Energy Company Obligations: Examples of delivering energy efficiency in Buildings and future trends

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1 INTRODUCTION

Today more than ever, there is an urgent need to scale up progress with energy efficiency. Energy efficiency is one of the pillars of a climate mitigation strategy[1]. It is also a critical element to meeting the global Sustainable Development Goals and to ensuring a cost-effective transition to a reliable, low-emitting energy system.

Energy consumption in buildings is a crucial contributor to global emissions of greenhouse gases and harmful pollutants. In 2017, buildings and appliances accounted for around 30% of global final energy use. Building energy use increased 20% between 2000 and 2017, and could increase significantly between now and 2040 without a step change in the efficiency of buildings and appliances. The Efficient World Scenario, presented in the IEA's 2018 Energy Efficiency Market Report, demonstrates how increasing the global rate of energy efficiency from 1.6% per year to 2.2% per year can result in flat energy demand in the buildings sector, despite a projected 60% increase in floor area.

What policies will deliver this level of increase in energy efficiency? It is clear that building codes and appliance standards are fundamental drivers of increased energy efficiency, and that continued progress – and expansion of coverage – will be a priority. At the same time, these policies alone are unlikely to deliver the level of savings needed.

In this context, it is important to consider the role that market-based instruments can play in improving the energy efficiency of buildings. Market-based instruments have gained attention in the past few years as effective tools in the policy portfolio to deliver energy efficiency. The most prevalent market-based instrument, energy company obligations, has become particularly widespread. In 2017, 47 obligation programmes were in operation in 21 countries in Africa, Asia, Australia, Europe, North America and South America.[2]

1 IPCC, Global Warming of 1.5ºC
2 IEA, Energy Efficiency 2018, p. 40-41.

Yet the level of ambition and coverage varies among jurisdictions. In the buildings sector, many jurisdictions are considering how to go beyond lighting programmes to achieve deeper, more comprehensive energy savings in both new and existing buildings. In this context, there is a question over what policy package will most effectively deliver these savings, the role energy company obligations might play, and how energy company obligations would need to be designed to deliver deeper savings. This paper considers historical experience and emerging innovations with energy company obligations[3] in delivering energy efficiency improvements in buildings. It considers the role of obligations as part of the broader policy framework of building energy codes and appliance standards, and of other incentive mechanisms and programmes targeting energy efficiency in buildings.

The paper addresses the following questions:

- To what extent have energy company obligations delivered energy efficiency in buildings?
- What is the experience with energy company obligations in delivering more cost-effective, targeted or comprehensive savings?
- What role have energy company obligations played in the broader framework of federal and state building codes, appliance standards, "best in class" programmes, and other incentive policies and programmes?
- What emerging opportunities are technology and innovation enabling to further advance energy efficiency in buildings through energy company obligations?

The paper focuses on the experience in delivering energy savings in buildings through energy company funded programmes in the UK, Portugal, Canada (Ontario and Nova Scotia), and emerging opportunities from the United States (Illinois, Texas, New York and California). The jurisdictions have been chosen for a combination of geographic diversity, illustration of different design dimensions, focus on different customer segments, and their delivery of energy efficiency in buildings, often going beyond lighting.

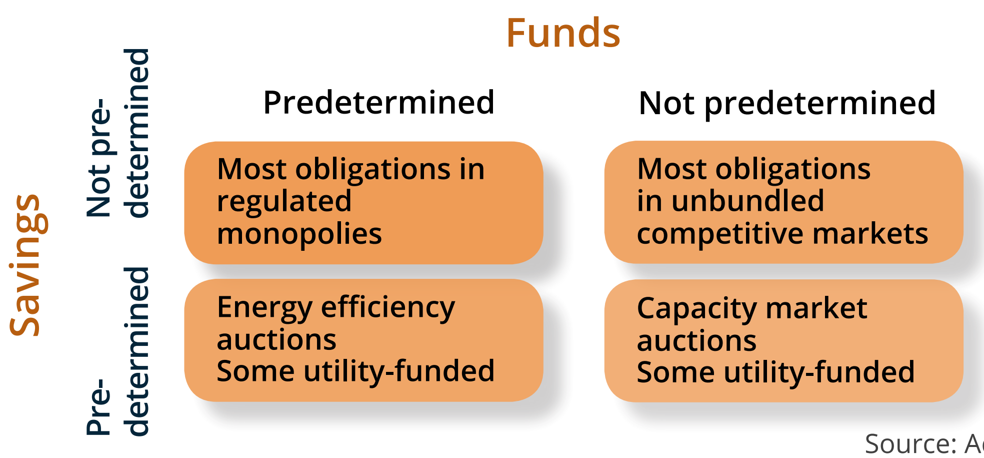
3 Referred to throughout this paper as "energy company obligations" and "obligations" interchangeably.

