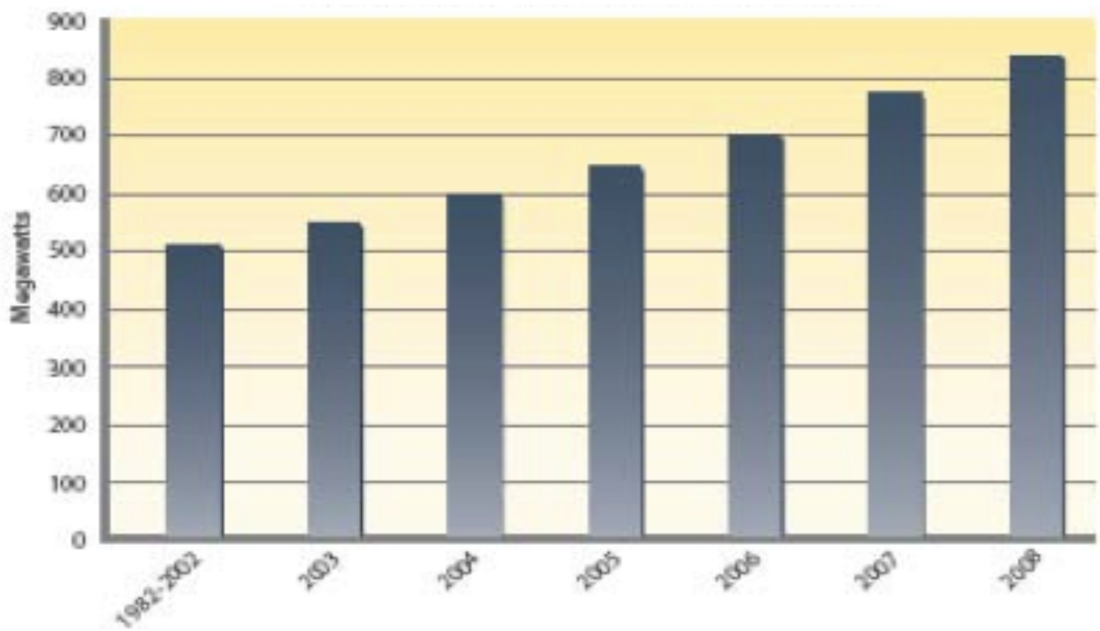
Nationally, energy efficiency programs provide energy at an average rate of 2.5 cents/kWh (ACEEE Scorecard of State Energy Efficiency Programs, 2009). AE's cheapest (and dirtiest) generation source is coal, at $0.07 /kWh, while AE's demand side resources come in at a cost of $0.03/kWh, less than half the cost of coal (Karl Rabago, AE, The Demand Side Resource, 2009, 4). AE spends about $350 per kilowatt (kW) of peak demand *avoided*, "a level far below the construction and operating cost of any type of new generation" (AE Resource Guide, 2008, 7).

Billing rates for AE customers are lower than rates in Houston, Dallas, El Paso and San Antonio—the same billing rates for the past 14 years. AE's conservation and DSM programs have helped AE maintain low billing rates by avoiding expensive construction of at least 800 MW of generation. In 2007 AE received the Energy Star Award for Sustained Excellence from the U.S. Environmental Protection Agency (EPA) and U.S. Department of Energy (DOE) for significant energy reductions and continuous improvement, as well as the EPA's Green Power Partnership Award for its overall savings in peak demand in 2008 (Austin Energy, "Past Awards" and "Recent Awards").

The City Council has pushed the utility further through a series of policy levers from the advent of energy conservation programs in 1983, to the Austin Climate Protection Plan (ACPP) enacted in 2007, and most recently the Energy Conservation Audit Disclosure (ECAD) effective June 1, 2009, that requires an energy audit at the point of sale for new homes and for all multi-family metered residences by the end of 2011. Some within AE feel that Council, with the blessing of AE's leadership including the last two general managers, Juan Garza and Roger Duncan, is moving too quickly into new investments in renewables, EE/DSM and not considering the long-term fiscal health of the utility. They also express concerns over the viability of these new technologies and the interoperability of the grid once these systems are integrated into the generation portfolio (Interview with Christopher Smith, AE, 2010). The ACPP sets out a comprehensive course for AE to reduce levels of carbon emissions by 20% by 2020 and EE/DSM are expected to play into that goal. In April 2010 AE consolidated its Resource, Generation and Climate Plans in an omnibus strategic plan that was the culmination of multiple phases of public participation and analysis.

By its own recommendation to City Council, AE has raised its minimum targets by 2020 for energy efficiency and renewables, from 700 MW of peak demand reduction to 800 MW. It has also increased minimum targets for renewables from 30% of its generation portfolio to 35%, with 200 MW to be solar power. The Generation Plan Task Force recommended AE aspire to peak demand reduction of 1000 MW. It has been nearly twelve years since AE has done a complete Energy Efficiency Potential Study. Assumptions, and the market have changed drastically in the past decade since the last study (AE Resource, Generation and Climate Protection Plan to 2020 Briefing to City Council, 2010, 1, and Karl Rabago, The Demand Side Resource Presentation, 2009, 6). Figure 1.2 illustrates AE's success in conservation/DSM efforts from 1982 to 2008. These savings include the savings from commercial, industrial, and government building efficiency programs in place, standards and codes in place since 1982, as well as deactivated programs between 1982 and 2002.

Figure 1.2 Net Peak Demand Reduction (MW) for AE, 1982–2008



Source: "Austin Energy Resource Guide." Austin Energy, October 2008.

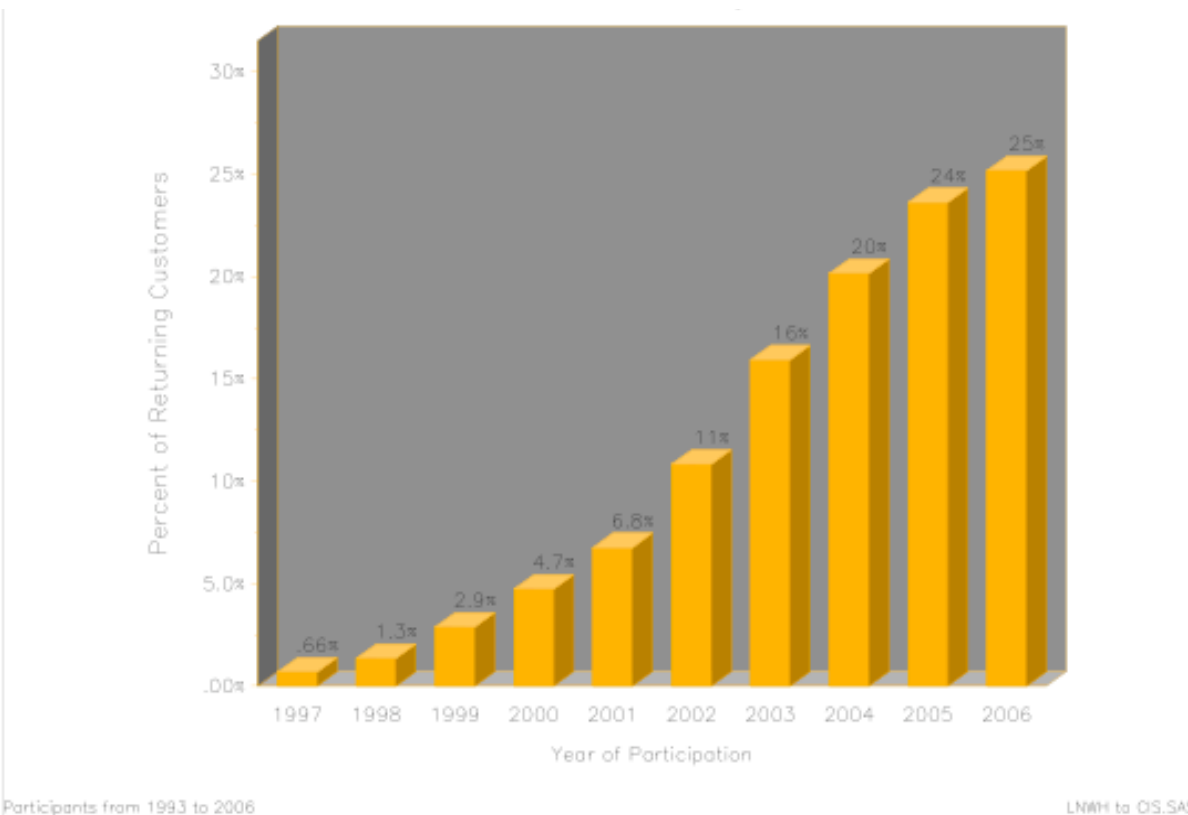
Fred Yebra, Director of Distributed Energy Services for AE, says that in order to achieve 800 MW of further demand reduction by 2020, AE will have to rely on technologies and programs that are not even on the market yet. AE and the City of Austin will have to develop the enabling policy framework and policy tools to capture the greatest savings.

The Status of AE's EE/DSM Customer Participation

Customers from all segments of the population have patronized AE's EE/DSM programs. This report found that 44% of households feeding off residential meters have accessed at least one AE energy conservation or DSM program or service installed and verified in the last five years. The Energy Star Home Performance program has been particularly successful, using a variety of incentives to facilitate customer participation. Financial incentives; an arrangement between AE and area hardware stores to stock

Energy Star appliances; advertising/marketing and education campaigns by the federal, state and local government, appliance manufacturers, and hardware stores have all lent support to AE's EE/DSM programs. Figure 1.3 highlights two key facts about AE's programs: Participants return to the program to access more than one efficiency measure. This would explain the increase in single measures, since so many homes have had some retrofits fewer options are left, pointing to a need for AE to find more energy savings in order to avoid market saturation and achieve peak demand goals and total energy savings.

Figure 1.3 Residential Customers Re-Applying for Additional EE/DSM Programs



Source: John Trowbridge, Austin Energy, and Net Impacts for Residential Customers, 2006.

In order to achieve 800 MW of peak demand reduction by 2020, conservation and DSM performance for AE will be a function of (1) increasing customer participation, and (2) reducing peak demand and increasing energy savings per participant.

Concerns about market saturation in some EE/DSM programs can be avoided by shifting to an approach of market transformation. AE has experienced significant success recently with two programs in particular in the existing Residential EE/DSM Portfolio: the Multi-Family Incentive program and the compact fluorescent light bulb (CFL) rebate program. Both have seen widespread adoption. According to the 2009 DSM Performance Review, AE's team asserts, "the AE Power Saver (including Power Partner for residential) and Green Building programs' drive market transformation" (AE DSM Performance Review, 2009).

AE has recently decided to shift out of its CFL rebate program by 2012, and instead focus incentives and marketing toward whole lighting-system design rebates. This example illustrates example market transformation at work. As the program nears saturation in the Multi-Family Residential sector in the next few years, AE is proactively developing Green Building Codes for new buildings that concentrate on integrated lighting system design, as well as an incentive model that will increase the attractiveness of investing in high-end lighting systems for existing homes (AE DSM Performance Measures Report, 2008). AE's transition from rebates for CFLs to comprehensive incentives for hyper-efficient whole lighting system design illustrates how market transformation can initiate changes for the utility, manufacturers, retailers and consumers.

Market Transformation

As early as 1998, the CPUC defined market transformation as:

"Long-lasting sustainable changes in the structure or functioning of a market achieved by reducing barriers to the adoption of energy efficiency measures to the point where further publicly-funded intervention is no longer appropriate in that specific market (CPUC, Long-Term Energy Efficiency Strategic Plan, 2008)."

Market transformation is an approach taken by the California Public Utility Commission to achieve significant energy efficiency for all end users. This report evaluates the performance of AE programs and their potential in achieving higher participation rates, whether savings are persistent, and how additional savings can be achieved with each residential end-user. Market transformation provides the best framework to look at this question because it provides a comprehensive matrix of policy design, implementation and evaluation, as well as a review of the policy tools at the disposal of states, utilities and other market-players to achieve greater savings.

A market transformation first requires an enabling policy framework that establishes clear policy direction, adequate financial incentives and funding, robust program administration and oversight, and firm ratcheting standards over time. In order to achieve maximum potential of this policy framework, policy tools push and pull the market to greater energy efficiency. According to the CPUC, these tools include:

- customer incentives, (including non-financial incentives)
- integrated models of services and programs to exceed existing savings (such as capturing embedded energy in water use and smart irrigation systems),
- codes and standards,
- education and information,
- technological assistance, and
- development of hyper-efficient emerging technologies and pilot programs.

Programs are better able to achieve their goals if they are reinforced with a robust and rigorous analytical methodology and evaluation that takes into account consumer behavior; breaks away from incorrect assumptions such as a focus on technology rather than *people and their energy behavior;* and ensures that a blend of direct contact (customer service, mailers, web portals, education, public participation processes), indirect influence (marketing/advertising, media communications) and market influences (incentives, standards and codes) attract those segments that would be in the market for EE improvements to building envelopes and EE appliance upgrades.

KEY LIMITATIONS TO MARKET TRANSFORMATION FOR AUSTIN ENERGY

As a public entity, AE DSM staff and resources are financially constrained from doing everything it can to invest in achieving higher peak demand and carbon emission savings. The utility, which houses a staff of 1700, requires City Council approval for any new employee over $50,000 in salary and benefits, and there has been a hiring freeze for many departments in the City since the Recession hit in 2008.

AE DSM programs operate in the Distributed Energy Services (DES) department and share space with the City of Austin Environmental Programs' Conservation offices. It is a silo of operations – even housed in a separate building. The programs can stand to be further integrated into Electric Service Delivery, Customer Service, and the Information Technology Departments to maximize the resources and staff that are available. DES does not have a Research and Development office that can develop more advanced and sophisticated programs to achieve more cost-effective customer outreach programs and methods to save energy. Research into developing more effective programs is restrained by fiscal and staff limitations.

AE operates a service territory of roughly 440,000 square miles, and manages an operating budget in the range of $3.5 billion, with nearly one million customers. Customers are defined as customer accounts that utilize a primary meter or submeter. Roughly a third of customer accounts are residential – slightly over 350,000 customer accounts. Commercial, public (government) and manufacturing customers make up the other two-thirds.

While AE may partner with other utilities to advocate on policy issues at the state level, statewide energy *mandates and clear policy direction* in appliance and electronics energy standards, climate legislation and decoupling particularly allowed California to shift toward greater conservation through an organic development of ratcheting standards over the past 40 years. That pushed the market toward more efficiency, leading to further efforts to improve the energy efficiency in an integrated energy policy regime. The results of the mandates and clear policy direction pushed and pulled the market and consumers alike towards greater efficiency.

AE is the ninth largest municipal utility in the US, the market impact of AE is smaller than many other utilities in Texas and cannot drive the EE/DSM marketplace in Texas because it does not have the economic, market and policy heft that the statewide AE does not have the driver of the PUCT or ERCOT establishing statewide directives on demand response, or even statewide efficiency standards. The average California consumer consumes roughly 7,600 kW of energy in a year- significantly less than the average Texan. Due to its large population and an energy-intensive economy, Texas leads the US in energy consumption, accounting for more than one-tenth of total U.S. energy consumption (Energy Information Agency, 2009). As a counterpoint to Texas overall, AE continues to lead the Californian IOUs in peak demand reductions per customer account despite these limitations because AE's customers welcomed the Power Partner program, and other Power Saver programs in large numbers.

The question of whether AE can compete with IOUs from the California's market has been asked – California has had a nodal structure for ten years, with state-level regulation of emissions and appliance efficiency standards, and has conducted significant levels of research and development for the past 40 years, thereby creating an EE market and feeding innovations into markets. It is true that California has led the national effort to address the climate imperative and movement toward more efficient energy service. Efficiency codes for HVAC and appliances, DSM standard protocols, market transformation, and many of the other leading policy and technical answers to the current climate imperative were first established in California (Skip Laitner, DOE, 2009). Currently the Public Utility Commission of Texas (PUCT) has no state-supported Climate or DSM programs. This is a stark counterpoint to California where the CPUC's 2006–2008 energy efficiency portfolio for investor-owned utilities (IOUs) was the single-largest energy efficiency program budget in U.S. history, with a $2 billion investment by California's energy ratepayers (Long-Term EE Strategic Plan, 2009, 2). In the 2010-2012 EE portfolio, expenditures have been approved for over $3.1 billion of ratepayer-supported EE programs to be administered by California's IOUs. Nearly two-thirds of that budget will be dedicated to the three most successful IOUs, namely Pacific Gas & Electric, Southern California Edison (SCE) and San Diego Gas & Electric (SDG&E). These three utilities will be reviewed at length in comparison to AE's DSM programs in Chapter 3. However, AE has operated an energy conservation, EE/DSM program since 1982, and has distinctly imprinted its own success on the community it serves, and the community has put its imprint on AE's program design and success as well.

AE's DSM initiatives took a significant hit, as they did across the country in the mid 1990s to early 2000s, when deregulation threatened old power monopolies by forcing them to break up their vertically-integrated services. In California, the brief period of deregulation in the late 1990s to early 2000s was referred to as "The Lost Years" in Ron Brownstein's article on the California energy regime. Load manipulation made famous by ENRON, price-gouging and price-fixing leading to rolling blackouts, a collapse of confidence in the governance of the energy markets, and ultimately to the end of such deregulation (Ronald Brownstein, The California Experiment, The Atlantic, 2009, 69). For municipally owned utilities (MOUs) operating in Texas, the concern with deregulation as it was deliberated at the Texas Statehouse in the late 1990s was that it might mean that publicly owned utilities would have to compete in their own markets. MOUs are locally owned and locally operated public agencies that reinvest in municipal and regional governments and regional economic development. Deregulated competition would have irrevocably altered the energy landscape in the state. It would have created a market environment akin to a race among market players to see who can create the most power—the opposite goal of EE/DSM and climate protection efforts.

Fear of such a scenario resulted in recommendations to a number of utilities, including AE, to scuttle their conservation programs (Austin Chronicle, 1999). AE chose to continue its programs after brief deliberation of the costs and benefits and a public outcry for more sustainable energy efforts from the City and AE.

Central Texas is home to AE as well as a unique cluster of large and small MOUs and electric cooperatives that derive electricity from a coal plant powered by the Lower Colorado River Authority (LCRA) and AE. Competition to produce more power would have severely altered existing DSM and conservation programs across Central Texas. AE conserves energy to delay the costs of new generation installation, reduce CO^2 emissions, and because the public and the City of Austin support efforts to conserve energy by directing AE to prioritize DSM as the first generation resource in its load order (AE Smart Energy Resource Guide, 2008, 4).

Still, a more challenging limitation exists: AE is functioning at a sophisticated level in DSM, but doing so under an antiquated business model where EE/DSM in effect cannibalizes profits. AE estimates it may operate at a deficit of $7 - $86 Million based on different accounting methods in 2010, and that number may significantly increase in 2011. On Roger Duncan's retirement, he lamented that if AE achieves its goals too quickly, it may go bankrupt. In the near term, AE has the opportunity to re-orient its business model, starting with a rate case that will likely enforce a rate increase in 2012. The current business model not only hinders AE's push into EE/DSM territory, but also renewable energy investments, on-site renewables generation by AE customers, and moving out of carbon-emitting coal, and to less reliance on the highly volatile natural gas costs that operate as AE's base load.

DSM cannibalizes AE's revenues and profit margin, as does onsite renewable energy generation such as photovoltaics and solar panels. To combat the growing challenges found across the energy industry, AE announced that it would propose a new rate case in 2012, to increase its rates for the first time in 15 years. In order to sustain profit over time, in April 2010 City Council approved the Resource, Climate and Generation plan that would require a rate increase of 20% over the next decade by Austin Energy's estimates. In other words, AE's average bill for a residence of 1,700 square feet is about $100. In 2020, that bill would be closer to $120-$125 (AE Generation, Resource and Climate Plan to 2020, 2010).

These new costs would go towards capital improvement projects and new operating and maintenance costs toward the diversification of the generation sources to include more clean solar and wind energy, distributed generation on-site by customers and businesses, and avoided energy use through conservation, efficiency and DR programs. These costs also include moving out of low-cost coal that emits three-quarters of AE's carbon emissions, and limits the risk associated with natural gas fuel cost volatility.

While decoupling or some system that mimics its separation of generation and consumption from its revenues is an option for AE, even if the rest of the state of Texas does not develop such a method. However, the effects this would have on AE as it competes on the energy wholesale market are a significant unknown variable. According to Andres Carvallo, such a system would not be considered by AE because it would not adequately answer issues that are faced by a municipally owned utility. With the advent of onsite renewable energy generation, issues to be solved across the whole state would include figuring out who pays the costs associated with distribution costs. These costs would have to be split between customers and the utility somehow since both parties participate in energy generation at the distribution level. Since AE holds a monopoly on energy generation in its service territory, net-metering and unbundling are two other policy levers that would need to be developed in accordance with decoupling. The City Council, AE's governing Public Utility Commission of Texas (PUCT) would also have to allow such policy levers to be developed and implemented by AE. All in all, decoupling is a relatively known market framework for a statewide regime, but not for a single utility. Furthermore, Texas has actively chosen to not go in the statewide policy direction of decoupling. Instead, the PUCT hope that investor owned and municipally owned utilities will collaborate and compete with their own new business models and rate structures.

The need for a rate increase is imminent, and AE has designed its Generation Plan since 2007 with the issue of a new business model looming over its head. In order to overhaul its business model from the 100-year old "spinning meter" model that equated more consumption to more revenue, AE is undergoing a rate case to that will likely be the underpinnings of a new business model. As Roger Duncan stated at his last presentation to Austin City Council in February 2010, "If we achieve our goals to fast, before we have a new business model, we go bankrupt (Austin American Statesman, 2010). The new business model must investigate "Unbundled rate structures" through dynamic pricing and demand response, and move from volumetric pricing to more fixed-cost pricing that accurately reflects the cost of energy at different times of the day and year – thereby accounting for costs to supply energy at peak times. AE is preparing for the rate review in 2012 by addressing some of these concerns through the Energy Efficiency Potential Study that will be prepared in the near future.

SUMMARY OF THE REPORT

The following five chapters take into the different frameworks in California and Texas, existing best practices across the country, compares overall DSM program success, establishes how AE set the 800 MW Peak Demand Reduction goal, reports on program performance to date, and the development of new programs that implement market transformation elements, and offers recommendations for cost-effective DSM program enhancements.

Chapter 2 of this report will define EE and DSM, review the technical and policy potential of residential programs, and report on best practices. Then Chapter 3 will address how well AE does in the EE/DSM field, and summarize the components of market transformation in Chapters 3 by highlighting examples of market transformation practices in California and Texas. Chapter 4 establishes how AE set the goal of 800 MW of peak demand reduction by 2020, and then provides a comprehensive review of AE's Residential DSM portfolio, and a review of program performance from 2004 to 2008. Chapter 5 critiques the methodology currently used by AE to establish DSM programs, market them to customers, and reach the greatest savings in a cost-effective manner. Chapter 5 concludes with a summary of findings and segues into the recommendations in Chapter 6 for AE to harness DSM savings that lie dormant in its residential customer base, by adopting a market transformation strategic plan, policies and policy tools.

Chapter 2. Literature and Survey Research Review

This chapter considers the best practices in energy efficiency policies, technical standards, consumer outreach, and program administration and evaluation derived from reports from utilities, research institutions, government agencies and energy regulators, journal articles, white papers and consultant reports. In order to identify the most appropriate approach for AE to increase benefits from customer uptake and participation in EE/DSM programs, this chapter is organized into five sections that:

- define the terms “energy efficiency,” “conservation,” “DSM,” and “demand response (DR)”;
- provide background to EE/DSM, and characterize utility program objectives;
- assesses the literature and survey research on consumer energy behavior, and consumer energy decision-making motivations;
- offer an assessment of the technical potential for EE/DSM energy savings, peak demand savings and CO^2 reductions;
- assess potential program achievements when market realities,, regulatory environment and other factors are introduced.

The final section provides a concluding analysis on how these issues can be organized methodologically to cultivate preferred scenarios for market adoption of EE/DSM measures.

Defining the Terms

Certain terms are critical to understanding the energy management. Particularly, terms that refers to infrastructure and technical processes, regulations and policies and markets forces. These components of the energy puzzle intertwine, and require greater context and understanding before proceeding. In the four sub-sections below, the terms

DSM, EE, DR and dynamic pricing are defined. Chapter 3 will provide deeper understanding on best practices in EE/DSM, and develop the market transformation narrative through existing examples as the focus.

Demand Side Management

DSM is an umbrella term for conservation initiatives, energy efficiency programs, and DR programs. DSM encompasses utility initiatives that modify the level and pattern of electrical use by customers by modifying customer behavior or by avoiding inefficient operation of systems (Lovins, 1996).

The California Energy Commission defines DSM as "the methods used to manage energy demand including energy efficiency, load management, fuel substitution and load building" and energy efficiency is defined as

> Using less energy/electricity to perform the same function. Programs designed to use electricity more efficiently - doing the same with less. For the purpose of this paper, energy efficiency is distinguished from DSM programs in that the latter are utility-sponsored and -financed, while the former is a broader term not limited to any particular sponsor or funding source (CEC Online Energy Glossary, 2010).

According to Austin Energy (AE), DSM refers to "measures taken by a utility to encourage conservation of electric usage or to reschedule electric usage for more uniform usage… Such efforts are intended to minimize the size and scale of future power generation facilities or designing strategic load growth (Yebra, AE DSM and Energy Efficiency Programs presentation, 2008, 5)." Yebra explains that DSM is required "when a utility must respond to increasing energy needs, or demand, by its customers" (LBJ School of Public Affairs, Sustainable Energy Options for Austin Energy, 2009, 51).

Energy Efficiency

EE programs are used to decrease demand by improving efficiency of appliances and technology such as lighting, air conditioning, heating, and plumbing. EE is the act of using less energy to provide the same level of service. EE is measured as a percentage that is calculated by the output of energy released by a process, divided by the amount of energy that was put into that process.

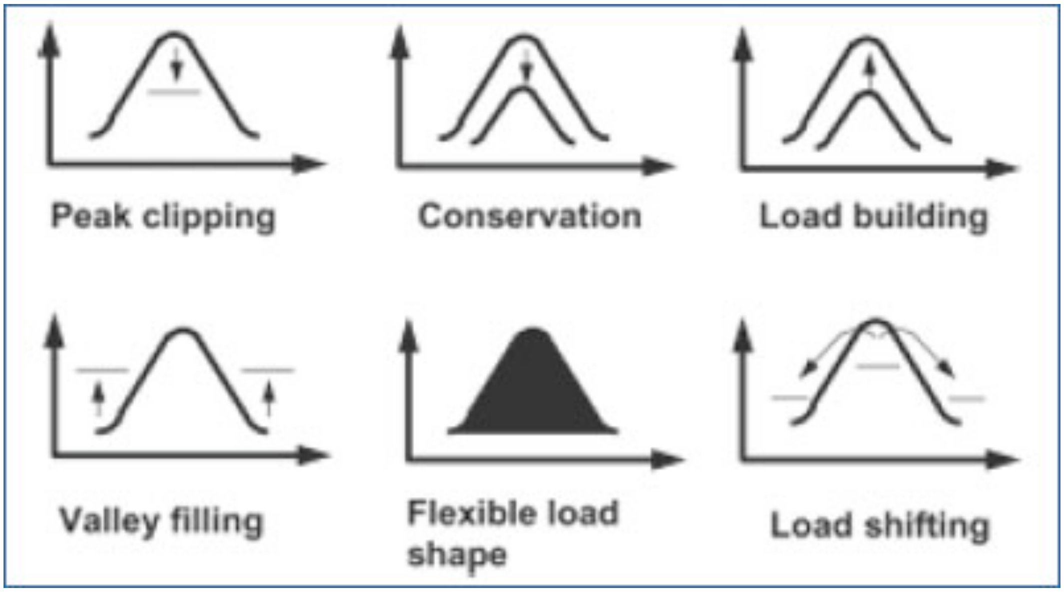
Conservation seeks change in actual behavior or reduction in demand by removing, downsizing, or turning off electricity-consuming equipment. Conservation seeks to eliminate an energy need altogether; efficiency changes the mode or speed of consuming energy to a less demand-intensive means.

