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Regulatory Mechanisms to Enable Energy Provider Delivered Energy Efficiency

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Executive Summary

Many electric and gas efficiency measures cost significantly less than the cost of delivering energy over the lifetime of the energy efficiency measure. Demand response programs can cost less per kW than building new generators and transmission lines. Properly designed and implemented programs reduce system-wide electricity costs and customer bills, reduce risk from fossil fuel dependence and environmental impacts, increase reliability and market competitiveness, and promote local economic development. One of today's biggest energy policy challenges is finding ways to deliver those savings throughout a nation's economy.

This review identifies varied, but complementary, government regulatory mechanisms utilized worldwide to mobilize the resources of energy providers[1] to implement investment in increasing end-use energy efficiency to achieve long-range energy policy goals. This review offers lessons from worldwide experience and from diverse economic settings. It is selective, identifying a short list of mechanisms that governments have used most effectively. It identifies and describes twelve types of regulatory mechanisms that governments use effectively to:

- mobilize energy provider investments directly;
- facilitate investments in demand-side resources;[2] or
- implement policies and programs that underpin important elements of successful investment programs.

The review also explains how each of those regulatory mechanisms functions in different market settings to mobilize resources or enable effective programs, identifies key issues that ensure successful implementation, and then outlines an example of how at least one jurisdiction has achieved successful implementation. Eight of the mechanisms focus directly on using energy provider resources to achieve energy efficiency; the other four mechanisms underpin the success of the first eight mechanisms. All of the mechanisms are briefly outlined below.

Regulatory Mechanisms

Energy Efficiency Obligations

Energy efficiency obligations (EEOs) use direct government authority to require energy providers to meet energy savings targets, typically within a long-term framework, by making qualifying investments in end-use energy efficiency. An EEO effectively states public policy and provides a clear benchmark for measuring progress. An EEO may require that obligated energy providers obtain savings directly or may allow them to purchase savings obtained by others. Implemented effectively, EEOs are a potent method of mobilizing energy providers to support end-use energy efficiency, but may require additional steps by government. These additional steps are addressed by the following regulatory mechanisms.

Integrated Resource Planning

Integrated resource planning (IRP) addresses energy efficiency and demand response by evaluating the entire energy supply chain in search of the most cost-effective way to meet long-term energy needs. IRP focuses on identifying

1 In this review of regulatory mechanisms "energy provider" refers to both entities that sell energy directly to end-users (energy retailers) and entities that transport energy to end-users' dwellings or premises (energy transmission and distribution system operators). In some jurisdictions these two functions are combined within vertically integrated energy utilities.

2 Demand-side or demand-side management (DSM) resources encompass both energy efficiency (delivering equivalent lighting, heating, or other energy services using less energy input) and load reduction during peak load periods (called demand response or load management resources).

the full potential for demand-side resources to meet energy needs cost effectively, laying out a plan of action to tap that demand-side potential. Government may use IRP in two quite different ways:

- Developing comprehensive long-range plans, based on IRP, that spell out an optimal or least-cost mix of supply-side and demand-side investments that will achieve energy demand goals (including environmental and social goals); and/or
- Using IRP analysis to support EEOs or other policies by identifying available cost-effective energy efficiency and demand management investment opportunities.

Regulators may require integrated energy providers to develop IRP or to carry out specific steps founded on IRP principles.

Stable Funding

Achieving long-term energy savings goals requires sustained expenditures on planning and delivering energy efficiency programs. Plans to implement large-scale energy efficiency programs with energy provider resources must address how the necessary funds will be generated and delivered. Sustained expenditure commitments provide energy efficiency industries and energy providers with the long-term commitment they require to invest financial and labor resources to expand significantly energy efficiency program capacity. Governments may require, by statute or regulation, that energy providers:

1. commit funds to energy efficiency programs as a normal cost of business; and
2. collect funds from their customers to support end-use energy efficiency programs, for example with a price surcharge, in addition to the price of energy.

Creating or Adapting Existing Markets to Mobilize Energy Efficiency Investments

Government may need to adapt existing markets or create new markets to allow demand-side resources to compete effectively with supply-side resources or to acquire demand-side resources. Government may create markets (1) for energy savings offerings that may be used to meet EEOs or (2) to allow demand-side resources to compete directly against energy supply to meet customer energy demand. Government will generally focus on establishing markets and setting ground rules for their operation.

Disclose Opportunities for Implementing Demand-Side Resources in System Resource Plans

Disclosure identifies system needs and then invites proposals to address those needs. Disclosure can be implemented alone or within an IRP. Disclosure goes beyond IRP by identifying very specific energy supply needs or specific transmission or distribution capacity needs that energy efficiency investments may address. Disclosure must reveal sufficient detail about system needs to enable developers to design specific demand-side resource proposals that will effectively address those needs.

Energy Provider Performance Incentives

Government may offer energy providers incentive rewards for achieving or exceeding energy efficiency goals. The primary reasons for offering such incentives are to ensure that:

- regulated energy providers obtain similar financial rewards for investments in energy efficiency and for investments in energy supply resources;
- energy providers will embrace a strong commitment to energy efficiency goals; and
- the performance of energy providers in energy efficiency program delivery is maximized.

Three major types of government action have been used:

- Awarding financial incentives for achieving or exceeding specified energy efficiency goals;
- Allowing energy providers to share financially in the net benefits consumers receive from energy efficiency investments; and
- Offering regulated energy providers a higher rate of return for investments in energy efficiency.

Government may also choose from a wide range of activities that lower energy efficiency program costs for energy providers, or reduce market barriers to energy efficiency.

Retail Tariff Design

Government may use their regulatory authority to mobilize energy providers to align the design of retail energy prices with energy efficiency and demand-side management goals. This is easiest in regulated markets where governments approve tariffs that specify the price consumers pay for energy. Two types of tariff designs can align price incentives with long-range energy supply goals and specifically provide the opportunity to support demand-side resource acquisition objectives:

- Time-of-use prices vary energy price at different times according to the actual cost of supply; and
- Inclining tiered block prices increase the per unit price of energy for high volumes of electricity and gas consumption.

Independent Energy Efficiency Delivery Providers

Governments may establish independent organizations to acquire energy efficiency. Government regulators may conclude that such dedicated energy efficiency providers will pursue aggressive energy efficiency goals more effectively than energy providers that operate primarily to sell energy. The independent energy efficiency organization may be charged with planning and implementing energy efficiency programs that directly encourage energy consumers to invest in energy efficiency or it may be called upon to obtain energy savings through using market-based mechanisms such as tenders. In jurisdictions that have adopted this mechanism, energy providers remain an important stakeholder and should be enlisted to support the efforts of the independent organization using their knowledge of end-user needs and access to energy consumption information.

Additional Mechanisms

Decoupling

Decoupling aligns the financial incentives facing regulated energy providers with energy efficiency goals. Traditional cost of service regulation provides energy service providers with a strong incentive to increase the volume of energy sales and a corresponding strong disincentive to allow energy efficiency to reduce such sales. Decoupling removes incentives to increase sales by adjusting prices to maintain the revenue (or net revenue) of an energy provider so as to eliminate the disincentive for energy efficiency.

Measurement and Verification

Measurement and verification (M&V) provides an essential guidance system that informs all stakeholders and maintains the credibility of energy efficiency programs. Establishing an M&V methodology prior to program implementation provides an objective basis for assessing progress toward energy efficiency goals. M&V must be conducted by competent M&V professionals according to well established professional standards.

Tradable White Certificates

In order to support markets for energy efficiency, government may establish a system of tradable certificates to document valid energy efficiency claims. Called tradable white certificates, such documents can facilitate market tenders for energy efficiency savings and certify that a certain amount of energy savings has been achieved according to prescribed conditions. Government may establish independent certifying bodies, define rules for awarding and trading white certificates, and ensure that effective M&V practices are used to validate and certify claims for energy efficiency savings.

An Unambiguous Policy Commitment to Energy Efficiency

A strong, lasting public policy commitment communicated clearly by government can contribute significantly to the success of many separate regulatory actions to capture the large, untapped, cost-effective potential of investments in energy efficiency. Strong government leadership that communicates clearly and forcefully that energy efficiency will play an important role in long-term plans to meet the community's electricity, gas, and other energy needs is essential.

Abbreviations and Acronyms

AEEG	Italy's Regulatory Authority for Electricity and Gas
ANEEL	Brazil's Electricity Regulatory Agency - Agência Nacional de Energia Elétrica (electricity regulatory agency)
CERT	United Kingdom's Carbon Emissions Reduction Target Program
CFL	Compact fluorescent light
CPUC	California Public Utilities Commission
CTEnerg	Brazil's Public Benefit Charge, price surcharge
tCO_2	tons carbon dioxide
CO_2e	carbon dioxide equivalent concentration
DM	Demand Management
DR	Demand Resources
DSM	Demand-Side Management
EEO	Energy Efficiency Obligation
ERSE	Portugal's Energy Service Regulatory Authority
EVO	International Efficiency Valuation Organization
GDP	Gross Domestic Product
GME	Italy's electricity market operator, Gestore Mercatto Elettrico
GW	Gigawatt
IEA	International Energy Agency
IPMVP	International Performance Measurement and Verification Protocol
IRP	Integrated Resource Planning
kW	Kilowatt
kWh	Kilowatt-hour
MMbtu	Million British thermal units (btu)
M&V	Measurement and Verification
MYT	Multiyear Tariffs (India)
NSW	New South Wales, Australia
NYISO	New York Independent System Operator
NYPSC	New York Public Service Commission (NY's energy regulatory agency)
Ofgem	United Kingdom's Office of Gas and Electricity Market (UK's energy regulatory agency)
PAT	India's Perform, Action, and Trade Program
PEPDEE	Policies for Energy Provider Delivered Energy Efficiency
PNAC	Portugal's National Plan for Climate Action
PPEC	Portugal's Plan for the Promotion of the Electrical Energy Consumption Efficiency
RAP	Regulatory Assistance Project
Rs	Rupee (India)
RTP	Real Time Pricing
TOE	Tons of Oil Equivalent
UK	United Kingdom
US	United States of America
USD	US Dollars ($)

Introduction

In all countries, there is significant untapped potential to improve the efficiency with which consumers use electricity and natural gas. Customers with aging, lower-efficiency equipment could replace it with newer, more efficient models or select a high-efficiency model when purchasing a new piece of equipment. Many electric and gas efficiency measures cost significantly less than delivering energy over the lifetime of the energy efficiency measure, including the cost of building new generators and transmission lines. Properly designed and implemented programs reduce system-wide energy costs, reduce customer bills, reduce risk from fossil fuel dependence and environmental impacts, increase reliability and market competitiveness, and promote local economic development. One of today's biggest energy policy challenges is finding ways to deliver those savings throughout a nation's economy.

This report surveys tools that have been used successfully worldwide to mobilize energy providers[3] to obtain energy efficiency savings and use demand-side resources to cost-effectively meet energy supply needs.[4]

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Energy providers may plan and implement energy efficiency investments to be made for or by their customers, enlist others to make such investments, or simply contribute funds for initiatives carried out independently of the energy company. This report focuses on actions that government may take to mobilize these approaches to achieve their energy savings goals.

This review of regulatory mechanisms supports the Policies for Energy Provider Delivered Energy Efficiency (PEPDEE) project effort to mobilize energy provider investments in energy efficiency. The PEDPEE project is being carried out cooperatively by the International Energy Agency (IEA) and the Regulatory Assistance Project (RAP).

Scope of the Review of Regulatory Mechanisms

This report focuses on regulatory mechanisms by which energy market regulators and other government authorities may tap into energy providers' knowledge of consumer energy use, market relationships, and ability to collect revenues and mobilize energy provider resources to increase investments in cost-effective energy efficiency and demand response. Such mechanisms aim to overcome the well-known barriers to investment in energy efficiency by consumers, set rules for effective market behavior, or marshal resources to achieve public policy goals.[5]

The report draws from experience in diverse regulatory

3 In this review of regulatory mechanisms "energy provider" refers to entities that sell energy directly to end-users (energy retailers) and entities that transport energy to end-users' dwellings or premises (energy transmission and distribution system operators). In some jurisdictions these two functions are combined within vertically integrated energy utilities.

4 Demand-side or DSM resources encompass both energy efficiency (delivering equivalent lighting, heating, or other energy services using less energy input) and load reduction during peak load hours (called demand response or load management resources).

5 Government initiatives considered here are only some of many that government may use to capture the vast potential that energy efficiency offers to reduce energy costs, serve environmental goals, and strengthen the economy. For example, governments or regulators can: enact building codes and appliance or equipment efficiency standards, conduct education and information programs, create centers of expertise on energy efficiency, fund research, support development and demonstration programs aimed at improving efficiency of energy-using technologies, or create economic and financial policies to stimulate energy efficiency investment, such as publicly funded incentive programs, favorable tax treatment (e.g., accelerated depreciation allowances), environmental taxation, or subsidized interest rates for loans.

This report addresses regulatory mechanisms that work well in all market settings, some that have proven effective primarily in regulated markets, and some that have emerged to address the needs of liberalized markets.

contexts worldwide. It focuses on regulatory mechanisms that have proven most effective at driving energy providers to implement large-scale energy efficiency and demand response programs. It has sought lessons that apply in liberalized as well as regulated energy markets. Many of the successful regulatory mechanisms addressed by this report were developed when regulated monopoly energy markets prevailed. As many governments have moved to more competitive energy markets, they have adapted regulation, public programs, and policies to serve continuing efforts to obtain the benefits of energy efficiency. This report addresses regulatory mechanisms that work well in all market settings, some that have proven effective primarily in regulated markets, and some that have emerged to address the needs of liberalized markets.

The insights considered here derive specifically from experience with mainly electricity and gas service providers. Increasingly other fuel and heat providers are also carrying out energy efficiency programs. The programs discussed may support energy efficiency investments in any end-use sector. This report is selective, identifying a short list of regulatory mechanisms that governments have used effectively. It presents twelve mechanisms for promoting energy efficiency: eight that focus directly on tapping energy provider resources and four more that facilitate the success of the first eight.

The regulatory mechanisms differ in the role they play. Three make a critical contribution to mobilizing and sustaining energy provider action:

- EEOs placed on an energy company;
- Integrated resource planning; and
- Securing stable and sufficient funding.

Others enable energy efficiency acquisition by:

- creating or adapting a market framework to mobilize energy efficiency investments;
- requiring disclosure in system resource plans of opportunities for implementing demand-side resource projects;
- offering energy providers energy efficiency performance incentives;
- designing retail energy tariffs to align consumer incentives with energy efficiency objectives; and
- creating and funding independent energy efficiency delivery providers.

A final group of additional mechanisms support effective implementation of the other eight by:

- reforming energy provider regulation to remove perverse incentives in the regulatory price controls that create incentives for energy companies to sell more energy;
- requiring effective measurement and verification (M&V) practice;
- enabling tradable certificates accounting for efficiency impacts; and
- providing broad public policy support for sustained efforts to achieve energy efficiency goals.

The remaining sections of this report take up one of those twelve mechanisms separately. Each section:

- describes the mechanism and potential implementing actions, characterizing its intended effect and practical application;
- identifies key issues that have proven important in designing and implementing the mechanism and describes how it is applied in regulated and liberalized energy market settings; and
- profiles an example of how the mechanism has been applied.

A final reference section identifies documents that provide useful resources for those wishing to learn more about the mechanisms addressed in this report.

> The PEPDEE project aims to facilitate cooperation and knowledge-sharing among International Energy Agency (IEA) and International Partnership on Energy Efficiency Cooperation (IPEEC) member countries on how energy providers can improve the efficiency of gas and electricity customers – and what regulators and governments can do to mobilize such efforts. PEPDEE seeks to improve collaboration by all stakeholders on regulatory mechanisms and program designs that save energy.

1. Energy Efficiency Obligations

Requiring energy providers to carry out or fund large-scale energy efficiency investment programs to achieve energy savings

1.1 What is the Energy Efficiency Obligation Regulatory Mechanism?

Energy efficiency obligations[6] (EEOs) use government authority, the force of law, directly to require that energy providers promote or stimulate energy efficiency investments that produce energy savings by end-use consumers. EEOs require energy providers to meet energy savings targets with qualifying energy efficiency investments. Typically, EEOs set energy savings targets to be achieved over several years. Obligated parties must meet the targets through reductions in energy consumption by end-users.

Core elements of an EEO are the "obligated party," the entity the regulation addresses, and the obligation "target," the specific requirement the obligated party must meet.

An EEO is an effective statement of what public policy seeks to accomplish and what energy providers should aim to accomplish. It provides a clear benchmark for measuring progress.

The target can be expressed in a range of ways, for example: annual energy savings (kWh of electricity savings or MMBtu of gas savings) for each of several years, total accumulated energy savings several years in the future, percentage of annual energy consumption saved compared to a baseline, emissions reductions (e.g., tCO_2), or reductions in energy intensity (e.g., kWh per unit of production or GDP).

An EEO may focus on overall energy savings or it may be integrated with other government objectives. For example, an obligation may require:

- that some component of the energy savings come from energy efficiency investments in the homes of low income families to reduce their energy bills; or
- that savings be measured in greenhouse gas emissions reductions (tCO_2) to serve climate change policy goals.

EEOs may be imposed by legislative mandate, utility regulators, or other government authorities. A mandate imposed by legislation is strong because it communicates the political force of legislative action, removes any uncertainty about regulatory authority, and states clearly that energy efficiency is a high value energy resource. (See Section 9.5.) An EEO established by regulation relies on existing regulatory authority and therefore may be implemented quickly. Mandating an obligation program by regulation offers regulators the opportunity to enlist energy provider support with a collaborative implementation process. An obligation framework implemented by regulation also may be modified in response to experience and to changing conditions more easily than a framework established by legislation. The best practice may be to mandate an EEO by legislation that sets forth clear goals and objectives and that empowers regulators to develop the implementation framework. In several instances EEOs have been launched by regulators using existing authority and later strengthened by legislation.

EEOs may be imposed on one or more types of energy providers, including:

- vertically integrated regulated energy utilities;
- electricity and gas companies operating in unbundled deregulated markets, including energy retailers, or transmission or distribution system providers; and
- transportation and heating fuel suppliers entirely outside the realm of regulated energy markets.

An EEO may require that obligated energy providers obtain energy savings directly or allow them to purchase energy savings obtained by others, for example, through

6 Energy efficiency obligations appear with a variety of other names, the more common of which are "Energy Efficiency Resource Standards," "Energy Company Obligations," and "Energy Supplier Obligations."

bilateral contracts with energy efficiency providers or through tradable energy savings certificates, often called "white certificates," to account for achieved energy savings. Energy providers use these certificates to document the energy savings they achieve. The existence of white certificates also enables trading of achieved energy savings among independent energy efficiency providers and obligated energy providers. Section 9.4 specifically addresses regulatory action to enable tradable white certificates.

Energy efficiency obligations are proving effective for their ability to focus the required multifaceted efforts to achieve significant savings and to do so cost effectively.

An effective EEO will establish a clearly defined energy savings target that can be achieved and will prescribe penalties for noncompliance, typically a penalty charge that imposes costs on energy providers that fail to meet their obligations. Obligated providers may pay the penalty rather than implement the programs to achieve the required energy savings, but few penalties have been levied in current EEO mechanisms because energy providers have met their obligations.[7]

Implemented effectively, EEOs are a potent method of mobilizing energy providers to support energy efficiency. Nevertheless, achieving the energy efficiency savings targets may require additional steps by government to mobilize or enable energy providers, for example, to identify productive energy efficiency opportunities, to commit and sustain necessary funding, to utilize or establish markets to solicit energy efficiency savings, and to align financial operating incentives with efficiency goals. Sections 2 through 9 of this report describe additional steps governments may decide are necessary to effectively translate obligations into effective action.

1.2 Key Issues in Design and Implementation of Energy Efficiency Obligations

EEOs have emerged as a principal regulatory mechanism for clearly communicating energy efficiency goals and for mobilizing diverse energy service sectors to take steps to achieve these goals. Experience in Europe, the United States, and Australia indicates that this regulatory mechanism is proving effective for its ability to focus the required multifaceted efforts to achieve significant savings and to do so cost effectively, sometimes producing more savings than originally sought and at a lower cost than projected.

EEOs are defined in terms of the desired outcomes, for example, target energy savings or emissions reductions. The obligations may be directed at specific energy sectors served by obligated parties (e.g., natural gas or residential energy use) or may allow energy savings from all energy sectors to ensure that the most cost-effective energy efficiency savings opportunities are included and that all energy uses that account for environmental impacts (public health and climate change) are addressed. EEOs offer great flexibility in selecting program designs to achieve the sought-for results.

Although the EEO regulatory mechanism is simple in concept, effective implementation requires careful planning. An effective EEO should:

- establish the sectoral coverage of the mechanism;
- identify the obligated parties;
- define the obligation clearly and specifically;
- prescribe adequate penalties for noncompliance;
- describe who may be accredited to carry out energy efficiency projects to meet the obligation;
- define the energy efficiency measures that will be eligible for meeting the obligation;
- define how energy savings will be counted and validated;
- define the source of funding, if required;
- require effective measurement and verification; and
- provide for adjusting the obligation mechanism at regular intervals.

Establish the sectoral coverage of the energy obligation. The obligation should prescribe the types of energy and end-use sectors from which savings must be obtained, rules that should serve the overall goals of the EEO program.

The obligation should define whether the required energy savings should come just from energy in the obligated energy provider's own market (i.e., electricity or natural gas or both) or whether the obligation should or may also be met from other fuel savings, such as heating or

7 Lees, 2010

transport fuels.

The obligation should also define which energy use sector(s) the obligation may target. The obligation may call for savings from any type of consumer or it may indicate that all or some portion of savings must come from specific sectors. The United Kingdom EEO described in Section 1.3, for example, requires that 40 percent of the savings come from energy efficiency measures benefiting low-income residential households. Regulators may target specific end-use sectors because energy efficiency studies indicate that some sectors may have much greater potential.

Identify the obligated parties. The obligations should state clearly the entities that will be responsible for meeting the EEO; for example, obligations are commonly applied to electric and natural gas retailers or distributors but have recently been placed on heating oil providers and district heating and, since January 2011 in France, have been applied to importers of road transport fuel.

