Policies to Achieve Greater Energy Efficiency

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EEG ENERGY FUTURES GROUP

October 2012

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Acknowledgements

We wish to thank a number of people and organizations whose assistance made this paper possible. RAP Senior Policy Advisors David Crossley and Eoin Lees provided invaluable counsel in the development and writing of this paper. They reviewed multiple drafts and provided tremendously informative and helpful feedback. Their knowledge of policies and policy development around the world was exceedingly helpful in informing our writing.

We also want to thank a number of people who reviewed country-specific information and helped to ensure that the case studies were accurate and current, specifically Søren Dyck-Madsen of The Danish Ecological Council, Martin Bornholdt of DENEFF and RAP staff Max Dupuy, Brenda Hausauer, Cathie Murray and Edith Pike-Biegunska. In addition, Patty Fong of the European Climate Foundation and RAP's Meg Gottstein helped to identify reviewers and Bill Steinhurst in providing editorial assistance during the final stages of the review.

Last, but certainly not least, we want to recognize and gratefully appreciate the support, guidance, research and editorial assistance provided by RAP's research staff especially, Lewy Lamont, Camille Kadoch, John Gerhard and Research Manager Riley Allen.

The Global Power Best Practice Series was funded by the Climate Works Foundation (CWF) and The Regulatory Assistance Project (RAP). The information and material provided in this series is general in nature. RAP and CWF make no warranty or guarantee regarding the accuracy of any forecasts, estimates or analyses contained in the Global Power Best Practice Series reports. RAP and CWF are not responsible for any liability in association with this content.

About the Global Power Best Practice Series

Worldwide, the electricity sector is undergoing a fundamental transformation. Policymakers recognize that fossil fuels, the largest fuel source for the electricity sector, contribute to greenhouse gas emissions and other forms of man-made environmental contamination. Through technology gains, improved public policy, and market reforms, the electricity sector is becoming cleaner and more affordable. However, significant opportunities for improvement remain and the experiences in different regions of the world can form a knowledge base and provide guidance for others interested in driving this transformation.

This Global Power Best Practice Series is designed to provide power-sector regulators and policymakers with useful information and regulatory experiences about key topics, including effective rate design, innovative business models, financing mechanisms, and successful policy interventions. The Series focuses on four distinct nations/regions covering China, India, Europe, and the United States (U.S.). However, policymakers in other regions will find that the Series identifies best — or at least valued — practices and regulatory structures that can be adapted to a variety of situations and goals.

Contextual differences are essential to understanding and applying the lessons distilled in the Series. Therefore, readers are encouraged to use the two supplemental resources to familiarize themselves with the governance, market, and regulatory institutions in the four highlighted regions.

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8. Integrating Energy and Environmental Policy
9. Policies to Promote Renewable Energy
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This Global Power Best Practice Series was funded by the ClimateWorks Foundation www.climateworks.org

Table of Contents

Abbreviations and Acronyms

ACEEE	American Council for an Energy-Efficient Economy
BTU	British Thermal Unit
CO_2	Carbon Dioxide
DSM	Demand Side Management
ECEEE	European Council for an Energy-Efficient Economy
EEO	Energy Efficiency Obligation
EERS	Energy Efficiency Resource Standards
EM&V	Evaluation, Measurement & Verification
ESCO	Energy Service Company
EU	European Union
GHG	Greenhouse Gas
IECC	International Energy Conservation Code
IEA	International Energy Agency
IOU	Investor Owned Utility
IRP	Integrated Resource Planning
LBNL	Lawrence Berkeley National Lab
M&V	Measurement & Verification
MEPS	Minimum Energy Performance Standards
$MtCO_2$	Million ton of Carbon Dioxide
Mtoe	Million ton of Oil Equivalent
NGO	Non-Governmental Organization
Ofgem	The UK's Office of the Gas and Electricity Markets
PACE	Property-Assessed Clean Energy
PAT	India's Perform, Achieve and Trade mechanism
PBC	Public Benefits Charge
PJ	Petajoule (1015 Joules or about 278,000 MWh)
RAP	Regulatory Assistance Project
RD&D	Research, Development and Demonstration
SBC	System Benefit Charge
tce	Tons of Coal Equivalent
toe	Tons of Oil Equivalent
tCO_2e	Tons of CO_2 Emissions Equivalent
T&D	Transmission and Distribution

List of Figures

Glossary[1]

Additionality: The concept of whether energy savings would have happened anyway, even in the absence of an energy efficiency project or the installation of an energy efficiency measure. Only when a project or measure causes energy savings that are "additional to" the business-as-usual scenario can the project or measure be considered to have caused the savings.

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

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

Competitive Markets: An electricity market (in one or more functional areas, such as wholesale generation or retail sales) where there is reasonably free entry; several reasonably comparable competitors (firms offering similar competitive products); and an absence of single-firm dominance (i.e. where one firm has a market share of 40 percent or more).

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: A system of tracking energy efficiency savings by relying on previously agreed upon savings values, typically for efficiency measures that have well-known and consistent operating conditions and savings values. Based on engineering estimates and/or past impact evaluations, deemed savings tracking systems do not require on-site testing or metering.

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

Demand-Side Management (DSM): The planning, implementation, and monitoring of utility or third party activities designed to encourage consumers to modify patterns of electricity usage, including the timing and level of their demand.

Distribution: The delivery of electricity to end users via low-voltage electric power lines (usually 34.5 kV and below).

Dynamic Pricing: A means of pricing retail electricity that creates changing prices based upon actual wholesale electric market conditions. Examples of dynamic pricing include critical period pricing and real-time rates.

Energy Intensity: Economy-wide or industry-specific energy intensity measures units of energy relative to units of gross domestic product (GDP) or industry output, usually expressed in MWh per $ of GDP for electricity or BTU per $ of GDP for energy, generally, or similar ratios using other currencies.

Energy Provider: An organization that sells gas, electricity and other fuels and/or provides energy services (e.g., energy performance contracting, energy audits, etc.).

Energy Portfolio Standard: A regulatory requirement that a utility meet a specified percentage of its power requirements from a combination of qualified renewable resources or energy efficiency investments. The former is often referred to as a renewable portfolio standard (RPS) and the latter as an efficiency portfolio standard; a policy that requires both may be referred to as a clean energy standard (CES).

Energy Retailers: Companies that provide energy services to the end customer.

ESCOs (Energy Service Companies): Companies that sell energy services (most commonly energy efficiency services) to retail customers. They are typically privately-owned and not regulated.

1 Many of these definitions were obtained from Jim Lazar's *Electricity Regulation in the US: A Guide* published by RAP or Crossley, 2000.

Free Riders: Customers who would have made an energy efficiency investment regardless of the availability of a policy mechanism or incentive.

Independent System Operator (ISO): A neutral and independent organization with no financial interest in electricity generating facilities that administers the operation and use of the transmission network business. This entity is often the same one that operates the wholesale electricity exchange market and the dispatch of power resources to meet utility and non-utility needs or both, but may be a separate entity.

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

Kilowatt-Hour (kWh): Energy equal to a demand of one thousand watts for one hour.

Local Distribution Company (LDC): A utility engaged primarily in the retail sale and/or delivery of natural gas through a distribution system. Some LDCs meet part of their peak demand with a mixture of propane and air.

Market Clearing Price: The price at which supply and demand are in balance, with respect to a particular commodity at a particular time, in a competitive market or an auction.

Market Transformation: The reduction in market barriers to the penetration of certain goods and services, such as energy efficient products, resulting from market intervention, as evidenced by a set of market effects, that lasts after the intervention has been withdrawn, reduced, or changed. Market transformation is sometimes seen as a goal in itself, as well as a strategy to achieve particular goals. For the latter, market transformation mechanisms can be targeted to manufacturers ('upstream'), distributors and retailers ('midstream'), and/or consumers ('downstream').

Measures: Specific actions that occur at the site of the end user and result in energy efficiency – examples include installing insulation or more efficient lighting fixtures, replacing equipment or appliances with more efficient models or altering industrial processes so that they use less energy.

Obligated Entity: An organization that is charged with meeting energy savings targets established by government. Such organizations can be named in law or specified through regulatory processes. Obligated entities may include retail energy providers, regulated distribution utilities, independent non-profit organizations and/or government agencies.

PACE District: A property-assessed clean energy (PACE) special assessment district. A financing mechanism designed for jurisdictions where government revenue is derived in whole or in part from taxes on property owners. Currently being used only in North America, PACE programs rely on a municipality's ability to attract lower-cost capital which is then used to provide property owners with longer term financing for renewable energy installations and energy efficiency improvements. The financing is repaid through a special assessment (similar to assessments for improvement districts) on the property tax bill

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

Policy Mechanisms: The specific laws, regulations and processes adopted by governments to encourage and support the development, implementation of energy efficiency programs and projects.

Privatization: Transferring publicly owned electricity sector assets to private ownership.

Programs: Approaches designed and implemented by obligated entities to directly influence energy efficiency investment decisions by customers. Appliance rebates, technical support and financial incentives for whole building audits/retrofits, and direct installation of efficient lighting are all examples of programs.

Restructuring: The reconfiguration of a country's or state's electricity sector. Restructuring can include the following (singly or in combination): privatization, unbundling, and/or the introduction of competition into various utility business functions.

Smart Appliance: Appliances that have the capability of using communication technology and smart grids to optimize energy use.

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

Smart Meter: An electric meter with electronics that enable recording of customer usage in short time intervals, and two-way communication of data between the utility and the meter.

Societal Cost Test: A measure of energy efficiency cost-effectiveness that considers all costs and benefits, including non-monetized environmental costs and benefits.

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

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. One therm is equal to 105.5 megajoules.

Unbundled Electric Providers: Unbundling refers to either service or corporate unbundling. Service unbundling refers to the disaggregation of electric utility service into functionally distinct components. For example, generation, transmission, distribution, and portions of retail service (including billing) could be unbundled and offered as discrete services. Unbundling can also refer to corporate unbundling in which services are separated into distinct industry groups through divestiture or sale of assets. Unbundling of either type is usually associated with efforts to infuse competition in one or more segments of service.

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. Typical transmission level voltages are 115 kV, 230 kV and 500 kV. 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.

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

Watt-Hour: The amount energy generated or consumed with one watt of power over the course of one hour.

Foreword

Energy efficiency continues to be a low-cost, low-risk resource in both developed and developing economies. In the United States and Europe, decades of experience demonstrate that a suite of energy efficiency enabling policies, complemented by an effective implementation strategy and support mechanisms, will lead to significant energy savings. For example, this model has allowed the State of California to maintain relatively level electricity consumption per capita over the past 40 years, while the rest of the United States has experienced 50 percent growth in per capita electricity consumption. In fast-growing economies like China and India, similar strategies are yielding significant results. During its 11th Five Year Plan, China reduced its energy intensity per unit of GDP by 19 percent.

However, in the 2012 edition of its authoritative annual publication *World Energy Outlook,* the International Energy Agency concluded that there remains significant untapped potential for further cost-effective improvements in energy efficiency. RAP's *Policies to Achieve Greater Energy Efficiency* contributes towards realising these improvements by identifying best practices in developing and implementing policy mechanisms to achieve increased energy efficiency.

Over the past 20 years there have been numerous attempts to identify, describe, and analyse actions taken by governments to support energy efficiency. These endeavours have ranged from databases of government energy efficiency policies and programs, such as those established by the International Energy Agency, through national and regional surveys of government activities such as those carried out by the World Energy Council and the Asia Pacific Energy Research Centre, to assessments of the effectiveness of government achievements, such as the "scorecards" developed by the American Council for an Energy-Efficient Economy.

Consequently, there is now a mass of detailed information available about government energy efficiency policies and programs. However, this information is becoming increasingly hard to digest, and even more difficult to use in developing and implementing new government interventions.

This paper takes a different approach. Rather than attempting a comprehensive survey, the paper builds on previous work by focusing on a relatively small number of policy mechanisms, that is, specific laws, regulations, processes, and implementation strategies that foster the development and use of products and services which require less energy input to deliver the same or more productivity and output.

The paper describes how each policy mechanism operates, assesses its likely effectiveness, and identifies best practices. In this way, the paper provides useful guidelines for those charged with developing new, effective ways for governments to support energy efficiency.

David Crossley
Senior Advisor
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Executive Summary

This best practices guide provides a summary overview of the most effective policy mechanisms that regional, national, state or local governments at the executive, legislative or regulatory level can adopt to achieve significant energy efficiency in buildings, processes and equipment used in the residential, commercial, industrial, public and institutional sectors. By policy mechanism, we mean specific laws, regulations, processes and implementation strategies that foster the development and use of products and services which require less energy input to deliver the same or more productivity and output.[2] Our focus is on how government policies can accelerate and increase efficiency investments to achieve additional savings. We do not address best practices in the design or delivery of efficiency programs that would flow from these policies. Nor do we address tariff structures or energy pricing and financing tools that can be employed to help end users invest in efficiency.

We begin by outlining the key prerequisites to creating energy efficiency policy. These include:

- Articulating goals and objectives
- Outlining criteria for success
- Clarifying roles and responsibilities especially the most appropriate role for government, which we believe to be focused on establishing policy and the rules of the game, not in actually delivering efficiency services.
- Understanding market conditions.

Rather than reporting on policy trends, we highlight the policies that demonstrate the most promise for yielding significant energy and greenhouse gas (GHG) savings. We describe each policy mechanism and possible variations, outline the prerequisites and essential characteristics, summarize "best practices," highlight examples and references that offer explicit guidance in, lessons learned from, and/or comparative approaches to implementing the mechanism. We organized our discussion around three broad policy categories – foundation or enabling mechanisms, implementation strategies and support mechanisms.

Foundational or Enabling Mechanisms – These policies define the over-arching approach or policy paradigm that governments use to achieve energy savings. We address five such policy mechanisms:

- **Codes and standards.** These are mandated minimum efficiency requirements for buildings and minimum energy performance standards (MEPS) for new energy consuming equipment.

- **Integrated Resource Planning (IRP).** IRP is a regulatory requirement that electric and gas providers analyze efficiency as well as supply-side options for meeting their customers' needs and commit to the least cost combination of those investments.

- **Binding Energy Savings Targets.** Binding targets specify levels of energy efficiency savings that must be acquired and by whom they must be acquired. They are typically set either legislatively or by energy regulators based on legislative guidance.

- **Voluntary Agreements.** These are agreements between government and large energy end users to improve energy efficiency by an agreed amount.

- **Enabling New Markets for Energy Efficiency.** Government changes the way energy markets function so that the markets themselves will cause efficiency investments to be made.

2 We do not address other demand-side resources, such as demand response or distributed generation. However, many of the policy mechanisms that we discuss in the context of promoting energy efficiency could also be used to promote other demand-side resources.

Implementation Strategies – Once foundation mechanisms have been adopted, there are three critical questions every jurisdiction must address in order to effectively implement energy efficiency policies.

- Who will oversee and deliver the energy efficiency services?
- How will the services be funded?
- How will accountability be ensured?

The most appropriate answers can vary from jurisdiction to jurisdiction, depending on local political, economic or social conditions and history of energy efficiency activity in that jurisdiction. In some jurisdictions there are multiple parties involved in the delivery and a variety of funding mechanisms, in others there may be only one or a few. Every jurisdiction needs to consider their goals, country culture, market environment and existing institutional structure in order to determine the most appropriate mechanism(s) to answer these key implementation questions. The wide variation in local circumstances has led to a variety of successful best practice approaches.

We highlight a number of potential delivery partners – energy providers, end users, quasi-government entities, public/private partnerships and contracts with third parties.

Funding options include: government-directed sources such as public benefits charges, energy provider obligations, direct appropriations or allocation of the proceeds from emissions or carbon trading; publicly partnered financing schemes; and market-based mechanisms including tradable white certificates and forward capacity markets.

We then highlight the importance of establishing evaluation, measurement and verification protocols as well as performance incentives or penalties.

Support Mechanisms – These policies can play important roles in enhancing the effectiveness of the core strategies. We provide descriptions and additional information for twelve mechanisms.

1. Mandatory energy audits and use disclosure
2. Mandatory energy labels
3. Energy efficiency information centers
4. Customer feedback
5. Energy pricing
6. Tax Relief
7. Tax Levy on end users
8. Decoupling/Revenue regulation
9. ESCO development strategies
10. Training and certification
11. Research, development and demonstration
12. Government as Exemplary Performer

We then look at how jurisdictions have combined the mechanisms to achieve energy efficiency goals by examining six case studies – Denmark and Germany in the EU, the US states of California and Vermont, China and India. The US and European examples have achieved significant GHG and energy savings while India and China both provide examples of approaches and lessons for fast-growing economies.[3]

Finally, we offer conclusions about the essential attributes to being a global efficiency leader and offer a few suggestions on directions for the future.

3 Currency conversions information provided in the case studies are based on average exchange rates for the relevant time period using http://www.oanda.com/currency/average. Current rates are based on the most recent quarter.

1. Introduction

The intent of this best practices guide is to provide a summary overview of the most effective policy mechanisms that governments can adopt to achieve significant energy efficiency in buildings, processes and equipment used in the residential, commercial, industrial, public and institutional sectors. By *policy mechanism*, we mean the specific laws, regulations, processes and implementation strategies adopted by governments to encourage and support the development and implementation of energy efficiency programs and projects. We define government broadly to include regional, national, state and local levels, as well as legislative branches, executive branches and regulatory agencies. Energy efficiency, as defined in this guide, encompasses initiatives that foster the development and use of products and services which require less energy input to deliver the same or more productivity and output.[4] It should be noted that some efficiency investments would occur without any government policy interventions, producing what are sometimes called "naturally-occurring savings." Our focus is on how government policies can accelerate and increase efficiency investments to achieve *additional* savings. Our intent is for this guide to serve as both a primer for those new to the field and an important refresher for seasoned policymakers looking to enhance existing approaches to energy efficiency.

The underlying premise for developing and implementing policies to enhance energy efficiency is that a variety of market barriers currently lead to much less than economically optimal levels of investment in end-use efficiency. Barriers include energy prices that do not accurately reflect the full societal cost of energy (including environmental and international security costs); unequal treatment of risk between efficiency and alternative energy supply measures; consumers' lack of information on the opportunities for and benefits of efficiency investments; split incentives between landlords who make investment decisions and tenants who pay energy bills; and the hassle, especially for households and small organizations of identifying all the energy efficiency measures and then organizing a variety of contractors to implement them.[5]

In all cases, our focus is exclusively on government policy. We do not address best practices in the design or delivery of efficiency programs that would flow from these policies. There are already a host of guides to effective programs including many documents available through the web sites of the International Energy Agency (IEA) and the American and European Councils for an Energy Efficient Economy.[6] Nor do we address tariff structures, energy pricing or financing tools that can be employed to help end users invest in efficiency.

Rather than reporting on policy trends, we have highlighted the policies that demonstrate the most promise for yielding significant energy and greenhouse gas (GHG) savings. Our focus is on government-initiated policies that foster market adoption of energy efficiency technologies and/or behavioral change. We have organized our discussion around the following three policy categories:

- **Foundational or Enabling Mechanisms** – These policies define the over-arching approach or policy paradigm that governments use to achieve energy savings. We address five such policy mechanisms.

4 We do not address other demand-side resources, such as demand response or distributed generation. However, many of the policy mechanisms that we discuss in the context of promoting energy efficiency could also be used to promote other demand-side resources.

5 Detailed discussion of these and other market barriers can be found in Sorrell et al., 2000 and Sorrell, 2004.

6 See www.iea.org, www.aceee.org, www.ecee.org, as well as http://www.eebestpractices.com/index.asp, http://www.dps.state.ny.us/07M0548/workgroups/WG2_NYC_Program_Best_Practices_Case_Studies_101207.pdf, http://www.ret.gov.au/energy/efficiency/best_prac/Pages/default.aspx and Bertoldi et al., 2010.

- **Implementation Mechanisms** – These policies put "meat on the bones" of the foundational or enabling mechanisms, addressing such questions as: who will be responsible for implementation; how implementation will be funded; and how accountability for effective implementation will be ensured. We address a number of different policy approaches to each of these questions.

- **Support Mechanisms** – These policies are not essential to carrying out the core strategies, but can play important roles in enhancing the effectiveness of the core strategies. We summarize twelve of these support mechanisms.

In the following pages we discuss several important issues governments should consider before determining what path they will pursue for promoting efficiency.

We then provide overviews of each policy mechanism – we offer a description of the mechanism, grade their effectiveness in achieving significant energy savings, describe variations, outline the prerequisites to their adoption, detail essential characteristics, summarize "best practices," and recommend potential improvements over time. For each mechanism we provide practical examples of the mechanism as implemented with links to relevant web sites that provide additional information. Where we are aware that they exist, we suggest references that offer explicit guidance in, lessons learned from, or comparative approaches to implementing the mechanism. We then provide six case studies describing how widely-varied jurisdictions around the world have effectively combined many of these mechanisms to achieve substantial energy efficiency savings. Finally, we offer some over-arching conclusions about what is required to be a global efficiency leader and possible new directions on the horizon.

2. Prerequisites to Creating Policy

A. Articulate Goals and Objectives

The first step for any effective policy is to understand why it is being created. While energy efficiency is a worthy goal in and of itself, jurisdictions often seek to meet a variety of additional policy objectives. These include reducing greenhouse gas emissions, reducing energy costs for consumers, obtaining increased energy security, lowering energy imports, conserving foreign exchange, increasing system reliability, enhancing economic development and job creation, improved competitiveness, improving building and housing stock, reducing the energy burden on low-income households, and enhancing public health. It is essential for these goals and objectives to be articulated and prioritized before deciding upon the specific details of any mechanisms. Clarity on goals is essential to guide energy regulators and implementers.

B. Criteria for Success

The second step is to recognize specific criteria that are crucial for success in achieving policy objectives, regardless of the mechanisms selected. First and foremost is a commitment to a consistent and sustained, long-term effort. Market participants, businesses and citizens need to be assured that government will be consistent in its approach to energy efficiency prior to making decisions about efficiency investments, restructuring their businesses to meet new market demands or making process changes. These entities need to feel confident that the policy will not be significantly altered with each change in government or leadership of an energy agency or regulatory body.

Policy makers need to recognize that ramping-up energy efficiency programs in response to policies takes time. If oversight is provided by energy regulators or other government bodies for programs being delivered by energy providers or other market participants, it can take three to twelve months just to establish the operating framework. Once the framework is defined, programs need sufficient time for recruiting and training program staff, rollout, market penetration and adoption. Well-recognized successful programs take at least several months to staff, design and launch; some take up to a year to begin to gain any market traction.[7] They are then able to grow and expand.

A final criterion for successful policies is that they allow flexibility to the entities charged with their implementation as long as these entities are delivering measurable results that meet the jurisdiction's policy goals and objectives. These entities should have the ability to determine the specifics of their design, implementation and delivery. Program deliverers need the ability to decide upon the best options for program design and delivery and the flexibility to be able to adjust and to innovate in response to lessons learned and changing market conditions. An important corollary is that the target or measurable result should focus on successful outcomes rather than inputs e.g. achieving the desired energy savings rather than the amount of money spent.

C. Clarity about Participants and Roles

Energy efficiency policies involve and affect a broad range of actors including legislators, energy regulators, other government agencies, wholesale and retail energy providers, equipment and appliance manufacturers, property developers and owners, building contractors, engineers and architects, land use planners and end use customers in sectors including industry, commerce, institutions, government and households. Government needs to be clear at the outset about the roles each of these groups of actors are expected to play in the rollout of an energy efficiency strategy.

Experience also suggests that energy savings objectives are most likely to be met if government's strategy includes a performance-based obligation on one or more entities in the market. Put another way, success can be clearly tied to

7 Lemoine, Huebner, Pickles, Prindle, & Buehler, 2009

both assigning responsibility for meeting energy savings goals and ensuring that there are consequences – financial and possibly others – for meeting or failing to meet those goals. A performance-based delivery framework places accountability for meeting goals on a specific organization or set of organizations – or "obligated entities." As we use the term, "accountability" refers both to responsibility for successful achievement of the goals, as well as reasonable flexibility in determining how best to achieve them.

While the obligated energy-savings *delivery* entities should be made directly accountable for results and face meaningful performance-based consequences, government has a key role to play. In addition to establishing the policy framework and defining the energy savings goal, government will need to identify sources of funding,[8] and act as or delegate the role of policy administrator to a government agency, regulator or named third party. Roles that need to be addressed through codification in laws or regulations or processes defined by the administrator include: defining the performance parameters of the obligation; outlining the oversight process and roles including the levels of transparency; spelling out the consequences for achieving or failing to achieve the goals; promulgating complementary regulations; and reinforcing the objectives of the initiative through communications with the public.

The development of a robust, competitive private sector infrastructure for the delivery of efficiency services is also critically important. Specifically, the private sector should be relied upon to complement the efforts of the government and its obligated entities. Roles for the private sector include financing, sale of efficient products and services and installation of the efficiency measures necessary to meet goals.

These roles are summarized in Figure 1 below.

8 As discussed further on page 40, funding can include government appropriations, direct regulatory spending mandates and/or obligations on various parties to achieve energy savings.

Figure 1

Roles of Participants in Energy Efficiency Policies

Government	• Establishes savings targets/goals • Identifies type of entities to be obligated • Identifies expected source of funding • Defines broad performance parameters, oversight process and consequences • Promulgates complementary regulations
Policy Administrator May be Government or its designee	• Negotiates performance parameters and consequences with obligated entities • Establishes consequences for failing to meet energy savings goals • Verifies achievement of savings goals
Obligated Entities	• Develop and continually refine strategy • Manage implementation of strategy • Supply chain development and relationships • Interact with end use customers • Quality assurance • Track and report (budget/expenses and energy saving results)
Private Sector • Product and Service Providers • Lending Institutions • Local Authorities • Community Organizations • Others	• Leverages strategy to sell efficiency • Provides financing • Installs efficiency measures

D. Understand Market Conditions

Policy makers need to fully understand the cultural norms for implementing change in their jurisdictions. In some regions, negotiating voluntary standards or agreements will be the most appropriate strategy; in others, government mandates may be the most successful approach.

Decisions on who is responsible for meeting goals should also be governed by local conditions, including the extent of market liberalization, the number of obligated entities, local capabilities and history of energy efficiency initiatives, social structures, economic conditions, political realities and other factors.

Fully understanding the market requires an assessment of the type and extent of barriers facing end users in each of the service sectors. Questions to consider include the following:

- What are the motivations that will propel a given class of end users to implement more energy efficiency?
- Are those end users most effectively motivated by regulatory requirements, financial incentives, increased productivity, healthier environments, having a greener image or some mix of those?
- What has stymied or encouraged end user investment in energy efficiency in the past for that class of end users?
- Are the barriers for that class of end users technical, financial, institutional or informational? How can they be mitigated?

The responses to each of these questions will vary greatly from jurisdiction to jurisdiction and among classes of end users – effective policies are responsive to these differences.

3. Policy Mechanisms

Within this guide, the term *policy mechanisms* refers to the specific policy initiatives taken by governments to encourage and support the development and implementation of energy efficiency programs and projects. Those mechanisms create the framework under which programs that directly influence investment decisions by customers are designed and implemented by obligated entities. Policy mechanisms include laws and regulations pertaining to energy efficiency, the process by which increased energy efficiency is obtained, who oversees the delivery of energy efficiency services and how efficiency programs are funded, as well as government-sponsored support initiatives.[9] Specific user approaches such as appliance rebates, technical support and financial incentives for whole building audits/retrofits, and direct installation of efficient lighting are all examples of programs. Measures are specific actions that occur at the site of the end user and result in energy efficiency – examples include installing insulation or more efficient lighting fixtures, replacing equipment or appliances with more efficient models or altering industrial processes so that they use less energy.

This guide focuses exclusively on policy mechanisms.[10] Rather than serving as a compilation of trends, it outlines what we consider to be the most effective policy mechanisms that governments can adopt to achieve significant energy efficiency in their jurisdictions. We describe each policy mechanism and then provide a brief outline of potential variations, details about the prerequisites and essential characteristics for its effective implementation, best practices, examples and specific links to resources that can provide more detailed information about adopting the policy mechanism.[11] We rate the effectiveness of foundation and support mechanisms using a star system; three stars indicate that we believe the mechanism to be critical to achieving aggressive savings; two stars suggesting opportunities for significant energy savings and one star denoting some savings potential. We also believe that addressing the broad questions of delivery, funding and accountability to be critical to achieving aggressive savings.

A. Foundation or Enabling Policy Mechanisms

Foundation mechanisms are the essential first steps in developing a jurisdiction's energy efficiency policy. They provide answers to the questions of "why" and "how." Put another way, they reflect different, over-arching policy paradigms.

9 For the purposes of this paper, we used the word "funding" to describe the sources required to establish and administer programs, exercise oversight, and evaluate performance. The word "financing" is used to describe the source(s) of funds that end use customers use to implement energy savings measures.

10 For more information about program best practices, see http://www.eebestpractices.com/index.asp, http://www.dps.state.ny.us/07M0548/workgroups/WG2_NYC_Program_Best_Practices_Case_Studies_101207.pdf, http://www.ret.gov.au/energy/efficiency/best_prac/Pages/default.aspx and Bertoldi et al., 2010

11 Currency conversions information provided in the case studies are based on average exchange rates for the relevant time period using http://www.oanda.com/currency/average Current rates are based on the most recent quarter.

There are five foundational mechanisms or paradigms:

- **Codes and standards.** These are mandated minimum efficiency requirements for buildings (typically, but not always, for new construction and major renovation) and minimum energy performance standards (MEPS) for new energy consuming equipment. They are typically imposed on builders and equipment or appliance manufacturers.[12]

- **Integrated Resource Planning (IRP).** IRP is a regulatory requirement that electric and gas providers analyze the life-cycle costs and benefits of the full range of supply-side and demand-side (including end user energy efficiency) options for meeting their customers' needs on an equal basis and commit to the least cost combination of those investments.

- **Binding Energy Savings Targets.** Binding targets, often called Energy Efficiency Resource Standards (EERS) or Energy Efficiency Obligations (EEOs), specify levels of energy efficiency savings that must be acquired and by whom they must be acquired. They are typically set either legislatively or by energy regulators based on legislative guidance.

- **Voluntary Agreements.** Voluntary agreements are, as their name suggests, agreements by a large energy consumer to improve energy efficiency by an agreed amount. They are typically established between government and large energy end users and sometimes linked to avoiding certain taxes or levies if the agreed target is met. They may be in terms of absolute energy consumption or consumption per unit of the consumer's output, such as MWh per unit of value added or per unit of service provided.

- **Enabling New Markets for Energy Efficiency.** Under this approach, government changes the way energy markets function so that the markets themselves will cause efficiency investments to be made.[13] This can occur by allowing efficiency (and other demand resources) to compete on price with generators, transmission providers and other supply alternatives to meeting various energy sector needs (e.g. acquiring peak electric capacity, addressing transmission reliability, meeting system-level energy needs). Although this approach has not yet been fully tested to meet all of these needs, there is growing interest in considering new ways to enable markets (e.g. efficiency "feed-in-tariffs").

These policy mechanisms are not mutually exclusive. For example, some jurisdictions have binding system-level savings targets as well as requirements to go beyond those targets in geographically specific regions when integrated resource planning suggests deeper levels of savings in those areas can cost-effectively defer transmission or distribution system upgrades. Voluntary agreements with specific industries and the creation of specific markets for efficiency can also be viewed as complements to IRP or binding system-level targets. Codes and standards are always complementary to the other four foundation policy mechanisms as they remove the poorest performing products from the marketplace and encourage consumers to purchase more efficient and cost-effective products. All of these enabling mechanisms will be further enhanced by policies that address the considerations described in the sections on implementation strategies and support mechanisms.

Globally, most jurisdictions that aggressively pursue energy efficiency rely on a combination of codes and standards *and* at least one of the other four foundational policy mechanisms. Experience suggests that this is a minimum requirement for achieving significant levels of savings. The remainder of this subsection details the particulars of the five foundational policy mechanisms.

12 Codes and standards are often supported by mandatory labeling which allows the differentiation between the "best and worst" products/buildings in terms of energy efficiency. This support mechanism is detailed on page 61.

13 In this context, we consider white certificates to be a market-based implementation or funding mechanism, rather than a foundational mechanism because they have no value absent a binding savings target/obligation (i.e., the savings target obligation is the foundation mechanism and white certificates are a market-based way to fund the meeting of targets).

i. Energy Efficiency Standards and Building Codes

Description	Standards are laws or regulations that specify the required energy performance of manufactured products including appliances, electronics, lighting and HVAC and process equipment. Building codes pertain to new construction and the energy system maintenance and performance in existing buildings. Codes and standards are often combined with energy labeling (see page 61, Mandatory Energy Labels). "[L]abeling stimulates technological innovation and the introduction of new more efficient products, while standards effect the gradual removal from the market of the least energy efficient appliances"[14]
Effectiveness	★★★ – Critical for achieving aggressive savings.
Variations	Standards and codes have wide variation. They can be: prescriptive – that is, they detail the required features of all products or buildings; minimum energy performance standards (MEPS) which specify the maximum permissible energy use or minimum acceptable performance for a product or building; and/or class-average standards which specify average efficiencies, thereby "allowing each manufacturer to select the level of efficiency for each model so that the overall average is achieved."[15] Class-average standards allow for more flexibility but also allow for the sale of less-efficient products. In addition, compliance with a class-average standard can only be assessed after the event. Codes and standards can be created through a government mandate or an agreement negotiated between government and the affected parties (e.g. manufacturers or building professionals). Existing buildings are usually exempted from or subject to a lower, age-specific building version of a building code, but a code may impose stricter standards that are triggered at the time of a building's sale or transfer in tenancy, which can be particularly useful in achieving improved energy performance in existing buildings.
Prerequisites	In order to have effective standards, there has to be a national or regional statutory framework covering the product or property. The standard and any associated labeling is developed following consultation with all stakeholders including product manufacturers or building professionals. Finally, a jurisdiction needs access to a regional or national certification center that is able to verify compliance of products with the law.

14 World Energy Council, 2008

15 See more information at: http://www.clasponline.org/clasp.online.resource.php?no=21&page=2

Essential Characteristics	Successful codes and standards are constantly evolving in response to changes in technology and market forces. They are particularly essential for new products and buildings. They are promulgated by trusted parties that understand the development cycles inherent to the product being manufactured or built and therefore allow sufficient preparation time for adoption or amendment. They apply to all industry participants, they are accompanied by information and training, and they are readily understandable to the sector that must comply with them. Codes and standards must have clear implementation dates. The availability of incentives can encourage early adoption. Finally, they must be effectively and efficiently enforced with meaningful penalties for non-compliance.
Best Practices	New construction thermal building codes that consider the whole building as a system and define maximum acceptable energy consumption per square or cubic meter of conditioned space. Higher-level energy requirements in existing buildings that are triggered at the time of renovation or when there is a change in occupancy due to sale or new lessee. Energy management standards that govern the qualifications of personnel operating energy systems in large buildings. Requirements about maintenance of heating systems. A process and schedule for regular updating of the code or standard. Standards should be set at a level of efficiency that is economically optimal for the average occupant (whether an owner or tenant) given life-cycle costing. Best practice is to coordinate the standard with other energy efficiency programs. This helps to bring the market to improved levels of efficiency as market prices for those efficiency products come down (with volume) and they become economic enough and sufficiently tested to warrant becoming the new standard.
Changes Over Time	Codes and standards typically define the minimum level of acceptable energy performance. Over time, they must be regularly reviewed and strengthened, especially when there are major changes in available technologies or energy costs.
Complementary Mechanisms	Energy efficiency programs resulting from binding targets or IRP.

Key Examples

Denmark's Building Regulations include a comprehensive set of mandatory energy requirements. The code specifies maximum energy use per square meter of heated floor area for specific building types as well as standards for insulation and air leakage.[16]

Korea's Energy Efficiency Label and Standard Program requires the manufacturers of 24 products to label their products and meet MEPS or be prohibited from manufacturing and selling their products. Its e-Standby Program requires mandatory standby power warning labels.[17]

Japan's Top Runner Program is a class-averaging variation on MEPS. It identifies the most efficient model on the market of 24 different energy-intensive product categories including vehicles, office equipment, appliances and HVAC equipment and then stipulates that the efficiency of this "top runner" shall be the weighted average standard for all products in the category within four to eight years.[18] Between 1997 and 2004, Japan achieved 68 percent savings for air conditioners and 55 percent for refrigerators.