EE and conservation programs generally cover, some or all of the following services and programs: energy audits, heating/ ventilation/ air-conditioning (HVAC) improvements, weatherization of homes, energy-efficient building codes, EE appliances, efficiency quotas for those appliances, and duct or plumbing repair and increasing the insulation of a building envelope.

Demand Response

The ability of a utility to counteract the need for new supply resources by reducing load during a period of relatively high consumption is called Demand Response (DR). DR is a type of market intervention based on pricing signals and load-size. DR is used at a utility-level to achieve aggregate energy demand reductions across the customer base to achieve reductions in a present generation load. This usually occurs at a critical peak time or specific interval of time. Change in consumption patterns can be induced through price variations over the course of time or through incentives designed to lower electricity use at times when market prices are high. DR is a means to reduce peak demand and can involve load shedding, load curtailing, load management, load shaping, or load shifting. Figure 2.1 shows different types of DR, and how loads are managed in response to peaks.

Figure 2.1 Demand Response Load Profiles

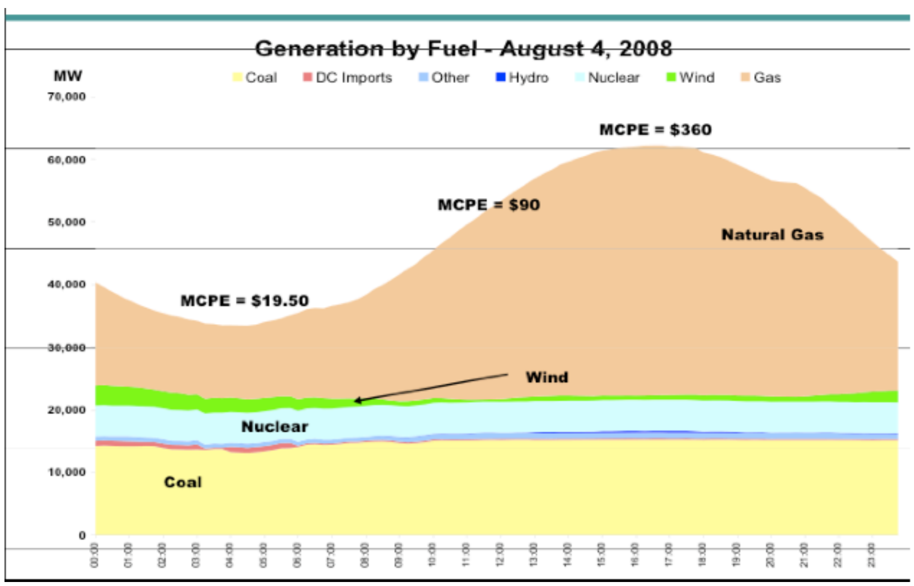


Source: Pandit, Nitin."Demand Side Management of Electricity and Water: an Exemplary Case for Institutional Partnership among Indian Utilities. Bulletin on Energy Efficiency, 2010

DR and demand control programs include active and direct means of controlling energy consumption, such as programs that cycle off air-conditioners or water heaters for 10-15 minutes over a 30-60 minute interval to reduce peak loads. They also include programs that utilize pricing signals to reduce energy use at critical peak periods when the temperature is hottest, air conditioners, pool pumps, dishwashers and TVs and computers are operating at homes and businesses, and people seek to stay cool.

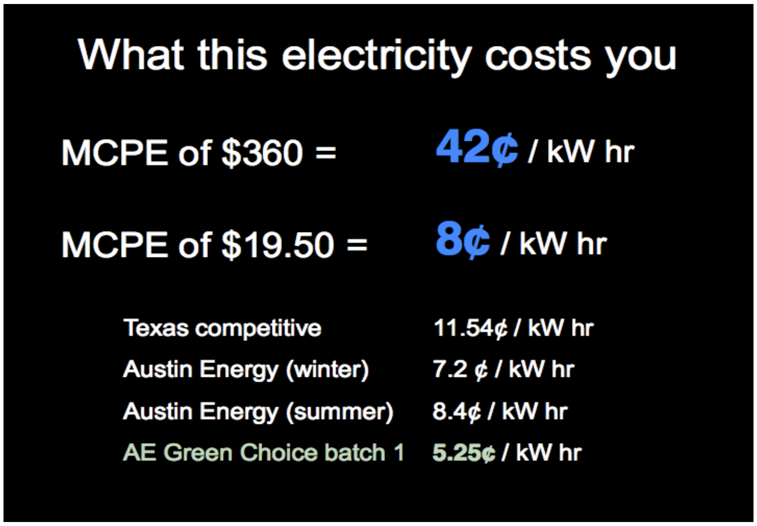
Growing populations increase demand, and when critical peak demand occurs, the sheer amount of electricity operating at full capacity threatens system reliability and electricity quality. This can lead to potential power outages and blackouts, which affect the most basic responsibility to ensure public health, welfare and safety. To cope with these critical peak periods, utilities in Texas purchase power on the ERCOT wholesale electric market. Such high demand times lead to extremely high costs, and energy sold at peak times costs much more than at low-demand times. Figures 2.2 and 2.3 reflect the cost of energy at different thresholds of consumption, or Market Clearing Price for Energy (MCPE). Peak prices are in the range of $0.42/kWh when the MCPE is $360. AE's base rate of $0.07/kWh over the course of the day is simply not reflective of the fluctuations in prices on the energy wholesale market. That is why pricing plans that reflect the actual load curve for a day are preferred to volumetric pricing structures.

Figure 2.2 Summer Day Load Shape with Fuel Mix and MCPEs



Source: Brewster McCracken, Pecan Street Project Presentation, 2010.

Figure 2.3 The Cost of Electricity for Austin Energy Residential Customers

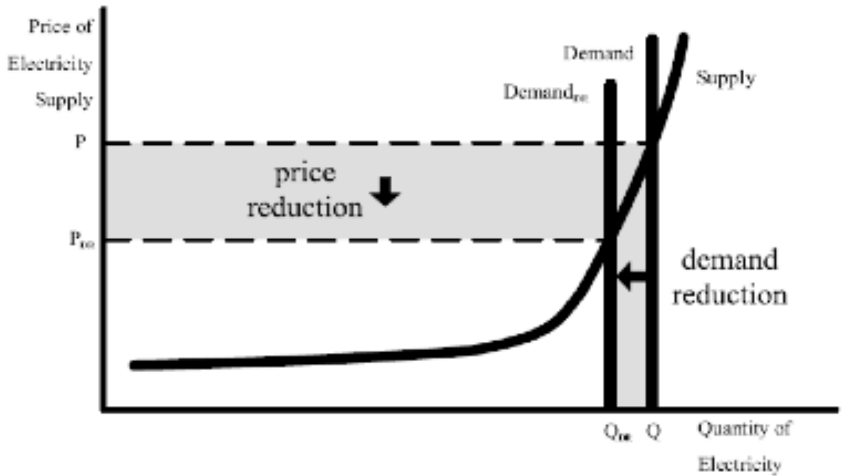


Source: Brewster McCracken, Pecan Street Project Presentation, 2010.

Dynamic Pricing Programs

DR programs are being developed and used across the country as utilities shift to new billing rate structures and regulations and policies intended to reduce carbon emissions. Customers have become more aware of the opportunity to manage their energy use (Vine, Consumer Behavior Potential Study, 2009). As customers demand more access to such programs, utilities began to design services and technology that allow customers to be active participants in their consumption. The core driver for such programs is the cost savings for both utility and customer and carbon emission reductions for utilities. Studies have shown that dynamic pricing combined with smart metering can eliminate very expensive energy at critical peak times. Figure 2.4 shows the elasticity of the price of electricity supply and the impact of demand reduction on quantity of electricity consumed.

Figure 2.4 Electricity Pricing Supply and Demand Curves



Source: United States Department of Energy. "Benefits of Demand Response in Electricity Markets and Recommendations for Achieving Them." 2008.

If a utility cannot communicate to a customer what the marginal value of consuming energy is, then it is hard to realize the behavioral shifts from price-minimizing customer choices. Dynamic Pricing holds much potential but will require new infrastructure, customer education, and installation of smart meters that display energy use data generated in real time. DR-based pricing programs have developed mainly along three paths for customer programs: Time-of-Use Pricing, Critical Peak Pricing and Real-Time Pricing.

A Time-of-Use (TOU) rate structure partitions the day into time-based price blocks. Cost for a block reflects the utility's costs of service at that time. TOU rates have the potential to lower system demand if a sufficient price signal is applied strategically to each time block.

A Real-Time Pricing (RTP) rate structure provides the real-time price of energy at a given time of day based on relative number of kilowatt-hours produced: the actual cost of service in small measured increments (hourly or even quarterly consumption). Prices on the wholesale energy market increase as the day gets hotter, market-clearing price signals can be established, customers can be made aware of the prices ahead of time and can reduce consumption or have automated energy savings installed to shut off at a given price signal. The method of communication to the customer is critical to success of such programs.

Critical Peak Pricing (CPP) is an amalgam of elements of TOU and RTP structures. When a "critical peak" occurs, the normal peak period in a TOU rate is shifted to a much higher price that reflects the marginal cost of supply at that given time. In the case of AE, this would be when power is purchased on the ERCOT wholesale energy market because it cannot generate any more electricity.

Developing dynamic pricing requires PUC approval, and in the case of public power, there is often a rate case that determines whether the public accepts the changes.

BACKGROUND OF ENERGY EFFICIENCY AND DSM

A state-level initiative to conserve energy and use it more efficiently began in 1977 in California in response to a proposal to build the Somerset Nuclear Plant, a proposal that awaited Governor Jerry Brown's signature. The status quo for California was to build a power plant to meet new peak demand. California was in a budget crunch and to the Governor, the idea of massive new construction cost, interest on that construction cost, installation and operation of new transmission lines, upsizing substations and distribution, the cost of water and energy to fuel the new nuclear power plant, pipelines and transfers, and then the pollution mitigation costs amounted to an enormous headache rather than a viable solution. Instead, the state established technical efficiency standards for all new refrigerators, freezers, and air conditioners, thereby avoiding the costs associated with the Somerset Nuclear Plant (Ron Brownstein, The

Atlantic, 2009). The public will behind energy conservation and efficiency standards in appliances such as Energy Star certified products took hold in California, and the state legislature instituted the first Energy Commission in 1978, and the Standard Practice Manual of industry standards for measuring the cost/benefit analysis tests for DSM programs in 1983 (Ron Brownstein, The Atlantic, 2009). Analysis of whether to advance EE programs was based on costs of building for more power versus reducing consumption, and the costs were broken out for utility, and customer stakeholders.

EE is an attractive alternative to building new power plants because the costs associated with EE include insulation, sealing ducts, shade trees, efficient HVACs, light bulbs, electronics, and energy management systems, along with utility system tools such as DR and new pricing models. These costs, when put together in the Total Resource Cost (TRC) test, evaluate whether a DSM measure is cost effective as a resource option compared to the costs associated with the conventional solution of building a peaking power plant (Marshall Keneipp, Summit Blue Consulting, 2008, 7). Recently, utilities have begun tests that include the value of other societal benefits such as environmental externalities—most commonly in the form of assessing costs associated with pollution mitigation. The addition of this element to the equation would only tip the balance further toward EE/DSM rather than building peaking power plants. This Societal Cost (SC) Test is used by utilities in states across the country (Keneipp, Summit Blue, 2008).

In "Negawatts: Twelve transitions, eight improvements and one distraction," Amory Lovins seminal reportage on the negation of energy use, or "negawatts," Lovins outlined the many milestones and challenges in the development of energy efficiency practices and standards. Advances and setbacks in content, scope, technology, and regulation have been driven by different motivations over the first twenty years. These issues affected how EE/DSM programs were designed over the first phase of DSM integration into energy policy and investments (Amory Lovins, Rocky Mountain Institute, Energy Policy, 1996, 331-343).

> Utilities in the 1970s tended to decide what efficiency improvements their customers should have, then deliver them directly ("We will wrap your water heater"). Utilities in the 1980s tended to let customers choose and buy the equipment, but still wanted to decide themselves what choices would be rewarded ("We will rebate each electronic ballast"). The best utilities in the 1990s build on the considerable achievements and flexibility of classical implementation programs: targeted and general information, rebates throughout the value chain (designer, manufacturer, wholesaler, retailer, installer) and for scrappage, rewards for beating minimum standards, concessionary loans, gifts, "golden carrot" contests to bring innovations to market sooner, equipment leasing and third-party investments such as performance contracts (Lovins, 1996, 332).

In the mid-1990s energy conservation efforts began expanding, supported by federal, state, and utility-driven initiatives. At its apex, DSM programs numbered in the thousands and utilities in over half the United States were adopting such practices and programs. However, the late 1990s saw a massive trend, began by the Federal Energy Regulatory Commission (FERC), toward electricity deregulation that pushed advances in DSM advances back a few years nationally.

Deregulation had a significant impact on the development of DSM activity in the United States because utilities cut back programs and delayed progress across the country for fear that deregulation would destroy the energy market. Deregulation policies broke up vertically integrated utility companies that operated across the whole life cycle of electricity, from generation to transmission to distribution to customer premise (property). Deregulated policy allows private power plants to sell power at the highest price they can charge and allows customers to "choose" their supplier. This is a big change from the 100-year history of cost-of-service regulated rates with prices mostly set by market-based prices (Slocum, 2008, 1). The new model removed the key element of the old model: a direct tie to costs, plus a reasonable, regulated profit. Deregulation allows plants to charge the highest price the market can bear. After the initial fears that deregulation would destroy the energy market subsided, programs have returned to wide scale deployment, in the past few years.

According to the Electric Power Research Institute (EPRI), achievable savings are far greater than previously supposed, and there is no hard "cap" on achievable market-based savings. In the 21st century, the discussion of best practices has shifted from applying scattershot programs across customer bases to synchronization of whole system designs and establishing a policy framework that supports market transformation (EPRI Energy Efficiency and Demand Response Potential Study, 2009, 3). Today, research has veered from the purely policy, technical, and market-based discussion and into social sciences as markets grapple with the core challenge addressed in this report, to wit, how a utility can increase its customer participation, account for persistence of savings, and ultimately achieve higher participation rates and maximize energy efficiency at every customer premises (Lutzenhiser, 2009).

The dialogue has moved towards a framework where energy efficiency lies on a curve, ever increasing, but perhaps in a stepladder form, relying on multiple criteria that include policy, technical, and market-based solutions. In order to set the course for Market Transformation, the state of California adopted a Long-Term Energy Efficiency Plan under the supervision of the California Public Utility Commission.

CHALLENGES IN RESIDENTIAL ENERGY CONSUMPTION

The two most critical challenges in electricity are managing peak demand and pollution impacts. Additionally, ensuring that savings are persistent and changing customer behavior are often cited as integral to EE/DSM efforts. But peak demand and pollution impact are the two reasons cited by both AE and the state of California as the two most urgent issues. Ultimately, the key to successful EE/DSM program design is finding the right blend of technical, policy, and market based solutions that address *both* peak demand and pollution impacts. Energy efficiency, energy system management software, DR, and smart meters all address peak demand reduction and reducing pollution impacts. These issues are addressed in greater detail below.

Peak Demand

In June 2009 AE experienced its three highest peak demands over the span of six days, eclipsing the 2,600 MW threshold at one point, which was not anticipated until sometime between 2012-2014. AE has revised its load demand for 2020 based on summer 2009 data (AE Press Release, 2009). This means that AE will need to invest in more generation (which it is doing) and accelerate DR tools and EE/DSM programs to achieve greater peak demand reduction in addition to overall energy savings and conservation.

There are four options for a utility to meet growing peak demand: (1) build a peaking power plant, (2) increase energy efficiency, (3) offer distributed on-site generation, and (4) design and implementation of energy system tools.

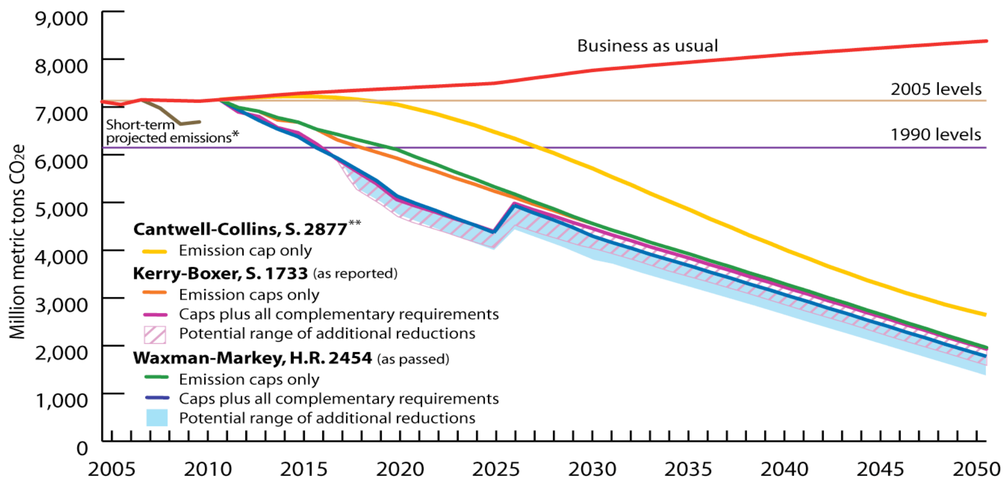
The costs of building peaking power plants include massive new construction costs; interest on those costs; installation and operation of new transmission lines; upsizing substations and distribution; the cost of water and energy to fuel the new nuclear power plant; pipelines and transfers; and subsequent pollution mitigation costs. The costs associated with increasing energy efficiency include sealing ducts and installing more insulation; energy management systems; efficient HVACs, light bulbs, and electronic appliances (the working parts of the home); and planting shade trees. Distributed generation costs include solar panels on roofs and inverters. Energy system tools require policy implementation for DR and new pricing models (soft costs).

The first option is the status quo, despite the significant costs. The other three, when combined, provide a robust response to the risks of electricity instability produced from peak demand. All the options have costs, however additional power plant construction may be delayed in the next 20 years by greater participation in EE/DSM programs and more investment to achieve the solution to twin challenges of peak demand and pollution reduction goals established by the Austin City Council.

Pollution Impact

If ultimately passed, carbon regulation will set a price on each ton of carbon dioxide (CO^2) emissions. The Waxman–Markey bill proposes a mandatory cap of carbon emissions on industrial producers and establishes a marketplace for the trading of unused CO^2 allowances. The Waxman–Markey bill is the most recent version of carbon regulations before Congress, and if it is passed into law in the result will be higher prices to produce energy for all utilities including AE because utilities are charged directly for their carbon emissions. These costs will be passed on to the consumer in some fashion. Figure 2.5 shows the current Cap and Trade proposal before the U.S. Senate in comparison to other proposals under discussion, namely a Cap and Dividend bill sponsored by Senators Collins and Cantwell. As the graph shows, Waxman–Markey under varying levels of regulation projects to more CO^2 reductions than the Collins-Cantwell bill.

Figure 2.5 Net Emission Reductions Under Cap-and-Trade Proposals in the 111th Congress, 2005–2050



Source: "Net Emissions Reductions." Climate Progress. Web. April 12, 2010. <http://climateprogress.org/2010/02/01/misguided-cap-and-divide-bill-by-cantwell-and-collins-is-neither-politically-nor-environmentally-viable/>.

As the cost of carbon is internalized, and the cost of power production increases more over time, EE becomes a more attractive option for utilities, including AE. California led the nation on this issue when it established carbon reduction as a mandatory requirement for utilities and a state-level cap-and-trade plan coordinated by the CPUC. There are other cap-and-trade plans developing in the United States. California's cap-and-trade plan is being integrated into the seven states of the Western Governors Association. This plan will be finalized and operational in 2012.

AE measures the incremental reduction of carbon emissions as a core mission of the utility operations, as it has done since the re-visioning of the Strategic Plan of 2003. Gellings, a leading DSM analyst, makes the connection between carbon reductions and the construction of new generation, "because DSM programs can postpone the need for new power plants, the costs and emissions associated with fossil-fueled electricity generation are avoided" (Gellings, 2006, 57).

While GHG reductions are a benefit from energy efficiency, Lutzenhiser, Stern, Wilhite et al. assert that there is a critical disconnect in the Climate Change–Energy Efficiency dynamic at the consumer choice level. "Fundamental policy frames that made sense for energy efficiency don't work for climate change." The mixed messages of save *energy, save money, and good for the environment* complicates communicating the benefits of energy efficiency (Lutzenhiser, Stern, Wilhite et al., 2009).

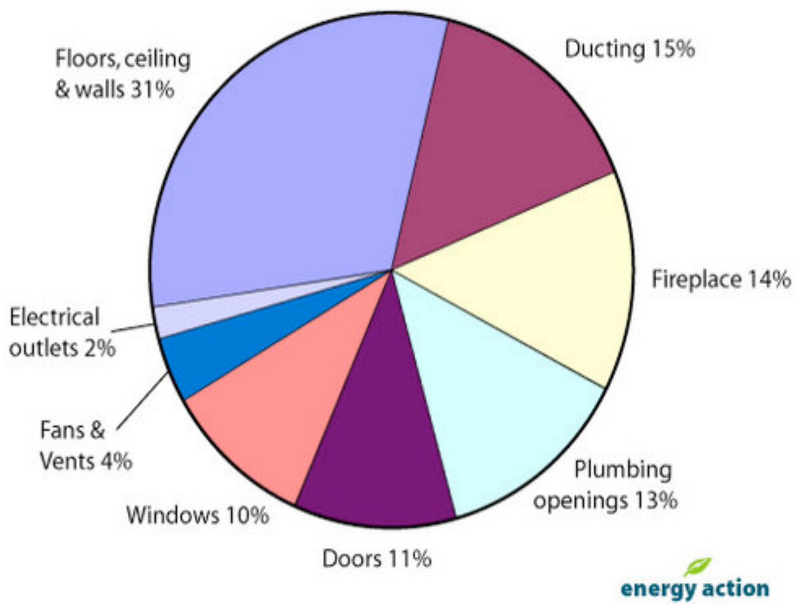
Of the four options to address peak demand, the challenge that utilities face is finding the right mixes of programs that also achieve verified greenhouse gas emissions reductions.

Improving Energy Efficiency

Market theory would suggest that utility, industrial, and manufacturing companies should have automatically achieved enormously profitable savings much earlier if decisions were made by sophisticated firms in a cost-conscious industry (Lovins, 1996). Lovins argued that the "USA has already misallocated, at marginal cost, a sum approaching $1 trillion alone to air conditioning equipment and power supplies to run it" (Lovins, 1996). In 1992 research led by Willett Kempton and Loren Lutzenhiser reported only 25–35% of U.S. residents used HVAC systems rationally. Most operated a thermostat based mainly on household schedules, folk theories about how air conditioners work, general strategic decisions for dealing with machinery, and complex personal belief systems about health and physiology, and even noise aversion. Lovins concluded that real consumers' ignorance of the operations of HVAC systems is a major barrier to greater savings. Engineering and economic models of energy-using behavior need further research, and "not giving at least equal weight to the complexities of human behavior wastes opportunities and risks unpleasant surprises" (Lovins, 1996).

There are multiple methods of measuring the condition of a home's energy consumption, and determining improvements can be achieved by knowing basic information about the building structure. Figure 2.6 shows the eight main ways that homes lose energy, according to the U.S. Department of Energy. "Homes" applies to all residential units. Floors, ceiling and walls account for 31% of total energy loss of homes. Energy loss through doors and windows each account for 11% loss. HVAC issues affecting ducts, and fans & vents mostly, account for 19%. These systems on average account for 15% and 4% of energy loss in homes, respectively. Areas where fireplaces are standard account for roughly 14% of energy losses. Plumbing leak-sealing and water management can improve energy efficiency by an average of 13%, while providing the twin benefit of water conservation. And electrical outlets can be improved to save about 2% energy consumption (US DOE Energy Efficiency and Renewable Energy Division, 2008). These numbers affect the standard building envelope, and do not factor in higher-series appliances, smart grid technologies on the utility or customer side, or on-site energy generation.

Figure 2.6 Energy Inefficiency in Households



Source: Energy Action Website, Data retrieved from U.S. Department of Energy Efficiency and Renewable Energy Division, 2008.

In order to assess needed improvements, an energy audit is the standard first step to achieving greater EE for a building due to the demonstrably significant savings at a relatively low cost to the homeowner. Simply tightening up the building envelope is not hard and provides immediate savings. A common-sense first step of improving home EE is by identifying where your particular home typically loses energy. This process is the energy audit, often done by a professional but which a layman can also do. Particularly expansion foam and caulking around leaky spots, window and door-stripping, and improved insulation offer an immediate payback that can pay for itself in a matter of months.

Shifting Consumer Behavior

To address the existing market failures and gaps in EE/DSM, academic and government researchers have increasingly moved from a narrowly technical analysis and delved into social sciences previously not touched on in the energy field: behavioral economics, cultural anthropology, social networking theory, sociology of lifestyles, game theory, and cultural segmentation to name a few. (Loren Lutzenhiser, Portland State University, 2009, 5). Lutzenhiser suggests that assumptions of how consumers *should* respond must be fettered out, and research must be expanded on unknown impacts.

Decisional analysis indicates that there are two phases to customer participation: a drawn-out pre-action phase and an action phase. In the pre-action phase, consumers are confronted by direct contact information, indirect influences, and market influences. Direct contact info includes energy audits, direct marketing, technical information and monthly energy bills. Indirect influence includes the presence of news, advertisements, easy-to-use utility web portals, bill inserts, kiosks, and public events. Market influences instruct users on financial incentives, codes and standards, and technical information (Lutzenhiser, 1993, Lutzenhiser et al., 2009). What research has shown to date is that consumer behavior shows weak connections to theory and research, and policy implementation plans and formal documents do not inherently lead to customer awareness or knowledge of EE/DSM (Lutzenhiser, 1993, Vine, 2009).

To address this disconnect, in 2004 the California Institute on Energy Efficiency (CIEE) and CPUC collaborated on a series of nine white papers that established some of the parameters from which to analyze barriers to more customer participation (Edward Vine, CIEE, 2005). Namely¸ the research focused on consumer decision-making and behavior and the impact that societal, environmental, and regulatory pressures have on how consumers behave and develop markets (Edward Vine, CIEE, 2009). These reports filled a void of information in the California energy regime's development of advanced market analysis and subsequently informed policy recommendations in developing and evaluating the California EE/DSM Market Transformation policy framework found in the Long-Term Energy Efficiency Strategic Plan.

Lutzenhiser compiled a meta-analysis of social science research on behavioral assumptions underlying policies on residential energy efficiency in California. Social and behavioral factors (Lutzenhiser, 1993), climate and social systems (Wilhite et al., 2001), progress toward integrated models (Kiersteads, 2006), residential decision-making (Wilson & Dowlatabadi, 2007) and psychology and environmentally significant behavior (Stern, 2008) were evaluated (Lutzenhiser, CPUC, "California Residential Energy Efficiency Participation," 2009). The research highlighted key findings that can inform future marketing/advertising, education, and outreach efforts to increase participation. The researchers concluded that an EE/DSM policy framework should ideally be established around these findings on how consumers would respond best to EE/DSM program participation:

- Focus of programs should be on *people* as opposed to devices.
- Groups, not individuals, use energy.
- Consumption and conservation are highly varied; no average/typical consumers,
- Lifestyles, cultures and social norms are involved.
- Customers are aware that the whole system is characterized by complexity that goes beyond arrays of devices.