Define the obligation clearly and specifically. The obligation should clearly define the principal policy objectives, for example:

- acquiring cost-effective energy efficiency as an energy resource;
- reducing energy bills for all consumers;
- achieving carbon emission reductions and other environmental outcomes;
- assisting low-income households; or
- enhancing energy security.

The definition of specific objectives will strongly influence how the EEO will function, and the obligation should be defined in terms that serve program goals directly. If the goal is achieving energy efficiency savings, for example, the obligation appropriately should be defined in electricity, natural gas, oil, or supplied heat savings in their natural units (often standardized to kWh). The obligation should specify the targeted end-use sectors, from which providers must obtain the savings to meet their targets.

An effective obligation will strike a balance between what is needed to achieve long-term goals and the shorter-term opportunities to achieve energy savings targets as cheaply as possible. Each obligated energy provider will be assigned a share of the total obligation target. The individual target of each obligated party may be tied to that provider's share of total energy sales, or all providers may be assigned an obligation that represents a common percent reduction in annual energy sales or emissions. The obligation may also be assigned according to or adjusted to address other metrics, for example, an EEO for residential sales that ties the target to the number of residential customers served.

The definition of specific objectives will strongly influence how the EEO will function.

The prospects for achieving aggressive energy efficiency goals will be significantly improved if the obligations are built upon a good understanding of available EEOs and the likely costs of achieving them. EEOs should be built upon or at least should commit to building a foundation of knowledge and analysis of energy use practices and related EEOs. Section 2 addresses IRP, a process that, as one step, identifies the full potential for energy efficiency to meet energy supply objectives cost effectively and the specific energy efficiency investment opportunities that can capture that potential.

Prescribe adequate penalties for noncompliance. The imposition of penalty payments on energy providers that fail to meet their energy savings obligations accomplishes two important functions: it provides a financial incentive for energy providers to meet their obligation and it may create a potential revenue source to fund additional energy efficiency investments carried out by others if the obligated parties do not meet their targets. The penalty may be viewed by obligated energy providers as posing a choice of paying the cost to meet the obligation or paying the penalty for not doing so. Setting the penalty too low may invite energy providers to accept the penalty instead of incurring the cost of meeting the obligation.

Describe who may be accredited to carry out energy efficiency projects to meet the obligation. The obligation program should spell out specifically who is eligible to carry out qualifying energy efficiency projects and how the qualifying parties may validate their projects' energy savings.

The EEO program may require that energy savings be obtained from obligated energy provider programs only or may allow savings from projects carried out by such others as

- energy efficiency service companies (ESCOs);
- contractors employed by the energy provider; and
- end-use consumers themselves.

The obligation program may permit energy providers to obtain energy savings from other parties under contract or from qualifying parties offering savings in white certificate markets. (See Sections 4.1.1 and 9.4.) To ensure that those carrying out energy efficiency projects are capable and adhere to the program's standards, the obligation program may require eligible parties to obtain EEO program accreditation.

Define the energy efficiency measures that will be eligible for meeting the obligation. Regulation should provide clear guidance on the energy efficiency measures that will be eligible for meeting the obligation so that obligated energy providers can plan and act to meet energy savings obligations. Eligible measures are usually identified in advance by the authority responsible for administering the obligation, based on independent measurement and verification information on such measures. The list of eligible measures, often accompanied by deemed savings[8] values for each measure, provides the administering authority the means to guide the investments of obligated parties. Common eligible measures across many programs in the commercial sector are energy efficient lighting and HVAC, roof/attic insulation, the best energy rated appliances, and efficient heating systems, including controls in the residential sector. Custom designed or engineered measures, such as industrial process heat savings, may be eligible, but are generally not suitable for deemed savings valuation. The list of eligible measures should reflect a thorough assessment of cost-effective energy efficiency opportunities, such as the type of energy efficiency potential study incorporated in IRP. (See Section 2.)

Measurement design and counting rules should discourage "cream skimming"

Define how energy savings will be counted and validated. Regulation should define how energy savings from efficiency investments will be counted. The valuation methods may impact significantly on compliance strategies and affect what kinds of energy efficiency measures are implemented. How to count and track multiyear savings from qualifying efficiency investments, how to count energy savings from energy efficiency investments funded jointly with non-obligated partners, and how to design effective tools to count savings (e.g., deemed savings, scaled engineering estimates, and measured savings) are all important issues.

Multiyear savings. Counting only first-year energy savings favors low cost/short lived measures that produce savings for only a short time compared to higher cost investments that produce savings that persist longer and are more cost effective when the lifetime energy savings are included. Counting estimated lifetime savings requires assumptions about measure life and future performance that can be validated only later and may complicate efforts to track cumulative impacts over time. The EEO should provide measurement criteria and qualifying investment guidelines that will drive a comprehensive approach to capture long-term "deep savings" that accumulate over time, minimize lost opportunities,[9] and maximize return on investment in single interventions. Measurement design and counting rules should discourage "cream skimming" (practices that capture low-cost, easy to obtain savings but overlook other long lasting savings available to that end-use customer).

Effective "deemed savings" tools. EEO mechanisms often use ex ante deemed savings estimates of the savings to account for energy provider compliance. Deemed savings offer a practical method of tracking progress toward obligation targets, a method that works best for energy efficiency measures that can be expected to produce

8 "Deemed savings" means an estimate of energy or demand savings for a single unit of an installed energy efficiency measure that (a) has been developed from data sources and analytical methods that are widely considered acceptable for the measure and purpose, and (b) is applicable to the situation being evaluated. Individual parameters or calculation methods can also be deemed.

9 Lost opportunities are energy efficiency opportunities available at the time of some other type of service from an energy efficiency program or at the time of a naturally-occurring market event, such as when a customer constructs, expands, renovates, or remodels a home or a building, makes an initial purchase of equipment, or replaces failed equipment, but which are not captured at that time, rendering their later acquisition more expensive than need be.

relatively uniform savings because of their standard features and standard application. To be effective, deemed savings values must be adjusted periodically based on ex post M&V review. (Section 9.4 addresses regulatory action mandating effective M&V.) Compact fluorescents light (CFLs) and high-efficiency ceiling fan replacements are examples of energy efficiency measures for which deemed savings work well; they have relatively predictable energy savings and involve widespread opportunities for deployment at relatively low cost. In some countries the deemed savings associated with widespread deployment of CFLs (e.g., Italy) and high-efficiency ceiling fans (India) have accounted for a large proportion of achieved savings. Deemed savings estimates do not work well for complex energy efficiency installations, which should be subject to both site-specific estimate and ex post verification.[10] To encourage deeper penetration of energy efficiency in individual locations, that is, delivering several efficiency investments together at a single property, deemed savings guidelines may offer additional savings credits for qualifying multi-measure installations.

Free rider effects.[11] In many jurisdictions obligation guidelines will seek to count only savings that would not have occurred without the investments by obligated parties. Addressing the energy efficiency that would occur without such investments (i.e., free rider impacts)[12] is a difficult but important issue. It is difficult to discern on a project-by-project basis, because the motives of the investor are difficult to observe and because large numbers of projects will be implemented to meet obligations. Authorities may use M&V studies to estimate overall free rider effects for individual energy efficiency measures and adjust the deemed savings values assigned to each measure to reflect estimates of the savings contributions from free riders.

Spillover effects. Additional savings resulting from program information or from its very existence, but not involving any incentive payments to the investing consumer, are termed spillover effects.[13] The operation of effective energy efficiency incentive programs often also results in consumers making investments in energy efficiency measures without an incentive because they learn from energy provider program information that the investment is cost effective or learn about the benefits from a program participant. These benefits can only be quantified retrospectively on a program-wide basis, but the deemed savings for individual measures can be adjusted for such effects using information obtained from M&V programs (Section 9.4). Deemed savings values may reflect adjustments that exclude the net effect of free rider and spillover effects.

Jointly funded investments in energy efficiency. Guidelines must set out how an obligated energy provider may count energy savings obtained from projects that receive funding from other sources, including public funding and funding from the beneficiaries of the energy efficiency investments. The guidelines need to ensure that the funding contribution from the energy provider is the impetus for the investment, and that counted savings are for projects that would not have happened but for the investment by the obligated party. This issue has been handled in a variety of ways ranging from disqualifying projects receiving such other funding or allocating the savings in proportion to the funding contribution from the energy provider. Some programs have required no adjustments to such savings provided (a) M&V studies indicate a low rate of free rider participation for the energy efficiency measure, and (b) the measure is not otherwise required by law or regulation, such as a building code.

10 "Scaled engineering estimates" (e.g., scaling standard measures such as air compressors or HVAC equipment from known performance to specific applications) can be used for measures that have somewhat predictable impacts, but impacts that can vary in predictable ways from site to site.

11 A free rider is a program participant who would have implemented the program measure or practice in the absence of the program. Free riders can be (1) total, in which the participant's activity would have completely replicated the program measure; (2) partial, in which the participant's activity would have partially replicated the program measure; or (3) deferred, in which the participant's activity would have completely replicated the program measure, but at a future time than the program's timeframe. In the United Kingdom, such effects are known as "deadweight."

12 In some jurisdictions (e.g., the Australian state of New South Wales) free rider impacts are ignored.

13 In the United States, such investing customers are sometimes known as "free drivers" in contrast to "free riders."

Define the source of funding. To meet their obligations energy providers may expend their resources directly on investments in energy efficiency or acquire energy efficiency savings obtained by others by purchasing white certificate savings credits (if allowed by the regulatory mechanisms chosen by government), or contribute to a fund that provides energy savings services across defined end-uses and groups of customers. Regulation may impose the obligation with the expectation that energy providers in liberalized markets will fund this requirement as a cost of doing business or regulation may provide cost reimbursement to regulated energy providers. Section 3 addresses different ways to fund EEOs.

Require an effective measurement and verification (M&V) program. EEO guidelines should require and provide for an effective M&V program. M&V programs provide objective estimates of achieved savings and monitor the quality of work carried out under the EEO. Section 9.4 addresses M&V specifically.

Adjust obligations at regular intervals. The performance of the EEO mechanism should be regularly evaluated, and the findings used to modify obligation targets, the guidelines identifying eligible measures, deemed savings values, and other guidelines that control energy efficiency investment practices. EEO targets are often set for three-year intervals, providing energy providers with the time to develop and implement programs required to meet their obligations. These intervals should also be used to assess progress toward long-term obligation mechanism goals and the need for program adjustments to address problems and changing conditions, including any changes needed in energy saving values due to market development or the introduction of new regulations. For example, the obligation mechanism's performance may reveal that energy providers' programs are producing "cream skimming effects" that may require adjustments to ensure that more expensive but still cost-effective measures are addressed when low-cost measures are introduced. The mechanism's performance may also suggest changes in overall obligation targets, the need to adapt to changing technology, or changing public policies, such as the introduction of new energy efficiency standards.

EEO targets are often set for three-year intervals

1.2.1 Application in Regulated and Competitive Markets

EEOs serve energy efficiency goals well in many situations, including both vertically integrated regulated utilities and markets served by fully competitive wholesale energy supply and retail energy providers supported by regulated transmission and distribution network operators. The design of an EEO should consider market structure in deciding where to assign the obligation. In liberalized markets, the government will decide whether to assign the obligation to retail energy providers or to owners and operators of the transmission and distribution network. Network operators manage the transport of energy to end-users' dwellings or premises; energy retailers are responsible for selling energy to end-users. The choice of where to assign the obligation may be determined by evaluating what entity is most qualified 1) by knowledge of customer energy use and efficiency investment opportunities, or 2) by capacity to manage programs to acquire energy efficiency savings, or 3) by the history of energy efficiency with certain types of energy companies, or 4) by public expenditure classification rules.[14]

The obligation may be imposed on only large entities or may simply require all energy providers to fund energy efficiency programs that are carried out by third-party entities assigned full responsibility for implementing energy efficiency programs or market tenders designed to obtain energy efficiency savings from diverse providers. The United Kingdom, for example, imposes EEOs on competing energy service providers, but only entities retailing to more than 50,000 residential customers.

14 The specific locus of spending, collection of funds, or both may trigger or may avoid specialized accounting or budgeting requirements in a given jurisdiction. Such requirements may facilitate or hinder demand-side resource planning and financing, and so should be taken into account. See, for example, the UK's Public Expenditure Statistical Analysis frameworks at http://www.hm-treasury.gov.uk/pespub_pesa_tes_framework.htm

1.3 Application: Energy Efficiency Obligations in the United Kingdom

The United Kingdom (UK) is credited with initiating the first EEO mechanism in Europe in 1994. This mechanism has evolved with changing market conditions and has responded to productive lessons of experience.

1.3.1 United Kingdom – The Carbon Emissions Reduction Target (CERT) Scheme[15]

The CERT scheme is the latest manifestation of the United Kingdom Government's EEO. CERT imposes energy savings obligations on electricity and gas providers. It requires obligated energy providers to obtain energy savings from investment in residential customer energy efficiency, but defines the obligation in avoided carbon emissions. CERT is a primary component of the UK environmental climate change action plan and requires that 40% of the energy savings be obtained from investments that improve energy efficiency in the homes of low-income consumers.

The EEO has been imposed by statute. The UK's energy regulatory agency, the Office of Gas and Electricity Markets (Ofgem), is responsible for administering and enforcing the obligation. Ofgem must provide the regulations that energy providers follow to meet their assigned obligation, including all the rules that define what kinds of energy saving actions may be sponsored to meet the obligation, how energy savings will be counted and validated, and the required sampling to ensure that measures meet the required quality standards.

Energy suppliers may meet their obligation by investing in any of an approved list of qualifying energy efficiency measures, for example, home wall insulation, low-energy lighting, high-efficiency boilers and heating controls, energy efficient home appliances and information and control technology (ICT).

Ofgem is also responsible for enforcing compliance with the obligations. It mandates that energy savings be justified by M&V analysis, using that information to implement deemed savings methods of valuing most energy savings claims. Ofgem decides what investments will qualify and what savings should be attributed to qualifying investments. For example, Ofgem recently ruled that replacing incandescent lighting with CFLs would no longer qualify, as UK legislation had introduced legislation banning the sale of most incandescent light bulbs.

Ofgem offers energy providers no specific cost compensation for achieving their CERT obligations. CERT compliance is regarded by energy providers simply as a cost of doing business like other environmental and health and safety requirements. This "level playing field approach" provides competing energy providers with a strong incentive to minimize the cost of meeting their CERT obligations. Although concentrating on low-cost energy efficiency measures may reduce the cost to energy providers, doing so may not yield all the longer lasting and more comprehensive benefits provided by certain higher cost measures, benefits that are important from a national perspective. Ofgem, however, on instructions from the UK Government, addresses such issues through specific investment mandates or exclusions. For example, the current phase of CERT requires 68% of savings to come from professionally installed insulation and the more expensive solutions for carrying out wall insulation in solid wall properties have bee n awarded an energy saving bonus above actual savings to provide incentives for this option.

Ofgem is responsible for compliance with obligations. The Ofgem certification of compliance does not produce energy savings certificates that represent predefined quantities of certified savings, reflecting instead the exact savings values from individual projects. Energy providers can trade a defined fraction of their Ofgem certified savings to other energy providers and Ofgem permits banking of certified savings once their targets have been met, enabling an energy provider to credit surplus savings toward future obligations. This practice was introduced in 2002 to avoid "stop-go" situations for the energy efficiency industries as energy providers stopped activity once their target had been met.

The CERT EEO program is distinctive for its exclusive focus on residential energy users and its mandate to obtain 40% of the obligation from low-income residential customers. It is also distinctive in defining the obligation in terms of avoided CO_2 emissions. It allows only energy providers to request certification of efficiency savings, restricting opportunities for independent energy efficiency service companies to serve this program except as contractors to energy providers.

15 This example is informed in large part by Bertoldi et al., 2010; Togeby et al., 2007 ; and Lees, 2010.

2. Integrated Resource Planning

Requiring use of demand-side resources to meet customer needs, instead of generation, transmission and distribution capacity, where cost effective on a life-cycle basis

2.1 What is the Integrated Resource Planning Regulatory Mechanism?

IRP is a valuable regulatory mechanism for mobilizing support for energy efficiency. There are two approaches to using IRP for this purpose. First, certain types of energy providers may be required to present and implement comprehensive, long-range plans that spell out a least-cost mix of supply-side and demand-side investments that will meet future customer energy requirements and achieve other energy supply goals (including reliability, environmental, and social goals). This approach is most relevant to vertically integrated utilities (in fully regulated energy markets) or to regulated energy distributors (in liberalized competitive retail markets). Alternatively, regulators may conduct an IRP-type analysis to determine the amount of demand-side resources an IRP would contain and use that information to set EEO targets or similar policies.

In either case, the applicable principle is to present plans for meeting future customer energy requirements that identify the full potential for energy efficiency and demand response (and nontraditional supply resources) to meet those needs at a lower life-cycle cost than traditional supply-side resources (generation, transmission and distribution).

Regulators may require that energy providers conduct a full IRP analysis or may require specific steps that, although founded on IRP principles, do not involve the full development of comprehensive IRPs.

IRP identifies, analyzes, and then presents action plans to acquire the most cost-effective resources that will achieve long-term energy supply objectives.

IRP Principles Provide a Foundation for Effective Energy Efficiency Program Design

IRP in one form or another is applied in various countries to identify and mobilize cost-effective investments in energy efficiency and demand-side management. The comprehensive IRP approach, developed and applied most widely in North America, has evolved into a flexible planning framework that has been adapted to serve diverse approaches to energy planning employed worldwide.[16] Done well, IRP can produce a plan that meets a range of planning goals such as: minimum economic cost, reliable energy supply, climate protection, public health protection, and affordable energy for low-income households.

Stated simply, IRP identifies, analyzes, and then presents action plans to acquire the most cost-effective resources that will achieve long-term energy supply objectives. IRP analysis seeks the combination of energy efficiency and supply-side resources that meets energy needs at the lowest life-cycle cost subject to the range of business uncertainties and environmental constraints that are familiar to energy providers and regulators. IRP serves energy efficiency goals well if regulators require valid analysis and the energy provider commits to acquiring the energy efficiency resources that surface as the cost-effective option.

Some jurisdictions have modified the IRP process, requiring energy providers to develop resource procurement plans that acquire a mix of resources that complies with IRP guidelines. Such procurement plans differ from IRPs by focusing on shorter planning horizons

16 D'Sa, 2011

with more frequent updates, and addressing actual purchasing strategies.[17]

Applying IRP Analysis to Support Energy Efficiency Obligations

If government or regulators choose to require IRP analysis in support of other policies instead of full resource plans, the IRP analysis itself is still valuable. It can provide a map of cost-effective energy efficiency opportunities, inform EEO targets and longer-term goals, and guide energy efficiency program designs, market acquisition, and performance incentives. Regulators may, for example, require energy providers to evaluate carefully the costs and benefits of the diverse mix of energy efficiency opportunities and to design energy efficiency programs that match their service territories and the customers they serve. IRP analysis also thoroughly documents the energy efficiency programs that should be carried out and what funding is required.

IRP analysis, whether done independently or as part of a full action plan, identifies the energy efficiency investments that can meet energy and capacity needs at lower cost than investments in system infrastructure. It may produce useful energy efficiency supply curves and provides a baseline against which actual energy efficiency performance can be evaluated.

It is important to note that IRP typically focuses on electricity or natural gas planning needs. An IRP-based electricity supply plan, for example, addresses how energy efficiency investments may serve electricity supply objectives. IRP has not addressed energy efficiency for other fuel supply needs, such as using petroleum to heat homes or fuel transport, but could in principle do so.

2.2 Key Issues in Design and Implementation

The IRP mandate, codified in law or regulation, should be specific in spelling out the key elements of compliant IRP practice.

What will be the primary objectives of requiring IRP?

Governments or government regulators should first decide whether IRP will be used for action planning *per se* or as a support for EEOs and other policies. When used for action planning, it guides energy provider resource acquisition, specifying investment plans for demand-side and supply-side resources. When used in support of EEOs, IRP can identify cost-effective energy efficiency opportunities and required investments, informing the setting of long-term goals and short-term energy obligation targets by revealing what is available and where it may be found.

When used for action planning, the IRP mandate should require that compliant plans choose demand-side resources when a fair comparison of costs and outcomes with supply-side resources reveals demand-side resources to be the low-cost option on a life-cycle basis. Without such a requirement, IRP may be informative but may not increase investments in energy efficiency.

When IRP analysis is mandated to support energy efficiency obligations, the mandate should spell out the range of end-use energy efficiency and demand-side resource options that should be evaluated and how their cost effectiveness should be determined.

IRP is a significant analytical challenge, and IRP deliberations regarding assumptions and methods can be contentious. The analytical and procedural cost of IRP means that the resulting information must be used productively. The IRP statute or regulatory mandate should spell out the required analysis, the frequency of updates, and how demand-side resources should be evaluated *vis a vis* supply-side alternatives.

Governments or government regulators may also want investments in demand-side resources to serve environmental and social policy objectives, for example, climate policy goals or public policy commitments to provide services to low-income households. This will require further guidance on identifying cost-effective demand-side resources that serve these goals. For example, if a government's climate change goals are to be addressed in IRP, a shadow price for carbon emissions may be imputed to fossil generation in the analysis.

Who will be responsible for carrying out the required IRP analysis?

Regulators must decide who will be responsible for carrying out the required IRP analysis.

Energy providers are best equipped to implement a comprehensive IRP program that is designed to provide

17 Wilson and Peterson, 2011

long-range action plans. Government regulation may require that energy providers present their plans for public review and may require regulatory approval of the proposed investment plans.

Energy providers are also often best equipped to carry out the IRP analysis aimed at defining energy efficiency investment opportunities within their sector, so IRP analysis is often assigned to energy providers. In liberalized markets this responsibility is often assigned to transmission and distribution network operators because these entities serve all consumers.

When consumers are served by competing energy providers, the capacity of the providers to conduct IRP analysis effectively may vary depending on the number and types of customers each provider serves. Energy retailers can utilize their knowledge of customer energy use to conduct this work, but if the market is served by multiple providers, requiring all energy providers to do this separately may be inefficient and may yield fragmented results.

Regulators may assign responsibility for analyzing demand-side resource potential to a government agency or authority independent of energy providers. Independent government authorities also can tailor the analysis to address public policy goals and priorities and will allow open scrutiny of the analysis and findings. Independent government authorities may also be entrusted by diverse stakeholders in energy efficiency program planning to produce findings that are objective and comprehensive.