California has Appliance Efficiency Regulations that create standards for twenty-three categories of appliances that are sold or offered for sale in the state, subject to very limited exceptions.[19] Its Building Energy Code applies to all residential and commercial buildings and exceeds 2009 IECC. Buildings must also meet CALGreen, the statewide green building code.[20]

The Canadian Province of Ontario's Building Code, requires that the energy efficiency of buildings securing a permit beginning in 2012 exceed, by not less than 25 percent, the energy efficiency levels attained with conformance to the 1997 Model National Energy Code for Buildings (MNECB+25 percent).[21]

In the US, Memphis, Tennessee, has adopted minimum energy efficiency standards for rental housing units in which the tenants (as opposed to the building owners) pay for energy.[22] Burlington, Vermont, has a "time of sale" Minimum Rental Housing Energy Efficiency Standards Ordinance.[23]

Implementation References

Collaborative Labeling and Appliance Standards Program (CLASP) - http://www.clasponline.org

Online Code Environment and Advocacy Network (OCEAN) - http://www.bcap-ocean.org/

16 See more information on Section 7 at: http://bcap-ocean.org/sites/default/files/Bygningsreglementet_englesk.pdf

17 See more information at: http://www.kemco.or.kr/new_eng/pg02/pg02100101.asp

18 See more information at: http://www.eccj.or.jp/top_runner/index.html

19 See more information on appliances at: http://www.energy.ca.gov/appliances

20 See more information on buildings at: http://www.energy.ca.gov/title24/

21 See more information at: http://www.mah.gov.on.ca/Page9528.aspx

22 See more information at: http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=TN05R&re=1&ee=1

23 See more information at: http://www.burlingtonelectric.com/ELBO/assets/INTRODUCTION%20TO%20TOS%20ORDINANCE.pdf

ii Integrated Resource Planning (IRP)

Description	Laws or regulations that require retail energy providers of electricity, natural gas, or both (regardless of whether they provide vertically-integrated or unbundled services) to systematically evaluate the least cost/least risk portfolio of resource choices including energy efficiency and load management program options. Least cost is defined in terms of life cycle present value of the portfolio over a suitable long term planning period; network operators are further required to implement the most cost-effective approaches. IRP encompasses the analysis process, the development of the plan, its implementation, evaluation and the process for stakeholder involvement. IRP requirements can establish a market for demand-side resources where such a market does not already exist; and can increase the implementation of demand-side resources.
Effectiveness	★★ – Opportunities for achieving significant savings in regulated energy supply systems.
Variations	Variations involve who carries out the planning, the range of potential resources, and the valuing and comprehensiveness of societal and environmental costs (e.g. emissions, carbon, land use, water use, waste disposal, decommissioning) can all vary based on a jurisdiction's overall energy and climate goals and objectives. IRP requirements can be implemented in both vertically integrated and restructured markets, and can be imposed on electricity providers that own and operate transmission and distribution networks. A mechanism analogous to IRP is a requirement that electricity providers include all available cost-effective energy efficiency measures when they are acquiring resources. The mechanism adds a condition to the resource acquisition procedure. A "loading order" is a variation in which electricity demand must be met first by cost-effective energy efficiency measures.
Prerequisites	Regulators that recognize the social and economic benefits of expanding beyond supply resources and motivated energy providers who are willing (or required) to publicly identify current and projected load growth, load profiles and constraints and geographic limitations. A lack of readily available supply resources has often provided the initial motivation. IRP requires an entity with significant analytical resources and sophisticated data collection to be charged with the responsibility of carrying out system planning. In traditional markets, this role has typically been performed by a vertically integrated energy utility. However, IRP can also be conducted by regulated distribution and/or transmission utilities to identify least cost paths to addressing distribution and/or transmission reliability needs.

Essential Characteristics	IRP requirements should be well-framed in law, regulation or through case precedent. The requirements should detail the planning objectives, resources to be examined, the planning horizon (typically 10 to 20 years), consideration of end effects (the economic value or cost of a resource still in service at the end of the planning horizon), the frequency with which plans must be updated (three to five years), the factors to be addressed (e.g., risk, reliability, diversity, environmental costs, etc.) and the standard against which alternatives are measured (typically life-cycle costs). The overall objective is a consistent and integrated methodology for evaluating demand and supply resources. The regulator, energy agency and energy providers must have a mutual understanding of the procedures, protocols and sufficient funding for evaluating resources and their cost-effectiveness. There must also be transparency in the process and an opportunity for engagement from interested entities and potentially competitive service providers. Providers also need clear expectations regarding obligations to follow through on the implementation of least cost plans. Key steps in the development of an IRP are to forecast demand, identify specific resource options and their costs – both supply resources (existing and new plants, purchases, and distributed generation) and demand-side resources (energy efficiency (EE) programs, promoting efficient new construction, reducing transmission line losses, etc.), and sometimes even future requirements for transmission and distribution infrastructure. Subsequent steps are to develop the optimal portfolio of resources to meet the jurisdiction's objectives, solicit and respond to public consultation and finally, create and implement the long-term plan. After the plan is implemented, evaluation and measurement of the programs is conducted, which in turn informs the next iteration of the IRP.
Best Practices	Best Practices IRPs include load forecasts that utilize end-use and econometric models under a range of load growth scenarios. The models assess energy efficiency resource potential as well as its costs, supply curves and availability. Environmental and societal costs and benefits are included in assessing the cost-effectiveness of resource options. When assessing generation potential, the models include uncertainty in resource cost, construction schedules and availability. They also require the IRP process to be integrated with construction permit and energy provider ratemaking processes. Finally, they assess cost and risk across a range of future conditions to prepare a resource portfolio and option model. In addition, the entire process is subject to public review and input.[24]
Changes over time	For vertically integrated utilities, IRP requirements usually start at the system level. That is, the utilities are charged with determining how to meet their customers' annual energy and peak demand needs at least cost. More sophisticated jurisdictions also require an IRP approach to meeting distribution or transmission reliability needs at least cost, taking into account the effect of those approaches on life cycle power cost. For utilities that are not vertically integrated, regulators typically require an IRP approach to meeting needs at least cost taking into account costs and risks associated with market based power supply, often implemented by the distribution utility.

24 Messenger & Eckman, 2010

Complementary Mechanisms	Renewable portfolio standards, BEST, forward capacity markets, all energy efficiency implementation mechanisms.
Key Examples	The Northwest Power and Conservation Council is authorized to develop electric energy plans for the four Northwestern states in the US. Its latest plan estimates that conservation and efficiency can "be available and cost-effective to meet 85 percent of the region's load growth for the next 20 years."[25] The US State of Connecticut requires its two investor-owned utilities to submit an annual IRP for the state as a whole. Connecticut statute dictates that "resource needs are to first be met through all available energy efficiency and demand reduction resources that are cost-effective, reliable and feasible."[26] The US State of California has a "loading order" policy that requires cost-effective energy efficiency to be the top priority energy resource for meeting power needs.[27] The loading order applies when investor-owned utilities submit procurement plans.
Implementation References	IEA DSM Guidebook (Task IV) - http://www.ieadsm.org/ViewTask.aspx?ID=17&Task=4&Sort=4 US AID Best Practices Guide - pdf.usaid.gov/pdf_docs/PNACQ960.pdf UNEP – Tools and Methods for Integrated Resource Planning (Swisher, 1997) - http://uneprisoe.org/IRPManual/IRPmanual.pdf Survey prepared for the American Clean Skies Foundation (Wilson & Peterson, 2011) RAP Publications - http://www.raponline.org/ Con Edison's approach to Planning for Efficiency (Gazze, 2011) - http://www.fortnightly.com/pdf.cfm?id=08012011_PlanforEff.pdf

25 Northwest Power and Conservation Council, 2010

26 Connecticut Public Act No. 07-242, section 51 available at: http://www.cga.ct.gov/2007/act/pa/2007pa-00242-r00hb-07432-pa.htm

27 See more information at: http://docs.cpuc.ca.gov/published/REPORT/51604.htm

iii Binding Energy Savings Targets

Description	A legally-binding quantitative cap or target on energy use, energy savings or emissions which is established in law by the Government and imposed on regulated or other entities. Targets may be set as a capped value or volume, typically for a long-term period in the future or as a goal compared to a base year or projected baseline. They are most frequently defined in terms of a specific energy or demand goal (kWh or kW), savings (% as compared to base or baseline), emissions reduction (tCO_2e) or in terms of energy or emissions intensity (kWh or tCO_2e per GDP). Binding energy savings targets are also called Energy Efficiency Resource Standards (primarily in North America) and Energy Efficiency Obligations (primarily in Europe).
Effectiveness	★★★ – Critical for achieving aggressive savings. Targets are generally very effective in establishing new markets for energy efficiency as a resource.
Variations	Targets may be created based on total energy, peak demand or grid expansion. They may be expressed in terms of primary energy or final energy delivered to end use sectors and can be imposed on the economy as a whole or on specific sectors or jurisdictions. Jurisdictions may adopt longer-term cumulative savings targets, in which lifetime savings of energy efficiency measures are counted and annual targets increase over time to reflect this; or yearly savings targets that provide short-term goals. Targets can also be married to additional policy objectives. Examples might include requirements that significant portions of savings come from long-lived measures or from low income households. Targets can be imposed on energy retailers, distributors, large customers, or an agency charged with delivering energy savings. The obligation can be imposed on a central agency or shared among energy suppliers and large customers. Targets may be used with vertically integrated or unbundled electricity providers. In many regions, obligations are verified with a certificate of savings (white certificates) certified by the oversight entity. A number of jurisdictions have established markets for trading these white certificates.[28] Some jurisdictions require obligated parties to pay for the resource delivered, but the parties have no role in delivering the energy efficiency. In addition, some jurisdictions allow obligated parties to make a compliance payment in lieu of meeting the target.
Prerequisites	Binding energy savings targets require a transparent methodology to establish base or baseline energy use. They are substantially easier to implement if the jurisdiction has a history with implementing energy efficiency programs or if there are well established market data and trends for sales of energy efficiency measures.

28 See page 50 of this report for more information about tradable white certificates.

Essential Characteristics

"Targets need to balance achievability and ambition."[29] To be effective and to minimize free riders, they must exceed business as usual.[30] They need to be for a period of time that provides ample opportunity for achieving success without being so far out into the future that they lose relevancy due to any rapid market transformations that reduce the energy saving values.

In setting targets, a regulator or government determines the level of the target to be achieved, who the obligated parties will be, and the energy efficiency measures that will be included in measuring savings to achieve the target.

There must be a transparent, regular and straightforward system for measuring and monitoring progress including clear procedures for defining eligible energy savings and annual variations due to weather or business cycles.

Mandated obligations need effective and independent evaluation, measurement and verification (EM&V) protocols, a method to address cost recovery (if applicable), and penalties for non-compliance. In particular, if the obligation is placed on a regulated entity, there needs to be a funding mechanism that is sufficient to achieve the target. In most cases, these schemes require a governing body or regulator to administer the targets, establish rules, assess penalties and oversee trading if it is permissible. Additional requirements include an implementation infrastructure that defines the roles and obligations of key players including energy regulators, energy producers, transmission operators, distribution entities, energy retailers, appliance manufacturers, builders and end users.

There must also be clarity about how the target interacts with other policies including codes and standards, use of renewable energy, mandated end user energy performance targets, emissions regulations, regulatory obligations on energy providers and energy supply plans. In particular, only energy savings arising from going beyond legislative requirements (i.e., codes and standards) should be counted towards the obliged entities' targets.

Targets and the methodology by which performance is measured should be clearly documented and communicated. The targets are accompanied by a robust and universal EM&V protocol that allows for deemed savings.

Best Practices

Leading jurisdictions are achieving incremental "first year" annual electric savings levels of 1.5 percent to 2.5 percent per year. Though some savings targets are expressed in such "first year" terms, that approach is increasingly being viewed as leading to too much emphasis on cheaper short-lived measures and under-valuing longer-lived measures. Thus, targets expressed in terms of lifetime savings but derived from annual consumption figures (or perhaps as first-year savings with minimum average lifetime requirements) are preferable. Best practices include a focus on achieving all the cost-effective energy savings at a site, instead of "cream skimming" only the low-cost, easy-to-install measures.

29 Wade, 2011

30 Free riders are customers who would install an energy efficiency measure without any incentive because of the return on investment of the measure, but are eligible to receive a financial incentive under a given program offering that energy efficiency measure.

	Centralized accountability at a single delivery agency fosters coordination, mitigates customer confusion and facilitates data collection and program evaluation. Targets are accompanied by a meaningful incentive or penalties framework that imposes accountability on obligated parties. Options include providing financial incentives for achieving savings, imposing penalties on obligated parties that do not achieve the targets and the threat of losing the responsibility and the business in the future. In view of the changing values of energy savings from certain energy efficiency measures over time, a useful time horizon for energy savings targets is of the order of three years. However, to signal to the energy efficiency industry that these are long term activities and to encourage them to invest to meet the required step change in energy efficiency activity, a clear signal should be given that such obligations will remain in place for some time, e.g., for ten years. If the goal is energy savings and GHG reductions, it is better to set a goal that relies on more than just peak demand. A focus solely on peak demand reduction involves strategies that are less durable and may not result in any energy savings by end users, may yield lower GHG savings, and are less comprehensive and not as responsive to customer needs.[31]
Changes Over Time	Higher level savings targets and broader range of applicability
Complementary Mechanisms	IRP; codes and standards; see all of the Implementation mechanisms; white certificates; voluntary programs; allowing efficiency to count in RPS strategies; decoupling.
Examples	The UK Energy Efficiency Obligation has been in place since 1994. Its current Carbon Emissions Reduction Target (CERT)[32] sets mandatory carbon reduction targets in the residential sector for retail electricity and gas suppliers who have 50,000 or more residential customers. The CERT sets an overall target of reducing 293 million lifetime tons of CO_2 for the period from the beginning of April 2008 to the end of 2012.[33] The UK's policies have resulted in a 15 percent drop in annual residential gas consumption over the five years from 2005-2010.[34] China's Top-1000 Program set energy-saving targets for the 1008 highest energy-consuming enterprises in nine industrial sectors. Launched in 2006, the program encompasses: the national government, which sets the objectives, targets, scope and implementation guidelines; provincial governments, which oversee the details of implementation and the enterprises which must report annually on their progress. The Program met its initial energy savings goal by 2009.[35]

31 Parker, 2008

32 For Cert Technical Guidance Manual see: http://www.ofgem.gov.uk/sustainability/environment/energyeff/infprojmngrs/documents1/TM%20guidance.pdf

33 See more information at: http://www.decc.gov.uk/en/content/cms/funding/funding_ops/cert/cert.aspx

34 See more information at: http://www.eceee.org/columnists/Eoin_Lees/Do_Obligations_Work/

35 Price et al, 2011 and Taylor, Draugelis, Zhang, & Ang Co, 2010

The US State of Massachusetts Green Communities Act requires utilities to acquire "all available energy efficiency and demand reduction measures." Since the Act provided no guidance about the quantity of demand reduction available, an EERS-style policy was negotiated between the relevant parties and the Energy Efficiency Advisory Council (EEAC). The Massachusetts Department of Public Utilities (DPU) approved targets of 1.4 percent of retail energy sales in 2010, 2.0 percent in 2011 and 2.4 percent in 2012.[36] The DPU also approved gas savings targets of 13,598,098 therms in 2010, 19,097,305 therms in 2011 and 24,706,795 therms in 2012.[37] As a percentage of retail sales, the targets are 0.6 percent, 0.9 percent and 1.15 percent, respectively.

India's Perform, Achieve and Trade (PAT) scheme has established energy consumption targets for around 460 energy intensive industrial companies for the period from 2011 to 2014. The savings targets, which are estimated to total 10 Mtoe, reflect about 4 percent savings for the period.[38]

iv. Voluntary Agreements

Description	A formal contract between government and a business, institution or industry association that compels the participant to document and manage their energy use, GHG emissions or both, to agree to a future target and to detail the energy efficiency investments they plan to undertake. Although called "voluntary," these agreements are often used in conjunction with tax relief if targets are met or under the threat of adopting energy and/or GHG emissions taxes. Voluntary agreements may be the result of government/industry negotiations in cooperative cultures or environments where prescriptive approaches or more traditional mechanisms have been politically stymied or would not be well received. By their nature they are really only workable for sophisticated energy users and have not been applied to households or small businesses.
Effectiveness	★ – Tool that has potential for energy savings
Variations	Voluntary agreements are often accompanied by favorable tax treatment or financial incentives. They are frequently the first step in developing an emissions trading scheme.
Prerequisites	Data about existing energy use baselines, adequate EM&V resources, technical expertise regarding large customer energy efficiency measures.

36 See more information at: http://www.ma-eeac.org/docs/091006-KeyIssuesOfferDOER-AG-EEAC-Approved.pdf

37 2010-2012 Massachusetts Joint Statewide Three-Year Gas Energy Efficiency Plan: http://www.ma-eeac.org/docs/DPU-filing/GasPlanFinalOct09.pdf

38 The PAT consultation document can be viewed at: http://220.156.189.23/NMEEE/PAT%20Consultation%20Document_10Jan2011.pdf

Essential Characteristics	Government and business are equal partners in developing the agreement. The business or industry has access to information on acceptable technologies and practices. The agreement has clear performance indicators, reporting requirements and consequences for failure to perform.
Best Practices	Targets need to be set at levels that are high enough to stretch the participants beyond business as usual. Financial incentives are available. Integration with existing management systems like ISO 9001 and ISO 14001
Changes over time	Increased targets
Complementary <echanisms	ESCO development; financing incentives; training; tax incentives
Key Examples	Since 1996, Denmark has had a VA scheme developed in collaboration with the Confederation of Danish Industries. Over 280 energy-intensive companies have executed VAs. These three-year agreements include an energy management system, energy flow screening, special investigations and an assumption that identified cost-effective energy saving projects will be implemented. Companies signing a VA receive reduced rates on their CO_2 tax.[39] The Netherlands Long-Term Agreements (LTAs) are civil law contracts executed between the ministry, sector organizations and "competent organizations" that now apply to about 900 companies. They originated in 1995 as an alternative to new regulations. From 2001-2007, the average savings for these companies was 2.4 percent.[40]
Implementation References	Industrial Energy Analysis web site - http://industrial-energy.lbl.gov/resources Lawrence Berkeley National Lab (LBNL) assessment report - (Price, 2005) EU LTA Toolkit - http://www.ltauptake.eu/lta_phase_flash.asp?id_phase=0

39 See more information at: http://www.ens.dk/en-us/consumptionandsavings/industry/sider/voluntaryagreementsindustryonenergyefficiency.aspx

40 See more information at: http://www.cen.eu/cen/Sectors/Sectors/UtilitiesAndEnergy/Energy/Documents/3janssen.pdf

v. Enabling Markets / Resource Alternatives

Description	Laws or regulations that require market-based mechanisms to allow energy efficiency (and other demand-side resources) to compete against generators, transmission providers and other traditional supply-side resources. Whenever energy efficiency resources bid lower prices than supply alternatives, they are selected and contracts are established to purchase them. A related mechanism is for regulators to require electricity providers or market operators to publish information about opportunities for using energy efficiency resources, so that other entities can propose options to meet those needs. This information is usually published in a regular public report (for example, the 2011 ISO-New England Regional System Plan in the U.S.), and includes details around the nature, size, timing, and geographic locations of additional capacity needs, descriptions of the decision-making process and procurement process, etc. Such requirements allow third parties to identify opportunities to contribute to the activities of electricity providers, particularly by providing load reductions as alternatives to expanding capacity.
Effectiveness	To be determined – there is not enough experience yet with reliance on markets to determine how much efficiency investments can be accelerated through this approach.
Variations	This approach can be used to capitalize on an array of energy efficiency attributes including the provision of peak electric capacity, to address transmission and distribution (T&D) constraints or to meet seasonal or annual energy needs (e.g. through an efficiency feed-in-tariff).
Prerequisites	Must have well-established market mechanisms for the purchase of peak capacity, energy, etc. Must also have well-established EM&V protocols and will require certification of energy savings.
Essential Characteristics	If market-based mechanisms are to be the primary way of generating investments in energy efficiency, then markets must be established for all major attributes of energy efficiency – peak capacity reliability improvements, T&D system reliability improvements and, especially, energy savings. Capacity markets alone are not enough to drive very much incremental investment in energy efficiency since only modest amounts of energy efficiency are cost-effective based on peak savings alone. That will be true of most other energy efficiency attributes as well. Thus, if only some market-based mechanisms are put in place (e.g. only capacity markets), then other foundational mechanisms (e.g. binding and/or voluntary energy efficiency targets or integrated resource planning requirements) must be employed as well (with the partial market-based approach becoming a complementary approach) if the full potential of cost-effective energy efficiency is to be realized. A strategy that relies on other foundational approaches and gradually transitions to a fully market-based approach could be pursued. Rigorous EM&V standards must be employed to ensure that the energy savings and/or load reductions being bid against supply alternatives are credible and actually delivered. Penalties for failure to deliver on bid resources are necessary.

Best Practices	This mechanism has limited experience to date. Nonetheless, a few best practices have emerged. The full life of the energy efficiency resources (many energy efficiency measures provide savings for 15 years or more) must be valued in the bidding process and contracts established at the outset for the full life of the energy efficiency resources. To encourage payments for comprehensive and higher-cost projects where it may be more challenging to measure and verify savings, it may be necessary to establish different markets for different kinds of energy efficiency resources (i.e. like different "feed-in-tariffs" for different kinds of renewables).
Changes over time	Since it will be challenging to start with a wholesale commitment to simultaneously changing all markets for all types of energy attributes (e.g. system peak reliability, annual and/or seasonal energy needs, T&D reliability, etc.), it may be necessary to start with one or two markets (e.g. capacity markets) and gradually phase in changes in other markets (as noted above) and rely on other foundational mechanisms in the interim.
Complementary Mechanisms	Codes and standards, EM&V
Key Examples	ISO New England (ISO-NE) oversees that region's bulk electric power system. In 2006, the US Federal Energy Regulatory Commission, which regulates wholesale energy markets, approved a Settlement Agreement between ISO-NE and the region's stakeholders to replace its Installed Capacity Market with a new Forward Capacity Market (FCM) that would value demand-side as well as supply-side resources.[41] The FCM seeks to procure all of the projected needed capacity for three years in the future. ISO-NE allows new and existing resources from "qualified" supply-side and demand-side providers to compete on an equal basis.[42] Procurements for the 2014-2015 market included 33.2 GW of capacity, including 3,468 MW of demand-side resources, 263 MW of which were for new demand-side resources. New capacity can set the market-clearing price and obtain a price commitment of up to five years. The floor price was US $3.21 per kW-month.[43] PJM Interconnection is a regional transmission organization (RTO) that operates a competitive wholesale electricity market and manages the high-voltage electricity grid for much of the mid-Atlantic and mid-West region of the US. It has conducted six Base Residual Auctions with energy efficiency first allowed in the 2012/2013 auction. The most recent auction (2013/2014) procured 152.7 GW of capacity including 679.4 MW of energy efficiency or 90 percent of the amount offered.[44]

41 See more information at: http://www.iso-ne.com/regulatory/ferc/orders/2006/jun/er03-563-030_er03-563-055_6-16-06.pdf

42 See more information at: http://www.iso-ne.com/markets/othrmkts_data/fcm/index.html

43 See more information at: http://www.reuters.com/article/2011/06/27/idUS201345+27-Jun-2011+BW20110627

44 See more information at: http://www.pjm.com/~/media/markets-ops/rpm/rpm-auction-info/2012-13-base-residual-auction-report-document-pdf.ashx

Implementation References	EnergyAustralia, an electric distributor has made use of an Energy Efficiency Standard Offer to reduce peak demand in T&D constrained regions. The Brookvale / Dee Why DSM Program offered AUD 200/kVA of load reduction for commercial and industrial energy efficiency projects of at least 0.8 MVA of load reduction in the target area. The offer was open for approximately 11 months or until 1.5 MVA had been subscribed.[45]
	RAP report on Forward Capacity Markets: (Gottstein & Schwartz, 2010) - http://www.raponline.org/document/download/id/92
	RAP presentation on designing capacity markets for D3 Resources (UK): (Neme & Petersen, 2011) - http://www.raponline.org/document/download/id/658
	Energy Efficiency article on experience with bidding efficiency resources into capacity markets - (Jenkins, Neme, & Enterline, 2010)

B. Implementation Mechanisms and Strategies

Once foundation mechanisms have been adopted, there are three key questions every jurisdiction must address in order to effectively implement energy efficiency policies.

- Who will oversee and deliver the energy efficiency services?
- How will the services be funded?
- How will accountability be ensured?

Addressing these questions is critical for achieving aggressive savings (★★★). The most appropriate answers can vary from jurisdiction to jurisdiction, depending on local political, economic and/or social conditions and history of energy efficiency activity in that jurisdiction. In some jurisdictions there are multiple parties involved in the delivery and a variety of funding mechanisms, in others there may be only one or a few. Every jurisdiction needs to consider their goals, country culture, market environment and existing institutional structure in order to determine the most appropriate mechanism(s) to answer these key implementation questions.

In this Implementation section, we present a slightly different format. For each of the broad topics – delivery, funding and accountability – we present a brief narrative detailing key considerations and universal best practices. We also provide links to additional references that provide further comparative guidance about the advantages and disadvantages of each option.

We then detail specific approaches that have been effective in different jurisdictions. For each approach, we describe the mechanism, its essential characteristics and potential variations. We then outline advantages, disadvantages, discuss the situations when and where the mechanism may be most effective, offer mechanism-specific best practices, describe examples and where available, provide links to resources that can provide more detailed information about what a jurisdiction should consider in adopting the specific mechanism. It is important to stress that because of the wide variation in local circumstances, there have been a variety of successful and best practice approaches.

i. Delivery of energy efficiency services

As noted above, government and the private sector both have important roles to play in ensuring the delivery of energy efficiency services. In those jurisdictions with binding energy savings target or active IRPs, the critical policy decision is who must meet those obligations. Even with voluntary agreements, there are policy considerations related to the administration and oversight of the agreement and best practices. In jurisdictions where there are no obligated entities and the prevailing expectation is that the market will deliver energy efficiency services, government can encourage certain market participants and place certification criteria or other constraints on who delivers services.

45 See more information at: http://www.ieadsm.org/TaskXVNetworkDrivenDSMCaseStudiesDatabase.aspx

Jurisdictions need to assess their policies, environment, culture and infrastructure to assess whether the delivery entity should be housed within government or outside of it. If there is sufficient infrastructure and expertise, the delivery of energy efficiency programs to end-use customers is best accomplished by an entity that is not a government agency. If it is housed within government, we would strongly recommend that it be a quasi-public entity (e.g. a Crown corporation, Government-owned business, etc.) or public-private partnership. If the obligated entity is not a government entity, the jurisdiction needs to decide if the obligation should be imposed on energy providers, end users or procured from the private sector by government. Other considerations include deciding the parameters, if any, by which market players can be involved in the delivery. This section details the options and considerations related to obligated deliverers of energy efficiency. Specific supporting mechanisms for market-delivery are described on pages 71 and 73.

The most important considerations in determining who should be obligated to deliver energy efficiency services are competence and the degree of commitment by the administrator and the organization to energy efficiency. Other critical considerations include absence of real or perceived conflicts of interest, the presence of trusted relationships with customers and vendors of efficiency services and products, and nimbleness in responding to market feedback and opportunities.[46]

Regardless of who is charged with the obligation, there are specific best practices that need to be in place or readily adopted by the obligated entity. The most important of these are described below:

- **Trusted relationships with the market** – The entity must have or be able to easily develop relationships with existing energy service businesses as well as with other market actors. They also need an understanding of the end use customers, their investment considerations and how best to motivate them to adopt energy efficiency measures – a trusted and established brand can be very helpful here. All of these players need to trust the entity and its ability to deliver cost-effective efficiency programs and recommendations without bias or conflict of interest.
- **Energy use information** – Access to customer energy use data and a dedicated commitment to keeping customer-specific information confidential.
- **Strong data tracking systems** – The information technology system used by the entity to track customers and their energy use must be sophisticated and robust while protecting customer data and allowing for compiled reports of savings. This is essential to planning, evaluation and effective targeting of various resource acquisition strategies.
- **Strong EM&V systems and expertise** – savings will need to be well documented by the obligated entity and able to be readily audited. Design of the EM&V system needs to be addressed from the beginning, not added after the strategy has been implemented.
- **Regional Coordination** – Requiring coordination among obligated entities with adjoining or overlapping service territories is important, particularly when obligated entities have relatively small territories or customer bases. Such coordination is also required if electricity and gas energy efficiency are the responsibility of different obligated entities. This sends more uniform signals to other market participants such as builders, contractor and retailers, who often serve multiple service territories and have a difficult time dealing with the transaction costs associated with different program designs.
- **Incentives and Penalties** (See page 58) – Implementing entities can deliver stronger performance if there are incentives to maximize energy efficiency or, at the very least, that disincentives to promote energy efficiency are removed. These include clear performance incentives/penalties.

Additional Implementation References:

Alliance to Save Energy – Models for administering (Brown, 2009)

IEA DSM Task VI (Crossley, 2000)

UN Institutional arrangements in Asia (Li, Molodtsov, & Delina, 2010)

OECD/IEA Energy Efficiency Governance (OECD/IEA, 2010)

World Bank report on Financing Energy Efficiency (Taylor et al, 2008)

Energy Efficiency article (Waide & Buchner, 2008)

46 Neme, 2011

a. Delivery by Energy Providers

Description	The energy saving targets described above are assigned to the entities that provide energy to the jurisdiction.
Variations	The obligation may fall only on energy distributors and/or retailers, on all providers of energy (including district heating and cooling) or only on energy providers above a certain size based upon number of customers or volume of energy sold. This approach has a history of working in both monopoly and liberalized markets.
Prerequisites	Binding energy saving targets allocated to the energy provider or providers.
Essential Characteristics	Energy provider is committed to energy efficiency and there are mechanisms in place to recover program costs or in a liberalized energy market, that there is a "level playing field" with respect to all the companies in that market place. Funding typically comes from the regulated price tariffs either directly or as a system benefit charge (SBC); in a liberalized market it becomes "a cost of business" which all companies should strive to deliver at lowest cost to their customers. Customers trust the energy provider and its ability to analyze and protect their energy use data and provide them with safe, reliable and unbiased efficiency recommendations. The utility and the regulator have a well-established set of processes that can be used to make decisions about funding levels (if appropriate), program plans, evaluation or results, awarding of financial rewards or imposition of penalties, and other related issues.
Advantages	Energy retailers have relationships with their customers, have access to customer usage data, understand their energy needs and often have the engineering expertise, marketing competence, service and delivery networks, and data management systems necessary to run energy efficiency programs tailored to those needs
Disadvantages	Historically, energy providers have been in the business of selling energy use, not its conservation. As a result, end users generally and some energy regulators perceive an inherent conflict of interest. There are also issues related to fair competition, particularly if the energy provider is selling energy efficiency products and services as well as designing and delivering energy efficiency programs to promote those products and services.[47]
Best Application	When there is sufficient institutional credibility, capacity and commitment to energy efficiency within the obliged energy sector and when the energy providers serve a large enough customer base to achieve economies of scale and are able to minimize customer confusion.
Complementary mechanisms	Trading of energy certificates (aka white certificates), incentives, decoupling

47 Heffner, 2011

Key Examples	The UK's current Carbon Emissions Reduction Target (CERT) requires energy retailers to deliver 293Mt (lifetime) CO_2 of reductions between April 2008 and December 2012, with additional requirements targeting insulation measures (currently 68 percent of the carbon saving target from the extension of the scheme from April 2011 to December 2012) and households at higher risk of fuel poverty.[48] Half of the US states obligate their utilities to deliver energy efficiency. By 2004, per capita residential electricity consumption was 31 percent lower in these states than the other 25 states despite being similar in 1973.[49] California's Investor-owned utilities operate and fund their efficiency programs pursuant to plans filed with and approved by the California Public Utilities Commission. A minimum of 20 percent of the work is bid out to third parties. Denmark places the obligation on energy distributors but does not allow them to carry out the energy efficiency activities.[50] These are implemented by energy retailers, energy service companies or through bilateral contracts with energy efficiency installers.
Implementation References	For US best practices see ACEEE - (York, 2008) - http://aceee.org/research-report/u081 For California see (Martinez, 2010) - http://docs.nrdc.org/energy/files/ene_10030901a.pdf

b. Delivery by End Users

Description	End users, typically energy-intensive industries, are obligated to deliver specific amounts of energy savings.
Variations	Government can play a variety of supporting roles through tax incentives, creating a trading market for the obligated savings or accelerated depreciation for energy efficiency equipment.
Prerequisites	Ability to secure adequate information about existing energy use for all participants, EM&V capacity to measure results.

48 See more information at: http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/CU/Documents1/CERT_newsletter_Q13_web.pdf

49 Waide & Buchner, 2008

50 Energy distributors typically own the poles and wires while retailers sell the energy to end users. In some jurisdictions like Denmark separate entities are responsible for each of these functions, which in other jurisdictions (e.g. the US) one entity typically plays both of these roles.

Essential Characteristics	Longer-term, typically encompass goals for a period of 5 to 10 years. Targets must be established in a way that is understandable, transparent and equitable. Require supporting programs typically funded by government including facility audits, target setting, information sharing, technical assistance, training, financial incentives as well as recognition for success and penalties for not reaching the targets. Need to implement effective EM&V protocols and reporting mechanisms that allow for necessary degree of transparency.
Advantages	Can have a significant impact relatively quickly. Facilitates a cooperative approach among industry, policy makers, funding entities and ESCOs to address energy savings and GHG reduction goals. Large customers often believe that they have adequate in-house expertise to address efficiency opportunities and object to system-wide programs that they can perceive to be a requirement to subsidize their competitors.
Disadvantages	Risk of only addressing projects that are easy to implement, low cost, and which are probably not comprehensive if the targets are not high enough. Works most effectively for large users; can leave smaller customers without energy saving services. May be hard to insulate from politics or corruption in some jurisdictions.
Best Application	In jurisdictions with a significant number of large energy-intensive enterprises and an available risk-sharing financing facility. This approach is particularly useful in jurisdictions where there is little infrastructure or a lack of appetite for regulator-driven mechanisms. This approach has also been used in some US jurisdictions by large industries that energy regulators have allowed to opt-out of an energy efficiency scheme funded by a system benefit charge. These businesses are required to make their own investments and document the resulting savings.
Best Practices	Setting targets that are attainable and ambitious. Effective use of case studies and other tools for information dissemination and training. Sector-specific outreach and technical assistance.
Complementary mechanisms	Voluntary agreements, tradable white certificates, mandatory audits, EM&V, financial incentives, ESCOs

Key Examples	In 2006, China's Top-1000 program set energy savings targets to be achieved by 2010 for the 1008 most energy-intensive industrial consumers. Each industrial consumer signed a contract with the local provincial government to deliver a set amount of savings. The local government is evaluated on its ability to achieve the target. Enterprises that fail to meet their targets are denied annual rewards and may be subject to higher electricity rates.[51] India's PAT scheme is a newly-initiated market-based mechanism that requires industrial consumers in energy-intensive industries to meet a specified annual percentage reduction in specific energy consumption.[52] The Energy Efficiency Opportunities Program in Australia requires large industrial consumers in energy-intensive industries and electricity generators to identify and evaluate energy savings opportunities using a whole of business approach (i.e. leadership, management, policy, data accuracy and quality, decision-making). The companies and their senior managers must publicly report on the assessment outcomes, opportunities for projects with paybacks of four years or less and the business response to these opportunities.[53]

c. Delivery by Quasi-Government or Public Private Partnership

Description	An obligation created in law and placed upon either an independent entity created by government, or a private entity that has entered into a partnership with the public sector. If the entity is within government, it may report to the Energy Minister or a legislative body or a regulator but it exists independently from them and typically has personnel continuity despite changes in political leadership.
Variations	These entities may receive public funding or the proceeds from levies on energy providers. They can be charged with: the design, administration or delivery of programs; the selection and engagement of other program providers, private contractors or ESCOs; the implementation and oversight of programs; training; funding; or some combination of these functions. In addition to energy efficiency, these entities may focus on increasing sustainability, expanding the use of renewable energy or other public purpose objectives. The entity's Board may be comprised of some named ministers/agency leaders and private citizens appointed by the jurisdiction's leader (President, Governor, Prime Minister, etc.) or entirely independent.
Prerequisites	Jurisdiction needs the authority to create or authorize partnerships with these types of organizations.