2 GLOBAL EXPERIENCE WITH ENERGY COMPANY OBLIGATIONS

End-use energy efficiency programmes that are funded through energy customers' bills can be found all around the world. Many jurisdictions have designed market-based instruments to shape and drive these programmes. Some have put in place policies or market rules that set specific savings or spending targets, or expanded the definition of "resource" in energy markets and regulation to allow energy efficiency projects to compete with other energy resources.

The top row in **Figure 1** includes energy company obligations, under which obligated companies are expected to deliver a defined level of savings. The level of funds expected to deliver these savings can be predetermined (top left), or left open (top right). These kinds of obligations are in place in many US states and European countries, as well as in Australia and Canada.

Figure 1. Classification of market based instruments based on whether funds and savings are predetermined



Source: Adapted from IEA (2017b)

Energy efficiency auctions, such as those in place in Portugal, Switzerland and Germany, define a budget, but leave it to bidders to identify the level of savings that can be reached within the budget. This is illustrated in the bottom left field. Some utility-funded programmes fall here as well, where they determine a spending target without defining the savings target. Brazil is an example of a country that requires a certain level of spending, without pre-defining expected energy savings levels.

Finally, in the bottom right field are capacity market auctions in which energy efficiency programmes can participate by bidding peak demand reductions. In this case, the level of savings and funds depends entirely on which energy efficiency programmes clear the auction. Competitive tenders for energy efficiency as a grid resource, described in section 5 of this paper, also fall in this field, as do some other energy company funded energy efficiency programmes. For instance, many US states have some form of utility-funded programmes, but without legal spending or savings requirements. Similarly, Portugal's demand-side management programme, in place from 1998 – 2006, required utilities to prepare energy savings programmes without predefining spending or energy savings levels.

Within energy efficiency obligations, there are a range of programme designs. This paper considers some relevant examples of programme designs within specific regions.

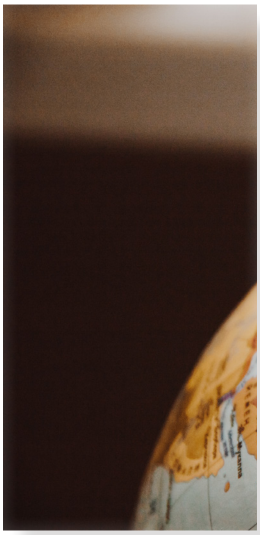
Figure 2. White certificate schemes in Australia and Italy

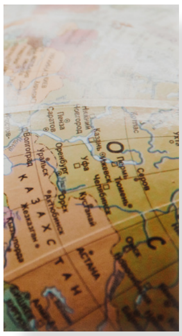
Australia

There are currently four energy company obligations in Australia, which, similar to the United States and Canada, are administered at state or territory level. Obligations are currently in place in the states of New South Wales, Victoria and South Australia, as well as the Australian Capital Territory. The obligations in New South Wales and Victoria also incorporate white certificate markets, where energy savings are traded between suppliers and obligated parties. Obligations in Australia prefer low cost, easily scaled and replicable measures, that are suitable for deemed savings. As a result, the majority of activity occurs in the buildings sector with lighting measures the dominant source of savings.