2.2.1 Additional Regulatory Mechanisms to Carry Out IRP Recommendations

Additional government policies may be required to take advantage of the energy efficiency opportunities IRP identifies, to ensure that cost-effective energy efficiency investments happen. For example, energy efficiency obligations can effectively complement IRP, and IRP can strengthen the capacity of government to set obligation goals and to guide energy provider efforts to meet obligation targets.

2.3 Application: IRP in California

The energy planning and resource acquisition process mandated by the State of California in the United States provides an example of an IRP process (called the Long Term Procurement Plan) that has operated productively.

A 2002 California statute requires investor owned electricity and gas utilities to develop and periodically update long-range plans to acquire the necessary resources to meet future service needs. The statute specifically requires electric and gas utilities to develop resource procurement plans that will meet unmet resource needs first through all available energy efficiency and demand reduction resources that are cost effective, reliable, and feasible.[18]

California adopted an energy policy in 2005 that formalized this guidance in what is termed a "loading order" for resource additions to meet future energy service needs.[19] For electricity, the prescribed order is energy efficiency and demand response first; renewable energy and distributed generation second; and clean fossil-fueled sources and infrastructure improvements third. For natural gas, the loading order policy calls on utilities to adopt all cost-effective energy efficiency measures, including replacement of aging power plants, with new, efficient power plants.

California's energy policy document notes that this strategy reduces greenhouse gas emissions and diversifies the state's energy sources and notes that "[t]he loading order policy is a key element of this plan."[20] Periodic plan updates ensure that assessments of need and options are current. The plans must identify energy efficiency opportunities, evaluate their cost, and offer strategies for acquiring them.

Procurement plan oversight is the responsibility of the California Public Utility Commission (CPUC). Every 2 years it convenes proceedings to review and adopt new 10-year procurement plans for each of the utility energy providers and establishes rules for funding procurement plan resource acquisitions in tariff regulation policy. The CPUC proceedings specifically address how the proposed resource acquisition plans conform to state energy policy and other programs serving state energy goals and ensures that changes in code and standard requirements for energy efficiency are reflected in updates.

18 California Public Utilities Code 701, Section 454.5 and 454.56.

19 California (2005). Senate Bill 1037 (SB 1037) September 29.

20 California Energy Commission. 2007

3. Stable Funding

Securing a long-term framework with predictable levels of expenditure by energy providers to support expanded energy efficiency obligations

3.1 What is the Stable Funding Regulatory Mechanism?

Government action is needed to ensure that energy efficiency programs have the sustained funding required to achieve long-term energy savings goals. Sustained and stable expenditure commitments provide energy efficiency industries and the energy providers with the commitment they require to invest financial and labor resources to significantly expand energy efficiency program capacity and to support innovation.

To that end, governments may require that energy providers:

- treat energy efficiency program costs as a normal cost of business; or
- collect funds from their customer to support end-use energy efficiency programs, for example, as a surcharge to the price of energy collected from energy consumers.[21]

The next section explains these two quite different regulatory approaches to financing energy provider-funded energy efficiency programs, addressing key issues governments or government regulators will confront implementing them.

Where energy providers are not required to commit their own funds to cover these costs, effective energy efficiency program cost recovery should:

- provide a clearly defined path for timely recovery of energy efficiency program costs;
- provide for multiyear budgeting and cost recovery to support the ramp-up and delivery of energy efficiency programs;
- set multiyear energy saving targets[22] and also signal longer-term energy saving targets, at least in general terms;[23] and,
- provide means to 1) increase funding levels if program

> Interview and desk study results consistently cite reliable and adequate sources of funding as perhaps the most important enabling framework for successful long-term energy efficiency (EE) implementation. Countries with well-developed energy efficiency industries and a history of continuous efficiency improvements have usually paid particular attention to EE funding mechanisms.
>
> In contrast, "stop-go" funding is a perennial problem for energy efficiency managers. If EE funding depends on annual government budgets, implementation is susceptible to variations in budget availability. A common occurrence is for EE budgets to be reduced when economic conditions result in overall government cutbacks. This makes it difficult to maintain the continuity of effort needed to build new EE industries and accomplish market transformation objectives.
>
> *International Energy Agency. Energy Efficiency Governance. 2010*

21 Such a price surcharge is sometimes called a tariff rider, a tax, an industry levy, a public benefit charge, or a system benefit charge. The last two names reflect the public or energy system purposes to which the resulting funds are committed. The revenue raised by price surcharges is often dedicated to such additional purposes as research and development, resource planning (see Section 2), and assisting low-income households to meet their essential energy needs.

22 Targets are often set for 3-year intervals.

23 In the UK, the Government has signalled that the next phase of the energy supplier obligation from 2013 will operate at least at the same level as the current activity and would last until 2020.

performance and planning needs justify expansion,
2) ramp down less successful programs, and
3) move the funds between programs to achieve greater savings.

3.2 Key Issues in Design and Implementation

The design and implementation of the two approaches to providing timely energy efficiency program cost recovery involve very different issues.

3.2.1 Requiring Energy Providers to Fund Energy Efficiency Investments

Energy providers operating in liberalized markets. In liberalized markets served by competing energy retailers, government may require that the retailers achieve energy efficiency goals using their own resources as ordinary business costs. The competing retailers will be motivated to minimize the cost of meeting their energy efficiency obligations because there is no guaranteed source of funding.

The strong incentive in competitive markets to spend as little as possible in meeting energy efficiency obligations, however, may reduce prospects for meeting long-term goals or may increase costs in the long term by focusing on minimizing cost in the short term. For example, an energy provider may go after those energy efficiency measures that are the most cost-effective in terms of energy provider contribution, but this is not necessarily the most cost-effective when viewed from a national perspective. This kind of program behavior may save the provider money in the short term but increase overall costs in the long term by eventually requiring multiple projects to capture all cost-effective savings opportunities. Regulators may address such adverse outcomes in the design and implementation of the energy efficiency obligations, for example, by prescribing specific investment mandates or exclusions that address how qualifying savings may be achieved (see Section 1.3.1) or by selecting transmission and distribution providers or independent entities as delivery agents (see Section 1 and Section 8, respectively).

Energy providers operating in regulated monopoly markets. In markets served by regulated energy providers, regulators may treat mandated energy efficiency investments[24] as a cost of service to be addressed in rate setting subject to regulatory review. In that event, there are several cost recovery choices, for example, including forecasted costs in current rates along with a reconciliation adjustment and prudence review. Another option is the "book and defer" approach, in which costs are incurred by the provider and recorded for later recovery. For regulated energy providers the primary issues address traditional cost recovery practices. Three regulation issues dominate:

1. Whether energy efficiency costs should be treated as capital investments or as operating expenses;
2. How to remove strong conflicts between energy efficiency goals and the provider's financial incentive to maximize energy sales (addressed in Section 9.2); and
3. Whether energy providers should be offered performance incentives for achieving or exceeding energy savings goals (addressed in Section 6).

Cost recovery mechanisms must provide sufficient and reliable cost recovery on a timely basis if programs are to have stable funding. Revenue requirement regulation can be an awkward method for providing assurance that programs costs will be compensated on a timely basis. Rate cases may occur infrequently, can take extended periods to complete, and may give scant attention to the needs of new energy efficiency programs in proceedings in which primary attention may be on minimizing revenue requirements and energy prices. Nevertheless, price regulation practices provide well developed pathways, such as riders and decoupling, to overcome these concerns and compensate energy providers.

Cost recovery mechanisms must provide sufficient and reliable cost recovery on a timely basis if programs are to have stable funding.

24 Energy efficiency programs may be an outcome of IRP-based investment plans or in response to regulatory mandates, such as earlier discussed energy efficiency obligations.

3.2.2 Using an Energy Price Surcharge to Fund Energy Efficiency Investments

Energy price surcharges are the other main way to fund energy efficiency investments in both liberalized markets and markets served by regulated monopoly providers. Government authority may impose, by statute or regulation, a price surcharge on retail energy consumers to fund energy efficiency programs. The price surcharge typically is an increment to the per-kilowatt-hour price of electricity or the per-therm price of natural gas collected by energy providers from their customers.

To work effectively, the surcharge must be both non-bypassable[25] and competitively neutral. Because the transmission and distribution network serves all end-users, all must pay for service, which will include any surcharge dedicated to funding energy efficiency programs. Because the surcharge applies to all end-users, it is competitively neutral. Because the charge for energy efficiency programs is a non-bypassable charge assessed on all customers, all of a network operator's customers should be eligible to participate in energy efficiency programs, regardless of the customer's retail supplier.[26] The funds collected by such a surcharge should be directed to a designated organization that is responsible for managing the funds to achieve energy efficiency goals. The designated organization may be an existing energy provider, a nonprofit entity, or an existing government agency or government enabled authority, but needs to be an organization clearly committed to serve energy efficiency goals. This regulatory mechanism should also ensure that the funds are used effectively to serve their intended purpose. The surcharge design should address the following questions:

- What will be the size of the surcharge? This decision will determine the short-term impact on energy prices and the resources that will be available to obtain the benefits of energy efficiency programs. Effective resource planning, discussed in the preceding Section 2, can helpfully guide these decisions. Inflexible caps on surcharges, unrelated to benefits and costs, may disrupt energy efficiency programs by limiting the available resources and should be avoided.

Statute or regulation should specify clearly how the funds collected from the surcharge may be used and who will be eligible to be reimbursed

- What will be the surcharge design? Surcharges commonly are levied on a per-unit-of-energy basis (i.e., per kWh electricity, per therm of natural gas sales) but may be designed with a peak demand-based component or a fixed per-customer charge. A fixed charge per customer places larger burdens on smaller customers, however, particularly low-income households.

- What are qualifying energy efficiency activities? Statute or regulation should specify clearly how the funds collected from the surcharge may be used and who will be eligible to be reimbursed from the funds collected. In a few cases funds have been diverted from energy efficiency to serve unanticipated government budget needs, a problem that should be addressed by prescribing qualifying expenditures in the statute.[27]

- What program planning, administration, and evaluation costs will be paid by these funds? Regulation may allow funds to be used to compensate entities responsible for efficiency potential assessments, management of surcharge funds, and M&V, all functions required to assure that resources are used effectively to achieve long-term energy savings goals.

25 To be non-bypassable, the surcharge must be designed to prevent energy consumers from taking steps, such as switching from one provider to another or to higher voltage receipt of power, to avoid surcharge costs.

26 In the case of a liberalized market, a customer's decision to take service from a competitive energy retailer and not the vertically integrated utility should not interfere with that customer's ability to participate in energy efficiency programs to which they are contributing through the non-bypassable charge.

27 For example, in 2003 the State of Texas in the United States tapped funds raised by the public benefits charge in this state to serve general government purpose needs. For more information see: http://liheap.ncat.org/dereg/states/texas.htm and http://www.dsireusa.org/solar/solarpolicyguide/?id=22. The Brazil case described below varied the funds allocated to energy efficiency programs until the legislature intervened, requiring specific funding for energy efficiency programs.

3.3 Application: Funding Energy Efficiency in the United Kingdom and Brazil

3.3.1 United Kingdom – Funding Efficiency as a Cost of Business

Energy efficiency obligations, discussed in Section 1, have been in place in the United Kingdom (UK) since 1994, initially on the electricity industry but on both the electricity and gas suppliers since 2000. Since 2002 the UK Government has indicated that the costs of meeting energy efficiency obligations should be treated by energy providers as a cost of business and should be funded accordingly. The Government consults all stakeholders on the overall target it plans to submit to Parliament, at the same time publishing an "Illustrative Mix" of energy efficiency actions and associated costs providers may use to meet the proposed target. The Government sets the target by balancing the desire to achieve ambitious energy savings with the costs that energy providers pay but which ultimately may affect consumers' bills. Whether or how the energy provider passes along the cost of meeting their energy efficiency obligations to consumers in the energy prices is left to the energy provider to manage.

Stable, sustained funding is assured by legislative action that imposes a long-term energy efficiency obligation on energy providers, communicating to energy providers that the obligation to provide energy efficiency savings will be in place for several years (currently to 2020), and that it will be their responsibility to plan, fund, and implement energy efficiency investments to meet these obligations.

3.3.2 Brazil – Funding Efficiency with a Price Surcharge

Brazil has implemented a surcharge that has funded energy provider energy efficiency for almost 15 years. Brazil's public policy support for energy efficiency extends back to the creation of the National Electricity Conservation Program (PROCEL) in the mid-1980s. The Brazilian electric regulatory agency, Agência Nacional de Energia Elétrica (ANEEL), did not mandate utility investments in energy efficiency until 1998. ANEEL then required that electricity distribution network operators set aside one percent of annual net revenues collected from their electricity customers, termed a wire-charge, to be used to implement energy efficiency programs and to support research and development programs.

In 2000 Brazil's National Assembly established by statute a public benefit fund, CTEnerg, to be managed by a board of directors comprised of representatives of several energy-focused government agencies, academia, and the private sector. This statute requires that a portion of the one percent bill surcharge supports CTEnerg, leaving the remainder for energy provider sponsored energy efficiency and research programs. The actions of the National Assembly at first diverted much of the fund to research and to energy planning, but in 2007 restored the energy efficiency commitment to a minimum of 0.5 percent of revenues, requiring that half of the energy efficiency funding target low-income customers.[28]

ANEEL now requires that Brazil's regulated electricity providers "…annually invest an amount not less than 0.5% of their net operational revenue in activities aimed at reducing electrical energy waste."[29] ANEEL requires that each electricity provider present a plan for the expenditure of these funds, defining goals and identifying planned actions and their associated costs.

The wire charge has sustained electricity provider energy efficiency investments by providing a steady source of funding for an extended period. Although the allocation of funding to energy efficiency has varied, the steady funding provided by the wire charge has enabled Brazil to sustain investments in energy efficiency, enabling the growth and survival of energy service companies, organizations that electricity providers use extensively to implement energy efficiency investments.[30]

Brazil has not decoupled revenues from sales. As a result electricity sales reductions resulting from effective energy efficiency investments reduce electricity providers' earnings, posing a significant barrier to energy efficiency program development.

Nevertheless, Brazil's energy efficiency programs are improving. Greater attention is being given to measuring and evaluation investment impacts, modifying implementation plans to improve performance. The commitment to sustain funding for energy efficiency and other public benefit purposes has provided the steady funding required for these programs to mature and improve.

28 Renewable Energy & Energy Efficiency Partnership, 2009

29 Agencia Nacional de Energia Eletrica (n.d.).

30 Renewable Energy & Energy Efficiency Partnership, 2009

4. Creating or Adapting Markets to Mobilize Energy Efficiency Investments

Integrating energy efficiency and demand response into competitive energy markets and using market tenders to mobilize efficiency investments

4.1 What is the Regulatory Mechanism that Enables Energy Efficiency to Participate in Competitive Energy Markets?

Government may adapt existing markets, or create new markets where none exist, to allow demand-side resources to compete effectively with supply-side resources and thereby to acquire energy efficiency and demand-side resources. Government may address:

- markets for energy saving offerings that obligated entities may use to meet energy efficiency obligations (EEOs); and
- markets to obtain competitively demand-side resources to meet customer demand.

Generally, government will establish markets to acquire resources and then establish ground rules for market operations. There are many ways to set the ground rules for market operation, depending on local energy efficiency program practice and existing energy provider regulation. Effective market designs that enable markets to acquire an optimal mix of supply-side and demand-side resources are a large topic beyond the scope of this review. This review identifies how markets can acquire demand-side resources cost effectively and how they can mobilize demand-side investments, especially in energy efficiency, to meet EEOs or to acquire the cost-effective savings from IRP analyses.

4.1.1 Energy Savings Markets

Markets provide a valuable tool for acquiring the many different types of resources that are required to produce, distribute, and sell energy to end-users. In recent years governments have increasingly used competitive markets for wholesale energy and capacity as well as ancillary services, for transmission and distribution capacity, and for sale of energy to end-use consumers.

Market acquisitions may either substitute for or supplement energy efficiency and demand response from energy provider programs. Government may either ensure that markets established to acquire savings from energy efficiency and demand response function effectively or may create such markets where none exist. The simplest form is to levy a non-bypassable mechanism to create a fund for energy efficiency that is subsequently open to tenders from all interested parties to deliver energy savings in end-use customers. A more challenging form is to ensure that demand-side resources can compete with supply-side resources on a reasonably comparable footing. To do so, market rules must allow the load reduction attributes of energy efficiency and demand response to compete with capacity from traditional generators. The purpose is to allow demand-side resources to compete fairly with supply-side resources, not to grant demand-side resources a preference.

An example of a fund raising approach is Portugal's Plan for the Promotion of the Electrical Energy Consumption Efficiency (PPEC) profiled at the end of this section. The PPEC uses a levy on the electricity distributors to raise funds for energy efficiency. The PPEC employs these funds in a competitive tender process administered by the energy regulator to obtain energy efficiency savings offered by energy efficiency service providers (including energy service companies, called ESCOs, and energy retailers) and directly by end-use customers. South Africa has developed a standard offer market tender program that promises to acquire energy efficiency savings that meet specified price and performance criteria.[31] The United Kingdom allows energy providers to engage in bilateral market trading of certified energy savings, allowing providers to sell surplus savings when energy efficiency programs produce more than planned or buy savings when they face deficits.

Government action may facilitate the development of such market-based practices by authorizing energy providers to use market acquisitions to meet energy efficiency supply obligations, spelling out in guidelines what will be required of such market tender practices to satisfy energy efficiency obligations. Governments may impose guidelines to ensure that markets operate effectively and to provide for market monitoring and rule enforcement. Such guidelines should:

- allow diverse energy efficiency providers to acquire and sell achieved energy savings;
- value energy savings appropriately;
- ensure that market-traded energy savings are real;
- compensate sellers fairly;
- contribute effectively to capturing cost-effective energy efficiency opportunities; and
- operate transparently to ensure fair competition.

4.1.2 Market Acquisition of Energy System Resources

Tenders of various kinds have long been used to acquire specific resources, even without organized competitive markets. Market tenders may be designed to acquire demand-side resources in at least four types of resource markets:

- Wholesale energy markets that obtain the short-term resources required to balance energy supply and demand on a daily or hourly basis;
- Ancillary service markets that obtain resources, such as reserves, that electric power systems require to maintain system reliability and service quality in response to varying supply and demand;
- Wholesale capacity markets that obtain long-term capacity commitments to balance system peak load supply and demand; and
- Markets designed to obtain resources required to maintain network performance.

For example, in some US electricity markets, such as the New England ISO and PJM markets, offers of demand-side resources compete head-to-head with generation in annual and daily market auctions. Section 4.2.3 describes the contributions demand-side resources may make and actions government may take to enable demand-side resources to participate effectively in these market acquisitions.

4.2 Key Issues in Design and Implementation

4.2.1 Application in Regulated and Competitive Markets

Market mechanisms are an effective means for supply-side and demand-side resource acquisition in most types of electric and natural gas industry structures, including both liberalized market structures and regulated energy markets. Market acquisition of energy savings, specifically, has been developed in a liberalized market setting but can be used as well by vertically integrated energy providers.

The restructuring of electricity and gas markets from regulated vertically integrated organizations to liberalized unbundled structures, which are becoming increasingly common worldwide, has been the impetus to use competitive energy supply markets. Government should enable energy efficiency and demand response to participate in these markets as well.

Vertically integrated energy utilities often plan and implement their resource acquisition plans using only narrowly focused, technology-specific tenders. Until recently it has been unusual for energy providers to conduct competitive tenders to select among competing types of resources to maintain and expand energy delivery systems, but this is changing.

4.2.2 Key Issues – Creating Efficient Markets to Acquire Energy Efficiency Savings

Governments may decide that market tenders provide an effective way to acquire energy savings from energy efficiency investments; they may establish open competitive markets in which demand-side resources can compete, or both. It is an axiom of economics that government may and should act to ensure that markets operate fairly and effectively; without such intervention the cost-reducing benefits of market competition are at risk. Government, accordingly, should ensure that price competition is a component of whichever mechanism they select.

31 Limaye, 2010

Government policy that calls for such markets should provide guidelines that prescribe at least the following:

- What energy efficiency resources qualify for such markets, including benefit-cost criteria and eligible efficiency measures;
- What entities may participate in the markets (e.g., energy providers, energy efficiency providers, end-use consumers installing energy efficiency measures in their own premises);
- Specific requirements for measuring and verifying the energy savings from energy efficiency measures (e.g., establishing guidelines for defining and validating deemed savings) through M&V practice guidelines (see Section 9.3);
- Rules defining the tradable instrument for buying and selling energy efficiency savings, if allowed (see Section 9.4); and
- Trading practices that will address "cream skimming," as discussed in Section 1.2.

Government may also encourage stakeholders to contribute to the development of market designs so that the resulting markets meet the needs of buyers and sellers, and may assign market support functions to appropriate entities, for example, responsibility for administering funding of markets by participants, administering tradable energy efficiency certificates, if allowed, and monitoring markets.

4.2.3 Key Issues - Enabling Demand-Side Resources to Participate in Markets

For demand-side resources to compete fairly, markets must be designed to recognize the contributions that energy efficiency and demand response offer. These include 1) their ability to address system needs by reducing or shifting customer demands, and 2) the reductions in the "external" costs of energy supply, including environment, public health, and energy security.

Energy system planners and market participants are often willing to invite demand response providers to provide capacity, knowing that these commitments may be treated as dispatchable resources, but less ready to acknowledge and monetize the value of energy efficiency to provide long-term capacity. Markets must recognize and accommodate both types of resources, making acquisition choices that reflect the full benefits they contribute, including direct economic savings and reductions in external costs. These attributes should be recognized in all markets, including markets for wholesale energy, ancillary services, wholesale capacity, and transmission capacity.

For demand-side resources to compete fairly, markets must be designed to recognize the contributions that energy efficiency and demand response offer.