The barriers that must be overcome include:

- Choices are infrequent and decisions are not carefully considered.
- Everything *but* costs and benefits are important to consumers.
- Little evidence of information seeking.

Attitudes and values are often trumped by context and restraints (Stern, 2008). To solve the consumer behavior puzzle, to date there are no clear agreement among models, theories, and perspectives, and mass information is not very effective. Little progress toward integration has been made, and that data has been scattered and uneven in findings (Keirstead, 2006).

The California team that is designing the Market Transformation framework decided to establish more research and development into preparing programs that address the axioms above – a host of research is under way in this field, and the solutions are not yet defined. Psychoanalysis for a whole service territory is not germane to this topic, empirical information is useful, and data that is steeped in regulatory guidance & policy documents, informational interview. Critical reviews, database searches and expert summaries can offer possibilities to innovation through experimental and pilot approaches (Lutzenhiser and Vine, CIEE, 2009).

Lutzenhiser, Vine et al. explain that behavior change and consumer choice research are new territory for energy policy. To better equip decision-makers with the right tools, we need to better understand the fundamental dynamics of consumer behavior, how choices upstream from consumers affect behavior and choice, and determine how different segments of customers approach household choices (Lutzenhiser, 2009). Once this is established, consumers may better understand options for improving their home energy efficiency.

TECHNICAL AND MARKET-BASED POTENTIAL FOR CONSERVATION/DSM

The technical potential for savings is based on program availability, and is distinguished from pure program potential by limitations such as customer participation, program funding, staff and resource constraints, and shifting priorities in light of new regulations and overall market evolution.

The U.S. Department of Energy's 2006 Annual Energy Outlook projected that 2010's potential energy savings could reach 47.4 Terawatts per hour in the residential sector, and 16.1 Gigawatts in peak demand reductions, through improved air conditioning systems, green building codes, and efficient lighting and appliances (DOE, 2006). Impacts are based on direct load control and energy efficiency programs.

A review of the most successful state and utility energy efficiency programs shows that savings can be achieved in practice, and in fact actual savings *today* are comparable to the market-based savings levels that were projected in the mid-1990s (Gellings et al., EPRI, 2006). Gellings and associates Greg Wikler and Debyani Ghost produced a meta-analysis of 11 reports on end-use potential for energy efficiency-driven savings across three categories – technical, economic and achievable potential. From 2000 to 2003, the programs reviewed showed 33% technical potential savings, 20% economic potential savings, and 24% achievable potential savings. The findings for efficiency potential in the form of energy savings in Terawatt hours and demand savings in Gigawatts are shown in the table below.

Table 2.1 Technical End-Use Efficiency Potential in the Residential Sector

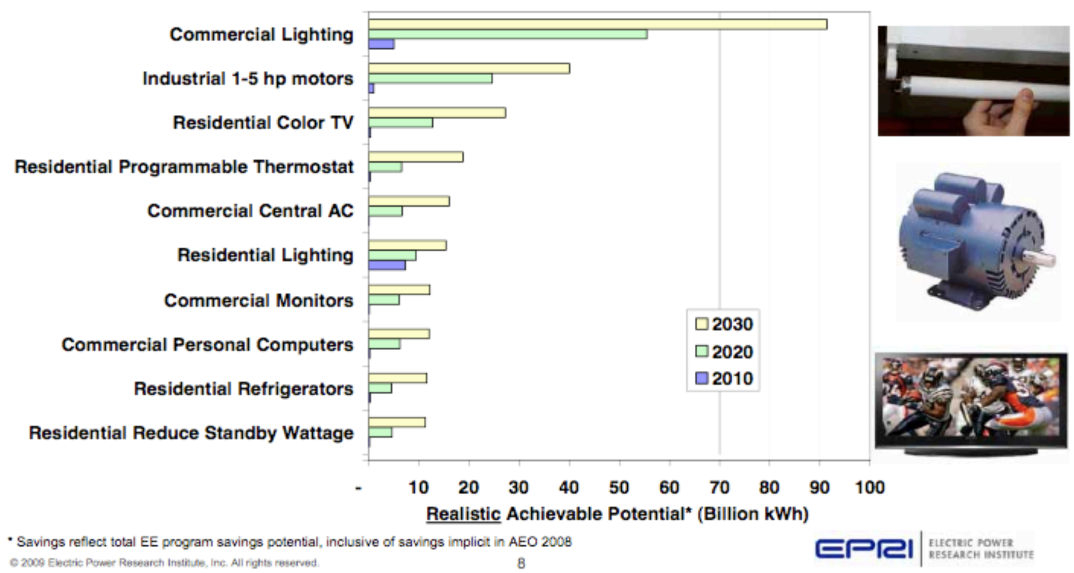
Energy Savings Potential in 2010 (TWh)		Demand Savings Potential in 2010 (GW)	
New Construction	10.6	Air Conditioning Direct Load Control	5.5
Audits/ Weatherization	10.3	Air Conditioning EE	3.2
Lighting	6.3	Water Heating Direct Load Control	2.4
Energy Star Appliances	6.3	New Construction	1.4
HVAC Tune-up/ Maintenance	4.7	Audits/ Weatherization	1.3
Air Conditioning EE	4.5	Lighting EE	0.7
Refrigerators EE	2.0	Appliance Removal	0.7
Other Equipment EE	1.8	Time-Based Tariffs	0.3
Fans EE	0.9	Energy Star Appliances	0.2
Total Residential	47.4	Fans EE	0.2
Source: Gellings et al, 2006		Other Equipments EE	0.2
		Total Residential	16.1

Source: Electric Power Research Institute (EPRI), Gellings et. Al, 2006

Multiple policy interventions were required to get to the point where these savings levels could be what they are, and Gellings et al. argue for asserting greater pressure on policymakers to promote the potential for energy reduction based on the success of prior EE interventions (Gellings et al, 1993).

In 2009 EPRI reevaluated the energy savings potential including evaluation for market-based adoption factors, and assuming that all customers that can replace existing inefficient appliances do shift to more efficient alternatives. The findings showed potential for 2010, 2020, and 2030. Residential opportunities show greatest potential for energy efficiency savings in lighting, televisions (an item not even on most lists ten years ago, before the widespread adoption of flatscreen LCD and plasma televisions), and DR systems such as programmable thermostats.

Figure 2.7 Top 10 Energy Savings—Achievable Potential

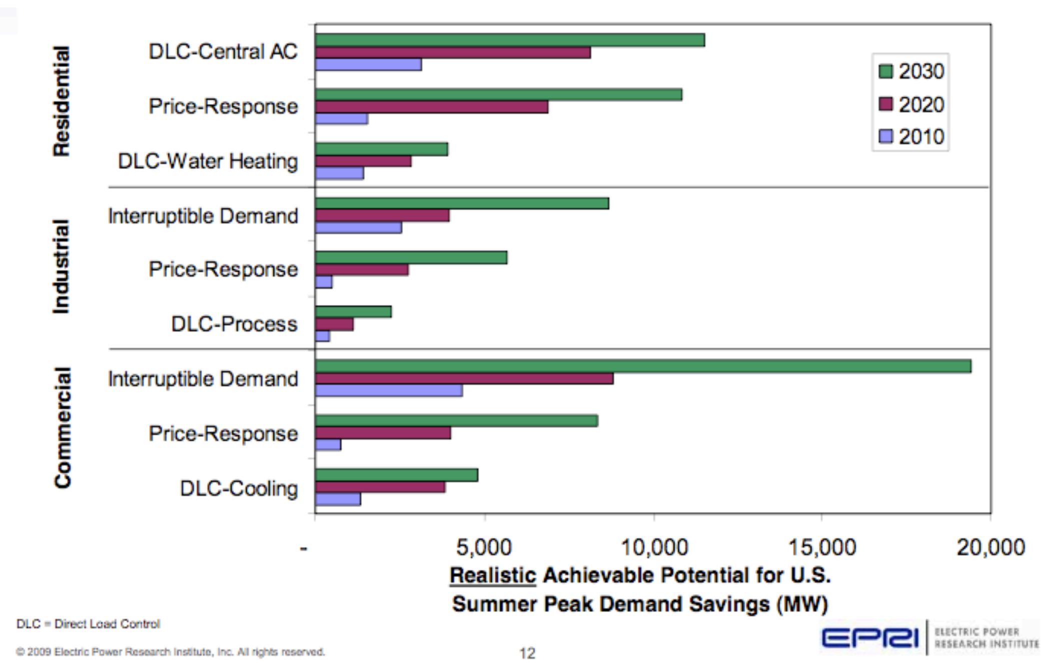


Source: Electric Power Research Institute (EPRI), Energy Efficiency and Demand Reduction Potential: Capturing Potential, Creating New Opportunities, 2009, 8.

EPRI's assessment of U.S. Peak Demand Reduction finds particularly high potential in direct load control programs for Air Conditioning (AC) and Water Heating and Price-Response programs where energy use is connected to price signals on the energy market. These programs can automatically curtail loads or inform customers of the cost of energy so the customer may make the decision.

The priorities for peak demand reduction are different from overall energy savings. Active and direct load control initiatives show the greatest peak demand reduction potential, according to EPRI's market-based potential study in 2009 (EPRI, 2009, 15). For concerns on reliability and quality of electricity, these programs are particularly important at meters and thermostats that feed multiple residential units.

Figure 2.8 U.S. Peak Demand Reduction Potential



Source: EPRI U.S. Energy Efficiency and Demand Reduction Potential Study, 2009, 12

Based on analysis of the combination of peak demand and energy savings reductions estimates by EPRI, Diane Moody, Director of Statistical Analysis for the American Public Power Association (APPA), reported that efficiency programs could realistically reduce electricity growth rate from its current rate of 1.07% per year, to 0.83% per year. With enhanced programs and wider acceptance of conservation programs, the growth rate of energy consumption could fall to 0.68% growth per year (Moody, Public Power, 2009). EE/DSM research and implementation can be integrated into the existing energy regime without disrupting the economy and infrastructure or drastically altering standards of living (Jordan, 1981; Hanson et al., 1991).

Demand Response Potential

A balance between supply and demand is essential to ensure electrical system stability and reliability. This can be achieved either by Supply-Side Management (SSM), through the addition of supply when demand is high, or by DSM, by curtailing system demand when supply availability is lower (Haines et al., 1991; Sains, 2004). For short periods of time, such as peak demand, SSM is not efficient, as it takes a long time for power plants to ramp-up production, or cost-effective, as the costs associated with installing peaking power plants and of buying peak power showed, DSM can be implemented immediately and in more economic ways, particularly through the establishment of energy system tools that more accurately account for the cost of electricity, reflected by the cost of peak power, and the incentives to participate in DR programs (Sains, 2004). Sains notes in his report "Conservation v. Generation: The Significance of DSM" that one unit of electricity saved at the consumer end is worth 1.10 units saved at the generator end. Studies by Sains report that with universal DSM application the United States could lower peak energy demand by at least 30,000 MW, or roughly 250 peaking plants.

CONCLUDING ANALYSIS

The most potential, according to EPRI's analysis, lies in Advanced DSM techniques such as demand/load response programs that use dynamic pricing and real-time information to shift and reschedule energy generation, distribution, and finally consumption (Sains, 2004). Costs of DSM include regular operations and maintenance costs, expenditure for incentives such as rebate or loan programs, physical infrastructure, data management, equipment and technology and other miscellaneous costs. Benefits of DSM to consumers, enterprises, utilities, and society as a whole include reduction in customer energy bills; reduction in heavy investments in new power plants, transmission, and distribution networks; lessened grid congestion; stimulation of economic development; and creation of long-term jobs due to innovations and new technologies brought to market (Sains, 2004).

Increasingly, utility companies and state governments are interested in using price signals and alternative rate designs to stimulate greater naturally occurring energy efficiency, and these efforts compliment DSM initiatives (Gellings et al., 2006). From 2003 to 2004 the California Public Utility Commission (CPUC) sponsored the California Statewide Pricing Pilot Program which was a dynamic pricing experiment employed to measure consumer response to pricing signals to reduce energy use, and participate to cycling off HVAC systems during periods of peak demand. Installation of smart meters and consumer education resulted in peak-use reductions between 5 and 27 percent. A report from The Edison Foundation in 2005 suggested that dynamic price plans would inform customers of peak use and costs. In this case, participants benefitted from the warning about energy costs at peak hours (Edison Institute, 2005).

Residential energy customers have a multitude of options for participating in energy efficiency opportunities. The national standards, energy audits, incentives offered to end-users, ratcheting of building codes, state-level laws, regulations, programs and technical support, and effective marketing and outreach all play a part as tools available to mitigate and adapt to energy demands for the future. There is significant room for growth in understanding consumer behavior; however wide scale adoption of CFL bulbs offers hope that more research in this field will lead to "a better handle on behavior and consumers in a context of complexity and evolving systems" (Lutzenhiser, 2009). Different regulatory regimes affect utilities in how they market programs, and invest in efficiency – decoupling the market shows a direct correlation with greater efficiency based on the energy efficiency scorecard for ACEEE – 4 of the top 5 grades went to states that utilized decoupling.

In order to achieve greater efficiency, synchronizing efforts across the market and market-players is preferable; however California has that benefit while AE does not. Regardless, synchronization efforts across departments or utilities will still require a seamless unified framework to operate under. Policy tools provide a wide scale, broad-based approach to energy savings across numerous facets of operations, and covering many realms—technical, market-based, political and regulatory. In order for consumer behavior to adapt, the message to the consumer must be synergistic and communicated in cross-agency and/or cross-departmental coordination across a diverse array of media, always consistent with the overall mission of energy savings, benefit to the consumer, reduced carbon emissions and promoting a sustainable energy future. When these forces merge, they establish the potential for market transformation to optimal efficiency of energy use.

To develop an optimal policy framework and policy tools, it is important to understand the best practices in increasing customer participation. Chapter 3 weighs the EE/DSM policy frameworks used in California and Austin, Texas, then compares the relative efficacy of their EE/DSM programs. I then present a summary of the four elements that are required to develop a Market Transformation policy framework, and the seven policy tools that can be used to achieve the greatest reduction in peak demand, pollution impacts, and persistent energy savings based on literature. Chapter 3 uses existing best practices to illustrate components of market transformation.

Chapter 3. Best Practices in Increasing Customer Participation

The goal of this chapter is to define and review the best practices in EE/DSM programs. As discussed in Chapter 2, EE/DSM programs have significant potential to achieve greater savings. AE's EE/DSM programs operate *without* the built-in benefit of decoupling that California utilities have, and the common thought is that this limits AE's opportunity to achieve optimal savings and cost-effectiveness. There are three sections in this chapter. The first section highlights the policy tools and market barriers in place for the three most prolific programs in California, Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas and Electric (SDG&E), and the successful EE/DSM program operated by AE in Texas. The second section compares peak demand savings, overall energy savings, and CO^2 emissions reductions from 2006 to 2008 for AE, and the three California utilities, PG&E, SCE, and SDG&E. The third section details the four elements of a policy framework that enable market transformation. The fourth section outlines the seven policy tools that can be used to shift markets to greater efficiency. The third and fourth sections include examples of best practices in enacting these four policies and seven policy tools. This chapter utilizes policy documents, program information (program implementation plans, utility masterplans related to generation and specifically energy efficiency or DSM, and program evaluations), and data on annual energy efficiency progress available through the utilities and CPUC.

Comparing AE to California's Best

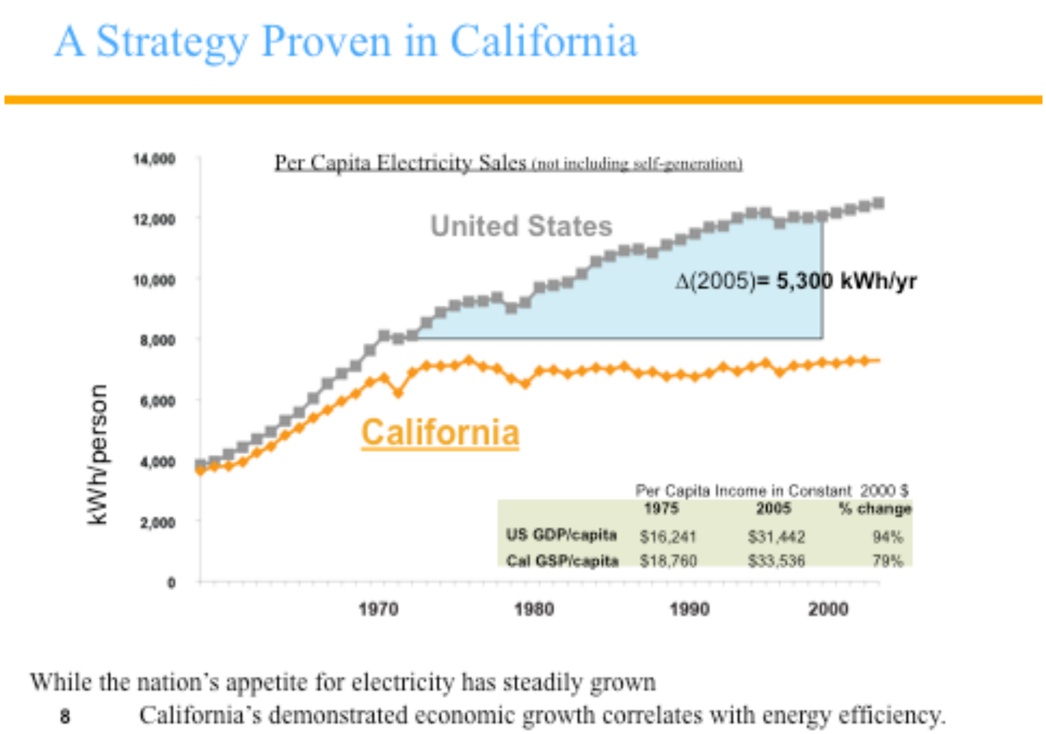
As Ronald Brownstein opined in his article "The California Experiment," the secret to California's success in achieving significant energy savings, reducing carbon emissions, establishing an industry cluster around clean energy solutions, and shifting into renewables was a byproduct of its conservation efforts in the 1970s (Brownstein, The Atlantic, 2009). Leading with efficiency standards created a market of more efficient utilities, appliances, and working parts of the home. Those standards led to greater regulation and increasing restrictions. In essence, this continuously improving system developed constituencies in the energy, environment, manufacturing, contracting, and services industries. California became reliant on the assertion that decoupling rendered utilities disinterested in increasing energy consumption, and EE/DSM investment and implementation would continue to grow.

Over the years, successive CPUC decisions approved by the legislative and executive branches have cultivated a policy framework to motivate the utilities operating in California to develop and continuously improve energy efficiency programs (Laitner, ACEEE, 2009).

Policies such as building codes, appliance standards, and utility DSM programs helped to reduce residential energy use. California residences consume less energy than typical U.S residences due in large part to structural factors such as less floor area per household, greater reliance on natural gas, and the significantly milder heating season compared to the national average. While California heating intensity (in energy/square meter/degree day) was higher than for the rest of the country in 1975, the gap was narrowed by 1990.

From initial HVAC and refrigerator efficiency standards in the 1970s to today, the average consumption per customer has leveled off at 7,600 kWh/person, almost half the national average for the past 35 years. Figure 3.1 shows an average Californian's consumption compared to the national average. In the residential sector, final energy demand per household in California declined 27% during 1970-93. For appliances, changes in appliance unit consumption over time, resulting from turnover of the stock, indicate faster decline in unit energy consumptions than for the United States. (ACEEE, Energy Efficiency in California: A Historical Analysis, 2009). Declining energy intensity was due to both structural effects (e.g., shifts in fuel shares and falling occupancy levels) and efficiency effects (e.g., appliance efficiency and building thermal integrity).

Figure 3.1 Energy Consumption in California and Nationally, 1975–2005



Source: CPUC Legislative Briefing, 2009, 8.

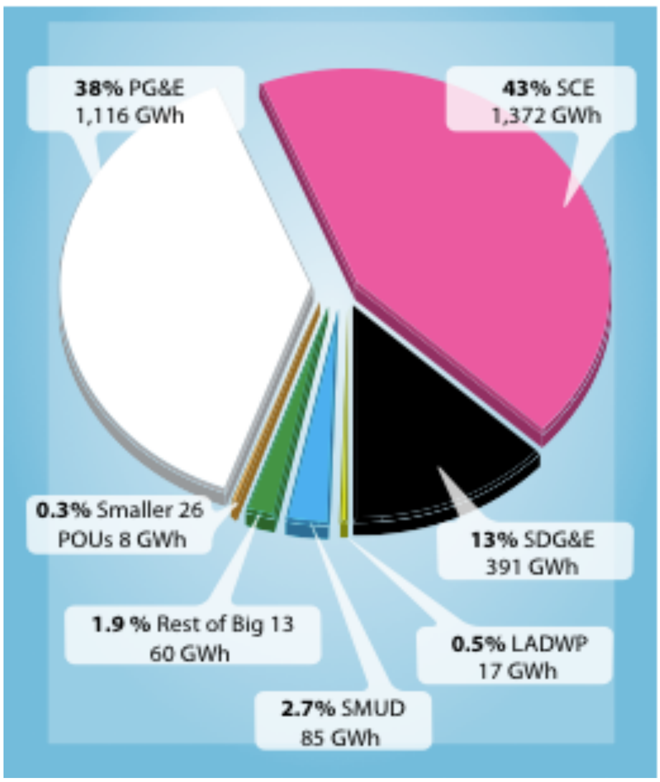
California's savings are achievable because it set out to structurally alter how people pay for energy by decoupling the markets. Since then, a market has developed in California for energy conservation and efficiency, first through industry and state codes and standards, then through pricing carbon emissions, and more recently through demand response programs offered by utilities. In order to attain aggressive energy efficiency standards, California's energy regime is seeking ways to reach many more customers with EE/DSM programs and affect energy consumption modifications to all segments of the population. This is the ultimate goal of market transformation, which the California energy regime funded and established via the California Long-Term Energy Efficiency Strategic Plan.

California's Reduction in Consumption, 1970s to 2000s

To assess AE's success today in achieving overall energy efficiency goals, it is best to compare the utility to other utilities that are considered leaders in EE/DSM. This section provides a comparison of AE's aggregate EE/DSM programs and the three California utilities that receive recognition for advanced EE/DSM programs. This section reviews the reported peak demand reduction, energy savings, and CO^2 reductions from 2006 to 2008 for the four utilities. The findings must also be put in perspective. As mentioned in Chapter 1, the average energy consumption per person in California has essentially leveled off since the late 1970s while Texas consumption per person has skyrocketed and now leads the nation in overall consumption. By operating in a more efficient energy system, the difference between potential savings and current savings is significantly smaller than Texas'. With that said, comparing AE's overall savings since 1982 to present is a relatively accurate depiction of savings since the history of energy conservation efforts dates back to nearly the same period that California initiated EE.

According to the California Energy Commission's (CEC) *California Energy Demand* Report, the overall residential energy consumption for the State of California in 2005 was 87,000 GWh (CEC Integrated Energy Policy Report, 2007, 78). The combined energy savings of public and private utilities in California for that same year totaled 3,049 GWh, which equates to 3.45% energy savings (California Energy Commission, 2007 Integrated Energy Policy Report, 78). SCE, PG&E and SDG&E provided the lion's share of energy savings, roughly *94% of total energy savings in California in 2005*. The CEC Electricity Consumption Data Management System looks at the electricity consumption by service territory. Based on reported and verified savings for the four ISOs provided on the CPUC's Energy Efficiency Groupware Application (EEGA) website, Figure 3.2 reflects the shares of electric energy savings in California for 2007.

Figure 3.2 Shares of Electric Energy Savings in California, 2007



Source: California Energy Commission, 2007 Integrated Energy Policy Report, 78, Online: http://www.energy.ca.gov/2007_energypolicy/, Accessed: May 12, 2010.

Comparison of the Efficacy of Four Utility EE/DSM Portfolios

With PG&E, SCE, and SDG&E established as the benchmarks to review AE's relative success with EE/DSM programs, the following three tables compare AE's implementation of EE/DSM in peak demand savings, overall energy savings, carbon emission reductions, and overall costs for the most recent reporting cycle, 2006 to 2008. As discussed in Chapters 1 and 2, peak demand reductions are the first priority of EE/DSM programs, before energy savings and CO^2 reductions, because reducing peak demand avoids the exorbitant costs associated with building new peaking power plants. To account for the contrast in size of the three California utilities with AE's relatively small service territory, Table 3.1, Peak Demand Savings, and Table 3.2, Overall Energy Savings, are factored into the comparison. The percentage of savings from residential EE/DSM programs per annum show a fluctuation in the proportion of savings from residential, commercial, and green-building programs. In Table 3.3, Reported CO^2 Emissions Reductions, the overall expenditures of the programs and their total resource costs (TRC provide an impression of the cost-effectiveness of the respective programs,

Table 3.1 Reported Peak Demand Reductions from DSM Programs, 2006–2008

Utility	Year	Customer Accounts (Est. Meters)	Demand Reduction (Peak MW)	Peak Avoided Per Customer (Peak kW)	% from Residential (MW from Residential)
AE	2008	390,000	64 MW	0.16	39.4% (25.3 MW)
AE	2007	385,000	65 MW	0.17	38.5% (25.2 MW)
AE	2006	380,000	57 MW	0.15	37% (24.2 MW)
PGE	2008	5,100,000	458 MW	0.09	29% (132.5 MW)
PGE	2007	5,000,000	298 MW	0.06	32% (96.3 MW)
PGE	2006	4,900,000	139 MW	0.03	32% (45.7 MW)
SCE	2008	4,900,000	329 MW	0.07	39% (134 MW)
SCE	2007	4,800,000	263 MW	0.06	59% (158 MW)
SCE	2006	4,700,000	138 MW	0.03	31.6% (42.4 MW)
SDGE	2008	1,300,000	69 MW	0.05	33.1% (20 MW)
SDGE	2007	1,200,000	73 MW	0.06	41% (26 MW)
SDGE	2006	1,100,000	26 MW	0.02	31.3% (10 MW)

Sources: CPUC Annual DSM Reports, 2006-2008, AE DSM Performance Review Report, 2006-2008

Table 3.1 shows that AE achieved the highest ratio of peak avoided per customer in every year from 2006 to 2008. This success is all the more startling when compared to SDG&E's 26 peak MW avoided in 2006, which represents less than half of AE's peak demand reduction over a customer base three times the size of AE's. Limitations for the three California utilities may include that the service areas are exponentially larger than AE's territory, since reaching all customers across such a large area is more difficult. The fluctuation of percentage of peak demand savings that comes from residential in California is much greater than the constant portion of residential peak demand savings in Austin. This table suggests a counterpoint to the notion that the Texas market currently has strong barriers to actually achieving significant peak demand reductions. However, even further savings are certainly possible with a more dynamic rate structure that accounts for the real costs associated with increasing or decreasing energy purchase costs on the Texas wholesale market. Data from investor-owned utilities (IOU) in Texas suggest that further significant demand reductions are achievable. For example, according to a September 2008 report presented to the Texas Senate by the Association of Electric Companies of Texas, energy efficiency programs hosted by IOUs in Texas achieved approximately 170 MW of peak demand reduction in 2007 alone, exceeding their goals by 23 percent.