Italy

The white certificates programme in Italy has the most active market for white certificates in Europe. Having started as a relatively open scheme in 2005, Italy has more recently shifted its focus to attract energy savings projects within the industrial sector. In 2012, Italy introduced a multiplier valuing longer-lived measures, such as insulation and industrial projects (Stede, 2016). This led to a sharp increase in both the lifetime of the savings as well as the total savings, with total savings from the industrial sector rising from just 6% in 2007 to 62% in 2015. In addition, Italy's white certificate scheme has driven activity in the energy service company (ESCO) industry, including some obligated parties launching ESCO business units themselves.

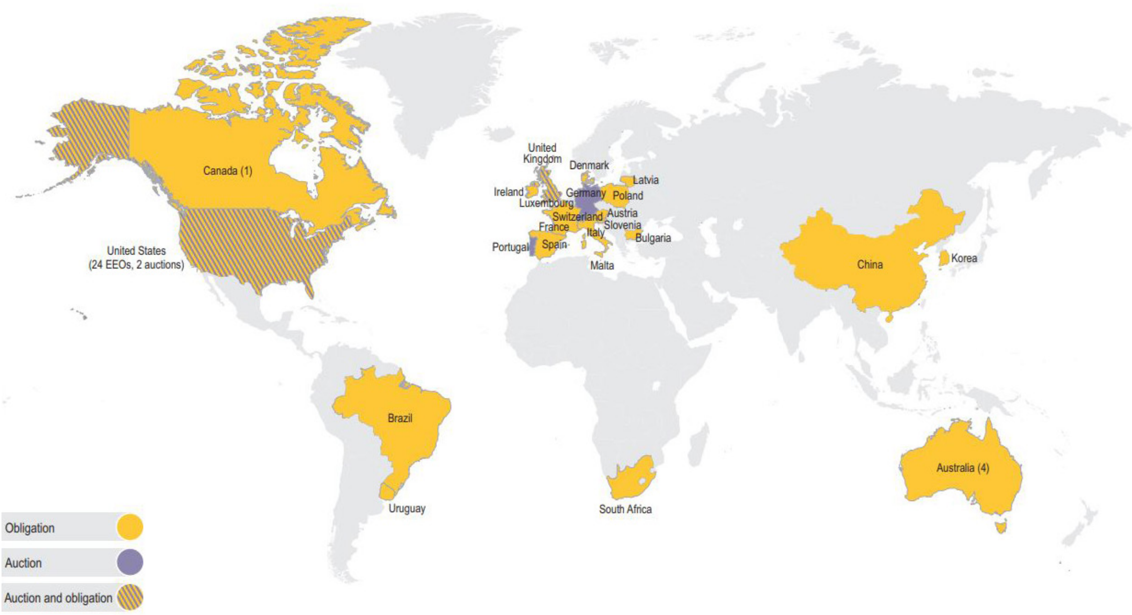




Coverage and scope

As demonstrated in **Figure 3**, market-based instruments are found in North America, Europe, China, Korea, Australia, South Africa, Brazil and Uruguay.

Figure 3. **Market-based Instruments Globally**[4]