Wholesale energy markets. Wholesale energy markets balance loads and generation supply on a day ahead and hourly basis.[32] The wholesale energy market obtains commitments that may be scheduled economically a day ahead and that may be called upon as needed to add electricity supply or to lower loads to keep supply and demand in balance. Demand response can serve in this market by enlisting customers to reduce electricity consumption as needed in return for a fee, and that fee then competes in the market with offers of generating capacity. Customers may sign up on a firm basis or without any firm commitment. Firm commitments are rewarded with higher fees but are subject to penalties for failure to deliver when called. Voluntary commitments are compensated only for the energy reductions they provide but face no obligation to provide those energy reductions. Consumers should be able to bid into wholesale energy markets individually or through aggregators that manage demand response commitments involving several electricity customers.

Although demand response can provide a valuable contribution in wholesale energy markets that obtain resources to meet system needs in the immediate future (i.e., from a few hours to a day ahead), energy efficiency has a more limited role. Investments in energy efficiency will affect the energy demand a wholesale energy market addresses, but the short-term focus of these markets offers no opportunity for these projects to participate. Long-term capacity markets, however, can do so.

Regulatory action may be required to ensure that

32 It should be explained that, although the particular type of market discussed here is *called* a wholesale *energy* market, it is still suitable for demand response resources, because triggering a load reduction at the premises of a demand response customer does, indeed, reduce the wholesale energy required on the system for the duration of that reduction. Reductions required of customers may have various advance notice rules and may be as short as 1 hour or as long as 16 hours, depending on the specifics of the provider's program and the market rules.

wholesale markets provide fair opportunities for demand-side resource providers to compete with energy suppliers and then compensate demand response fairly. Regulation may need to require that wholesale energy markets accept bids from consumer demand response offers and provide guidelines for evaluating fairly the contributions that demand response provides for compensating the demand response commitments selected in the market.

Ancillary service markets. Ancillary services are an array of functions that electric power systems require to maintain network performance as loads, generation availability, transmission and distribution equipment performance all vary. Electric system operators in market settings typically invite resource providers to offer bids for capacity to address energy imbalance, spinning reserves, reactive supply and voltage control, and regulation and frequency response. Some of these require specialized equipment, but demand response may, for example, provide a load reduction on very short notice (say, 10 minutes or 30 minutes, depending on the market) to meet electric system synchronized spinning reserve needs. Demand response can also provide valuable services in some of these markets, similar to the wholesale energy market offers described above. Participating customers may need special communication and metering equipment in place to respond to a call for service and to verify the response and compliance with market rules. When demand response resources can provide a service functionally equivalent to a given ancillary service, such as a 30-minute reserve product,[33] markets should provide these resources the same opportunities provided to generation resources, i.e. to submit bids, to be evaluated on a comparable basis, and to be selected when cost effective.[34] Again, energy efficiency projects take time to plan and implement, providing long-term savings, benefits that do not address the short-term, rapidly changing needs served by ancillary service markets.

Government may need to require market guidelines to address technical requirements of demand-side resources that differ significantly from supply bids. For example, for demand-side resources to participate in ancillary service markets, bidding procedures must allow demand response bidders to condition their commitments, for example, with limits on the duration and frequency of their service. These conditions are analogous to but very different from the conditions that electricity generators offer in their bids, such as start-up costs, ramp rates, and limits on the number of hours that they can provide generation services efficiently and the minimum downtime between generation starts. Generators include operational constraints in their bids; providing demand response resources with comparable treatment requires that demand response be allowed to do the same.[35]

Wholesale capacity markets. Electric system operators may employ markets to obtain the capacity resources needed to ensure that there is sufficient generation capacity available and committed to meet forecast electricity demand. Wholesale capacity markets acquire commitments to provide capacity and energy in the future (e.g., 3 years ahead), in contrast to wholesale energy markets that obtain resources to meet immediate needs. Accordingly these markets are often referred to as "forward capacity markets." Certain demand response programs may be able to meet such needs, but energy efficiency projects can offer long-term reductions in energy consumption with corresponding capacity value that can bid successfully into such markets.

Forward capacity markets are relatively new and are not yet used widely. Examples exist in several parts of the United States and in Brazil; Great Britain is exploring the development of these markets. Forward capacity markets address the focus on short-term purchases caused by dependence on short-term wholesale energy markets, which provide no compensation for long-term commitments

33 An offer of a demonstrated capability to deliver additional generator capacity or load reduction within 30 minutes of notification of need.

34 US Federal Energy Regulatory Commission. Wholesale Competition in Regions with Organized Electric Markets, Order No. 719, 73 FR 64100 (Oct. 28, 2008), FERC Stats. & Regs. ¶ 31,281 (2008) (Order No. 719). Available at http://www.ferc.gov/whats-new/comm-meet/2008/101608/E-1.pdf, and Eric Hirst (2002). Price Responsive Demand as Reliability Resources. Oak Ridge National Laboratory. Available at: http://www.hks.harvard.edu/hepg/Papers/Hirst_PRDReliability_04-02.pdf

35 US Federal Energy Regulatory Commission. Final Rule: Wholesale Competition in Regions with Organized Electric Markets. Docket Nos. RM07-19-000 AD07-7-000. Order No. 710. Issued October 17, 2008.

and hinder development of new capacity to meet long-term growth in electricity demand. Both energy efficiency and demand response can contribute to addressing the long-term capacity needs, because investments in energy efficiency can provide permanent, continuous reductions in loads; and demand response commitments can offer the capacity to reduce system peak loads.

In the past, forward capacity markets have excluded demand-side resources as qualifying bidders. Only two forward capacity markets allow demand-side resources to bid and to be compensated if selected, the New England Forward Capacity Market and the PJM Capacity Market, both serving areas of the eastern United States. Many other capacity markets ignore the ability of energy efficiency to deliver capacity savings. However, market guidelines can and should provide equal treatment for energy efficiency. Also, bid procedures must fairly quantify capacity value of energy efficiency and demand response. The New England Forward Capacity Market and the PJM Capacity Markets do this.[36]

Transmission network capacity markets. Transmission network operators may use markets to acquire the resources needed to balance the delivery capacity of the network with existing or forecast loads for specific network service areas. The main method for doing so is to allow for geographically targeted demand response and energy efficiency bids in transmission-constrained locations. Markets should be required to invite energy efficiency and demand response offers in such locations. Section 5 addresses regulatory action requiring network planners to disclose network needs and invite energy efficiency and demand response projects to compete with transmission upgrades.

4.3 Application: Enabling Market Tenders

4.3.1 Portugal – Enabling a Market for Energy Efficiency Savings [37]

Portugal's comprehensive multi-sector program to obtain energy savings is a major component of the nation's National Plan for Climate Action (PNAC). The PNAC assigns responsibility for developing and implementing an electricity energy efficiency program to the Portuguese Energy Service Regulatory Authority (ERSE).[38] In 2006 the ERSE launched the Plan for the Promotion of the Electrical Energy Consumption Efficiency (PPEC), a program that solicits reductions in end-use electricity consumption through periodic market tenders for energy efficiency. The ERSE administers the tenders, establishes the rules for participation, and ensures that winning bidders meet their energy savings commitments.

The ERSE decides the budget for the PPEC and has obtained the required funding by imposing a 0.2 percent surcharge on end-use prices paid by all end-use electricity consumers, supporting the PPEC 2-year, 23 million euro budget.

The PPEC invites electricity efficiency proposals from diverse "promoters" that include electricity suppliers, transmission and distribution network operators, energy efficiency agencies, business associations, municipal associations, and consumer associations. Separate tenders solicit proposals for two program categories, tangible energy efficiency measures and intangible measures.

The competitive tender process has produced bids with values at five times the original budget for these tenders, providing strong competition among proponents of energy efficiency projects. The ERSE now requires that proponents commit a minimum of 20 percent of the project cost, limiting the PPEC commitment to 80 percent of the cost of savings. Payments are only made when the investments are made. Proposals are selected using detailed criteria for

36 Jenkens, et al., 2009; Gottstein and Schwartz, 2010

37 This section is based on information from two principal sources (1) Association of Mediterranean Regulators for Electricity and Gas (MEDREG). Effects of the Introduction of Successful Mechanisms to Promote Energy Efficiency in non-EU Countries. May 6, 2010. Available at: http://www.iern.net/portal/page/portal/IERN_HOME/ICER_HOME/ABOUT_ICER/Publications/MedReg%20Part%201.pdf and (2) Braz, 2011

38 ERSE is Portugal's energy regulatory agency responsible for regulating the electricity and natural gas sectors.

economic cost effectiveness, environmental benefits, and other goals, all publicly discussed and approved ex ante. Successful proposals must provide a measurement and verification plan designed to verify that expected energy savings are achieved. ERSE estimates that the 2011–2012 PPEC tender will produce potential savings from tangible energy efficiency measures of 155 million euro for a cost of 18 million euro, and energy savings that surpassed projected results.[39]

The competitive tender process has produced bids with values at five times the original budget for these tenders, providing strong competition among proponents of energy efficiency projects.

The Portugal tenders program design features a long-term funding commitment provided by the regulatory authority and the national climate change program. It includes a strong commitment in the market rules to validate actual energy savings, requiring ex post M&V studies to validate the ex ante estimates used to evaluate and award winning proposals.

4.3.2 Wholesale Capacity Markets – Energy Efficiency in the New England Forward Capacity Market [40]

The New England Forward Capacity Market (FCM) has been designed by the New England Independent System Operator (ISO-NE)[41] to ensure that the resources needed to meet peak loads are acquired economically. Participants in the market compete through bids with binding contracts awarded several years in advance of delivery. This lag time allows successful bids to build or acquire the promised new capacity. ISO-NE conducted the first FCM auction in 2008 to obtain capacity commitments to meet forecast 2010 electricity demand. This market was the first and is currently one of only two wholesale capacity markets that enable energy efficiency, as well as other demand resources, to compete on an equal footing with supply resources in an organized market.[42]

The FCM was developed and approved within the context of US government regulation of transmission network systems. The US Federal Energy Regulatory Commission (FERC) reviewed, modified, and eventually approved a plan for the market, developed with input from state regulators, energy providers, ISO-NE, and stakeholder organizations representing environmental and consumer interests. The New England FCM was specifically designed to enable energy efficiency and other demand resources to compete with traditional generation supply resources to meet the region's future electricity capacity requirements.[43]

Wholesale capacity markets are a relatively new approach to meeting electric system demand. Energy efficiency has the potential to contribute to meeting those needs by reducing electricity use for the full operating period of the high-efficiency electricity-using equipment. Because energy efficiency programs take many months to achieve cumulative capacity benefits (i.e., the time required to plan and implement investments in many individual

39 Braz, 2011

40 This section is based on information from three principal sources (1) Jenkins, et al., 2011(2) Gottstein and Schwartz, 2011 (3) ISO-New England. 2010 Annual Markets Report. June 2011. Available at: http://www.iso-ne.com/markets/mkt_anlys_rpts/annl_mkt_rpts/2010/amr10_final_060311.pdf

41 The ISO-NE has responsibility for maintaining and operating the integrated electric system serving the six-state New England region in the northeast United States, i.e., including states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. The ISO-NE electric system serves a population of 14 million, comprising 6.5 million households and businesses.

42 The PJM Independent System Operator/Regional Transmission Operator (ISO/RTO) now operates a forward capacity market, called the Reliability Pricing Model, which invites energy efficiency and demand response to compete. At the beginning of 2012 these two are the only wholesale capacity markets that enable energy efficiency to compete with supply resources in market auctions. The PJM ISO/RTO serves a region of the United States that includes all or parts of several mid-Atlantic and mid-West states, an area with a population of 51 million. A few other wholesale capacity markets exist but do not permit bids from energy efficiency.

43 The market also allows customer-sited demand response and distributed generation (e.g., emergency and other onsite generators) to compete as demand resources.

end-use consumers), efficiency cannot respond to short-term needs, but with sufficient lead time can be mobilized to bid capacity in the longer-term FCMs.

The New England FCM market was the first and is currently one of only two wholesale capacity markets that enable energy efficiency, as well as other demand resources, to compete on an equal footing with supply resources in an organized market.

How the New England Forward Capacity Market Operates

The New England FCM conducts annual capacity auctions to meet demand forecasts for three years in the future. The three-year time horizon is designed to provide sufficient time to construct a gas turbine generator to meet peak loads or to implement demand-reducing energy efficiency programs. Each auction acquires supply and demand resources to meet a share of the region's "installed capacity requirement" for the target year. Only new resources are allowed to compete in the auction. The auction awards contracts to all resources based on the market-clearing price of the auction. Chosen new resources may select a multiyear (up to five years) price commitment. Residual capacity resources within the market also receive the same clearing price.

The FCM auction process includes three important phases:

1. **Qualification Period –** leading up to the auction; determines what resource projects may be submitted into the auction

2. **Planning and Construction Period –** between the auction and the commitment period; provides project sponsors time to construct new supply and demand-side resources to meet capacity obligations as determined by the auction

3. **Commitment Period –** a period beginning three years after the auction during which winning projects are obligated to deliver capacity: one year for existing capacity and one to five years for new capacity

Resources that obtain contracts are penalized if they fail to provide the committed supply capacity or demand reductions.[44] To receive capacity payments, resources must be able to demonstrate measured and verified performance during peak hours.

Any resource that exists at the time of an auction may provide a one-year commitment for capacity that will be paid the current-year market-clearing price. New auction-selected resources may elect delivery periods of one to five years. For that one- to five-year *commitment period* new resources receive the guaranteed auction-based price, locking in a price that is unaffected by the market-clearing price in subsequent auctions. After the initial commitment period, resources are treated as existing resources and are offered the opportunity to commit capacity annually for the life of the resource. [45, 46]

For demand resources, the *qualification process* is a key step, designed to verify the ability of the prospective projects to reduce electricity consumption. Here the demand resource is defined, the plan for capacity acquisition is documented, the source of funding for the project is identified, and a measurement and verification plan supporting demand resource performance is presented.

The approximate 2.5-year *planning and construction period* between the announcement of auction awards and the delivery of capacity to meet peak loads provides energy efficiency bid sponsors time to ramp up the capacity reductions associated with an increasing number of installed energy efficiency measures. Once selected, energy efficiency and demand response resources may continue to receive capacity payments as long as they perform.

During this planning and construction period, ISO-NE requires project sponsors to provide financial assurance that will be returned once the demand resource project is in service and has been tested or verified for its full capacity

44 For energy efficiency and other demand resources, the effect is simply to eliminate payment for any shortfall in the committed demand reduction.

45 In contrast, the PJM wholesale capacity market, called the Reliability Pricing Model, limits payments for energy efficiency to 4 years, after which these projects do not receive additional compensation for their capacity contributions.

46 Energy efficiency resource sponsors must demonstrate that the resource continues to deliver the committed capacity using M&V practice guidelines prescribed by the New England FCM.

commitment. Projects failing to meet the full capacity commitment will forfeit a portion of the financial assurance associated with any permanent capacity shortfall.

Challenges and Opportunities for Energy Efficiency

The New England FCM has broken new ground by establishing a wholesale capacity market that enables investments in energy efficiency to compete directly with supply resources. Because this market is designed to achieve electric system reliability objectives, the market rules require that energy efficiency providers navigate risks associated with the performance of energy efficiency investments far into the future and risks associated with the uncertain conditions in future capacity auction markets. Such risks and uncertainty differ significantly from the traditional business of developing and designing cost-effective energy efficiency programs to meet annual energy savings goals.

Vermont Energy Investment Corporation (VEIC) is the program administrator for Efficiency Vermont, the energy efficiency program funded by Vermont's energy efficiency surcharge, and has successfully bid energy efficiency commitments in all of the FCM auctions to date.[47] VEIC observes:

> *. . . we have to be able to predict what efficiency measures we will install over the next three years and then forecast expected capacity savings from those measures for up to eight years in the future—three years until the delivery period begins, and, if we decide to lock in that auction price for the future, up to an additional five years. This latter decision is based on expectations about the future capacity needs of the region and the behavior of other participants over that time frame … risks that are fundamentally different than those faced in the design and delivery of efficiency programs in the past.*

The FCM imposes new responsibilities on energy efficiency providers that change the way they plan, implement, and evaluate their programs.

The FCM imposes new responsibilities on energy efficiency providers that change the way they plan, implement, and evaluate their programs, but in return the FCM market offers compensation for the contribution energy efficiency investments make to meeting future capacity needs. Revenues from New England's FCM, despite the current period of level demand when the market-clearing prices remain low,[48] could provide as much as 10 percent of the budgets of energy efficiency program portfolios. Should future demand for capacity exceed current supply, auction-clearing prices would be expected to rise, giving the potential for even higher revenues from this market.

The proportion of capacity resources provided by energy efficiency grew steadily during each of the first five New England FCM auctions, i.e., contracts for energy efficiency projects amounting to

- 655 MW of 32,305 MW were awarded for 2010 (2.0%)
- 890 MW of 32,538 MW were awarded for 2011 (2.7%)
- 975 MW of 31,965 MW were awarded for 2012 (3.1%)
- 1,167 MW of 32,127 MW were awarded for 2013 (3.6%)
- 1,354 MW of 33,200 MW were awarded for 2014 (4.1%)

Demand-side projects are undertaken because they are more cost effective than generation options. As a result, bids from energy efficiency and other demand resources can be assumed to have reduced the capacity payment costs for ISO-NE significantly by reducing the market-clearing price settled in each annual auction. One estimate suggests that bids by demand resources in the first auction reduced the market-clearing price by at least USD $750 per MW-month, a savings in capacity payments amounting to USD $24 million per month.[49]

47 See Section 8.3 for more information about Efficiency Vermont.

48 In all of the FCM auctions conducted so far, the market cleared at the minimum floor price established for each auction. In the first four auctions, the market resulted in commitment offers exceeding the capacity needed to meet the region's resource adequacy requirements, the installed capacity requirement, by 24 to 31 percent. *ISO-NE 2010 Markets Report.*

49 Jenkins, et al,, 2011

5. Requiring Disclosure of Demand-Side Resource Opportunities in System Resource Plans

Inviting energy efficiency and demand response investments to meet system resource needs

5.1 What is the Disclosure of Demand-Side Resource Opportunities Regulatory Mechanism?

This regulatory mechanism requires energy providers or others in the electric or natural gas supply chain who prepare resource plans (1) to publically communicate the opportunities identified in those plans for energy efficiency and demand response and other nontraditional supply resources to meet system requirements, and (2) to invite proposals to address those requirements. The public disclosure of resource requirements and energy efficiency and demand response investment opportunities alerts the public to develop specific proposals to address these requirements. Disclosure can be implemented alone or with an IRP analysis mandate.

The public disclosure of resource requirements and energy efficiency and demand response investment opportunities alerts the public to develop specific proposals to address these requirements.

Disclosure should identify very specific energy supply requirements or specific transmission or distribution capacity requirements that energy efficiency investments may address. Disclosure must be far enough in advance and reveal sufficient detail about the need to enable potential energy efficiency or demand response providers (as well as distributed generation providers and the like) to offer specific proposals to address those needs.[50] The disclosure of capacity needs, for example, should address for each specified requirement:

- the underlying assumptions about the supply/demand imbalances that need to be addressed;
- the specific size, timing, and geographic locations of required load reductions; and
- the tender process and evaluation criteria that will be used.

5.2 Key Issues in Design and Implementation

5.2.1 Application in Regulated and Competitive Markets

The practice has been developed specifically to strengthen the performance of market acquisition practices that have been implemented with the unbundling of integrated energy companies into separate energy generation, transmission and distribution system operations, and competitive retail market delivery of energy to end-users. However, requiring public disclosure of imbalances in the energy delivery system has been applied in both liberalized (e.g., New South Wales) and regulated (e.g., Vermont) markets.

Affirmative disclosure requirements recognize that the use of demand-side resources to meet system needs is a departure from the prevalent past practice of identifying capacity requirements and responding with capacity increasing investments. The early and detailed public disclosure of system capacity/demand imbalances is essential in both types of markets to give those resources the ability to compete with system capacity investments.

5.2.2 Key Design Issues

The overarching goal of the disclosure process is to

50 In this section, the term "demand-side resource" should be understood to include investments in customer-sited electricity generation and other distributed supply-side resource options.

ensure that demand-side resource projects will be identified and implemented when they offer the least-cost means to address energy system supply needs.

The disclosure process should be administered by the entity responsible for meeting the disclosed need. The entity will receive and evaluate competing demand-side resource proposals against a default system investment. Entities may include an individual energy provider responsible for maintaining the energy system or a market operator responsible for acquiring energy supply and/or network capacity.

The overarching goal of the disclosure process is to ensure that demand-side resource projects will be identified and implemented when they offer the least-cost means to address energy system supply needs.

To be effective, disclosure mandates must require that energy system needs be identified in sufficient detail and with enough lead time that demand-side resource developers can design and implement selected proposals. For example, the disclosure report should reveal the cost of the default system capacity investment, the timing of the need that demand-side resources must meet, and the energy network locations that must be served.

The disclosure process must also include a transparent project evaluation criteria and selection process so developers can evaluate the ability of a given project to meet a specific need and to assess the business risk of incurring the cost of offering a proposal. The evaluation criteria should be disclosed in detail and must specifically recognize and prescribe methods for valuing the contribution demand-side resources make to displacing or deferring investments in energy supply system capacity. If proposals will compete on non-price attributes, they must be objectively defined and the available compensation clearly stated.

Requiring disclosure of system requirements is a first step to capturing the full potential of energy efficiency to meet system needs, but disclosure alone often is not sufficient. Section 4 of this report addresses further steps to ensure that resource acquisition markets will select energy efficiency when it is the least-cost option for meeting system needs. Section 2 addresses steps to ensure that IRP analysis identifies energy efficiency opportunities.

The information required by this mechanism is typically published either by an individual electricity provider or by a market operator as a regular public report on the adequacy of the existing generation and network capacity to maintain an acceptable level of supply reliability. This public report is often referred to as a "Statement of Opportunities" or a "Regional System Plan." For example, in Australia, the *2011 Electricity Statement of Opportunities*,[51] published by the Australian Energy Market Operator, provides a broad analysis of opportunities for generation and demand-side investment in the Australian National Electricity Market (NEM). In the United States, the *2011 Regional System Plan,*[52] published by the independent system operator ISO-New England, outlines the region's electricity needs for the next 10 years and explores the generation, demand-side, and transmission improvements that can meet those needs.

