Energy provider-delivered energy efficiency: an international review

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Abstract

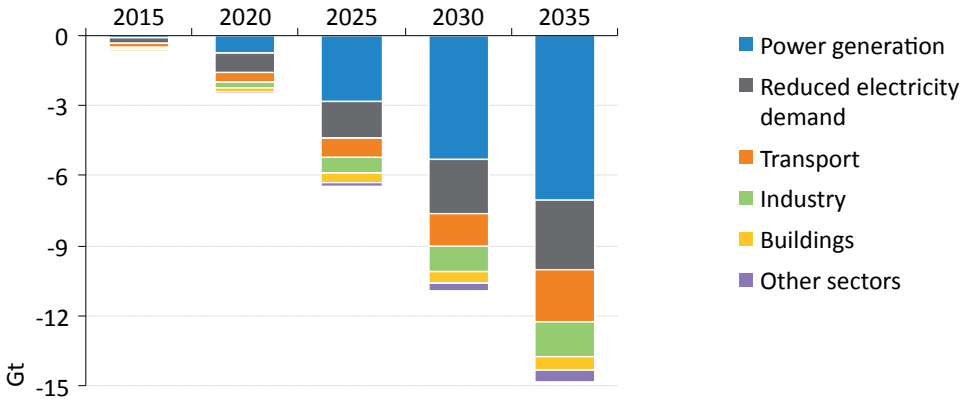
In many countries energy providers have proven quite effective in delivering energy efficiency (EE) – if the right regulatory framework and enabling conditions can be established. The past decade has seen a worldwide trend in mobilizing energy providers to invest in energy efficiency, with new policies obligating energy providers being implemented in the US, the EU, Australia, and China. This paper presents the results of a global review performed by the International Energy Agency of programme designs that energy providers have implemented to deliver energy efficiency to their end-use customers – households, businesses, and industry. This study is unique for two reasons (a) it has global coverage, and (b) it is specific to EE programs implemented by energy providers (as opposed to government agencies or third-party implementers). The review identified several distinct types of energy provider-delivered energy efficiency programme designs – incentives, on-bill financing, equipment replacement, advice and assistance, bulk procurement and distribution, information and comprehensive implementation. These energy efficiency programmes were effective in mobilizing increased energy efficiency investment by households, businesses, and industry alike. The review found there is no global "repository" for this energy efficiency information – a significant gap in the effort to track and monitor international efforts to scale up implementation of utility-driven projects. The review also found considerable innovation in programme designs including unified and collaborative delivery, use of stretch goals for programme administrators and contractors, comprehensive service delivery, multiple approaches to engaging the customer, enhanced financial support, and creating incentives to take a whole-house or whole-premise approach. The review also found numerous lessons applicable to energy providers around the world.

A global review of energy provider-delivered energy efficiency

Energy providers will play a pivotal role in global efforts to manage primary energy demand growth and reduce greenhouse gas (GHG) emissions. According to the 2011 World Energy Outlook, the power sector is expected to account for as much as two-thirds of cumulative emissions reductions by 2035, through switching to less carbon-intensive generation, more efficient plant operations, and lower electricity demand (IEA 2011a). Just reducing electricity end-use demand accounts for one-third in GHG emissions reductions expected over the next 15 years (See Figure 1).

In many countries energy providers play a central role in delivering end-use energy efficiency improvements. Based on available data, annual global spending on energy efficiency financed through networked energy bills and/or delivered by energy providers is estimated at over €8 billion in 2011 (Crossley 2011; Lees 2012; Faruqui 2011; Heffner 2012). Almost all of this spending stems from national and state/provincial efforts in Europe, North America, and Australia. Ratepayer-funded spending on gas and electricity efficiency in the United States and Canada topped $6 billion in 2011 and some energy providers spend over 3 % of their revenue on energy efficiency (Consortium for Energy Efficiency, 2010; Sciortino et al 2011).

World energy-related CO_2 abatement by sector in the 450 Scenario compared with the New Policies Scenario



The power sector accounts for 2/3 of cumulative emissions abatement to 2035, through switching to less carbon-intensive generation, more efficient plant & lower electricity demand

Figure 1: World energy-related CO_2 abatement by sector in the 450 Scenario (IEA 2011a).

In the UK, annual spending by energy retailers under the Carbon Emissions Reduction Target (CERT) supplier obligation has been €1.2 billion per year, while the Italian White Certificates scheme accounted for over €200 million in 2010 spending alone (Lees 2012). State schemes in Australia accounted for another €80 million in 2010 (Crossley 2011). Other G20 countries including China and Brazil have introduced targets and energy efficiency spending requirements for energy providers (Cowart 2012).

Governments and regulators turn to energy providers to deliver energy efficiency (EE) for several reasons. Energy providers have a strategic position in energy markets, often serving as middleman between energy producers and energy consumers. Given their extensive commercial relationships with even the smallest end-use customers, energy providers can help achieve energy savings in diffuse markets. Energy providers often have a ready-made infrastructure for delivering services, by virtue of offices and facilities in their area of operations or service territory. Energy providers also enjoy name recognition by end-users, and are often viewed as impartial or objective sources of information and expertise. Finally, energy providers have extensive and often detailed information on the consumption habits of energy consumers (International Energy Agency 2010). Given their strategic position in energy markets and ability to provide services directly to households, buildings, and factories, it is no wonder why governments are increasingly turning to energy providers to deliver EE improvements.