Table 3.2 shows that AE's achievements in overall energy savings fall in the middle with California's leaders in energy savings. The savings for AE have grown progressively over time, in part because of the success of AE's Green Building Code. In fact, California had a long head start developing firm ratcheting standards for appliance and home operating equipment efficiency (e.g., HVAC and duct systems). The savings per customer show generally steady progress across all four utilities. AE experiences the same fluctuation in percentage of GWh coming from residential as the California IOUs.

Table 3.2 Reported Overall Energy Savings from DSM Programs, 2006–2008

Utility	Year	Customer Accounts (Est. Meters)	Energy Savings (net annual GWh)	Energy Savings Per Customer (MWh)	% from Residential (GWh from Residential)
AE	2008	390,000	133 GWh	0.34	32.3% (42.8 GWh)
AE	2007	385,000	119 GWh	0.31	20% (25 GWh)
AE	2006	380,000	92 GWh	0.24	29% (20 GWh)
PGE	2008	5,100,000	2,838 GWh	0.55	36.3% (1,030 GWh)
PGE	2007	5,000,000	1,824 GWh	0.37	41.2% (751 GWh)
PGE	2006	4,900,000	782 GWh	0.16	40% (312 GWh)
SCE	2008	4,900,000	1,638 GWh	0.33	51.5% (871 GWh)
SCE	2007	4,800,000	1,574 GWh	0.33	67.5% (1,099 GWh)
SCE	2006	4,700,000	834 GWh	0.18	46.1% (368 GWh)
SDGE	2008	1,300,000	354 GWh	0.27	36% (127 GWh)
SDGE	2007	1,200,000	372 GWh	0.31	51% (189 GWh)
SDGE	2006	1,100,000	171 GWh	0.16	33.7% (58 GWh)

Sources: CPUC Annual DSM Reports, 2006-2008, AE DSM Performance Review Report, 2006-2008

Avoided Carbon Dioxide emissions achieved through EE/DSM programs are directly linked to overall energy savings, and as such, national energy efficiency standards like DOE's alliance with industry on the Energy Star program has resulted in successful deployment of millions of CFL bulbs, incentives to invest in energy efficiency appliances, and avoided energy consumption through ratcheting standards.

Table 3.3 shows the three major California utilities exhibited a new commitment to tackle energy efficiency through significant new expenditures to operate EE/DSM programs in 2007 and 2008. This new spending was in line with California's program to achieve the goals established in its long-term state energy efficiency goals. This process began in the 2003-2005 reporting cycle and has recently been expanded for the 2010-2012 reporting cycle. According to the CPUC, each utility is expected to spend more than double what was spent on EE/DSM programs in the 2006-2008 program cycle.

Table 3.3 Reported CO^2 Emissions Reductions, Expenditures and Total Resource Costs, 2006–2008

Utility	Year	Customer Accounts (Est. Meters)	CO^2 Emission Reductions (Tons)	Annual Expenditures ($)	Total Resource Cost Ratio
AE	2008	390,000	85,500	17,673,110	2.35
AE	2007	385,000	78,512	17,527,356	1.93
AE	2006	380,000	69,438	16,329,238	1.89
PGE	2008	5,100,000	767,389	481,754,370	2.59
PGE	2007	5,000,000	686,243	298,065,479	2.74
PGE	2006	4,900,000	398,575	142,232,412	2.08
SCE	2008	4,900,000	934,262	300,615,304	2.05
SCE	2007	4,800,000	883,141	255,608,311	1.96
SCE	2006	4,700,000	417,539	131,190,408	2.39
SDGE	2008	1,300,000	207,306	215,159,482	1.91
SDGE	2007	1,200,000	222,499	104,500,206	2.53
SDGE	2006	1,100,000	97,319	34,209,244	2.06

Sources: CPUC Annual DSM Reports, 2006-2008, AE DSM Performance Review Report, 2006-2008

In total, AE's EE/DSM programs achieve greater peak demand on average than the California utilities, but AE has yet to surpass the California utilities in overall energy savings and commitment to carbon emissions reductions. However, the TRC and significantly smaller allocation to annual EE/DSM expenditures for AE show that in some ways, the Texas utility has gotten more "bang for the buck." For most years, all four utilities garnered about a third of its energy savings and peak demand savings from residential EE/DSM programs, and AE showed a slightly higher ratio of residential savings compared to commercial and new building than the three California utilities.

Best Practice Implementation of Demand Response in California

Another utility that offers a relative comparison to AE is the Sacramento Municipal Utility District (SMUD). SMUD is comparable to AE in size, organizational structure, and prioritization of EE/DSM. SMUD has also received relatively comparable accolades and national recognition. SMUD has used a unique approach to reaching as many customer segments as possible to participate in DR programs. With 11 Demand

Response programs based on customer class and income there is little wonder why customer uptake and participation is high: there is "something for everyone," or as Brownstein says, SMUD "attacks the problem from all angles—[programs] might be implemented in different ways, but their basic principles can be applied everywhere." SMUD's dynamic pricing options utilize critical peak pricing, time-of-use pricing, and real-time pricing. Furthermore, SMUD offers eight Residential Energy Efficiency Upgrade programs, and Energy Star programs, not to mention various financing models for distributed generation.

SMUD took the approach of attacking the energy/climate/environment/economy imperative from all directions, increasing the odds that customers may find comfort or a good deal with one program out of a variety of programs, and then perhaps participate in further programs. Karl Rabago, Vice President for Distributed Energy Services at AE calls this approach the "Silver Buckshot" approach to reducing peak demand. SMUD's dynamic array of DR programs is in sharp contrast to AE's single Power Savers program (Power Partner for residential) and AE can review these programs and how they were formulated, to develop a more clear understanding of the relative merits and weaknesses of such accelerated DR rollout. A business model that mimics decoupling would offer more incentive to AE to develop more DR programs.

Customer outreach and marketing of programs is critical to SMUD's EE/DSM program successes. SMUD provides an Energy Dictionary to facilitate customer awareness online and a popular online tutorial directly linked to its website, with links to external websites designed to facilitate customer comfort with EE/DSM and expand energy savings opportunities. One such example is the Flex Your Power program. SMUD has attempted to consolidate as much information in one source (its website), so that the utility's efforts are buttressed by enormous amounts of publicly accessible information from the CPUC, California Energy Commission (CEC), and California Institute on Energy and Environment (CIEE).

The data reported in this section establishes that AE compares favorably to some of the more advanced EE/DSM programs in the United States, and has done so at considerably less cost than the California energy regime. AE's achievements to date have established that it is in a prime position to continue increasing its peak demand reductions, energy savings, and carbon emissions reductions. The AE Plan suggests a review of options to cost-effectively achieve 1000 MW of peak demand savings by 2020. The two concluding sections define the elements of a market transformation policy framework and the policy tools that push and pull consumers toward greater efficiency and more energy conscious decision-making.

MARKET TRANSFORMATION—AN ENABLING POLICY FRAMEWORK

This section details the elements of a policy framework that enables EE/DSM market transformation and includes instances where utilities, regulatory agencies, and coordinated efforts from market players and policymakers have achieved the objectives of market transformation. An enabling policy framework for market transformation consists of:

1. Clear policy direction
2. Adequate financial incentives and funding
3. Robust program administration, evaluation and oversight
4. Firm ratcheting standards

These pillars of market transformation are analyzed in depth in the section below. Where utilities, state agencies and market-players have adopted these elements in real policies, this report offers examples of these best practices. The best practice examples that are listed under section headings are done so for their primary relation to that given element of market transformation. It should be noted that best practices described in this section in some cases exhibit multiple elements of the enabling policy framework and tools identified as staples of market transformation.

Clear Policy Direction

A clear policy direction establishes top priorities and goals for EE/DSM programs, then shifts program goals from individual benchmarks to a whole-system focus, and integrated resource management in general. In California there are a number of resource master plans, as well as regional initiatives that address the "Climate Imperative" (Skip Laitner, ACEEE, 2006). However, with various state agencies, municipalities, and regions addressing these issues, priorities become jumbled when dozens of market-players are operating "in silos without windows."

As an example of the need to establish a clear policy direction, the CPUC Integrated Energy Policy Report in 2007 established the directive to phase-in market transformation strategies by establishing a policy-enabling framework and policy tools by which to drastically reduce carbon emissions and achieve steep energy reduction goals established for 2020. What followed, however, was a directive by the State Attorney General that clarified this order, and required that all regional transportation, land use, water, and energy plans, as well as community master plans must address key issues of not only embedded energy use in all these systems, but also carbon reductions.

That 2007 CPUC Report stated that "a key element of the Long-Term Strategic Plan would be that it articulates how energy efficiency programs are or will be designed with the goal of transitioning to either the marketplace without ratepayer subsidies, or codes and standards" (CPUC Long-Term Energy Efficiency Strategic Plan, 2009, 3). By developing a review and analysis of energy efficiency potential and barriers to market adoption, the CPUC initiated the first phase to achieve exponentially higher peak demand savings and carbon emission reductions. The CPUC Long-Term Plan reviewed all customer classes and developed specific primary strategic objectives in each customer class. For the residential customer class, the objectives were framed as a vision statement, followed by a profile of the customer class. Strategic plans were set in place to achieve goals, with specific metrics outlined in quarterly progress reports. Strategic plans to achieve goals , included implementation plans for near-, mid- and long-term goals. These plans were reviewed and adopted by the State Legislature and now act as the cornerstone for policy movement forward for EE/DSM in California.

On April 8, 2010, the CPUC approved the 2010–2012 Utility Energy Efficiency Portfolios. The portfolios follow the policy recommendations made in the Long-Term Energy Efficiency Strategic Plan of 2009. The CPUC's goal is to save energy during peak usage hours of nearly 5,000 MW by 2013. The CPUC's cumulative energy savings goal is more than 23,000 GWh by 2013. These savings are projected to meet 55 percent to 59 percent of the utilities' incremental electric energy needs between 2004 and 2013 (CPUC IOU EE Portfolio Goals, 2010). The plan approves $3.1 billion dollars of ratepayer-supported energy efficiency programs for 2010–2012 to be administered by California's investor-owned utilities. The 2010–2012 Portfolios are expected to avoid the construction of three 500 MW power plants, save almost 7,000 GW hours of electricity, and avoid 3 million tons of greenhouse gas emissions (http://www.cpuc.ca.gov/PUC/energy/eep /goals.htm).

Specifically for residential programs, the Utility EE Portfolios launch the nation's largest home retrofit program under the Statewide Program for Residential Energy Efficiency (CalSPREE), targeting 20 percent savings for up to 130,000 homes over 2010–2012. This program uses tiered-incentive and reward for performance designed to leverage municipal funding programs, federal stimulus dollars, and related programs of the California Energy Commission (CPUC Energy Efficiency, 2010)

The 2010–2012 Utility EE Portfolios phase down subsidies for basic Compact Fluorescent Lamps (CFLs) and shift emphasis to advanced lighting programs, including specialty CFLs, solid-state lighting, and other technologies. The 2010–2012 Utility EE Portfolios also require the development of performance metrics to measure the progress of each program towards market transformation and achievement of the goals and strategies set forth in the California Long-Term Energy Efficiency Strategic Plan.

Adequate Financial Incentives & Funding

In California incentives and performance measures in a decoupled market have combined to persuade consumers to invest in EE/DSM programs, and California has nurtured the growing customers base of DSM program participants (CPUC EE Plan, 2009, 2). Effective financial incentives avoid "free-ridership," where customers would have invested in more efficient options without the financial incentive. Adequate financial models should address fundamental bias against efficiency among those that need the investments most (Vine 2005, Lutzenhiser, 2008, CPUC EE Plan, 2009, 21). Researchers are still developing methodologies to evaluate consumer behavior, and measure the relative impact of different frameworks to approach the issue.

A recent example of new adequate financial incentives is the U.S. Department of Energy's "Recovery Through Retrofit" program, which hopes to replicate some of the financial models and incentive packages that were recently awarded to utilities for competitive energy efficiency block grants (EECBGs). Awards were determined through a review of many factors, but were required to develop improved financial incentives and funding models. Secretary of Energy Steven A. Chu announced the 25 winners of a competitive block grant for energy efficiency in April 2010. This is the most recent effort at the national level to require utilities to (1) design financial models that can sustain their revenue streams over the long run by packaging incentives that show return on investments for utility and customer alike, and (2) develop a business model that can sustain financial incentives and fund programs after the "Recovery Through Retrofit" program ends (Recovery Through Retrofit Press Release, DOE, 2010). DOE hopes that this program can evaluate the 25 different financing and business models to identify best practices that are scalable and replicable across the country. These programs also offer unique opportunities to evaluate consumer choice patterns and consumer behavior once customers' buy-in to the programs. Austin Energy won $10.5 Million for this program, which will be reviewed in Chapter 4.

Another important example of incentives that facilitate program participation is the alignment of incentives with performance-based achievements such as bonuses for achieving benchmarks of energy savings per square foot of the residence (Keirstead, 2006, CPUC Integrated Energy Policy Report, 2009). Performance-based financial incentives usually complement existing programs where services such as customer education, access to information through a web portal, and technological assistance have already been established as services provided by the utility (CPUC EE Plan, 2009).

In order to examine the link between customer behavior and appropriate financial incentives, in 2004 the CIEE and CPUC collaborated on a series of 9 white papers addressing the issues of DSM and energy savings from the eyes of the end-use customer. These papers focused on research on consumer behavior and energy use and the interaction of societal, environmental, and regulatory pressures on how markets behave and develop, as opposed to maximizing technical benefits of programs.

Limitations to Current Financial Incentive Structures

The energy efficiency gap between potential and actual levels suggests that there are significant barriers to achieving sustainable adequate financing models that avoid free riders and actually attract new participants. Researchers observe that rebate programs do not fulfill the desired participation rates and concomitant energy savings because of three main limitations: (1) widespread irrational failure to adopt EE, (2) distrust and apathy, and (3) perceived "efficiency gap" and information deficit. (Lutzenhiser, 2009, 18).

One limitation exposed in the California Long-Term EE Strategic Plan is that more research must be done on negating "free-riding" by doing a better job of identifying the people that would participate, and matching services or programs to their needs. A significant point to remember in reviewing the literature is that no two people are the same, and as such no two energy consumers are incentivized to adopt conservation or DSM the same either. To wit, there is no "average" energy consumer (Lovins, 1996, Lutzenhiser, Wilhite, Stearn, et al., 2009).

Robust Program Administration, Evaluation and Oversight

Since EE/DSM programs are largely administered by utilities, state governments maintain primary responsibility for overall program direction and oversight, including evaluation and measurement of savings.

In the realm of residential energy efficiency, approval of the CPUC's 2010–2012 Utility Energy Efficiency Portfolios offered key policy implementation and administration decisions that should markedly increase peak demand and GHG emissions reductions were established in the portfolios. One key development is adoption of a protocol to count energy savings from behavior-based energy efficiency programs. This is a decision that affects the Evaluation, Measurement, and Verification (EM&V) of energy efficiency programs across the state (CPUC EM&V Press Release,, 2010).

The new administrative structure accompanying the Energy Efficiency Portfolios for 2010–2012 places utilities in the lead role for developing program plans and managing portfolios with input from advisory groups. The structure establishes safeguards, namely an advisory group structure, competitive bidding minimum requirements, and a ban on affiliate transactions. The CPUC's Energy Division is responsible for all Evaluation, Measurement and Verification studies, policy oversight, research and analysis, quality assurance, and dispute resolution. The CPUC has updated policy rules and set objectives and is guiding the development of energy efficiency program portfolios (CPUC IOU 2010-2012 EE Portfolio Press Release, 2010).

A protocol to count energy savings from behavior-based EE/DSM programs will afford programs that provide home energy reports, designed to engage customers to make better choices about their energy consumption using neighbor comparisons and personalized, targeted energy-saving recommendations, to be rolled out in California on a larger scale than in the past.

These savings are found in programs that aim to motivate behavioral change as opposed to hard-wired efficiency. The savings from such programs have thus far been treated as non-resource programs, ineligible for energy savings credit. However, the experience in a number of pilots in California and other region shows that these programs can produce a very real capacity for significant and measurable energy savings.

CPUC Commissioner Dian M. Grueneich asserted, "as California pursues the strategies identified in the California Long Term Strategic Plan for Energy Efficiency, and seeks to make energy efficiency a way of life for Californians, it is essential that we create a regulatory environment in which potential game-changing efforts such as these innovative behavioral-based strategies can flourish" (CPUC IOU 2010-2012 EE Portfolio Press Release, 2010).

The CPUC in partnership with California IOUs offers an example of best practices in education and outreach: The current California “Flex Your Power” program has been recognized in consumer survey research as enhancing customer awareness of ways they can save energy (CPUC EE Plan, 2009, PG&E, 2009). PG&E’s collaboration with the Flex Your Power program illustrates the integration of robust program administration and development. Flex Your Power’s administrative and marketing teams are developing EE/DSM programs in collaboration with PG&E. This is a unique effort between a state-sponsored, CPUC-operated program and a specific utility to maximize statewide familiarity with the Flex Your Power brand in order to harness more savings from local program offerings. Communication and logistics coordination was required to ensure consistency across the two agencies on getting the word out to promote Flex Your Power program offerings. To both the CPUC and PG&E it was important that strategic planning and program management staff see eye-to-eye and meet regularly to discuss technical program design, financing methods, and public awareness campaigns at the local and state level.

The CPUC noted that it was important to “avoid cannibalizing” each other’s EE/DSM strategies and business models, and instead align strategic priorities with both organizations’ program metrics and benchmarks (CPUC EE Plan, 2009). Inter-departmental and inter-agency cooperation, and developing universally approved implementation plans, evaluation methods, oversight and feedback loops, are critical to the success of enhanced EE/DSM programs.

Firm Ratcheting Standards

Minimum efficiency standards for buildings and appliances must be updated on a regular basis to drive guaranteed program savings. Ratcheted standards are responsible for expanding the market absorption of efficient building envelopes and the working parts of the home, such as HVAC, plumbing, lighting, and appliances (CPUC EE Plan, 2009, 3). Over and above minimum thresholds for efficiency, optimal efficiency benchmarks begin to offer high-end thresholds that customers may invest in, which would feed into the larger-scale adoption of hyper-efficient products.

California's building and appliance standards led to the flattening of the state's per capita electricity use for the past 30 years and averted building 15 large plants, in addition to saving consumers more than $56 billion in electricity and natural gas costs. The new, tighter standards established in 2007 will save an additional $23 billion by 2013 (Long-Term EE Strategic Plan, 2009, 2).

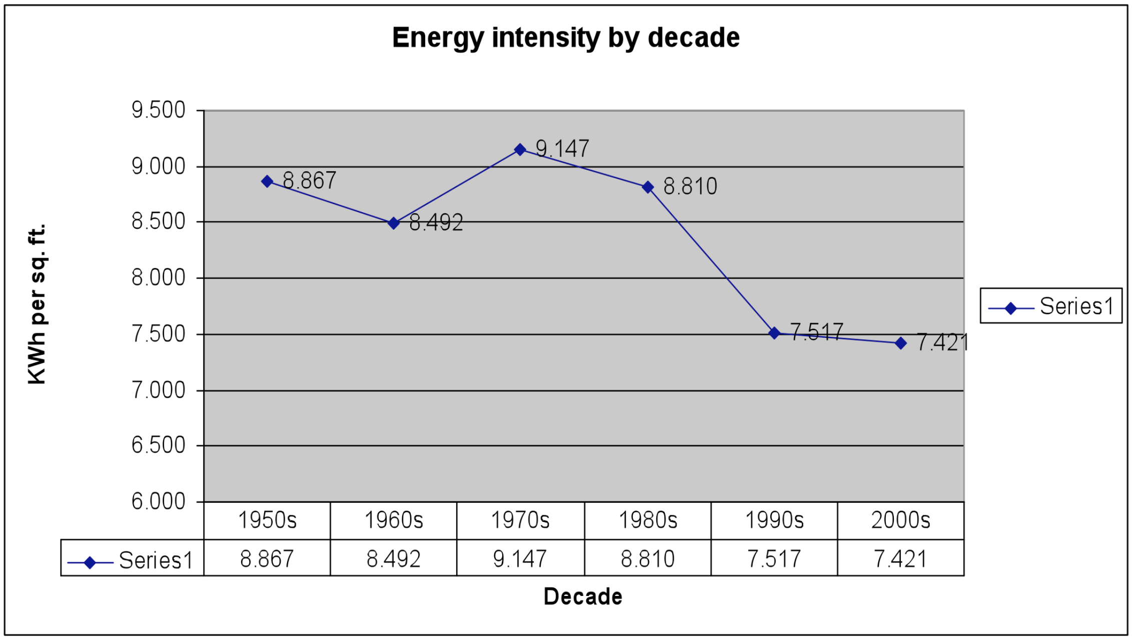
AE's Green Building Program is an exemplar of firm ratcheting standards. As codes become more stringent, the Green Building rating tools have to become stronger to stay ahead of the codes (Richard Morgan, AE Green Building Codes & ACPP Presentation, 2009, 4). The result is a continuous improvement cycle that has led to a progressive energy code and a green building program recognized as the most advanced and effective in the United States. (Richard Morgan, ACPP Presentation, 2009, 5).

In 2009, the City of Austin enacted the Energy Conservation Audit Disclosure (ECAD) Ordinance – the ECAD ratcheted up the building code by making an energy audit mandatory. The ordinance required energy audits at point of sale for single-family residential and by 2009. The audit provides basic information to occupants or owners on the buildings' energy use, measuring efficiency levels, with an estimated cost to improve the home's operations. The focus is on reducing duct system and envelope leakage, lighting and solar screens, and films. By 2015 Green Building will adopt Zero-Energy Capable Homes (ZECH) building standards. The ZECH Code will roll out in three phases, with Phase 1 amendments including (1) HVAC sizing, (2) HVAC testing, (3) radiant barrier, (4) high efficiency lighting controls. The anticipated results are reductions of 19% in electric energy, 1% in gas by 1%, and 11% overall (Richard Morgan, AE Green Buildings Code and ACPP Presentation, 2009, 12). Austin will have the first building code to achieve this standard in the country, beating California and Oregon by five years.

The societal benefit of the Green Building program has had a compounding influence throughout the economy and building industry by touching all the industries that supply working parts and materials that compose the building envelope. AE has collaborated with the national standards associations for construction of homes, including the National Building Association, to develop its initial rating scale. This process can be adapted to various mandatory or voluntary programs that are administrative in nature.

The Green Building program began in 1983, and as Figure 1.7 shows, the decline of kWh per square foot achieved through ratcheting standards.

Figure 3.3 Energy Intensity Of Newly Constructed Austin Residences, By Decade of Construction, 1950–2000



Source: Richard Morgan, AE Green Building Codes & ACPP Presentation, 2009, 8

POLICY TOOLS FOR MARKET TRANSFORMATION

Market transformation strategies as outlined in the California Long Term EE Plan are built upon one or more of the following policy tools employed to push or pull more efficient products or practices to market. Many of these descriptions of tools and best practices were developed at Austin Energy or in California, and may not reflect the larger picture of the national approach to EE/DSM.

Customer Incentives

Customer incentives include financial incentives, such as rebates and innovative or discounted financing. Incentives may also be non-financial support to consumers. Incentives are the "carrots" that help pull consumers into choosing efficient energy options. Once a consumer participates in EE/DSM programs, getting that consumer to make more EE decisions and participate in more EE/DSM programs will require "sticks" or performance benchmarks that offer customers the opportunity to build on small successes. Incentives may be market influences, such as a rebate program, or informational/decisional influences, such as an energy audit, a web portal that provides hourly energy consumption and savings information, or technological advances that allow a consumer to achieve more savings or take more control of their energy use, such as smart meters (Wilson & Dowlatabadi, 2007).

Research affirms that customers generally are conscious of their energy use and the consumption of the devices in their homes (Wilson & Dowlatabadi, 2007). As Chapter 2 detailed, the research and literature around why consumers choose or do not choose to participate in EE/DSM provide a smattering of uneven, and "sketchy depictions of behavior at best" (Lutzenhiser, 2009, 11). However, creating demand for products requires incentives not only from the utility supplying the EE/DSM program, but also incentives, marketing and outreach, from many appliance retailers and device and appliance manufacturers. These influences may be indirect and market-based. Deploying packages of rebates, incentives, and voluntary industry agreements can significantly increase use of the best current technologies for managing plug-loads and ensure that retailers and manufacturers are invested in the success of EE programs (US DOE Energy Star Annual Report, 2009)). Effectively getting the message out about incentives is critical to ensuring efficient decisions.

Kiersteads' research on integrated models may provide a framework for those seeking to promote program bundles that include offerings across a range of services from EE to DR, to water efficiency, or solar and distributed generation options (CPUC Integrated Energy Policy Report, 2009). Kiersteads suggests that "bonus" money upfront (in addition to existing rebates), aligned with technical support, will combine to challenge the cognition and calculation of consumers (Lutzenhiser, 2009).

Education, Marketing, and Outreach

Education, advertising/marketing, continuing education, media and community outreach *all* inform consumers and market stakeholders about energy efficiency opportunities (CPUC Long-Term Energy Efficiency Strategic Plan, 2009, 5). Communicating content effectively requires approaches that may be less technically savvy but instead call into play (1) the psychology of decisions; (2) meanings and actions in everyday life; (3) class, culture, and social structure; (4) and identifying consumer subgroups, "segments" based on usage levels, demographic traits, psychological responses and regional differences. Social practices, human–technology interactions, and socio-technical systems hold value as new policies are shaped around people and their behavior, as well as new and improved EE/DSM technology.

Education, marketing, and outreach offer the ability to reach out to a greater diversity of customers in tailored forms of communication: through either direct contact or indirect influence. Many EE/DSM programs are further optimized when customers choose to further reduce energy use. Methods to reach this goal include access to deeper information about a consumer's personal energy use, the average energy use of similar structures or neighbors' energy usage, and the average use of best-practices energy users, as well as personalized audits at intervals throughout the year that allow customers to compare and contrast their energy use to local averages as well as their own energy use at the same time the year before.

Examples of education and information efforts include: (1) direct customer contact such as outreach and education opportunities, professional and trade materials, public events, conferences and green expos; and (2) indirect influence of customers, including benchmarking goals, standards and labeling, and multi-media EE/DSM communications and campaigns.

The goal of customer outreach and education is to persuade customers to adopt programs or behaviors. As consumers are aggressively advertised to, and inundated with virtually thousands of messages from thousands of sources/advertisers each day, it has become natural to filter out messages that don't appeal to a particular need or interest (Bolding, CPUC, 2007, 6).

The previous chapter provided an in-depth analysis of issues pertaining to converting consumer behavior and the limitations of existing research. Recently, PG&E began working with the CPUC on a new suite of EE/DSM programs under the Flex Your Power brand. While not yet on the market, the programs will be synched on the Flex Your Power web portal through PG&E's service. Consistently identifying the You're your Power brand across all markets and mediums by CPUC and PG&E is necessary to ensure customers associate benefits of EE/DSM with the Flex Your Power brand, and continue to trust the brand. The program steering committee is working across both institutions, ensuring cohesive program implementation. Integrated Marketing Communications (IMC) to customers on EE programs seek to establish brand consistency across multiple stakeholders, as in the case of Flex Your Power, which works across the CPUC, CEC, and utilities in California. IMC is used in the marketing industry as "a planning process designed to assure that all brand contacts received by a customer or prospect for a product, service, or organization are relevant to that person and consistent over time" (Këri Bolding, CPUC, Energy Efficiency Marketing, Education & Outreach Presentation, 2007, 3).

Ultimately, a central point web portal initiates an ongoing, relevant conversation, with conversations taking place over time and across an integrated and two-way communication infrastructure of shared information that is provided in real time.