The following levels of information are typically included in such public reports:

- A low level of detail across the whole system to provide an indication of where additional capacity is, and is not, likely to be required in the foreseeable future;
- A medium level of detail for parts of the system where additional capacity is forecast to be required within a defined period (e.g., five years) to allow customers and third parties to consider whether they may be able to assist in addressing any capacity shortfalls; and
- When action is being taken or considered to acquire additional capacity, a higher level of detail on the nature, size, timing, and geographic location of the forecast capacity shortfall, including illustrative system support options developed by the electricity provider.

The reports may also include:

- information about consultation with customers and other interested parties in relation to specific forecast

51 Australian Energy Market Operator (2011). *2011 Electricity Statement of Opportunities for the National Electricity Market.* Melbourne, AEMO.

52 ISO New England (2011). *2011 Regional System Plan.* Holyoke, MA, ISO-NE.

capacity shortfalls; and
- details of the resource procurement process to be implemented by the electricity provider.

5.3 Application: Disclosing Demand-Side Resource Opportunities in New South Wales[53]

Expansion and augmentation of electricity networks is an area in which information disclosure can be effective in encouraging increased use of cost-effective demand-side resources. Many jurisdictions with unbundled electricity providers are now requiring mandatory disclosure about forecast network constraints.

This case study briefly describes the mandatory Code of Practice[54] (the Code) of the state of New South Wales in Australia. The Code requires electricity distributors to publish information about network constraints in their systems and evaluate alternative options for addressing these constraints.

The current third edition of the Code has been formally issued in accordance with Clause 6 of the Electricity Supply (Safety and Network Management) Regulation 2002. This requires electricity distributors in New South Wales to take the Code into account in the development and implementation of their network management plans. In particular, the network management plan must specify where it, or its implementation, departs from the provisions of the Code and, if so, what arrangements are in place to ensure an equal or better outcome.

The Code requires electricity distributors in New South Wales to:

- publish information that makes the underlying assumptions and decision-making process relating to investments that expand their distribution networks transparent;
- publish detailed information regarding the need for network expansion in a way that enables interested parties to identify likely locations of forthcoming network constraints;
- use a formal process to determine whether demand-side resource investigations are warranted for identified emerging network constraints and publish the results;
- carry out demand-side resource investigations that provide opportunities for market participation;
- analyze demand-side resource and network expansion options on an equal basis according to the published methodology and assumptions and publish the result of those determinations;
- implement demand-side resource options where they are determined to be cost effective; and
- prepare and publish reports on these activities annually.

The Code's objectives are transparency in information provision and equal treatment in processes and evaluation in "circumstances in which it would be reasonable to expect that it would be cost effective to avoid or postpone the expansion of the network by the implementation of [demand-side resource] strategies."

The Code recognizes that the focus should not just be on the network, but rather on the delivery of end-user energy services by means of the electricity system as a whole. Constraints that arise within the distribution network can be addressed by changes in customer behavior, by changes in equipment used by customers or by installation of small-scale generation at a local level, as well as by enhancement of the distribution network.

These options could be devised and implemented by customers or by electricity distributors. The market-based procedure in the Code is intended to ensure that all supply- and demand-side options developed by customers or third parties and by the distributor itself can be developed and evaluated at the same time and in the same manner as network augmentation.

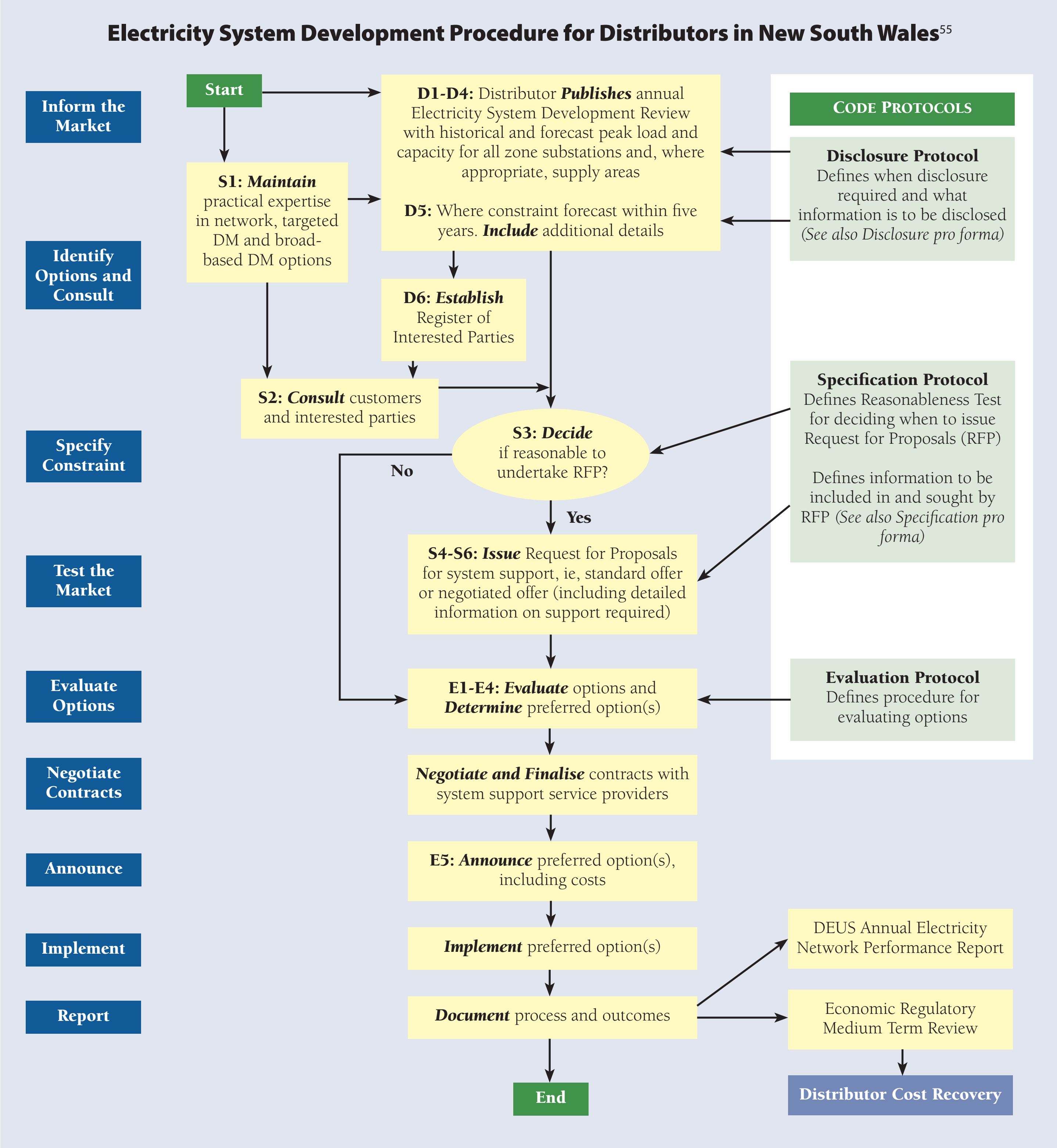
The procedure described in the Code is illustrated in Figure 1 below. The procedure requires:

- a process for informing the market by disclosing appropriate information about the current and future state of the electricity supply system – the Disclosure

53 The New South Wales application example is taken from Crossley, 2012

54 Department of Energy, Utilities and Sustainability (2004). Demand Management for Electricity Distributors. NSW Code of Practice: Sydney, DEUS.

Figure 1



55 Source: Department of Energy, Utilities and Sustainability (2004). *Op. cit.*

Protocol;

- a process for fully and consistently specifying the constraint in the electricity supply system – the Specification Protocol; and
- a process for fairly and consistently evaluating proposals to overcome this constraint – the Evaluation Protocol.

The Disclosure Protocol ensures that distributors provide regular public reports on the status of their networks that include all necessary information in a clear and consistent form, without wasting effort in providing unnecessary information.

The Specification Protocol ensures that system constraints are fully and accurately specified. The protocol requires distributors to consult with customers and interested parties in relation to each of the constraints and options to address them. The Protocol also describes the process through which alternative options for addressing constraints can be invited and proposed in a manner that allows direct comparison with each other and with options developed by the distributor. The Specification Protocol defines a Reasonableness Test, which the distributor should apply in deciding whether to issue a formal Request for Proposals in relation to each constraint.

The Evaluation Protocol ensures that disparate network enhancement and other system support options are given fair consideration and are equitably evaluated including all relevant costs and benefits. The Protocol requires that all conforming options should be evaluated and ranked on the basis of total annualized cost of providing the system support adjusted to account for the relative risk profile of options. The Protocol also requires distributors to publicly announce the recommended options resulting from the evaluation and the annualized cost to the distributor of the recommended options.

6. Energy Provider Performance Incentives

Providing energy providers with incentive rewards for achieving energy efficiency goals

6.1 What is the Performance Incentive Regulatory Mechanism?

Government may choose to offer incentive rewards to energy providers for achieving energy efficiency goals. While enforcement action associated with the previously described energy efficiency obligations may be considered a performance incentive[56], here the focus is on providing financial rewards for achieving or exceeding measures of success.

Governments should ensure that the implicit and explicit financial incentives posed by regulation encourage energy providers to provide consumers with energy at least cost, that is, the energy provider's least-cost plan should be the most profitable plan of action for the provider.[57] Section 9.2 of this report addresses steps to remove the financial impact of reduced sales that are the result of successful energy efficiency investments. Energy provider performance incentives can play an important role in aligning incentives with required energy savings.

The primary reasons for offering such incentives are to ensure that:

- energy providers embrace a strong commitment to programs that achieve energy efficiency goals; and,
- regulated energy providers obtain similar financial rewards for investments in energy efficiency as for investments in energy supply resources.

Performance incentives do influence energy provider behavior; energy providers usually meet or exceed performance targets and spend more on energy efficiency when performance incentives reward achievement.

Regulators may offer financial incentives to energy providers to encourage them to design and implement energy efficiency programs that achieve high levels of performance. The long history of efforts to capture the economic potential offered by energy efficiency investments has confronted persistent barriers that effective programs must overcome. Success requires a strong energy provider commitment to innovative program design and effective program management. Experience in the United States reveals that performance incentives do influence energy provider behavior; energy providers usually meet or exceed performance targets and spend more on energy efficiency when performance incentives reward achievement.[58]

Where energy providers are subject to government price regulation, regulators may offer financial incentives simply to ensure that the financial returns regulated energy providers obtain from investments in demand-side resources equal the returns provided by supply-side resources. Investments in system capacity usually are capital expenditures for which price regulation offers a financial return. Demand-side program expenditures normally are treated as operating expenses for which price regulation offers cost recovery without a return. Regulators may offer incentives tied to demand-side program cost or to program performance to balance the financial returns on

56 Some argue that if energy providers are obligated to pursue energy efficiency by policy or regulation they should not receive rewards for meeting those obligations; i.e., the only energy provider incentive should be penalties for failing to meet obligations.

57 Expressed in the context of achieving the outcomes recommended by IRP, financial incentives should align with IRP goals.

58 Hayes, et al., 2011

expenditures for demand-side programs with returns on expenditures for supply-side resources.

6.2 Key Issues in Design and Implementation

A financial incentive typically diverts some of the consumer benefits of energy efficiency savings to provide energy providers with a financial reward for their contributions to energy efficiency program success. The incentives typically reward energy providers with extra payments, beyond the compensation for the energy efficiency investment itself, for achieving more savings or savings at lower cost than planned (i.e., surpassing some milestone criteria for energy efficiency program success). The design of any performance incentive must address a balance between what is needed to mobilize energy providers to achieve energy efficiency goals and allowing consumers to retain their fair share of the economic benefits such investments produce. The key issue is whether the incentives create sufficient extra benefits for consumers through the increased energy savings or reduced costs of implementation to justify the cost paid by consumers.

The design of any performance incentive must address a balance between what is needed to mobilize energy providers to achieve energy efficiency goals and allowing consumers to retain their fair share of the economic benefits such investments produce

Three major types of incentives commonly employed include:

1. Awarding financial incentives for achieving or exceeding specified energy efficiency goals;
2. Allowing energy providers to keep a share of the financial savings from avoided costs as a result of energy efficiency investments; and,
3. Offering regulated energy providers a financial return on expenditures for energy efficiency programs comparable to the return on supply-side investments.

In addition to such direct incentives, government may pay for activities that lower energy efficiency program costs for energy providers or reduce market barriers to energy efficiency. Government may perform these functions directly or reimburse energy providers who perform them.

Performance incentives require regulatory oversight, including reviews of the supporting M&V data to determine what incentives will be awarded. More regulatory oversight is necessary to administer the incentives effectively because they are increasingly complex. However, this increased oversight also enables the administrator to address more regulatory policy issues. When energy providers use market tenders to obtain energy savings from competing bidders, energy providers may not be directly involved in the programs that deliver the savings. As a result, incentives for energy suppliers may have little impact on program performance, raising questions about the merit of providing incentives at all.

6.2.1 Financial Incentives for Achieving or Exceeding Energy Efficiency Goals

Government may encourage energy providers to accelerate the progress toward long-term energy efficiency goals by offering financial incentives for exceeding specific performance targets. For example, incentives may be awarded for exceeding targets for energy (kWh) or demand (kW) savings, or for acquiring such savings for lower than projected cost. Incentives are often structured in performance ranges, sometimes with penalties for failing to achieve minimum performance, no incentive for performance below a minimum target, and total further incentives above some level.

This type of financial incentive is often paid from the funds obtained from consumers for program delivery; as such, they increase the cost of savings or decrease the operating budget for savings. Incentives also may include penalties for failure to meet minimum performance targets, in which case the penalties may amount to reductions in the compensation energy providers receive for the delivered energy efficiency.[59] Regulators may earmark penalty payments to fund energy efficiency programs, committing resources to addressing in some way the poor energy efficiency program performance that triggered the penalty.

Incentives for achieving or exceeding targets may be

59 For the penalties to be effective, regulation must prevent regulated energy providers from recovering these losses in subsequent tariff regulation proceedings.

applied to regulated energy utility providers, to energy providers operating in competitive retail markets, and to third-party independent service providers. There is little to be gained by offering performance incentives where energy savings are obtained through competitive market tenders.

6.2.2 Sharing Savings between Consumers and Energy Providers

Shared savings mechanisms give utilities a share of the net benefits from demand-side resource investments (called resource savings in California). Net benefits are commonly defined for this purpose as the avoided-cost benefits produced by the demand-side management program minus the costs of installing the measures.[60] By tying the incentive to the net benefits from energy efficiency and demand response programs, the energy provider is encouraged to maximize benefits and to minimize the cost of getting the benefits.

Shared savings incentives may be structured with different incentive sharing rates for different performance ranges. Shared savings incentives sometimes include penalties for failure to achieve minimum performance and often are capped. The remaining net benefits flow to consumers as lower energy costs. Because net benefits are tied to the utility's avoided costs, the potential upside to a utility from use of a shared savings mechanism will be greater in jurisdictions with higher avoided costs.

In sum, establishing a shared savings incentive mechanism will require decisions about:

- the share of net benefits the energy provider will keep;
- whether the total incentive will be capped;
- whether penalties will be imposed for failing to achieve minimum performance milestones;
- how avoided costs will be determined for calculating net benefits;[61]
- how performance will be measured for awarding incentives; and,
- how rewards will be related to varying levels of performance.

Shared savings incentives may be used in markets served by regulated utility energy providers. In competitive retail markets, such incentives may be used if responsibility for energy efficiency programs is assigned to the monopoly network provider, an entity subject to price regulation. Shared savings incentives do not work well for energy providers operating in competitive retail markets, because information on program costs may be confidential, so government has little ability to estimate net savings benefits produced by energy providers and little ability to allocate shares between consumers and the energy provider.

6.2.3 Rate of Return and Possible Premium for Investments in Energy Efficiency

Regulators may offer energy providers a financial return on expenditures for energy efficiency programs instead of the usual treatment of those costs as expenditures, which are recovered but without a return. This financial return may be accomplished by treating energy efficiency costs as a capital asset that may receive financial returns. The idea is simple in concept: offer expenditures on energy efficiency that defer capacity the same financial returns provided expenditures for facilities that increase system capacity. This can be extended to promote investments in energy efficiency by providing a higher financial reward for energy efficiency expenditures than is provided by supply-side investments.

To ensure that the financial return rewards productive expenditures, regulators should require energy providers to demonstrate that the resulting programs have achieved performance targets.

Treating energy efficiency costs as a capital asset may pose financial management problems because this asset, although it produces revenues for the provider, is not backed by physical capital. This can be a problem for retail energy providers that lack a large base of capital assets because accounting standards or bond rating agencies sometimes treat such "assets" as contingent. The amortization period for the investment may be tailored to

60 Avoided costs are the costs that an energy provider would otherwise incur to provide the energy that is not consumed as a result of an energy efficiency program. These costs may be determined following calculation methods spelled out by regulators or they may be valued using wholesale market costs to represent avoided costs. Such avoided costs are also a major factor in any assessment of energy efficiency cost-effectiveness.

61 Id.

mitigate this concern by being amortized over a few years, or matched to the life of the savings (typically more than a few years) or some other length of time that is agreed upon.

In 2004 the Nevada regulatory commission in the United States introduced a policy that encouraged increased investments in demand-side resources, which allowed regulated energy providers to earn their approved rate of return plus 5% on the capitalized portion of their demand-side resource investments. This policy ended in 2010 when the regulatory commission introduced a net lost revenue adjustment.[62] (Net lost revenue adjustments are addressed in Section 9.2.) Few other jurisdictions have offered this type of incentive mechanism.

6.2.4 Funding for Planning, Consumer Education, and Market Development Activities

Government may support a wide range of planning, market development, technology testing and development, labor force development, and consumer education activities that improve the performance of energy efficiency programs overall or reduce their costs but do not address any specific efficiency investment opportunity.

For example, government may:

- provide training for the businesses that will install efficiency measures, design and build high-efficiency structures, and sell high-efficiency equipment/appliances;
- provide technical training for a pool of skilled workers and qualified businesses required to install energy efficiency measures;
- conduct energy efficiency baseline and potential studies that energy providers may use to design effective implementation programs;
- conduct studies of the cost and performance characteristics of energy efficiency measures that energy providers may use to design implementation programs and M&V programs; and,
- conduct public education campaigns that encourage consumers to invest in energy efficiency.

Such activities reduce the planning, implementation, and evaluation costs of energy efficiency programs and may significantly improve program performance. Regulators may be able to enlist government agencies, academia, and other public purpose organizations to conduct these activities.

Where energy providers are offered performance incentives for reducing costs and increasing savings, regulators may encourage energy providers to support these activities directly by removing the associated costs from any calculation of net savings benefits upon which performance incentives are calculated, removing a disincentive for doing this important work. Although these activities contribute to overall program effectiveness, they are difficult to associate with specific energy efficiency investments. Accordingly, although the costs may be removed from shared savings incentive determinations, these costs should be counted in the evaluation of overall program cost effectiveness.

6.3 Application: California's Shared Savings Performance-Based Incentives

California – A Shared Savings Performance-Based Incentive for Energy Provider Energy Efficiency

In 2007 the California utility regulator, CPUC, authorized financial incentives for electric and gas utilities that promise utilities a share of the net resource benefits produced by their energy efficiency programs. The incentive mechanism establishes electricity kWh and kW savings goals and gas therm savings targets for each utility. Those targets are applicable for three years and are then revisited and adjusted for another three-year interval. The calculation of achieved savings and the resulting resource benefits that define progress toward targets and determine the incentive award are verified using CPUC-approved measurement and verification procedures.

The CPUC observed that the incentive levels were decided using Commission judgment, "…not a precise science."[63]

Incentives are awarded in two steps: nine percent of net benefits for achieving 85 to 100 percent of the assigned goal, and 12 percent of net resource benefits associated with any savings that exceed the assigned goal.

There is a penalty if the utility achieves less than 65 percent of the assigned goal or if the savings fail to meet cost-effectiveness criteria. The penalty levels are set at USD

63 CPUC, 2007

$0.05/kWh, USD $25.00/kW, and USD $0.45/therm, for each unit below the assigned goal.

The total incentive payments and total penalties are each subject to a statewide cap, USD $150 million for each year in the three-year incentive cycle, USD $450 million total, which represents less than 1 percent of total consumer bills. California utility energy efficiency program budgets for this period equaled USD $1.9 billion.

In the first incentive cycle, 2006 through 2008, the CPUC awarded utilities a total of USD $147 million. The American Council for an Energy-Efficient Economy reports, "[a]lthough 30% of each interim reward payment is withheld to cover potential errors in estimated earnings calculations and independent measurement and evaluation studies managed by CPUC staff are used to verify savings, there has been significant debate surrounding program results." The controversy over the large difference between ex ante and ex post estimates of program savings has created delays in deciding final incentive awards. Despite the controversy, utilities proposed significant increases in energy efficiency budgets for the 2009 through 2011 incentive cycle.[64]

64 Hayes, et. al., 2011

7. Energy Tariff Design

Aligning consumer price incentives with energy efficiency and demand response goals

7.1 What Is the Energy Tariff Design Regulatory Mechanism?

Energy tariff design, or "rate design," has long been an important part of the work of regulators responsible for setting the prices energy providers charge consumers in retail monopoly markets. Rate design includes deciding how energy provider costs will be recovered from consumers. In general, economically efficient tariff design should provide energy consumers with price signals that are aligned with long-run energy provider costs and accordingly lead consumers to make economic purchases of energy. Here the focus is on aligning the design of retail energy prices with energy efficiency and demand response goals. Tariff design is a valuable policy tool in price- or revenue-regulated markets.

Economically efficient tariff design should provide energy consumers with price signals that are aligned with long-run energy provider costs and accordingly lead consumers to make economic purchases of energy.

A rate or tariff is the standard pricing formula that energy providers offer customers and it is usually subject to approval by regulators. Variations are numerous, but rates for residential customers usually have two parts: a fixed periodic charge, and a charge for each unit of energy consumed, that is, a per-kWh charge for electricity or a per-therm charge for gas. The prices charged to large nonresidential consumers may also include a third price component, a demand charge that relates to their maximum usage, that is, the consumer's peak energy demand.

Two types of rate designs can align price incentives with demand-side resource acquisition objectives:

1. Time-varying pricing, also known as time-of-use tariffs or rates, specify different energy prices at different times of the day, week, or year, aligning the prices with variations in the actual cost of energy; and,
2. Inclining tiered block rates (or rising block tariffs) increase the per-unit price of energy for high volumes of electricity and gas consumption.