Approach

The International Energy Agency (IEA) together with its working partner the Regulatory Assistance Project (RAP) are delivering a new work programme focused on energy efficiency and energy providers. Formulated under the auspices of the International Partnership on Energy Efficiency Cooperation (IPEEC) and led by the UK's Department of Energy and Climate Change, the Policies for Energy Provider Delivery of Energy Efficiency (PEPDEE) activity has been established to promote cooperation and knowledge-sharing on how energy providers can improve the energy efficiency of their customers. Other participating governments include the US, Australia, and the European Commission. PEPDEE will facilitate cooperation and knowledge-sharing among IEA and IPEEC member countries on how energy providers can improve the efficiency of gas and electricity customers – and what regulators and governments can do to mobilize such efforts.

One of the key PEPDEE work streams was a stock-taking of innovative energy efficiency programmes delivered by energy providers in IEA and IPEEC member countries. This stock-taking was performed by the IEA Project Team in cooperation with regional and global networks of energy provider associations.

The EE programme stock-taking team took a three-step approach to cataloguing the diversity of EE programme designs: (i) outreach through associations of energy providers; (ii) outreach directly to energy providers; and (iii) desk study of EE programs. The team then screened the programs in order to identify a representative sample of proven and innovative programme designs.

The team began with a desk review of relevant reports related to energy efficiency (EE) and demand-side management (DSM) programs implemented by gas and electric utilities internationally. Most of these documents describe energy efficiency policy frameworks, energy efficiency business models, and market mechanisms such as white certificates. Other topics include program evaluation, energy efficiency financing schemes, energy efficiency resource standards, regulatory incentives, and outreach and education. There were relatively few documents containing national, regional or global reviews of energy provider-delivered energy efficiency programme designs.

The desk study found a small collection of particularly useful documents – compendia and collections of case studies documented programs and policies in some form (ACEEE 2011; ACEEE 2008; Eurelectric 2011 and 2007; Fuller 2008; REEEP

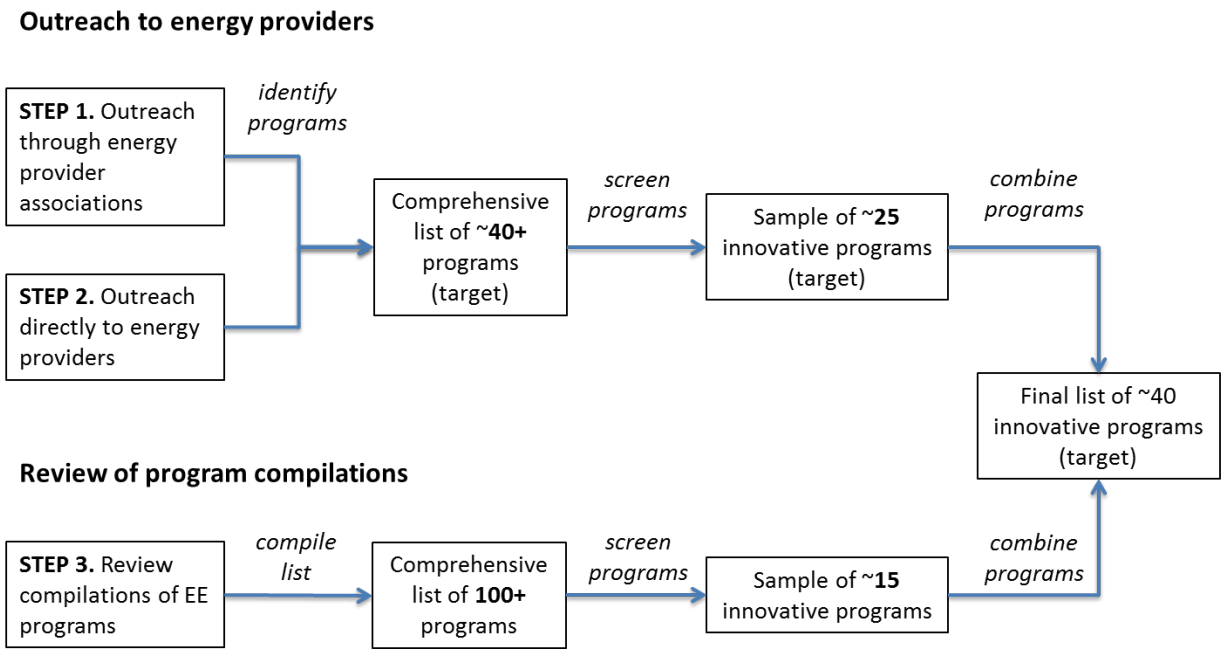


Figure 2: Stock-taking process for energy provider delivered energy efficiency programmes.

and Alliance to Save Energy 2010). These valuable documents reviewed specific programs, examined progress and trends, highlighted delivery challenges, and described the characteristics of outstanding programs. Many of the programmes identified here were drawn from this small but extremely useful compendia literature.

Unfortunately there is no systematic way to link or compare the information and knowledge in these previous compilations. There is no global "repository" for this energy efficiency information – which is a significant gap in the effort to track and monitor international efforts to scale up implementation of utility-driven projects.

The stock-taking effort identified over 200 EE programs, of which 72 were found with the assistance of energy provider associations and the remainder identified through literature review. The Project Team developed case studies for a total of 40 programs, in 12 countries worldwide, using a combination of surveys, phone interviews, and web-based research (see Figure 2).

Regional Overview – Energy-provider delivered energy efficiency

NORTH AMERICA

Energy providers in North America have been obligated for years to carry out DSM programs, with cost recovery through rates or system benefit charges included in regulated tariffs. There are three basic implementation models found in the 50 states: implementation by a regulated utility (e.g., in California), by a state agency (e.g., in New York), or by an "energy efficiency" utility (e.g., in Vermont, Maine, and Oregon). Performance contracting by third parties is also used (e.g., Texas, New Jersey). Electric utilities are by far the largest providers of EE in the US, with utility budgets comprising 84 % of the total ratepayer-funded electric efficiency budget nationwide.