51 Price, Wang, & Yun, 2010

52 Raghuraman, 2011

53 For information on Industry Guidelines see: http://www.ret.gov.au/energy/Documents/energyefficiencyopps/EEO-IndustryGuidelines.pdf

Essential Characteristics	Professional (as opposed to political) management. Typically funded through a public benefit charge or energy tax. Entity needs political support in order to obtain funding from government agencies and/or from energy providers through regulatory mechanisms.
Advantages	Typically held to a high performance standard. If housed outside government, may have greater access to additional funding from private sources.
Disadvantages	These organizations often have many "masters" whose competing desires can be difficult to navigate. Funding can be susceptible to political pressures. If housed within government, accountability and transparency requirements may necessitate cumbersome procurement procedures.
Best Application	When there is a desire for more direct accountability to government or where other more independent approaches are not politically feasible.
Best Practices	Performance metrics, financial controls, audits and contracting are all fully transparent.
Key Examples	Enova is a non-utility quasi-governmental agency overseen by the Norwegian Ministry of Petroleum & Energy. Its mission is "to contribute to environmentally sound and rational use and production of energy, relying on financial instruments and incentives to stimulate market actors and mechanisms to achieve national energy policy goals." Enova's staff evaluate proposed projects and provide funding and oversight for those projects.[54] New Zealand's Energy Efficiency and Conservation Authority (EECA) is a Crown Entity with a goal "to maximize cost-effective energy savings and the co-benefits for all New Zealanders, and stimulate the uptake of both large and small-scale renewable energy." EECA does this by providing financial incentives, information, business support, setting and monitoring standards and labels and conducting research and EM&V.[55] Spain's Institute for Energy Diversification and Saving (IDEA) is a public, business-structured organization reporting to Ministry of Industry, Tourism and Commerce. In addition to offering technical assistance and financial incentives, IDEA acts as an ESCO including providing third-party financing for energy efficiency and renewable generation projects.

54 See more information at: http://www.enova.no/sitepageview.aspx?sitePageID=1346

55 See more information at: http://www.eeca.govt.nz/

	New York State's Energy Research and Development Authority (NYSERDA) was established a as a public benefit corporation in 1975 to reduce the State's petroleum consumption. Today it helps New Yorkers reduce energy consumption, promote the use of renewables and protect the environment. It also helps to develop competitive markets for energy efficiency. Funding comes from a statewide system benefit charge.[56] Belgium's Fedesco is a third party investor and public ESCO that concentrates on federally-owned buildings.[57]

d. Independent Entity Awarded Funding by Government

Description	An autonomous entity that is typically awarded funding by government, but exists completely independent from it.
Variations	These entities may receive public funding or the proceeds from levies on energy providers to design, administer or deliver programs, select and contract with other program providers, private contractors or ESCOs, implement training, funding and programs, or some combination of those functions.
Prerequisites	Political support and funding from government agencies and/or from energy providers through regulatory mechanisms.
Essential Characteristics	Typically multiple sources of funding including government, government directed levies and the private sector.
Advantages	Better access to private sector resources including funding; may be more trusted by industry than quasi-government entity; likely to be more entrepreneurial.
Disadvantages	As organizations with Boards comprised of both government appointees and a range of other stakeholders, these organizations have many "masters" whose often competing desires can be difficult to navigate. Funding can be susceptible to political pressures.
Best Application	When there is a desire for more direct accountability to government, but an aversion to creating additional Government agencies.

56 See more information at: http://www.nyserda.org/default.asp

57 See more information at: http://www.fedesco.be/

Key Examples	The Energy Trust of Oregon is an independent NGO that was created in 2002 by the Oregon Public Utilities Commission to administer and invest in efficiency programs for the state. In 2007, the Oregon Legislature extended the life of the organization through 2025. It provides cash incentives, information and services to electric and gas customers. It is funded by a system benefit charge.[58] The UK's Energy Savings Trust is also an independent not-for-profit company with the Government and some energy companies as its members and guarantors. It provides impartial advice and information on saving energy and reducing GHG emissions. It undertakes pilots of new delivery mechanisms and evaluation of programs. Funding comes from government and the private sector.[59]

e. Delivery by Contractual or Appointed Third Party

Description	A contract or franchise by Government or its agent with an independent entity to deliver a specific energy saving target. Funding is usually provided by Government.
Variations	May have a "rolling" term in order to avoid end of contract effect. An appointment by the policy administrator, as opposed to a contract, allows the entity to be regulated similarly to a utility.
Prerequisites	The availability of an organization or enterprise with the expertise to provide these services.
Essential Characteristics	Entity has no commercial interest in traditional energy supply or as a direct installer of energy efficiency measures. Government provides funds from the public purse and/or creates a legal mechanism to raise funds from some part of the energy providers or their customers and establishes an effective oversight system for allocating the funds to the third party. There is also a need for a multi-year commitment in order to provide the stability to support training, investment in needed systems and innovation.
Advantages	Entity has energy efficiency as its primary purpose and therefore measures its success by its ability to deliver savings. Able to provide highly-trusted independent third-party advice. Need to periodically seek re-appointment keeps the organization focused on strong performance and allows change if the incumbent is under-performing.

58 See more information at: http://energytrust.org

59 See more information at: http://www.energysavingtrust.org.uk

Disadvantages	Need to develop relationships with energy consumers and other market actors, potentially from "scratch" (if the hired party does not have much of a local presence historically). There is a cost to periodically re-bidding the responsibilities. Although the potential to change the contracted party has the advantage of providing a strong incentive for good performance and the ability to remove parties who are under-performing, it also can eliminate some advantages of continuity. The need to deliver within specific contract periods (and uncertainty about whether the entity will have the job in the long-term) reduces incentives to integrate long-term planning into program offerings. There may be a perception that the entity is less accountable to public oversight standards.
Best Application	When there is existing knowledge of energy efficiency and capacity within existing organizations domiciled in or near the jurisdiction.
Complementary mechanisms	Public benefits charge for regulated energy companies. Hypothecated taxation income from energy or carbon taxation and/or revenues.
Key Examples	Efficiency Vermont is administered by the Vermont Energy Investment Corporation (VEIC), an independent NGO that won an initial three-year contract in 2000 in response to a request for proposal issued by the state's regulator. VEIC secured a three-year renewal and a second six-year contract. In 2010, state law changed the terms of the relationship to the award of a quasi-utility appointment to deliver energy efficiency services. Efficiency Vermont provides financial incentives, technical assistance and programs directly to all electric ratepayers.[60]
Implementation References	Vermont Public Service Board web site – http://psb.vermont.gov/utilityindustries/EU/generalinfo/creationandstructure ACEEE article about Efficiency Vermont's transition from contract to an appointment - http://www.aceee.org/proceedings-paper/ss08/panel05/paper14

60 See more information at: http://www.efficiencyvermont.com/about_us/information_reports/how_we_work.aspx

ii. Funding

As the OECD/IEA report *Energy Efficiency Governance* notes, "a reliable and continuous source of funding may be the single most critical factor in scaling-up energy efficiency investment"[61] This subsection discusses the key issues in funding energy efficiency activities and then considers the various available models for doing so.

Funding needs to be credible, adequate and as free (as possible) of political pressures. It also needs to support existing market actors and not create price distortions. Structuring how funds will be used requires consideration of additional policy guidance including spending or savings by sector, treatment of low- and limited-income customers as well as other hard-to-reach customers, and/or emphasis on shorter-term resource acquisition vs. longer-term market transformation.

Inevitably some customers will benefit more than others within any particular timeframe. It is therefore important to ensure jurisdiction-wide benefits from the investments. However, experience has shown that increased economies of scale (via some concentration of program resources on certain issues or groups at any given time) bring down the cost of energy efficiency measures and this benefits all customers in the end.[62] There are also policy considerations related to whether a jurisdiction seeks to achieve a diverse portfolio of savings opportunities that is available to all sectors or prefers to maximize the savings per dollar of spending, which often results in under-serving low-income customers and small businesses.

Finally, there is the question of acceptability – will the jurisdiction's energy users accept a system benefits charge, increased energy prices or energy taxes? If yes, can the resulting revenues be reserved for this purpose? In addition, it is worth considering whether the jurisdiction would benefit, overall, from establishing and operating market-based mechanisms such as tradable white certificates or auctions.

Best practices that apply for all funding mechanisms include:

- Structuring the use of the funds so that groups that are already disadvantaged do not receive a disproportionately lower amount of benefits.
- Creating the political certainty that the funding mechanism is stable and will last for a long enough period to encourage companies (energy providers and the energy efficiency industry) to make the necessary investments to bring about a significant change in energy efficiency activity.

Additional References:

World Bank report on Financing Energy Efficiency (Taylor et al, 2008)

OECD/IEA Energy Efficiency Governance (OECD/IEA 2010)

a. Government-directed funding

Included below are funding mechanisms that have been imposed as the result of government laws or regulations. The funds may not pass through government budgetary appropriations, but the process by which they are levied, managed and collected are the result of government action.

Public Benefits Charge (PBC) or Levy

Description	In this model energy savings are funded by a mandatory charge or levy imposed by government or its agent. This competitively neutral charge is collected in an equitable fashion from all energy users by energy providers (as opposed to government) for uses that benefit the public interest. Funds may be retained by the energy provider if the provider is obligated to deliver efficiency, or they may be deposited in a pool overseen by energy regulators that is available to other entities charged with delivering efficiency services. If the energy provider collecting the funds is regulated, the fund amount may be determined by legislation or regulations and oversight is typically by the regulator. Public benefits charges are also called system benefit charges, wires or pipes charges, or line charges.

61 OECD/IEA 2010

62 Lees, 2008

Variations	There is considerable variation in the methodology by which public benefits charges are levied, calculated, managed and collected. The charge can be assessed as a fixed charge per customer or volumetrically, and may be itemized separately on the bill or included in rates. Commonly, all customers are subject to the charge, although some jurisdictions have allowed large users to opt out.[63] In some jurisdictions PBCs have been directed to support investment in renewable energy systems, particularly smaller-scale, customer-sited systems, as well as or instead of energy efficiency.
Prerequisites	A regulatory system that is able to effectively impose the PBC and ensure that it is managed prudently and effectively for the intended purpose.
Essential Characteristics	Mandatory participation by all energy users. The PBC must be applied to all energy providers selling similar products to end customers (e.g., all retail electric suppliers, all gas companies).
Advantages	Provides significant funding for implementing comprehensive energy efficiency programs. Can leverage additional funds from end users or others, and can require energy savings from more-comprehensive (deeper) retrofits, etc. Treats efficiency investments as a cost of energy service. Funds are separate and distinct from those collected and used by government, and therefore should be more stable and reliable over longer periods of time. Relatively simple to administer.
Disadvantages	Can be perceived as a "tax" by detractors. Also, there may be complaints about subsidizing laggards from customers who have implemented energy efficiency measures at their own cost, or of unfairness from customers who perceive themselves as unable to increase their energy efficiency.
Best Application	When there are clear long-term targets and the jurisdiction needs a steady source of funds to implement the programs required to meet the target.
Best Practices	PBCs that are collected on a volumetric basis, generally per kWh. Setting a rate that is commensurate with achieving the savings target. In 2010, electric PBCs in the five US states most committed to energy efficiency were based on spending levels between 2.92 percent and 4.57 percent of sales. For gas suppliers, the top five states spent between US $44 and $64 per residential customer.[64]

63 Most jurisdictions that allow an opt-out require these users to demonstrate that they are making investments to improve efficiency in their own facilities.

64 Sciortino et al., 2011. Note that spending on natural gas efficiency is generally not reported as a percent of sales due to the wide fluctuations in gas prices.

	An open regulatory process by which plans for spending the funds are filed for review and approval, with opportunities for participation by stakeholders in the design and implementation of programs and evaluation of effectiveness. These plans should include evaluation requirements, standards and funding, cost-effectiveness standards, and response to other policy directives. Funds should be allocated in proportion to the amounts paid in by different customer sectors (i.e., residential, commercial, industrial in North America; households and tertiary in the EU).
Complementary Mechanisms	Binding targets, IRP
Key Examples	Brazil's regulatory agency ANEEL originally mandated a wires charge on private distribution utilities equal to 1 percent of revenues in 1998. The proceeds were to be used for public benefit investment, subject to oversight by ANEEL. Over the next few years the wires charge was also assessed on state-owned distribution utilities and generation-and-transmission companies. In 2007, the Brazilian Congress passed legislation requiring 50 percent of the revenues to be spent on energy efficiency activities and half of that amount to be targeted to low-income households.[65] Italy imposes a "unitary tariff contribution" on energy distributors as a cost-recovery mechanism for energy efficiency investments. The contribution, which has been set at €92.22/toe (US $122.45) for 2010, is set annually pursuant to a formula that takes into account trends in energy prices.[66] The fixed contribution for cost recovery is designed to encourage Italy's obligated parties to seek out highly cost-effective energy efficiency measures.[67] Distributors may recover costs up to their annual obligation. The US state of Massachusetts has imposed a PBC for energy efficiency and renewable energy on its electric utilities since passing restructuring legislation in 1997.[68] The rate for energy efficiency is $.0025 per kWh. The state combines this with other funds, including an electricity and gas surcharge, to fund its requirements that providers of electricity and natural gas acquire "all available energy efficiency and demand reduction measures."[69]
Implementation References	RAP Issues Letter - http://www.raponline.org/docs/RAP_IssuesLetter-SystemBenefitsCharge.pdf

65 See more information at: http://electricitygovernance.wri.org/files/egi/Case%20Study%20Brazil%27s%20wire-change%20mechanism.pdf

66 AEEG Resolution available at: http://www.autorita.energia.it/it/inglese/enlex/09.htm. The formula was established by AEEG Resolution available at: http://www.autorita.energia.it/it/inglese/enlex/08.htm.

67 Eyre, 2009.

68 See more information at: http://www.mass.gov/legis/laws/seslaw97/sl970164.htm

69 See more information at: http://www.aceee.org/sector/state-policy/massachusetts#Energy%20Efficiency%20Program%20Funding

Mandates on Energy Providers to Fund Savings

Description	This model requires energy providers to save energy in their customers' homes or premises using the providers' own revenues or equity; there is no PBC to cover the costs of the energy providers' energy efficiency activities. Energy efficiency goals are imposed on energy retailers, who then have a competitive desire to deliver on those goals as cost-effectively as possible. The use of the funds and many of the essential characteristics are comparable to PBCs. However, the amount of money spent and details regarding how it was spent are much less publicly transparent (since one of the key objectives of this approach is to enable market competition between energy retailers to lead to the achievement of savings at least cost). In addition to designing and overseeing programs, the energy supplier can design and market funding and financing schemes that address various market barriers.
Variations	The design, cost-recovery methods, and terms of this funding model vary considerably. Some of the programs are prescriptive while others are negotiable. Costs can be absorbed by the energy provider, charged to the beneficiary, or recovered through regulated rate procedures.
Prerequisites	A robust competitive market for retail energy services. An administrator capable of verifying that funding is being applied to energy saving. Legislation in place that not only requires the energy companies to undertake such activities but provides penalties to be enacted by the administrator in the event that the obligation is not fulfilled.
Essential Characteristics	Energy provider has or has access to sufficient capital resources, and recognizes the commercial potential of offering these services. Transparent process for evaluating results.
Advantages	Less complex than many other funding schemes, since government does not have to estimate the required cost of energy efficiency measures over the obligated period, nor create a fund to receive and/or dispense the funds, nor impose retrospective cost-adjustment mechanisms. The spending amount is not defined by government. It is simply treated as a cost of doing business and can therefore be more acceptable politically. It can be seen as better aligning treatment of energy efficiency and supply-side options (by locating responsibility and spending for both in the same organizations). It may encourage the energy provider to look at a new business model that has a greater element of energy services.
Disadvantages	Less opportunity for public/stakeholder input on how money is spent, although government can require that minimum energy savings must come from certain customer classes (e.g., low income) or from certain end use measures (e.g., insulation), or from whole house approaches.

	Perceived conflicts of interest associated with energy suppliers designing and funding the system of 'selling' efficiency.
Best Application	When there is a preference for market-based approaches and/or a need to keep spending "off the books" for government bodies. (In some countries, like the UK, even PBCs are treated as taxes and are therefore subject to procedures and political treatment similar to other taxes).
Best Practices	Savings targets specifically designed to ensure that all policy objectives are met (e.g., by requiring portions to be acquired through long-life measures and/or from low income customers). Programs for all customer sectors.
Complementary Mechanisms	Revenue regulation
Key Examples	Energy efficiency obligations in a fully liberalized market have existed in Great Britain since 2002. The targets have increased dramatically during this period, and even though the obligation is restricted to residential energy consumption, the energy retailers are now spending about US $1.5 billion per year on energy efficiency measures in their customers' homes. The latest phase running, to the end of 2012, requires energy retailers to attain 68 percent of their energy savings from professionally installed insulation measures and 15 percent of the energy savings from those customers most likely to be in fuel poverty.[70] South Africa's national utility, Eskom, uses a three-year standard-offer contract to pay a specified pre-determined price per kWh for verified energy savings of 50 kW to 5 MW. Energy savings are calculated only on weekdays between 6 a.m. and 10 p.m.[71] The US state of Texas has had an energy efficiency portfolio standard since 2000, which requires IOUs to offset a percentage of their load growth through end-user efficiency programs. The IOUs meet this requirement by funding standard offer (SOP) and market transformation programs delivered by third parties. The SOP pays the third-party provider a set incentive amount, determined by the regulator, for each kW of peak demand savings and each kWh of energy savings resulting from an installed measure.[72]
Implementation References	Ofgem technical and administrative documents - http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/Pages/EnergyEff.aspx

70 See more information at: http://www.legislation.gov.uk/uksi/2010/1958/article/4/made

71 See more information at: http://www.eskomidm.co.za/industrial/sop

72 See more information at: http://www.texasefficiency.com/PUC_Staff_SOP_Training.ppt

Direct Government Investment

Description	An appropriation and approval of funds for energy efficiency programs in the government's general expenditure budget.
Variations	Funds may be allocated to a government agency, a quasi-government entity, or made available to third parties for delivering specified services or savings. Often used to meet multiple policy objectives including poverty alleviation, improving the quality of publicly owned or publicly supported housing stock, and job creation.
Prerequisites	Administering entity in place that government is comfortable funding.
Essential Characteristics	Most commonly used to fund programs administered by the government or a quasi-government entity.
Advantages	Can quickly create a market for energy efficiency services, train installers, and provide significant sums of funding.
Disadvantages	Subject to annual budgeting process and the politics that can accompany it. The availability and amounts may therefore be subject to annual change.
Best Application	When the jurisdiction is able, or desires, to make direct allocations for energy efficiency.
Best Practices	Consistent levels of funding from year-to-year.
Complementary Mechanisms	Binding targets, Voluntary Agreements, Energy Centers, Tax levy, training and certification.
Key Examples	The US Weatherization Assistance Program (WAP) provides funding to states for the express purpose of weatherizing homes occupied by low-income households. Most states use the funds to support weatherization NGOs or local governments that install energy efficiency measures. WAP has operated since the late 1970s and installed energy-saving measures in more than 6.4 million homes. The program is responsible for decreasing annual US energy consumption by the equivalent of 24.1 million barrels of oil. The program also funds a technical assistance center and training facilities.[73] China's central government makes annual allocations to energy conservation and to GHG-reduction special funds, as do most of the provinces. The central government's special fund for energy conservation and pollution abatement, which is managed by the Ministry of Finance, was allocated 49.5 billion RMB (US $7.3 billion) in 2009. Energy conservation funds are used for a portion of the implementation costs of energy investment projects, technology demonstrations, information dissemination, R&D, and awards based on a payment per ton of coal equivalent of annual energy savings achieved.[74]

73 See more information at: http://www1.eere.energy.gov/wip/about.html

74 See more information at: http://www.chinafaqs.org/library/chinafaqs-chinas-ten-key-energy-efficiency-projects

	Australia's National Framework for Energy Efficiency (NFEE) and its Council of Governments' National Partnership on Energy Efficiency defines the country's cooperative approach to energy efficiency. It includes the provision in 2008 of AU$88 million (US $74 million) to support these policy initiatives.[75]

Directing Cap-and-Trade Proceeds to Energy Efficiency

Description	Mandatory carbon or emissions cap combined with a requirement that emission allowances are auctioned (rather than allocated at no cost). Some or all of the revenues from the auction are invested in energy efficiency. Cap-and-trade mechanisms are based on the premise that a carbon price alone is not enough to achieve economy-wide emissions reductions. Complementary policies are therefore needed to overcome barriers to obtaining low-carbon resources such as energy efficiency. The directive for how auction revenues are spent can be as, or more, important as the carbon price in driving down emissions.
Variations	The portion of auction revenues directed to energy efficiency, and whether it is for new or existing programs. The strategy for directing the revenues (or pre-auction allowances) and any requirements attached to how they are spent. Integration with other societal goals, including environmental protection and public health.
Prerequisites	An operating cap-and-trade system with mandatory auctioning of some portion of allowances. May require multi-jurisdiction cooperation in order to have a large enough region to support an auction.
Essential Characteristics	Clear evaluation, monitoring, and verification criteria. Long-term success depends on maintaining a stable carbon price while continuing to invest in energy efficiency. This requires periodic tightening of the cap in order to maintain the carbon price at a level that will drive emissions reductions and support energy efficiency.
Advantages	Market-based mechanism that can lower the cost of carbon reduction to consumers and the economy. This occurs because carbon reductions from energy efficiency are less costly than those from changes in energy supply. Produces a triple benefit: (1) a target for GHG emissions reductions; (2) a cap-and-trade system which serves to drive lowest-cost emissions reductions; and (3) provides revenue for lowest-cost emissions reductions through energy efficiency.

75 International Confederation of Energy Regulators, 2010

	Uses an explicit carbon policy to establish a funding stream that may be more stable than other sources of funding. Stable funding will depend on the design of the cap and trade system, the stability of the carbon price, and a continued requirement that auction revenues be invested in EE.
Disadvantages	More complex and time-consuming to implement than other funding mechanisms (requires legislative adoption, negotiation, detailed rulemaking, and a trading platform to implement). Could face the danger that auction revenues will be re-directed to other uses, such as filling budgetary shortfalls.
Best Application	When the jurisdiction is already committed to putting in place a cap and trade system to reduce carbon emissions.
Best Practices	Use of auctions for the sale of emissions allowances. Providing favorable treatment to participants who attain higher energy efficiency performance. Coordination of cap and trade with support for energy efficiency to secure lowest-cost, economy-wide emissions reductions.
Complementary Mechanisms	Binding energy-savings targets
Key Examples	The Regional Greenhouse Gas Initiative (RGGI) is a cap and trade system involving ten northeastern US states. Its initial objective is to reduce GHG emissions from the electric power sector by 10 percent by 2018 by auctioning off emission allowances. Each RGGI state independently determines the portion of allowances that are to be auctioned and the percentage of revenues to be used for energy efficiency. States have spent a significant portion of auction revenues on energy efficiency.
Implementation References	Vermont Law Review article on carbon caps and efficiency - (Cowart, Richard 2008) NARUC Task Force on Climate Policy Issue Brief - http://www.naruc.org/Publications/ClimateIssueBrief4_Jul2009.pdf RAP description of RGGI - (Regulatory Assistance Project, 2008) Funding DSM Projects with Revenue from Carbon Trading – (Crossley, 2010)

b. Publicly Partnered Financing and Securitization

This type of funding relies on government incentives to induce private-sector funding and financing.

Description	Government-sponsored financing or credit enhancements for private-sector investments in energy efficiency measures. Typically designed to stimulate lending by local banking and finance institutions.
Variations	Options include direct lending, offering credit lines, establishing revolving loan funds, partial credit guarantees, and funding loss reserves. A recent development in the US and UK is long-term financing provided by the government or private sector which is repaid by an assessment on the property tax bill or through the electricity meter. This variation is known as PACE (Property-Assessed Clean Energy) in the US[76] and is being proposed as part of the UK's Green Deal.[77]
Prerequisites	Available capital; lending and underwriting capacity
Essential Characteristics	Like any financing program, should be preceded by well-designed market-demand assessments that identify energy efficiency potential, as well as local barriers and capabilities, in order to develop optimum operational strategies. Sufficient capital at the rates and terms needed by local market participants. Incentives to encourage participation by local financiers.
Advantages	Market transformation can be encouraged when certain measures receive dedicated financing schemes. High leveraging value. PACE and Green Deal schemes are able to eliminate two common barriers to adopting energy efficiency measures: the split incentive in rental properties, and financing that must be repaid when there is a change in a property's owner-occupier.
Disadvantages	Transaction costs can be high and procedures can be bureaucratic. Addresses only some of the market barriers, as lack of access to financing is not the only reason consumers fail to invest in optimal levels of efficiency. In addition to providing funding, offerings must be well structured with appropriate development assistance and enabling environment. May have high free-ridership if eligible entities have ready access to private capital or internal cash flow.

76 See more information about PACE at: http://www.pacenow.org

77 See more information about the UK Green Deal at: http://www.decc.gov.uk/en/content/cms/tackling/green_deal/green_deal.aspx

Best Application	When there is limited access to energy efficiency project financing due to perceived risk, lack of expertise, or insufficient capital among traditional banks and financiers. Most applicable to promoting retrofit investments (rather than to influence new construction or equipment-purchase decisions, which typically have access to competitive financing).
Best Practices	Accompanied by effective marketing efforts and technical assistance. Government underwriting of some of the risk by subsidizing the interest rate or providing credit enhancements, such as loan guarantees or loan loss reserve funds. Financing packages that are structured to provide greater incentives (e.g., better loan terms) for achieving deeper energy savings through comprehensive packages of energy efficiency measures. Integrated within a larger strategy that includes education, marketing, technical assistance, and other features (all of which require their own funding source), rather than a standalone solution.
Complementary Mechanisms	Building labeling requirements; strong codes and standards; stable funding; binding energy-savings targets; decoupling/revenue regulation
Key Examples	Germany's federally owned Kreditanstalt für Wiederaufbau (KfW) development bank operates Europe's largest financing program for energy efficiency. Homeowners can borrow up to €75,000 (US $100,000) per unit for comprehensive measures and up to €50,000 (US $67,755) per unit for individual measures including replacement of heating systems and windows, and thermal insulation of the exterior walls of buildings. Terms include low- and fixed-rate interest, long terms, 100-percent financing, and no commitment fee. Loans are promoted nationwide by KfW but originated through applications at local banks. In 2009, €8.9 billion (US $12.4 billion) was committed by KfW in loans for residential energy efficiency construction and retrofits.[78] The Bulgarian Energy Efficiency Fund (BgEEF) is an independent entity that was established in 2006 with US $15 million from the World Bank, the Bulgarian government, and others to support energy efficiency improvements in the country. It provides below-market-rate loans, co-financing, partial credit guarantees and portfolio guarantees for the first 5 percent of defaults incurred by ESCOs or residential portfolio managers undertaking energy efficiency projects. It approved more than 75 projects valued at just under US $22 million in its first three years of operation.[79]

78 See more information at: http://www.kfw.de/kfw/en/Domestic_Promotion/Our_offers/Housing.jsp

79 See more information at: http://www.bgeef.com/display.aspx. See also: http://www.enercee.net/fileadmin/enercee/pdf/Croatia/bgeef.pdf

	The Indian Renewable Energy Development Agency (IREDA) is a Public Limited Government Company, with a mission of financing energy efficiency and renewable energy technologies. Loans can be obtained for 70 percent of ESCO project costs and 80 percent of the cost of efficient equipment. Rates are comparable to commercial loans and terms are from six to ten years. As of 2008, IREDA had approved 19 projects totaling US $60 million.[80] Thailand launched an Energy Efficiency Revolving Fund in 2003 to stimulate and leverage financial-sector interest in lending to industry for energy-savings projects. The Department of Alternative Energy Development and Efficiency (DEDE) provides low-cost capital (initially 0 percent, then .5 percent) to banks which evaluate and approve the loans to end customers. As of October 2008, loans totaling 5.4 billion baht (US $155 million) for more than 230 projects had been approved.[81]
Implementation References	World Bank report on Financing Energy Efficiency (Taylor et al, 2008) Energy Policy article – (Sarkar,Ashok 2010) US AID|Asia Report on Demand Side Management Program Procedures Manual DSM Financing Annex (China-US Energy Efficiency Alliance, 2009)

c. Market-based Mechanisms

The market-based mechanisms described below rely entirely on the private sector for funding, but they have been enabled as the result of government action.

Tradable White Certificates

Description	An instrument that documents achieved energy savings in a manner that allows them to be bought and sold in the marketplace. White certificates are both an accounting tool and a tradable commodity.[82] Both obligated and non-obligated parties can carry out eligible energy efficiency projects and create certificates for the total amount of verified energy savings they achieve through each project. At the end of each accounting period, obligated parties surrender sufficient certificates to meet their energy-savings targets.
Variations	Energy regulators can impose predefined penalties for failing to meet energy-savings obligations. Savings can be measured on an annual or lifetime basis. There are also variations associated with who is obligated to deliver the energy savings.

80 Taylor, 2008

81 China-US Energy Efficiency Alliance, 2009

82 Bertoldi, 2008

Prerequisites	Binding energy-savings targets and obligated parties who can create the demand for energy efficiency measures. Well-designed M&V protocols that can certify energy savings. A sophisticated, transparent, and liquid financial infrastructure and skilled market participants who can participate in the trading of the certificates.
Essential Characteristics	A defined process for certifying the savings represented by the tradable instrument. This includes M&V protocols that have addressed additionality, defined deemed savings or other measuring protocols, and established standard discount factors for calculating savings. The process must also outline how data will be collected, the savings apportionment of various levels of investment, cost-recovery mechanisms if appropriate, and compliance and enforcement procedures. Eligible projects and technologies must be welldefined in advance of implementation.
Advantages	Economic efficiency; allows obligated parties to achieve savings at the most cost-effective price.
Disadvantages	Costs associated with establishing and maintaining the market can be significant. Also, can be costly to implement if there is not an M&V system already in place. May lead to implementing only those measures where savings can be easily measured and verified. May therefore focus solely on low-cost opportunities and lack comprehensiveness. Tend to omit small, atypical energy-savings opportunities due to the complexity of certifying the savings.
Best Application	Very well suited for low-cost and standard measures. Easiest to implement with standardized energy efficiency measures and deemed savings. Best suited for end use sectors where an emissions trading scheme is unlikely in the near future.
Best Practices	Providing longer timeframes for the obligated parties to acquire certificates allows for greater comprehensiveness and supporting measures with higher upfront costs. Additional policy directives that allow non-obligated parties to carry out energy efficiency projects can provide an incentive to attract diverse participants into the market.
Complementary Mechanisms	Binding energy-savings targets and obligated parties.

Key Examples	The Australian state of New South Wales has had a tradable white certificate program focused on reducing GHG emissions associated with the generation and use of electricity since 2003. GHG-reduction legislation in 2003 imposed a benchmark 2007 target of 7.27 tCO_2e GHG emissions/capita for the electricity sector. Obligated parties, primarily electricity retailers, needed to meet individual targets through purchasing electricity from low-emission generators, undertaking energy efficiency projects, or purchasing white certificates created by other actors. In 2009, this scheme, which was originally part of a broader emissions trading scheme, was converted to a "pure" white certificate scheme. Italy places an energy efficiency obligation on all companies distributing gas or electricity to more than 50,000 customers. The obligation can be met by implementing efficiency measures, contracting with ESCOs, or purchasing white certificates created by non-obligated parties, each of which represents primary energy savings of one ton of oil equivalent ("toe"). Savings can occur in any sector, including transportation, although no savings in that sector have been reported to date. From 2005 to 2008, the certificates resulted in 3.7 Mtoe of energy saving, 80 percent of which occurred in household heating and electricity.[83] Market trading occurs on a dedicated market, organized and managed by the Gestore Mercati Energetici (GME), the company that organizes and manages IPEX (the Italian Power Exchange). Most of the trading has been bilateral. The Italian regulator, AEEG,is responsible for developing the rules for issuing and trading certificates, establishing the cost-recovery mechanism, defining sanctions for non-compliance, certifying savings, EM&V, and publicly publishing results.[84]
References	(Bertoldi, 2010) (Crossley, 2008) (Lees, 2010)

Forward Capacity Markets

Description	Auction-based markets that allow energy efficiency savings to compete with supply-side power generators and therefore "create a revenue stream for [demand-side management] resources that can commit to being available at times of system peak several years in the future"[85] Since energy savings reduces total demand, it is included. Markets are managed by independent system operators or regional transmission organizations.
Variations	Payments can be made for specific attributes (i.e., peak demand savings in capacity or reserve markets, energy savings in energy markets, environmental attributes in relevant markets) or combined to address all of the attributes.

83 Lees, 2010

84 See more information at: http://www.wupperinst.org/uploads/tx_wiprojekt/Pavan_BMU_10122009.pdf

85 Gottstein, 2010, inside cover

Prerequisites	System operator has established the level of capacity or other attributes required in future years. A sophisticated energy efficiency evaluation, measurement and verification industry.
Essential Characteristics	Auction lead time must be long enough for energy efficiency resources to be developed and delivered. (Such lead times, for example, are typically based upon the construction period for a new peaking power plant in the case of forward capacity markets.) Separate auctions for regions with distribution or transmission bottlenecks. Prequalification of bidders to ensure their ability to meet their commitment to deliver energy efficiency in the future. Clearly articulated EM&V requirements or standards for energy efficiency resource bidding.
Best Practices	Energy efficiency, demand response, and distributed generation resources (as well as grid-connected generators) are paid both continuing-availability payments and quantity-based payments for the load reductions they provide during the periods when they are called by the system operator. Differential prices are paid for resources with different attributes (rather than a single market clearing price based on one attribute). Increased payments to low- or zero- carbon and emitting resources.
Advantages	Provides additional revenues for energy efficiency. Can reduce the prices paid for all capacity resources.
Disadvantages	Primarily values system peak capacity savings – meaning that other sources of funding are necessary if cost-effective efficiency potential is to be fully addressed – unless more markets than forward capacity are available. Potentially high M&V costs to document actual load reductions achieved. Carbon-emitting, supply side resources still dominate the mix of capacity clearing the auction if a single market clearing price is used to pay all market participants based solely on their peak capacity (i.e., without considering whether they already exist or are new, their carbon emissions, and other attributes).
Best Application	As a place to start exploring market-based approaches to promoting efficiency. If a capacity market is going to be implemented, energy efficiency and other demand-side resources should be allowed to participate.
Complementary Mechanisms	Strong codes and standards; stable funding; binding energy savings targets; decoupling/ revenue regulation

Key Examples	ISO New England (ISO-NE) oversees that US region's bulk electric power system. Its annual capacity auction seeks to procure all of the projected needed capacity for three years in the future. ISO-NE allows new and existing resources from "qualified" supply- and demand-side providers to compete on an equal basis.[86] Procurements for the 2014-2015 market included 33.2 GW of resources, including 3.5 GW of demand-side resources, 0.26 GW of which were new demand-side resources. New capacity can set the market clearing price and obtain a price commitment of up to five years. The auction proceeds in a descending fashion with resources withdrawing their offers at prices below what they believe then can accept. The minimum, or floor price, for the 2014-2015 market was US $3.21 per kW-month.[87] PJM Interconnection is an RTO that operates a competitive wholesale electricity market and manages the high-voltage electricity grid for much of the mid-Atlantic and mid-West region of the United States. It has conducted six Base Residual Auctions with energy efficiency first allowed in the auction of 2012/2013. The most recent auction (2013/2014) procured 152.7 GW of supply including 0.68 GW of energy efficiency, which was about 90 percent of the energy efficiency resources offered in the auction.[88]
Implementation References	RAP report on forward capacity markets - (Gottstein, Meg 2010) ECEEE paper on ISO-NE– (Jenkins, Cheryl 2009)

iii Accountability

Accountability encompasses system-wide procedures that ensure that energy savings and other policy goals are being achieved at an appropriate cost and level. This section includes descriptions of (1) the policies and the procedures by which these determinations may be made and measured, and (2) the process by which stakeholders can be assured of high-quality services and participate in decision-making.