Rate designs should be aligned with the long-range cost of providing energy supply, including the important cost of adding new capacity to meet growing energy demand. Time-varying prices and inclining block rates are designed to do this.

Time-varying prices offer consumers price incentives to use less energy when the cost of service is high. Inclining block rates serve energy efficiency objectives by offering consumers price incentives to consume less by increasing the unit price as the volume of consumer energy use increases.

It is important to note that the implementation of rate design policies for energy efficiency may need to be accompanied by decoupling to remove the financial penalties energy providers face when their revenues are linked to sales. Decoupling mechanisms that remove the financial penalties resulting from reductions in sales are addressed in Section 9.2.

The ability to affect rate design in unregulated retail markets is a limited but emerging issue.[65] Government may encourage competitive retail providers to implement rate designs that serve energy efficiency objectives or seek

65 For example, in the United Kingdom, the regulator is in discussions with the six major energy retailers to reduce the complexity of their tariff offerings, which make comparisons extremely difficult for consumers.

to apply these principles to transmission and distribution prices.

7.1.1 Time-Varying Pricing

Time-varying pricing signals consumers when the cost of delivering energy rises or falls, offering consumers the opportunity to reduce use during high supply cost periods. Consumers may choose to avoid high prices by curtailing use, by shifting use to lower cost periods, or by making investments in energy efficiency to achieve long-term savings. Time-varying pricing promotes economically efficient purchases, allowing consumers to decide whether they would prefer to pay high prices during high supply cost periods or to reduce consumption.

For residential customers, time-varying pricing may include year-round, fixed period time-of-use rates, or dynamic real-time pricing in which prices vary with system operating costs, for example, on an hour-to-hour basis. Dynamic real-time pricing has been limited to very large commercial and industrial consumers in the past because of the cost of specialized metering. Grid technology improvements and declining costs for smart meter technology[66] are making time-varying pricing economic for many more consumers. The deployment of smart grid systems that integrate distribution system communication with most customer meters extends the reach of time-varying pricing to a large proportion of the total energy system load and to a large proportion of consumers, including many residential energy users.

Reducing peak demands on the entire system or in capacity constrained network locations is the primary benefit provided by consumer responses to time-varying pricing. Evidence to date as to whether time-varying pricing produces long-term energy savings is mixed.[67]

Time-varying pricing promotes economically efficient purchases.

7.1.2 Prices for Increasing Volumes of Energy Use – Tiered Block Pricing

Per-unit energy charges may be tiered into usage blocks, for example, so much per kWh or therm for the first X units and a different price for units beyond that amount. If the higher usage blocks are at a higher unit price, the tiered block pricing is called an inclining block rate. Inclining block rates encourage consumers to reduce energy consumption by charging more as the level of use increases and pushes past price block thresholds. Inclining block rates usually are mandatory, not optional; that is, they are imposed on all consumers in the tariff group.[68]

For residential electricity consumers, inclining block pricing may also align prices with the traditional cost factors considered in rate design. For those customers the end-uses of electricity that cause higher usage levels, largely space conditioning, typically coincide with peak demand periods when costs are highest. Basic residential usage (lighting and refrigeration) does not correlate strongly with common summer peak demand periods and operates with a better load factor, thereby imposing lower unit costs on the electricity delivery system. This is consistent with a lower priced initial block in such a tariff.[69]

Because commercial and industrial consumers use electricity in widely varying quantities and patterns, it may be more complex to design optimal block sizes and to align prices with costs, and inclining block rates are most common in residential tariffs. This may make inclining block pricing more difficult to implement effectively for commercial and industrial energy consumers than for residential consumers.[70]

One econometric modeling study estimates energy consumption savings could amount to about six percent in the first few years and much more in the longer term. The energy savings achieved by inclining block rates will depend on how consumers respond to increasing price levels and how sharply the price rises with increasing use.[71]

66 Smart meter technology refers to the metering and communication equipment and operating systems that, among other features, record energy use by time-of-use (i.e., interval meters) and the communication systems that enable energy providers to communicate the changing prices to consumers. This smart meter technology may also extend to automated controls that enable consumers to program equipment use to respond to changing prices.

67 Charles River Associates, 2005; Jessoe and Rapson, 2011; Tiedemann and Sulyma

68 Pollock and Shumilkina, 2010

69 Lazar, et al., 2011

70 Pollock and Shumilkina. 2010

71 Faruqui, 2009

7.2 Key Issues in Design and Implementation

7.2.1 Application in Regulated and Competitive Markets

Direct regulatory mandates for rate design are more easily implemented in regulated markets. Price regulation commonly involves two key rate regulation steps, establishing a revenue requirement upon which rates will be based and rate design. Rate design performs two functions. One is allocating the revenue requirement among the different customer classes. The other is deciding what rates should be charged for energy in different quantities and at different times. These are all an established part of energy provider price regulation.

Energy providers subject to price control may be required to impose time-varying energy pricing on specific types of customers. Government may support such requirements by allowing providers to recover metering and administration costs associated with deploying time-varying prices.

Regulatory policy will also address how the unit price of energy will vary with increasing levels of consumption by individual consumers. These policies address how fixed costs (e.g., account administration, costs of connecting the customer to the energy system), network delivery costs, and energy costs will be recovered from consumers, in fixed charges and prices for increasing levels of consumption (i.e., tiered block prices).

When energy supply is provided to retail consumers in liberalized unregulated markets, it becomes the business of energy providers, not government regulators, to price energy. In most circumstances, government can influence pricing directly only by regulating the prices that transmission and distribution system operators charge energy retailers for their monopoly services. Government influence on retail pricing design is more limited, but they may have the ability to require pricing be in certain formats that favor demand-side resources, similar to rules that prescribe the weights and measures by which certain goods, such as groceries, are sold and priced. Government policy can also encourage energy providers to provide time-varying prices by subsidizing the cost of or mandating the use of interval meters that enable such pricing.

7.2.2 Key Design Issues – Time-Varying Pricing

Clear guidance on how rate design should address important implementation issues is essential. Guidelines should address:

- how different forms of time-varying pricing should be applied to different classes of consumers, defined by service class and level of electricity use;
- how capacity costs should be assigned to peak period prices to ensure that costs are accurately reflected in the time-varying prices;
- whether the metering and administration costs associated with time-varying pricing will be subsidized, and if so, from public funds or by nonparticipating customers;
- whether or in what ways participation in time-varying rates will be optional or mandatory for each class of customer; and
- what steps may be taken to encourage the development and deployment of automation technology to enable consumers to automatically respond to changes in price according to the time of day.

Time-varying pricing focuses primarily on load response and changing load patterns.

Time-varying pricing focuses primarily on load response and changing load patterns. Reductions in energy use may occur but such reductions have been relatively modest. Consumer response to time-varying prices depends on the important rate design details, especially the price differential between peak and off-peak periods.[72] When peak prices do not fully reflect the capacity costs imposed by peak loads, such pricing will understate price differentials and diminish the incentive for consumers to reduce peak period energy use.

7.2.3 Key Design Issues – Tiered Block Pricing

When tariffs include all fixed costs in a fixed charge, or in a fixed charge and the initial volume block, the result is reduced unit prices as total energy use increases, in effect a declining block price structure. Inclining block

72 Pollock and Shumilkina, 2010; Jessoe and Rapson, 2011

tariffs may be achieved by a tariff with a small fixed customer charge, covering only billing and metering costs, with the remaining fixed costs (e.g., the capital costs of generation, transmission and distribution) included in the variable energy charges, which are, themselves, structured to increase with increasing levels of consumption.

Clear guidance on tariff design is essential and guidelines should address:

- whether or how fixed charges are billed separately or incorporated in the per-kWh price of electricity in the first block, the block that sets the price for the lowest levels of consumption;
- how many price blocks will be used to cover different levels of consumer energy use;
- how to determine the cut-offs for the first price block and any subsequent blocks; and,
- how the prices in each price block relate to long run marginal avoided costs of energy supply, including consideration of external costs.

Regulators will want to assess carefully how the block price structure will impact the bills of low-income households and whether additional policy or program initiatives may be required to address the needs of low-income consumers with limited options to current high electricity use.

As with a number of the mechanisms discussed in this report, regulators will want to consider how any revenue erosion resulting from consumer reductions in energy use impact the revenues of energy providers. Section 9.2 addresses methods for doing so.

Regulators will want to assess carefully how the block price structure will impact the bills of low-income households

7.3 Application: New York Mandates Real-Time Pricing

In the United States, the New York State regulator, the Public Service Commission (NY PSC), has long had a strong interest in capturing the benefits of time-varying pricing. The NY PSC observed,

> *"Real-time pricing programs can provide significant value to utilities and their customers. The programs can assist customers in reducing peak load demands and in shifting load to off-peak, less expensive time periods. Real-time pricing also provides clear price signals to customers and its integration with the customers' hourly load profiles can influence the manner in which they use electricity. Thus, hourly, load integrated pricing programs allow customers to reduce their electric bills by changing their load profiles in response to price signals."*[73]

In 2001 the PSC approved one mandatory real-time pricing (RTP) program and several voluntary ones for large industrial and commercial customers. It observed that few customers were choosing the voluntary program and opened an investigation on steps to remedy the poor participation, particularly on issues that included the impact of the proposed RTP on consumer bills, energy use, and mandatory participation.[74]

In October 2003 the regulator decided not to impose mandatory programs but directed the energy providers to work on improving and promoting their voluntary RTP programs. The regulator directed energy providers to reach out to their largest customers, customers who could benefit most from RTP and many of whom already had the required interval meter equipment.[75] Two years later, the regulator observed slow progress with increasing participation, that mandatory RTP implemented by two energy providers had encountered few objections and that rising natural gas prices added some urgency to the need to reduce peak demands on the New York electric system.[76]

The PSC then directed the electric utilities to mandate RTP for more customers "…to realize the benefits of reducing the electric system's peak period demand and shifting load to off-peak, less expensive time periods." It directed the utilities to deploy interval meters for customers served by competitive energy retailers. The PSC observed that the mandate for RTP would enable participating customers to reduce bills by shifting loads to off-peak periods and would benefit all customers by reducing the electric system peak loads. The NY PSC order included M&V to address problems and improve programs. RTP was applied to about half the large commercial and industrial customers. Regulatory staff observed, *"The initial, 2006 hourly prices charged by the utilities generally failed to do a reasonable job of signaling the capacity market prices, which,*

73 New York State Public Service Commission, April 2003

74 New York State Public Service Commission, April 2003

75 New York State Public Service Commission, October 2003

76 New York State Public Service Commission, April 2006

if done properly, would concentrate a year's worth of utility capacity payments into just a few peak and near-peak summer days. Without this capacity price signal, the hourly prices understate summer peak hour prices by a lot."

Regulatory oversight is now focused on designing RTP prices that effectively signal the full cost of providing energy supply during peak periods.[77]

77 Personal email correspondence with Mr. M. Reeder, Director, Office of Regulatory Economics, NYS Department of Public Service. November 2011.

8. Independent Energy Efficiency Delivery Providers

Using energy provider-funded independent organizations to deliver energy efficiency savings

8.1 What is the Independent Energy Efficiency Provider Regulatory Mechanism?

Under this regulatory mechanism governments mandate one or more existing organizations or create a new organization to plan and implement programs to obtain energy savings.

Governments may establish independent energy efficiency delivery organizations by statute or regulation, assigning responsibility for acquiring savings from energy efficiency to those entities. Government may also need to:

- fund the independent provider from energy provider resources or otherwise;
- prescribe responsibilities for delivering and verifying energy savings;
- define performance requirements; and
- establish oversight relationships.

Regulators in some jurisdictions concluded that independent, dedicated energy efficiency providers pursue aggressive energy efficiency goals more effectively than energy providers that operate primarily to sell energy. Independent organizations can involve government and other energy efficiency stakeholders, including energy providers, consumers, and businesses that produce or install energy efficiency measures in the governing board or advisory boards.

This approach sidesteps the perverse financial incentives regulated energy providers may face that reward increased sales and penalize reduced energy sales, an issue addressed specifically in Section 9.2. Some jurisdictions that created independent energy efficiency delivery organizations, however, have also implemented the decoupling reforms that address these perverse incentives.

Independent, dedicated energy efficiency providers pursue aggressive energy efficiency goals more effectively than energy providers that operate primarily to sell energy.

An independent energy efficiency organization may be charged with planning and implementing energy efficiency programs or it may be called upon to obtain energy savings using market tenders.

Although several jurisdictions have assigned primary responsibility for energy efficiency to independent organizations, energy providers remain an important stakeholder in any such mechanism. They should be enlisted to support the efforts of the independent organization. Their knowledge of end-user needs and access to energy consumption information are important resources for the energy efficiency provider organization.

8.2 Key Issues in Design and Implementation

8.2.1 Application in Regulated and Competitive Markets

An independent energy efficiency provider can be effective in either regulated markets served by monopoly service providers or in liberalized markets. In jurisdictions with competing energy retailers, the retailers and government together, or government alone, may decide to assign energy efficiency program delivery to one energy efficiency provider instead of calling on the several energy retailers to each pursue energy efficiency. In these instances the funds required may be obtained from price surcharges collected by the regulated monopoly transmission and distribution service provider. (See Section 3.)

8.2.2 Key Design Issues

When assigning responsibility for energy efficiency delivery to one or more independent organizations government should ensure the organization(s) will:

- have a clearly defined mission and performance goals;
- be accountable for achieving energy efficiency objectives;
- have the expertise, funding, and mandate to achieve clearly defined goals;
- carry out the M&V research and analysis required to provide objective information on the outcomes of the efficiency investments and the cost of achieving those outcomes;[78] and,
- be free of real and perceived conflicts of interest.

Government should set performance targets for the new organization, set the budget that energy providers will fund, and establish the means, by statute or existing regulatory authority, to obtain the funds from energy providers.

The independent organization assigned energy efficiency program responsibilities should be encouraged to sustain effective relationships with energy providers and other stakeholders that have knowledge and experience with energy efficiency.

8.2.3 Choosing the Structure for the Independent Energy Efficiency Provider Organization

Several different business models have emerged for assigning responsibility for energy efficiency program delivery to independent organizations.[79] Each of these models features an independent government-created or -selected organization responsible for delivering energy efficiency programs, but the funding source for these organizations varies, some funded from energy provider sources, for example, energy price surcharges (described in Section 3), and others from government revenue sources.

The various business models include:

- a government or quasi-government organization established by law that reports to an Energy Minister or legislative body, which may be overseen by a Board of government officials or politically appointed directors (e.g., New Zealand's Energy Efficiency and Conservation Authority; the New York State Energy Research and Development Authority);
- an autonomous entity funded by government either directly or through directed sources such as a rate surcharge on consumer bills, or a public benefits charge.[80] It may be overseen by an independent Board of Directors that includes government and other stakeholder representatives (e.g., the United Kingdom's Energy Savings Trust and the Energy Trust of Oregon); and
- a private entity that government contracts or assigns to plan and operate energy efficiency programs (e.g., the Vermont Energy Investment Corporation that is designated by the Vermont state utility regulatory board to conduct electricity efficiency programs).

Jurisdictions often decide the organization structure and the source of funding on the basis of available authority and experience with creating independent organizations to serve other public purposes.

8.3 Application: Vermont Creates An Energy Efficiency Utility

In 1999 the Vermont Public Service Board (PSB), the state utility regulator, directed electricity providers to fund an independent entity to deliver electricity efficiency services to consumers. This action was taken with support from the Vermont Legislature and the state's electricity companies.

The PSB conducted a competitive bid tender to select an entity to create and administer an organization dedicated primarily to achieving energy savings goals, described in

78 Section 9.3 addresses regulatory action to provide a foundation of effective measurement and verification to support energy efficiency policies and programs.

79 Wasserman and Neme, 2012

80 See Section 5 for an explanation of public benefit charge funding mechanisms.

Vermont as a statewide Efficiency Utility. The PSB selected Vermont Energy Investment Corporation to establish and maintain a new Efficiency Vermont entity that would be funded by Vermont's regulated monopoly electricity providers.

The PSB also established a Contract Administrator independent of the PSB but responsible to it. That additional position, funded in the overall Efficiency Utility budget, is responsible for routine contract administration and resolving disputes between Efficiency Vermont, consumers, the electric utilities, and other stakeholders. If an issue cannot be resolved at that level, it can be brought to the PSB.

The PSB authorized an "Energy Efficiency Charge," a non-bypassable price surcharge (see Section 3), to fund Efficiency Vermont, subject to legislative confirmation. A fiscal agent collects Energy Efficiency Charge funds and disperses them to pay program costs. The Energy Efficiency Charge revenues are allocated among programs for residential, commercial, and industrial customer classes on the basis of their contributions to overall electricity sales revenues. The funds are collected in a per-kWh price surcharge from residential customers and in a combination kWh energy and kW demand charge from customers whose tariffs include both energy and demand charges.

The PSB not only provided for compensation for program costs but prescribed performance incentives paid for meeting specific objectives that serve policy goals. Performance objectives include not only cost-effective energy savings targets but also other policy goals, such as a balanced distribution of energy efficiency services and resulting benefits across the state and across economic sectors, and efficiency market transformation. A portion of the payment to the Efficiency Utility is tied to meeting the performance goals, goals that are negotiated with the contractor at the beginning of each three-year period. The PSB provided for stable and continuous funding by competitively awarding contracts for three-year intervals, with opportunities for contract extensions, based on satisfactory program performance. Recently the PSB altered the process to appoint an entity as Efficiency Utility for a longer period and give it the same standing as a utility, rather than a contractor.

The PSB selects the Efficiency Vermont designee, employs the contract administrator and fiscal agent, approves annual program plans proposed by Efficiency Vermont, approves performance incentive payments, establishes the program budget and supporting Energy Efficiency Charge, and reports to the Vermont Legislature on funds collected, expenditures, and program achievements.

The PSB requires that the electricity companies support the energy efficiency utility contractor with consumer and other information it needs to plan and implement energy efficiency programs. Electricity companies retain the obligation to obtain energy efficiency resources to meet transmission and distribution system constraints, but may employ Efficiency Vermont to meet those obligations.

Efficiency Vermont describes its achievements:

> *By the close of the [most recent] contract period, Efficiency Vermont's services to businesses and households in every county of the state had reduced annual energy use by 98,050 MWh, which reflects a lifetime economic value of $66 million. These savings prevented power plant emissions of carbon dioxide by more than one million tons of carbon dioxide, 1,343 tons of oxides of nitrogen, 4,383 tons of sulphur dioxide and 361 tons of particulates. These results were achieved at an energy-saving rate [cost] 52% lower than what utilities would have paid to purchase this energy on the wholesale supply market. These energy savings will last an average of 14.4 years.*[81]

Efficiency Vermont has proven very successful at carrying out expanded energy efficiency services in Vermont. In 2010 the Vermont electricity efficiency program budget ranked first among states in the United States, committing 4.6 percent of electricity sales. In 2009 Vermont's electricity efficiency programs also ranked first for achieved energy savings, 1.6 percent of annual electricity sales.[82]

81 Efficiency Vermont, 2012

82 Sciortino, et al., 2011

9. Providing a Foundation for Energy Provider-Funded Energy Efficiency

9.1 Introduction

Previous sections address regulatory mechanisms that directly mobilize resources, enable program designs and program delivery practices, establish energy efficiency goals, and offer energy providers rewards for energy efficiency accomplishments. This section addresses four important additional ways to remove barriers energy providers face in delivering energy efficiency:

1. Decoupling, aligning the financial incentives of regulated energy providers with energy efficiency goals by removing financial penalties that result from reducing energy sales;
2. Mandating effective evaluation, measurement and verification (M&V) programs prior to implementing energy efficiency programs to provide an objective basis for assessing program performance;
3. Developing market-based energy efficiency certificate[83] programs to support energy efficiency resource acquisition; and,
4. Ensuring the continuity and certainty in energy efficiency obligations to build sustained energy provider programs and business models to achieve energy efficiency goals.

These actions play an essential role in assuring that the energy efficiency programs undertaken with support from energy providers will be implemented effectively and sustained to meet long-term energy savings goals. In effect, these actions ensure that necessary infrastructure is in place to implement effectively the regulatory mechanisms described in previous sections of this report.

9.2 Decoupling

Aligning regulated energy provider incentives with energy efficiency goals

9.2.1 What is Decoupling?

Decoupling aligns the financial incentives facing regulated energy providers with energy efficiency goals by removing perverse financial incentives that reward increases in energy sales and penalize reductions in energy sales. Decoupling modifies traditional price regulation, removing disincentives for mobilizing regulated energy providers to achieve sales-reducing energy efficiency goals.

Decoupling modifies traditional price regulation, removing disincentives for mobilizing regulated energy providers to achieve sales-reducing energy efficiency goals.

The feature of traditional regulation that ties energy provider profits to the revenue produced by selling energy is that energy providers earn additional net revenue when they sell more energy, a "throughput incentive." The main issue is recovery of that lost net revenue. Lost revenue arises as a ratemaking issue because energy efficiency reduces retail energy sales. Some short-run expenses are avoided (less fuel burned, for example) and very large savings are reaped in the long run. Under typical retail tariffs, however, in which at least some of the fixed cost revenue collection is based on energy consumption, the utility still loses the portion of its rate that was meant to cover fixed costs (interest and depreciation, for example) and its return to stockholders (the lost net revenue). To

83 Energy efficiency certificates are often called white certificates or tradable white certificates.

address this, some jurisdictions track net lost margins and allow their recovery, contemporaneously or after the fact. Others adopted decoupling. One version of decoupling adjusts rates to make the utility's net revenue constant, independent of the amount of electricity sold, rather than just to eliminate net lost revenue from energy efficiency. This section addresses steps regulators can take to realign rate regulation to eliminate the throughput incentive, that is, to decouple profits from sales.

Traditional regulation sets energy prices by deciding the revenues an energy provider will need to cover costs. The regulated price equals authorized revenue divided by sales. Because the authorized revenue includes an allowance for fixed costs and return on capital, once the regulated price is set the energy provider can increase its net revenue by increasing sales, as long as growing sales do not increase costs more than revenues.

Traditional rate setting mobilizes all aspects of energy provider operations to ensure that unit costs are kept below the prices charged to customers and that sales continue to grow to provide a healthy stream of increasing revenues to cover costs and increase profits, or net margins.