The past few years have seen increased use of legislation to establish energy savings targets. Energy Efficiency Resource Standards (EERS) for electricity or natural gas (or both) have been adopted in 22 states in the US (ACEEE 2011). These standards, which place obligations on competitive retail suppliers, state agencies, energy efficiency utilities, and third-party contractors, are driving the acceleration and expansion of utility-sector electricity and natural gas energy efficiency programs. Budgets are increasing rapidly: US ratepayer-funded electric efficiency budgets increased 25 % from 2010 levels, to $6.8 billion in 2011. State budgets for ratepayer-funded natural gas energy efficiency programs have increased 36 % from 2009 to $970 million in 2010 (ACEEE 2012). These increases have been matched with growth in annual energy savings: from 92.6 TWh in 2009 to 112.5 TWh in 2010 (IEE, 2012), and from 290 million therms in 2008 to 529 million therms in 2009 (See Figure 3).

States with regulatory frameworks supporting utility energy efficiency efforts generally have the largest energy efficiency expenditures and budgets. As more states adopt EERS, and as states with existing EERS increase their annual savings goals, annual ratepayer-funded energy efficiency budgets are expected to approach $15 billion as soon as 2015 (Consortium for Energy Efficiency 2011).

EUROPEAN UNION

The European Union has set a primary EE Target: by 2020 the EU should save at least 20 % of its primary energy in a cost-effective manner (Lees 2012). The EU Directive of 2003 also stipulated that all customers be able to choose their gas and electricity supplier by 1 July 2007 at the latest. In Europe, national EE policies are complemented by policies of the European Union (EU), and a good mix of these policies is essential. The main regulatory measure driving the implementation of EE measures is obligations that are placed by the EU and national governments on energy providers. Although obligations are imposed upon retail energy suppliers in some countries such

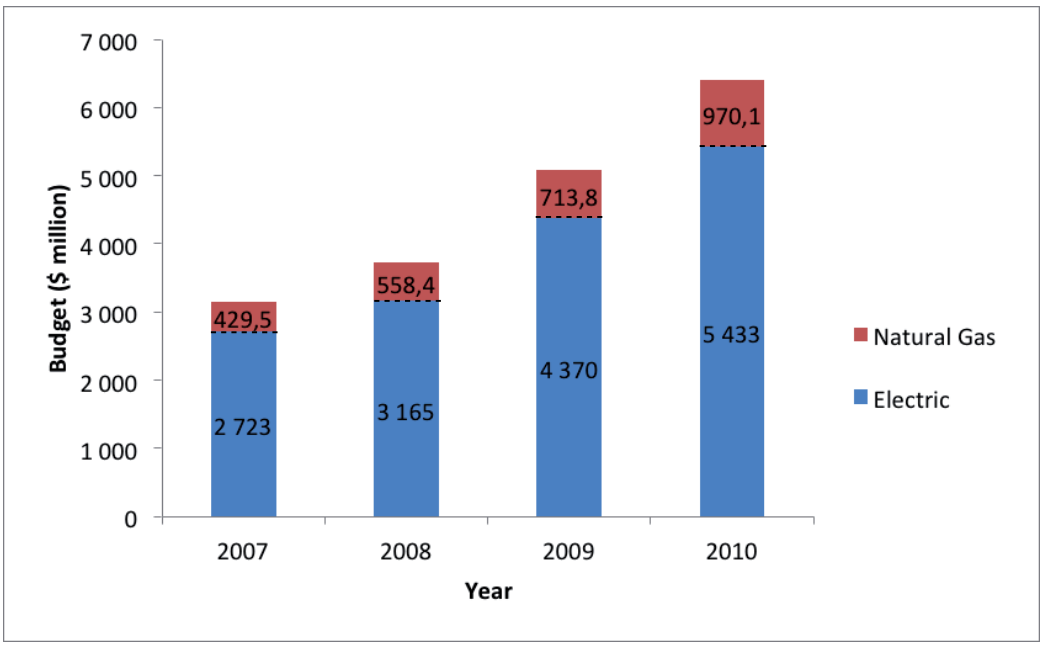


Figure 3: Budgets for Ratepayer-Funded Electric and Natural Gas Energy Efficiency Programs in the US. Source: IEE (2012) and ACEEE (2012).

Table 1: Spending on Energy Efficiency by Energy Providers in Europe, 2008 (Staniaszek and Lees 2012).

Country	Estimated Annual Spending by Energy Providers
Denmark	$33 million
Belgium/Flanders	$34 million
France	$237 million
Italy	$250 million
United Kingdom	$1.18 billion

as the UK and France, the obligations are imposed upon energy distribution network providers in other countries such as Belgium and Italy.[1] Energy efficiency certificates, which certify the value of the energy saved, are present in a few countries but are only traded in Italy. Table 1 shows the level of annual spending on EE programs by energy providers in Europe in 2008.

AUSTRALIA

In Australia, the majority of demand-side energy efficiency initiatives have been implemented by electricity transmission and distribution network companies. However, there have low levels of participation due to many difficulties, resulting in low market impacts. Expected energy savings from these initiatives in 2010/11 are on the order of 0.02 % of total electricity use in Australia, and peak demand reductions are on the order of 0.2 % of total peak summer demand (Australian Alliance to Save Energy, 2011).