Accountability best practices include:

- Development of a standard practice manual for the jurisdiction that transparently outlines key criteria including quality standards to be met by each energy efficiency measure and in its installation, costs and benefits from the energy efficiency measure, and how those are measured;
- A transparent process that is readily accessible to all stakeholders.

Additional References:

Guide to Resource Planning with Energy Efficiency – (Lemoine, 2009) – http://www.epa.gov/cleanrgy/documents/suca/resource_planning.pdf

86 See more information at: http://www.iso-ne.com/markets/othrmkts_data/fcm/index.html

87 See more information at: http://www.reuters.com/article/2011/06/27/idUS201345+27-Jun-2011+BW20110627

88 See more information at: http://www.pjm.com/~/media/markets-ops/rpm/rpm-auction-info/2012-13-base-residual-auction-report-document-pdf.ashx

a. Evaluation, Measurement & Verification (EM&V)

Description	Rules and practices by which the results of efficiency programs are evaluated, measured, and verified. There must be a rigorous process for establishing and regularly updating deemed savings assumptions (for common efficiency measures – typically for residential and smaller commercial and industrial customers) and for regularly evaluating and adjusting estimates of savings from custom projects (for efficiency measures that are uncommon and/or whose savings depend on site-specific conditions – typically for larger commercial and industrial customers). This is always important, but is particularly critical for market-based mechanisms and for binding savings targets or IRP obligations in which the entity obligated to deliver efficiency savings has the potential both to incur penalties and receive rewards for its performance.
Effectiveness	★★★ - Critical for achieving aggressive savings.
Variations	The focus can be on gross savings, net savings, or both. In any case, accurate estimates of savings would be required.[89] The cost of EM&V is linked to the way that the energy savings have been claimed. For example, for deemed energy-savings the costs are lower, as no explicit measurement *in situ* is required and verification is usually undertaken by the administrator of the scheme (or its agent) of a random sample of the energy provider's claimed installations. In Great Britain, a national database of residential properties has been developed, to which all obligated parties must contribute their energy-saving data to ensure that double claiming does not occur. Different jurisdictions have different rules regarding the level of independence required of the evaluators. Some allow the managers of energy efficiency programs to hire independent contractors and rely on the professionalism of those contractors to ensure objectivity. Others require that the entire EM&V process – including deciding which evaluation studies to carry out, selecting evaluation contractors and overseeing the work of those contractors – be managed by an entity other than the entity obligated to deliver energy savings. This approach is the norm in Europe and increasingly is being pursued in North America as a way to eliminate conflicts of interest. The level of resources devoted to EM&V is a third critical variable.

89 Gross savings are the total physical savings achieved, after adjusting for "take back" or "rebound" or "comfort" effects (e.g., customers in homes that have been more efficient using higher winter thermostat settings because they can now afford to do so), but without regard to whether it was the program that caused the savings to occur. Net savings are gross savings adjusted downward for "free riders" or "deadweight," i.e., customers who would have made the efficiency investments even without the program, and upward "spillover" or "free drivers," i.e., customers who were indirectly influenced by the program, but were not directly counted as program participants because they took no program rebates subsidies, or for other reasons).

Prerequisites	A well-established EM&V industry is critical. If one does not exist, it must be developed, (e.g. with initial reliance on expertise from outside the jurisdiction and training of firms inside the jurisdiction).
Essential Characteristics	Clearly established and publicly articulated EM&V plans, processes, and standards.
Best Practices	Initially focus on gross savings and specific energy efficiency measures or programs that generate the most savings. Over time (but relatively quickly), all aspects of savings should be evaluated and both gross and net savings – should be evaluated.[90] Fully independent management – i.e., responsibility for EM&V, including management of the EM&V budget, is vested with an entity other than the entity obligated to deliver efficiency savings. For broad-based energy efficiency programs, 2 percent to 4 percent of total spending on the program should be devoted to EM&V. On a periodic basis, research should be conducted to verify that deemed or ex ante savings (including assumptions about free riders and adjustments for "take back" or "rebound" effects) remain valid. Stakeholders should be engaged in the EM&V process as this is essential, in the long term, to the transparency and confidence in results necessary to maintain support for efficiency policies. Public disclosure of EM&V plans and results is also essential to maintain public support.
Complementary Mechanisms	Relevant to all foundational mechanisms (though less so for codes and standards); Data tracking
Key Examples	Efficiency Vermont has produced a Technical Resource Manual that documents its policies and procedures for determining savings calculations. Oversight and savings verification, as required by statute, includes an annual independent financial audit, a third-party savings-verification process initiated by the state's Department of Public Service (the consumer advocate), and a triennial audit of the energy and capacity savings claims and cost-effectiveness of the state's delivery approach.[91] Ontario gas utilities and other stakeholders have devised a new process for bringing transparency, accuracy, and credibility to the utilities' savings claims. It involves the creation of a technical committee and an audit committee. The technical committee

90 Estimation of free ridership and free drivership requires special data collection over and above that for measuring gross savings.

91 See more information at: http://www.efficiencyvermont.com/about_us/information_reports/evt_oversight.aspx

	consists of utility representatives, stakeholder representatives, and "at large" experts charged with developing – through a consensus process – evaluation priorities, overseeing evaluation studies, and developing planning assumptions for savings. The audit committee includes a utility representative and three stakeholder representatives who are collectively charged with hiring and overseeing an independent auditor of each company's annual savings claim. Though the audit committee aims to reach decisions by consensus, the utility has final say on the bidders list (which must have at least nine qualified auditing firms) and the stakeholders have final say over hiring of the auditor. This process is the product of a negotiated settlement that was put to regulators for approval in November 2011.[92] The UK's Office of the Gas and Electricity Markets (Ofgem) has developed a variety of technical administrative evaluation tools, including manuals for quality and customer-satisfaction requirements placed on energy suppliers.[93]
Implementation References	EERE Guide for Managing General Program Evaluation Studies (prepared for US Department of Energy – http://www1.eere.energy.gov/ba/pba/pdfs/evaluation_mgmt_guide_final_2006.pdf AID-EE Guidelines for the monitoring, evaluation, and design of energy efficiency policies – http://www.aid-ee.org/documents/000Guidelinesforthemonitoringevaluationanddesign.PDF International Program Measurement and Verification Protocols (IPMVP), a set of technical standards often relied upon by the evaluation industry – http://www.evo-world.org/index.php?option=com_content&view=article&id=272&Itemid=504&lang=en LBNL National Energy Efficiency E, M & V Scoping Study (Schiller, 2011) New England ISO M&V Manual – http://neep.org/uploads/m_mvdr_measurement_and_verification_demand_reduction_revision_2_06_01_10.docx

92 See more information at: http://www.enbridgegas.com/DocumentBrowser/Other%20Regulatory%20Proceedings/EB-2011-0295%202012-2014%20DSM%20Plan/B%20-%20Evidence/B-2-9.pdf

93 See more information at: http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/Pages/EnergyEff.aspx

b. Performance Incentives (or Penalties)

Description	Depends on a process for validating performance levels of the entities charged with delivering energy efficiency (obligated entities). This mechanism includes rewards for exemplary performance and penalties assessed for inadequate results. This mechanism contrasts sharply with the 1990s North American utility-administered energy efficiency model, which tended to focus more attention on expenditures and cost recovery than on the actual achievement of results.
Effectiveness	★★ - Opportunities for achieving significant savings.
Variations	Incentives can be structured so that the implementing entity earns a share of the achieved savings, a portion of the program costs, a portion of the net present value of avoided costs or an increased rate of return, or larger rewards for greater performance. They may have minimum thresholds, penalties for lack of performance, or both.
Prerequisites	Robust EM&V protocol
Essential Characteristics	Incentives are tied to the effectiveness of spending on energy efficiency, rather than just the amount spent. "Effectiveness" may be defined in a variety of ways depending on the jurisdiction's goals. The rules by which the incentive will be determined (including EM&V protocols) are spelled out in advance.
Best Practices	Accompanied by binding energy-savings targets. Savings goals are set to encourage delivery innovation. The implementing entity has a great deal of flexibility in determining the specifics of how to achieve the savings. Incentives are sufficiently high to motivate entities to exceed them. There is a penalty for poor performance and a minimum threshold for earning any incentive. The incentive amount is capped (typically as a percentage of program spending) within a specific time period. The rules governing the incentive are defined through a collaborative process involving energy regulators, energy providers, and stakeholders. Incentives are tiered, volumetric, or both, creating opportunities along an appropriate spectrum of performance to continue to earn more for improving results (not just achieving a minimum threshold).

Key Examples	The California Public Utilities Commission (CPUC) has adopted a shared-savings approach (called the "risk return incentive mechanism" or "RRIM") that is designed to align ratepayer and shareholder interests by creating a significant rewards or penalty for IOUs ability or failure to meet regulatory targets for reducing customer demand for electricity and natural gas.[94] IOUs are eligible for the RRIM if they achieve 80-85 percent of the CPUC savings targets; they can earn greater incentives if they exceed the goal. Penalties may be triggered if savings are below 65 percent of the goal.[95] The operator of Efficiency Vermont has been eligible to receive a performance incentive for meeting or exceeding specific goals as defined by the regulator.
Implementation References	ACEEE 2006 report on decoupling and incentives – (Kushler, York, & Witte, 2006) Report on US state electric efficiency frameworks – (Institute for Electric Efficiency, 2010) ACEEE report on shareholder incentives – (Hayes, Nadel, Kushler, & York, 2011)

C. Support Mechanisms

Support mechanisms are the "carrots and sticks" that government can adopt to encourage action by end users. They include a variety of mandatory and voluntary ways to provide information including product labels, web sites and requiring energy audits, tax policies, revenue and pricing regulation and industry support including training, encouragement of research and development and government procurement policies. As is the case with other mechanisms, the choice of which mechanisms to employ depends on cultural, political, and market environments.

i. Mandatory Energy Audits and Use Disclosure

Description	Laws that require specified end users to identify, evaluate, and report on cost-effective energy-savings opportunities. This mechanism can be used to reach a large number of customers relatively quickly. Its focus is on informing current building owners so that they may consider efficiency investments for their own benefit.
Effectiveness	★ - Opportunities for achieving significant savings. However, "energy audits do not lead to energy savings per se" as they only tackle the barrier of personalized advice.[96]
Variations	The economic sectors covered and the range of facilities on which the mandate is imposed. Reporting can be to the general public, to new buyers or tenants, or just to the end customer. Often combined with an ESCO development strategy.

94 See more information at: http://docs.cpuc.ca.gov/published/FINAL_DECISION/73172.htm

95 See more information at: ftp://ftp.cpuc.ca.gov/gopher-data/energy%20efficiency/DRAFT%20Energy%20Division%20Scenario%20Analysis%20Report_5-4-10v2.pdf. The CPUC is continuing to review the RRIM rule through Docket R. 09-01-019 which can be viewed at: http://docs.cpuc.ca.gov/proceedings/R0901019.htm

96 World Energy Council, 2008

Prerequisites	An adequate number of qualified energy auditors.
Best Application	Mandatory audits are often used as a first step to gain experience in carrying out energy efficiency activities, to respond to an energy shortfall, to mitigate the impact of price spikes, or to prepare for an energy savings trading program.
Essential Characteristics	The most effective approaches include establishing a cadre of well-trained and qualified third-party energy auditors native to the jurisdiction, and developing certification and training programs for both auditors and energy managers employed within the audited facilities. Standards for both the audits and the way information is disclosed are essential. Quality control processes to ensure accuracy in reporting.
Best Practices	Ensuring that there is sufficient capacity to respond to recommendations. Support from key leaders in the covered economic sectors. Financial incentives and other program elements to help implement the recommendations from the audit.
Changes over Time	Requiring implementation of all opportunities that meet specific criteria.
Complementary Mechanisms	Training programs; ESCO development; financial incentives; labels; tradable white certificates
Key Examples	Australia's Energy Efficiency Opportunities program requires corporations using more than 0.5 PJ of energy per year to "identify, evaluate and report publicly on cost effective energy savings opportunities" (i.e., those with a financial payback of four years or less).[97] India requires designated large energy-intensive industries to conduct audits to identify energy savings measures and undertake corrective action with penalties for non-compliance. India's PAT scheme will add a market mechanism to help fund these improvements.[98] Throughout the European Union, there is a legal requirement on all properties to have an energy performance certificate at the time of sale or new rental which gives an energy rating from A to G in terms of energy performance. The certificate must also provide recommendations for the cost-optimal or cost-effective improvement of the energy performance.[99]
Implementation References	(World Energy Council 2008, pp 51-57)

97 See more information at: http://www.ret.gov.au/energy/efficiency/eeo/pages/default.aspx

98 See more information at: http://www.powermin.nic.in/acts_notification/energy_conservation_act/introduction.htm and Raghuraman, 2011; See Case Study - page 1

99 See more information at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:EN:PDF

ii Mandatory Energy Labels

Description	The requirement that appliances, other energy-using equipment, and real estate properties have a label that describes their energy efficiency performance, usually under typical operating conditions. Generally, the label provides an estimate of annual energy consumption and cost, as well as how the product or property compares with comparable products or properties. The purpose is to inform customers who are in the process of purchasing or leasing a product or property. Labels also provide a means for manufacturers, landlords and sellers of real estate to differentiate their products in the marketplace. Labels have been shown to spur the development of more efficient product models and real estate properties.
Effectiveness	★★ - Opportunities for achieving significant savings.
Variations	The format of ratings can vary. In addition, some are asset ratings, while others are operational ratings.[100] Some jurisdictions have both mandatory disclosure labels and voluntary E-brand endorsement logos such as Energy Star (developed by the US Government and now used internationally) or Top Ten (developed in Europe and also used internationally).[101] Products must meet a certain standard to be entitled to use the E-brand, and then may benefit from joint marketing and consumer awareness. "Mandatory labels have proven more effective than voluntary labels since they require manufacturers to put labels on all products and properties, not just on the most energy efficient ones"[102]
Prerequisites	Need to have certification bodies, testing facilities, agreed-upon or legally binding performance criteria, and accreditation authorities.
Best Application	Labels are effective when there is a lack of knowledge about energy consumption, when there are significant differences in energy use among similar products, and when products are being mass marketed to large numbers of customers.
Essential Characteristics	Labels need to be tied to standards and codes, and updated according to their revisions. Labeling mechanisms need to ensure accuracy and be readily understood by the end consumer. Their development should be conducted in consultation with all parties involved in the transaction, including consumers. For appliances and equipment, that also includes manufacturers, distributors, installers, and retailers. For properties, it includes realtors, appraisers, and lenders.

100 Asset ratings refer to the efficiency of a product under typical operating conditions – i.e. independent of how it will be used by the building occupant. Operational ratings compare the actual consumption of a product or building based on its actual use.

101 See more information at: http://www.energystar.gov/

102 World Energy Council, 2010

Best Practices	The label is presented as a simple graphic; its requirements have been developed by an independent organization that also markets the label and its attributes, rather than the product. The most successful labeling programs have fully engaged trade allies in ensuring they are understood and used by end consumers. Labels must be modified over time to keep up with changes in markets. For example, if product efficiencies are rated on a scale of A through F, the definition of an "A" needs to change over time as the energy efficiency of the products on the market improves (so that not all products are A's or B's). This is particularly important following changes in codes and standards, and for products whose markets are very dynamic (e.g., consumer electronics).
Key Examples	The EU's recast Energy Performance of Buildings Directive (EPDB) requires energy performance certificates (EPCs) which give an energy rating from A to G for all commercial, residential, and government buildings.[103] EPCs must be displayed in all public and commercial buildings larger than 250m² that are frequently visited by the public, and must be available for all properties at the time of sale or new rental.[104] The United States requires labeling on appliance, lighting, and plumbing products.[105] Canada requires an EnerGuide label to be placed on all new electrical appliances manufactured in or imported into Canada.[106] Australia and New Zealand use a star rating system. EU Directive 92/75/EC requires energy labeling for household appliances and other products.[107]
Implementation References	Lawrence Berkeley National Lab review of labeling - http://eetd.lbl.gov/ea/emp/reports/ee-policybrief_090711.pdf For Buildings – http://www.buildingrating.org/ For appliances and equipment – Collaborative Labeling and Appliance Standards Program (CLASP) - http://www.clasponline.org

103 Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings available at: http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2010:153:SOM:EN:HTML

104 Directive 2010/31/EU of the European Parliament available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:EN:PDF

105 See more information at: http://www.ftc.gov/bcp/conline/edcams/eande

106 See more information at: http://oee.nrcan.gc.ca/residential/personal/appliances/energuide.cfm?attr=

107 Directive 92/75/EEC of the European Community available at: http://europa.eu/legislation_summaries/consumers/product_labelling_and_packaging/l32004_en.htm

iii. Energy Efficiency Information Centers

Description	Independent or government organizations with an explicit objective of promoting energy efficiency. These centers typically provide end users with information, audits, referrals to and assistance in selecting qualified energy consultants or ESCOs, and training and certification for energy professionals.
Effectiveness	★ - This tool has potential, but as currently used it only addresses the information and personal advice barriers.
Variations	These centers may be linked with, but typically operate independently from, energy providers, industry associations, or other energy providers. In some jurisdictions the centers also provide information about the use of renewable energy and other GHG-mitigation or resource-conservation practices.
Prerequisites	Dedicated funding source(s)
Best Application	When there is a lack of information, coordination, or comfort about energy efficiency services and products. When relying extensively on market-based mechanisms for achieving savings.
Essential Characteristics	Energy centers need a clear vision, mandate, and a plan that complements rather than duplicates existing infrastructure. They also require sustainable funding and knowledgeable and impartial staffing. Sponsorship by industry as well as government helps to encourage sustainability, although it may compromise impartiality.
Best Practices	Making the advice as personalized as possible is likely to improve the probability of subsequent energy saving initiatives. Clear performance goals, plus performance measurements and incentives to ensure that the energy efficiency information centers are meeting them.
Key Examples	Japan's Energy Conservation Center aims to be a one-stop location for energy conservation initiatives. Its services include subsidizing projects; providing information and audits to industry and the commercial sector; supporting ESCO programs; encouraging energy-saving lifestyle choices; promoting greater dissemination of energy-saving equipment; educational programs; international cooperation; and providing training and certification for qualified energy managers.[108] Sweden supports a network of local energy advisers housed within local municipalities who provide the general public, small companies, and organizations with objective advice and information on energy efficiency and renewable energy. They are supported by Regional Energy Offices that provide training and coordinate information activities. The network is designed to encourage actual investments by households, companies, and organizations.[109]

108 See more information at: http://www.asiaeec-col.eccj.or.jp/index.html

109 Khan, 2006

	France's Environment and Energy Management Agency (ADEME) helps to fund a network of more than 200 local energy information centers with 400 advisers who provide public information on efficiency and renewable energy sources. From 2008 to 2010, these centers provided 600,000 contacts.
Implementation References	AID-EE Case Study on Sweden - http://www.aid-ee.org/documents/005LocalEnergyadvice-Sweden.PDF

iv. Customer Feedback – Metering and Use Information

Description	A requirement placed on energy providers to give customers detailed energy-use feedback based on the customer's actual energy consumption, in a form that the customer can use to make informed decisions regarding their energy use.
Effectiveness	There is not enough experience yet with reliance on markets to determine the degree to which efficiency investments can be accelerated through this approach. The most recent large-scale trials with smart meters, consumer feedback via energy bills, visual display units for electricity consumption, and control groups have been conducted by Great Britain's energy regulator, Ofgem. (See link below for more details.)
Variations	Use information may be presented as a peer-to-peer comparison, which may encourage behavioral modification, and/or through the use of smart meters, which can provide two-way data communication about energy use. Smart meters need to be accompanied by either displays located at the customer's site or online information portals. Smart meters can provide varying levels of detail regarding energy use, from simply building totals to breakdowns by end use (the latter obviously being more helpful to consumers). Information can also be provided through a government, energy provider, or third-party web site.
Prerequisites	Sophisticated IT and communication systems; access to energy use data, the ability to analyze the data and effective EM&V protocols, and support programs to assist customers to change their energy-using behavior based on knowledge of their existing energy use.
Best Application	Best used in conjunction with other energy efficiency programs that help consumers figure out how to reduce energy use. Also effective where there are concerns about peak demand, as providing customer feedback has been shown to have a greater impact on the times of use of electricity than on total usage. Customer-feedback mechanisms are also useful when a jurisdiction has or expects to have access to a smart grid and smart appliances.

Essential Characteristics	In order to have an impact on energy savings, the information must be provided frequently. It must reflect actual consumption, be continuous and understandable, and be provided with historical and/or social comparisons.[110] Two-way communications between customer and energy provider is beneficial. Consumers should be assured that their consumption data will be appropriately safeguarded. Informational devices must be installed as well as delivered, and interface easily with existing meters.
Best Practices	If the feedback process is not mandatory, opt-out (as opposed to opt-in) approaches have greater participation rates. Jurisdictions should adopt strong, easy-to-understand privacy policies that allow customers to determine how and with whom their consumption data is shared. Providing consumption information that is disaggregated by appliance and end use. Providing automated load-switching technology that enables customers to make one "set and forget" decision about when selected appliances and equipment will be turned off and on.
Changes Over Time	Integration with smart grids and smart appliances.
Key Examples	Ofgem is finalizing the design of a national smart meter rollout that will be implemented over the next seven years.[111] Opower's Home Energy Reporting Program uses behavioral science, analytics, and technology to deliver targeted consumption information, peer comparisons, and useful and specific energy-savings tips using data from peer households served by dozens of utilities across the United States.[112] A recent evaluation found that these programs yielded savings ranging from 1.4 percent to 3.3 percent of baseline usage.[113] Denmark's Energy Saving Trust's has a website tool called Home Energy Check (Boligtjek) that provides householders with their actual domestic energy consumption and estimates of savings.[114]
Implementation References	UK Cabinet Report on Behavioural Change and Energy Use – (Behavioural Insights Team, 2011) Franklin Energy report on behavioral change pilot – (Carroll, Ed 2009) Ofgem Energy Demand Research Project Final Analysis 2011[115] IEADSM Task XV Research Report (Crossley, 2008a)

110 Fischer, 2007

111 See more information at: http://www.decc.gov.uk/en/content/cms/tackling/smart_meters/

112 Laskey & Kavazovic, 2010

113 Davis, 2011 and Allcott, 2011

114 See more information at: http://www.savingtrust.dk/news/consumer/here-is-your-homes-new-best-friend

115 See more information at: http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=21&refer=Sustainability/EDRP

v. Energy Pricing

Description	There is a wide range of energy-pricing policies or strategies that government, particularly utility regulators, can employ to encourage consumers to invest more in cost-effective energy efficiency. Examples include inclining block pricing (higher per-unit prices as consumption increases), real-time pricing, time-of-use pricing, seasonal pricing, critical peak pricing, discounts for permitting interruption to energy delivery, differential tariffs based on the relative energy intensity of the business (higher tariffs for relatively greater energy intensity), and sliding-scale hookup fees (higher fees for inefficient new buildings, lower fees for efficient ones). The aim of time-varying pricing policies is to better match prices to the time-varying costs of supplying electricity, and to provide pricing signals to encourage customers to reduce their load at peak times. Time-varying pricing combined with direct load control of customer loads can give electricity providers considerable flexibility to manage loads during different time periods throughout the day and year. Smart meters, which have the ability to record the quantities of energy consumed over set, frequent time intervals, are often used in conjunction with time-varying pricing. Electricity providers often implement time-varying pricing by requiring customers with particular end-use applications or high-volume electricity use to go on the pricing regimes, or allowing customers to voluntarily choose the regimes. These and other pricing strategies are discussed in detail in RAP publications on retail pricing. This report's pricing discussion is intended to identify pricing as an important area of policy to consider when devising strategies to promote energy efficiency.
Effectiveness	★★ - Experience to date suggests that pricing strategies typically have only a modest impact on conservation and efficiency investments. More experience is needed before drawing conclusions regarding the impacts of new approaches to integrating pricing strategies with more timely and detailed consumer feedback on energy-usage patterns. Impacts on peak usage, however, can be substantial as consumers shift usage from expensive to inexpensive times of day.[116]
For additional information	See *Time-Varying and Dynamic Rate Design*, Regulatory Assistance Project, 2012 and *Rate Design Using Traditional Meters* (forthcoming)

116 A pilot test of real time pricing for more than 10,000 residential customers in southern Illinois demonstrated significant reductions in peak demand (about 15%) but very slight increases (0.2%) in total annual electricity consumption (Navigant Consulting, "Power Smart Pricing 2010 Annual Report", prepared for Ameren Illinois Utilities, April 26, 2011 (http://www.icc.illinois.gov/docket/files.aspx?no=06-0693&docId=165814)

vi. Tax Relief

Description	Allowing special tax treatment or an exemption or substantial reduction of taxes that would otherwise have been owed, or that would otherwise be imposed on the purchase and installation of energy efficient products or services.
Effectiveness	★★ - Opportunities for achieving significant savings.
Variations	Variations include sales tax reductions on the purchase of efficient products or services, property tax abatements on the design and construction of energy efficient buildings, credits or deductions applicable to income tax liabilities, and credits or exemptions for energy efficient retrofits. Another variation is alternate tax treatment such as allowing businesses to use accelerated depreciation schedules for these investments.
Prerequisites	Economic climate and tax structure that enables government to provide tax relief and makes tax reductions attractive.
Best Application	When there are financial barriers or a large group of end use customers who are reluctant to make the investment and need a financial incentive to spur them to action.
Essential Characteristics	Most effective in jurisdictions with higher taxes and a healthy economy. These incentives need to be extremely well targeted in order to avoid rewarding free riders. Tax relief mechanisms must be effectively marketed to the target taxpayer and regularly updated to respond to changes in technology. They should be available for a long-enough timeframe to encourage investment, but terminated once "success" has been achieved. Tax-exemption strategies need to be easy to administer, but do require a quality- assurance mechanism that can ensure the energy savings of the investment. Knowing when the right time will be to reduce or discontinue the incentive.
Best Practices	Define the available timeframe or maximum total expenditure at the onset so that the incentive does not suddenly terminate without notice.
Key Examples	France offers an income tax credit of 22-45 percent (dependent upon the measure installed) of the cost of materials associated with improving the energy efficiency or installing renewable energy sources at a principle home (including certain leased premises). All measures must meet a prescribed performance standard and be installed and purchased by a registered company. The maximum credit is €8,000 (about US $10,800) for one person, €16,000 for a couple (about US $20,600), plus €400 (US $560) available for each additional person in the household. The government has also reduced the tax on energy renovations in existing buildings from 19.6 percent to 5.5 percent.[117]

117 See more information at: http://www.epbd-ca.org/Medias/Pdf/country_reports_14-04-2011/France.pdf

	Italy provides tax relief equal to 55 percent of the costs for installing high-efficiency boilers, high-efficiency windows, or insulation in buildings, up to a maximum deduction of €60,000 (US $81,360). Improvements must meet thermal conductivity requirements (watts per square meter) pursuant to the Italian Finance Act. There is also a tax credit equal to 36 percent of the cost of upgrading high-efficiency lighting in commercial buildings.[118] Italy also offers a tax credit of 20 percent of the cost of replacement refrigerators and freezers, up to a maximum deduction of €200 (US $280) per appliance, in a single installment. Korea offers a 20-percent tax deduction on investments in "energy saving facilities."[119] The United States approved a stimulus package weatherization program known as "cash for caulkers" that provided direct payments and income tax breaks to homeowners who installed energy efficient windows, furnaces, and boilers. Annual spending for the program rose to US $6.6 billion in 2010 from US $369 million in 2007.[120]
Implementation References	LBNL survey on international tax and fiscal policiesto promote industrial energy efficiency (Price, Lynn et al. 2005) ACEEE report on tax incentives - (Gold & Nadel, 2011)

vii. Tax Levy on End Users

Description	Taxes imposed on the consumption of energy with the goal of reducing wasteful use.
Effectiveness	★★ – Opportunities for achieving significant savings if energy costs are a major expense and taxes are substantial.
Variations	Taxes on carbon or other energy emissions.
Best Application	As a companion to emissions taxes and voluntary agreements. If the jurisdiction wants to use the tax system to influence energy-consumption patterns.
Essential Characteristics	Rates need to be high enough to be effective, but not enough to cause industry to relocate or raise concerns about international competitiveness. The groups impacted are fully informed about the policy and understands its value for global competitiveness.

118 See more information at: http://www.odyssee-indicators.org/publications/country_profiles_PDF/ita.pdf

119 See more information at: http://www.kemco.or.kr/new_eng/pg02/pg02080000.asp

120 See more information at: http://bnef.com/

Best Practices	The tax revenue is earmarked for use in activities designed to implement energy efficiency and/or GHG reduction measures. Incentives and technical assistance are in place to help energy-intensive users reduce their consumption.
Key Examples	The UK's Climate Change Levy is imposed on suppliers of electricity, natural gas, liquid petroleum and hydrocarbon gas (non-transport), coal, lignite, and coke at the time of supply to the end user. The levy is calculated based on a uniform rate per unit of energy, and expressed in an amount per kWh for gas and electricity and per kg for other energy products. Residential and non-business charity use are exempt. Energy intensive facilities covered by climate change agreements (CCAs) can receive an 80-percent discount on the levy.[121] Denmark has had energy taxes since the 1970s and a CO_2 tax since 1993. Currently, the tax is based on energy consumption as well as CO_2 and SO_2 emissions. The tax is applied in different ways for households, non-VAT registered businesses (including the public sector), and industry. It is calculated differently for space heating, light processes and heavy processes. Denmark's initial experience with these taxes required exemptions for most energy-intensive businesses due to concerns about competitiveness and jobs; this has since been remedied.[122] Netherlands imposes a regulatory energy tax on fuel oil (non-transport uses), gas oil, liquefied petroleum gas (LPG), natural gas, and electricity. The tax, which has a rate that declines with greater use, is designed to encourage behavior change and is directed primarily at households and small business.[123] The Canadian province of British Columbia has a carbon tax that applies to all emissions from fossil fuel combustion. Effective July 1, 2008, it applies to fuel used for transportation, in industry, and to create heat for households. The tax rate was initially C $10/ton of GHG emissions; it is set to increase by $5/ton annually until 2012, when it will be $30/ton. The tax is revenue neutral, with 100 percent of revenues from the tax being returned to citizens through tax reductions and tax credits.[124]
Implementation References	LBNL survey on international tax and fiscal policies to promote industrial energy efficiency (Price, Lynn et al. 2005) Soon to be released RAP paper – Strategies for Decarbonizing Electric Power Supply

121 See more information at: http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?_nfpb=true&_pageLabel=pageExcise_ShowContent&id=HMCE_CL_000290&propertyType=document#P36_2223

122 See more information at: http://www.ens.dk/da-DK/ForbrugOgBesparelser/IndsatsIVirksomheder/TilskudtilCO2afgift/Documents/Green_taxes%20danish%20experiences.pdf

123 See more information at: http://www.wind-works.org/FeedLaws/Netherlands/NLEnergytax2004.pdf

124 See more information at: http://www.fin.gov.bc.ca/tbs/tp/climate/A4.htm

viii. Decoupling/Revenue Regulation

Description	Using price controls to separate the revenues that regulated energy providers are allowed to collect to cover fixed costs from the volume of energy sold. This removes the traditional incentive suppliers have relied upon to increase profits by increasing sales. This mechanism refocuses energy suppliers toward encouraging customers to make energy efficiency improvements and making least-cost investments to deliver energy services even when such investments reduce the amount of sales.
Effectiveness	★★ – A tool that has potential. Decoupling diminishes a bias against reducing sales, but it does not provide an incentive for energy providers to use energy efficiency programs to reduce load.
Variations	Energy regulators can determine an appropriate cap for total revenues, for gross margin, or per customer class. The caps can be determined on a per-customer basis with each billing cycle, or on an annual accrual basis. Decoupling can be full, partial or limited, depending on the portion of total revenue that is subject to the cap.
Prerequisites	Regulated energy price setting process.
Best Application	Decoupling can occur with energy providers who are subject to regulatory price controls, including in jurisdictions where electricity providers have been unbundled, but not in jurisdictions where the retail electricity market is fully competitive.
Essential Characteristics	The regulator first determines the revenue requirement for the energy provider, and selects the method by which the allowed revenue will be set. A portion of the total revenue of the provider is set by the regulator at a particular monetary value ("cap"). The structure and levels of retail prices are then set to ensure that the regulated portion of revenue remains within the cap. The prices are adjusted regularly to keep the revenue at the allowed level. Any over- or under-collection of revenue during one time period is corrected in determining the revenue cap for the following time period.
Best Practices	Ensure that service-quality standards are maintained or enhanced with the adoption of decoupling. Implement concurrent overhaul and simplification of energy provider's bill.
Key Examples	In Great Britain a "pure" revenue cap totally decouples the revenue earned by the energy distributor from the volume of energy transported through its network for the residential sector. California has decoupling for all of its investor-owned utilities (IOUs). Decoupling was implemented in 1978 for gas utilities and by 1982 for electric IOUs, then revised or abandoned during industry restructuring. Legislative action in 2001 directed the energy regulator to resume decoupling with the 2004 revenue requirement. Decoupling is currently combined with performance incentives for meeting or exceeding energy efficiency

	targets. Revenue requirements are adjusted on an [annual basis with rate cases every three or four years], varying by utility. Adjustments allow for variations in customer growth, productivity, weather, and inflation.[125]
Implementation References	Role of decoupling - (Schwartz, 2009) RAP guide on decoupling (Lazar et al, 2011) Report on US state electric efficiency frameworks - (Institute for Electric Efficiency, 2010) Discussion of how Australian state of New South Wales approached revenue regulation, caps and decoupling over the past 18 years (Crossley, 2011) p. 14-19

ix. ESCO Development Strategy

Description	Efforts by government to encourage the development of an energy services company (ESCO) industry through regulatory changes, business incubation, providing access to financing, and other support. ESCOs are private organizations that identify and invest in energy efficiency improvements (as well as onsite energy generation and procurement) at a customer's facilities and are then repaid from the energy savings over a specified timeframe. The arrangement relies on energy performance contracts or shared savings agreements that detail the source and terms of financing, expected work, energy management, anticipated savings, EM&V procedures, and whether repayment will be based on a shared or guaranteed savings scheme. ESCOs can offer expertise in any or all of the following: energy, efficiency, technology, financing, and regulatory requirements. Due to the complexity and risks, ESCOs typically target large energy users; for example, public and institutional markets accounted for 84 percent of ESCO market in the US in 2008.
Effectiveness	★★ – Opportunities for achieving significant savings.
Variations	The range of supportive services provided by government to the ESCO industry varies. A number of jurisdictions have sought to encourage the development of the industry by adopting regulatory changes and providing business incubation, development of standardized documents, access to financing and venture capital, risk mitigation, and other supports. In addition, government can help develop an ESCO market by contracting with ESCOs for their own facilities.