Nike exemplifies synchronized and integrated advertising, outreach, and education with its "Just Do It" campaign. Regardless of the medium, Nike products make the same message that *if you use Nike, you will be able to "do it."* Nike embraced marketing integration approaches that allow the company to communicate their message (the "swoosh") consistently across media outlets, and provide consistent information at every customer touch point (Bolding, CPUC, 2007, 13). Such outreach coordination can be achieved among a state public utility commission and its four major IOUs in the case of California. CPUC has packaged the "Flex Your Power" energy efficiency public education and awareness program with the advertising done by local utility companies across the state (Flex Your Power, Online. Flexyourpower.com).

Codes and Standards

Removing the less efficient appliances, devices, and home equipment from the marketplace over time has shown that "sticks" that push buildings and manufactures to provide efficient goods and services are effective (CPUC EE Strategic Plan, 2009). In 1992 the Energy Star program was established, a collaborative effort between DOE and EPA to incentivize industry to develop minimum-efficiency thresholds for energy efficient appliances and equipment. The program also offers a rebate or loan to consumers to offset part of the costs of the investment.

Energy Star is a fitting example of the efficacy of utilizing codes and standards. Energy Star uses continuously ratcheting standards to achieve persistent savings. By increasing minimum standards over time, these programs provided more savings as well as opportunities for customers to reapply for programs or reinvest in more whole system-oriented savings opportunities such as lighting, HVAC, and duct improvements. It also allows industry to expand into new phases of research and development, product and equipment lines, and adopt additional evaluative measures to ensure that programs are not relying on inaccurate assumptions of consumer preference (Bolding, CPUC, 2007). Industry has complied and today Energy Star has created an energy efficiency market in many industries. Austin Energy has built onto that national incentive, partnering with construction materials stores and hardware providers to stock Energy Star-labeled appliances and equipment. The State of California hopes to achieve the Zero Energy Capable Home (ZECH) building code threshold by 2020. AE expects to achieve this building code standard by 2015, a full five years before the marketplace.

In 1982 the City of Austin and Austin Energy set its own building code: a green building code. It is an important distinction, as virtually no major U.S. city use the local utility to enforce the building code, verifying that construction and operation of buildings is fully compliant and "green," Austin took this approach so it could directly install and verify savings of energy efficiency upgrades or DR measures, and not rely on LEED or some other rating agency or standard that may not require verified energy savings. Austin's Green Building Code has influenced the local, national, and international housing markets, and AE's initiative to achieve Zero-Energy Capable Homes (ZECH) building codes surpasses the California Long-Term EE Strategic Plan. This is even more impressive considering the higher average energy consumption and hotter temperatures in Austin.

A final consideration is that while minimum codes and standards for efficiency are a great first step, a next step is needed, where labeling of hyper-efficient products is designed to show maximum potential savings, since establishing minimum and maximum efficiency metrics for consumers is important to certain segments of the population (Lutzenhiser, Wilhite, Stearn et al., 2009).

Technological Assistance

Technical assistance tools give customers access to, and control of, their energy use. Communicating this information about the technical aspects of EE/DSM programs is important to achieving savings from altered consumer behavior. Programs perform better when customer service staff, web sites, and educational resources are adept at responding to common technical issues. Educational resources may provide the greatest cost-effectiveness, while standardizing certification and training for installers and energy auditors also shows significant benefits (CPUC EE Strategic Plan, 2009). Education at the point of service for an EE upgrade or audit shows a corollary with other energy efficient behavior when literature or one-on-one appointments are provided. Knowledge barriers surrounding the technical aspects of EE/DSM on the part of customers, installers, and retailers hamper the progress of initiatives, widen the energy efficiency gap, and contribute to market failure. If knowledge gaps are not addressed and potential customers receive imperfect information, not only may EE/DSM initiatives see a decline in customer willingness to participate but also an impression of the program provider improves.

Ted Flanigan and June Weintraub reviewed all DSM programs for residential, industrial, and commercial programs in 1994, and found many programs utilizing education and customer outreach to derive long-term benefits. Flanigan reviews these programs and suggests “these programs…deliver the lowest cost energy savings over time” (Flanigan and Weintraub, 1994, 59).

Seattle City Light operated a demonstration tools and educational facility for customer seminars and building professionals, while Wes Birdsall in Osage, Iowa reported significant efficiency gains at very low cost "a tribute to education as a low cost DSM strategy" (Flanigan and Weintraub, 1994, 60). Western Massachusetts Electric's Neighborhood Program, Espanola, and United Illuminating's Homeworks programs delivered education and literature with all new installs, and program installers were trained to explain preferable life-cycle economic and environmental benefits of efficiency to customers (Flanigan and Weintraub, 1994, 59). Furthermore, many programs have specific benchmarks and mechanisms to promote customers to the next steps up the supply curve of efficiency in the form of bonus or complementary programs.

Limitations of Technical Assistance

As Edward Vine notes in his critique of the policy frames and program assumptions underlying California's Residential EE consumer behavior, the interaction between human and technology has evolved significantly in the past 10–20 years, and there are significant generational gaps on understanding how to manage energy use in the digital age. The ability to make decisions on energy use based on real-time information, using a cell phone or home computer is something that younger generations are more attuned to, while other segments are wary of issues such as cyber security and interoperability of the working parts of a home. In important way, consumers that install solar panels see the energy production made possible on their property and feel emboldened in their energy-related decisions.

A device-centered view of programs may result in a backlash among consumers who remain skeptical of new gadgets or significant investments requiring persistent changes in their behavior and social norms.

To avoid this pushback, and to proactively ensure that customers are not intimidated by the sheer complexity of the whole EE/DSM field, technical assistance relies in many ways on three modes to overcome this barrier:

1. Effective market analysis of different customer segments and what their barriers to conversion are;
2. Understanding where a given customer is at, in the hierarchy of factors/variables important to consumption and conservation, such as how strong their habits are or what social contexts and constraints they operate in; and
3. Clear and consistent communication with customers to articulate the benefits, safety, and improvements to overall quality of life that EE/DSM programs offer (California Long Term EE Strategic Plan, 2009).

Emerging Technologies

If states and utilities are to "meet the climate imperative head-on," they will have to collaborate with industries to promote development of significantly greater levels of innovation in accurate measurement and control data and new technologies. Most importantly, they will need to do so at a scale of market penetration that "has not been previously imagined or managed" (Skip Laitner, ACEEE, 2008). Collaboration between all participants will demand innovation in all four stages of the technology development pipeline (Laitner, ACEEE, 2008).

Hyper-efficient technologies that are ready to be brought to market, but at a much higher cost to install than smaller investments, may receive bonus incentives at the point of purchase, along with standard rebates and financing for less robust energy efficiency programs, i.e., heat pump water heaters, tank-less water heaters for small units, ductless residential heat pumps and air conditioners, and hyper-efficient residential appliances (especially dual washers and dryers and vampire-power automatic shut-off equipment). All of these can be developed more robustly to achieve a place in the market, and more specifically, on sales floors of local hardware and appliance stores.

Conclusion

Literature review shows the potential savings from improved EE/DSM program design as well as a framework to begin achieving even deeper savings through the deployment of policies and tools. Chapter 4 will review AE's current residential DSM offerings and their reported achievements from 2004 to 2008.

Chapter 5 first looks at how AE came to the conclusion that 800 MW is an achievable goal by 2020, and summarizes AE residential program design and efficacy. The core of Chapter 5 evaluates the methodology that AE uses to review Program Performance, and briefly compares its program performance against that "800 MW by 2020" benchmark. Chapter 5 will also include energy efficiency programs through ARRA support that take on new and old ways of reaching customers, and reducing energy loss. Then the report will evaluate how well AE is adopting market transformation policies and tools. This chapter will answer the question of whether AE is doing everything it can to increase participation, maximize savings through promoting programs, providing funding to install energy efficiency upgrades, managing power loads, and educating customers, in order to produce savings. Then Chapter 6 recommends ways for AE to apply market transformation strategies.

Chapter 4. Austin Energy’s Conservation and DSM Programs

This chapter sets out to summarize AE’s current approach to achieving the 800 MW goal for peak demand reductions by 2020. There are three sections to this chapter. The first section reports on AE’s current approach and methodology to achieve the aggressive 800 MW peak demand and 20% CO^2 reduction goals. The second section describes AE’s ten residential EE/DSM programs and briefly describes each program’s purpose and function. The third section reports on the performance of AE’s programs based on eight performance measures.

AUSTIN ENERGY’S ROAD TO 800 MW PEAK AND 20% CO^2 REDUCTIONS BY 2020

AE sets dual goals of peak demand and GHG emissions reductions. A review of the ten established residential EE/DSM programs reveals that many programs use incentives to achieve benchmarks. Rebates or loans to homeowners and owners of multi-resident housing, installation of energy efficiency upgrades by third-party contractors, and the recent introduction of voluntary direct and active load control programs that allow AE to cycle off systems that consume a lot of electricity are popular incentives. Programs are designed to enhance electricity reliability and quality for the utility, to result in reduced energy bills for customers, and to reduce carbon emissions at the point of generation for the benefit of society.

AE has had laudable success to date in all three major areas of concern (peak demand savings, overall energy savings, and CO^2 reductions), and furthermore has successfully built a rapport with the customer base and continues to welcome back repeat customers for more energy savings opportunities. Recently, the required ECAD or Energy Audit at the point of sale has opened a new door for customers to begin looking at their energy use and improve their own energy consciousness.

The modus operandi is to constantly improve services, but market disruptions such as extremely hot summers, economic recessions, and other externalities, affect consumer behavior. In summer 2009 AE experienced its three highest peak days. While these were momentary occurrences, when 2009 DSM performance is reviewed on the whole, the heat and the recession resulted in a significant dip in peak demand reductions to 52 MW, the lowest level since 2005. Additionally, energy efficiency upgrades were not installed at the same rates as in 2007 and 2008, especially in the multi-family market (AE DSM Performance Review, 2009, 18).

The recent drop in peak demand savings throws a wrench in AE's plans to hit the 800 MW goal particularly. AE's methodology behind establishing the 800 MW goal for peak demand reductions and 20% CO^2 reduction goals by 2020 is reviewed here.

Perhaps the most surprising finding of this report is that there is no real methodology to the 800 MW DSM goal other than that AE hopes to average reductions of 61.5 MW of peak reduction from 2007 to 2020. At the rate of 61.5 MW of peak reduction between 2007 and 2020 (not *through* 2020), AE would hit the 800 MW goal. However, there has been no further extrapolations based on considerations of market saturation of existing programs as they are currently designed; there is no business-as-usual case compared to different models of DR, or customer outreach. While Fred Yebra, Karl Rabago, and Ed Clark espouse confidence in hitting this goal, they also readily acknowledge that new programs, a new business model that is not cannibalized by EE/DSM programs, and new technologies will have to be developed to overcome plateaus in peak demand savings as the population may or may not grow by another 750,000 people by 2030. As one can see from the updated DSM Performance Measures Report from 2007 to 2009, AE averaged 60.5 MW DSM, but the numbers dropped off precipitously in 2009 because of the recession. Just two years into the plan, the 61.5 MW annual peak reduction is not being achieved. A more robust analysis is planned for 2011 or 2012, to complement AE's new rate case request. The rate case is critical to implementing new program designs and demand response mechanisms as it allows the utility to more accurately reflect the true cost of energy on the wholesale market and pass those costs onto the customers.

It is also worthwhile to examine the assumptions that AE's models are based on. If recessions persist, temperatures in the summer maintain their current trends, and Austin's population explodes, then overtime it is possible that some of the assumptions that AE used to establish the 800 MW peak demand and 20% CO^2 reduction goals must be revised. AE's goal of additional demand savings is also based upon assumptions that new technologies, code regulation enforcement, automatic meter reading (enabled by the smart grid system), and adjustments to the billing system will be available in the future. It is an open question whether AE's customers will continue to adopt new technologies that increase efficiency or shift demand. Karl Rabago has reported to the City of Austin Energy Efficiency Task Force that the assumptions for weather normalization over time, economic and population projections, potential carbon pricing, and other externalities must be overhauled in the next Energy Efficiency Potential Study.

RESIDENTIAL ENERGY EFFICIENCY AND DSM PROGRAMS

Austin Energy's Energy Efficiency and Conservation Department makes residential energy management programs and services available to its customers. These energy management services come in the form of active, direct, and passive load control management. These are offered on a first-come, first-serve basis to AE customers until the allocated funds for those programs run out.

This section consists of two parts. The first part provides an overview of the service territory; number of residential customer accounts over time, and examines the participation rates for the ten programs over the past five years. In the second part the ten programs are described in detail.

Program Uptake and Participation

In order to accurately assess market penetration based on the 2008 DSM Performance Measures report, the number of residential meters in 2008 must be derived. The number of residential meters in the AE service territory in 2008 is estimated at 349,897. The residential building stock for the City of Austin in 2009 held 144,659 single-family residences (including duplex and triplex homes), with an average square footage of 1,779 sq. ft. per building, and 84,620 apartment units, at an average of 701 sq. ft. per unit (AE DSM Performance Review, Database, 2009). The total residential customer base for the AE service territory was 338,000 in 2006 (AE Strategic Plan, 2006); 345,197 in 2007(AE Resource Guide, 2007); and in 2010, Andres Carvallo estimated that the service territory includes 364,000 residential meters (Interview with Andres Carvallo, 2010). AE reported that total consumption in the residential energy sector was 3,908,318,000 kWh in 2007 (AE Resource Guide, 2008).

The total is an average of growth from 345,197 residential meters in 2007 to 364,000 residential meters in 2010. Growth between 2006 and 2007 was roughly 7,000 new customers. That pace slowed as new home building declined between 2007 and 2010. In that time, the area added only 18,803 new residential meters, an average growth of 4,700 new meters per year. While AE Residential Energy Efficiency programs tailor services to buildings built ten years ago or more, owners and residents of homes ten years old or younger still do participate.

AE's Distributed Energy Services department estimates that nearly a quarter of residential AE customers have participated in at least one AE energy efficiency program in the last five years (interview with Fred Yebra, 2010). While many homeowners have come and/or gone, or moved from one place to another within AE's service territory, the participation levels show that AE's programs remain popular. As Figure 1.1 showed, AE has seen ever-increasing levels of customers returning to participate in more EE/DSM programs. John Trowbridge, an AE employee that developed a rigorous analysis of customer participation concluded that AE is dealing "with a public that is by and large familiar with program offerings and willing to participate in them" (Interview with John Trowbridge, AE, 2010).

Table 4.1 shows a breakdown of customer participation in AE's residential EE/DSM programs from 2004 to 2008. Each new "customer participation" applies to a customer account. The Year of participation is based on year of inspection of the energy efficiency upgrade. Table 4.1 shows the number of customers that have participated in each of the nine programs (CFL is removed because it is not possible to measure). 155,612 residential energy efficiency upgrades were made over 2004 to 2008. Roughly 45% of residential customers have at least participated in a single EE/DSM program offered by AE in the last five years. However, the Multi-Family Program, CFL and Power Partner Program have seen the bulk of customer participation. The Appliance Efficiency Program and Home Performance with Energy Star rebate and loan programs have also seen over 26,000 participants from 2004 to 2008 – nearly 8% of all residential customers have participated in these programs. Overall, the programs that include additional benefits to the overall value proposition show higher participation. For example, the base rebate for the Energy Star program includes additional rebates offered by AE. The city offers up to three complimentary CFL light bulbs for customers that call

AE and want to pursue higher energy efficiency in their lighting systems. The Multi-Family Program includes a thorough energy audit conducted by one of AE's Energy Conservation Specialists. This multi-family building audit identifies areas of gross inefficiency and the Specialists provide technical assistance to the realtors and property managers that want to identify the most efficient methods to save energy.

The participation rates of various programs fluctuate by year, which can be ascribed to a number of reasons including incentive structures, strong or weak fiscal years, and budget allocations. For any given program in any given year, the budget is subject to change, and as such, marketing, outreach, staff resources, and incentives are heavily influenced, which may result in higher or lower program participation rates. From 2004 to 2008 AE has incrementally found effective means to increase its overall residential EE/DSM program customer participation, with huge strides made in the multi-family program and significant savings found in the Power Partner and Cycle Saver Programs, as well as duct, HVAC, and lighting-related programs. Participation applies to where the EEU was installed, inspected, and approved by AE.

Table 4.1 Customer Participation in EE/DSM Programs, 2004–2008

Program	2004	2005	2006	2007	2008	2004-2008	Penetration
Appliance Efficiency Program	3,665	4,688	4,214	2,415	3,093	18,075	5.17%
Home Performance ES - Rebate	1,106	1,075	1,381	1,712	2,223	7,497	2.14%
H. P. Energy Star - Loan	232	324	350	248	213	1,367	0.39%
Free Weatherization	565	455	720	632	505	2,877	2.40%
Multi-Family Program	8,044	6,501	7,899	10,505	21,814	54,763	35.33%
Clothes Washer Rebate	420	411	545	882	813	3,071	0.88%
Duct Leaks Sealing/Diagnosis	251	238	232	147	231	1,099	0.31%
Refrigerator Recycling	198	2,323	2,679	3,200	4,114	12,514	3.58%
Power Partner	5,931	8,314	10,210	10,355	9,934	44,744	12.79%
Cycle Saver	1,126	2,597	2,366	2,279	1,237	9,605	2.75%
Subtotal Residential	21,538	26,926	30,596	32,375	44,177	155,612	44.47%

Source: AE DSM Performance Review, 2008, 14

To grasp the technical aspects of the ten residential programs listed in Table 4.1, the second section of this chapter describes the core functions and benefits of each program. Section three of this report takes a deeper look at some of the drivers to customer participation in AE's DSM programs.

AE's Current Residential EE/DSM Offerings

Following are the descriptions of AE's ten residential energy efficiency programs. Programs are broken up by their critical function: Energy Efficiency Upgrades (EEUs), Direct Load Control, and Active Load Control.

The Power Partner program is an active load management program. Active load management is a form of demand response. This program reduces consumption at critical peak periods or in response to energy prices reaching a threshold market price, often called a price signal. A high performance direct electricity load control system is rarely used, so the total energy savings are relatively minimal, but the peak demand is *significantly* reduced through the capability of programmable thermostats to schedule the "on-off" operation of AC systems and pre-program temperature setbacks.

The Cycle Saver Program is a direct load control program for water heater timers. Direct load control represents the consumer load that can be interrupted at the time of annual peak load by direct control of the utility system operator (Energy Information Administration, 2006). The program is used in multi-family properties and targets large electric water heaters. Water heaters have a device installed that is designed to meet the dedicated peak control demands of a utility but also provide pre-programming functions for customers to use the device. The system is a two-way communicator between the utility and customer premises, its working parts, appliances water heater, and high-energy equipment. It reports the number of times the system is cycled off and the duration.

The remaining eight AE residential energy conservation programs utilize passive load management. This reflects the consumer load that can be reduced through energy efficiency upgrades of appliances or equipment on the customer premises. Passive load management essentially engages customers through Energy Efficiency Upgrades. The majority of residential energy efficiency programs and budget are concentrated on equipment and appliance change-outs, according to AE staff (Yebra, 2010).

Energy Efficiency Upgrade Programs

1. **Home Performance with Energy Star – Rebate.** This program incentivizes customers to invest in energy-saving home improvements. The rebate can be up to $1575 for air conditioning, attic insulation, solar screens, caulking, Energy Star windows, and weatherstripping. In order to receive the rebate the unit must have an energy analysis performed by a trained home performance contractor.

Improvements required to qualify for the rebate bring the home to current energy code standards. Installs qualify for a "bonus" rebate. These can reach $650 and are higher than the rebate offered in the Appliance Efficiency Program. The Home Performance with Energy Star Program is designed to improve the energy efficiency of the total home, or building envelope. Benefits for customers include greater comfort, better energy performance, and improved indoor air quality, without changes in consumer behavior.

2. **Home Performance with ENERGY STAR—Loan.** This program is identical to the rebate program, with the exception that the loan enables customers to borrow money to complete EE improvements. AE processes loans through a partnership with Velocity Credit Union. Benefits for customers include greater comfort, better energy performance, and improved indoor air quality, without changes in consumer behavior.

3. **Free Home Improvements and Weatherization.** Free home improvements are offered to qualified low- to moderate-income, elderly, and physically or mentally disabled customers. Materials and installation are provided by AE. The free

home improvements program is available to customers who are also participating in the Home Performance with Energy Star Loan or Air Conditioning Rebate to install cooling equipment. Home safety improvements include advanced smoke and carbon monoxide detectors and improved methods of air testing to insure the health and safety of AE customers. AE offers qualified customers a $500 voucher for the purchase of Energy Star window unit air conditioners through the Window Unit Voucher Program. Benefits for customers include greater comfort, better energy performance, and improved indoor air quality, without changes in consumer behavior. Table 4.2 shows the Income Guidelines and required income-to-occupants ratio for Free Home Improvements through AE.

Table 4.2 Free Home Improvements Income Guidelines

# of people who live in house	An occupant is 60 or older, or has a physical or mental disability, and the gross household income is less than the amount listed	Head of household is under 60, and the gross household income is less than the amount listed
1	$41,050	$25,650
2	$46,900	$29,300
3	$52,800	$33,000
4	$58,650	$36,350
5	$63,350	$39,600
6	$68,050	$42,500
7	$72,750	$45,450
8	$77,400	$48,400

Source: AE, Energy Efficiency Home Improvement Income Guidelines for Energy Star Loan, 2009.

4. Multi-Family Incentive, Power Saver Program. This program provides rebates for energy efficiency improvements to owners, developers, and managers of apartment communities, mixed-use and other multi-unit properties. To assess a building, AE's Conservation Program Specialists perform a free walk-through energy audit to identify energy improvements that qualify for rebates. Eligibility is restricted to air-conditioned buildings with four or more residential units. Recommendations are made to the property manager for duct improvements. Program success is substantial. Initial duct leakage testing shows that average duct leakage rates in homes is roughly 40%; the program brings leakage rates closer to 5–10% (AE DSM Performance Review, 2008).

The development community has used the program to great effect to enhance the attractiveness of its units, using the Power Saver logo in advertisements for the units. Increasing allowable rebates up to $100,000 may explain why there was such a huge uptick in 2008 for the Multi-Family Incentives program. Fiscal Year 2008 reported a significant spike from 7000 MW in energy savings in 2007 to 24,000 MW in 2008. The DSM programs saved 11% more energy in 2008, in large part due to CFL participation increasing from 28% to 87%. Unit savings increased from 300 kWh/participant in 2007 to 1,100 kWh/participant in 2008. CFLs are expected to saturate the market sometime in early 2010. Benefits for residents include energy savings range from 10% to 40%, improvements in indoor air quality, and higher comfort year-round. Benefits for owners, developers, and property managers included lower operating costs, higher occupancy rates, decreased turnover rates, and increased market values of communities.

5. Air Conditioning Rebate (Appliance Efficiency). Rebates are offered on the purchase of high efficiency air conditioning units, and improved efficiency heat pumps. To qualify for the rebate an appliance must be more efficient than local energy code requirements and national appliance manufacturing standards.

The DOE requires central air conditioning systems to have an efficiency ratio of at least 14.0 SEER and 11.5 EER to receive an ENERGY STAR label. Rebates for Energy Star appliances are available for existing home and small business installs of five tons and less. Benefits for customers include reduced energy bills and improved air flow.

6. Duct Diagnostics and Sealing (Multi-Family). Duct diagnostic testing includes duct leakage analysis, duct airflow test, temperature test, return-sizing test, and combustion safety test. The cost for testing is $50 per unit. Problems that occur in ducts include leakage that reduces cooling and heating capacity, insufficient air flow through the whole duct network, receiving and returning air vents balancing air pressure, and avoiding unwanted allergens in rooms. AE provides rebate opportunities to offset costs of EEUs. Benefits for customers include energy bill reductions, increased airflow and comfort, improved indoor air quality, and increased property value.

7. Compact Fluorescent Lamps (CFL) Rebate Coupon. AE offers $2–$4 discount coupons on the purchase of Energy Star–labeled CFLs. Local retail participants stock eligible CFLs, send the collected coupons to AE, and are reimbursed for the face value of coupons. The main benefit of this program is the long life and low energy use of the CFL bulb. The CFL market has shown substantial growth, as the Performance Tracking Section will detail. Benefits for customers include lower energy bills and less frequent bulb replacement since most CFLs last ten times longer than conventional white bulbs. Benefits to AE include reduced power generation for lighting, as well as lower carbon emissions and greenhouse gasses,

8. Refrigerator Recycling. This Power Saver program is AE's newest EE venture, offering cash incentives for turning in old 14 to 27 cubic foot refrigerators/freezers. Since these are the third highest energy consumer in most homes (behind heating/air conditioning units and water heaters), energy savings are substantial. Older models use two to three times more energy than new energy-efficient models.

AE offers a $50 cash incentive per unit from a single-family home customer and $35 per unit for apartment communities with four dwellings or more. AE reuses 98% of the material from old appliances, and all harmful refrigerants are disposed of with rigorous enforcement of proper hazardous waste management practices. Benefits for customers include lower energy bills and savings. AE estimates that inefficient refrigerators can cost homeowners an average of $150 extra per year.

Active Load Management Program

9. Power Partner. The Power Partner program is a part of AE's DR portfolio, Power Saver, which provides DR measures for commercial, industrial and residential customer bases. Power Partner includes installation of a load management programmable thermostat that allows residential owners to schedule the "on–off" operation of the air conditioner as well as schedule pre-program setback temperatures. Participation in the program is voluntary and offered on a first-come, first-served basis.

As a condition for participating in the Program, AE is allowed to coordinate the "cycling-off" of air conditioners in the customers' home between 3 p.m. and 7 p.m. on summer days. Air conditioners cycle-off as needed for no more than 10 minutes every half-hour. AE offers a $25 payment if customers agree to an extra 5 minutes of 50% cycling time following the initial 10 minute interval of cycle-off time. This option is cost-effective for homes with multiple air conditioners and residents that are out of the home often between 3 p.m. and 7 p.m. Participants receive free installation and warranty.

Direct Load Management Program

10. Cycle Saver Water-Heater Timers. This program installs energy control timers on individual electric water heaters at multi-family properties. It is a complementary offering for load management during summer days, Monday–Friday, 3 p.m. to 7 p.m. Cycling-off does not occur on weekends or holidays. Property managers advertise participation in the program in their marketing literature, as customers generally prefer saving money on their electric bill. AE uses state-of-the-art microprocessor load-control technology.

Benefits include programming capabilities flexible enough to accommodate AE's load management strategies to save energy, money, and also reduce peak summer demand for electricity (AE DSM Performance Tracking, 2008). The system also includes a vacation button that can shut off the water heater for extended periods.

EE/DSM Program Performance

The goals of this section are two-fold: to introduce the eight performance measures used by AE to determine performance of EE/DSM programs and to review the ten residential EE/DSM programs performances from 2004 to 2008. This section is composed of eight subsections. These subsections are named for the eight performance metrics: peak demand reduction, total energy savings, participation goals, carbon dioxide emissions reductions, program costs, benefit/cost analysis, net present value, and expenses for demand reduction. Tables 4.3 through 4.10 are derived from the AE DSM Performance Measures Report for fiscal year 2007-2008. Each program reports annual results in energy savings, carbon emission reductions, and customer participation. Similar methodologies are used for Commercial and Green Building programs.