More recently, three demand-side EE schemes have been introduced at the state level that establish "EE obligations" – requiring energy retailers to achieve certain levels energy savings. These obligations imposed on the retailers are expected to have a much more significant impact. Energy savings obligations in the New South Wales Energy Savings Scheme are ramping up from 0.4 % of annual electricity sales in 2009 to 4 % in 2014, and continuing until 2020 (Crossley 2011). This scheme sets energy savings targets for electricity retailers and converts energy savings into a tradable commodity by establishing Energy Savings Certificates (IPART 2011). It was established in July 2009 to help residential and commercial customers reduce electricity consumption and costs, to complement any national carbon emission reductions scheme, and to reduce the cost of and need for additional energy infrastructure. The state regulator of New South Wales, the Independent Pricing and Regulatory Tribunal (IPART), regulates and administers the Energy Savings Scheme, and Accredited Service Providers create certificates from energy savings projects. In the first 18 months of the scheme, more than 1 million energy savings certificates were created, primarily through low-flow showerheads and equipment upgrades. During this time, an estimated 7.5 TWh of lifetime energy savings were also generated (Databuild, 2011).

The energy saver initiative in Victoria, known as the Victorian Energy Efficiency Target (VEET), is broadly similar to the ESS in terms of obligated parties (electricity and gas suppliers), creation of a certificates market, and accredited project developers. This scheme aims to deliver 2.7 million tCO_2e annually from 2009–2011 and 5.4 million tCO_2e annually from 2012–2015, mostly from lighting and water heater measures (Woolley 2011).

The Residential Energy Efficiency Scheme in South Australia is patterned after the CERT scheme in the UK. This scheme sets up targets for energy retailers to meet, aimed at assisting low income households in particular in improving the affordability of their energy bills. The target for the scheme in 2011 is 255,000 tCO_2e saved (Philipson 2011).

1. Retail suppliers have strong links to the final consumer and motivation to market value-added services. For suppliers, the obligations seek to transform their business model away from pure commodity sales and towards energy service sales. Distributors are more stable, regulated organisations, which are regional monopolies. With proper tariff regulation, these do not have the strong push to sell "more kWh," as is in the case of retail suppliers.

Review of innovative programme designs

The stock-taking process sought to capture the range of program types in common use by energy providers and their delivery partners. Creating categories for energy efficiency measures is ultimately somewhat arbitrary, as many programmes are not mutually exclusive (e.g., an equipment replacement program can also have an incentive). The program categories settled on were as follows:

1. Incentives
2. On-bill financing
3. Equipment replacement
4. Advice and assistance
5. Bulk procurement and distribution
6. Information and communication
7. Comprehensive implementation

INCENTIVES

Incentive programs provide rebates, grants, subsidies or other form of payment to participating customers. The incentives are generally a portion of the cost of the energy efficiency measure and may be offered in various forms: $/measure, $/unit of energy saved, $/unit of demand saved, % of measure cost, % of project implementation cost, and others. Incentives can be offered directly to the participating customer (downstream model), to the vendor or supplier of equipment (upstream model), to a performance contractor (to reduce the risk premium to the energy service company (ESCO), or some combination of these. Incentive programs are typically designed to help reduce the initial the cost of the energy efficiency measure, thereby making the investment in the measure economically more attractive and affordable. Two examples of this type of program included in the case studies are the Custom Process Rebate Program (Industrial Market) implemented by CenterPoint Energy in the US and the Standard Offer Program implemented by Eskom in South Africa.

ON-BILL FINANCING

On-bill financing programs offer customers options to pay for the cost of the energy efficiency measure or project over a period of time through their utility bills, thereby helping to reduce the initial burden and spreading the costs over time. These programs may work in combination with direct incentive programs to help the customer finance their portion of the costs. The utility may also subsidize the interest rate to make the measure or program more attractive. Generally these programs are designed such that the customer's monthly payment (through the utility bill) is less than the monthly savings from the measure or project.

On-bill financing generally refers to a financial product that is serviced by, or in partnership with, a utility company. Such financing can be very useful in otherwise underserved markets, such as rental and multifamily buildings, by being structured as a service charge that follows the meter. There is also the potential for customers who have difficulty getting loans to gain access to financing through a loan from the utility that takes bill payment history into account. Also, because customers tend to prioritize their utility bill payments, such programs assure a very low payment default rate. Two examples of this type of program included in the case studies are the Mumbai Efficient Lighting Program for CFLs implemented by Reliance Infrastructure Limited in India and the Home Energy Solutions Program implemented by Connecticut Light & Power and Yankee Gas Services Company in the US.

EQUIPMENT REPLACEMENT

Equipment replacement programs are designed to replace existing, less-efficient energy-using equipment with high-efficiency equipment. Equipment replacement programs typically offer direct incentives for the higher-efficiency model. These incentives (see above) are often designed to cover 50–100 % of the incremental cost to the customer to purchase the high efficiency model, versus a standard-efficiency model. These programs may also be a part of a direct installation program, where equipment is replaced on the spot during the program activities. Many times, these replacements are for lower-cost measures such as lighting and are often offered free of charge to the customer. A wide range of equipment types can be seen in these programs; appliances, lighting, motors, HVAC, refrigeration, electronics, kitchen equipment, and others. Two examples of this type of program included in the case studies are the Procel Reluz program implemented by Eletrobras in Brazil and Lighting for SMEs implemented by Gas Natural Servicios S.A. in Spain.