125 See more information at: http://www.aceee.org/energy-efficiency-sector/state-policy/California/1575/all/191

Prerequisites	Jurisdictions need to make certain their contract laws and procurement and budgeting policies allow for energy performance contracts. A banking sector interested in financing energy efficiency and committed to understanding the ESCO model. Political and economic stability.
Best Application	In economically stable jurisdictions with a legal infrastructure that supports contract law. When large energy-intensive consumers (including the public sector) have a lack of capital, expertise or interest in making energy efficiency investments. Not useful in jurisdictions where there is a fear of outsourcing energy management or where the procurement and budgeting procedures lack flexibility.
Essential Characteristics	Most successful when there is active government support for the model, especially in the initial stages. This support may be financial (capital or risk guarantees), technical, strategic, or it may focus on market development and/or capacity building. Requires public-procurement guidelines that reflect the long-term value of the ESCO approach Effective contract enforcement. Requires a large amount of capital to establish the industry and provide financing for end users. Requires access to seed financing for the ESCOs and capital for the projects they support, especially in jurisdictions where there is not already an established infrastructure for financing energy efficiency. In addition to deep knowledge of energy efficiency and project finance, the supported ESCOs must have the business acumen to sell and implement varied solutions that can be tailored to meet different customers' requirements.
Best Practices	Employing local labor and ensuring that employees have or gain the training and capacity to undertake project development.
Key Examples	The China Energy Conservation Project, which was initiated by the Chinese Government and supported by the World Bank, the United States, the European Commission and others, helped to establish ESCOs (called EMCs, or energy management companies) in Beijing, Liaoning, and Shandong. Support included grants to help develop initial projects, access to loan capital, and technical assistance. Each of the companies has successfully and profitably completed hundreds of projects. This success led to additional support from the UK and World Bank to expand the model nationwide. Assistance in this second round included establishing an ESCO association, a loan-guarantee program, and training, technical assistance, and policy-development support.[126]

126 Taylor, Govindarajalu, Levin , Meyer, & Ward, 2008

	The Swedish Energy Agency (STEM) has spurred the demand for and supply of ESCO services by forming an ESCO network and preparing guidelines for procurement and evaluation, and developing model contracts.[127]
Implementation References	IEADSM Task XVI final report (Bleyl-Androschin, 2010) World Bank report on Financing Energy Efficiency (Taylor et al, 2008) EU report on the status of ESCO market in Europe (Marino, Angelica 2010) World Energy Council - Energy Efficiency Policies around the World: Review and Evaluation (World Energy Council, 2008) p. 59-65

x. Training and Certification

Description	Government-initiated or -funded programs designed to educate and/or accredit tradespeople and professionals who are involved with commercial, industrial, and residential energy use. Unlike the broad outreach of the information programs described above, these tend to be much more vocationally oriented. Training and certification mechanisms may be offered in partnership with industry associations, unions, professional and trade associations, or educational institutions.
Effectiveness	★ – Tool that has potential for energy savings
Variations	May be combined with apprenticeships or incentives to attract newcomers to the field; can provide training for those who sell energy-efficient products to improve the energy efficiency skills and knowledge of such practitioners as builders, electricians, architects, and building managers.
Prerequisites	Economic outlook that has energy efficiency as an important part of its activities in the next decade and hence offers a career opportunity. Workforce interested in receiving training.
Best Application	When lack of knowledge is a barrier or when there is a large target market of potential trainees.
Essential Characteristics	Training programs need to be linked with other support mechanisms to ensure that there is an adequate market for the skills being provided. Training needs to be integrated into existing offerings and coordinated with revised qualification standards and accreditation requirements.

127 Marino, Bertoldi, & Rezessy, 2010

Best Practices	Rigorous tests of knowledge, on paper and in the field. Supplemented by accreditation of firms who employ certified technicians and meet other appropriate business standards to enable referral to customers. Quality assurance – i.e., periodic assessments of samples of work completed to ensure it is done to certification/accreditation standards. Periodic re-certification and continuing education requirements.
Key Examples	The EU's Intelligent Energy—Europe program recently selected 21 projects to receive funding for BUILD UP Skills, a new Workforce Training and Qualification Initiative designed to embed training on high energy performance solutions for buildings into the training and practice of building professionals.[128] India's Bureau of Energy Efficiency is charged with specifying the qualifications for accredited energy auditors and certified energy managers. It is also charged with preparing curriculum on energy efficiency for educational institutions and others.[129] Japan's Energy Conservation Center provides technical training, seminars, and lectures for engineers, community energy conservation advocates, energy managers and others. There is a state examination for energy managers for the industrial sector, required by the Energy Conservation Law.[130] The US Weatherization Assistance Program maintains a web site that contains a "virtual" library of all rules, regulations, and policies, as well as presentation materials, photos and videos of field work, program administration, and site demonstrations.
Implementation References	India's Energy Manager training web site – http://www.energymanagertraining.com/new_index.php Building Performance Institute web site - http://www.bpi.org/home.aspx Weatherization Assistance Program Technical Assistance Center – http://www.waptac.org

128 See more information at: http://www.buildup.eu/news/18351

129 See more information at: http://www.beeindia.in

130 See more information at: http://www.asiaeec-col.eccj.or.jp/index.html

xi. Research, Development and Demonstration (RD&D) – Government Funded

Description	Government provides funding for the research, development and demonstration (RD&D) of the next level of efficiency technologies.
Effectiveness	★★ – Opportunities for achieving significant savings in the longer term.
Variations	Some jurisdictions offer traditional RD&D grants toward the development and demonstration of new energy efficient technologies; others have created awards to encourage cooperation or private-sector development of highly efficient products, while other have contributed to risk sharing or the provision of specialized resources.
Prerequisites	RD&D capacity within the jurisdiction.
Essential Characteristics	Promotes the creation, development and commercialization of new technologies. Like all technology development, successful support of RD&D requires a continuum of financing and technical assistance. Government funding should support a non-proprietary knowledge base.
Best Practices	Long-term strategic planning. Cross-jurisdiction coordination.
Key Examples	Austria's Program on Technologies for Sustainable Development has subprograms focusing on Factory Systems, Energy Systems, and Buildings of Tomorrow. The program offers grants for early research, concept, commercial research, and development and demonstration of projects addressing the efficiency aspects of energy supply and systems.[131] In the UK, the Carbon Trust's Industrial Energy Efficiency Accelerator (IEEA) has worked collaboratively with industry sectors to identify energy-saving opportunities and challenges in manufacturing equipment, processes, and product strategy. It then funds R&D to address the challenges.[132] California's Public Interest Energy Research (PIER) program secures ratepayer funds to support R&D in the fields of energy efficiency, renewable energy, advanced electricity technologies, energy-related environmental protection, and transmission and distribution, and transportation technologies. The FY 2011 appropriation was US $86.5 million, $7 million of which is earmarked for industrial, agricultural, and water-efficiency projects.[133]

131 See more information at: http://www.nachhaltigwirtschaften.at/english/index.html

132 See more information at: http://www.carbontrust.co.uk/emerging-technologies/current-focus-areas/ieea/pages/industrial-energy-efficiency-accelerator.aspx

133 See more information at: http://www.energy.ca.gov/contracts/pier.html#environmental

	The Super-efficient Equipment and Appliance Deployment (SEAD) is an initiative of the Clean Energy Ministerial, a high-level global forum to share best practices and promote clean energy.[134] SEAD's partners are cooperating to pull super-efficient appliances and equipment into the market through incentives, procurement, awards, and R&D investments. SEAD has announced the first international competition to recognize the most efficient appliances in the world, with a first round focused on televisions.[135] The US Environmental Protection Agency (EPA) played a leadership role in the first "Golden Carrot" program, which pooled $30 million in utility funds to induce manufacturers to build super-efficient refrigerators. The EPA's role included encouraging research of appropriate technologies, engaging utility partners, educating utility regulators, and making certain the project did not violate US antitrust provisions.[136]
Implementation References	UNEP Sustainable Energy Finance Initiative (SEFI) report on Public Finance Mechanismsto Increase Investment in Energy Efficiency - (Makinson, 2006)

xii. Government as Exemplary Performer

Description	Government as a large and highly visible energy consumer can play a significant role in moving markets toward implementing energy efficiency and enhancing the skills of local providers of energy efficient products and services. This can be done through procurement of energy efficiency products, aggregating purchases, the use of ESCOs to overcome financial restrictions, and building retrofits or new construction that demonstrates new technologies and the implementation of all cost-effective efficiency measures. Savings in government facilities (and many types of institutions, such as schools, hospitals and military bases) have the additional benefit that reduce public outlays and, thus, economically benefit all members of society.
Effectiveness	★ – Some energy-savings potential (depends on portion of the economy and building stock owned or occupied by government entities). In many instances, may have greater public awareness impact as opposed to delivering actual savings.
Variations	Government-procurement specifications can require meeting reach standards such as LEED Platinum or Net Zero. At a minimum, procurement standards should be significantly higher than MEPS and current building codes. Government can also jumpstart the market by aggregating purchases for a higher-standard appliance or piece of equipment.

134 As of April 2011, SEAD's member governments were: Australia, Brazil, Canada, the European Commission, France, Germany, India, Japan, Korea, Mexico, Russia, South Africa, Sweden, the United Arab Emirates, the UK, and the US. Together, they represent about half of the world's energy demand.

135 See more information at: http://www.superefficient.org/Activities/Awards.aspx

136 See more information at: http://www.gcrio.org/USCCAP/case_kitchen.html

Prerequisites	Government that is deeply committed to energy efficiency; mandatory MEPS and building codes; effective use data and metering information that can be used for post-implementation case studies and education and training. Public accounting and procurement rules that encourage rather than hinder the use of ESCOs.
Essential Characteristics	Government employees need sufficient support and training to implement energy efficiency practices. This includes both technical assistance and budgeting practices that recognize life-cycle costs, allow for autonomy on longer-term energy improvement investments, and share savings with the implementing agency. These initiatives also need high-level political endorsement and support from networks of local government. The goal is to foster civic pride in the investments and support from networks of local government.
Best Practices	Procurement practices that specify reaching standards that constitute stretch goals.
Key Examples	The US government is the world's largest volume buyer of energy-consuming products. The Federal Energy Management Program and its energy-efficient procurement specifications reduce energy consumption, save money and impact the worldwide market.[137] France's national strategy of sustainable development, including a commitment to eco-responsible policies and "The State Sets the Example" (Etat Exemplar).[138] The US Department of Defense added an Assistant Secretary for Operational Energy Plans and Programs in 2010 and recently published a strategy to "transform the way the Department consumes energy in military operations." The Department will produce an implementation plan that is expected to "provide a strong and sustained pull for innovation, given the scale of military energy requirements and the need to change current energy use patterns."[139] California's Green Building Action Plan requires all new state buildings and major renovations to be designed, constructed, and certified at LEED-NC Silver or higher; all existing state buildings larger than 50,000 square feet to meet LEED-EB standards no later than 2015; all state-owned buildings to be benchmarked for energy efficiency by 2007; and that state agencies seek leases in ENERGY STAR-rated buildings.[140]
Implementation References	US Federal Energy Management Program – http://www1.eere.energy.gov/femp/technologies/eep_resources.html EU Green Public Procurement Program Toolkit – http://ec.europa.eu/environment/gpp/toolkit_en.htm

137 See more information at: http://www1.eere.energy.gov/femp/technologies/procuring_eeproducts.html

138 See more information at: http://www.microsofttranslator.com/bv.aspx?from=fr&to=en&a=http%3A%2F%2Fwww2.ademe.fr%2Fservlet%2FKBaseShow%3Fsort%3D-1%26cid%3D96%26m%3D3%26catid%3D13346(translated)

139 See more information at: http://energy.defense.gov/Operational_Energy_Strategy.pdf

140 California Governor's Executive Order S-20-04 available at: http://www.documents.dgs.ca.gov/green/GreenBuildingActionPlan.pdf

4 Case Studies

A. Introduction

The following six case studies describe how widely varied jurisdictions have combined the mechanisms to achieve energy efficiency goals. The US and European examples have achieved significant GHG and energy savings, while India and China provide examples of approaches and lessons for fast-growing economies.[141]

i. Europe

The European Union member countries are subject to a number of EU Directives and standards pertaining to energy efficiency. The existing Energy Services Directive mandates that member states "adopt and achieve an indicative energy saving target of 9 percent by 2016 in the framework of a national energy efficiency action plan (NEEAP);" adopt public sector procurement practices that encourage efficiency; provide consumption information for end users; and repeal any legislation that impedes energy-savings financing.[142] A revised draft Directive on energy efficiency, proposed in June of 2011, includes a legal obligation to establish energy saving schemes in all member states, and calls for the public sector to lead by example and achieve major energy savings for consumers.[143] Existing Directives and standards include: the Energy-related Products Labeling Directive adopted in May 2010;[144] the Eco-design Directive;[145] the EN 16001 standard for energy management which came into force in 2009; and the Energy Performance in Buildings Directive (EPBD), which mandated that member states apply MEPS requirements for new and existing buildings, certify energy performance, provide energy performance labeling and disclosures, and require boiler and air conditioning system inspections.[146] In May of 2010, the EPBD Directive was strengthened, streamlined, and clarified, including a requirement that a near-zero consumption standard be applied to public buildings by the end of 2018 and to all new buildings by the end of 2020.[147, 148]

The two European examples showcase countries with a deep commitment to reducing their energy consumption and GHG emissions. Germany, which is Europe's largest country in terms of population, economy, and emissions, has relied on strong codes and standards, a state-supported bank providing financing, and the provision of technical

141 Currency conversions information provided in the case studies are based on average exchange rates for the relevant time period using http://www.oanda.com/currency/average. Current rates are based on the most recent quarter.

142 Summary of Directive 2006/32/EC available at:http://europa.eu/legislation_summaries/energy/energy_efficiency/l27057_en.htm. Directive 2006/32/EC available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006L0032:EN:NOT

143 Proposal for a Directive of the European Parliament, 2011 available at: http://ec.europa.eu/energy/efficiency/eed/eed_en.htm

144 Directive 2010/30/EU available at: http://eur-lex.europa.eu/Notice.do?checktexts=checkbox&val=517716%3Acs&pos=1&page=1&lang=en&pgs=10&nbl=1&list=517716%3Acs%2C&hwords=&action=GO&visu=%23texte

145 Directive 2009/125/EC available at:http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:285:0010:0035:EN:PDF. Implementing measures available at: http://ec.europa.eu/energy/efficiency/ecodesign/legislation_en.htm

146 Directive 2002/91/EC available at: http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexplus!prod!DocNumber&lg=en&type_doc=Directive&an_doc=2002&nu_doc=91

147 Directive 2010/31/EU available at: http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2010:153:SOM:EN:HTML

148 Power & Zulauf, 2011

assistance to encourage energy efficiency. Energy efficiency expertise and green technology are recognized economic exports. By comparison, Denmark is one of Europe's smaller countries and has its lowest energy intensity. Denmark's goal is for its "energy and transport system to be based 100 percent on renewable energy by 2050."[149] Its approach relies on energy taxes and cooperative agreements between the government, utilities, and industry.

ii. United States

In the United States, the federal government provides general energy-savings information, develops product standards and energy labeling requirements, and funds some energy efficiency RD&D. Most of the country's other energy efficiency mechanisms are implemented at the state level, typically, although not always, by mandates on energy providers. The major exception is the federally funded low-income Weatherization Assistance Program, which provides income-eligible households with whole-house, comprehensive energy efficiency improvements at no cost. The program is administered by state agencies that contract with community-based NGOs for service delivery. Annual federal appropriations to the program have ranged from US $100 million to $450 million annually, although augmented with US $4.7 billion of one-time economic Reinvestment and Recovery Act funds early in 2009. Evaluations have concluded that savings for gas customers average 23 percent of pre-treatment gas consumption.[150] Other national-level initiatives include federal tax credits for 2010 and 2011 of up to US $1500 per household for qualifying energy efficiency and renewable energy improvements to existing single-family homes.

The two US examples profiled here include the country's largest state and one of its smallest. Both rely on strong building codes and energy efficiency resource standards. California is one of the world's most populous places and the fifth-largest consumer of total energy. It has a long history of aggressive energy conservation, particularly as it applies to electric and gas utilities. California has often been the US leader on codes and standards as well as innovative energy-saving programs. At the other extreme, tiny Vermont is noted for its progressive energy policies, the use of a system benefit charge to fund a highly successful independent energy efficiency utility (Efficiency Vermont), and its ability to sell energy savings into the market-based ISO-New England forward capacity market.

iii. China and India

China and India both offer examples of fast-growing economies grappling with the challenges of large populations, increased urbanization and modernization, and a need to simultaneously increase energy supply, modernize technology, and reduce GHG emissions. Both countries have focused much of their efforts on implementing energy-savings targets for industry and benefited from outside investment and efforts to develop a stronger ESCO industry.

China's centralized economic and political structure has enabled the country to rapidly address energy modernization and conservation in its 11th and 12th Five-year Plans. The successful Top-1000 program focused both government officials and energy-intensive industries on finding and implementing energy efficiency measures. China also focused considerable effort on eliminating outdated technology.

By contrast, India's approach is far more market-based. The PAT scheme, which is designed to operate from 2011to 2014, encompasses mandatory requirements including energy-savings targets for the country's largest energy users combined with a market-based trading system designed to encourage even greater savings.

B. Denmark

Denmark has one of the EU's and OECD's best records in efficient use of energy and reducing CO_2 emissions, despite being a relatively small country (2011 population of 5.6 million) with a GDP per capita (€40 thousand or US $56 thousand) that is above average for the EU15.[151] Since 1980, the Danish economy has grown by 78 percent, yet non-transportation energy use remains constant and CO_2 emissions have gone down.[152] Denmark was the first member of the EU to use building labels, has aggressively

149 Danish Government, 2011

150 Oak Ridge National Laboratory, 2010

151 See more information at: http://www.denmark.dk/en/menu/About-Denmark/Denmark-In-Brief/Facts-about-Denmark.htm

152 Danish Ministry of Climate and Energy, 2009. It should be noted that the growth in GDP includes substantial earnings from shipping and related support industries. The emissions and energy use from these activities are reported with transportation use, and are therefore not included in this statistic.

implemented energy efficiency in its building stock, meets much of its heating needs through district heating and combined heat and power (CHP) production, has increased its use of renewables, and has provided R&D and other support to the increasingly important Danish green technology sector.[153]

Denmark's goal as detailed in the government's plan, *Our Future Energy,* is for its energy and transport systems to be based 100 percent on renewable energy by 2050, to reduce GHG emissions by 40 percent from 1990 levels by 2020, and to be carbon neutral in the electricity and heating sectors by 2035. An additional goal is for Denmark to "be at the forefront in energy policy" and lead by example in showing other countries how to transition away from fossil fuels and build green growth.[154] The plan raises the bar on Denmark's earlier *Energy Strategy 2050.* Both documents detail specific objectives and strategies to meet the goals, including increased spending.[155]

Denmark is unique in seeking collaboration among its political parties to negotiate comprehensive multi-year agreements related to energy policy. Our Future Energy lays out the intentions for an agreement that will cover the period from 2012 to 2020. The 2008 agreement, covering the years 2008 to 2011, specified that gross energy consumption by 2020 fall 4 percent from 2006 levels, and that the annual energy efficiency savings in 2010 increase to 1.5 percent of the 2006 levels of consumption (10.3 PJ), with a little more than half of those savings being met through obligations placed on energy providers (i.e., 5.4 PJ annually). Future targets are currently being negotiated; expectations are that the target will be 75-percent higher in 2013 and 2014, and 100-percent higher for 2015-2020.

Foundational Mechanisms

Denmark's foundational mechanisms include the following:

- **Energy Efficiency Requirements for Buildings** – The Danish Building Regulations have had a section related to energy consumption since 1961. The current version, BR10, which took effect in January of 2011, reduces energy use by 25 percent compared to 2008 regulations with comparable levels of improvements slated for 2015 and 2020. New buildings must meet annual kWh/m2 caps for total energy supply including heating, cooling, ventilation, hot water, and lighting (when it can be estimated at construction). Requirements for existing buildings must be met at the time of major renovations, change of heating supply, or replacement of boilers, windows, and roofs.[156]
- **Appliance Standards** – Denmark conforms to the EU appliance ecodesign requirements for energy-related products.
- **Savings Targets** – Denmark's Energy Agreement sets a savings goal for the country. More than half of the goal is destined to be met by energy distributors through a legal obligation executed with heat distributors and a voluntary agreement negotiated with the electricity and heating oil and gas distribution companies.[157] The goal can be met in any non-transport sector and with any energy type.[158]
- **Integrated Resource Planning** – Denmark's 1994 Electricity Act included an effective IRP obligation. Combined electricity distribution/retail supply companies were required to prepare DSM plans. Generation and transmission companies and the independent system operator drew up scenarios for generation and transmission. The Danish Energy Agency developed guidelines and coordinated an overall 20-year plan for the whole country.[159]
- **Voluntary Agreements** – Denmark has had a VA scheme available to energy-intensive industries since 1996. Companies executing the three-year VA receive reduced rates on their CO_2 tax based upon their energy intensity.[160]

153 Approximately 12 percent of Denmark's 2009 exports were energy technologies and equipment.

154 Danish Government, 2011b

155 Danish Government, 2011a

156 See more information in section 7 at: http://www.ebst.dk/file/155699/BR10_ENGLISH.pdf

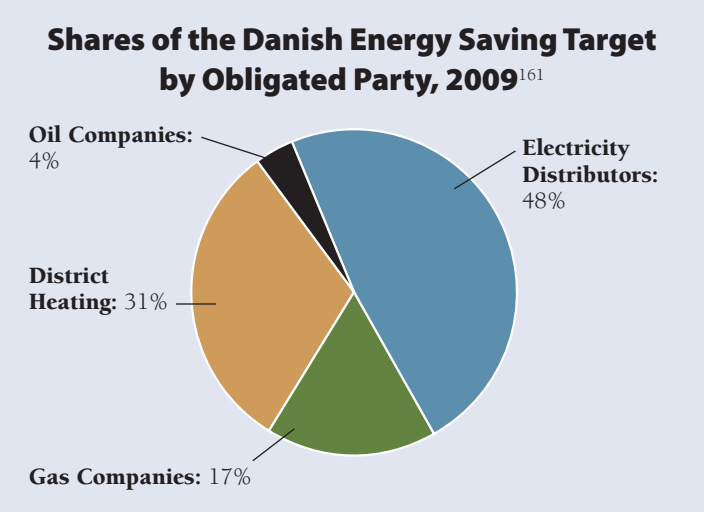
157 Lees, 2010

158 Togeby, Dyhr-Mikkelsen, Larsen, Hansen, & Bach, 2009

159 D'Sa, A. (2005). IRP and power sector reform in developing countries. Energy Policy 33, 1271-1285.

160 See more information at: http://www.ens.dk/en-us/consumptionandsavings/industry/sider/voluntaryagreementsindustryonenergyefficiency.aspx

Figure 2



Implementation Strategy

Delivery Structure – Denmark has a multi-pronged delivery structure. The Danish Energy Regulatory Authority regulates the Danish markets for electricity, natural gas, and district heating by setting the allowed price for obligated suppliers, but has no mandate for environmental activities including energy efficiency. The Danish Energy Agency (DEA) is responsible for overall planning, developing codes and standards, prioritization of energy-savings measures, and oversight and verification of energy efficiency obligations. The DEA also houses the Danish Energy Savings Trust (Go' Energi), a public authority charged with "ensuring energy savings by focusing on energy savings based on campaigns, and by influencing the market to introduce new energy efficient products and services."[162] The Trust was formerly the Danish Electricity Savings Trust (Elsparefonden). Finally, Denmark's 240 electric, gas, oil, and district heat distributors are obligated to provide energy efficiency services, although the installation of the measures is typically delivered by subsidiary companies since the energy distributors are banned from directly delivering the energy efficiency measures themselves.[163]

Funding – In 2009, Denmark spent approximately US $58 million per year on energy efficiency activities. Sources of funding for these expenditures include taxes, a public benefits charge, user fees and utility funding as detailed below:[164]

- **Public Benefit Charge** - Households and the public sector pay a charge of DKK 0.006/kWh which is used to fund the Energy Savings Trust. The total annual proceeds are approximately DKK 90 million (about US $16.4 million in 2011).
- **Direct Government Investment** - Annual allocations based upon the 2008-2011 agreement include DKK 30 million (about US $5.5 million) for the promotion of heat pumps in areas situated outside the collective supply grid, and DKK 20 million (US $3.65 million) to promote energy savings in buildings, including DKK 10 million (US $1.8 million) to operate the Knowledge Center on energy savings in buildings. The 2012 Finance Act includes DKK 500 million (US $89.8 million) in 2013 and 2014 for tax deductions related to energy renovation of housing.
- **Energy Provider Funding** –To meet their energy-savings targets, it is estimated that energy distributors spent about US $30 million in 2009, which are recovered through tariffs.
- **White Certificates** - Since 2006, Denmark has allowed the trading of obligations between distributors and purchasing savings from other market actors without requiring formal certification.
- **User Funding** – Building owners pay for the mandatory energy labeling of their buildings. They also provide the majority of investment required for installing energy-saving measures, which is estimated to cost about US $23.6 million annually.

EM&V – Denmark estimates first-year savings based on two methods of measurement – standard values established by the DEA for prescriptive activities, and calculated savings based on engineering methods for larger projects. Standard values were revised in the beginning of 2011 to reduce the savings on short-lived measures and reward longer-term measures. The utilities are responsible

161 Source data for Figure 5 were compiled by Eoin Lees Energy based upon data supplied by Peter Bach of the Danish Energy Agency.

162 See more information at: http://www.savingtrust.dk/about-us/about-the-trust

163 Bach, 2011

164 Figures in this section come from (Togeby et al., 2009) or the reporting obligation letter detailing measures related to implementation of EU EPBD available at: http://ec.europa.eu/energy/efficiency/buildings/doc/dk_letter.pdf

for the specific calculations, verification, documentation, and reporting. Independent audits and quality control are required. Evaluation is about 2-4 percent of the total cost.[165]

Support Mechanisms

Additional Danish policies include:

- **Mandatory Heating System Inspections** – In conformance with the EU's Building Performance Directive, Denmark requires regular inspections of boilers and heating installations fired by oil, gas, coal, or coke, and energy inspections of large ventilation plants every five years.
- **Mandatory Energy Labels** - Denmark's energy labeling process covers virtually all new and existing buildings. It must be completed whenever an existing building is sold or rented, and no less than every five years for public and larger (>1000 m^2) buildings. The process, which must be completed by an approved and registered energy consultant, results in an energy label, an energy plan, and a registration of the building's thermal envelope and technical systems. As of 2012, actual energy-consumption information will also need to be provided. Consultants working in smaller buildings must be trained engineers, architects or similar professionals with at least three years' experience in building technology. Since 2006, more than 250,000 certificates have been issued, including more than 190,000 for single-family homes. There are approximately 1,000 accredited energy consultants in Denmark.[166] As of July 2010, real estate agents must include the energy label on any announcement of a property sale.[167]
- **Energy Efficiency Information Centers** – Denmark established the Knowledge Center for Energy Savings in 2009 to provide building professionals with free access to expertise, best practices, and advice pertaining to obtaining energy savings in buildings. The government allocated DKK 32 million (about US $6.15 million) for its first three years of operation.[168] Since 2005, the country has also had an independent network of regional energy efficiency advisory services — The Energy Service Denmark — operated by citizen-based organizations.[169]
- **Tax Levy** – Denmark has raised prices on energy through taxation as a strategy to reduce consumption and currently has the highest residential energy prices in the EU. It has had an energy tax since 1977, a CO_2 tax since 1996 and a NO_x tax since 2010. The energy tax is currently charged on all fossil fuels. It is estimated that without these taxes, consumption would be 10-percent higher.[170] Rates vary by sector and use. Households and the public sector pay an electricity tax that includes the energy tax, a public benefit obligation, a CO_2 tax, and a VAT. Together they amount to about 64 percent of the cost of electricity. Denmark has also had a longstanding tax on incandescent light bulbs. Energy taxes, including those on transport, yielded DKK 36.4 billion (US $6.8 billion) in 2009.[171]
- **R&D** – the Danish government provides DKK 130 million (US $23.7 million) in annual funding to Elforsk, an energy efficiency R&D program.[172]
- **Government as Exemplary Performer** – Denmark requires consideration of energy efficiency in public procurement, mandatory implementation of all energy efficiency measures with a payback of less than five years, and public reporting on energy use in public buildings.[173] In 2009, a new requirement committed all ministerial areas to obtain a 10-percent reduction in their energy consumption from 2006 levels by 2011.[174]

165 Bach, 2009

166 Jensen, Hansen, Thomsen, & Wittchen, 2007

167 Aggerholm, Thomsen, & Wittchen, 2011

168 See more information at: http://www.byggeriogenergi.dk/about (translated)

169 See more information at: http://www.energitjenesten.dk/index.php?id=1955#6

170 Togeby et al., 2009

171 See more information at: http://www.odyssee-indicators.org/publications/country_profiles_PDF/dnk.pdf

172 Support measures related to implementation of EU EPBD available at: http://ec.europa.eu/energy/efficiency/buildings/doc/dk_letter.pdf

173 World Energy Council, 2010; See http://data.energibesparelseistaten.dk/StateEnergyConsumption.html for public reporting (in Danish).

174 See more information at: http://www.iea.org/textbase/pm/?mode=pm&id=4391&action=detail

Impact

Denmark's obligated parties exceeded their targets for the 2006-2008 period (on average by 11 percent), but some of the individual heat distribution companies did not; for 2008 the electricity distribution companies exceeded their target by 25 percent.[175] Denmark's EEO savings came from a more diverse set of customers than other European countries; half of the 2008 savings were from industry and commerce, 8 percent from the public sector, and 42 percent in the residential sector.[176] Average utility first-year savings cost in the 2006-2009 period was € 0.045/kWh (US $0.061).[177] Since then, there has been a steady increase in residential energy savings; it is now the dominant end use sector for savings.[178]

Figure 3

Recorded Energy Savings per Sector in Denmark, 2006 to 2008[179]

	Savings by Sector			
Fuel Type	Residential Sector (TJ)	Public Sector (TJ)	Trade and Industries (TJ)	Total (TJ)
Electricity	694	283	2,444	3,421
Natural Gas	1,011	73	530	1,614
District Heating	952	192	541	1,685
Heating oil	347	0	50	397
Total	3,004	548	3,565	7,117
	42%	**8%**	**50%**	**100%**

Concerns and Areas for Improvement

As part of its 2005 agreement on energy efficiency, Denmark evaluated its entire policy portfolio in 2008. Evaluators were asked to look at additionality and societal costs and make recommendations for improvements. Key findings included the realization that 47 percent of utility-supported projects would have been undertaken without the energy companies' help, and that all of the policy initiatives except energy labeling of buildings had been cost-effective. In addition to policy-specific suggestions, the evaluation recommends better coordination, increased and longer-term energy efficiency activity, prioritizing assistance in the business sector, higher energy taxes on industry, and improved data collection concerning impacts and costs.[180]

Key Jurisdiction Attributes

Denmark's unique political process seeks multi-party consensus on major issues including energy policy. These multi-year energy agreements provide the stability required to encourage longer-term investment. The country's cooperative culture and deep commitment to sustainability have resulted in: Denmark being home to one of the world's highest penetrations of cogeneration and district heating; a higher reliance on energy and pollution taxes rather than income taxes; an expanding energy provider obligation; and a commitment to aggressive research, development, demonstration, and deployment of clean energy solutions.

What is on the Horizon

Denmark's vision of becoming reliant entirely upon renewable energy by 2050 in an economically responsible way offers a model for other jurisdictions. Planned changes in various mechanisms include higher savings targets, revising the energy labeling scheme so that it focuses on older buildings with the greatest savings potential, adjusting the savings calculations to reward measures with higher lifetime savings such as insulation, increased NO_X taxes, and applying the energy security tax to biomass.

175 World Energy Council, 2010

176 Togeby et al., 2009

177 Bach, 2009

178 Richard Shamburg (DanskEnergi) 2011, private communication

179 Togeby, et al, 2009 at 303

180 Togeby et al., 2009

C. Germany

Germany has both the largest population (81.8 million) and the largest economy in the European Union. It has an export-oriented economy with recognized strengths in green technology engineering and manufacturing. Although it is the EU's largest consumer of primary energy (343.7 mtoe in 2008), it has the sixth-lowest energy intensity (151.1 kgtoe per €1000 of GDP).[181,182] Germany also has the EU-27's highest GHG emissions;- its 2010 overall volume was 960 million tons of CO_2 equivalent, below its Kyoto 2008-2012 target of 974 million tons but 4 percent higher than its 2009 amount due to economic activity after the recent economic crisis.[183] It has a goal of reducing CO_2 emissions by another 40 percent, to 739 million tons by 2020.

German energy policy focuses on efficient supply and use of energy, security of supply, and environmental compatibility. The country relies on imports for 62 percent of its energy, and recently made the decision to phase out nuclear power.[184] Germany sees the use of renewable energy and energy efficiency as a key method for slowing or abating climate change. In 2010, Germany adopted the Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply (Energiekonzept), which outlines the country's energy strategy up to 2050. The plan sets goals that include an 80-percent reduction (from 1990 levels) of GHG emissions by 2050; increasing gross final energy consumption from renewable sources to 18 percent by 2020 and 60 percent by 2050; and reducing primary energy consumption from 2008 levels by 20 percent by 2020 and 50 percent overall, including an 80-percent reduction in the building sector by 2050.[185]

Germany's approach to energy efficiency is based on three strategies:

- A legal framework and regulation at the federal level;
- A unique public investment bank that provide subsidies and loans for CO_2 reduction and efficiency improvements tied to energy performance standards in buildings, as well as subsidies for energy audits in small and medium enterprises; and
- Campaigns with regional and local entities designed to change behavior, including enforceable standards, energy performance certificates, and demonstration projects throughout the country.[186]

Foundational Mechanisms

Germany's foundational mechanisms include the following:

- **Energy Efficiency Standards for Buildings** – Since buildings account for 40 percent of Germany's energy use, strong standards and codes have been a longtime priority. Germany has had thermal insulation ordinances since 1977. Its current Energy Saving Ordinance (Energieeinsparverordnung) was adopted in 2007, and strengthened in 2009.[187] The 2009 amendments increased standards for all new and any renovations in existing buildings: primary energy consumption must be at least 30 percent lower than the 2007 limits, and insulation must be increased so that transmission heat losses are at least 15 percent better than the previous standard. Energy performance certificates are required for all buildings or units at the time of lease or sale. Germany also has codes and incentives that require the use of renewable sources of heat in new buildings and prescribe the methodology for allocating energy efficiency improvement costs to tenants in rental buildings.
- **Appliance and Equipment Efficiency Standards**– Germany conforms to the EU standards directive for appliances and ecodesign requirements for energy-related products.[188]

181 Population available at: http://www.statistik-portal.de/Statistik-Portal/en/en_zs01_bund.asp

182 Other statistics available at: epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-EI-11-001/EN/KS-EI-11-001-EN.PDF

183 See more information at: http://www.umweltbundesamt.de/uba-info-presse-e/2011/pe11-020_greenhouse_gases_well_below_the_limit.htm (translated)

184 Power & Zulauf, 2011

185 See more information at: http://www.bmwi.de/English/Navigation/Service/publications,did=367764.html

186 Power & Zulauf, 2011

187 See more information at: http://bcap-ocean.org/sites/default/files/engl_EnEV%202009_nichtamtliche%20Lesefassung_180309_ENGLISCH%20(2).pdf (unofficial translation)

188 Power & Zulauf, 2011

- **Voluntary Agreements** – In 1995, Germany executed energy savings agreements with 14 energy-intensive sectors representing more than 4,000 firms and 70 percent of industrial consumption. These were designed to yield emissions reductions of 25 percent between 1990 and 2005, and were seen by industry as more desirable than regulatory or fiscal instruments.[189] More recently, however, these agreements appear to have been dissolved.

Implementation Strategy

Delivery Structure –The German federal government oversees targets and regulations. The German Energy Agency (DENA) provides public information and education including a call center and a comprehensive web site, and provides advice on public-sector projects. State governments and some municipalities bear responsibility for implementation and compliance with energy performance certificates as well as adding their own energy policies.