Peak Demand Reduction

Peak demand reduction is measured in the annual amount of reduced MW to peak demand achieved by conservation programs. The majority of peak demand reductions were through the Power Partner program. The Power Partner program was designed specifically to address the issue of residential peak demand reduction. The program accounts for more than a third of the residential peak reductions from 2004 to 2008. This program shows promise to continue to achieve significant savings. In 2008 Power Partner generated more peak savings than all the Energy Star, CFL rebate, Cycle Saver and Refrigerator Recycling programs combined. The installation of over 180,000 smart thermostats that communicate with the utility to cycle thermostats on and off has achieved the stated goal of reducing demand at critical peak periods and shows promise for achieving further savings if Critical Peak Price (CPP), Real Time Pricing (RTP), or Time-of-use (TOU) rates were to be considered.

The Home Performance with Energy Star Rebate program also brought significant demand reductions in large part because the savings accrued are not achieved through fractured measures, but rather designed to be an integrated package of efficiency improvements designed to compound energy savings across interdependent and interrelated working parts of the home and building envelope. In 2008 the combined peak reductions through increased efficiency standards for appliances, lighting, and refrigeration totaled roughly 6 MW.

As shown in Table 4.1, participation rates have grown incrementally in the majority of programs from 2004 to 2008, thus resulting in increased peak demand savings for programs. The Power Partner program's peak demand savings are triggered by critical peak periods. As such, fewer critical peak periods, as there were in 2008, results in lower overall peak reductions for this program. The long-term benefits of the Energy Star program are evident in the yearly increase peak demand savings. Table 4.3 depicts annual peak demand reduction (MW). This table reflects savings in electrical energy consumption that was achieved by the energy programs listed below. Losses from Utility Capacity Reserve Margin of 12% and Transmission & Distribution losses of 7% are already factored in (AE, 2009). The 433 MW of peak demand reduction achieved from residential programs are cumulative from 1982 to 2008.

Table 4.3 Annual Peak Demand Reduction (MW)

Program	1982-'03	2004	2005	2006	2007	2008	Total
Appliance Efficiency Program	123.60	3.30	4.20	3.70	2.29	2.93	140.02
Home Performance ES - Rebate	42.10	2.40	2.40	2.50	3.08	4.02	56.50
H. P. Energy Star - Loan	36.60	0.50	0.70	0.60	0.45	0.38	39.23
Free Weatherization	16.00	0.50	0.40	0.70	0.60	0.48	18.68
Multi-Family Program	36.70	3.90	3.20	3.80	5.15	4.61	57.36
Clothes Washer Rebate	0.30	0.10	0.00	0.10	0.11	0.04	0.65
Duct Leaks Sealing/Diagnosis	0.80	0.30	0.30	0.30	0.18	---	1.88
Refrigerator Recycling	0.00	0.00	0.60	0.60	0.73	1.21	3.14
Power Partner	33.20	5.90	8.20	10.10	10.22	9.80	77.42
Cycle Saver	3.50	0.70	1.80	1.50	1.48	0.80	9.78
Compact Fluorescent Light Bulbs	0.20	0.10	0.10	0.30	0.94	0.99	2.63
Discontinued Programs	25.80	0.00	0.00	0.00	0.00	0.00	25.80
Subtotal Residential	318.80	17.70	21.90	24.20	25.23	25.26	433.09

Source: AE DSM Performance Review, 2008, 13

Total Energy Savings

Energy savings is measured in MWh savings in electricity consumption achieved by conservation programs. The Multi-Family Power Savers program has consistently been the highest performing program in total energy savings from 2004 to 2008. In 2008, the Multi-Family program had a four-fold increase in total energy savings. This coincided with AE's addition of staff Energy Management Specialists, tasked with reviewing multi-family properties across the service territory and diagnosing key areas in each distinct multi-family property. This program showed immediate promise and provided almost half of 2008s' total savings for the Residential DSM portfolio.

The EEU programs accounted for the lions' share of total energy savings per annum. Reducing energy consumption through ratcheting standards and ever improving efficiency is the driving force for energy efficiency upgrade programs. Appliance Energy Efficiency Program, Refrigerator Recycling, Home Performance with ENERGY STAR, and notably the CFL Rebate program, combined to provide over 40,000 MWh of total savings in 2008. The savings from the EEU programs directly correlate to greenhouse emissions reductions, and as such the benefit of these programs is two-fold. Table 4.4 depicts the overall reduction in annual energy consumption (MWh) achieved by the EE programs. These numbers already account for avoided Transmission & Distribution losses of 7% (AE, 2009).

Table 4.4 Annual Energy Savings (MWh)

Program	1982-'03	2004	2005	2006	2007	2008	Total
Appliance Efficiency Program	116,324	3,927	4,243	4,290	2,768	3,782	135,334
Home Performance ES - Rebate	46,037	543	758	819	496	421	49,074
H. P. Energy Star - Loan	50,836	2,891	2810	3610	3382	4390	67,919
Free Weatherization	12,913	619	499	789	691	552	16,063
Multi-Family Program	54,065	5,368	4165	5055	7198	23847	99,698
Clothes Washer Rebate	1,057	208	204	270	254	234	2,227
Duct Leaks Sealing/Diagnosis	1,216	302	469	457	1,954	---	4,398
Refrigerator Recycling	0	234	2193	2446	2706	3235	10,814
Power Partner	394	76	88	107	102	97	864
Cycle Saver	470	106	16	15	14	7	628
Compact Fluorescent Light Bulbs	1,140	801	338	1898	5440	6244	15,861
Discontinued Programs	11,567	0	0	0	0	0	11,567
Subtotal Residential	296,019	15,075	15,783	19,756	25,005	42,809	414,447

Source: AE DSM Performance Review, 2008, 15

Greenhouse Gas Emissions Reductions

Pollutant emissions reductions are measured in reduced quantities of pollutant emissions resulting from DSM activities for 2008 (AE, 2009). The CFL Program offers the second largest emissions savings of all AE programs, while the Multi-Family Power Saver program had savings a whole magnitude higher. The $3–$5 investment in each CFL light bulb has aggregated a large savings in carbon emissions for AE. The utility is bracing for a saturation of the CFL market, particularly in the multi-family market by 2012. To address the market shift, AE will reallocate funds currently appropriated for CFL incentives and rebates to rebates and incentives for efficient lighting systems beginning in 2012. This shift is expected to compound benefits across multi-family and lighting programs. Table 4.5 shows the reduced quantity of pollutants' emission as a result of DSM activities for FY 2007-2008.

Table 4.5 Emissions Reductions (Metric Tons)

Program	Sulfur Dioxide	Nitrogen Oxides	Suspended Particulates	NMOC / VOC	Carbon Monoxide	Carbon Dioxide	Total
Appliance Efficiency Program	1.40	1.55	0.19	0.05	1.08	2,220	2,224.27
Home Performance ES - Rebate	1.62	1.80	0.22	0.06	1.25	2,577	2,581.95
H. P. Energy Star - Loan	0.16	0.17	0.02	0.01	0.12	247	247.48
Free Weatherization	0.20	0.23	0.03	0.01	0.16	324	324.63
Multi-Family Program	8.82	9.76	1.20	0.34	6.78	13,998	14,024.90
Clothes Washer Rebate	0.09	0.10	0.01	0.00	0.07	137	137.27
Duct Leaks Sealing/Diagnosis	0.00	0.00	0.00	0.00	0.00	0	0.00
Refrigerator Recycling	1.20	1.32	0.16	0.05	0.92	1,899	1,902.65
Power Partner	0.04	0.04	0.00	0.00	0.03	57	57.11
Cycle Saver	0.00	0.00	0.00	0.00	0.00	4	4.00
Compact Fluorescent Light Bulbs	2.31	2.55	0.31	0.09	1.78	3,665	3,672.04
Subtotal Residential	15.84	17.52	2.14	0.61	12.19	25,128	25,176.30

Source: AE DSM Performance Review, 2008, 16

Participation Goals

The two components of achieving AE's participation goals are: number of customers participating in programs to reduce demand in MW and energy savings in MWh (AE, 2009). AE set its goals for participation based on previous years' participation levels, and expected a slight drop in program participation based on the economic downturn. In developing the goals, AE believed that customers in general have less income to invest in EE upgrades, and that customers reduce their overall spending during economic downturns. AE expected consumers to not choose now to invest in programs like the Home Performance Program because return on investment may take longer than lower-cost higher return-on-investment programs. Nevertheless these programs continued to show promise and do well against the 2008 goals. Yebra believes these savings show that homeowners are more familiar with the long-term savings associated with EE programs. "Customers identify right now with belt-tightening. They see EE as belt-tightening" (Interview with Fred Yebra, AE, 2010). Fred Yebra mentioned that there has historically been a "Pendulum Effect" of in EE participation in the last three decades at AE. Yebra noted that there have been many times in the past 30 years where energy efficiency seemed ascendant, only to decline in subsequent years for one reason or another.

According to Yebra, AE expected reduced customer investment for energy savings in 2008. This was especially anticipated in the single-family market. However, as mentioned previously, the success of the Multi-Family program had the effect of boosting the whole residential DSM program success. Instead, both low-cost investment programs (e.g., CFL rebate, Refrigerator Recycling and Power Partner) and higher-cost investment programs (e.g., Home Performance with Energy Star) saw more participation in many key programs from 2007. Yebra pointed to the growing sophistication of customers on one key point as a driver for increased participation in the future: Customers are attending to the long-term payback of energy efficiency more than ever. They are investing in their homes based on long-term benefits to their property values and applying least-cost planning to their energy budgets.

While goals for participation were achieved across the ten programs, the Home Performance with Energy Star *Loan* program did not achieve the expected levels of participation. Yebra asserts that lower-income AE customers have been more affected by the economic downturn and the loan program is thought to have been affected by this factor. Table 4.6 depicts the performance measures listed for participation, demand (MW) and energy (MWh). Goals were achieved in both peak demand and total energy savings.

Table 4.6 Goals for Participation, Reduced MW, and Saved MWh

Program	Participants	MW			MWh		
		Goal	Actual	% Goal	Goal	Actual	% Goal
Appliance Efficiency Program	3,093	2.97	2.93	99%	3,833	3,782	99%
Home Performance ES - Rebate	2,223	2.66	4.02	151%	2,568	4,390	171%
H. P. Energy Star - Loan	213	0.54	0.38	71%	593	421	71%
Free Weatherization	505	0.53	0.48	91%	598	552	92%
Multi-Family Program	21,814	2.68	4.61	172%	13,863	23,847	172%
Clothes Washer Rebate	813	0.02	0.04	203%	115	234	203%
Duct Leaks Sealing/Diagnosis	231	---	---	---	---	---	---
Refrigerator Recycling	4,114	0.72	1.21	168%	2,668	3,235	121%
Power Partner	9,934	9.48	9.80	103%	93	97	105%
Cycle Saver	1,237	0.65	0.80	124%	6	7	118%
Compact Fluorescent Light Bulbs	0	0.20	0.99	494%	1,263	6,244	494%
Subtotal Residential	44,177	20.45	25.26	124%	25,600	42,809	167%

Source: AE DSM Performance Review, 2008, 13

Program Costs

Expenditures are measured in operating expenses and incentives of each program for 2007 and 2008 (AE, 2009). Expenditures are determined by a formula that includes the sum of incentives, marketing, and 65% of operational expenses. Investments in incentives account for nearly 90% of DSM expenditures, and the two programs that received the largest funding in incentives and marketing saw the most significant returns in pollutant emission reductions, energy savings, and peak demand reductions. The incentives for EEUs include rebates, loans, in some instances installation costs, direct payments to customers, and other methods designed to increase customer uptake.

The total costs for marketing of the Energy Star programs and appliance efficiency programs do not factor in private marketing around these same programs. Home improvement and hardware stores, appliance manufacturers, the U.S. DOE, and the State of Texas all made marketing efforts. In some ways, AE and these other market players piggybacked on one another's efforts to educate customers about the benefits of investing in these programs.

The Power Partner program was widely advertised in late Spring through late Summer, and according to Yebra, this has shown to be an effective marketing approach since the high costs of summer energy bills due to peaking temperatures are on customers' minds at those times. Consequently, most customers sign up for the Power Partner program between the months of May to September (Interview with Fred Yebra, February 2010).

When compared to the expenditures listed in Chapter 3 for PG&E, SDG&E, and SCE's DSM portfolios, AE's 2008 benefit/cost ratio reflects a relatively cost-effective path toward energy efficiency and carbon emissions reductions. Table 4.7 presents expenditures for AE, categorized as operating costs, 65% of operating costs, incentives and marketing for the ten residential programs in 2008. The third column of Table 4.7 cites the heading, 'Oprt – 65%'. The 65% of indirect operational expenses represents the portion of the total operational budget for that program is dedicated to actually serving EE/DSM programs. Since some staff time and resources aren't directly spent on the DSM programs, AE estimates that 65% of operational budgets for programs are dedicated directly to the management of programs.

Table 4.7 Program Expenditures ($)

Program	Operating	Oprt - 65%	Incentives	Marketing	Total
Appliance Efficiency Program	$219,261	$142,520	$1,348,529	$51,334	$1,542,383
Home Performance ES - Rebate	$300,708	$195,460	$1,849,451	$70,402	$2,115,313
H. P. Energy Star - Loan	$28,684	$18,644	$233,380	$6,715	$258,739
Free Weatherization	$35,892	$23,330	$757,545	$8,403	$789,278
Multi-Family Program	$344,893	$224,180	$1,549,841	$80,747	$1,854,768
Clothes Washer Rebate	$3,041	$1,977	$50,495	$712	$53,184
Duct Leaks Sealing/Diagnosis	---	---	---	---	---
Refrigerator Recycling	$90,475	$58,809	$515,186	$21,182	$595,177
Power Partner	$733,541	$476,802	$2,512,974	$171,738	$3,161,514
Cycle Saver	$60,154	$39,100	$220,129	$14,083	$273,312
Compact Fluorescent Light Bulbs	$73,947	$48,066	$101,265	$17,313	$166,644
Subtotal Residential	$1,890,596	$1,228,888	$9,138,795	$442,629	$10,810,312

Source: AE DSM Performance Review, 2008, 17

Benefit/Cost Analysis

According to AE's DSM Performance Reviews, "Benefit cost analysis ratio is measured in the benefits versus cost assessment for society, the utility, and customers, based on programs offered for 2008" (AE DSM Performance Review, 2008). The benefits to the utility generally are higher than the benefits for the customer and society. The cost of implementing energy efficiency measures is the incremental first cost over and above the cost of installing a standard efficiency product. The benefits are all operating and maintenance savings over the life of the equipment (AE DSM Performance Review, 2008). Table 4.8 introduces the Benefit Cost Ratio for residential DSM programs. Benefit-cost ratios should exceed 1.0 to be considered beneficial. These ratios represent the present value (PV) of all benefits divided by the PV of all additional costs incurred over the life of the installed measures. As mentioned for Table 4.7, these values incorporate direct departmental expenses and 65% of operating (indirect) departmental expenses. The societal benefits cover the overall effects on society as a whole. Municipal incentives pay full technology cost as well as education, databases, etc. Free Weatherization is not evaluated for Benefit and Cost.

AE does not adequately explain how the benefit-cost ratios are established in its DSM Performance Review. AE does not include hard data in its Benefit-Cost Analysis. Particularly, the report does not distinguish how the values for societal, utility and customer benefits are derived. This is a weakness of the AE DSM Performance evaluation reporting method.

The Utility Levelized Life Cycle cost is measured in cents per kWh. It is derived from the present value of all benefits divided by the PV of all additional costs incurred over the life of the installed measures. The incremental first cost beyond the cost of installing a standard efficiency product is the basis for measuring the benefits accrued from the energy efficiency measure. Benefits represent both operating and maintenance savings over the life of the equipment (AE, 2009). Based on the measure of levelized life cycle, the two DR programs are far and away the greatest investments for all parties involved. DR already shows extremely high benefits for achieving AE's 2020 goals for peak reduction, savings for customer. The Residential DSM Portfolio accrued gross benefits across all categories in 2008.

Table 4.8 Benefit/Cost Ratio

Program	Load	Societal	Utility	Customer	Utility Levelized Life Cycle (cents/kWh)
Appliance Efficiency Program	Passive	1.39	3.59	1.32	4.20
Home Performance ES - Rebate	Passive	1.17	3.25	1.09	4.96
H. P. Energy Star - Loan	Passive	1.21	2.54	1.24	6.33
Free Weatherization	Passive	---	---	---	---
Multi-Family Program	Passive	1.73	5.10	1.98	2.91
Clothes Washer Rebate	Passive	1.08	3.47	1.34	3.09
Duct Leaks Sealing/Diagnosis	Passive				
Refrigerator Recycling	Passive	1.61	4.86	1.70	2.50
Power Partner	Active	1.29	1.29	High	582.00
Cycle Saver	Direct	1.62	1.62	High	500.00
Compact Fluorescent Light Bulbs	Passive	6.92	11.13	9.08	1.00

Source: AE DSM Performance Review, 2008, 18.

Net Present Value of Programs

The Net Present Value (NPV) of any given program investment is the present value of all income or benefits minus the present value of all costs incurred over the life of the program investment. Unfortunately, again, AE does not articulate the distinguishing features of the three measurements, Societal, Utility and Customer. Costs incurred reduce the present value of benefits by discounting the cash flows by the cost of borrowing funds, estimated to be 5% for the City and 7% for participating customers. The benefits to society generally reflect environmental benefits, and the benefits to the utility and customer are the "hard" costs and benefits associated with DSM. Market observers also verify the current value of the CFL rebates to customers anecdotally and quantitatively; the payback for the rebate is usually seen in the first year that the bulb is installed. The Multi-Family program provided AE with its most significant value. The NPV alone is a testimony to the value of investing in energy management specialists employed to audit multi-family residences across the city. Table 4.9 defines the Net Present Values for fiscal year 2007-08.

Table 4.9 Net Present Values

Program	Societal	Utility	Customer
Appliance Efficiency Program	$1,564,400	$3,992,206	$1,192,841
Home Performance ES - Rebate	$1,013,718	$4,768,664	$517,072
H. P. Energy Star - Loan	$114,398	$399,640	$124,088
Free Weatherization	---	---	---
Multi-Family Program	$3,992,053	$7,608,349	$5,059,220
Clothes Washer Rebate	$13,492	$131,315	$56,783
Duct Leaks Sealing/Diagnosis	---	---	$1,210,371
Refrigerator Recycling	$1,098,243	$2,300,343	$58,777
Power Partner	$928,614	$928,639	$453,536
Cycle Saver	$142,058	$142,058	$1,637,082
Compact Fluorescent Light Bulbs	$1,586,994	$1,688,258	$10,309,770
Subtotal Residential	$10,453,970	$21,959,472	$20,619,540

Source: AE DSM Performance Review, 2008, 19)

Expenses for Demand Reduction

Expenses for demand reduction are measured in $/kW. The weighted average is based on the level of demand reduction derived from each program (AE, 2009). Table 4.10 illustrates the cost of demand reduction based on dollars per kilowatt of demand reduction. The CFL, Power Partner and Multi-Family Programs compare favorably with the other programs for cost of demand reduction, and the Free Weatherization program is significantly less cost-effective than the rest of the portfolio. The Free Weatherization program is a federal program that is operated by AE. Costs are covered federally. The rate of return on investment for the Power Partner, Multi-Family, and CFL programs highlight AE's competence in finding cost-effective means to reduce peak demand.

Table 4.10 Expenses of Demand Reduction ($/kW)

Program	Financial Incentives ($/kW)					Total Allocated Expenses ($/kW)				
	2004	2005	2006	2007	2008	2004	2005	2006	2007	2008
Appliance Efficiency Program	447	362	447	403	460	571	421	543	536	526
Home Performance ES - Rebate	395	406	411	410	460	519	519	482	515	526
H. P. Energy Star - Loan	362	411	475	598	609	486	515	580	730	675
Free Weatherization	1,010	1,084	1,165	824	1,579	1,102	1,084	1,362	1,057	1,645
Multi-Family Program	324	389	349	234	336	344	438	399	290	402
Clothes Washer Rebate	382	605	400	400	1,242	506	719	443	453	1,308
Duct Leaks Sealing/Diagnosis	504	583	598	922	---	628	611	658	1,008	---
Refrigerator Recycling	---	455	750	537	426	---	575	809	602	492
Power Partner	153	245	267	324	256	172	261	286	347	322
Cycle Saver	328	285	234	299	274	378	311	256	325	340
Compact Fluorescent Light Bulbs	249	771	220	207	102	373	955	259	247	169
Subtotal (Weighted Average)	298	308	367	349	362	372	396	417	404	428

Source: AE DSM Performance Review, 2008, 20

Conclusion

Over recent years, AE has shown incremental progress towards its climate and energy efficiency goals. Across the residential DSM portfolio, programs show a favorable cost/benefit ratio and produce thousands of kWhs of avoided generation and pollutant emissions. The concomitant effects of reduced peak demand through ratcheting standards for appliances, lighting, and multi-family units have had an immediate payback for both the utility and customers, As markets get closer to saturation, particularly in the CFL and to a lesser extent in the Multi-Family program, AE can look at the success of the marketing campaigns for those initiatives and consider similar campaigns for other programs. It could also consider investing more money into marketing and incentives for those programs, to ensure greater overall savings in those key categories of peak demand, carbon emissions, and total energy savings.

The next chapter will take a look at how AE established the 800 MW peak demand reduction goal, the importance of customer satisfaction in reaching the 2020 goals, and also offer a review of AE's performance evaluation, and concludes with an analysis of necessary improvements to the EE/DSM portfolio for residential customers.

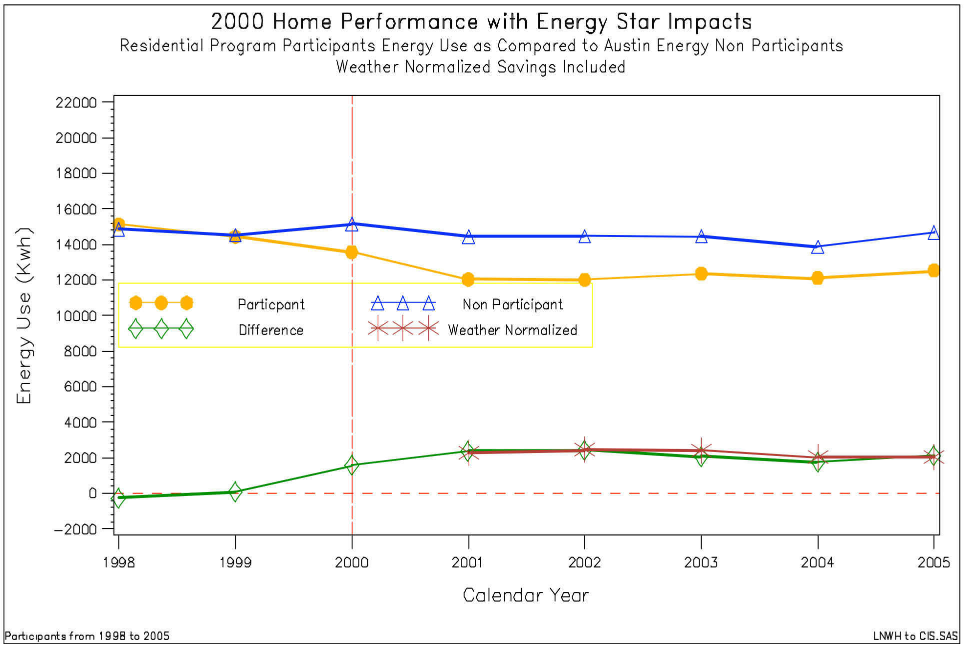
Chapter 5. Program Performance and Measurement Methodology

This chapter will review the program performance, evaluation methodology, and new EE/DSM program development methods of AE, in order to better understand the options for increasing customer participation levels. The chapter is broken into three sections. The first section assesses the customer base's response to the utility's residential EE/DSM offerings and looks at the methodology that AE uses to review its own EE/DSM programs internally. The second section provides context to AE's developing new EE/DSM programs in light of funds funneled through the American Recovery and Reinvestment Act (ARRA). The third section provides an analysis of options that AE may consider for increasing the efficacy of its residential EE/DSM program portfolio, highlights challenges that lie ahead in increasing program participation and barriers to reaping all the benefits available to the customer base, utility and environment.

EVALUATING AE'S INTERNAL ASSESSMENTS OF EE/DSM PROGRAMS

AE's Home Performance Program has seen consistently growing participation rates over nine years. AE consolidated multiple services into this single offering supported by Energy Star. AE has seen energy savings beginning in the very first year, 2000. AE's Home Performance with Energy Star program offers packaged whole-system efficiency upgrades, or a single EE upgrade at a time. The Home Performance program covers a cross-section of devices and equipment in the home, dependent on the needs of the customer. Table 5.1 shows the increased savings in 2000 from the program (Trowbridge, AE Energy Impacts for Residential Conservation Programs, 2008, 9). Persistence of savings is demonstrated in Table 5.2.

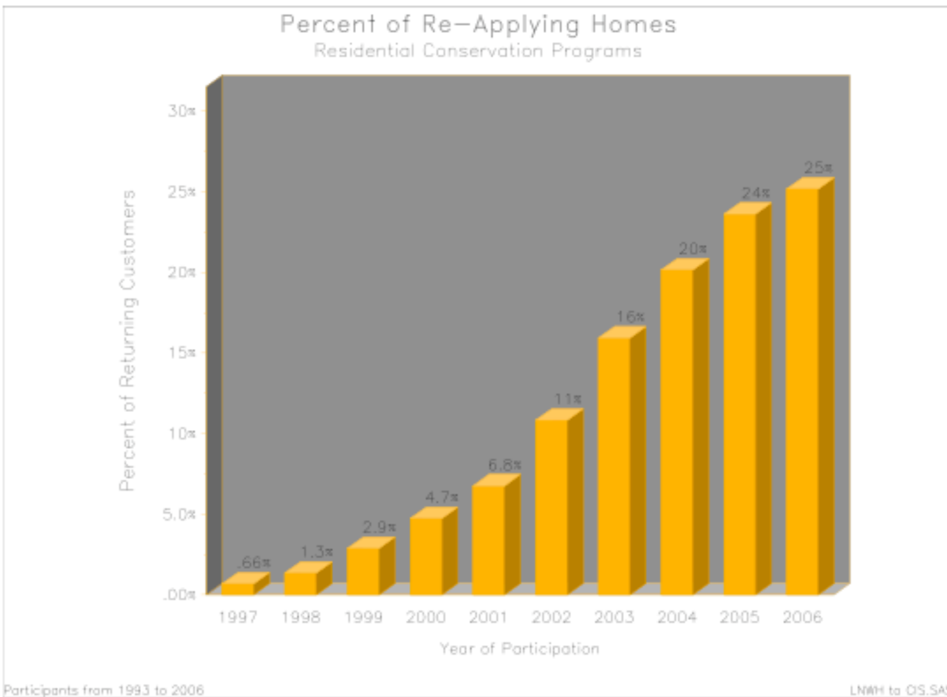
Table 5.1 Savings from AE's Home Performance with Energy Star, 2000–2005



Source: Trowbridge, AE Energy Impacts for Residential Conservation Programs, 2008, 9

As customers became more comfortable with the Energy Star brand, and AE continued to offer consistently good levels of customer service in their EE/DSM installs and services, more customers returned to participate in additional programs over all energy conservation programs. Table 5.2 shows the incremental increases of AEs customers who participated in conservation programs and subsequently applied for more programs. John Trowbridge, lead researcher for AE's EE/DSM programs explained why people reapply, "The programs work, the savings are persistent, participants love it, and are coming back" (Interview with John Trowbridge, AE, 2010). Trowbridge and AE conclude that neither the technical aspects of DSM measures or the rebates are not the main factor accounting for returning customer participation. Trowbridge concludes that increases in single measures participation are due to so many homes previously undergoing retrofits so that fewer options for additional energy efficiency upgrades remain. This may indicate that, at least for a segment of AE's customers, some programs are approaching saturation levels. A comprehensive Energy Efficiency Potential Study will flesh out whether that is true, but if it is, then holistic and integrated EE/DSM market transformation may achieve the goals that AE has set out for the ACPP, particularly the 800 MW demand reduction benchmark.