DIRECT INSTALLATION

Direct installation programs offer customers the implementation of energy efficiency measures as part of or shortly following an energy audit or assessment. The main distinguishing feature of a direct installation program is that the utility or an agent engaged by the utility does the installation. Typically, these programs target residential customers and smaller businesses and focus on measures that are more easily installed with little or no lead-time such as lighting, programmable thermostats, water heater insulation, water-saving measures (aerators), and weatherization measures. Direct installation measures can either be offered free to the customer or at a reduced price. Two examples of this type of program included in the case studies are the Direct Installation of Gas and Electric Measures in Small Businesses by National Grid Company in the US and the Energy Storage Pilot Program implemented by Bonneville Power Administration in the US.

ADVICE AND ASSISTANCE

Advice and assistance programs cover a wide range of energy efficiency program topics. Probably the most common type of program is an energy auditing or assessment program, where the utility offers free or subsidized energy audits to customers in order to help them assess energy efficiency opportunities in their facilities. The intent of these programs is to educate the customers about energy efficiency opportunities and the amount of energy saving associated with these opportunities. Typically, auditing and assessment programs focus on identifying equipment replacement opportunities that may qualify for an incentive or low-cost measures that are easy and inexpensive for the customer to implement.

Some of these programs may also provide funds to the customer to hire outside firms to provide engineering or other services required for project design and implementation.

While the goals of advice and assistance programs are increased customer awareness, many programs also incorporate a vendor or installer educational component. Advice and assistance program scope ranges from simple product awareness, to system optimization training, to corporate-level energy management opportunities. And outreach efforts may include workshops, newsletters, individual site visits, bill stuffers, web sites, and more. Two examples of this type of program included in the case studies are the Energy Savings Assistance Program for low-income customers implemented by Southern California Edison in the US and the Quick Home Energy Check-up implemented by Baltimore Gas & Electric in the US.

BULK PROCUREMENT AND DISTRIBUTION

Bulk procurement and distribution programs reduce the price and increase the availability of products by combining a large-scale procurement with direct distribution and installation of the equipment. Such programs increase market availability of higher-efficiency equipment, and are typically put in place to transform lighting markets (e.g., with compact fluorescent lamps). These types of programs typically require cooperation between the program implementer and equipment suppliers, as well as distributors and retailers. Two examples of this type of program included in the case studies are the CFL bulk procurement programs by Electricity Generating Authority of Thailand and by Electricity of Vietnam.

INFORMATION AND COMMUNICATION

Information and communication programs come in a variety of forms, but all provide information to energy consumers to help them better understand their energy use. Through this understanding, consumers are able to improve their habits and reduce their overall energy consumption. The majority these of programs involve delivery of information via the Internet, and include websites with real-time consumption reporting or websites providing a one-stop-shop of information about available energy efficiency services and incentives, but also include more traditional pathways such as mailings. Another form of an information and communication program is one which provides a rating on the energy efficiency of equipment. This program type also includes programs that require labeling of energy efficiency equipment, or providing customers with "benchmarking" type information comparing their energy consumption to that of their neighbors. Two examples of this type of program included in the case studies are the Energy Management Platform implemented by Endesa in Spain and the OPower Home Energy Reports implemented by SourceGas Arkansas in the US.

COMPREHENSIVE IMPLEMENTATION

Comprehensive implementation programs encompass several measures offered through a single program or package, as well as combinations of program types described above. For example, comprehensive implementation may include a free energy assessment that leads into the direct installation of lower cost measures (such as lighting) along with the purchase of larger, more costly energy efficient measures that qualify for a utility incentive program.

Many comprehensive programs target the large non-residential market. For example, a program may combine a free or subsidized energy audit, assistance in identifying suitable equipment and its suppliers, design assistance, and financial incentives for implementation. Common features of such programs include identification and encouragement of comprehensive projects that go beyond single measures and common efficiency practices; focus on implementation of custom efficiency measures and projects that do not lend themselves well to a rebate or other incentive; use of incentive strategies that encourage and allow for custom and comprehensive projects; inclusion of technical design or engineering review as part of the incentive approval process, and requirements for proof of project installation. Two examples of this type of program included in the case studies are the Energy Upgrade California program implemented by Pacific Gas & Electric in the US and the Integrated Energy Management program implemented by Iberdrola in Spain.

Energy provider programmes especially suited for industrial end-users

The global stock-taking found that some programs were especially well-suited for serving the needs of industrial customers. Of the 40 case studies developed, 10 were especially targeted for industrial customers (See Table 2). These energy efficiency programmes fell into four main categories – advice and assistance, incentives, on-bill financing, and information and communications. The energy efficiency services offered fell into three main modalities – project preparation facilitation, access to financing, and project risk reduction.

CenterPoint Energy's Custom Process Rebates provide significant financial incentives to customers who improve their energy efficiency through innovative customized energy saving projects. The Custom Process Rebate Program provides rebates primarily to large volume and dual fuel customers who use throughput for process rather than heating purposes. Project supported include bio-methane energy recovery, waste heat energy recovery, boiler flue gas condensers, thermal oxidizers, integral quench furnaces, heat treat ovens, control packages, window replacement, stack economizers, enthalpy wheels, among others. Financial incentives are awarded to customers to assist with the first cost of the energy efficient upgrade.

Eskom's Standard Offer program offers payments at a fixed rate for delivered peak (6 am–10 pm on weekdays) savings from 50 kW–5 MW EE projects for a period of three years. The typical technologies implemented under this program include efficient lighting and fixtures, LEDs, hot water systems, solar systems, and industrial process optimization. A standard payment is made based on the technology, between US$0.05 to 0.08 per kWh saved. Payments are made to the project developers in installments, with 70 % of the payment upon project completion and 10 % at the end of each of the three years. Measurement and Verification (M&V) is required for each of the 3 years, and payments are adjusted to reflect actual savings. The fund can be accessed by either ESCOs or by industrial end-users.