Germany's state-owned Kreditanstalt für Wiederaufbau development loan bank (KfW) provides grants and long-term, subsidized interest rate loans for capital for energy efficiency measures through its Housing Modernization, Ecological Construction, Building Rehabilitation and other programs. Subsidies of up to €15,000 (about US $20,400) per unit or 20 percent of the cost of the improvement are available for refurbishing existing housing; the amount is based upon the final energy performance of the property with higher efficiency as compared to the requirements for new buildings resulting in greater subsidies. Loans can be used for 100 percent of the cost of the improvement, including design costs in amounts of up to €50,000 (about US $68,000) per unit for individual measures or €75,000 (about US $102,000) for whole-house retrofits. Greater efficiency results in lower interest rates. In order to receive a loan, property owners must have a registered energy adviser confirm the CO_2 savings, and measures must be installed by certified private contractors, who can lose their certification if complaints are logged against them. Loans are processed by local financial institutions, which forward approved funding requests to KfW and receive an administration fee from KfW of 1 percent of the credit volume. All KfW obligations are guaranteed by the federal government and delivered through local, traditional lending outlets. Loans are also available for building improvements on properties owned by local governments, community associations, and nonprofit organizations, including churches.[190]

Funding – Germany places no obligation on its utilities, although some municipally owned utilities offer voluntary efficiency programs. The major sources of funding for efficiency are taxes, CO_2 emissions trading payments and a levy on nuclear power.

- **Direct Government Investment** – The federal government approves funding levels for KfW's financial programs for households, businesses, and municipalities. Disbursements from KfW for energy efficiency efforts were €2 billion (about US $2.8 billion) in 2009 and €1.25 billion (about US $1.65 billion) in 2010.[191] The German government recently approved the 2012 budget of €1.5 billion (about US $2 billion) for this program.
- **Emissions Trading** – Germany established a Special Energy and Climate Fund in 2010, which was designed to provide additional financing to fund renewable energy, energy efficiency, and national and international climate protection. Initially, it was slated to receive the additional profits associated with extended the operating lives of Germany's 17 nuclear power plants. With Germany's decision to phase out nuclear power, the German government made the decision to allocate, as of 2012, all of its auction revenues from the EU Emissions Trading Scheme to this Fund.[192,193]

EM&V – Germany routinely conducts ex-post and or ex-ante evaluations of its climate and energy measures. In addition, the federal government evaluates the lifetime energy and CO_2 savings, cost, and required public investment of its Integrated Energy and Climate Program every two years. Independent experts commissioned by the German government provide the data.[194]

189 Krarup & Ramesohl, 2000

190 Power & Zulauf, 2011

191 Power & Zulauf, 2011

192 Esch, 2011

193 See more information at: http://www.bmu.de/english/energy_efficiency/doc/46723.php

194 Schlomann, Mauch, & Eichhammer, 2009

Support Mechanisms

Additional German policies include:

- **Mandatory Energy Audits** – In conformance with the EU's Building Performance Directive (EBPD), Germany requires regular inspections of boilers to make certain they meet emissions requirements (including flue gas losses.) Local registers of all boilers are maintained and those that do not meet requirements must be upgraded. Air conditioning units with outputs in excess of 12 kW must be inspected every ten years.[195]
- **Mandatory Energy Labels** – Pursuant to the EU EPBD, Germany requires energy performance certificates for all new and existing buildings that are being refurbished, sold, leased, or used by the public. Standard forms disclose either the calculated energy demand or consumption and include recommendations for "cost-effective modernization."[196] Germany also requires energy labels on eight types of appliances.
- **Energy Efficiency Information Centers** – The German Energy Agency, DENA, and regional entities provide easily accessible energy information and technical advice. There are about 400 advice centers in the country.[197] The government also provides subsidies for on-site energy advice provided by qualified advisers.
- **Customer Feedback** – Germany required smart meters to be installed in new buildings beginning in 2010. Effective in 2011, German utility companies were to provide load-based or time-of-day-based power-saving incentives.[198]
- **Tax Levy on End Users** – Germany introduced ecological tax reform (Ökologische Steuerreform) in 1999 and modified it in 2003. The law imposes an energy tax on electricity, gas, fuel oil, and motor fuels. As of 2003, the rates were €2.05 cents/kWh for electricity, €15.34 cents/liter of diesel and motor fuel, €2 cents per liter of natural gas, and €2.05 cents per liter of light heating oil. By 2003, the tax yielded about €52.7 billion.
- **Training and Certification** – Germany has a number of technical training institutes that focus on renewable energy and efficiency. These institutes provide contractor training. A certification process exists for qualifying energy assessors for Germany's EPC.
- **Research and Development** – Germany is aggressive in its efforts to reduce carbon emissions and combines substantial public investment in R&D with quality-controlled installation practices of efficiency measures.
- **Government as Exemplary Performer** – The German government has adopted (non-binding) guidelines on environmentally friendly and priority procurement of energy-efficient appliances and services. Some of Germany's 12,000 local municipalities have their own investment entities, called Stadtwerke, which have provided energy and water infrastructure services for years. More recently, these entities have played a leadership role in implementing energy conservation, renewable energy, and CHP projects.

Impact

From 2006 to 2009, KfW's program supported the refurbishment or construction of 1.4 million flats and more than 600 municipal buildings.[199] A study conducted for the Federal Environmental Agency developed a number of scenarios for energy consumption and GHG emissions, and estimates the impact of various policy measures. Estimated savings for the period from 2005 to 2030 are 12 $MtCO_2$ for KfW's building-refurbishment program, 7 $MtCO_2$ from the Energy Savings Act, 7 $MtCO_2$ from various electricity savings measures, and 15 $MtCO_2$ from the revision of the EU trading scheme.[200]

Concerns and Areas for Improvement

Although Germany is one of the most aggressive countries in refurbishing existing buildings, it is estimated that at the current rate of improvement it will take 80

195 Schettler-Kohler & Kunkel, 2011

196 Schettler-Kohler & Kunkel, 2011

197 See more information on the MURE database at: http://www.isisrome.com/data/mure_pdf/GER4.PDF

198 See more information at:http://a1.siemens.com/innovation/en/publikationen/publications_pof/pof_fall_2008/gebaeude/zaehler.htm

199 Kwapich, 2010

200 See more information at: http://www.odyssee-indicators.org/publications/country_profiles_PDF/rfa.pdf

Figure 4

Impact Evaluation of Selected Measures[201]

Sector addressed	Title of the measure	CO_2 Reduction (Mt) in 2030 (compared to base year 2005)
Power sector	Extension of electricity generation from renewable energy sources	36
Power sector, industry	Revision of the EU emission trading scheme (EU-ETS)	15
Industry	Incorporation of industrial N_2O emissions into the EU-ETS	40
Transport	Introduction of mandatory admixing for fuels	11
Buildings	KfW CO_2 building refurbishment programme	12
Households, tertiary, industry	Electricity savings resulting from various measures	7
Buildings	Energy Savings Ordinance	7
Transport	Reduction in car fleet consumption as part of the EU CO_2 strategy	6
Buildings	Market incentive programmes for biomass and solar power	5

years to refurbish the remaining stock. There are also concerns about the lack of enforcement of existing laws by local communities, the ability of properties to be exempt from regulation if they can demonstrate that refurbishment is not "economical," and the complexity of both the legal framework for energy efficient buildings and the decentralized system of accessing energy advice and subsidies.[202]

Key Jurisdiction Attributes

Germany was one of the first countries to actively grow its economy while protecting its natural and environmental resources. As a result, Germany is in the forefront of green manufacturing.

The availability of the KfW, which was created as a post-World War II reconstruction bank, has been essential for Germany's ability to refurbish existing buildings. In addition, the local and municipal ownership through Stadtwerke of utilities and infrastructure has helped to foster a culture of energy conservation in some localities.

What is on the Horizon

Germany has plans to introduce standards for near-zero energy buildings, with government buildings expected to be the first required to meet the standards that will eventually be applied to all new buildings. There are also plans to require disclosing energy performance in real estate advertisements, developing a "renovation roadmap," and reforms of tenant law to address efficiency.

201 Energy Efficiency Profile: Germany, July 2011. Odyssee Indicators. Available at: http://www.odyssee-indicators.org/publications/country_profiles_PDF/rfa.pdf

202 Power & Zulauf, 2011

D. California

The most-populous (37.3 million) of US states, California, if considered as a country, would have the world's ninth-largest GDP (US $1.9 trillion in 2010) and would be the world's fifth-largest consumer of energy.[203,204] The state has consistently led the US in aggressive energy efficiency policy and programs, including the nation's first appliance and equipment standards, a well-enforced building code, and aggressive utility-sector programs.[205] California per capita electric use has remained relatively level over the past 30 years as compared with the 50-percent growth experienced by the rest of the US, partly as a result of the state's energy efficiency policy and other demographic and economic factors.[206]

The state's energy efficiency goals are to "produce cost-effective energy savings, reduce customer demand, reduce overall system costs, increase reliability, and increase public health and environmental benefits."[207] California's Global Warming Policy (2006 Assembly Bill 32) sets a goal of reducing GHG to 1990 levels by 2020, an 11-percent reduction from current levels and a 30-percent reduction from business as usual. A quarter of the GHG emissions are attributed to electricity generation, while 38 percent are from transportation.

California's investor-owned utility (IOU) efficiency programs are guided by the Long Term Energy Efficiency Strategic Plan published by the California Public Utilities Commission, the state's regulator, which outlines four "Big Bold Energy Efficiency" strategies. The four strategies are: 1) All new residential construction will be net zero energy by 2020; 2) All new commercial construction will be net zero energy by 2030; 3) Heating, Ventilation and Air Conditioning requirements will be transformed to ensure that their energy performance is optimal for California's climate; and 4) All eligible low-income customers will be given the opportunity to participate in the low-income energy efficiency program by 2020.[208]

Foundational Mechanisms

California foundational mechanisms include the following:

- **Energy Efficiency Standards for Buildings** – The current mandatory standard was issued in 2008 and took effect on January 1, 2010. It exceeds IECC standards for residential buildings and meets or exceeds ASHRAE/IESNA 90.1-2007 for commercial buildings. The standards include performance-based specifications that allow for flexibility in design and field verification for certain measures.
- **Appliance and Equipment Efficiency Standards** – California's appliance and equipment standards apply to all products that are offered for retail sale in California. The 2010 Regulations, which took effect on January 1, 2011, include standards for 23 categories of appliances, including televisions and eight other products that are not covered by federal standards.[209]
- **Integrated Resource Planning** – IOUs are required to develop long-term procurement plans, which must incorporate energy-savings targets.[210] California statutes include a "loading order" that requires IOUs and publicly owned utilities to meet their "unmet resource needs through all available energy efficiency and demand reduction resources that are cost-effective, reliable, and feasible."[211] In addition, California statutes specify that "all load-serving entities procure all cost-effective energy efficiency measures."[212]

203 See more information on Population at: http://2010.census.gov/2010census/data/apportionment-pop-text.php

204 See more information on Energy Use at: http://www.energy.ca.gov/commission/overview.html

205 See more information at: http://www.aceee.org/energy-efficiency-sector/state-policy/California/1575/all/193

206 Balash & Pickenpaugh, 2009

207 California Assembly Bill 2021 Section 1 at: http://www.energy.ca.gov/sb1/meetings/ab_2021_bill_20060929_chaptered.pdf

208 See more information at: http://www.cpuc.ca.gov/NR/rdonlyres/D4321448-208C-48F9-9F62-1BBB14A8D717/0/EEStrategicPlan.pdf

209 See more information at: http://www.energy.ca.gov/2010publications/CEC-400-2010-012/CEC-400-2010-012.PDF

210 See more information at: http://docs.cpuc.ca.gov/published/Final_decision/33625.htm

211 Public Utility Code Section454.5(b)(9)(C) for IOUs and Section 9615 for POUs

212 See more information at: http://www.energy.ca.gov/sb1/meetings/ab_2021_bill_20060929_chaptered.pdf

- **Energy Savings Targets** – Targets have been established for the four IOUs which provide two-thirds of the state's retail electricity. The savings goals for 2010-2012, as established by regulatory decision, are: 6,965 GWh (0.9 percent of sales), 1,537 MW, and 150 million therms.[213] Publicly owned utilities are required to develop non-binding targets, which are reviewed by the California Energy Commission.

Implementation Strategies

Delivery Structure - The state's utility regulator, the California Public Utilities Commission (CPUC), oversees and approves energy efficiency programs and budgets administered by the IOUs.[214] The approved 2010-2012 portfolios direct the IOUs to administer "twelve statewide programs that will be consistent throughout the utilities' service area," as well as some local and pilot programs.[215] Efficiency services are delivered by both the IOUs and third-party contractors. IOUs also are required to make a significant portion of their energy efficiency funds available to cities, counties, regional entities, and state entities and institutions so that they may deliver their own energy efficiency programs. California's publicly owned utilities, which include entities serving the cities of Los Angeles and Sacramento, also administer efficiency programs.

California's energy policy and planning is overseen by the California Energy Commission (CEC), a government entity. It is charged with adopting a biennial "Integrated Energy Policy Report" that assesses trends and issues and provides policy recommendations. The CEC's Energy Efficiency and Renewables Division promulgates codes and standards, promotes energy efficiency, reports on programs administered by publicly owned utilities, and assists the public sector in implementing energy efficiency measures.[216] They also partner with utilities and trade associations to offer training. Building code compliance is enforced by local building departments.

Funding – California relies on a number of sources to fund energy efficiency, including:

- An electric public benefits charge equal to about US $.003/kWh for customers of the IOUs (an additional US $.0018/kWh funds increased use of renewable energy and R&D). Expenditures in 2010 totaled US $755 million.[217]
- Funding from the publicly owned utilities. The amount expended in 2010 was US $123 million.[218]
- A natural gas public benefits charge; gas-program expenditures were US $228 million.[219]
- Electricity and natural gas procurement budgets with rates authorized by the CPUC. California's approved 2010 budgets were US $1.833 million, including US $335.9 million for load management.[220]
- State funding for public sector efficiency; and
- Federal government funding for the Weatherization Program (US $16.3 million awarded for 2009 and 2010 plus Recovery grant of US $141.3 million),[221] as well as funding from the US Department of Energy and the American Recovery and Reinvestment Act (ARRA).

The state has also passed legislation enabling PACE districts. PACE programs provide property owners with long-term financing that is repaid by an assessment on their property tax bills. Six local jurisdictions established PACE programs, but most were suspended as a result of concerns from the US Federal Housing Finance Agency.[222]

EM&V – California's most recent energy efficiency EM&V protocols were developed by the CPUC and stakeholders in 2006.[223] CPUC's Energy Division manages and contracts for savings-and-demand EM&V studies and

213 See more information at: http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/85995.pdf

214 See more information at: http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/

215 California Public Utilities Commission Decision 09-09-047

216 See more information at: http://www.energy.ca.gov/efficiency/index.html

217 Lewis, McFarlin, Rogers, & Kemmer, 2011

218 Lewis, McFarlin, Rogers & Kemmer, 2011

219 Caracino, 2010

220 Caracino, 2010

221 See more information at: http://www.bsa.ca.gov/pdfs/reports/2011-503.2.pdf

222 See more information at: http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA198F&re=1&ee=1

223 See more information at: ftp://ftp.cpuc.ca.gov/puc/energy/electric/energy+efficiency/em+and+v/EvaluatorsProtocols_Final_AdoptedviaRuling_06-19-2006.doc

rigorous financial and management audits for individual programs, groups of programs and portfolios. The current budget for EM&V is 4 percent of the overall adopted portfolio budgets for 2010-2012.[224] The Energy Division oversees the issuance of three types of reports: verification of program activities and their costs; updating the parameters used to estimate program savings and benefits; and reports of the earning incentives the IOUs can claim. The utilities retain a limited budget to undertake studies related to market assessment and portfolio implementation.

Performance incentives and penalties – California has a legislative requirement for IOU decoupling that has been combined with CPUC-imposed performance incentives and penalties, called the "risk reward incentive mechanism" (RRIM).[225] IOUs are eligible for the RRIM if they achieve 80-to-85 percent of the CPUC savings targets; they can earn greater incentives if they exceed the goal. Penalties may be triggered if savings are below 65 percent of the goal. Total awarded incentives for the 2006-2008 cycle for the four utilities combined were US $212 million, or about 11 percent of the amount invested by the IOUs in efficiency. Two interim payments were provided, first after verifying actual measures installed and program costs, then after EM&V reports document projected per-measure savings. Thirty percent of the total incentive was held back pending a final post-installation EM&V "true-up."[226]

Support Mechanisms

Additional California policies include:

- **Energy Use Disclosure** – An energy-use disclosure policy that will require the release of efficiency ratings for commercial buildings effective January 1, 2012.[227]
- **Tax Relief** – Tax deductions for the interest paid on loans from publiclyowned utilities for energy efficiency improvements in residential properties.[228]
- **ESCO Development** – Enabling legislation supportive of ESCOs.
- **R&D** – The Public Interest Energy Research (PIER) program funds advance research, development and demonstration of more efficient technologies and processes.
- **Government as Exemplary Performer** – California has an Executive Order requiring state agencies and departments to reduce their energy consumption by 20 percent from 2003 levels by 2015.[229] The Order mandates Energy Star equipment whenever it is cost-effective; that all new buildings and major renovations meet LEED-NC Silver or higher; that all existing state buildings of more than 50,000 square feet meet LEED-EB standards no later than 2015; and that leases for state offices be restricted to Energy Star-rated buildings.

Impact

The impact of California's policies has been significant. The 2006–2008 IOU investments of US $2.1 billion have resulted in verified cumulative annual savings of more than 6,400 GWh, 84 million therms, and 1,175 MW, based on EM&V study results adopted by the CPUC. It is estimated that two-thirds of the savings would not have occurred without these policies. Savings have been delivered at a cost of less than US $.03/kWh (less than half of the CPUC's benchmark price for baseload power.)[230] These savings levels represent approximately 3.2 percent of electricity and 1 percent of the 2008 natural gas sales. The majority of electrical savings (58 percent) were due to lighting, while gas savings were due to improvements in HVAC (43 percent) and industrial processes (38 percent). The commercial sector was responsible for 46 percent of electrical savings and 75 percent of gas savings. The total resource cost benefit ratio for 2006-2008 was 1.14, while the program administrator cost benefit ratio was 1.59. In

224 This is a substantially lower percentage than earlier budgets where the guideline for EM&V was 8 percent of the portfolio. See more information in section 7 available at: http://docs.cpuc.ca.gov/PUBLISHED/AGENDA_DECISION/107378.htm#P4291_517513

225 See more information at: http://www.cpuc.ca.gov/NR/rdonlyres/33471B66-CCCB-4999-B727-CB02CBAB8734/0/D0709043.pdf

226 The CPUC is continuing to review the RRIM rules. See more information at: http://docs.cpuc.ca.gov/proceedings/R0901019.htm

227 See more information at: http://www.energy.ca.gov/ab1103/documents/index.html

228 The California Revenue and Taxation Code § 17208

229 See more information at: http://www.dot.ca.gov/hq/energy/ExecOrderS-20-04.htm

230 Martinez, 2010

other words, the state received US $1.59 in benefits for each dollar invested in IOU efficiency.[231]

Programs targeted to help lower-income households improve their efficiency reached an annual average of 160,000 households over the last decade, or more than 40 percent of all eligible participants.[232]

Concerns and Areas for Improvement

Energy efficiency programs in California are administered, designed, and delivered by many participants at many levels. The variety of players and their associated reporting requirements, planning processes, EM&V, and the need to negotiate agreements with third-party providers and community programs, has resulted in a very complex, uncoordinated, and occasionally confusing delivery system.[233] Historically, California had one of the largest allocations of funding to EM&V budgets in the country; its authorized IOU EM&V budget for 2006 through 2009 was 8 percent of EE program budgets.[234] Some have criticized California's EM&V budget as being too expensive and not in ratepayers' best interests. However, the budget has decreased more recently. California's EM&V budget for 2010-2012 is US $125 million, or 4 percent of EE program budgets.[235]

Key Jurisdiction Attributes

California's size has meant that the state could command respect and compliance from appliance and other equipment manufacturers as well as builders and retailers. This has helped propel the state as the national leader on these issues. The state has also benefited from a highly sophisticated and knowledgeable regulatory framework.

What is on the Horizon

The 2013 update of the California Building Standards, which is currently under development, will be the first to include a targeted standard for net zero properties. This is a preliminary step in meeting the state's goal for new building standards to require net zero energy levels by 2020 for residences and by 2030 for commercial properties.[236] The state is also moving forward in implementing its Long Term Energy Efficiency Strategic Plan and its four "Big Bold Energy Efficiency" strategies.

E. Vermont

Vermont is one of the smallest and least-populated states in the US, with just over 600,000 people. Its heavy reliance on hydro and nuclear power has resulted in the lowest carbon intensity of electricity consumption of any US state.[237] Most of the state's carbon emissions associated with building energy use are the result of direct use of fossil fuels (gas, fuel oil, and propane). Natural gas is available to only about 15 percent of the population due to low population densities in much of the state and constraints imposed by its hilly terrain.

Vermont has a reputation for progressive environmental policies and ethics. Recent state ratings placed Vermont with the fifth-best energy efficiency policies in the country.[238] Vermont received the highest score of any state in the area of utility-funded efficiency programs, one of six policy categories upon which total state rankings are based.[239] Vermont pioneered the concept of an "energy efficiency utility," now known as Efficiency Vermont, in 2000. It has since been emulated in a variety of jurisdictions in the United States and Canada.

Vermont's Department of Public Service (DPS), which doubles as the state energy office and the state's consumer advocate, is responsible for developing a 20-year energy plan every five years. The plan issued in December 2011

231 See more information at: ftp://ftp.cpuc.ca.gov/gopher-data/energy%20efficiency/2006-2008%20Energy%20Efficiency%20Evaluation%20Report%20-%20ES.pdf

232 See more information at: http://www.californiaenergyefficiency.com

233 Lewis et al., 2011

234 See more information at: http://docs.cpuc.ca.gov/published/AGENDA_DECISION/107378.htm

235 California Public Utilities Commission, 2010

236 See more background information at: http://www.energy.ca.gov/title24/2013standards/prerulemaking/background.html

237 Stanton & Ackerman, 2010

238 Sciortino et al., 2011

239 The others are policies related to transportation efficiency, building codes, appliance standards, combined heat and power and other government initiatives.

sets a goal of attaining 90 percent of the state's energy from renewable energy sources by 2050 in order to foster economic security and independence, safeguard the environment, drive innovation and job creation, and increase community involvement and investment. The plan explicitly states that "efficiency and conservation must be the first priority."[240]

Foundational Mechanisms

Vermont foundational mechanisms include the following:

- **Energy Efficiency Standards for Buildings** – The current mandatory standard for new residential construction took effect on October 1, 2011. A new standard for commercial buildings is expected to go into effect January 3, 2012. Both exceed 2009 IECC standards. In addition, since the 1990s the state's largest city, Burlington, has required that all existing residential retrofit properties meet minimum energy efficiency standards at the time of sale.
- **Appliance and Equipment Efficiency Standards** – Vermont is one of about 15 states that have, at times, adopted minimum efficiency standards for products not covered by national standards. The state does not currently have any standards that exceed national requirements.
- **Integrated Resource Planning** – Vermont law requires that distribution utilities and the statewide transmission utility (which is owned by all the distribution utilities) prepare 10-year forecasts of potential transmission and distribution system reliability needs, to assess whether efficiency and/or other demand-side resources could meet any potential needs, and to pursue those demand-side investments whenever they are less expensive.[241]
- **Energy Savings Targets** – The state's regulator sets three-year electricity savings targets in its contract with Efficiency Vermont and the Burlington Electric Department. For 2009-2011 the target was incremental annual savings of 360,000 MWh, or an average of 120,000 per year. That translates to about 2.2 percent of sales per year (so that the cumulative impact of the three years of programs would be to reduce sales by about 6.6 percent). Goals for the next three year period have not been finalized, but they are expected to be higher.[242] Vermont Gas is required to operate natural gas DSM programs and prepares annual budgets and targets that must be filed with the state's regulator.
- **New England Forward Capacity Market** – As one of six states in the New England power pool, Vermont bids the peak demand impacts of its efficiency programs into the region's Forward Capacity Market. The revenues from participation in the market are dedicated to programs addressing unregulated fuels such as fuel oil and propane.

Implementation Strategies

Delivery Structure – Throughout the 1980s and 1990s the state's distribution utilities were responsible for implementing efficiency programs. In late 1999 the state's regulator, the Vermont Public Service Board (PSB), decided to transfer most of that responsibility to an independent energy efficiency utility (EEU). Vermont Gas and the Burlington Electric Department retained the right to continue to implement their own efficiency programs, but both coordinate closely with Efficiency Vermont. All three entities coordinate with the state's weatherization agency and its NGO contractors. An RFP process resulted in the Vermont Energy Investment Corporation (VEIC) being selected to serve as the EEU under a three-year contract with an option for renewal for a second three years. VEIC created the Efficiency Vermont brand (owned by the state) under which all statewide electric efficiency programs for residential, commercial, and industrial customers have been marketed, and has been selected by the PSB to serve as the EEU since inception.

Beginning in 2012, the state will treat the efficiency utility –again with VEIC selected by the PSB to play that role – as more of a regulated "franchise" with a longer-term commitment, rather than rebidding the contract every three to six years. The objectives of this change include allowing the efficiency utility to take a longer-term view to efficiency planning and investments and interact more in

240 See more information at: http://vtenergyplan.vermont.gov/publications#Public Review 2011

241 30 VSA §218c

242 Information provided by Mike Wickenden, Planning Manager, Policy and Public Affairs, Vermont Energy Investment Corporation, 10/27/11.

policy arenas and with the states' distribution utilities than it had in the past. However, it will still operate with three-year performance goals. Although initially focused solely on electric efficiency, Efficiency Vermont's mission has been expanded to address opportunities for reducing use of unregulated fuels such as fuel oil and propane.

Funding – Vermont relies on several sources to fund energy efficiency, including:

- An electric public benefits charge equal to roughly US $.006/kWh from 2009 through 2011. Expenditures during that period totaled nearly US $103 million.
- A natural gas public benefits charge equal to roughly US $0.25/Mcf (about $.0008/kWh) in 2010, leading to total gas efficiency program expenditures of US $2 million.[243]
- Revenues from participation in the New England Forward Capacity market which are dedicated to programs addressing unregulated fuels such as fuel oil and propane. Net revenues were forecast to be approximately US $5 million for the three years from 2009 through 2011.[244]
- Revenues from auctions of carbon-emission allowances under the northeastern states' Regional Greenhouse Gas Initiative (RGGI), which are also dedicated to programs addressing unregulated fuels. Revenues for the three years from 2009 through 2011 were forecast to be approximately US $4.1 million; and
- Federal and state government funding for the low-income weatherization program; federal funding averages between US $1 million and $2 million, while annual state funding of approximately US $3 million comes from a 0.5-percent gross receipts tax on all non-transportation fuels sold in the state. Under the federal Reinvestment and Recovery Act, Vermont received a one-time supplemental US $16.8 million for the period from 2009 to 2012.

The state has also passed legislation enabling PACE Districts. Following concerns expressed by the US Federal Housing Finance Agency (FHFA)[245] about the PACE concept, Vermont modified its PACE legislation to make PACE subordinate to other liens on a property, and subsequently received FHFA approval. Although no PACE program is currently operational, dozens of communities are considering the adoption of PACE programs to be administered primarily by Efficiency Vermont.

EM&V – Efficiency Vermont uses prescriptive assumptions and site-specific calculations for custom commercial and industrial projects to provide a preliminary annual report on its previous year's savings. The Vermont Department of Public Service is charged with evaluation and verification of the savings. This review is typically conducted by a third-party consultant with expertise in efficiency program evaluation; it involves, among other things, a detailed review of a statistically representative sample of custom projects. The DPS and Efficiency Vermont resolve any differences of opinion on technical matters and ultimately file recommended adjustments to the regulators for final approval or – if there are outstanding disagreements – resolution of disputes. A final savings report is then prepared. Savings claims are usually equally divided between measured and prescriptive, the latter of which are based on a Technical Reference Manual that was developed by Efficiency Vermont. Values in the manual are periodically updated through collaborative discussions with the DPS when evaluation work in Vermont (or elsewhere) provides a basis for changes. Participation in the New England Forward Capacity Market also involves extensive EM&V planning and work.

Performance Incentives and Penalties – The Efficiency Vermont contract includes a "hold-back" of roughly 3 percent of the total budget. That 3 percent is

243 See more information at: http://www.vermontgas.com/pdf/VGS%202010%20Annual%20Report.pdf

244 Total revenues were projected to be $7.6 million. However, it was estimated that approximately $2.6 million would be needed to support participation in the capacity market (much of it associated with monitoring and evaluation), leaving a net of $5.0 million for additional efficiency program investments.

245 See http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA198F&re=1&ee=1 The Federal Housing Financing Agency (FHFA) issued a statement in July 2010 concerning the senior lien status associated with most PACE programs. In response to the FHFA statement, most residential PACE programs have been suspended until further clarification is provided. See http://pacenow.org/blog/library/ for additional information.

allocated across several different performance metrics, including total first-year MWh savings actually delivered, coincident peak demand (MW) savings delivered, and the net present value of the economic benefits of the efficiency programs. As the operator of Efficiency Vermont, VEIC eventually receives the held-back payments, or portions of the payments, based on its performance relative to the metrics.

Support Mechanisms

Additional state-level support policies include:

- **Customer Feedback/Real Time Pricing** – Vermont recently received a competitively bid federal matching grant to extend smart grid infrastructure to every electricity customer in the state. As part of that effort, Efficiency Vermont and the state's utilities are conducting a study of several different cohorts of residential customers to determine how different combinations of consumption information, energy pricing, and efficiency support services will affect consumer behavior, and which will lead to the greatest investment in energy efficiency.
- **Decoupling** – Vermont's two investor-owned utilities, which serve most of the state's electric customers, have alternative regulation plans that essentially decouple their revenues from their sales.
- **Training and Certification** – Vermont has an extensive training and certification initiative for contractors who perform whole house efficiency audits and retrofits. The training focuses extensively on understanding building science and is designed, in part, to prepare contractors to pass the Building Performance Institute's (BPI) national certification tests. In order for homeowners to receive financial incentives for home retrofits, they must use a firm with a BPI-certified contractor.
- **Government as Exemplary Performer** – In 2011, the Vermont Legislature passed a law requiring that established a goal of reducing energy use by state government agencies by 5 percent per year. Among the strategies the state is pursuing to meet that goal is benchmarking the actual operating efficiency of every state government building using the US Environmental Protection Agency's "Portfolio Manager" tool.

Impact

The impact of Vermont's policies has been significant. Demand reductions in 2010 were 17.2 MW for the summer peak and 20.9 MW on the winter peak. Efficiency Vermont's energy savings for the period from 2009 to 2011 are expected to result in verified annual savings of nearly 300 GWh. This represents incremental annual savings of 5.5 percent of sales (an average reduction of about 1.8 percent per year). Electric savings have been delivered at a levelized cost of about US $.04/kWh. For 2009 to 2011, Vermont Gas' incremental annualized efficiency savings goals added up to more than 200,000 Mcf, or an average of close to 70,000 Mcf.[246] That translates to an average of roughly 0.8 percent of average annual sales (so that the cumulative three year impact would be to reduce sales by 2.4 percent).[247] Gas savings have been delivered at a levelized cost of about US $2/Mcf (about $.0066/kWh). Programs targeted to help lower-income households improve their efficiency reached approximately 2000 homes in 2010 – or about 0.8 percent of the existing housing stock.

Concerns and Areas for Improvement

The principal deficiency of Vermont's efficiency efforts has been in reducing consumption of unregulated fuels such as fuel oil and propane. This stems primarily from the very recent adoption of authority for Efficiency Utility activities in that area, and a lack of adequate funding for programs to address those fuels.

Key Jurisdiction Attributes

Vermont has a long history of environmentally conscious laws and utility regulators. The adoption of an energy efficiency utility may have been simplified by the presence of a significant number of creative and skilled efficiency consultants and the fact that this small geographic area is served by many small energy utilities. As a result, there was

246 See more information at: http://www.vermontgas.com/pdf/VGS%202010%20Annual%20Report.pdf

247 From 2002 through 2009, annual sales averaged 8.4 billion cubic feet, with a low of 8.0 in 2006 and a high of 8.8 in 2007. Information available at: http://www.eia.gov/state/seds/hf.jsp?incfile=sep_use/tx/use_tx_VT.html&mstate=Vermont

a significant opportunity to achieve greater energy savings, avoid customer confusion, and maximize economies of scale.

What is on the Horizon

The state has just adopted a new long-term energy plan that identifies increasing energy efficiency as its first priority. A number of specific related initiatives are under consideration. These include:

- Identifying options for funding efforts to promote the efficiency with which unregulated fuels such as fuel oil and propane are used.
- Adopting a time-of-sale building energy efficiency labeling and disclosure requirement. This seemed likely to be considered in the 2012 legislative session.
- More extensive use of consumer-feedback tools is a possibility, depending on the results of current pilot experiments with smart grid applications and various supporting services.
- More aggressive use of PACE and other financing schemes.
- More aggressive building codes (the comprehensive energy plan sets a target that all new buildings be zero net energy by 2030).
- Increased activity by town energy committees and other community-oriented vehicles for promoting efficiency investments.

F. China

China is the world's most populous (>1.3 billion) country, with its second-largest economy. Its fast-growing economy demands energy; China is the world's largest producer and consumer of coal and second-largest consumer of oil.[248] However, its per capita energy use is one-eighth that of the United States and one quarter of the European Union. China's estimated 2010 GDP per capita is US $7,600.[249, 250]

Beginning in 1980, China invested aggressively in energy efficiency and cogeneration (accounting for 10 percent of its energy investments) and was able, until 2001, to keep growth in energy demand at half the growth of GDP. This reversed from 2002 to 2005 when China's rapid expansion of energy-intensive industry pushed energy intensity (measured as energy use per unit of GDP) to grow by 3.8 percent per year. In response, in late 2005 the Communist Party leadership called on the country to reduce energy intensity by 20 percent by 2010. The 11th Five Year Plan (FYP), for 2006-2010, mandated that government at all levels contribute to achieving this goal and implementing the "ten key projects" outlined by National Development and Reform Commission (NDRC) in its 2004 *Medium and Long-Term Plan for Energy Conservation.*[251] Projects included building-sector measures, the Top-1000 Program, energy efficient lighting, motor system efficiency, cogeneration projects, renovation of coal-fired industrial boilers, and energy system optimization.[252]

China's 12th FYP for the period from 2011-2015, has binding targets for reducing energy intensity during the period by 16 percent and CO_2 emissions per unit of GDP by 17 percent. The FYP also includes the concept of limiting total energy consumption. Although there is not yet an official target — and it is unlikely that an energy-consumption target would be accorded the same degree of importance as energy-intensity targets — a senior official indicated a national cap of 4 billion tce by 2015.[253] (This would represent a significant decline in the growth rate of energy consumption, compared to the previous five-year period.) The FYP includes a Top 10,000 program, increased support for the development of energy efficient technology, increased efforts on DSM and construction of "efficiency power plants," and the gradual establishment of carbon trading mechanisms.[254] A crucial question will be whether the government is able to hold to its framework to reduce GDP growth and limit the growth of energy-intensive industry, which has been outstripping other sectors of the economy. Similar targets in the previous FYP to achieve slower growth and structural transformation where not achieved.