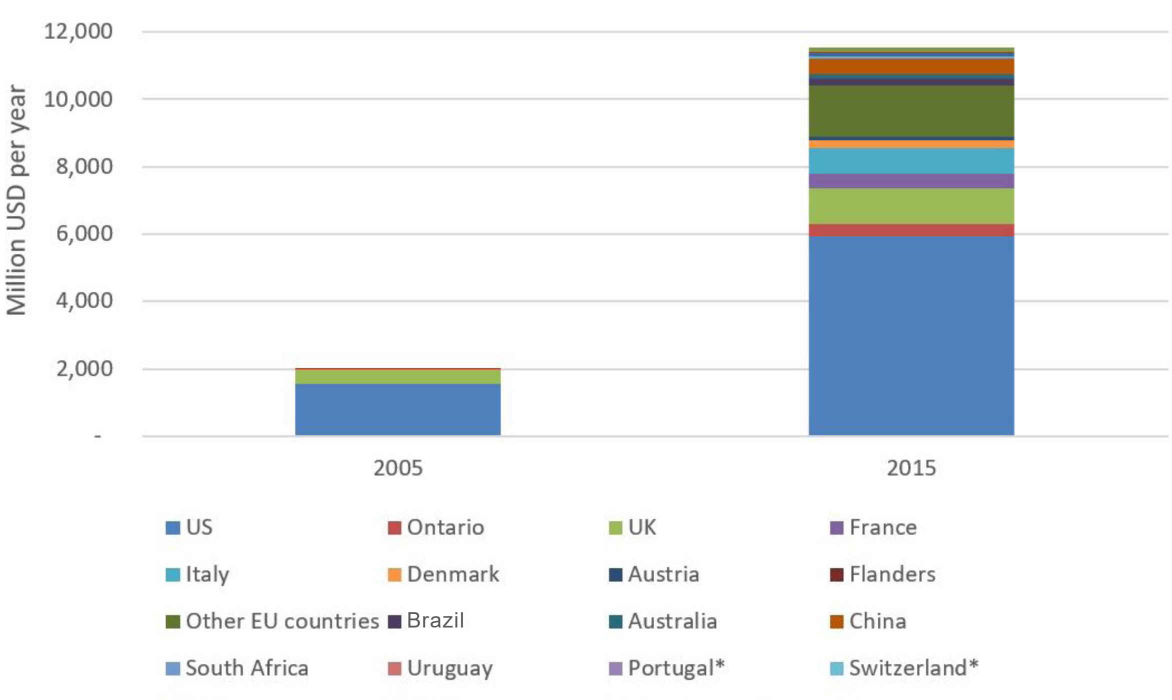
This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area

Source: IEA (2017b)

4 As of 2017.

The rise in the number of energy company obligations has stimulated increased investment. In 2015, these programmes delivered around USD 26 billion of investment (**Figure 4**), accounting for 12% of the USD 221 billion invested in energy efficiency globally (IEA 2017b).

Figure 4. **Global investment stimulated by market-based instruments for energy efficiency**

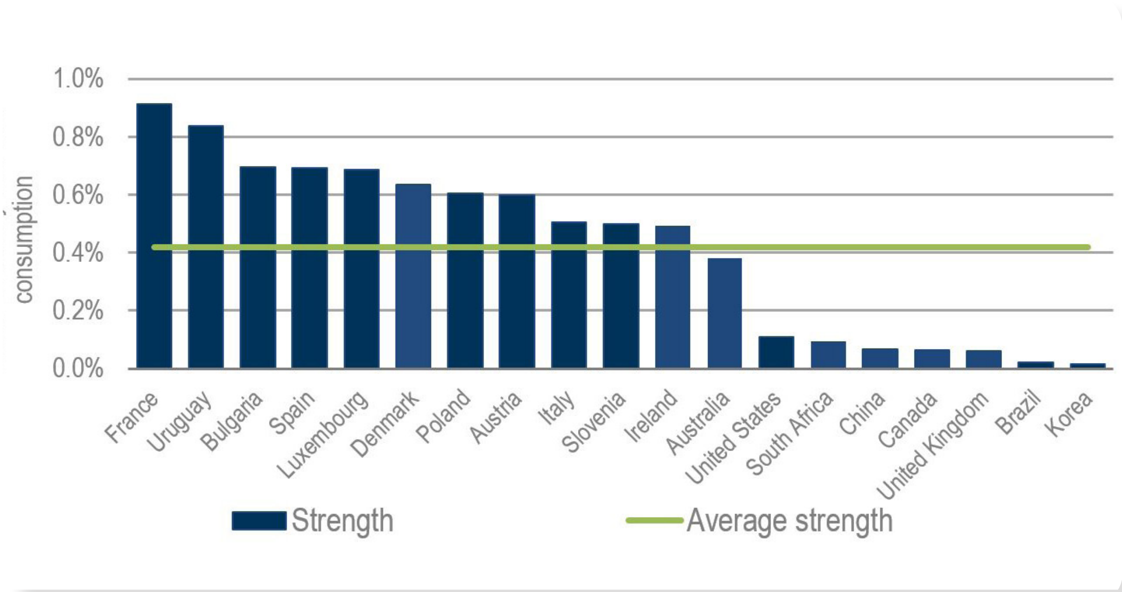


* Auctions and competitive procurement programmes.
All other jurisdictions represent energy company obligations.