Iberdrola USA's Block Bidding Program offers opportunities for commercial, industrial, and municipal customers and third parties such as Energy Services Companies ("ESCOs"), performance contractors, management companies to competitively

Table 2: Energy provider delivered energy efficiency schemes for industrial users.

Energy Provider	Programme Name	Programme category	Annual Savings
Centerpoint Energy (USA)	Custom Process Rebates	Advice and assistance; Incentives	0.4 PJ
Eskom (South Africa)	Standard Offer and Performance Contracting programmes	Incentives	$700 million
Iberdrola USA	Block Bidding Programme	Incentives	24,500 MWh
Sempra Energy (USA)	SoCalGas and SDG&E on-bill financing programmes	On-bill financing Incentives	Not directly estimated
Connecticut Light and Power/Yankee Gas Services (USA)	Small Business Energy Advantage Programme	Comprehensive Implementation; On-Bill Financing	30,000 MWh
Electrabel (Belgium)	Energy Efficiency Expert Centre Energy Kronos	Advice and assistance; Information and Communications	N/A
Endesa (Spain)	Energy Management Platform	Information and communication	N/A
Bonneville Power Administration (USA)	Scientific Irrigation Scheduling Service	Advice and assistance; Information and communications	40,000 MWH
Origin Energy (Australia)	Energy Savings Guarantee	Direct Installation; On-bill Financing	N/A

bid for energy efficient project funding through the New York State Public Service Commission's Energy Efficiency Portfolio Standard (EEPS) funded programs, operated by New York State Electric and Gas Corporation (NYSEG) and Rochester Gas & Electric Corporation (RG&E), part of Iberdrola USA. Program participants submit bids for blocks of permanent and sustainable energy savings, with a minimum of 100 MWh annual savings reduction, through periodic Requests for Proposals. Bids are evaluated and ranked based upon the relationship between the bid amount and the energy resource savings (kWh) resulting from the project. Bids are selected from lowest to highest cost per resource benefit up to the amount of funds available at the time of the bid. Contracts are then executed with winning Bidders, and payments made upon project completion and savings verification.

Sempra Energy's on-bill financing programme facilitates investments in energy efficient equipment (gas equipment for SCG customers and electric and gas equipment for SDG&E customers) by businesses already participating in the utilities' rebate programs. The program achieves this by providing zero interest loans for a term of up to five years (10 years for institutional/government customers). The loan is designed to be "bill neutral," with the monthly loan repayment equal to the monthly bill savings realized by the customers from the energy savings. The program requires that loan funds must be used for the purchase and installation of energy efficiency equipment that qualifies for the utility rebate or incentives. Eligible EE equipment includes pipe and tank insulation, furnaces, kilns and ovens, heat recovery equipment, natural gas engines, boiler economizers, HVAC, refrigeration, motors and pumps, and energy management systems.

The Small Business Energy Advantage program offered by Connecticut Light & Power Company and Yankee Gas Services Company offers comprehensive energy audit and energy efficiency project installation services to support small commercial and industrial customers (10 kW to 200 kW) in their service territories. Contractors bid to participate in the program and then provide audit and installation services in support of the utility administration of the program.

Electrabel provides free technical services to its commercial and industrial customers, including energy-efficiency training sessions for building and factory managers and technicians. The program also offers customized awareness campaigns for staff regarding Rational Energy Use (i.e. energy efficiency and savings) within a company. The training is centered on several web-based tools that Electrabel has developed, including: (i) Energy Manager, a tool that allows industrial customers to monitor consumption of electricity and gas- and-related CO_2 emissions and get advice on energy savings; (ii) Energy Kronos, an on-line tool which lets businesses make detailed analyses of changes in their energy consumption and the associated costs; and (iii) E-Subsidies, a web-based tool that provides an overview of incentives and subsidies available from the government and the utilities (e.g., the grid operator) for efficiency investments.

Endesa offers the Energy Management Platform to its large commercial and industrial customers. The platform helps its customers monitor and manage their energy and water costs more intelligently. It also provides real-time and historical data that helps customers manage different types of energy consumption in an aggregated manner. Endesa also offers its customers energy audits that result in recommendations for measures to save energy, including equipment replacement. Endesa also partners with a number of companies to provide equipment for its customers. There is no regulatory mandate for the retail utilities in Spain to offer energy-saving programs, and the main driver for this program is customer retention.

Bonneville Power Administration's Scientific Irrigation Scheduling programme provides predictive analytic services to growers allowing them to reduce water and thus energy consumption. The scientific services provided include weekly field visits, soil testing, weather data collection, and ongoing communication with the agricultural customers to inform them of appropriate irrigation strategies on a weekly basis. The aim of the Scientific Irrigation Scheduling program is to have growers use the best available information (such as current moisture content, stage of growth of the crop and forecasted weather) to

Table 3: Innovative elements observed in the case studies.

Unified and collaborative delivery	Stretch goals
Comprehensive service	Engaging the customer
Enhanced financial support	Whole-facility Incentive

make decisions on water quantities to use on their fields. Reducing excess water use allows for reduced pumping and thus reducing overall energy usage on this end-use.