248 See more information at: http://news.bbc.co.uk/2/hi/asia-pacific/country_profiles/1287798.stm

249 Levine, 2010

250 See more information at: https://www.cia.gov/library/publications/the-world-factbook/fields/2004.html

251 Zhou, Levine, & Price, 2010. Plan can be viewed at: http://www.beconchina.org/energy_saving.htm

252 See more information at: http://www.chinafaqs.org/library/chinafaqs-chinas-ten-key-energy-efficiency-projects

253 See more information at: http://www.chinadaily.com.cn/business/2011-10/24/content_13960190.htm

254 Lewis, 2011

Foundational Mechanisms

China's foundational mechanisms include the following:

- **Energy Efficiency Requirements for Buildings** – China's Civil Building Energy Conservation Ordinance, which was adopted in 2008, includes regulations for building energy management, rating systems, energy-consumption data reporting, retrofits, and construction practices. Since 2005, the energy efficiency design standard for new urban commercial buildings has been a 50-percent energy reduction compared to buildings built in the 1980s. There are also stronger local standards in major cities such as Beijing, Shanghai, Wuhan, and Chongqing.[255] Enforcement and compliance for these standards have lagged; full compliance was projected by 2010. The new construction design standard contained in the 12th FYP is slated to increase energy reduction to 65 percent of 1980 levels.
- **Appliance Standards** – China has national MEPS and voluntary performance standards on lighting and 22 categories of appliances, equipment, and office products. Each revision of the standard typically reduces the maximum energy allowed by about 10 percent.[256]
- **Savings Targets** – China's FYP includes energy intensity reduction targets for industrial, building, and transportation sectors. The national target is translated into provincial targets, which are then disaggregated into city and county targets. China's Top-1000 Program set energy consumption targets (which are included in the national target amount) for the 1,000 highest energy-consuming businesses in nine industries: iron and steel, petroleum and petrochemicals, chemicals, electric power, non-ferrous metals, coal mining, construction materials, textiles, and paper. These enterprises account for approximately one-third of total energy consumption in China.[257] As mentioned above, the program is now covering the 10,000 highest energy consuming enterprises. In November 2010, the State Council issued the DSM Rule, which obligates grid companies to achieve a level of energy savings equal to at least 0.3 percent of the company's previous-year annual sales and peak demand.[258]

Implementation Strategy

Delivery Structure – Energy efficiency policy and programs are designed and delivered by the National Development and Reform Commission (NDRC), a government entity that is "half a level above ministries in the Chinese hierarchy."[259] In 2005, an Energy Leading Group headed by Premier Wen Jiabao was created to "set strategic direction and to improve policy coordination."[260] NDRC has signed "responsibility documents" with provincial-level authorities, charging them with ensuring program implementation and compliance by enterprises within their borders.[261] Local authorities in provincial, regional, and municipal governments are evaluated on their ability to achieve the energy conservation targets in their jurisdictions. Those who do not meet the targets are denied honorary titles, participation in annual awards, and promotions.[262]

Funding – The major source of China's energy efficiency funding is the government.

- **Direct Government Investment** – China's total investment for energy conservation under the 11th FYP was estimated to be 1 trillion ¥ (US $143 billion), or an average of 200 billion ¥ (US $28.5 billion) per year, with investment in industry accounting for 15 percent of this total.[263] The government's comprehensive energy-saving investment in 2009 was 36 billion RMB (US $5.3 billion), which leveraged 100 billion ¥ (US $14.7 billion) from industry.[264] In addition to providing direct funding, the government provides subsidized loans and credit guarantees.

255 Levine et al., 2010

256 Price et al., 2011

257 Zhou et al., 2010

258 Schultz, 2011

259 Levine, Zhou, & Price, 2009

260 Andrews-Speed, 2009

261 Price, Wang, & Yun, 2010

262 Zhou et al., 2010

263 Price, Wang, & Yun, 2008, currency conversion factor of US $1 = 7.0 RMB¥.

264 Levine, 2010

- **Mandated Utility Funding** – Grid companies will need to invest to meet the DSM rule.
- **Public Partnerships** – International entities, including the United Nations Environmental Program and the International Finance Corporation, are also supporting energy efficiency for large end-users.[265]

EM&V – China's State Council has called for the creation of monitoring and valuation systems for energy efficiency and pollution abatement. Top-1000 enterprises must report their energy consumption quarterly, by fuel, to the National Bureau of Statistics.[266] However, numerous evaluations have concluded that there is a lack of "systematic reporting and monitoring of these programs." Programs were designed without planning for EM&V, targets were not well defined, China has no systematic methodology for gathering data about building energy use, and there has been a lack of clarity about whether the reported savings represented annual or cumulative goals. In addition, data were not particularly accessible or transparent, there was no third-party review of any reported results, and information provided through reports, interviews, or websites were "conflicting and difficult to interpret."[267]

Support Mechanisms

Additional Chinese policies include:

- **Mandatory Energy Audits** – As part of the Top-1000 program, all key enterprises were required to have energy audits. As of 2010, energy efficiency appraisals were required for new fixed-asset investments made by major industries.[268]
- **Mandatory Energy Labels** – China requires energy information labels on 23 product categories of household appliances, lighting, and office and commercial equipment.[269]
- **Energy Efficiency Information Centers** – China has had hundreds of energy conservation services centers for decades. One of the 11th FYP Top Ten priorities was to establish a National Energy Conservation Center to provide technical support for energy efficiency management. The country also has provincial energy conservation centers with varied capacity. The potential of the National Center as a central information and data resource has not yet been fully realized.
- **Real-time and Differential Pricing** – China has adopted "world-class pricing and related policies aimed at encouraging large users to invest in energy efficiency and load control."[270] These policies include: time of use pricing for all industrial and some residential customers; "differential pricing," which considers energy efficiency in setting electricity prices for energy-intensive sectors, with enterprises that are less efficient being charged higher prices; and in a few provinces, interruptible pricing schemes.[271]
- **ESCO Development Strategy** – The government has supported development of and incentives for the ESCO industry, particularly for projects with energy savings between 500 and 10,000 tce. ESCOs must share savings with their clients.[272] China's ESCO industry is one of the world's largest; 2008 investment in energy-performance contracting was close to US $1.5 billion.[273]
- **Training and Certification** – China's Energy Conservation Law requires key enterprises to designate qualified "energy managers." China is implementing training programs and standardized energy management systems to support this approach.[274]
- **R&D** – The 12th FYP identified support of seven "Strategic Emerging Industries" through tax breaks and procurement policies. "Energy conservation and environmental protection" and "new energy" are two of the targeted industries.

265 Price et al., 2008

266 Price et al., 2011

267 Levine et al., 2010 & Price et al., 2011

268 Reinaud & Goldberg, 2011

269 Hathaway & Zhao, 2011

270 Regulatory Assistance Project, 2011

271 Schultz, 2011

272 Reinaud & Goldberg, 2011

273 Taylor, Draugelis, Zhang, & Ang Co, 2010

274 Taylor et al., 2010

Impact

During the 11th FYP, China reduced its energy intensity by 19.06 percent.[275] Programs that met or exceeded their targets included the Top-1000 Program, the Small Plant Closure Program, and most of the Ten Key Projects. Savings in the period from 2006 to 2008 included 41 Mtce from buildings energy efficiency, 124 Mtce from the Top-1000 program, 129 Mtce from small plant closures, 37 Mtce from appliance standards, and 90 Mtce from other projects included in the Ten Key Projects.[276] Nonetheless, energy consumption and CO_2 emissions increased over the same period due to the growth in GDP. In addition, the determination of success was obtained by comparing 2010 consumption to a baseline of 2006. In order to meet their targets, a number of local governments imposed power cuts over the latter half of 2010 to reduce consumption and increase the energy savings rate rather than making investments in long-term energy-savings strategies.[277]

Concerns and Areas for Improvement

Although China has made great strides in a relatively short period of time, there is still significant room for improvement. Some argue that China's targets are not high enough to induce structural energy savings. Targets and data collection will need to focus on energy saved and emissions reduced not just energy intensity.[278]

China would also benefit from a systematic data system and a sophisticated EM&V process including third-party audits. This is needed to improve the accuracy of energy-savings reports and better position the country for any market-based trading programs.

China's power sector offers opportunities for additional energy savings. IRP is not yet utilized by the national government for long-term power system development. Furthermore, there is ample room for improving efficiencies. For example, electric motors consume more than 50 percent of the electricity in China, but their efficiencies are 10-20 percent lower than the international advanced practices.[279]

Key Jurisdiction Attributes

China's economic and political structure encourages long-term national planning, policy continuity, and the implementation of strong top-down measures. "Five-year plans are more than mere political intent; delivery of their targets is a crucial source of political legitimacy for the Chinese leadership."[280]

What is on the Horizon

China's 12th FYP proposes a significant commitment to sustainability and green investment. Successful programs will be expanded as the country seeks deeper savings. Some policymakers and observers are calling for greater use of "market mechanisms" such as cap-and-trade schemes. There are also plans for a 5.3 trillion ¥ (US $807 billion) investment in the power sector (much of which will be for coal-fired facilities) and 500 billion ¥ (US $76 billion) on ultra high voltage transmission lines. In addition, investments over the next decade in smart grids are likely to be more than 4 trillion ¥.[281]

G. India

India is the world's second-most-populous country (about 1.2 billion), largest democracy, and seventh-largest in geographic area; it ranks fifth in GDP purchasing-power parity, GDP growth rate, and energy consumption. India's estimated 2010 GDP per capita is US $3,500.[282] In addition to economic, social, and geographic disparities, the country is challenged by energy inadequacy and inequity; its 2007 per capita energy consumption was 346 kg of oil equivalent versus the world average of 1,680, and as of 2009, one-third of the country did not have access to electricity.[283] At the same time, the energy efficiency of some of its production facilities is among the best in the world.

Much of India's energy infrastructure still needs to be built, since energy demand is growing due to rising population and incomes, accelerated industrialization, and increased urbanization.[284] The Indian government

275 China Dialogue, 2011

276 Price et al., 2011

277 China Dialogue, 2011

278 China Dialogue, 2011

279 Hu et al., 2010

280 China Dialogue, 2011

281 China Dialogue, 2011

282 See more information at: https://www.cia.gov/library/publications/the-world-factbook/geos/in.html

283 Balachandra, Ravindranath, & Ravindranath, 2010

284 Balachandra et al., 2010

estimates that consumption will rise from 2005 levels by 50 percent by 2016 and by 245 percent by 2026.[285] Energy planning policies and objectives have evolved over time and currently focus on reducing energy intensity. Initially, energy efficiency was viewed as a mechanism for ensuring adequate supply, then for attaining cost-effectiveness, and most recently it is seen as "critical to mitigating climate change."[286] India's approach has typically been to adopt enabling legislation, then define voluntary codes, standards, or requirements, and move toward mandatory compliance as the market transforms. The Energy Conservation Act, 2001 (ECAct) established the Bureau of Energy Efficiency (BEE) and provided the central government with the authority to specify codes and standards and energy-intensity norms for energy-intensive industries.[287] In 2007, the government notified companies in nine energy-intensive industries that they were "Designated Customers" as defined by the Act and were therefore required to hire a certified energy manager, file annual energy consumption returns, and periodically conduct energy audits.[288]

The National Action Plan on Climate Change announced in 2008 defines eight National Missions to address climate change, including one for Enhanced Energy Efficiency (NMEEE). It builds upon the BEE's statutory scope with four new initiatives: "1) A market based mechanism to enhance cost effectiveness of improvements in energy efficiency in energy-intensive large industries and facilities, through certification of energy savings that could be traded; 2) Accelerating the shift to energy efficient appliances in designated sectors through innovative measures to make the products more affordable; 3) Creation of mechanisms that would help finance DSM programs in all sectors by capturing future energy savings; and 4) Developing fiscal instruments to promote energy efficiency" (Framework for Energy Efficient Economic Development).[289] The NMEEE's implementation framework was approved by the Union Cabinet in May of 2010. Its 2014-2015 goals are to obtain annual fuel savings in excess of 23 Mtoe, cumulatively avoid adding an additional 19,000 MW in electric capacity, and mitigate CO_2 emission by 98 million tons per year.[290]

Foundational Mechanisms

India's foundational mechanisms include the following:

- **Energy Efficiency Requirements for Buildings** – India's Energy Conservation Building Code (ECBC) sets minimum energy performance standards (MEPS) for new buildings.[291] It was introduced as a voluntary code in May 2007, to become mandatory for commercial buildings in eight states in 2012.[292] The code covers the building envelope, lighting, solar hot water, HVAC, and electrical systems. ECBC-compliant buildings will have an energy performance index of approximately 110 kWh/m2/year.[293]
- **Appliance Standards** – India has introduced appliance labels and MEPS but has been slow to make them mandatory. As of January 2010, MEPS are required for four products: frost-free refrigerators, room air conditioners, fluorescent tube lights, and distribution transformers. Energy labels, which will lead to MEPS, have been introduced for another 10 products.
- **Binding Energy Savings Targets** – India's PAT scheme has established specific energy-intensity targets for approximately 500 energy-intensive industrial companies for a three-year period beginning in April 2011. Together, these companies use about 54 percent of the total energy consumed in the country.[294] Targets are being set for each of nine sectors and companies will be required to reduce their intensity by a fixed percentage. The targets, which are estimated to total 10 Mtoe, reflect about 4-percent savings for the period.[295]

285 Mathur, 2009

286 Balachandra et al., 2010

287 See more information in Chapters II, V, and VI at: http://powermin.nic.in/acts_notification/pdf/ecact2001.pdf

288 Dhingra, 2011

289 See more information at: http://pmindia.nic.in/Pg01-52.pdf

290 Kumar, 2010

291 See more information at: http://www.emt-india.net/ECBC/main.htm

292 See more information at: http://switchboard.nrdc.org/blogs/rkhosla/moving_forward_on_energy_effic.html

293 Mathur, 2009

294 Dhingra, 2011

295 The PAT consultation document can be viewed at: http://220.156.189.23/NMEEE/PAT%20Consultation%20Document_10Jan2011.pdf

- **Enabling Markets** – India's PAT scheme includes a tradable certificate component, which is expected to become active in 2013. Companies that exceed their target will receive an energy savings certificate that can be traded with companies that are unable to meet their targets.

Implementation Strategy

Delivery Structure – BEE is the designated agency for spearheading the improvement of energy efficiency in the Indian economy through regulatory and promotional mechanisms.[296] It has the statutory authority to plan, manage, and implement the provisions of the ECAct, including drafting building codes and appliance standards and labeling requirements, monitoring energy use among energy-intensive industries, certifying energy managers and auditors, facilitating energy conservation in agricultural and small and medium enterprises by developing detailed project reports for third-party implementation of DSM, and undertaking national-level awareness campaigns. BEE is also designing the framework for the PAT scheme and will act as the market regulator and administrator for PAT certificate trading.

India's Ministry of Power has created Energy Efficiency Services Ltd (EESL) to facilitate the implementation of energy efficiency projects. EESL is a joint venture of the government and four public sector companies. It is designed to provide consulting and act as a "Super ESCO" as well as a funder, guarantor, and packager for energy efficiency activities. It will also provide implementation and monitoring for the PAT scheme. EESL was capitalized with initial equity equal to US $45 million.[297]

Funding – BEE estimates that the volume of energy efficiency activities in India over the next few years will cost about 740 billion Indian rupees (about US $15 billion).[298] Funding for these improvements is expected to come from ESCOs, the Clean Development Mechanism, publicly partnered loans and guarantees, and the owners of the properties and industries being improved. The Indian Renewable Energy Development Agency (IREDA) is a Public Limited Government Company, providing loans for 70 percent of ESCO project costs and 80 percent of the cost of energy efficient equipment. Rates are comparable to commercial and terms are from six to ten years.

EESL manages a venture capital fund for energy efficiency financing as well as a partial risk guarantee fund. In addition, BEE has established an Energy Efficiency Financing Platform (EEFP) to provide non-recourse financing to ESCO projects.[299]

EM&V – The National Productivity Council (NPC) undertakes annual third-party verification of energy savings related to the BEE. The study is based on secondary data and stakeholder interactions.[300]

A measurement and verification system is being designed by BEE for the PAT scheme, to be carried out by "designated energy auditors." The system assumes that the energy performance of designated customers will be assessed by third-party auditors at the end of each target period. (The first assessment will be in 2014.) Verification reports will be submitted to EESL.

Designated customers who do not meet their targets within the timeframe will be subject to a noncompliance penalty equal to 1 million rupees (~US $20,200).[301]

Support Mechanisms

Additional policies in India include:

- **Mandatory Audits** – Audits to identify energy-savings measures are required for "designated customers" in energy-intensive businesses. Businesses are expected to undertake corrective action, with penalties for non-compliance.
- **Mandatory Energy Labels** – India introduced voluntary labels in May 2006. Labels are expected to be mandatory when 50 percent of the market starts using them, at which time the lowest-rated label will become the MEPS.
- **Tax Relief** – India provides tax and duty exemptions for the promotion of energy efficiency, graduated excise duty for energy efficient equipment, accelerated

296 Mathur, 2009

297 Kumar, 2010a

298 Mathur – "74,000 crores" = 740,000 million rupees, Conversion rate on November 1, 2011 – US $1 = 49.3900 INR

299 Kumar, 2010a

300 See more information at: http://220.156.189.23/content.php?page=miscellaneous/energy_savings_achieved.php

301 Kumar, 2010b

depreciation rates for energy-savings equipment, and income and corporate tax incentives for ESCOs and venture capital funds focusing on energy efficiency.[302]

- **ESCO Development Strategy** – ESCOs are promoted by BEE and EESL through the development of model contracts, accreditation, ratings, and assistance in securing financing. EESL provides both seed and project-based financing for accredited and rated ESCOS. BEE also provides assistance in preparing investment-grade audits for municipal street lighting and pumping projects.
- **Training and Certification** – Indian energy managers and auditors must be certified, which requires passing a three- or four-component examination.[303] BEE specifies the accreditation qualifications, provides technical support and prepares curricula for educational institutions and others. The Bureau also offers a comprehensive web site detailing certification requirements, course materials, case studies, technical equipment and design information, with listings of jobs, tenders and certified personnel.[304]
- **Outreach and Recognition** – BEE operates a high-profile annual energy conservation awards program that recognizes high achievers in almost 40 different industry sectors and five building types.[305]
- **Large-scale Accelerated Penetration of CFLs** – BEE coordinates and supports various elements of the Bachat Lamp Yogna (BYL) scheme. Under BYL, high-quality, long-lasting CFLs are distributed to grid-connected customers for Rs 15 (about US $0.30) and exchange of an incandescent bulb. The difference in market price and the BYL price is met using Clean Development Mechanism (CDM) payments for resulting emission reductions. The goal is to distribute 200 million lights, avoiding 4,000 MW of capacity.[306]
- **Government as Exemplary Performer** – BEE offers incentives to help the public sector undertake energy efficiency and promotes energy efficient public procurement.

Impact

The base year for India's reported energy efficiency savings is 2007-2008. The NPC report for 2009-2010 indicates cumulative verified savings of more than 32,900 GWh and 22.5 Mtoe for the three-year period.[307] Energy consumption for designated consumers is reportedly decreasing by about 4 percent per year.[308]

Concerns and Areas for Improvement

Much of India's framework for energy efficiency has not yet had a chance to be fully tested. Although the PAT scheme holds considerable promise, it does not yet have a robust EM&V system, enforcement mechanisms, or a trading platform. There is also a lack of good quality energy-consumption data.[309]

India's utilities and regulatory structure has not been conducive to significant gains in energy efficiency. Reasons for this include a lack of skilled energy efficiency technicians, utility focus on supply security and reducing distribution losses, cross-subsidy structures that provide disincentives for energy efficiency, and severe financial problems for government-owned distribution companies. The Forum of Regulators — composed of the chairs of all the state electric regulatory commissions (SERCs) -- has issued recommended DSM regulations, and a few SERCs have taken steps to promote efficiency, primarily utility subsidies for the sale of efficient lighting, cooling, and pumping equipment. While utility regulation remains an opportunity, significant energy savings have and are likely to continue to be the result of national programs or frameworks.[310]

302 Kumar, 2010b

303 See more information at: http://www.emt-india.net/exam/exam_main.htm

304 See more information at: http://www.beeindia.in/

305 Mathur, 2009

306 See more information at: http://pib.nic.in/newsite/erelease.aspx?relid=47970

307 See more information at: http://220.156.189.23/miscellaneous/documents/energy_saving_achieved/document/Verified%20Savings%20Report%20for%202009-10.doc

308 Kumar, 2010a

309 Reinaud & Goldberg, 2011

310 Singh, Bharvirkar, Kumar, Sant, & Phadke, 2011

Key Jurisdiction Attributes

India is severely challenged by its size, rapid economic growth, and huge disparities in economic status and access to energy. While the country has some of the most advanced and efficient industrial technology in the world, a significant portion of the population has no access to grid-connected electricity and reliability is increasingly privatized (if you can afford a generator, batteries, or a private purchase-power agreement, you can have reliability). Within this context, India has established one of the world's only statutorily created, national-level energy efficiency bodies.

What is on the Horizon

The BEE is nearing rollout of the first phase (ceiling fans) of a national framework that provides incentives to manufacturers to develop and sell super-efficient appliances.[311] The National Planning Commission's Twelfth Five Year Plan is likely to include support of some kind for future super-efficient appliance programs, given the emphasis that prospective savings were given in the Commission's *Interim Report of the Expert Group on Low Carbon Strategies for Inclusive Growth.*[312]

The PAT scheme, which has been in development for the past few years, is slated to be implemented over the next few years. It merits watching.

311 See more information at: http://articles.economictimes.indiatimes.com/2011-04-18/news/29443848_1_energy-efficiency-star-rated-products-ajay-mathur

312 See more information at: http://planningcommission.nic.in/reports/genrep/Inter_Exp.pdf

5. Conclusions

Policy mechanisms for promoting substantial investments in cost-effective energy efficiency have been debated, tested, and periodically revised in a variety of jurisdictions around the world for more than three decades. Many jurisdictions are now annually achieving significant levels of energy savings – enough in some cases in developed countries to eliminate load growth or even produce gradually declining levels of energy consumption. However, no jurisdiction has yet come close to capturing all cost-effective efficiency potential, particularly if we define "cost-effective" in the context of the need to reduce global carbon emissions by 80 percent by 2050. What follows are some conclusions regarding the keys to creating a policy framework that would put a country or state among the global leaders in efficiency investment today, as well as some thoughts about new directions that may need to be explored to achieve broader and deeper levels of energy savings in the future.

A. Keys to Being a Global Efficiency Leader

Some policy directions are essential to achieving substantial levels of energy savings through efficiency:

Codes and standards *plus…*

Setting minimum efficiency performance standards for the production, importation, and sale of energy-consuming products, as well as codes for the efficiency of construction of new buildings and major renovations, is a policy that virtually any jurisdiction can and should adopt. However, codes and standards should be pursued in tandem with *at least* one other foundational policy – binding energy-savings obligations, integrated resource planning requirements, or enabling market mechanisms that allow efficiency investments to compete with supply alternatives – that encourages consumers to invest in efficiency measures.

The interplay between codes and standards and the other foundational mechanisms is critically important. By creating demand for energy efficiency measures that go beyond code and standard minimums, the other foundational policies can fundamentally change and transform markets for efficiency products and services. These market demands can:

- Lead manufacturers to produce and sell more energy efficient products (once committed to a new product, manufacturers usually keep promoting it);
- Encourage distributors, contractors, vendors, and retailers to stock and sell efficient products (once they are comfortable with new products, they are likely to continue promoting them);
- Lead the entire supply chain to lower the price of efficient products (as sales increase, both economies of scale and product innovation often enable such price reductions); and
- Change consumer awareness and perceptions of the efficient products and services in a positive way.

When such market transformations become substantial enough, codes and standards can be put in place or updated to secure the gains and "lock in" the resulting savings.

Performance-based incentives for savings obligations

Any mechanism that obligates energy providers, large customers, or other entities to meet specific energy-savings targets should include a clearly articulated and meaningful set of goals, and consequences for meeting or exceeding those goals. In particular, financial rewards or penalties are terrific motivators.

Sufficient and sustained sources of funding

Even though energy efficiency resources are often much less expensive per unit of energy than supply resources, the amount of investment required to achieve all cost-effective savings is still quite substantial. Government policy should endeavor to leverage as much private-sector investment

for such energy efficiency resources as possible. However, it is abundantly clear that economically optimal levels of investment in energy efficiency will not be reached without substantial government or government-mandated spending[313] (e.g., to support managing initiatives, consumer subsidies, tax subsidies, market development and other marketing activities, EM&V, and further strategies). While many moderately priced energy efficiency investments can be promoted through subsidies and other expenditures equal to a quarter or a third of the measure's costs, deeper levels of savings will likely require even higher average levels of spending if they are to be achieved across a substantial portion of society. Many leading jurisdictions are now spending on the order of 2 percent to 5 percent of total energy supply revenues to leverage or subsidize private-sector investment in energy efficiency.

Independent Evaluation, Measurement and Verification (EM&V)

It is absolutely essential to establish an independent system for measuring and verifying the energy savings that are actually accomplished. Equally, it is vital to periodically evaluate programs in their entirety to ensure that their objectives are still relevant and are being met in the most cost-effective manner possible. In some jurisdictions, this may require investment in developing an EM&V industry. Such investments will pay off handsomely over time, and EM&V expertise can be "imported" in the interim. Leading jurisdictions typically spend up to 4 percent of total energy efficiency spending on EM&V.

Simplicity for consumers

One of the key barriers to increasing consumer investments in energy efficiency are the significant transaction costs consumers face in trying to understand the nature of efficiency opportunities, how they can be addressed, what the benefits of addressing them might be and who can help consumers address them. Given the inherent complexity, it is important for policymakers to define options that minimize consumer confusion and adopt policies that are mutually reinforcing.

Consistency and stability

Programs to promote energy efficiency can sometimes (depending on complexity and depth of savings) take years to become established and start generating substantial levels of savings. This is partly because the market supply chains through which efficiency measures and practices are ultimately sold to consumers can take years to fully mature. Policymakers need to recognize that it can be difficult to persuade a business to change what it manufactures or how it sells its products. There are significant risks in such decisions. Businesses will be much more likely to invest in energy efficiency if policies are stable and funding remains consistent regardless of changes in the government.

Within the context of maintaining consistent and stable policy, there are advantages to policies that can be institutionalized. For example, funding for energy efficiency initiatives that is based on broad-based energy-system charges – whether explicit charges or taxes, or costs embedded in the prices of energy charged to consumers – is usually preferable to government treasury appropriations. Mechanisms that create political constituencies for maintaining funding are ideal.

B. Possible New Directions for the Future

Although aggressive policies have produced significant achievements in the advancement of energy efficiency investments and energy savings in leading jurisdictions, no jurisdiction has yet found or adopted a policy package that will produce economically optimal levels of energy efficiency, particularly in the context of the need to reduce carbon dioxide emissions by 80 percent over the next several decades. Thus, advocates and policymakers are continuing to explore and test new approaches. Among the areas being explored are:

- **Increased cross-jurisdictional coordination.** Regional or even multi-regional approaches to minimum equipment-efficiency performance standards may ultimately be necessary to maximize savings potential in some markets. Similarly, the development of cross-border programs to promote efficiency is more likely to quickly and successfully engage some aspects of the supply chain.

313 Such mandates can either be explicit (i.e., requiring certain levels of spending) or implicit (e.g., requiring that specific levels of energy savings be achieved and leaving it to the energy suppliers to determine how much they need to spend to achieve such targets). See Laitner 2012 for discussion of market barriers.

- **Increased use of codes for existing buildings.** Building energy codes have traditionally focused on new buildings. However, some jurisdictions have begun to establish energy code requirements for existing buildings through "rental energy codes" (requiring minimum efficiency levels before a building can be rented), "time-of-sale" requirements (requiring minimum efficiency levels before a building can be sold), and requirements imposed at the time of renovation. This focusing of codes on existing buildings can be particularly important in developed countries where the vast majority of the building stock that will be used decades from now has already been built.
- **Innovative financing.** Much of the financing that has historically been available to consumers for investment in energy efficiency has been difficult to access for those who needed it most (i.e., those with credit or related financial difficulties) and often not attractive enough (e.g., not long enough terms, low enough rates or with enough flexibility) to encourage a broad range of consumers to invest deeply in efficiency. Governments in several jurisdictions are now exploring more innovative tools (e.g., financing through municipalities with repayment as part of property taxes, and financing on electric or gas utility bills). Such mechanisms are not a panacea, but they can be an important "tool" to help end customers invest in efficiency.
- **More expansive set of energy market mechanisms.** Energy market mechanisms that allow efficiency to compete with energy supply are only just beginning to be explored. One new option is an Energy Efficiency Feed-in-Tariff (FIT), similar to the widely used Renewable Energy FITs. Efficiency-resource providers are paid pre-specified prices for documented savings from an aggregated set of consumer efficiency investments. If coupled with other markets that valued other energy efficiency benefits – e.g., electric capacity markets that allowed energy efficiency resources to compete with generators for meeting system peak capacity needs, and mechanisms that allowed energy efficiency resources to compete with traditional "poles and wires" solutions to meet transmission and distribution system reliability needs – energy efficiency FITs could become part of a new paradigm that endeavored to treat buildings (and their efficiency) as an integral part of the energy-system infrastructure.
- **Institutionalizing consideration of energy efficiency in other markets.** One of the reasons energy efficiency investments lag behind economically optimal levels is that the benefits are not fully conveyed or valued in the rental or sale prices of buildings. This has been mitigated in Europe, Australia, and parts of the United States through requirements for building energy efficiency labeling and disclosure. However, lenders do not consider the higher risk of vacancy or default associated with providing loans for inefficient buildings. If such risks were fully valued, they would likely lead to either rates or lending limits that valued energy efficiency levels. Some jurisdictions are exploring how to institutionalize such considerations.

6. Bibliography

Aggerholm, S., Thomsen, K. E., & Wittchen, K. B. (2011). Implementation of the EPBD in Denmark - Status in November 2010. Brussels: European Union. Retrieved from http://www.epbd-ca.org/Medias/Pdf/country_reports_14-04-2011/Denmark.pdf. Country update report from the book "Implementing the Energy Performance of Buildings Directive (EPBD)" produced by the Concerted Action EPBD, a joint initiative of the EU Member States and the European Commission, whose aim is to enhance the sharing of information and experiences from national adoption and implementation of the Energy Performance in Buildings Directive.

Allcott, H. (2011). Social norms and energy conservation. *Journal of Public Economics,* 95(9-10), 1082-1095. doi:10.1016/j.jpubeco.2011.03.003. An evaluation of OPower's behavioral approach to energy savings using home energy reports with residential customers in the United States.

Andrews-Speed, P. (2009). China's ongoing energy efficiency drive: Origins, progress and prospects. *Energy Policy,* 37(4), 1331-1344. doi: 10.1016/j.enpol.2008.11.028. Excellent outline of the historical context of China's approach to energy efficiency; also discusses the potential for the changes included in the 11th Five Year Plan, particularly those applied to energy-intensive industries.

Bach, P. (2009). *Energy savings obligations and savings center in Denmark.* Danish Energy Agency. Retrieved from http://www.wupperinst.org/uploads/tx_wiprojekt/Bach_BMU_10122009.pdf. (from a Workshop presented in Berlin) Excellent background, prepared by the Danish Energy Agency's chief adviser.

Balachandra, P., Ravindranath, D., & Ravindranath, N. H. (2010). Energy efficiency in India: Assessing the policy regimes and their impacts. *Energy Policy,* 38(11), 6428-6438. doi:10.1016/j.enpol.2009.08.013. Good background on the evolution of energy efficiency policies in India and their impact.

Balash, P. C., & Pickenpaugh, G. (2009). *An investigation into California's residential electricity consumption.* No. DOE/NETL-2009/1371).National Energy Technology Laboratory. Retrieved from http://www.netl.doe.gov/energy-analyses/refshelf/PubDetails.aspx?Action=View&PubId=267. This paper investigates discrepancies in electricity usage between the state of California, where consumption per person has grown slowly, and the rest of the United States where it has increased approximately 50 percent.

Bertoldi, P., & Rezessy, S. (2008). Tradable white certificate schemes: Fundamental concepts. *Energy Efficiency,* 1(4), 237-255. doi: 10.1007/s12053-008-9021-y Includes excellent comparison table of systems in the United Kingdom, Italy, and France.

Bertoldi, P., Rezessy, S., Lees, E., Baudry, P., Jeandel, A., & Labanca, N. (2010). Energy supplier obligations and white certificate schemes: Comparative analysis of experiences in the European Union. *Energy Policy,* 38(3), 1455-1469. DOI: 10.1016/j.enpol.2009.11.027 Most recent of Bertoldi et al's articles on white certificates; provides an up-to-date review and analysis of the results of the white certificate schemes in the European Union.

Bleyl-Androschin, J. W. (2010). Final task report of task XVI competitive energy services (energy-contracting, ESCo services) - phase 1 (July 2006 – June 2009). No. 100608). Graz, Austria: IEA-DSM. Retrieved from http://www.ieadsm.org/Files/Exco%20File%20Library/Key%20Publications/100608_T16-ExCo_Final%20Task%20Report%20(2006-2009).pdf. Provides an in-depth expert-led focus designed to assess innovative ESCO and financing models for supporting and implementing activities and disseminating results. Includes policy recommendations, advantages and disadvantages, limitations and realistic potentials of outsourcing energy service packages to ESCOs in comparison to in-house implementation.

Brown, M. (2009). State energy efficiency policies: Options and lessons learned brief #4 models for administering ratepayer-funded energy efficiency program. Washington, DC: Alliance to Save Energy. Retrieved from http://ase.org/resources/brief-4-models-administering-ratepayer-funded-energy-efficiency-programs. Good discussion of the advantages and disadvantages of different delivery mechanisms.

California Energy Commission. Retrieved October 7, 2011, from http://www.energy.ca.gov/. General background information on the Commission.

California Energy Commission. (2011). *2010 integrated energy policy report update*. No. CEC-100-2010-001-CMF). Sacramento, CA, US: California Energy Commission. Retrieved from http://www.energy.ca.gov/2010publications/CEC-100-2010-001/CEC-100-2010-001-CMF.PDF

California Public Utility Commission. (2010). 2010-2012 Energy Efficiency Evaluation, Measurement and Verification Work Plan version 1. San Francisco, CA, US: California Public Utility Commission. Retrieved from http://www.calmac.org/events/2010-2012_Energy_Efficiency_EM&V_Plan_12-20-10.pdf

Caracino, J. (2010). *State of the efficiency program industry 2009 expenditures, impacts & 2010 budgets*. Boston, MA, US: Consortium for Energy Efficiency. Excellent compilation of statistical information about programs in Canada and the United States. Retrieved from http://www.cee1.org/files/2010%20State%20of%20the%20Efficiency%20Program%20Industry.pdf

Carroll, E., Hatton, E., & Brown, M. (2009). *Residential energy use behavior change pilot*. No. CMFS project code B21383). Port Washington, WI, US: Franklin Energy. Retrieved from http://www.state.mn.us/mn/externalDocs/Commerce/Franklin_Energy_Behavioral_Programs_Report_050809034016_ResEnergyBehavior.pdf

chinadialogue. (2011). In Hilton I. (Ed.), *China's green revolution - energy, environment and the 12th five-year plan*. London: China Dialogues. Retrieved from http://www.chinadialogue.net/UserFiles/File/PDF_ebook001.pdf. Succinct presentation of China's approach to energy in both the 11th and 12th Five Year Plans.

China-US Energy Efficiency Alliance. (2009) *Demand-side management (DSM) Program Procedures Manual, DSM Financing Annex*. Bangkok, Thailand; US AID|Asia. Retrieved from www.chinauseealliance.org/docs/DSM_Report_6_July_2011.pdf

Cowart, R. (2008). Carbon caps and efficiency resources: How climate legislation can mobilize efficiency and lower the cost of greenhouse gas emission reduction. *Vermont Law Review,* 33(2) Policy-level discussion of the role of carbon caps authored by one of the leading advisers on the issue. Retrieved from http://lawreview.vermontlaw.edu/articles/12%20Cowart%20Book%202,%20Vol%2033.pdf

Crossley, D. (2000). *Developing mechanisms for promoting demand-side management and energy efficiency in changing electricity businesses*. Hornsby Heights NSW Australia: Energy Futures Australia Pty Ltd. Retrieved from http://www.ieadsm.org/Files/Exco%20File%20Library/Key%20Publications/resrpt3_fin.pdf. (Research Report No 3 Task VI of the International Energy Agency Demand-Side Management Programme) When originally published may have been the most complete study available on the subject of energy efficiency mechanisms. Remains a superb introduction to the topic.

Crossley, D. (2008a). *The role of advanced metering and load control in supporting electricity networks.* (Research Report No 5 Task XV of the International Energy Agency Demand-Side Management Programme.) Hornsby Heights NSW Australia: Energy Futures Australia Pty Ltd. Retrieved from http://www.efa.com.au/Library/David/Published%20Reports/2008/IEADSMTaskXVResearchReport5.pdf

Crossley, D. (2008b). Tradeable energy efficiency certificates in Australia. *Energy Efficiency,* 1(4), 267-281. doi: 10.1007/s12053-008-9018-6.