The incentive is powerful because it is large. A 2005 study in the United States found that on average, each kWh contributes USD $0.05 to a utility's bottom line profit (before income taxes). A one percent change in sales will produce a 100 basis point change in a utility's return on equity.[84]

Such a penalty undermines an energy provider's commitment to provide any more support for energy efficiency than is required to comply with other regulatory directives. Removing it is a necessary step in mobilizing energy providers to acquire energy efficiency. The effect is insidious because it influences the level of effort, the quality of staff resources assigned to planning and implementing energy efficiency programs, and the role assigned to energy efficiency resources in resource planning, that is, the priority assigned to this resource. Even in liberalized energy markets, electricity and gas distribution network operators remain regulated and often retain the throughput incentive that rewards increasing sales.[85] Decoupling shifts the focus of regulation from setting price to setting a revenue target and adjusting prices when revenues increase or decrease. The practical objective is to make revenue immune to changes in sales volumes. Small adjustments are made to prices from time to time to reconcile actual revenues with target revenues. Energy providers cannot then increase profits by increasing sales, but can do so by cutting costs. Any over- or under-collection of revenue during one time period is corrected in determining the revenue cap for the following time period.

Full decoupling adjusts the revenue collected by an electricity provider from any deviation at all of actual sales from expected sales. The cause of the deviation (e.g., increased investment in energy efficiency, weather variations, changes in economic activity) does not matter. Any deviation will result in an adjustment ("true-up") of collected revenue with allowed revenue.[86]

With decoupling, consumer bills are still determined by the amount of energy the consumer buys. Consumer bills are higher when they use more and lower when they use less. They retain the incentive to manage their energy use cost effectively.

With stable revenues, the sales reductions caused by energy efficiency programs no longer reduce energy company profits.

> Many utility-sector stakeholders have recognized the conflicts implicit in traditional regulation that compel a utility to encourage energy consumption by its customers, and they have long sought ways to reconcile the utility business model with contradictory public policy objectives. Simply put, under traditional regulation, utilities make more money when they sell more energy. This concept is at odds with explicit public policy objectives that utility and environmental regulators are charged with achieving, including economic efficiency and environmental protection. This throughput incentive problem, as it is called, can be solved with decoupling.
>
> *Regulatory Assistance Project 2011*

9.2.2 Key Issues in Design and Implementation

There are a number of ways to decouple profit incentives from energy volume sales.[87] These choices will be affected by other regulatory policy objectives, but can

84 Regulatory Assistance Project, 2005

85 This has now been removed or reduced in Italy and the UK.

86 For extensive discussion of the details of decoupling and its variants, see Lazar, June 2011.

be summarized as deciding whether to fully decouple profit incentives from variations in sales or to limit the decoupling to some degree, in the extreme case only accounting for sales reductions that can be attributed to the direct effects of energy provider energy efficiency programs. The range of decoupling options includes:

- **Full Decoupling –** insulates an energy provider's revenue collections from any deviation of actual energy sales from expected sales. All deviations result in a true-up of collected revenues with allowed revenues to match the revenue requirement established in the last rate proceeding. Decoupling adjusts prices to meet revenue targets authorized in rate proceedings, sometimes referred to as a change from price regulation to revenue regulation.
- **Partial Decoupling –** insulates a portion (e.g., 50 or 90 percent) of an energy provider's revenue collections from deviations of actual from expected energy sales, perhaps a portion that increases with the level of energy savings achieved through energy provider energy efficiency.
- **Limited Decoupling –** provides revenue adjustments only for specified causes of variations in sales, such as the lost margin related specifically to energy provider energy efficiency programs and such other causes of energy sales variations as weather or general economic conditions. Limited decoupling, sometimes described as a net lost revenue adjustment mechanism, requires calculation of estimates of the different causes of deviations in energy sales and revenues from rate case assumptions.

Removing the throughput incentive can also facilitate the implementation of electric and gas tariff designs that encourage energy efficiency, voluntary curtailment and peak load management, upgraded codes and standards, and other energy efficiency policies that energy providers might otherwise oppose.

Decoupling is a big improvement over the system that penalizes energy providers for consumer investments in cost-effective energy efficiency.

Changing utility regulation from a system that focuses on prices to one that focuses on revenues is not a perfect outcome. Just as there are challenges in price regulation, revenue regulation also poses challenges for regulators. When applied effectively, adjustments are made to align revenue regulation with the overarching goal of providing safe, reliable, environmentally safe energy supply at a fair and reasonable cost to consumers. Certainly decoupling is a big improvement over the system that penalizes energy providers for consumer investments in cost-effective energy efficiency.

9.2.3 Application: India's "True-up" Decoupling Mechanism[88]

India has implemented an annual "true-up" or retrospective adjustment for electricity utilities subject to price regulation to decouple revenues from sales, addressing the throughput incentive directly. The process by which India developed its true-up mechanism is notable for two reasons: most experience with decoupling in price regulated countries has been limited to regulated energy providers in North America, and India recognized the barrier posed by the throughput incentive early in its efforts to plan and implement large-scale energy efficiency programs.

As a byproduct of comprehensive energy policy reform intended to improve many aspects of electricity service, including but not limited to energy efficiency, and initiated by the Electricity Act, 2003,[89] India implemented new guidelines for electricity tariff regulation that took effect in 2006.[90] This Tariff Policy encouraged state regulators to implement multiyear tariff frameworks that include provision for the speedy recovery of "uncontrollable costs," including adjustments for revenue reductions resulting from energy sales that are less than forecast.

87 For a thorough discussion of the choices regulators face in establishing decoupling, see Lazar, June 2011.

88 This example is based primarily on information presented in the following report: Abhyankar and Phadke, 2011

89 India. Electricity Act, 2003. Available at: http://powermin.gov.in/acts_notification/electricity_act2003/preliminary.htm

90 Ministry of Power, India. Tariff Policy. Resolution No. 23/2/2005-R&R (Vol. III). Effective January 6, 2006. Available at: http://powermin.gov.in/acts_notification/electricity_act2003/pdf/Tariff_Policy.pdf

Electricity Supply System in India

Investor-owned energy retailers play a small role in India's very large electricity supply system. India has more than 150 gigawatts (GW) of installed electricity generation capacity. Almost all electricity sales (87 percent) are delivered by state-government utilities; the remaining 13 percent is delivered by private and municipal utilities.

Electricity demand is growing rapidly, already exceeding the capacity of the electricity supply system to serve customer demand. Power shortages are chronic and increasing. Several studies have suggested that investment in energy efficiency and demand response could significantly reduce power shortages, reduce supply costs, and contribute to India's effort to address climate change.

India is developing several major energy efficiency programs,[91] but has not implemented large-scale energy provider-funded energy efficiency programs. There is, however, growing interest in mobilizing energy providers to invest in energy efficiency to reduce costs and to mitigate electricity supply shortages. Small-scale programs are being implemented in two states, Maharashtra and Delhi, where electricity regulators have allocated electricity sector revenues for pilot-scale energy efficiency programs. The Bureau of Energy Efficiency and the Forum of Regulators have launched the Regulatory Multi-State DSM Program, which lays a foundation for developing regulated energy provider energy efficiency programs across India.

Electricity Price Regulation and the True-up Mechanism

India employs revenue requirement-based price regulation, setting prices to meet a revenue requirement determined in periodic price regulation proceedings. The revenue requirement is based on cost of service plus a fixed rate of return on invested capital.

Many state regulatory commissions set prices for several years under multiyear tariffs (MYT). Each year regulators "true up" the previously approved revenue requirement for "uncontrollable costs." The difference in actual consumer sales compared to the rate proceeding approved forecast sales is treated as an uncontrollable factor, along with other uncontrollable changes in operating costs.

Because revenue adjustments are calculated on the past year but do not apply to rates until the next year following, there is a one-year lag in the revenue adjustments that is never recovered when sales decline.

Practical Impact of the True-Up Adjustments

Because India faces chronic energy capacity shortages, energy demand continues to grow faster than available capacity. The power that energy providers obtain to meet shortages comes from expensive short-term purchases. For example, in 2009 energy providers in Delhi purchased almost six percent of their total energy needs to meet short-term peak demand at an average cost of INR 5.0/kWh, compared to their average electricity cost for the remaining 94 percent of INR 2.6/kWh.

Energy efficiency and demand response that reduces peak demand can reduce expensive power purchases. Because electricity demand often exceeds available capacity, however, energy providers may use the electricity savings produced by energy efficiency and demand response to meet unmet demand rather than reducing expensive peak power purchases.

The annual true-up effectively reduces the lost sales revenue throughput incentive. There is some further concern, however, that a threat of lost earning remains. If energy efficiency and demand response programs avoid the need for investments in new capacity,[92] energy providers worry that they will see losses in earnings on capital investments in new generating capacity.

9.3 Requiring Effective Measurement and Verification

9.3.1 Why Measurement and Verification?

Establishing a measurement and verification (M&V) methodology prior to implementing energy efficiency programs provides an objective basis for assessing progress toward energy efficiency goals, monitoring compliance

91 India has developed several large-scale government-managed and -financed energy efficiency programs, including the Perform, Achieve and Trade (PAT) program, the Market Transformation for Energy Efficiency (MTEE) program, the Energy Efficiency Financing Platform program, and the Framework for Energy Efficiency Economic Development.

92 That is, additional investment in generation, transmission, and distribution infrastructure.

with energy efficiency obligations, validating incentive payments, and achieving integrated resource plan goals.

When public policy commits regulated energy providers to carrying out energy efficiency programs to achieve significant reductions in energy use, the regulatory authorities responsible for energy provider price regulation should take steps to establish a supporting program of independent M&V of efficiency program performance.

M&V provides an essential guidance system that informs all key stakeholders and helps maintain public credibility for demand-side resource programs. It plays a central role in the effective implementation of each of the regulatory mechanisms described in this report. M&V is a continuous process and is usually accompanied by periodic retrospective evaluations of the entire suite of regulatory mechanisms to measure performance against a range of policy goals.

The importance of M&V cannot be overstated. M&V provides a foundation for almost all aspects of effective energy efficiency program planning and implementation. M&V provides essential information about energy efficiency program performance required to determine whether energy savings targets are being met. Effective M&V programs:

- validate energy savings claims;
- ensure that quality requirements for the energy efficiency installations have been met;
- provide information on the impacts of efficiency measures;
- award performance incentives or penalties;
- plan annual budgets and long-range resource commitments;
- design energy efficiency program tracking systems for day-to-day operations; and,
- assess program cost effectiveness.

M&V must be done by competent M&V professionals according to well established standards of the profession. To ensure M&V objectivity and credibility, the M&V analysis should be carried out by entities that are independent of the organizations that implement the energy efficiency programs and should be open to public scrutiny.

The importance of M&V cannot be overstated. M&V provides a foundation for almost all aspects of effective energy efficiency program planning and implementation.

Governments may direct energy providers to commit resources to establishing a professional, independent M&V program or establish rules and practice guidelines that energy provider M&V programs must meet. Government may assign M&V responsibility to an existing government or quasi-government entity along with the necessary budget resource support, widely found to be three to five percent of energy efficiency program budgets. In some jurisdictions, government has established multi-stakeholder oversight or advisory bodies to ensure that key stakeholders can participate directly in M&V program development and implementation.

9.3.2 International Performance Measurement and Verification Protocol [93]

The international community of energy efficiency professionals long ago recognized the importance of elevating M&V practice and committed to defining best practices. The international nonprofit Efficiency Valuation Organization (EVO) was formed to develop and promote the use of effective M&V methods to quantify the benefits and costs of efficiency investments. EVO has observed, "…in order for efficiency to be considered a reliable resource, its energy savings, including the persistence of savings, must be verifiable and project transactions costs must be kept to reasonable levels." EVO now publishes and regularly updates an International Performance Measurement & Verification Protocol (IPMVP) that outlines effective practices for measuring, computing, and reporting savings produced by energy efficiency investments.[94]

The IPMVP provides guidance to professionals responsible for M&V practice. It is a technical document but its existence provides a valuable benchmark for M&V practice that regulators mandate. IPMVP does not describe how regulators enforce M&V mandates but it does define clearly the level and scope of analysis good M&V practice should address.

93 Efficiency Valuation Organization, 2010

94 Efficiency Valuation Organization, 2012

9.3.3 Applications: Italy, the United Kingdom, and California

Italy. The Italian Regulatory Authority for Electricity and Gas – Autorità per l'energia elettrica e il gas (AEEG), the regulator responsible for overseeing the energy efficiency obligation program, retains responsibility for M&V oversight. The AEEG defines M&V practice standards and requires that energy providers submit monitoring plans for preapproval. The AEEG uses the M&V results to determine how white certificate credits are awarded to energy efficiency projects. For example, the AEEG uses M&V information to determine deemed savings values for many specified energy efficiency measures. The AEEG also requires ex post M&V analysis for very large efficiency projects involving difficult to predict energy savings impacts.

United Kingdom. The Office of Gas and Electricity Markets (Ofgem), the regulator responsible for overseeing the energy efficiency obligation program, retains responsibility for M&V oversight. Ofgem defines M&V practice standards and requires that energy providers submit monitoring plans for preapproval. Ofgem uses the M&V results to determine how savings credits are awarded to energy efficiency projects. Ofgem defines the deemed savings values used to credit savings for the eligible energy efficiency measures that energy providers may implement to meet their obligations. M&V study results are used to modify deemed savings when ex post analysis reveals that actual impacts differ significantly from projected savings in the deemed savings estimates.

California. The CPUC, the regulator responsible for overseeing utility energy efficiency programs, retains responsibility for M&V oversight. The CPUC defines M&V practice standards and requires that energy providers submit monitoring plans for preapproval. The CPUC uses M&V results to project savings from energy efficiency programs carried out by California's electricity and gas companies. The CPUC offers energy companies a shared savings incentive to mobilize energy providers to achieve energy efficiency goals; the shared savings awards are estimated using M&V based on ex ante estimates of expected savings but are not awarded until ex post M&V analysis confirms that the savings have been achieved.

9.4 Tradable White Certificates

Establishing a system of tradable white certificates to document valid energy savings claims and to facilitate the market trading of energy savings

9.4.1 Regulatory Action to Establish Tradable White Certificates

Tradable energy efficiency certificates, also known as white certificates,[95] provide a valuable tool that can be used to document compliance with energy efficiency mandates and that can be traded, facilitating market tenders for energy efficiency savings.

White certificates certify that a certain amount of energy savings has been achieved according to prescribed conditions.

White certificates: certificates issued by independent certifying bodies confirming the claims of market actors for savings of energy, as a consequence of energy end-use efficiency measures. (Commission of the European Communities 2003[96])

White certificates certify that a certain amount of energy savings has been achieved according to prescribed conditions. White certificates are documented links to a certain amount of energy savings and a guarantee that the savings have not been accounted for elsewhere.[97] They are both an accounting tool and, optionally, a tradable

95 Energy efficiency certificates are identified by several different terms that include: white certificates (WC), energy savings certificates (ESC), and energy efficiency credits (EEC).

96 Commission of the European Communities, Brussels, 10/12/2003. COM (2003) 739 final. 2003/0300 (COD): Proposal for a directive of the European parliament and of the council on energy end-use efficiency and energy services. p. 26. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2003:0739:FIN:EN:PDF

97 Bertoldi, et al., 2010

instrument for market tenders and energy efficiency obligation mandates if authorized.

Government may organize the scheme that issues white certificates for validated energy savings by establishing or mobilizing energy providers and other energy efficiency stakeholders to establish independent certifying bodies, to define rules for awarding and trading white certificates, and to ensure effective M&V practices are used to validate and certify claims for energy savings achievements.

Tradable white certificates are being used in several European countries, in two Australian states, and are planned in India to support government-mandated energy efficiency programs. The extent to which white certificates are traded ranges from virtually none in France to extensive trading in Italy and two Australian states, New South Wales, and Victoria. In the United Kingdom and South Australia, bilateral trading of certified energy savings occurs between obligated energy providers. India's new Perform, Action, & Trade (PAT) scheme will use white certificates for recording verified energy savings and to facilitate trading to enable efficient compliance with end-user efficiency obligations.

Tradable white certificates can facilitate trading of measured energy savings from energy efficiency that enables energy providers to use market tenders or bilateral trading with other energy providers to obtain savings at a lower cost than they can be obtained from their own programs, and enables end-use consumers and independent energy efficiency vendors (e.g., energy service companies) to trade energy savings they obtain from implementing their own energy efficiency projects.

Government should provide the ground rules for the operation of white certificate schemes, ensuring that the certificates serve the objectives the energy efficiency programs seek to achieve. In Italy, for example, the regulator directly administers the white certificate program, setting rules for obtaining certificates, managing the M&V assessments that support the validation of claims, and issuing certificates.

9.4.2 Key Issues in Design and Implementation – Enabling Tradable White Certificates

Application in Regulated and Competitive Markets

Tradable white certificate schemes may be established in both regulated energy markets and in liberalized competitive energy markets. They may be used to enable market trading of energy savings from diverse sources.

Key Design Features

Measurement and verification. Tradable white certificate schemes require the same well developed level of M&V capacity as described in Section 1.2 discussing energy efficiency obligations. Facilitating an effective trading platform requires judgments about:

- whether and how the white certificates will be valued (e.g., in units of savings or savings per project) and the methods used to value savings attributed to white certificates (e.g., using deemed savings, scaled engineering estimates, ex post evaluations) (see Section 1.2);
- how the annual and lifetime expected savings from each eligible energy efficiency measure are handled in the trading process; if the payment for the white certificate is over a fixed number of years, what confirmation process will be enacted to ensure that the energy saving equipment is still in place;
- where the trading platform will be established and who will administer the registry of the owners of the white certificates;
- what entities will be eligible to participate in the trading market for white certificates;
- how the white certificates credited for specific energy efficiency projects should be adjusted for such factors as free-riders and spillover effects; and,
- how to address persistence when valuing the energy savings for specific energy efficiency measures.

A tradable white certificate scheme will be well served by providing white certificate stakeholders with a role in designing the rules and monitoring white certificate operations. Key stakeholders include the energy providers who will use the white certificates to meet obligations, regulators who enforce such obligations, and energy efficiency investors who seek credit and eventual compensation for the energy savings achieved through implementing their energy efficiency projects.

Addressing technology change. White certificate award criteria requires continuing attention to address evolving standards for energy use, reflecting changing technology, new codes and standards, and other factors that affect performance minimums. For example, when energy regulations improve the minimum energy performance of appliances, such as refrigerators or lighting, calculations of energy efficiency savings from investments in those appliances must be adjusted.

Valuing savings: annual savings vs. multiyear savings. In addition to estimating the annual savings that an energy efficiency measure produces, certification must also address whether or how to value the expected multiyear savings each measure will produce. The life of an energy efficiency measure is affected by the expected lifetime of the measure but also by site-specific events that may result in premature measure retirement. White certificates sometimes account for only first-year savings, but this leads to undervaluing savings from long-lived measures and may promote practices that capture low cost, easy to obtain savings but overlook other long lasting savings, sometimes called "cream skimming." The solution may involve scheme designs that integrate white certificate practices with other energy efficiency program regulation. The issue is a persistent one and should be considered when deciding how the crediting of white certificates will address annual savings and multiyear savings associated with each energy efficiency measure.

The design of a white certificate scheme should assure stakeholders that the program will be administered fairly and will provide opportunities for a fair and transparent hearing of complaints, for example, by inviting stakeholders to serve as scheme advisors, providing comment in hearing processes, or both.

Once a white certificate scheme is in place and is issuing tradable white certificates, these certificates may be used:

- by energy providers or others to document their compliance with energy efficiency obligations;
- by energy providers to handle year-to-year surpluses and deficits in the energy via trading;
- by third-party energy efficiency investors to obtain compensation from energy providers for energy savings; and,
- by energy providers to bank energy savings to meet future obligations.

The actual accounting, trading, and banking practices, such as whether certificates may be banked for future use, will be governed by local energy efficiency program policies and goals, for example, low-income consumer assistance goals, goals for electricity, gas, transport, and other energy savings, and the relationship of the white certificate scheme to greenhouse gas policy goals.

9.4.3 Application: Italy's Energy Efficiency Titles[98]

Tradable white certificates play a central role in energy efficiency obligations the Italian Government has imposed on electricity and gas distributors. In Italy white certificates are termed "energy efficiency titles"; EEOs are termed "energy efficiency decrees." Energy efficiency titles are awarded for electricity and gas savings achieved by qualifying investments in energy efficiency by users in all consuming sectors. The current energy efficiency title program has been in place since 2007.

Overall responsibility for all aspects of the EEOs, including the white certificate scheme, is administered by the Italian Regulatory Authority for Electricity and Gas, the AEEG. The AEEG evaluates energy efficiency projects, communicates savings to the market operator, Gestore Mercatto Elettrico (GME), and administers obligation compliance. The energy market operator, GME, administers the issuance and tracking of white certificates, subject to guidance from the AEEG. The AEEG develops the rules that define eligible energy efficiency measures, prescribes how the energy savings will be estimated, and carries out the M&V program upon which savings estimates are calculated and verified. The GME administers the day-to-day operation of the white certificate registry, handling applications and administering certificates.

Energy efficiency titles are issued in units of energy savings that are expressed in tons of oil equivalent (toe). The energy efficiency titles assign a life of five years for most energy efficiency measures, eight years for a few designated longer-life measures. Confirmation that the energy efficiency measure is still functioning entitles the title holder to receive an annual payment for five or eight years as appropriate.

Energy savings from eligible energy efficiency measures are determined using three different approaches:

- Deemed savings for measures that produce savings that do not exceed 25 toe per year, that are widely deployed with reasonably predictable results, based

98 This example is informed in large part by Bertoldi, et al., 2010; Togeby et al., 2007; and Lees, 2010

on ex ante estimates developed from M&V studies of impacts from such measures (e.g., compact fluorescent light bulbs, high-efficiency home heating boilers);
- Engineering estimates that incorporate some field application information (e.g., hours of use) for measures that produce savings that do not exceed 50 toe per year for applications from small gas or electric energy providers and energy efficiency providers and 100 toe per year from large energy providers; and
- Measured savings from field observations of energy use, based on preapproved M&V analysis methods, for measures that produce savings of up to 100 toe per year from small gas or electric energy providers and energy efficiency providers and 200 toe per year from large energy providers.