Origin Energy has formed a strategic alliance with Low Carbon Australia to make it easier and more cost effective for businesses across Australia to implement and finance their energy efficiency projects. The result is an Energy Savings Guarantee (ESG) product which can be funded through repayments to be included as a line item on the customer's energy bill, also called 'on-bill financing'. Origin structures the cost of repayments so they are offset by the energy savings, delivering cost neutral or positive returns. This can help remove the need to obtain upfront capital to cover the cost of buying energy efficiency equipment. Key features of the initiative are the guarantee on energy savings achieved and the option to have Origin fund the works, taking advantage of competitively priced funds sourced from Low Carbon Australia. When taking advantage of Low Carbon Australia funding, charges are set out on a business customer's energy bill and paid monthly over a set term. Origin also project manages the works, end to end, further minimizing the risk that can prevent businesses taking up energy efficiency measures.

Patterns of programme innovation

The case studies cover a range of programs that varied in terms of their design, and well as the local economic and regulatory circumstances. Despite these differences, there were six innovative elements that were found among these programs (see Table 3). The section describes how these features contributed to the success of the programs.

UNIFIED AND COLLABORATIVE DELIVERY

Many energy providers utilize partnerships to achieve their program goals. The delivery partners included market players such as suppliers and service providers, local and state government, other utilities, R&D laboratories and energy efficiency utilities. Many energy providers commented on the usefulness of this type of cooperation in achieving economies of scope and scale and coordination.

Iberdrola USA found that leveraging the relationships other parties have with their customers helps to increase participation in its EEPS Block Bidding program. Vermont Gas Systems Inc. and Efficiency Vermont similarly found that the partnerships between utilities help secure ratepayers in their Vermont ENERGY STAR Homes program. Both Residential Natural Gas Appliance Rebates from Florida Public Utilities and Small Business Energy Advantage from Connecticut Light & Power and Yankee Gas Services Company, found that collaboration allowed consistency in rebate programs and pricing across utilities, making it possible to combined marketing efforts and thereby simplify the delivery process for both customers and contractors. Southern California Edison's Energy Leaders Partnership program and ESAP programs were able to leverage local municipalities and community based organizations to effectively reach hard-to-reach customers, respectively.

COMPREHENSIVE SERVICE

A major market barrier to implementing EE measures is the "hassle factor" – i.e. it takes resources for a potential program participant to engage in a project from start to finish. There are various means in which this market barrier addressed, and one of the successful strategies is to develop a turn-key program with comprehensive services.

Some comprehensive service programs use an energy services approach patterned on the ESCO model to provide a turn-key service inclusive of identifying, financing, and delivering energy efficiency measures. Iberdrola's Integrated Energy Management and Baltimore Gas & Electric Co.'s Small Business Lighting Solutions are good examples of this approach.

Other programs offered advice and assistance programs coupled with direct installation that combined all EE measures in the house or building into a single project, allowing more measures to be installed at once and easier access to financing. Examples of this include Pacific Gas & Electric's Energy Upgrade California, Southern Company's Low-Income Weatherization Program, and United Illuminating, Connecticut Light & Power and Yankee Gas Services Company's Home Energy Solutions and Home Energy Solutions Income Eligible programs.

In a few programs, the innovation was in the development of customized solutions for customers. These programs included the Custom Process Rebate Program from CenterPoint Energy, the Integrated Energy Management from Iberdrola, and the Energy Efficiency Program from Electrabel. Finally, the EEPS Block Bidding Program offered by Iberdrola USA is unique in this report in that it allows multiple measures over multiple sites to be aggregated into a single project.

ENHANCED FINANCIAL SUPPORT

The up-front cost of EE measures represent an obvious barrier that most EE programs work to address in one fashion or another. Attacking the specific financial burden can be addressed in numerous ways. Possibilities include free installations, rebates, interest rate buy-downs, on-bill finance, and third party financing.

Many programs featured free initial offers or services to customers, especially for targeted segments and as a sort of "introductory offer". These included Southern Company's Low-Income Weatherization Program, United Illuminating's Home Energy Solutions Income Eligible program, Vermont Gas Systems Inc. and Efficiency Vermont's Residential New Construction-Vermont ENERGY STAR Homes program, and Baltimore Gas & Electric Co.'s Quick Home Energy Check-Up.

Some programs charged a fee set at lower-than-market cost to increase initial market penetration. Examples include Reliance Infrastructure's Mumbai Efficient Lighting Program and the Home Energy Solutions programs implemented by United

Illuminating, Connecticut Light & Power and Yankee Gas Services Company.

One common method was financing EE upgrades through on-bill financing, in which the cost of the measure is recovered through the customer's energy bill. These and other loan options are sometimes combined with zero- or low-interest financing – e.g., the Home Energy Solutions and Home Energy Solutions Income Eligible programs offered by United Illuminating, Connecticut Light & Power and Yankee Gas Services Company. On-bill financing works best when the monthly repayment is fully offset by lower energy bills resulting from energy efficiency.

Accessing credit from third party financial institutions leverages energy provider funds and allows more customers to participate. This was the case in Société Tunisienne d'Electricité et du Gaz's Prosol program.

STRETCH GOALS

Many program managers attributed their success of their programs to using "stretch goals" that exceeding normal EE requirements and guidelines. For example, Electric Ireland provided web-based data and information services to its customers very early on during the uptake of the Internet, through its Energy Extra program. Pacific Gas & Electric filled a gap in the supply chain with its Fluorescent Lamp Recycling Program. Both Electrobras in its Procel Seal Program, Vermont Gas Systems Inc. and Efficiency Vermont in their Residential New Construction: Vermont ENERGY STAR Homes program keep their qualifying levels raised higher than the minimum EE standard level.

Another way in which energy providers have used a "stretch goal" approach is by researching and pioneering innovative energy-saving technologies and solutions, such as Bonneville Power Administration, through its Energy Storage Pilot, Emerging Technologies, and Scientific Irrigation Scheduling programs.