Crossley, D. (2010). *Funding DSM projects with revenue from carbon trading.* (Research Report No 4 Task XVIII of the International Energy Agency Demand-Side Management Programme.) Hornsby Heights NSW Australia: Energy Futures Australia Pty Ltd. Retrieved from http://www.efa.com.au/Library/David/Published%20Reports/2010/IEADSMTaskXVIIIResearchReport4.pdf

Crossley, D. (2011). *Demand-side participation in the Australian national electricity market - A brief annotated history.* Montpelier, VT, US: Regulatory Assistance Project. Retrieved from http://www.raponline.org/document/download/id/4460. Excellent background on policy development in Australia.

Danish Government. (2011a). *Energy strategy 2050 - from coal, oil and gas to green energy.* Copenhagen, DK: Ministry of Climate and Energy. Retrieved from http://www.ens.dk/Documents/Netboghandel%20-%20publikationer/2011/Energy_Strategy_2050.pdf

Danish Government. (2011b). *Our future energy.* Copenhagen, DK: Ministry of Climate and Energy. Retrieved from www.ens.dk/Documents/Netboghandel%20-%20publikationer/2011/our_future_energy_%20web.pdf

Danish Ministry of Climate and Energy. (2009). *"The Danish example" – the way to an energy efficient and energy friendly economy.* Copenhagen, DK: Ministry of Climate and Energy. Retrieved from http://www.kemin.dk/Documents/Publikationer%20HTML/The%20Danish%20Example/index.html

Darby, S. (2006). *The effectiveness of feedback on energy consumption: A review of the literature on metering, billing and direct displays.* Oxford, England: Environmental Change Institute, University of Oxford. Retrieved from http://www.eci.ox.ac.uk/research/energy/downloads/smart-metering-report.pdf

Darby, S. (2010). *Literature review for the energy demand research project.* London, UK: Ofgem (Office of Gas and Electricity Markets). Retrieved from http://www.ofgem.gov.uk/Sustainability/EDRP/Documents1/SD%20Ofgem%20literature%20review%20FINAL%20081210.pdf. Looks at a variety of energy demand intervention and customer feedback projects around the world. Combines qualitative and quantitative results and outlines theoretical approaches and key lessons.

Davis, M. (2011). *Behavior and energy savings: Evidence from a series of experimental interventions.* New York, NY, US: Environmental Defense Fund. Retrieved from http://www.edf.org/sites/default/files/behavior-and-energy-savings.pdf

Dhingra, N. (2011). Perform achieve and trade mechanism (PAT). Paper presented at the ECEEE 2011 Summer Study - *Energy Efficiency First: The Foundation of a Low-Carbon Society,* Belambra Presqu'île de Giens, France. 777-778-786. Retrieved from http://proceedings.eceee.org/visabstrakt.php?doc=3-494. General background on India's PAT mechanism and how it is intended to be implemented.

D'Sa, A. (2005). Integrated resource planning (IRP) and power sector reform in developing countries. *Energy Policy* 33 (10), 1271-1285. doi:10.1016/j.enpol.2003.12.003

Dupuy, M., Crossley, D. D., & Moskovitz, D. (2011). Market-based mechanisms and supporting policies to achieve energy efficiency, energy consumption, and carbon emissions reduction goals. Montpelier, VT, US: Regulatory Assistance Project. Retrieved from http://www.raponline.org/document/download/id/868. High-level exploration of market-based mechanisms designed to achieve targets for energy consumption, energy efficiency, and carbon emissions. Sketches out several illustrative options and frames key issues as well as areas needing additional discussion; framed in terms of policies for a hypothetical sub-national region that wants to limit overall energy consumption.

Esch, Anja. (2011). *An innovative approach:The German use of ETS revenues for national and international climate financing.* Berlin, Germany: German Watch. Retrieved from http://www.germanwatch.org/klima/clifin-ets11.pdf

Eyre, N., Pavan, M., & Bodineau, L. (2009). Energy company obligations to save energy in Italy, the UK, and France: What have we learned? *Summer Study of the European Council for Energy Efficient Economy.* ECEEE, La Colle sur Loup. Retrieved from http://www.eceee.org/conference_proceedings/eceee/2009/Panel_2/2.164/paper

Fischer, C. (2007). *Influencing electricity consumption via consumer feedback: A review of experience.* Paper presented at the ECEEE 2007 Summer Study Proceeding, La Colle sur Loup, France. 1873-1874-1884. Retrieved from http://www.eceee.org/conference_proceedings/eceee/2007/Panel_9/9.095/Paper/

Gazze, C., & Massarlian, M. (2011). Planning for efficiency: Forecasting the geographic distribution of demand reductions. *Public Utilities Fortnightly,* 149(8), 35. Retrieved from http://www.fortnightly.com/pdf.cfm?id=08012011_PlanforEff.pdf. Con Edison details how it is forecasting the expected geographic distribution of demand reductions within the grid and integrating this information into a utility's capital planning process.

Gold, R., & Nadel, S. (2011). *Energy efficiency tax incentives, 2005-2011: How have they performed?* Washington, DC, US: American Council for an Energy-Efficient Economy. Retrieved from http://www.aceee.org/files/pdf/white-paper/Tax%20incentive%20white%20paper.pdf. Outlines federal US tax incentives and lesson learned from their implementation.

Gottstein, M., & Schwartz, L. (2010). *The role of forward capacity markets in increasing demand-side and other low-carbon resource: Experience and prospects.* Montpelier, VT USA: Regulatory Assistance Project. Retrieved from www.raponline.org/document/download/id/91. An explanation of the wholesale market mechanism, how it evolved and has been implemented and recommendations about additional policies and design improvements that can help to better align capacity markets with carbon-reduction goals.

Hamilton, B. (2010). *A comparison of energy efficiency programmes for existing homes in eleven countries.* Montpelier, VT, US: Regulatory Assistance Project. Retrieved from http://www.raponline.org/docs/RAP%5FHamilton%5FComparisonOfEEProgrammesForExistingHomesInElevenCountries%5F2010%5F02%5F19%2Epdf. Detailed presentation and discussion of approaches from seven European countries as well as Australia, Canada, Japan, and the United States.

Hathaway, D., & Zhao, Y. (2011). *Energy efficiency standards and labeling in China and Asia.* ICF International. Retrieved from http://www.clasponline.org/files/Energy%20Efficiency%20SL%20in%20China%20and%20Asia%20-%20ICF%20International.pdf. Background PowerPoint on China's Codes and Standards.

Hayes, S., Nadel, S., Kushler, M., & York, D. (2011). *Carrots for utilities: Providing financial returns for utility investments in efficiency.* No. U111). Washington, DC, US: American Council for an Energy-Efficient Economy. Retrieved from http://www.aceee.org/node/3078?id=1129. Report on shareholder incentives for energy efficiency.

Heffner, G. (2011). *Energy efficiency policies for utilities.* Paper presented at the IEA Energy Training and Capacity Building Week, Retrieved from http://www.ipeec.org/docs/energy_training_week_2011/7_April_Energy_Efficiency_Utilities_FINAL.pdf. IEA PowerPoint addressing the role of energy providers in delivering energy efficiency and policies that help to support that delivery.

Hu, Z., Tan, X., Yang, F., Yang, M., Wen, Q., Shan, B., & Han, X. (2010). Integrated resource strategic planning: Case study of energy efficiency in the Chinese power sector. *Energy Policy,* 38(11), 6391-6397. doi:10.1016/j.enpol.2010.04.021

IEA. Energy and efficiency policies and measures databases. Retrieved from http://www.iea.org/textbase/pm/?mode=pm. A detailed compendium of policies from IEA member countries and others; searchable by country, type of jurisdiction, policy type, year of adoption, status, target sector, keyword, and whether or not there has been an evaluation. Explication of each policy includes all of the information cited above plus a full description, legal references, information about preceding or subsequent policies, and links to the relevant URL.

IEA. (2010). Monitoring, verification and enforcement: Improving compliance within equipment energy efficiency programmes. Paris, France: IEA. Retrieved from www.iea.org/papers/pathways/monitoring.pdf. Part of IEA's Policy Pathways series which is designed to provide guidance to all countries on the essential steps and milestones in implementing specific energy efficiency policies. This volume focuses on the best practices in monitoring, verification, and enforcement of end-use appliance and equipment standards and labeling programs.

IEA DSM. *Task XIV - market mechanisms for white certificates trading.* Retrieved August/20, 2011, from http://www.ieadsm.org/ViewTask.aspx?ID=17&Task=14. A wealth of information pertaining to various countries experience operating or considering white certificates or similar schemes.

Institute for Electric Efficiency. (2010). *State electric efficiency regulatory frameworks.* Washington, DC: Institute for Electric Efficiency. Retrieved from http://www.electric-efficiency.com/issueBriefs/IEE_StateRegulatoryFrame_0710.pdf. Succinct description of the regulatory framework, status and relevant laws or orders for electric efficiency in each of the US states.

International Confederation of Energy Regulators. (2010). *A description of current regulatory practices for the promotion of energy efficiency.* No. I10-CC-02-04). Retrieved from http://www.eusew.eu/upload/events/480_391_icer%20energy%20efficiency%20full%20report_final.pdf. Compilation of regulatory practices aimed at increasing energy efficiency, originally prepared for G8 Energy Ministers. Approaches are grouped as legal and regulatory obligations, financial instruments, market-based incentives, voluntary agreements, energy audits, and consumer education and information.

Jenkins, C., Neme, C., & Enterline, S. (2011). Energy efficiency as a resource in the ISO New England forward capacity market. *Energy Efficiency,* 4(1), 31-42. doi:10.1007/s12053-010-9083-5 This paper describes the FCM, examines the experience and trade-offs involved in participating for efficiency programs, and reviews the benefits of such participation for the program and the region, including the positive value from increased exposure of the part that efficiency can play in our energy mix.

Jensen, O. M., Hansen, M. T., Thomsen, K. E., & Wittchen, K. B. (2007). *Development of a second generation energy certificate scheme – Danish experience.* Paper presented at the ECEEE Summer Study, La Colle sur Loup, France. 911-912-919. Retrieved from http://www.eceee.org/conference_proceedings/eceee/2007/Panel_5/5.176. Describes the Danish experience in developing mandatory building energy certification schemes, lessons learned and how data collection, certification procedures, and quality control will be addressed in developing the next generation of certification schemes.

Jollands, N., Waide, P., Ellis, M., Onoda, T., Laustsen, J., Tanaka, K., Meier, A. (2010). The 25 IEA energy efficiency policy recommendations to the G8 Gleneagles plan of action. *Energy Policy,* 38(11), 6409-6418. DOI: 10.1016/j.enpol.2009.11.090. Explores the lessons from past attempts at using international-level recommendations for energy efficiency and outlines a "necessary conditions" framework that was used to develop a set of energy efficiency policy priorities. Presents recommendations covering seven priority areas: buildings, appliances, lighting, transport, industry, energy utilities, and cross-sectoral issues.

Khan, J. (2006). *Evaluation of the local energy advice programme in Sweden.* AID-EE. Retrieved from http://www.aid-ee.org/documents/005LocalEnergyadvice-Sweden.PDF. Evaluation conducted by the Active Implementation of the proposed Directive on Energy Efficiency (AID-EE),which is committed to identifying and explaining key factors behind the success and failure of energy efficiency policies, and sharing lessons learned.

Krarup, S., & Ramesohl, S. (2000). *Voluntary agreements in energy policy – implementation and efficiency. C*openhagen, Denmark: AKF Forlaget. Retrieved from http://www.sei.ie/uploadedfiles/InfoCentre/voluntaryagreementsfinalreport.pdf. An analysis and lessons from five agreement schemes: the Swedish ECOEnergy, the Danish Agreements on Industrial Energy Efficiency, the Dutch Long-Term Agreements on Energy Efficiency, the Declaration of German Industry on Global Warming Prevention, and the French Voluntary Agreements on CO2-Reductions.

Kumar, H. R. R. (2007). Energy efficiency policy planning & development in India. I*nstitutional Frameworks and Policies for Energy Efficiency Implementation (IFPEEI)*, Beijing, China.

Retrieved from http://www.iiec.org/index.php?option=com_docman&task=doc_download&gid=36&Itemid=. Succinct summary of India's Plans for Energy Conservation and the four programs of the NMEEE.

Kumar, S. (2010a). *A market for energy efficiency in India.* Presented at the International Symposium on New Paradigms for Energy Policy and Regulation, Kanpur, India. Retrieved from http://www.iitk.ac.in/reg/EE%20Policy-S(BEE)-01-10.ppt. PowerPoint presentation describing India's approach to energy efficiency.

Kumar, S. (2010b). *Promoting innovative energy efficiency financing mechanisms.* Retrieved from http://asiaesco.org/pdf/presentation/6-2.pdf. PowerPoint presentation describing India's approach to energy efficiency; similar to previous reference with a bit more emphasis on financing tools.

Kushler, M., York, D., & Witte, P. (2006). Aligning utility interests with energy efficiency objectives: A review of recent efforts at decoupling and performance incentives, Oct. 2006, report #. No. U061). Washington, DC, US: American Council for an Energy-Efficient Economy. Retrieved from http://www.aceee.org/research-report/u061

Kwapich, Thomas. (2010). *Germany´s Approach to Increase the Share of Energy Efficient Buildings.* Presented at the March 2010 City Reformers Group: Transforming cities across Europe. London, England. Retrieved from http://sticerd.lse.ac.uk/case/_new/research/weakmarketcities/cityreformers/2010_03/3.1_thomas_kwapich.pdf

Laitner, J., Nadel, S., Elliott, R., Sachs, H & Khan, A. (2012). *The long-term efficiency potential: What the evidence suggests.* No. E121). Washington, DC, US: ACEEE. Retrieved from http://www.aceee.org/node/3078?id=4496

Laskey, A., & Kavazovic, O. (2010). Opower: Energy efficiency through behavioral science and technology. *XRDS,* 17(4), 47-48-51. doi:10.1145/1961678.1961687

Lazar, J., F. Weston, and W. Shirley. (2011). *Revenue regulation and decoupling: A guide to theory and application.* Montpelier, VT, US: Regulatory Assistance Project. Retrieved from http://www.raponline.org/document/download/id/902

Lees, E. (2008). *Evaluation of the energy efficiency commitment 2005-08.* Wantage, Oxon, England: Eoin Lees Energy. Retrieved from http://ebasic.easily.co.uk/031047/02105C/EEC2Report18Dec08.pdf. An evaluation of Great Britain's requirement that electric and gas suppliers achieve energy-savings targets. This evaluation focused on five main areas: target-related issues, energy- and environment-related issues, financial- and social-related issues, market transformation impacts, and other issues.

Lees, E. (2010). *European and South American experience of white certificates.* Retrieved from http://www.worldenergy.org/documents/ee_case_study__obligations.pdf. Detailed case studies on white certificates in Brazil, France, Italy, and the United Kingdom; one of the few papers to include a non-EU country.

Lemoine, P., Huebner, T., Pickles, D., Prindle, B., & Buehler, N. (2009). *Rapid deployment energy efficiency (RDEE) toolkit: Planning & implementation guides.* Washington, DC, US: ICF International. Retrieved from http://www.epa.gov/cleanenergy/documents/suca/rdee_toolkit.pdf. Prepared for the US Environmental Protection Agency as a guide for state and regional jurisdictions.

Levine, M. D. (2010). *Energy efficiency in China: Glorious history, uncertain future.* Retrieved from http://www.aps.org/units/maspg/meetings/upload/levine.pdf. PowerPoint Presentation made to American Physical Society (APS) Mid-Atlantic Senior Physicists Group, April 21, 2010, by the group leader of LBNL's China Energy Group. Great introduction to China's approach to energy efficiency.

Levine, M. D., Price, L., Zhou, N., Fridley, D., Aden, N., Lu, H., . . . Yining, Q. (2010). *Assessment of China's energy-saving and emission-reduction accomplishments and opportunities during the 11th five year plan.* No. LBNL-3385E). Berkeley, CA, US: Lawrence Berkeley National Laboratory. Retrieved October 18, 2011 from http://china.lbl.gov/sites/china.lbl.gov/files/LBNL_3385E.Ace_Study_Report_FINAL.pdf. Most thorough and most-frequently cited assessment of the policies and programs that China has instituted in its quest to fulfill the national goal of a 20-percent reduction in energy intensity by 2010. In English and Chinese.

Levine, M. D., Zhou, N., & Price, L. (2009). *The greening of the middle kingdom: The story of energy efficiency in China.* No. LBNL-2413E). Berkeley, California: Lawrence Berkeley National Laboratory. Retrieved from http://china.lbl.gov/sites/china.lbl.gov/files/LBNL-2413E.Story_of_EE_in_China.pdf. Provides excellent background to China's policy development. Much of the content is repeated in the previous publication, while other content areas are attributed to Price, Zhou, and to LBNL's China Energy Group.

Lewis, J. (2011). *Energy and climate goals of China's 12th five-year plan.* Retrieved October 20, 2011, from http://www.pewclimate.org/international/factsheet/energy-climate-goals-china-twelfth-five-year-plan. Succinct fact sheet that details the intent of the 12th FYP.

Lewis, K., McFarlin, C., Rogers, C., & Kemmer, D. (2011). Achieving cost-effective energy efficiency for California 2011–2020. No. CEC-200-2011-007-SD). Sacramento, CA, US: California Energy Commission, Electricity Supply Analysis Division. Retrieved from http://www.energy.ca.gov/2011publications/CEC-200-2011-007/CEC-200-2011-

007-SD.pdf. Energy agency report detailing the progress of California utilities' efforts to increase energy efficiency; also an evaluation of publicly owned utilities' 2010 revised energy efficiency potential estimates and targets. Includes energy and peak savings for electricity, and gas savings.

Li, T., Molodtsov, S., & Delina, L. (2010). Assessment report on energy efficiency institutional arrangements in Asia. No. ST/ESCAP/2581). Thailand: United Nations Economic and Social Commission for Asia and the Pacific. Retrieved from www.unescap.org/publications/detail.asp?id=1402. This report presents a review of the existing EE institutional arrangements in Central, South, and Southeast Asia and includes a presentation of good practices and case studies of some national and international EE institutions.

Ludewig, D., Meyer, B., & Schlegelmilch, K. (2010). *Greening the budget: Pricing carbon and cutting energy subsidies to reduce the financial deficit in Germany.* Washington, DC: Heinrich Böll Stiftung. Retrieved from http://www.foes.de/pdf/2010-10-HBF_GreeningTheBudget.pdf. Discussion of the background and role of carbon taxes primarily in Germany includes lessons for and from other jurisdictions.

Makinson, S. (2006). *Public finance mechanisms to increase investment in energy efficiency – A report for policymakers and public finance agencies.* Basel Agency for Sustainable Energy. Retrieved from http://www.sefalliance.org/fileadmin/media/base/downloads/pfm_EE.pdf. Prepared as part of the UNEP Sustainable Energy Finance Initiative, this report highlights the importance, value, and methods of public-sector financing of energy efficiency.

Marino, A., Bertoldi, P., & Rezessy, S. (2010). *Energy service companies market in Europe: Status report 2010.* No. JRC 59863). Luxembourg: Publications Office of the European Union. doi:10.2788/8693.

Martinez, S., Wang, D & Chou, J. (2010). *California restores its energy efficiency leadership: Smart policies provide enormous economic and environmental benefits.* San Francisco, CA, US: National Resources Defense Council. Retrieved from http://docs.nrdc.org/energy/files/ene_10030901a.pdf

Mathur, A. *Energy efficiency roadmap for India.* Bureau of Energy Efficiency. Retrieved from http://www.infraline.com/power/events/presentations/AjayMathur-BEE.pdf. PowerPoint describing India's approach to energy efficiency presented by the director of the Bureau of Energy Efficiency.

Messenger, M., & Eckman, T. (2010). I*ntegrating the impact of energy efficiency policy and programs into utility resource planning.* Montpelier, VT, US: Regulatory Assistance Project. Retrieved from http://www.raponline.org/document/download/id/756. PDF version of a webinar given on August 24, 2010, which focused on incorporating energy savings into resource planning and demand-forecasting processes.

Ming, Y. (2006). Energy efficiency policy impact in India: Case study of investment in industrial energy efficiency. *Energy Policy,* 34(17), 3104-3114. doi:10.1016/j.enpol.2005.05.014

The MURE (Mesures d'Utilisation Rationnelle de l'Energie) database. Retrieved from http://www.isisrome.com/mure/index.htm. Provides a compendium of information on energy efficiency policies and measures that have been planned and/or adopted by the European Union.

Neme, C., & Petersen, P. (2011). *Competitive procurement of D3 resources.* Montpelier, VT USA: Regulatory Assistance Project. Retrieved from http://www.raponline.org/document/download/id/657. Presentation from workshop for UK demand resource providers (the "D3 Expert Stakeholder Workshop": demand reduction, demand response, and distributed generation) in London. Focuses on lessons learned when the US opened up markets to allow efficiency and other demand resources to compete with supply alternatives.

Neme, C., Gottstein, M., & Hamilton, B. (2011). *Residential energy retrofits: Roadmap for the future.* Montpelier, VT, US: Regulatory Assistance Project. Retrieved from http://www.raponline.org/document/download/id/918. Designed to inform policymakers about how to design and implement a residential retrofit strategy. Outlines principles for success based on the lessons learned from more than two decades of international experience, and the need to achieve deeper and broader levels of savings.

Northwest Power and Conservation Council. (2010). *Sixth northwest conservation and electric power plan.* (No. Council Document 2010-09). Portland, OR, US: Northwest Power and Conservation Council. Retrieved from http://www.nwcouncil.org/energy/powerplan/6/default.htm

Nowak, S., Kushler, M., Sciortino, M., York, D., & Witte, P. (2011). *Energy efficiency resource standards: State and utility strategies for higher energy savings.* No. U113). Washington, DC, US: ACEEE. Retrieved from http://www.aceee.org/node/3078?id=3926. Explanation of the mechanism and details of how it is being used in various US states.

Odyssee. *Energy efficiency indicators in Europe.* Retrieved September 9, 2011, from http://www.odyssee-indicators.org/publications/country_profiles.php. Updated (May 2011) information about each country's progress in meeting energy efficiency goals.

OECD/IEA. (2010). Energy efficiency governance. Paris, France: OECD/IEA. Retrieved from http://www.iea.org/papers/2010/eeg.pdf. Relevant and accessible information to support the development of comprehensive and effective governance mechanisms for energy efficiency including legal frameworks, institutional frameworks, funding mechanisms, coordination mechanisms, and accountability arrangements, such as evaluation and oversight.

Optimizing the CDM resources in Ontario: Direct testimony of Scudder H. Parker: Ontario Energy Board, EB-2007-0707 Integrated Power System Plan (2008). Retrieved from http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/73633/view/

Power, A., & Zulauf, M. (2011). *Cutting carbon costs: Learning from Germany's energy saving program.* What Works Collaborative. Retrieved from http://www.brookings.edu/~/media/Files/rc/papers/2011/0902_germany_energy_power_zulauf/0902_energy_power_zulauf.pdf. In-depth description of Germany's approach and policies including details of KfW loan and subsidy programs.

Price, L. (2005). *Voluntary agreements for energy efficiency or GHG emissions reduction in industry: An assessment of programs around the world.* No. LBNL-58138). Berkeley, CA, US: Lawrence Berkeley National Laboratory. Retrieved from http://ies.lbl.gov/iespubs/58138.pdf

Price, L., Galitsky, C., Sinton, J., Worell, E., & Graus, W. (2005). *Tax and fiscal policies for promotion of industrial energy efficiency: A survey of international experience.* No. LBNL-58128). Berkeley, CA, US: Lawrence Berkeley National Laboratory. Retrieved from http://ies.lbl.gov/iespubs/58128.pdf

Price, L., Levine, M. D., Zhou, N., Fridley, D., Aden, N., Lu, H., Yowargana, P. (2011). Assessment of China's energy-saving and emission-reduction accomplishments and opportunities during the 11th Five Year Plan. *Energy Policy,* 39(4), 2165-2178. doi: 10.1016/j.enpol.2011.02.006 Most recent of the many LBNL China Energy Group-authored papers on China's energy savings policies and accomplishments.

Price, L., Wang, X., & Yun, J. (2008). *China's top-1000 energy-consuming enterprises program: Reducing energy consumption of the 1,000 largest industrial enterprises in China.* No. LBNL-519E). Berkeley, CA, US: Lawrence Berkeley National Laboratory. Retrieved from http://china.lbl.gov/sites/china.lbl.gov/files/LBNL_519E._Top-1000_Energy_Consuming_Enterprises_Program._Jun2008.pdf

Price, L., Wang, X., & Yun, J. (2010). The challenge of reducing energy consumption of the top-1000 largest industrial enterprises in China. *Energy Policy,* 38(11), 6485-6498. doi: 10.1016/j.enpol.2009.02.036

Raghuraman, V. (2011). PAT: An objective analysis. *Energy Press,* 4(1), 11-13. Retrieved from http://www.energyprofessional.in/articlepages.php?category=35&id=319. Explanation of the intent and design of India's PAT Program.

Regulatory Assistance Project. (2008). *The regional greenhouse gas initiative in the northeastern United States: Auctioning emissions allowances.* Montpelier, VT, US: Regulatory Assistance Project. Retrieved from http://raponline.org/docs/RAP_RGGIAuctioningEmissionsAllowances_2008_12_05.pdf

Regulatory Assistance Project. (2011). *Power sector policy in China: Next steps.* Montpelier, VT, US: Regulatory Assistance Project. Retrieved from http://www.raponline.org/document/download/id/4598 This paper outlines recommendations about how the decade-old Chinese power sector development plans can be reevaluated and updated to better address the nation's current and future economic and environmental goals.

Reinaud, J., & Goldberg, A. (2011). *Ten key messages for effective policy packages – sharing best practices in industrial energy efficiency policies.* Retrieved from http://www.iipnetwork.org/publications.php#tenkey. Identifies the best practices and key messages pertaining to energy efficiency policies that are characterized as effort-defining, supporting measures or implementation tools. Provides details of and analyzes the policy packages of China, India, Japan, the Netherlands, the United Kingdom, and the United States. Excellent companion to this paper.

Sarkar, A., & Singh, J. (2010). Financing energy efficiency in developing countries—lessons learned and remaining challenges. *Energy Policy,* 38(10), 5560-5571. doi:10.1016/j.enpol.2010.05.001 Explores the key factors of various programmatic approaches and financing instruments that have been applied successfully for delivering energy efficiency solutions. The paper uses case studies to examine institutional issues related to the identification, packaging, designing, and monitoring approaches that have been used to catalyze traditional and innovative financing of energy efficiency projects.

Schettler-Kohler, H. P., & Kunkel, S. (2011). *Implementation of the EPBD in Germany – status in November 2010.* Brussels: European Union. Retrieved from http://www.epbd-ca.org/Medias/Pdf/country_reports_14-04-2011/Germany.pdf. Country update report from the book "Implementing the Energy Performance of Buildings Directive (EPBD)" produced by the Concerted Action EPBD, a joint initiative of the EU Member States and the European Commission, whose aim is to enhance the sharing of information and experiences from national adoption and implementation of the Energy Performance in Buildings Directive.

Schiller, S.R., Goldman, C.A., & Galawish, E. (2011). National energy efficiency evaluation, measurement and verification (EM&V) standard: Scoping study of issues and implementation requirements. No. LBNL-4265E). Berkeley, CA, US: Lawrence Berkeley National Laboratory. Retrieved from http://eetd.lbl.gov/EA/EMP/reports/lbnl-4265e.pdf

Schlomann, B., Mauch, M., & Eichhammer, W. (2009). Energy efficiency policies and measures in Germany- monitoring of energy efficiency in EU 27, Norway and Croatia (ODYSSEE-MURE). Karlsruhe, Germany: Fraunhofer ISI. Retrieved from http://www.odyssee-indicators.org/publications/PDF/germany_nr.pdf

Schultz, R. (2011). *Demand response in China.* Unpublished manuscript.

Schwartz, L. (2009). *The role of decoupling where energy efficiency is required by law.* Montpelier, VT, US: Regulatory Assistance Project. Retrieved from http://raponline.org/document/download/id/275

Sciortino, M., Neubauer, M., Vaidyanathan, S., Hayes, S., Nowak, S., & Molina, M. (2011). *The 2011 state energy efficiency scorecard.* No. E115. Washington, DC, US: ACEEE. Retrieved from http://www.aceee.org/node/3078?id=3935. The annual ranking and report on how the US states are addressing energy efficiency.

Sciortino, M., Nowak, S., Witte, P., York, D., & Kushler, M. (2011). Energy efficiency resource standards: A progress report on state experience. No. U112). Washington, DC, US: ACEEE. Retrieved from http://www.aceee.org/research-report/u112

Singh, D., Bharvirkar, R., Kumar, S., Sant, G., & Phadke, A. (2011). *Using national energy efficiency programs with upstream incentives to accelerate market transformation for super-efficient appliances in India.* Paper presented at the ECEEE 2011 Summer Study - Energy Efficiency First: The Foundation of a Low-Carbon Society, Belambra Presqu'île de Giens, France. 377-378-384. Retrieved from http://proceedings.eceee.org/download.php?filename=2-194_Singh.pdf&returnurl=http%3A%2F%2Fproceedings.eceee.org%2Fvisabstrakt.php%3Fdoc%3D2-194. Discussion of how national initiatives (as opposed to utility-administered DSM) can be used to bring about more rapid reductions in the energy consumption of appliances.

Sorrell, S. (2004). Understanding barriers to energy efficiency. In S. Sorrell, E. O'Malley, D. J. Schleich & D. S. Scott (Eds.), *The economics of energy efficiency* (pp. 25-26-92). Cheltenham, UK: Edward Elgar.

Sorrell, S., Schleich, D. J., Scott, D. S., O'Malley, E., Trace, F., Boede, U., Radgen, D. P. (2000). *Reducing barriers to energy efficiency in public and private organisations.* No. JOS3CT970022). Sussex, England: SPRU (Science and Technology Policy Research). Retrieved from http://www.sussex.ac.uk/Units/spru/publications/reports/barriers/final.html

Stanton, E. A., & Ackerman, F. (2010). *Emission reduction, interstate equity, and the price of carbon.* Somerville, MA, US: Economics for Equity and the Environment Network. (This report was produced in partnership with Ecotrust and SEI-US.) Retrieved from http://sei-us.org/Publications_PDF/SEI-E3-EmissionsInterstateEquity-10.pdf

Swisher, J. N., de Martino Januzzi, G., & Redlinger, R. Y. (1997). *Tools and methods for integrated resource planning: Improving energy efficiency and protecting the environment.* Roskilde, Denmark: United Nations Environment Programme. Retrieved from http://sei-us.org/Publications_PDF/SEI-E3-EmissionsInterstateEquity-10.pdf

Tanaka, K. Review of policies and measures for energy efficiency in industry sector. *Energy Policy,* In Press, Corrected Proof doi: 10.1016/j.enpol.2011.07.058

Taylor, R. P., Draugelis, G. J., Zhang, Y., & Ang Co, A. U. (2010). *Accelerating energy conservation in China's provinces.* No. 56416). The World Bank. Retrieved from http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2010/09/01/000333038_20100901232632/Rendered/PDF/564160ESW0whit1in0China1s0Provinces.pdf. Description of China's energy-saving programs including industrial and provincial-level projects. Designed to provide provincial agencies and groups in China, and those that support them, an outside perspectives and ideas on further development of energy conservation programs over the next several years.

Taylor, R. P., Govindarajalu, C., Levin , J., Meyer, A. S., & Ward, W. A. (2008). *Financing energy efficiency: Lessons from Brazil, China, India and beyond.* Washington, DC: The World Bank. Retrieved from http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2008/02/18/000333037_20080218015226/Rendered/PDF/425290PUB0ISBN11OFFICIAL0USE0ONLY10.pdf. Provides an excellent background on energy efficiency, case studies of various financing mechanisms including ESCOs and loan guarantees and lessons from the World Bank's efforts in financing energy efficiency in China, India, and Brazil.

Togeby, M., Dyhr-Mikkelsen, K., Larsen, A., Hansen, M. J., & Bach, P. (2009). *Danish energy efficiency policy: Revisited and future improvements.* Paper presented at the ECEEE 2009 Summer Study, La Colle sur Loup, France. 299-310. Retrieved from http://www.eceee.org/conference_proceedings/eceee/2009/Panel_2/2.043/paper. Presents the findings from an evaluation of the Danish energy efficiency portfolio that was carried out in 2008. Excellent background about the Danish approach along with lessons that have relevancy for the EU.

Wade, D. J. (2011). *National energy efficiency and energy savings targets*. ECEEE. Retrieved from http://www.eceee.org/Policy/Targets/TargetsFinalReport24May2011.pdf. Compilation of status of EEU member states and their use of energy efficiency targets.

Waide, P., & Buchner, B. (2008). Utility energy efficiency schemes: Savings obligations and trading. *Energy Efficiency,* 1(4), 297-311. doi:10.1007/s12053-008-9024-8 Looks at the history of utility financed and/or operated energy efficiency schemes, the white certificate schemes under development, and the impact of savings obligations. Identifies key features associated with utility-delivered mechanisms.

Wesselink, B., Harmsen, R., & Eichhammer, W. (2010). *Energy savings 2020: How to triple the impact of energy savings in Europe.* European Climate Foundation. Retrieved from http://roadmap2050.eu/attachments/files/1EnergySavings2020-FullReport.pdf. (A contributing study to Roadmap 2050: a practical guide to a prosperous, low-carbon Europe.) Provides detailed guidance about implementing binding energy savings targets.

Weston, R. (2009). *Integrated resource planning: History and principles.* Montpelier, VT, US: Regulatory Assistance Project. Retrieved from http://www.raponline.org/docs/RAP_Weston_IntegratedResourcePlanningOverview_2009_05_20.pdf

Wilson, R., & Peterson, P. (2011). *A brief survey of state integrated resource planning rules and requirements.* Cambridge, MA, US: Synapse Energy Economics, Inc. Retrieved from http://www.cleanskies.org/wp-content/uploads/2011/05/ACSF_IRP-Survey_Final_2011-04-28.pdf. (Prepared for the American Clean Skies Foundation)

World Energy Council. (2008). *Energy efficiency policies around the world: Review and evaluation.* London UK: World Energy Council. Retrieved from http://www.worldenergy.org/documents/energyefficiency_final_online.pdf. Describes and evaluates energy efficiency trends and policies from about 70 countries around the world. Three-year study coordinated by the French Environment and Energy Management Agency (ADEME) includes detailed case studies on mandatory energy audits, ESCOs, energy incentives for cars, energy efficiency obligation for energy utilities, and a package of measures for solar water heaters.

World Energy Council. (2010). *Energy efficiency: A recipe for success.* London, UK: World Energy Council. Retrieved from http://www.worldenergy.org/documents/fdeneff_v2.pdf. Describes and evaluates energy efficiency trends and policies from about 90 countries around the world. Includes detailed case studies focused on seven policy measures: innovative communication tools; good practices in the public sector; successful financial tools for households; energy efficiency measures for low income households; obligation of energy savings, regulation, and compliance; and smart meters. Excellent introduction to the field.

York, D., Kushler, M., & Witte, P. (2008). *Compendium of champions: Chronicling exemplary energy efficiency programs from across the U.S.* (No. U081). Washington, DC, US: ACEEE. Retrieved from http://aceee.org/research-report/u081. Provides overall observations on the characteristics of exemplary programs, with summary profiles of 90 programs selected.

Zhou, N., McNeil, M., & Levine, M. D. (2011). *Assessment of building energy-saving policies and programs in China during the 11th five year plan.* No. LBNL-4606E). Berkeley, CA, US: Lawrence Berkeley National Laboratory. Retrieved from http://china.lbl.gov/sites/china.lbl.gov/files/Assessment_of_Building_Eenry-Saving_Policies_and_Programs_in_China_During_the_11th_FYP.pdf.

Zhou, N., Levine, M. D., & Price, L. (2010). Overview of current energy efficiency policies in China. *Energy Policy,* 38(11), 6439-6452. doi: 10.1016/j.enpol.2009.08.015

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