Measures that are awarded energy efficiency titles based on deemed savings or engineering estimates accounted for 90 percent of the certified savings during the period 2005 to 2007. As of 2008 almost 60 percent of certified savings came from savings in the residential electricity sector, mostly from CFL installations. The disproportionately large contribution of savings by CFL installations has raised concerns that other long-life energy efficiency investments are being missed.

Energy efficiency providers deliver a large proportion of the savings that obtain energy efficiency titles, more than 75 percent in 2009. Energy service companies are very active in Italy, delivering energy savings, obtaining energy efficiency titles, and selling them in the certificate trading market. Italy stands apart from the white certificate programs in France, the United Kingdom, and elsewhere for the very large amount of trading between energy service companies and obligated energy providers.

9.5 An Unambiguous Public Policy Commitment to Energy Efficiency

Ensuring long-term continuity and certainty in government commitment to obtaining the benefits of large-scale investments in energy efficiency

A final powerful mechanism is strong government leadership that communicates clearly and forcefully that energy efficiency will play an important role in long-term plans to meet the community's electricity, gas, and other energy needs. Government can contribute significantly to the success of many separate regulatory actions by taking steps to communicate clearly a strong, lasting public policy.

Government can contribute significantly to the success of many separate regulatory actions by taking steps to communicate clearly a strong, lasting public policy.

Energy efficiency can be elevated to a high priority by elected and appointed officials (e.g., regulatory commissioners, energy agency commissioners, consumer advocates) through statutory mandates, executive orders, or strong regulatory commission orders and policy directives. Such leadership ensures the continuity and certainty in energy efficiency obligations, encourages sustainable business models for energy efficiency goals, and paves the way for the many other important steps to effective energy efficiency implementation. Steps toward such a commitment include:

- understanding the specific ways energy efficiency provides value;
- understanding how energy efficiency will substitute for supply-side and network investments;
- understanding the many benefits energy efficiency delivers by lowering the cost of meeting electricity and gas needs, by lowering the bills of program participants, and the environment and environmental compliance benefits;
- developing challenging goals for energy efficiency programs;
- ensuring the availability of funding required to carry out the energy efficiency programs;
- designing incentives that reward energy efficiency success;
- effectively implementing energy efficiency programs to meet energy savings goals;
- carrying out the monitoring and evaluation to learn lessons from program experience;
- gaining the buy-in and confidence of staff of both energy providers and government so they will make energy efficiency a priority in the varied work that they do; and
- communicating to stakeholders how energy efficiency contributes benefits to their lives, their businesses, and the health of their communities.

A recent study by the American Council for an Energy Efficient Economy observed that in cases where energy efficiency programs were achieving success,

> *There was repeated emphasis on the need for a large framework of established policies supporting and encouraging efficiency. Shareholder incentives in the context of a large framework, such as legislation or a state efficiency standard can reduce controversy, help parties to reach consensus, solidify regulatory authority, and provide regulatory certainty. Fractured treatment of efficiency makes it difficult for regulators to see what the true impacts of policies are, reducing confidence and the ability to adjust mechanisms appropriately. (ACEEE 2011)*

Strong leadership communicates clearly to key stakeholders that energy efficiency is a high priority resource, equivalent or superior to supply-side resources.

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Applications

In 2008 the United Kingdom enacted the 2008 Climate Change Act, imposing a legally binding commitment to reduce carbon emissions by 80 percent by 2050. The UK's Department of Energy and Climate Change has developed the Low Carbon Transition Plan that commits to reducing 2008 CO2 levels by 29 percent by 2020. This long-term commitment requires that the CERT EEOs contribute the needed immediate progress that will put the UK on a path to achieve the long-term goal[99] (Section 1.3).

Portugal has adopted the PNAC that establishes long-term carbon reduction goals and mandates actions to achieve them. The subsequent National Action Plan for Energy Efficiency (PNAEE) established a 2015 target to achieve a 10% energy savings and committed Portugal to a wide range of programs and measures to achieve this objective. This national energy policy framework provided the impetus and goals that guide Portugal's new energy efficiency tender program (Section 4.3).

99 UK Department of Energy and Climate Change (2009). Extending the Carbon Emissions Target: Consultation on a CERT Framework for the Period April 2011 to December 2012. URN 09D/845 December 2009. Available at: http://www.decc.gov.uk/assets/decc/Consultations/certextension/1_20091218162222_e_@@_extendingcertcondoc.pdf

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Glossary[100]

A

Adjustment Clauses: Allow for recovery of specified costs as incurred (e.g., on a monthly or annual basis).

Allocation: The assignment of utility costs to customers, customer groups, or unbundled services based on cost causation principles.

Ancillary Services: Services needed to support the transmission of energy from generation to loads, while maintaining reliable operation of the transmission system. These include regulation and frequency response, spinning reserve, non-spinning reserve, replacement reserve, and reactive supply and voltage control.

Average Cost: The revenue requirement divided by the quantity of utility service, expressed as a cost per kilowatt-hour or cost per therm.

Average Cost Pricing: A pricing mechanism basing the total cost of providing electricity on the accounting costs of existing resources. *(See Marginal Cost Pricing)*

Avoided Cost: The cost of providing additional power, including the cost of the next power plant a utility would have to build to meet growing demand, plus the costs of augmenting reliability reserves, additional transmission and distribution facilities, environmental costs, and line losses associated with delivering that power.

B

Billing Cycle: The period of time between customer bills, typically one or two months.

BTU (British Thermal Unit): A standard unit for measuring the quantity of heat energy, equal to the quantity of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

C

Capacity: The maximum amount of power a generating unit or power line can provide safely.

Capital Structure: The mix of common equity, preferred equity, and debt used by a utility to finance its assets.

Capitalized Costs: Utilities capitalize costs of investments that provide service over multiple years. *(See Operation and Maintenance Costs.)*

Carbon Intensity: The carbon dioxide a utility emits divided by its energy sales, typically expressed in tons/megawatt-hour.

Connection Charge: An amount to be paid by a customer to the utility, in a lump sum or in installments, for connecting the customer's facilities to the supplier's facilities.

Cost-Based Rates: Electric or gas rates based on the actual costs of the utility. *(See Value-Based Rates.)*

Cost-of-Service Regulation: Traditional electric utility regulation, under which a utility is allowed to set rates based on the cost of providing service to customers and the right to earn a limited profit.

Cream Skimming: The practice of providing a product or a service to only the high-value or low-cost customers of that product or service. In energy efficiency programs, the practice of investing in only low-cost, high-impact energy efficiency measures at a property but passing up opportunities to invest in other cost-effective energy efficiency measures. Cream skimming can be contrasted with a comprehensive approach to energy efficiency, which invests in a package of cost-effective energy efficiency investments that produce large total savings, deep savings, but at lower rate of return on investment.

100 This glossary was adapted from the Glossary in the Regulatory Assistance Project report, Electricity Regulation in the United States and the "Glossary of Terms: Version 1.0" Northeast Energy Efficiency Partnership.

Customer Charge: A fixed charge to consumers each billing period, typically to cover metering, meter reading, and billing costs that do not vary with size or usage. Sometimes called a Basic Charge or Service Charge.

Customer Class: A group of customers with similar usage characteristics, such as residential, commercial, or industrial customers.

D

Declining Block Rate: A rate structure that prices successive blocks of power at increasingly lower per-unit rates. *(See Inclining Block Rate.)*

Decoupling: A regulatory design that breaks the link between utility revenues and energy sales, typically by a small periodic adjustment to the rate previously established in a rate case. The goal is to match actual revenues with allowed revenue, regardless of sales volumes.

Deemed Savings: An estimate of energy or demand savings for a single unit of an installed energy efficiency measure that (a) has been developed from data sources and analytical methods that are widely considered acceptable for the measure and purpose, and (b) is applicable to the situation being evaluated. Individual parameters or calculation methods can also be deemed.

Deep Savings: Achieving savings from a comprehensive package of cost-effective investments in multiple energy efficiency measures, some of which are more cost effective than others, producing large energy savings at a single property.

Demand: The rate at which electrical energy or natural gas is used, usually expressed in kilowatts or megawatts for electricity and therms for natural gas.

Demand Charge: A charge based on a customer's highest usage in a one-hour or shorter interval during a billing period.

Demand Response: The reduction of customer energy usage at times of peak usage in order to help system reliability, to reflect market conditions and pricing, or to support infrastructure optimization or deferral of additional infrastructure. Demand response programs may include contractually obligated or voluntary curtailment, direct load control, and pricing strategies.

Demand-Side Resource: An energy efficiency measure (delivering equivalent lighting, heating, or other energy services using less energy input) or a demand response program designed to encourage consumers to modify patterns of electricity usage, including the timing and level of their demand, sometimes referred to as demand-side management. Customer-sited and other distributed electricity generation used to modify the level and timing of the demand, although often described as a demand-side resource, are not included here unless specifically mentioned.

Distribution: The delivery of electricity to end-users via low-voltage electric power lines.

Dynamic Pricing: Dynamic pricing creates changing prices for electricity that reflect actual wholesale electric market conditions. Examples of dynamic pricing include critical period pricing and real-time rates.

E

Elasticity (of Demand): The percent change in usage with respect to a 1percent change in price.

Embedded Costs: The costs associated with ownership and operation of a utility's existing facilities and operations. *(See Marginal Cost.)*

Energy Audit: A program in which an auditor inspects a home or business and suggests ways energy can be saved.

Energy Charge: The part of the charge for supplying electricity based upon the electric energy consumed or billed.

Energy Distributor: The entity that transports energy to the dwellings or premises of end-users. In restructured markets, such entities do not necessarily sell energy directly to end-use customers.

Energy Efficiency Investment: The expenditure of funds required to implement energy efficiency projects.

Energy Efficiency Measure: An installed piece of equipment or system, or modification of equipment, systems, or operations on end-use customer facilities that reduces the total amount of electrical or gas energy and capacity that would otherwise have been needed to deliver an equivalent or improved level of end-use service.

Energy Efficiency Obligation: A requirement imposed on energy providers (obligated parties) to meet quantitative energy savings targets by implementing cost-effective end-use energy efficiency.

Energy Efficiency Portfolio Standard (EEPS): A regulatory requirement that energy providers achieve a specified target reduction in energy use from qualifying customer investments in energy efficiency. *(see Energy Efficiency Obligation)*

Energy Efficiency Program: A strategic program designed to carry out the implementation of energy efficiency projects across many different dwellings or facilities.

Energy Efficiency Project: The planned implementation of a single energy efficiency measure or a coordinated group of different measures in a single dwelling or facility.

Energy Intensity: Economy-wide energy intensity measures units of energy relative to units of gross domestic product (GDP).

Energy Provider: Refers to entities that sell energy directly to end-users (energy retailers) and/or entities that transport energy to end-users' dwellings or premises (energy transmission and distribution system operators). In some jurisdictions these two functions are combined within vertically integrated energy utilities.

Energy Provider: Refers to any entity in the energy supply chain involved in providing energy directly to end-users. This includes energy retailers, entities that transport energy to end-users' dwellings or premises (energy transmission and distribution system operators), electricity generators, and importers of energy. In some jurisdictions, some or all of these functions are combined within vertically integrated energy utilities.

Energy Retailer: The entity that sells energy directly to its end-use customers. In restructured markets, such entities do not necessarily own transmission and distribution assets.

Energy Supply: The full process of energy production, transport, and retail sales.

External Cost: A cost not transmitted through price. For example, air pollution is an external cost of electricity production when the impacts are not accounted for in electricity prices.

Externalities: Costs or benefits that are side effects of economic activities and are not reflected in the booked costs of the utility. Environmental impacts are the principal externalities caused by utilities (e.g., health care costs from air pollution).

F

Fixed Cost: Costs that the utility cannot change or control in the short-run and that are independent of usage or revenues. Examples include interest expense and depreciation expense. In the long run, there are no fixed costs, because eventually all utility facilities can be retired and replaced with alternatives.

Flat Rate: A rate design with a uniform price per kilowatt-hour for all levels of consumption.

Free Rider: An energy efficiency program participant who would have implemented the program measure or practice in the absence of the program. Free riders can be 1) total, in which the participant's activity would have completely replicated the program measure; 2) partial, in which the participant's activity would have partially replicated the program measure; or 3) deferred, in which the participant's activity would have completely replicated the program measure, but at a future time than the program's timeframe.

G

Greenhouse Gases: Gases that trap heat in the atmosphere, including carbon dioxide emitted from power plants.

H I J

Inclining Block Rates: A rate structure that prices successive blocks of power at increasingly higher per-unit rates, typically reflecting higher costs of newer resources, or higher costs of serving lower load factor loads such as air conditioning. Baseline and lifeline rates are forms of inverted rates. Also referred to as "inverted rates."

Incremental Cost: The additional cost of adding to the existing utility system.

Incremental Pricing: A method of charging customers based on the cost of augmenting the existing utility system, in which low-cost resources are sold at one price and higher-cost resources at higher prices.

Independent System Operator (ISO): In the United States a non-utility that has regional responsibility for ensuring an orderly wholesale power market, the management of transmission lines, and the dispatch of power resources to meet utility and non-utility needs.

Integrated Resource Planning (IRP): A public planning process and framework within which the costs and benefits of both demand-side and supply-side resources are evaluated to develop the least total-cost mix of utility resource options. Also known as least-cost planning.

Interruptible Power: Power made available under agreements that permit curtailment or cessation of delivery by the supplier. Customers typically receive a discount for agreeing to have their power interrupted. Interruptions are usually limited to reliability needs, rather than the cost of power.

Interval Meter: A meter that measures the amount of energy used during a specific interval of time shorter than those used in billing (e.g., a month).

Inverted Rates: Rates that increase at higher levels of electricity consumption, typically reflecting higher costs of newer resources, or higher costs of serving lower load factor loads such as air conditioning. *(See Inclining Block Rates.)* Baseline and lifeline rates are forms of inverted rates.

Investor-Owned Utility (IOU): A privately owned electric utility owned by and responsible to its shareholders. About 75% of US consumers are served by IOUs.

K

Kilowatt-Hour (kWh): Energy equal to 1,000 watts for 1 hour. The W is capitalized in the acronym in recognition of electrical pioneer James Watt.

L

Liberalized Energy Market: Electricity and gas markets that have transitioned from regulated monopoly markets to markets in which wholesale and/or retail energy supply are provided by competing firms. Network activities remain natural monopolies subject to economic regulation. Electricity network monopolies include high-voltage electricity transmission and low-voltage transmission service. Gas network monopolies include high-pressure gas transmission and sometimes low-pressure gas distribution systems. Also referred to as restructured energy market.

Lifeline Rate: A lower rate for qualified low-income consumers. The discount may apply only to the basic charge, only to the initial block of usage, or to all usage.

Load Factor: The ratio of average load to peak load during a specific period of time, expressed as a percent.

Load Shape: The distribution of usage across the day and year, reflecting the amount of power used in low-cost periods versus high-cost periods.

Load-Serving Entity (LSE): The entity that serves the electrical demand and energy requirements of its end-use customers. In restructured markets, such entities do not necessarily own transmission and distribution assets.

Local Distribution Company (LDC): A utility engaged primarily in the retail sale and/or delivery of natural gas through a distribution system.

Load Shedding: Disconnection of certain customers or circuits when system emergencies would otherwise cause a complete outage.

Load Shifting: Moving load from on-peak to off-peak periods.

Long-Run Marginal Costs: The long-run costs of the next unit of electricity produced, including the cost of a new power plant, additional transmission and distribution, reserves, marginal losses, and administrative and environmental costs. Also called Long-Run Incremental Costs.

Lost Opportunities: Energy efficiency opportunities available at the time of a naturally occurring market event, such as when a customer constructs, expands, renovates, or remodels a home or a building or makes an initial purchase of equipment, or replaces failed equipment.

M

Marginal Cost Pricing: A system in which rates are designed to reflect the prospective or replacement costs of providing power, as opposed to the historical or accounting costs. *(See Embedded Cost.)*

Market-Clearing Price: The price at which supply and demand are in balance, with respect to a particular commodity at a particular time.

Minimum Charge: A rate-schedule provision stating that a customer's bill cannot fall below a specified level. These are common for rates that have no separate customer charge.

Municipal Utility: A utility owned by a unit of government and operated under the control of a publicly elected body.

N O

Operating Expenses: The expenses of maintaining day-to-day utility functions. These include labor, fuel, and taxes, but not interest or dividends.

Operating Revenues: Revenues directly related to the utility's primary service activities.

P

Payback Period: The amount of time required for the net revenues of an investment to return its costs. This metric is often employed as a simple tool for evaluating energy efficiency measures.

Peak Load: The maximum total demand on a utility system during a period of time.

Peak Shaving: Employment of supplemental power supply, demand-side resources, or rate designs to reduce peak demand for short periods.

Price Cap: A method of setting a utility distribution company's rates whereby regulators establish a maximum allowable price level. Flexibility in individual pricing is allowed in some cases, and where efficiency gains can be encouraged and captured by the company.

Public Utility Commission (PUC): In the United States, a state regulatory body that determines rates for regulated utilities. Sometimes called a Public Service Commission (PSC) or a regulatory board or commission.

R

Rate Base: The total investment used to provide service, including working capital, but net of accumulated depreciation.

Rate Case: A proceeding, usually before a regulatory commission, involving the rates and policies of a utility.

Rate Design: The design and organization of billing charges to distribute costs allocated to different customer classes. Also referred to as tariff design.

Rate of Return: The overall cost of capital for a utility, weighting the cost of debt and the return on equity according to its capital structure.

Real-Time Pricing: Establishing rates that adjust as frequently as hourly, based on wholesale electricity costs or actual generation costs. Sometimes called Dynamic Pricing.

Regulatory Asset: A utility investment that is allowed in rate base, but for a non-physical item determined by the regulator to be appropriate for recovery from consumers. Incentive awards for meeting performance requirements can create a regulatory asset until collected from consumers.

Regulatory Lag: The lapse of time between a petition for a rate increase and formal action by a regulatory body.

Renewable Portfolio Standard (RPS): A regulatory requirement that utilities meet a specified percentage of their power supply using qualified renewable resources.

Renewable Resources: Power generating facilities that use wind, solar, hydro, biomass, or other non-depletable fuel sources. In some states, qualified renewable resources exclude large hydro stations or some other types of generation.

Restructuring: Replacement of vertically integrated electric utilities with competing sellers of electricity or competing wholesale electricity suppliers or both, leaving the utility as a distribution-only company. Restructuring allows individual retail customers to choose their electricity supplier but still receive delivery over the power lines of the local utility. Also referred to as energy market "liberalization."

Return on Equity: The profit rate allowed to the shareholders of an investor-owned utility, expressed as a percentage of the equity capital invested.

Revenue Requirement: The annual revenues that the utility is entitled to collect (as modified by adjustment clauses). It is the sum of operation and maintenance expenses, depreciation, taxes, and a return on rate base.

Revenue Cap: Revenue regulation is often called revenue cap regulation. When combined with decoupling, however, the effect is to simply regulate revenue – that is, there is a corresponding floor on revenues in addition to a cap.

S

Seasonal Rates: Rates that are higher during the peak-usage months of the year.

Self-Generation: A generation facility dedicated to serving a particular retail customer, usually located on the customer's premises.

Short Run Marginal Cost: Only those variable costs that change in the short run with a change in output, including fuel, operations and maintenance costs, losses, and environmental costs. Also known as system lambda.

Smart Grid: An integrated network of sophisticated meters, computer controls, information exchange, automation, and information processing, data management, and pricing options that can create opportunities for improved reliability, increased consumer control over energy costs, and more efficient utilization of utility generation and transmission resources.

Smart Meter Technology: The metering and communication equipment and operating systems that record energy use by time of use (i.e., interval meters) and the communication systems that enable energy providers to communicate the changing prices to consumers. This smart meter technology may also extend to automated controls that enable consumers to program equipment use to respond to changing prices.

Spillover Effects: Reductions in energy consumption and/or demand caused by the presence of an energy efficiency program, beyond the program-related savings of the participants and without financial or technical assistance from the program. There can be participant and/or nonparticipant spillover. Participant spillover is the additional energy savings that occur when a program participant independently installs energy efficiency measures or applies energy saving practices after having participated in the efficiency program as a result of the program's influence. Nonparticipant spillover refers to energy savings that occur when a program nonparticipant installs energy efficiency measures or applies energy savings practices as a result of a program's influence.

Spinning Reserve: Unused, quickly accessible generating capacity available from units that are already connected to and synchronized with the grid to serve additional demand.

T

Tariff: A listing of the rates, charges, and other terms of service for a utility customer class, as approved by the regulator.

Test Year: A specific period chosen to demonstrate a utility's need for a rate increase. It may or may not include adjustments to reflect known and measurable changes in operating revenues, expenses, and rate base. A test year can be either historical or projected.

Therm: A unit of natural gas equal to 100,000 Btu. The quantity is approximately 100 cubic feet, depending on the exact chemical composition of the natural gas.

Time-of-Use (TOU) Rates: Rates that vary by time of day and day of the week.

U V

Variable Cost: Costs that vary with usage and revenue, plus costs over which the utility has some control in the short-run, including fuel, labor, maintenance, insurance, return on equity, and taxes. *(See Short Run Marginal Cost.)*

Vertically Integrated Utility: A utility that owns its own generating plants, transmission system, and distribution lines, providing all aspects of electric service.

Volt: The unit of measurement of electromotive force. In the United States, typical transmission level voltages are 115 kV, 230 kV, and 500 kV, and typical distribution voltages are 4 kV, 13 kV, and 34 kV.

Volumetric Rate: A rate or charge for a commodity or service calculated on the basis of the amount or volume actually received by the purchaser.

W

Watt: The electric unit used to measure power. Kilowatt = 1,000 watts.

Watt-Hour: The amount of energy generated or consumed with 1 watt of power over the course of 1 hour. (See also Kilowatt-Hour.)

Weatherization: A process or program for increasing a building's thermal efficiency. Examples include caulking windows, weather stripping, and adding insulation to the wall, ceilings, and floors.

White Certificate: Certificates issued by independent certifying bodies confirming the claims of market actors for savings of energy as a consequence of implementing end-use energy efficiency measures.

X Y Z

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