Table 5.2 Percent of Homes Re-Applying for AE EE/DSM Programs, 1997–2006



Source: Trowbridge, AE Energy Impacts for Residential Conservation Programs, 2008, 21

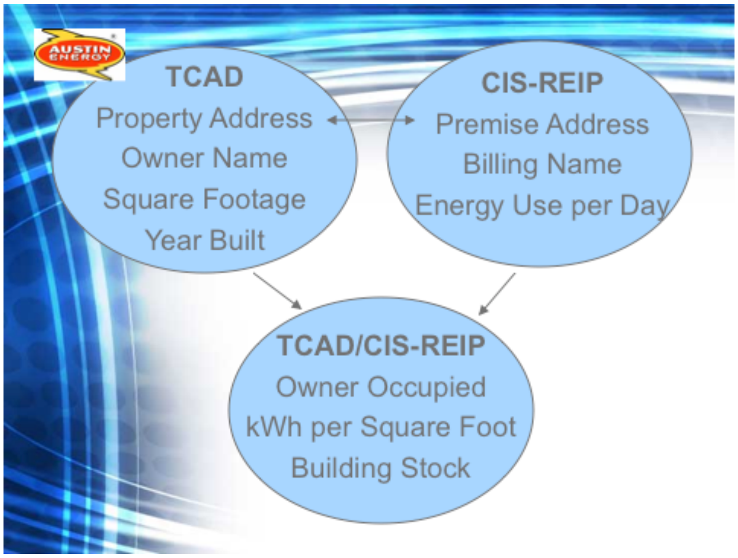
While AE's DSM programs are supposed to largely be for customers that live in homes older than 10-years old, AE has not publicly shared analysis about the share of customers that have installed EE upgrades prior to the 10-year old building benchmark. Interestingly, in 2007 AE added a $500 incentive for homeowners who participated in a third Energy Star service or program, following the model of performance-based incentives to increase the participation by those who are already familiar with services and generally have favorable impressions of it. This customer segmentation analysis is invaluable to a utility trying to increase program participation.

Methodology Behind the Data

The methodology of John Trowbridge's research was important because ordinarily direct billing analysis uses a linear regression of base year weather with kWh billing data to develop a model of energy use before the retrofit. Before AE could verify persistent savings it needed to establish regression data of savings from prior years. This establishes the difference change in energy efficiency with the retrofit.

Figure 5.1 reflects a meta-analysis that AE developed which took customers' energy use, and cross-referenced that information with data housed in separate departments of the City of Austin, in order to capture an accurate reading. AE matched up property addresses from the billing system with TCAD's data to create a new dataset of information for many customers (Trowbridge, AE, 11). By checking the names of the occupant with the names of the property owner, an assumption was made that the property was owner-occupied or rental property. Energy use per square foot and building stock (year of construction) was used to generate information about the home. A control group of homes that had not yet participated in any programs was identified, and so AE was able to establish key findings about customer uptake (Trowbridge, AE, 11). This allowed AE to go beyond the individual meter or account information to identify who uses what EE/DSM programs and what their energy consumption and program participation trends have been like over a time span of years.

Figure 5.1 Cross-Referencing Data To Pinpoint Customer Energy Use Information



Source: Trowbridge, AE Energy Impacts for Residential Conservation Programs, 2008, 14.

This allowed AE to also assess overall inefficient energy use in key geographic sections of the city. This information would be useful in tailoring programs to specific customer segments, i.e., going door-to-door for neighborhood blitzes, since best-practice research finds that low-income homeowners and renters participate more in door-to-door blitzes than high-income residents. Or this data could be useful in advising customers with pool pump switches to turn them off during peak times, since pumps operate at all times of day in the summer heat. For West Austin specifically, Trowbridge states that particularly high-energy use per square foot in a single-family detached home can usually be explained by the presence of a pool at the residence (Interview with John Trowbridge, AE, 2010). AE has the information and opportunity to focus its efforts on particular geographic, socio-economic, and consumer trends, in order to absorb the increasing demand for energy. This ability to pinpoint areas of strength, weakness, and opportunity bodes well for AE's participation in ARRA energy programs.

ARRA AND ITS EFFECT ON AE'S CONSERVATION/DSM EFFORTS

Awards granted by the U.S. Department of Energy (DOE) through the American Recovery and Reinvestment Act (ARRA), or "the stimulus," have netted AE over $25M dedicated to energy efficiency, weatherization, DSM, and renewable energy funding. Over $10M is being dedicated to retrofitting city buildings with energy efficient appliances, lighting, weatherization, and HVAC improvements. Additional funds are being used for cleaner burning natural gas turbine technology. These funds were allocated by formula out of a distribution to the state government. Another $5M was awarded to AE's preexisting Weatherization program to increase the amount provided to weatherize each home from $1,700 to over $6,000. Recently, the City of Austin and AE were awarded $10.5M for its Retrofit Ramp-Up in a competitive block grant sponsored by U.S. DOE. Together these three programs are establishing short term, mid term and long term goals for enhancing AEs energy efficiency upgrades through innovative financing models, and scalable and replicable program designs that will collect significant levels of data that can be analyzed further.

While the utility had already established a mandate for energy efficiency, the ARRA offered a unique opportunity for all utilities to combat energy inefficiency in new ways, more expansively, and at a greater scale. Funds allow for more rigorous energy efficiency upgrades, more staff to service customers, and more narrowly tailored, sophisticated programs with an eye to determining if they offer large savings achievable if scaled to the whole service territory. Furthermore, the DOE and Obama Administration cite job creation and continued growth in the energy efficiency sector as an impetus for the "Recovery through Retrofit" Initiative, supported by the $80 billion ARRA investment in clean energy and energy efficiency.

Retrofit Ramp-up ARRA Program

Austin was one of 25 cities to be awarded the Competitive Retrofit Ramp-up grant and led the grant writing effort. The awards were granted based on the relative strength of proposals incorporating innovative financing models to make these savings accessible through low- and no-interest loans repaid through property tax and utility bills, ability to build onto sustainable existing program, and market penetration of energy efficiency efforts to date (U.S. DOE EE Division Press Release, 2010).

The Retrofit Ramp-up will generate information for the DOE on how well the program removes barriers to customer participation through financing models and customer education, followed by arranged visits to further familiarize customers with the new features of the home, and energy savings to date. This information will deliver verified energy savings and ensure continued efficiency improvements, as well as ongoing customer education even after Recovery Act funds are spent. The DOE expects to use the lessons learned from this and other pilot programs to develop best-practice guides for comprehensive retrofit programs to be adopted and implemented in communities across the United States.

A unique aspect of neighborhood blitzes is that they often align the efforts of the utility, City departments, and/or philanthropic organizations with one another on a matter of mutual interest and mutual gain. The stakeholders involved in the AE Weatherization Grant in this case are AE, Travis County Health & Human Services, City of Austin Housing and Community Development Department, American Youth Corp, civil society organizations including local churches, and the One-Day at a Time Organization. The impact of ARRA is that it opens the door for AE to synchronize its efforts with other government agencies, civil society organizations, and regional stakeholders. It will begin door-to-door customer outreach campaign in the Fall 2010.

Weatherization Funds

AE's approach to weatherizing low-income homes was supported by the DOE funds received via ARRA. Weatherization loans are provided to elderly, disabled, low-income, or otherwise disenfranchised people to improve the air infiltration and working parts of their home. Prior to ARRA, a home might be provided services averaging over $1,700, but through the stimulus that average has increased by almost $5,000 (Interview with Fred Yebra, 2009). AE decided to apply a more narrowly tailored methodology to identify customers that would receive such benefits. This program significantly alters energy bills for customers, allowing for an improved quality of life in conjunction with significant reductions of CO^2.

The utility has taken a new approach to identify eligible homes to weatherize. While AE cannot lead the program due to resource constraints, it has frontloaded the program with strategic partners within City government, community stakeholders, and the thousands of certified ECAD auditors and its consultants to implement a dynamic neighborhood blitz in its service territory aimed at low-income and disabled/elderly customers.

In order to assess maximum potential benefits, information has been designed to integrate survey research, income/billing information, and new technology review made possible through AMI and a new billing system, and overlaid in GIS. Relative needs for residential customers have been cross-referenced with communities and particular pockets of the city with the highest energy burden. AE generated this data through census data, billing data, and information provided by Travis County Health & Human Services. Together, this information identified target areas for "Neighborhood Blitzes." This is a relatively common form of customer outreach, where the utility goes to a central location where inefficiency has been identified and offers weatherization services door-to-door. The scaled-up free weatherization program is expected to rollout in Fall 2010.

The ARRA money comes at a time when AE has finished major capital improvement projects such as (1) installation of almost 186,000 smart meters to customers over the past three years, (2) installation of over 48,000 smart thermostats across the past three years, (3) system-wide adoption of an Advanced Metering Infrastructure (AMI) that allows for two-way communication between the utility and customers, (4) billing system improvements that now allow for near real-time information available to both the customer and utility, and more information available at the point-of-contact with the customer, and (5) new supervisory control and data acquisition (SCADA) infrastructure.

Essentially these new improvements to AE's system allow it to shift into a "Smart Grid 2.0," where the customer is able to communicate with the utility on its energy use based on the fullest, most accurate, and up-to-date information. According to Andres Carvallo, AE now has the infrastructure to optimally implement dynamic pricing for its meters. Dynamic pricing would essentially give customers more control over their energy use and over their energy bills. Adopting a new pricing method is done through a rate case, AE is considering options to include allowances for new billing rate for its customers in 2012 (Interview with Chris Smith, AE, 2010). It is yet to be decided if AE will adopt dynamic pricing as a centerpiece of this effort. If it chooses to do so, its infrastructure can withstand the demands of such a complex system.

CONCLUSIONS

A thread of consistency across all AE's residential EE/DSM programs is that they are provided on a voluntary basis. This is at the heart of AE's approach to achieving the goals established by City Council. To paraphrase Ed Clark, Public Relations Director for AE, 'The way to paradise is through voluntary behavior change [by the customer] — self-started, not mandatory. Austinites are good, smart, and well intentioned' (Interview with Andres Carvallo, 2010).

As the AE 2008 DSM Performance Measures Report states, "During the last seven years, Austin has grown at a phenomenal rate. The Power Partner load management is a solution to accommodate that growth, and its associated need for increased energy" (AE DSM Performance Measures, 2008). In fact, AE has had the luxury of a customer base, and more importantly perhaps, the support of the community and city leaders, in reducing its energy consumption and carbon footprint. Participation in programs that provide incentives and show savings to customers are received well, and customers return to participate in more programs based on their prior experiences. Yet there are still many savings that must be made, and the sustained performance of the DSM program is not guaranteed.

AE, in collaboration with the City of Austin, could identify and implement a wider range of direct incentives such as residential rebate programs for retrofit, energy performance incentives, and promotion of a range of energy demand reduction actions. The residential point-of-sale ordinance presents a model for improving public participation in retrofitting residential structures, with enormous potential enhancement of energy efficiency. The utility can expand and accelerate existing energy efficiency programs. These include residential and commercial retrofit initiatives, particularly those that target lighting and HVAC modernization for buildings not previously upgraded.

AE consistently cites its objective of saving 800 MW of avoided power generation by 2020 but has not explicitly detailed how it plans to achieve this goal. Although revealing its tactical plan for achieving that objective would undermine its competitive strength vis-à-vis other Texas utilities, this target is relatively straightforward based on its yearly accounting for peak reductions. Yet in 2009, there are already bumps in the road to 800 MW, and that number is a generally conservative estimate of achievable DSM savings. The 800 MW goal fails to reflect robust research into anticipated technology improvements, incentives provided by carbon legislation, new market incentives, the potential effect of a shift in economic well-being, weather patterns, and most importantly, public expectations regarding energy usage. The most elusive component of what can be achieved beyond the 800 MW goal is the enormous potential suggested by behavioral change.

AE employs baseload energy at all times, and as energy consumption expands with higher temperatures, AE experiences peaks from 3 pm to 7 pm on the hottest of days. In July 2009, AE hit the highest peak ever, over 2,600 MW. However, the costs associated with peak demand, and installing new generation can generally be avoided through more demand response deployment. AE activated its top 100 MW of capacity rarely; this generation is provided by generators that use jet engines as a means to speedily ramp up power generation. AE will ramp up these generators in addition to activating its DR programs. AE initiated these generators for an average of only 43 hours per year from 2004 to 2008. The last 100 MW of peak demand is the most expensive and it occurs very rarely across the year. Since that last few MW of energy generation is so valuable, precise programs such as the Power Partner and Cycle Saver provide incredible value and increasing potential for a utility that is required to make conservation its top priority. Such priorities happen to also fall in line with fiscal responsibility, as it allows AE to delay investing in huge capital improvement projects, as well as carbon emissions avoided by new construction, operation and maintenance of new generation capacity.

Therefore, modulating consumer behavior to avoid placing heavy demand on the system at its most vulnerable periods (such as the late summer afternoon period) offers the most rewarding avenue to alter behavior, thereby perhaps beginning to alter the peak load demand model that undergirds AE's generation assumptions. AE and the City of Austin have multiple options to increase DSM programs' ability to help reach the stated 2020 goals. AE could pursue technological advances that allow a smart grid to apply price signaling to decrease demand. Price signaling efforts could utilize a number of demand response programs: real-time pricing, time of use, critical peak pricing, and other load shaping opportunities.

Although behavior modification, especially at a level that requires such complicated legal and regulatory intervention, remains a difficult variable in the range of options, given the impetus of public will and political determination it nevertheless presents a considerable opportunity to reduce demand beyond the 800 MW objective. Fred Yebra concurred that the potential for emerging research data to support the viability of achieving significant savings by 2020 is real and worthy of serious analysis. AE may be able to exceed its 800 MW goal by 2020 through behavioral modification. According to Yebra, Austin's consumers presents an opportunity to influence demand patterns, especially by avoiding the traditional periods of peak demand by voluntary and mandated changes to align with standard 8 am – 5 pm work schedules to avoid the typical surges on particularly hot days. Behavioral modification programs are relatively unexplored, yet they can be quickly adopted to change energy consumption patterns.

The challenge that AE faces to increase demand savings, energy savings, and carbon emissions reductions, is more the challenge to effectively reach out to customers and provide education and services that promote consumer behavior to complement energy efficiency efforts and flatten load curves in order to stabilize prices. Chapter 6 provides recommendations on how AE can utilize a market transformation policy framework and policy tools to enhance customer participation in residential programs.

Chapter 6. Market Transforming Recommendations

The final chapter of this report provides recommendations for AE to achieve greater energy savings through higher customer participation by aligning the residential DSM portfolio with market transformation policies and policy tools. As previously mentioned, this report provides a series of recommendations and a more strategic approach for AE to consider. As AE plans to undergo a comprehensive EE/DSM Potential Study in 2011, these recommendations can be included in the framework of the EE/DSM Potential Study to consider more methods of achieving higher levels of market-based and technology-based energy savings, peak and carbon emission reduction program design. The recommendations include a number of cost-effective policy measures (policies and policy tools in the verbiage of market transformation) that can immediately produce higher rates of participation. Since education and outreach remains one of the lowest cost solutions, a number of the recommendations below include proposed methods for reaching out to customers more effectively.

Chapter 1 of this report highlighted AE's goal of 800 MW of peak demand reduction and 20% CO2 emissions reductions by 2020, and also described limitations to achieving those goals. AE will undergo a rate case in 2012 to increase its residential billing rates by roughly 20% by 2020, in conjunction with the Climate Generation and Resource Plan. According to Fred Yebra, AE also expects concurrent growth in customer applications to participate in DSM programs to offset higher energy costs.

In Chapter 5 I directed attention to recent and ongoing developments in AE's residential DSM portfolio. Funds from the ARRA have allowed AE to expand its Free Weatherization Program, the Retrofit Ramp-up, and Pecan Street Project. These awards were designed to initiate more long-term efforts to improve residential energy efficiency efforts in the area. Many aspects of market transformation are already occurring in the form of these stimulus awards. Even without the stimulus awards, AE is successfully approaching its 2020 goals.

The three stimulus awards highlight how AE has adopted aspects of an enabling policy framework and policy tools for market transformation. Funds for the Retrofit Ramp Up program were awarded because DOE felt AE's program financing model was adequately funded for the future. The program's focus on wide-scale deployment of efficient lighting, HVAC, and ventilation systems is expected to produce enough return on investment over time to continue operating after stimulus funds run out. Lighting, HVAC, and duct repair remain three of the most significant areas to increase energy efficiency in the average household. Treating these as integrated systems, as opposed to a "silver buckshot" approach such as higher CFL rebates or marginal rebates for a new air conditioner, allows AE to compound benefits. This is similar to the success it had in ramping up the CFL rebate program through the Multi-Family Program, in which AE partnered with property managers and the realty community to galvanize large-scale savings. The importance of direct customer outreach, and facilitated technical assistance by AE Conservation Specialists to promote services to specifically the property managers and realtors is plainly seen in the uptick in participation level in 2008, when such actions began to take place.

The Pecan Street Project is perhaps the first pilot project of its size to address real time energy consumption and embedded energy use in water at the residential and commercial levels, providing hourly reads of unique customer information. This project has established rigorous standards for its program administration, data collection and oversight, technical assistance, and education and information tools for customers and has been chosen as one of the ten programs in the DOE's Smart Grid Demonstration

Project award. The Pecan Street Project also provides a local opportunity to evaluate new pricing models, new EE technology, and perhaps future business models that can be scaled up to apply to the whole AE service territory. The project will take place in a micro-grid with 1,000 residential accounts ranging across residential typology, operating within AE's service territory. The University of Texas and National Renewable Energy Laboratory will collect data and analyze energy efficiency, on-site renewables generation, and other customer and system-related data.

For the AE, the challenge to its business model is this: if a utility's revenue must be maintained and the utility's business model is based on the volume of energy sold, how can it justify changes that will require up-front investment and is explicitly intended to reduce the amount of energy it sells? The demise of the "spinning meter" business model is inevitable. Roger Duncan, former GM of AE says "people now think it's coming pretty quickly" (*Renewable Energy News*, 2010). What has not emerged yet is its replacement. Until utilities like AE *know* where the revenue streams will flow from and to, technical plans for programs matter little – policies by state utility commissions, and rate cases across the country will be the linchpin in updating the business model.

The most urgent and complicated challenge being faced on all utilities horizons is the urgent need to change the current spinning meters business model because it does not adequately secure revenues for the utility from onsite renewables generation, energy storage and simply does not incentivize the utility to develop robust and comprehensive energy efficiency programs and more aggressive demand response goals. During his time as General Manager at AE, Roger Duncan systematically pushed AE to explore ways to separate profit from volume. As President of the Board of the Pecan Street Project, which will set out to establish new rate structures, Duncan has prioritized, "exploring new ways to provide value to customers and test pricing options for those services. It means the utilities need to upgrade their systems so the private market can participate more meaningfully in what has historically been a two-party energy relationship where the utility provides energy one way, and customers provide revenue back to the utility for that energy" (Roger Duncan, *Renewable Energy News,* 2010).

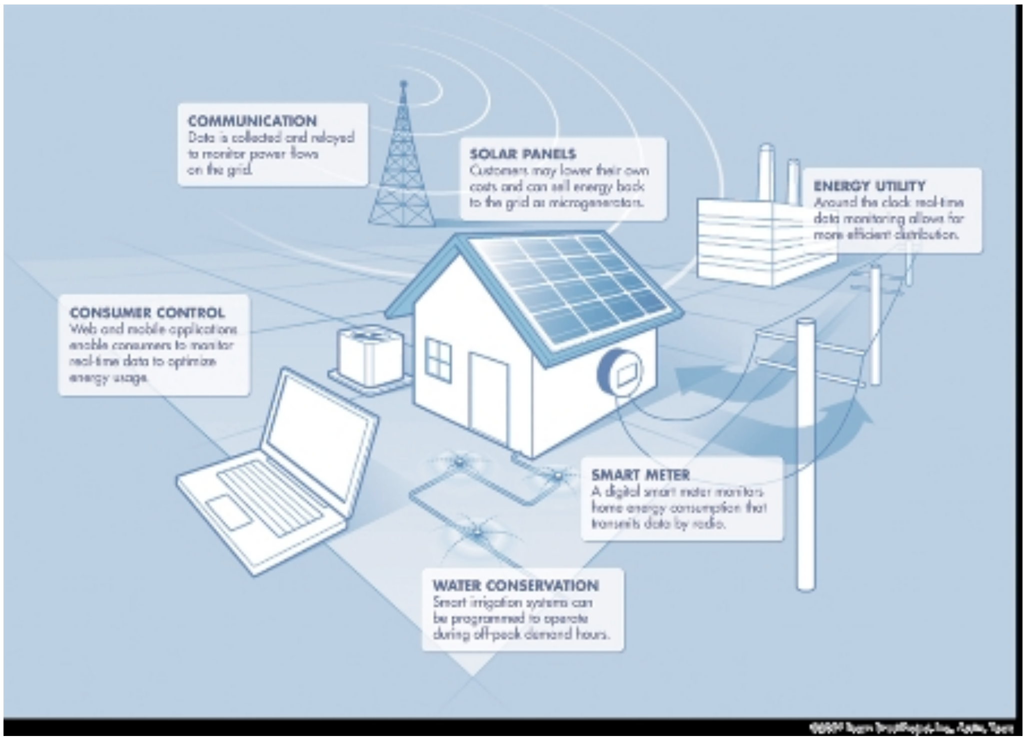
Rate-structure recommendations from the Pecan Street Project report from March 2010 include several concepts that have been debated in the utility industry but yet to be acted on: unbundled rates that separate generation costs from transmission and distribution; new rate structures that integrate customer-generated energy (specifically solar) into the grid in a financially sustainable way; and introducing dynamic, real-time pricing. For customers participating in the Pecan Street Project, AE will not be a rate-charging commodity provider but a fee-based service provider (Duncan, Renewable Energy News, 2010). Customers could sign up for a service plan for a CPP, TOU, RTP or even flat-rate fee. By participating in the program, the customers are guaranteed that the energy bill they receive would not be allowed to go over the cost of the current rate structure for the same amount of energy produced. In effect, customers still get all the power they need, within a tested and predetermined range. In exchange for the predictable fee, customers would agree to become energy partners-not just customers-with AE. Participate in AEs demand response program in addition to programs that either directly limit peak use of non-essential appliances (in favor of off-peak use), or indicate to the customer that price signals will begin charging more for energy consumption at established times of day or based on cost of energy on the wholesale market. The data collected by the University of Texas and the National Renewable Energy Laboratory will cover five years of rate and savings/consumption studies. Over the five years, the Pecan Street Project expects to introduce dozens of new DSM and DR related devices into the market, multiple pricing models with verified data from this study.

In these new rate structures that the Pecan Street Project will evaluate, AE is not the “rate-charging commodity provider”, but more of a “fee-based service provider”. Customers in the Pecan Street Project sign up for service plans for a fixed cost per month. For that fee, they agree to become energy partners. They make their rooftops available to solar equipment owned by AE. Customers agree to reduced-cost appliance upgrades such as solar water heaters, participate in AE’s DR program, and agree to limit their peak use of non-essential appliances in favor of off-peak use. Beyond a test of a smart grid and new business models, Pecan Street Project is also a social science research project that looks at the heart of customer awareness and all types of incentives that may manipulate customer energy consumption behavior. And in this agreement Pecan Street and AE will not deny power when customers need it. However, customers do agree to being charged “pay as you go” for exceeding energy consumption quotas based on the baseline energy consumption data from the year prior to project participation.

Decoupling, as done in California, is not a viable option for AE because decoupling requires a statewide initiative to shift the energy wholesale market and the assumptions that underlie the trading of energy on the market. The decoupled rate structure would be evaluated as a feasible option for systematically moving Texas in a more energy-efficient direction, however to date the state has shown no proclivity toward seriously evaluation such a dramatic alteration to the ERCOT or Texas wholesale market.

The Pecan Street Project report includes the goal of strategically positioning Austin as the Silicon Valley for green and clean energy innovation. It likens a third-party service potential of these devices and services to Apple's app store for iPhones. This free-market energy platform is purely hypothetical; it hasn't been tested or even fully imagined. While it is not at all clear what this third-party service potential could add to the business model, it is clear that this is the type of imaginative thinking is what is needed to change the business paradigm. Figure 6.1 shows a graphic representation of a sample single-family residence in the Mueller neighborhood activated with full smart grid capability on the utility side of the meter and the customer-facing side of the meter.

Figure 6.1 Early Schematic Design of Smart Grid 2.0 in the Mueller Neighborhood



Source: McCracken, Duncan, Carvallo et al. Pecan Street Project Recommendation Report, March 2010.

In short, the Austin area—its utility, the City of Austin, customers and market players, are working towards the same goals. With many changes occurring in the energy industry today, AE has shown a resolve to grow in a sustainable direction in the future despite the loss of revenue from advancing its EE/DSM and smart grid initiatives. This chapter considers further recommendations that can enhance program participation and higher savings in peak demand and total energy savings. This chapter is broken into three sections: technical recommendations, policy recommendations, and market-based solutions. These sections include recommendations that cut across the policy framework and policy tools that enable market transformation. Crosscutting recommendations offer a mix of new policies, more sophisticated market analysis, customized incentives, education and customer outreach, and ongoing performance reviews for programs and customers alike. The recommendations align with the objectives of market transformation policies and policy tools discussed in Chapters 1-3. The enabling policy or policy tool of market transformation are distinguished in the introduction of each recommendation.

It is important to reiterate that AE is functioning at a sophisticated level in DSM, but doing so under an antiquated business model where EE/DSM in effect cannibalizes profits. On Roger Duncan's retirement, he lamented that if AE achieves its goals too quickly, it may go bankrupt. In the near term, AE has the opportunity to re-orient its business model, starting with a rate case that will likely enforce a rate increase in 2012. The current business model not only hinders AE's push into EE/DSM territory, but also throws up barriers to moving into renewable energy investments, on-site renewables generation by AE customers. It prevents lessening AE's dependence on carbon-emitting coal and continued reliance on natural gas, with its highly volatile costs, as AE's baseload.

The following three sections take into account all the progress to date, best practices, policies and policy tools, as well as limitations discussed throughout the report, and offers recommendations for cost-effective DSM program enhancements.

MARKET-BASED SOLUTIONS

AE may explore solutions that influence the market. Appropriate solutions would use customer education, technical assistance, and non-financial incentives, and establish policies that ensure robust program administration and oversight as well as responsible financial incentive structures. Recommendations include developing customer service protocols and online programs such as web portals and telephone scripts for customer service representatives to use to educate customers on their real-time energy use. Such protocols and programs could also provide customers with energy efficiency information, offer technical advice, or register customers with programs. Other recommendations include showcasing advanced EE/DSM technology, collaborating with customers and community stakeholders to attract customers who have not previously participated in EE/DSM programs, and designing market analyses to strategically promote AE's programs to unique market segments,

Customer Education and Outreach

Current programs have received accolades for relatively high levels of use by customers and promoting overall market awareness. However, AE has the capacity to build upon relationships with customers that have already participated in energy efficiency programs to encourage participation in other services. An effective education and outreach policy tool at the disposal of AE would include a synchronized campaign of customer outreach, followed by a scheduled energy audit, presentation of potential savings, DSM installation and verification, customer education on ways to save more energy, and periodic check-ins to ensure cost-effective investment on the side of the customer. This recommendation is similar to elements of the ABACE in that it provides a step-by-step process, rather than a buckshot approach to DSM offerings. Market analysis culled from cross-referenced data about the customer even before the outreach contact and audit would ensure robust program administration, while the periodic check-ins with customers would provide necessary oversight to ensure the installed energy savings measure is verified and accurate.