Source: Based on IEA (2017b)

Obligation programmes covered just under 18% of global final energy use in 2017. The strength of utility programmes varies by country and programme, as illustrated in **Figure 5**. The most ambitious national programme was in France, whose obligation achieved nearly 1.0% of total final energy consumption. It is also worth noting that in some countries and particularly in the United States and Australia, the strength of state and provincial programmes can vary significantly, with some programmes exceeding 2.0% annual savings and some states and provinces having no target at all. Across all programmes, the average savings target is 0.4% of total final energy consumption.

Figure 5. **Strength of utility obligations in operation since 2005**



Source: IEA (2018)

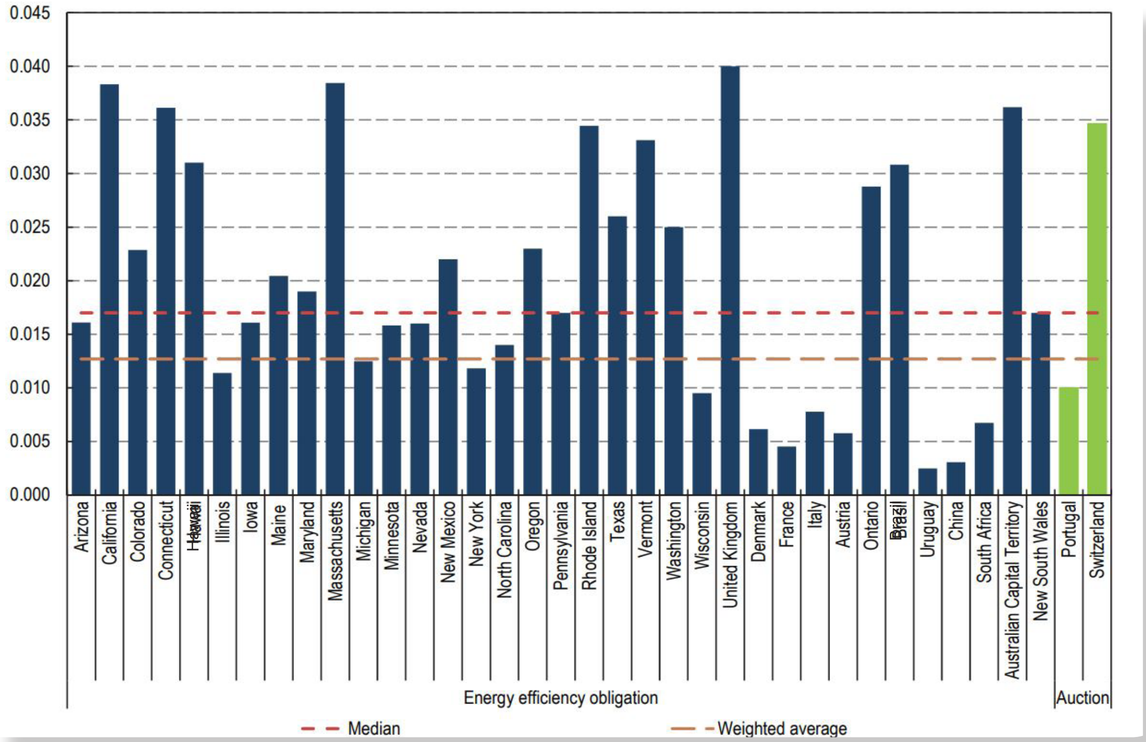
Costs

The costs and benefits of utility-funded energy efficiency programmes are often compared with those of supply-side resources to determine whether they deliver value to ratepayers, who ultimately pay for the programmes through their energy bills. This can be done by combining the cost of delivering energy efficiency programmes with the contribution of customers benefitting directly from the programme. For example, a utility might offer a 30% rebate on an efficient appliance, with the customer contributing her own money to pay for the remaining 70%.[5]

Figure 6 summarises the average cost, across programmes, to deliver a kWh of energy savings. The cost of delivery includes financial incentives paid to consumers, education, marketing, outreach, programme administration, evaluation, measurement and verification.