ENGAGING THE CUSTOMER

Two of the programs reviewed were designed to motivate customers to develop new energy-saving habits. BC Hydro's Team Power Smart Residential Program and SourceGas Arkansas' Opower Home Energy Reports provide comparisons of a customer's energy use with similar (in terms of home type, size, and occupancy) neighboring customers. In addition to the comparison to peers, these programs also provide a platform for customers to voluntarily set goals for energy savings.

A number of programs provide customers with web-based tools that help them view, interact with, and understand their own consumption data on-line. As smart meters become more widespread, the information that these tools provide can become more valuable. Programs providing this type of service included Electrabel's Energy Efficiency Programme, BC Hydro's Team Power Smart Residential Program, Helsinki Energy's Sävel Plus, Endesa's Energy Management Platform.

WHOLE-FACILITY INCENTIVE

Several programs provide incentives based on energy reduction on an entire facility regardless of the specific energy efficiency measures that were installed. By providing such an incentive, it is possible for the program to drive deeper energy savings by installing numerous measures at one time, thus reducing program administrative costs. Examples of such programs include Connecticut Light and Power/Yankee Gas Services' Small Business Energy Advantage and Origin Energy's Energy Savings Guarantee programme.

Lessons Learned

The dozens of case studies contain hundreds of individual insights and features. However some of the main lessons learned across many of the programme designs include the following:

1. **Customer retention as a driver.** Many demand-side EE programs are strongly driven by customer satisfaction and retention (both in perception of being "green" and in saving the customer money, rather than purely being about saving energy). This is present in all market types, but is particularly true in "open retail" markets where customers can choose their energy provider.
2. **Voluntary versus mandatory.** While mandatory EE programs tend to have greater budgets, there are many successful voluntary programs. In Finland, for example, there is a general understanding that by voluntarily participating in EE programs under the national Energy Efficiency Agreement, energy providers can avoid less-flexible legislation.
3. **Building on previous programs.** Many energy providers have built their current programs either on the foundation and experience of previous programs, including imitating programs that other energy providers had successfully implemented.
4. **Need for innovative communication.** A major challenge in program implementation is connecting with customers. More diverse communication strategies, such as, cross-selling, innovative media strategies, and partnerships should be executed.
5. **Engagement with government agencies.** US utilities in particular noted the importance of cooperation with utility and state agencies, especially with targeted programs (e.g., low-income energy efficiency).
6. **Government utilities in developing countries.** Government-owned electric utilities in developing countries can be key players in transforming electrical appliance markets in both the public and private sectors through equipment standards and labeling initiatives. This was notably the case in Thailand, with early standards and labelling efforts implemented by energy providers.
7. **Bulk purchasing and CFLs may not be a silver bullet.** Bulk purchasing to lower the price of compact fluorescent lamps (CFLs) in developing countries has had mixed success. The approach can reduce appliance or lamp unit costs, but can also lead to a flood of low-quality CFLs into the market if proper testing, certification, and labeling is not in place. In addition, bypassing normal retail channels, bulk procurement can upset lighting distributors and retailers if not carefully managed.
8. **Customer uptake during economic downturns.** Many programs had difficulty in acquiring new customers as a result

of the global economic recession in 2008-2009, and this difficulty existed across sectors. The primary reason for the low uptake was a lack of economic capital to invest in energy efficiency measures. Uptake is also hampered by low energy prices, which resulted in extended payback times.

9. **Keeping the programs simple**. Energy providers emphasized the importance of keeping the implementation process easy for customers and contractors to understand. This simplicity was an important factor for the success of a program, and this is especially at the beginning of a new generation of programs.

10. **Importance of working with contractor.** Contractors are important in many US programs, and it is important for energy providers to align their interests with the interests of the program. Builders who work on a program often get repeat work on subsequent programs. Contractors do some of their own work on advertising beyond what program administrators do. Also, as contractors have face-to-face contact with customers, they also are often the ones to introduce and sell measures, incentives, and financing options to customers. This underscores the importance of contractor training as a key to successful implementation. Respondents indicated that it is critical to continually update, train and engage contractors throughout the implementation of the program.

Conclusions

Over six months of international outreach revealed strong support from energy provider associations and individual utilities regarding cooperation and knowledge-sharing on regulatory mechanisms and programme designs for energy provider-delivered energy efficiency. A total of 72 programs were nominated by energy providers, and in interviews with program managers it was clear that they feel a sense of pride in delivering effective and economical energy efficiency schemes.

All end-users can benefit from the efforts of energy providers to assist their energy efficiency efforts. Of the 40 case studies described ten were based on programmes for industrial end-users. These energy efficiency programmes fell into four main categories – advice and assistance, incentives, on-bill financing, and information and communications. The energy efficiency services offered fell into three main modalities – project preparation facilitation, access to financing, and project risk reduction.

There are many venues for international cooperation and knowledge sharing among public agencies involved in energy efficiency. However there is much less scope at present for collaboration and cooperation between the energy efficiency operations of energy providers, especially outside the OECD. The Project Team was not able to identify any systematic engagement with utilities internationally to identify, monitor, and gauge the impact of EE programs delivered by energy providers, and it was clear that this international review of EE programs implemented by utilities represents an important new resource.

In the future, there is a role for the PEPDEE program to broaden and deepen its engagement with energy provider associations to institutionalize a regular international inventory of EE programs, their characteristics and progress, innovations and lessons learned, and their impacts. Given the international imperative to rapidly scale up implementation of EE efforts, this represents a golden opportunity to facilitate a global partnership with energy providers to track and monitor EE efforts implemented by energy providers.

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