A successful rudimentary example of this approach is the Multi-Family residential program, which provides a site visit by an AE Energy Conservation Specialist. The Specialist is able to talk with the owner, explain particulars of the efficiency standards, and suggest ways to enhance efficiency opportunities. With this service, AE collaborates with multi-unit property managers and realtors to provide free energy audits of their buildings to show how they can save operation money. Buildings that achieve certain levels of building envelope efficiency receive Energy Star performance awards, which are often used in marketing materials. Property owners participating in the Multi-Family Program also report higher occupancy rates and more lease renewals than prior to participating in the program. Such programs could open doors for even greater customer service if the AE Energy Conservation Specialist program was available to owners of single-family residences.

Marketing Research and Development

To build greater awareness in the community about efficiency opportunities while allowing the market to present the most promising practices in EE/ DSM technology, AE can work with private partners or act alone in developing AE Smart Home or Business Showcases akin to an Apple Store for energy management. This suggestion was first proposed in the Pecan Street Project Recommendations report and could be developed to address market demand from high-end and middle-income customers that would participate in the program with or without the offer of a rebate. Such participation, or "free-riders", remove funds from the total amount available to customers, and may leave less wealthy or fortunate customers without the opportunity to participate. It would appeal to consumers who more interested in the most advanced innovations and developments in home energy management while still receiving rebates. Hyper-efficient technologies can be coupled with customer incentives for high-efficiency homes in the form of performance-based rebates. Effectively marketing AE's efforts in hyper-efficiency (sensors, lighting, computer management, all things plugged in, and an energy efficiency lab onsite) could develop a new level of awareness in the population most interested in "green" and "sustainable" products and services. This recommendation reflects the need for AE to utilize the education and information and emerging technology policy tools at a more sophisticated level, by reaching market segments that are already efficient but looking to be more so. It could also be an opportunity as well to engage industry and manufacturing by providing a place for them to shop their wares, while establishing an R&D presence for the utility and in the community. AE may consider further exploration of a EE/DSM showcase building using local typologies: bungalows, coffeeshops, commercial or office spaces, and landscaping. The University of Texas has been tasked with collecting data and evaluating customer engagement. The Pecan Street Project may also help in assessing consumer behavior.

Market Analysis and Customer Contact

The new billing system and AMI infrastructure have the capacity to greatly improve energy use information because of the utility's increased capability to cross-reference data across sources, assess areas of energy inefficiency, and target particular customer groups, house types, etc., to improve energy efficiency through participation in a given program. The significance of the new Smart Grid lies in two-way communication between customer and utility being connected to billing information available to customer service representatives. Administration of EE/DSM programs as they relate to all customers, not just active participants, allows for a robust opportunity to optimize energy efficiency.

Improvements for end-users may exist if AE creates new information provided in monthly billing statements that includes:

(1) customer energy consumption,

(2) customer energy savings through DSM program participation,

(3) average energy consumption for a similarly-sized home in your neighborhood,

(4) average of the most energy efficient homes in the neighborhood.

Additional potential lies in more efficient customer service protocols designed to periodically update customers on their energy savings, answer questions, and generally harness latent opportunities to inform customers of the savings available. Most of AE's direct points of contact with customers are through the phone, dealing mainly with billing and outages. Customer Service can develop protocols to solicit participation in energy savings programs that would reduce customer costs, referencing potential savings based on billing information that cross-references income, billing history, house typology, and square footage through a new technology review that is a part of the City of Austin's GIS system. This new technology will give Customer Service access to more information at the point of contact with the customer related to their measured meter performance with any given energy efficiency program.

How AE's Customer Service Can Better Facilitate EE/DSM Program Participation

Another effective method of enhancing program participation occurs by providing real-time price feedback to customers regarding their energy use. AE has articulated and advertised the benefits to the public through mailers and billboards, sponsoring events, and public participation processes. Customer Service Representatives informed with relevant customer information can take a more holistic approach to education and outreach, and use this method to effectively (1) provide real-time price information to customers, (2) offer answers to frequently asked technical questions, and (3) register customers for EE/DSM offerings.

Fred Yebra actually cites the lack of "Customer conversion (to participate in DSM programs) over the phone" is one of the key barriers and challenges to reaching higher participation uptake. Scripts for customer service representatives would be a first step in actively engaging all the possible AE customers to get on board with the DSM portfolio. Beyond the implementation of a phone script for customer service representatives, Yebra envisions a new protocol where a customer has text service and immediate information by phone call for customers to check how much their program participation is saving them. Yebra hopes that AE service level "may continue to promote awareness by talking more holistically with given customers" (interview with Yebra, 2010).

San Diego Gas & Electric, Southern California Edison, Sacramento Municipal Utility District, Pacific Gas & Electric, and many other major utilities currently use this level of customer service. A customer can access information on their account and move fluidly through a customer service protocol that informs and educates customers at the immediate point of contact and removes hindrances to learning about or registering for programs.

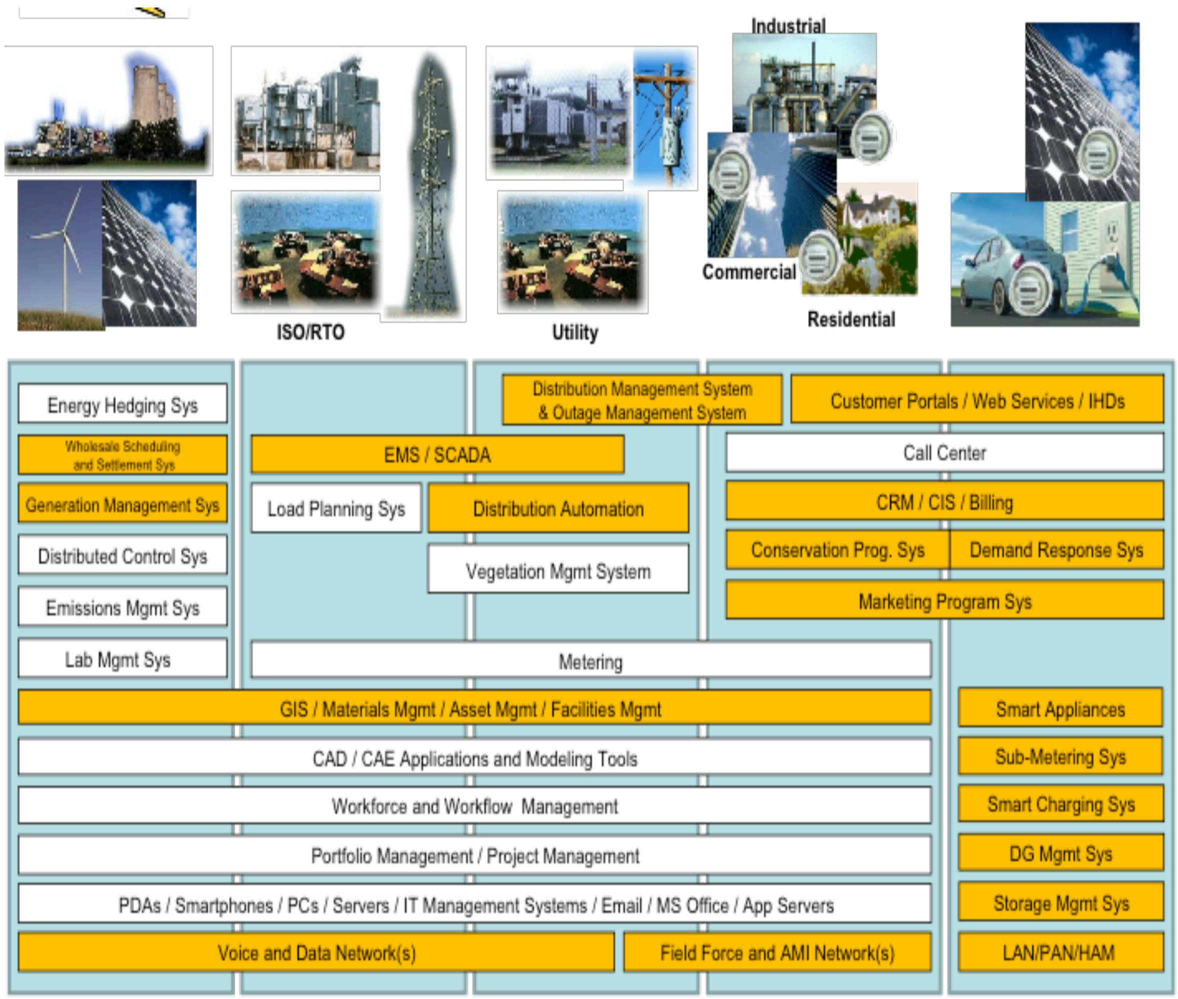
TECHNICAL RECOMMENDATIONS

AE is equipped with a staff and DSM portfolio that is advanced in its development. Over the past 28 years it has built a robust program portfolio, including a cutting-edge Green Building code that relies on firm ratcheting standards as a policy to help push and pull more efficient building design. AE has similarly ratcheted the standards of its own electrical grid, recently completing improvements to its meter data management for over 350,000 customers. By upgrading AE's automated meter response system into an advanced metering infrastructure, AE is now capable of syncing up the DR programs with TOU pricing using current load information detailed down to the individual customer. These technical recommendations identify further smart grid integration and more sophisticated ongoing performance evaluations as a means to achieve more cost-effective savings through residential programs.

Further Smart Grid Integration

AE cannot introduce new payment structures until it undergoes a rate case. The rate increase expected for 2012 and the approved Resource and Generation Plan which anticipates 20% higher rates for residential customers by 2020 will likely begin the discussion in Austin surrounding a shift to energy pricing models that are more in line with how energy is generated and consumed, with peak demands on hot days, and from three to seven pm generally, and demand troughs late at night. This would not be achieved without the development of Austin Energy's Smart Grid. Figure 6.1 graphically represents the capital improvement projects over the six years that AE has spent developing its smart grid. Table 6.2 shows the installed projects to date.

Figure 6.2 Newly Installed AE Smart Grid Systems, Updated in 2009



Source: Andres Carvallo, AE Smart Grid Implementation Presentation, 2009.

Table 6.1 AE Smart Grid Progress, Updated in 2010

Activity	Status
1. Build Enterprise Architecture	Started in 2004. Ongoing.
2. Upgrade Automated Meter Response (1-way) Network to Advanced Metering Infrastructure (2-way)	October 2007. Completed.
3. Install smart meters. 370,000 AMI meters	Started in 2003, Completed in May 2010.
4. Deploy Meter Data Management System (MDMS)	Acquired in September 2008. Project Started in December 2008. Completed in April 2010. Pilot Deployment in near future.
5. Deploy Distribution Management System (DMS)	Acquired in September 2008. Pilot deployment started in January 2009. Completed in December 2009.
6. Upgrade SCADA./EMS	Started in November 2009. Ongoing.
7. Upgrade Billing System (CIS)	Acquired in May 2009. Completed in April 2010. Pilot deployment currently underway.
8. Integrate Demand Side Management (DSM) and Demand Response (DR) devices	84,000 thermostats installed. Evaluating other technologies.

Sources: Andres Carvallo, Austin Energy, 2009, Interview with Andres Carvallo, Austin Energy 2010, Interview with Fred Yebra, Austin Energy, 2010.

AE has already invested tens of millions of dollars in an advanced smart grid. Adopting pricing signals of some kind is the next step toward achieving fiscal sustainability. A smart grid optimally utilized to implement pricing models that reflect an accurate cost of energy, reduce operating costs, improve outage management, and improve load profiles will allow AE to meet peak demand reductions goals or surpass them (AE EE Task Force Recommendations, 2009, AE Generation Task Force Report to City Council, 2010, Pecan Street Project Recommendations Report, 2010).

At the time of a rate case, AE can begin to reap the full rewards of major CIP investments that enabled the actual grid to become "smarter". Utilities have the opportunity now to reengineer the organization by integrating DSM activities with other company functions through an expanded approach to information resources and technology (Hanser, Electricity Journal, 1993) . AE's future avoided CIP investments through DSM can be used to find new ways to target customers for further energy efficiency.

Ongoing Program Evaluation

AE should further develop rigorous analysis of its DSM program performance, customer service, and customer behavior. An EE Potential Study can establish new performance measures such as breaking out peak demand reductions per customer account, or by housing typology to reflect more accurate information. Most importantly however, AE must establish a more thorough roadmap to how it expects to achieve the carbon emission and peak demand reduction goals set for 2020. The current method of extrapolating out 60 MW of peak demand reduction every year based on three years' worth of accounting is not robust enough to imbue confidence in the process. The EE Potential Study should include models that account for anomalies including continued or deepening economic recession, changes in weather patterns, particularly unexpected heat waves and storm systems, and a whole host of other exigent factors that may interrupt AE on its road to 800 MW peak reduction.

By aligning consumer surveys that track the value proposition of a DSM measure over time for different population segments, AE can better understand the motivations of consumer behavior, as well as the technical success of DSM measures over time. The Climate, Generation and Resource Plan simply offers a linear regression analysis as its proof that it can achieve the 800 MW peak demand reduction by 2020.

Lisa Skumatz, sponsored by the CIEE to assess over 100 reports on DSM program participation, developed a series of best practices for measuring lifetime and retention studies of residential consumers. She looked at customers' motivations to participate, not participate, reapply for more DSM measures, or halt their energy efficiency efforts. Best practices for evaluation of programs include sampling, data collection, and analysis/modeling. AE has developed new ways to cross-reference information on energy data for its residential customer base. However, AE cites staff and resource constraints that prevent developing a more robust oversight evaluation process of its ongoing programs. Figure 6.3 lists the recommendations from Skumatz' report to the CIEE. This approach to program evaluation will allow AE to constantly review its progress toward market transformation in an analytical setting.

Figure 6.3 DSM Program Evaluation Best Practices

Best Practices
Sampling: **1.** Obtain strong, unbiased population source list from which to conduct a sample. Strong data sets include data on contact information for the site, DSM measure(s) installed, and date(s) installed. **2.** Conduct a census, or probability sample. Stratify sample based on key population characteristics, such as climate zone, region of city and energy demand. Consider establishing panel survey that is revisited every several years – facilitates "bracketing" the removal data if a date cannot be recalled. **3.** Use measure-based sample, not site-based sample.
Data Collection: **1.** Use home and cell phone interviews. Schedule calls in advance, use at least 3-5 callbacks. **2.** Ask about conditions that might affect the operations of the DSM measure. **3.** Get the most accurate information about measure-failure dates and explores reasons. **4.** Conduct follow-up interviews at time intervals. **5**. Use trained supervised auditors.
Analysis/Modeling **1.** Include influential variables as regressors to control for exogenous factors **2.** Test for outliers **3.** Compare different models and model specifications related to congruence with theory, implications for results, and results from formal tests. **4.** Document the study and methods, alternatives considered, rationale, and discuss in context of results from similar studies

Source: Lisa Skumatz, California Institute on Energy Efficiency, 2008.

A consumer survey across population segments that used sampling, data collection, and analysis/modeling, and tracked over a long period of time, can provide invaluable insight into larger community and perceived value propositions in the minds of AE's customers.

POLICY RECOMMENDATIONS

Under the current business model, any enhancements to DSM programs that produce greater savings will have a more deleterious effect on the bottom line for AE. That is why this report followed the guidance of the Climate, Generation and Resource Plan for 2020 as its guiding strategy, as opposed to current operating procedure of the business model. The Generation and Resource Plan, City Council, AE, and the task forces associated with it more accurately balanced the challenges and opportunities that AE faces into the future. Meanwhile, AE's management team has publicly begun bracing for the ultimate demise of the old business model but is unsure of the next steps it must take. Two policy recommendations address this issue by advocating the development of dynamic pricing options and creation of a long-term strategic plan toward market transformation entitled ABACE. This plan would address the five phases of home improvement: the audit, improvement to the building envelope, appliance replacement, consumer behavior modification, and finally onsite distributed generation of energy. ABACE provides a methodical approach to provide incrementally larger incentives on home energy efficiency investments that offer rates of return commensurate with the cost of the DSM measure.

Dynamic Pricing Options

AE's current pricing models eventually must move away from volumetric pricing according to former General Manager Roger Duncan, and Acting General Manager Robert Goode. This report recommends that AE insert new pricing schemes in its 2012 rate case to prepare for a future with more renewables and onsite generation and more efficient end-users.

Dynamic pricing is a cost-effective market transformation policy tool that requires little to no new CIP expenditure from AE. Price signals provide immediate information on aggregate energy use, and thereby can employ more sophisticated billing rates on which both the utility and the customer can base their energy use. The advent of price signals and new rate structures with options for RTP, CPP and TOU would provide clear proof that AE is optimally utilizing all its technical, administrative and financial prowess to effectively shift out of its old business model and beginning to address the challenge of creating a new one for sustained progress into the future. Anything less is a suboptimal effort based on the technical sophistication of its infrastructure and information management systems.

One particular benefit to the utility is that time-of-use-based costs will look a lot more like the cost of energy on the wholesale energy market. This will allow AEs revenues to increase as energy rises in cost, and thereby contribute larger allocations to the City of Austin's budget. Customers benefit by more up-to-date information, which may include hourly averages, comparison of energy use with a neighborhood average, and optimal potential savings based on home energy audit information.

Developing new pricing offers AE an opportunity to update its billing rates for the first time in 15 years, as well as the chance to finally align consumer incentives to save with the costs of operating a utility. Volumetric billing rates take a complex issue of energy cost and consumption, based on bid-based or contract-based load, and has a tendency to average costs over time, distorting the true cost of peak events. Price signals, when properly designed, allow consumers a distinct behavioral choice. The critical component in the efficacy of price signals is whether the signal is communicated clearly and the consumer's choice of measuring the marginal value of producing a kilowatt-hour of energy. Price-minimizing choices are shown to have effect without risk of free riders. Pricing schedules have been devised as an attempt to relate the marginal cost of consumption to the consumer. In a rate case, AE could initiate TOU, RTP, or CPP tariffs for residential customers in conjunction with smart metering to maximize distribution. Currently, AE charges a fixed rate for connection to the distribution network, a constant fuel charge, and an inclined block rate for its base energy charge. Consumers have no inherent incentive in the current system to reduce peak load and therefore lower total cost, truly managing their energy use.

Estimates for savings through DR programs range considerably based on dozens of variables; however, DR has shown total energy savings in study after study. AE can look at new methods of DR for residential customers based on house typology, average energy use, and allow customers to oversee their own program participation settings by interfacing with a web portal where customers manage their energy.

Previous success with DR through the Power Partner and Power Saver programs points to the potential for load flattening through dynamic pricing options. According to Andres Carvallo, former CIO of Austin Energy, a lack of price signals is the single greatest barrier to improving the efficiency of AE's EE/DSM portfolio. Until the advent of price signals, the greatest barrier to improvement is simply greater customer participation. As such, AE has heavily promoted the DR Power Partner program during summer months. Participation in this program has steadily increased, reducing consumer bills at the most expensive time of year, providing AE with valuable space at the top of the peak demand curve.

Pricing signals aligned with DR provide new profit paths with the help of a newly installed advanced smart grid communications, smart metering and billing infrastructure.

Together, these systems integrate AE's operations and information, and thereby providing AE with more accurate information to establish an optimal dynamic pricing and DR structure for customers.

ABACE

ABACE, a concept first introduced by John Cooper of EcoMergence in 2007, speaks to the concept of "ecofitting" a home to make it as energy efficient as possible. The ecofit process is based on a formula, A + B + A + C + E = 100%. ABACE is the acronym for **A**udit, **B**uilding Envelope, **A**ppliance Replacement, **C**onsumer Behavior Modification, and **E**nergy (as in, onsite renewable energy generation). The formula for ABACE ecofit model is 20 + 15 + 15 + 50 = 100% of potential energy savings. Completed ecofitting takes these five phases to achieve optimal energy use. This concept assumes that optimal energy use is zero net energy produced and consumed by the home. ABACE offers a step-ladder-style framework for AE to develop a long-term strategy for market transformation in the residential EE/DSM market.

The ABACE process begins with an audit of the home's current energy performance in order to establish a baseline. It then shifts into low-cost investments that show immediate returns, followed by incrementally larger incentives and opportunities for home energy efficiency investments that offer rates of return commensurate with the cost of the DSM measure.

ABACE falls under the Policy Recommendation category as it encompasses the four components of an enabling policy framework for market transformation: clear policy direction, adequate financial incentives and funding, robust program administration and oversight, and firm ratcheting standards.

This concept is holistic and inherently integrated with various policies and policy tools surrounding market transformation. ABACE's potential is rooted in development of synchronized policies that are strategically aligned with one another to ensure market transformation. When developed in a systematic manner, ABACE ensures persistent returns on investment. ABACE as a policy framework would complement a number of policy tools for market transformation. The policy tool of facilitated education and outreach is required in ABACE to provide an effective long-term, low-cost method of energy conservation.

Establishment of ABACE would send a clear message of AE's policy direction. Energy efficient upgrades would be financed in part through returns on previous investments. ABACE relies on technical advances to continually update codes and standards, while potential DSM savings would continue to ratchet up. By aligning performance metrics with energy consumption data, AE would signal a new chapter in the systematic pursuit of incentivizing and optimizing existing building energy efficiency. The five phases of ABACE are listed below.

Audit

The energy audit is the natural first step for anyone looking to improve energy efficiency of an existing residence. The audit provides a diagnostic analysis of current energy consumption patterns and pinpoints inefficiencies and gaps, and describes the steps required to ecofit a home. The audit establishes a baseline for measuring future building performance. It is also an opportunity to initiate consultation with the customer about ways to save more energy, best practices for reducing energy bills, and opportunities to begin saving immediately. The energy audit process can be enhanced by frontloading the ecofit process with a survey or questionnaire about current consumer awareness of existing programs, energy consumption behavior, attitudes and needs.

Building Envelope

Weatherization and overall sealing of the building envelope is the first investment made to reduce energy consumption. These costs can be minor for well-constructed and maintained homes, or can be substantial if overhaul is necessary. Since there can be a significant variance in the level of "leakiness" of a home, sealing the building envelope can be a very low-cost endeavor that amounts to weatherstripping, insulating a water heater, or caulking leaks. Improving the building envelope provides immediate savings. On average, a comprehensive building envelope improvement will reduce energy expenses by up to 20%.

Appliance Replacement

Replacing old, inefficient appliances with new appliances, ranging from simple CFL light bulb replacement to more capital-intensive replacement of an old refrigerator or HVAC system, has an immediate impact on energy consumption while also making an immediate return on savings in energy costs. A series upgrade of appliances can reduce energy expense up to 15%. Simply addressing any given aspect of appliances, such as inserting CFL light bulbs, is very low-cost but provides a net benefit to the consumer after less than 2 years on average. An additional benefit to replacing appliances following an audit and sealing of building envelope can be a raised awareness in the consumer of some facets of the building envelope and a changed attitude about energy use—a critical step before behavior change, the next step the ecofit process.

Consumer Energy Behavior Awareness

Changing personal energy consumption habits in effect occurs across all steps of the ecofit ladder. This can be facilitated in a number of ways, including marketing and advertising, community engagement, neighborhood blitzes, or as training customer service representatives with scripts that outline relevant methods for improving energy efficiency. Alternatively, the energy future seems aligned with a culture that is most interested in information available in real time and easily accessible. Web-based energy conservation tips, customized residential information, dynamic pricing, and active/direct load control by the utility are various methods that can be part of the Consumer Behavior Modification step. Regardless of methods, the objective is to provided a deeper, more facilitated experience for the customer, where the customer is not hamstrung by the limitations of what the utility is offering, but instead, finding new ways to reduce energy use proactively. This step is accelerated if a utility company offers the relevant technological infrastructure and dynamic pricing capabilities that are associated with a two-way communication smart grid. Estimates project the expanded capabilities of a Home Energy Management Systems (or HEMS) can provide energy savings up to 15%.

Energy

After making all the other changes, a calculation can be made on the right size for a renewable energy system such as solar PV, currently the most expensive investment to reduce carbon footprint and enable energy independence. A solar PV system that fits a rooftop (and a budget) can generally provide about 50% of initial energy requirement (in areas of high wind, a micro wind generator may be a feasible alternative).

Currently AE offers its energy efficiency programs on a first-come, first-serve basis until the money allocated for that year runs out. While this is equitable in the sense that all customers have the same shot at participating, Yebra points out that it has resulted in the problem of free-riders who do not need rebates and incentives to help them participate in DSM measures. ABACE may offer an opportunity for more low-income and middle-income families to take the first steps up the ladder of energy efficiency. On a broader social level, it may begin to simplify customer understanding of how to achieve energy efficiency, and help alleviate the current imbalance of higher income customers participating in EE/DSM programs through AE. DSM programs may consider the alignment of rebates and rewards based on the commensurate cost of the investment, with those that achieve high performance energy efficiency getting first service. It is not sensible to install a solar panel on the roof of a house with leaky ducts and walls. One way to achieve the four-part goal of increasing overall energy savings, reducing carbon emissions and peak demand, and increasing customer participation that has not been looked at closely enough by City Council or AE is to establish rewards for achieving performance benchmarks.

CONCLUSION

The premise of this report is that AE can establish its own policies and policy tools to help manage the market, but outside forces – market influences such as retailers and manufacturers, and/or federal and state-level energy regulations and policies – can be aligned with AE's goals through coordination. By AE providing a new approach to energy management for its customers, it can establish new sources of revenue for AE. Understanding the motivations of energy customers is key to beginning a conversation to help customers protect the environment, save money and own more control over their energy use. As the market continues to find greater efficiency, AE must enhance and refine programs to keep track with the ever-changing energy efficiency landscape.

An EE Potential Study is well suited to be the first-step in AE working with residents, the City of Austin, and market-based interests, to develop a new strategy where the community is prepared to face impending market saturation of current types of EE measures. AE has begun shifting its CFL rebate funds to more lighting controls, efficient whole-lighting systems, and other means of reducing energy, but such steps will be required eventually across all the program types – and not just in the residential market.

By AE taking the step of produce a follow-up report on the options to achieve market transformation in the near-term, mid and long-term, the utility can establish a analytically sound approach to its 2020 goals.

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Vita

Andrew H. Johnston returned to school at The University of Texas at Austin to better grasp the technical and policy implications of our clean energy future. While in school, he was a lead researcher on the topics of DSM and renewable energy utilizing storage technology for the LBJ School of Public Affairs Policy Research Project with Austin Energy and Solar Austin. In school, he received fellowships from the Clinton Global Initiative – University (CGI-U), and a Young Energy Fellowship, which included speaking on panels at ConnectivityWeek in Santa Clara, CA, and GridWeek in Washington, DC in 2009.

In fall 2008, Andrew was asked by the office of Austin Mayor Pro-Tem Brewster McCracken to help with the first phase of the Pecan Street Project (PSP) by assisting the Regulatory and Legislative Issues Working Group and the Low Technology Solutions Working Group. Later, he accepted the appointment as Field Director for Brewster McCracken's Mayoral Campaign. Following the election, he worked for Austin Energy as a "Grant Wrangler" for AE's two Smart Grid Stimulus Applications. In the summer of 2009 he helped guide AE's Executive Committee and key department heads through both the Smart Grid Investment Grant and Demonstration Project Applications. The efforts were rewarded with a $10.5 Million DOE Grant for the PSP

Andrew Johnston is continuing to work in the emerging local clean energy industry in Central Texas, particularly with DSM/Energy Efficiency and Smart Grid adoption and implementation initiatives.

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