5 There are also examples of programmes or projects that have additional support from another source, such as additional tax incentives or rebates. However, this is more the exception than the rule.

Figure 6. Cost to deliver a kWh of energy savings in USD



Source: IEA (2017b)

To get the full picture, it is necessary to know how much customers contributed to the costs of implementing energy efficiency measures.

The customer contribution will vary significantly across programmes. For instance, programmes targeting low-income households deliver energy savings with little-to-no customer contribution, while other residential and commercial sector programmes and measures might have a customer contribution covering 2 to 3 times the programme's cost contribution (LBNL, 2018).

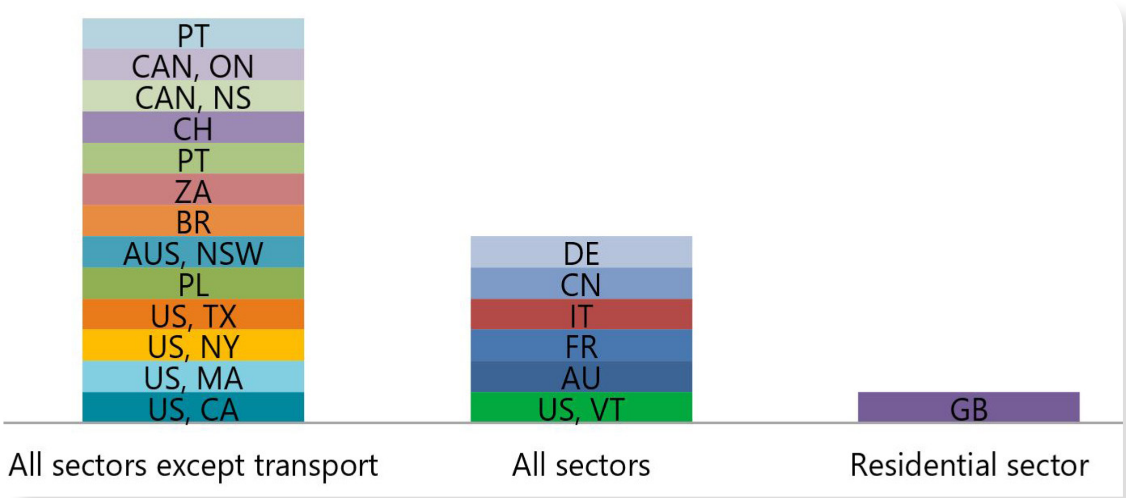
Many programmes do not provide information on the level of customer contribution. A survey of available studies in the US and Europe found that the ratio varies widely depending on the aggressiveness of the target or ambition level, degree of focus on low-income households, approach to additionality, and sectors covered (Rosenow, Cowart and Thomas, 2018).

Applying a leverage factor of two to three to the programme costs in **Figure 6** suggests median total costs of between USD 0.038 and 0.057/kWh lifetime savings and a weighted average of between USD 0.026/kWh and USD 0.039/kWh lifetime savings (Hoffman et al., 2015). This is well below the typical costs of energy supplied in most sectors and locations, even before factoring in the benefits of energy savings such as reduced emissions and improvements in health.

Savings by sector

Most utility-funded programmes allow for savings in all sectors, often excluding transport. “All sectors” (**Figure 7**) include the residential, commercial and tertiary sectors, as well as industrial programmes and transport, though these sectors might be framed differently in different regions. The UK is unique in that its energy company obligation covers only residential buildings.

Figure 7. **Sector coverage of select utility-funded energy efficiency programmes**

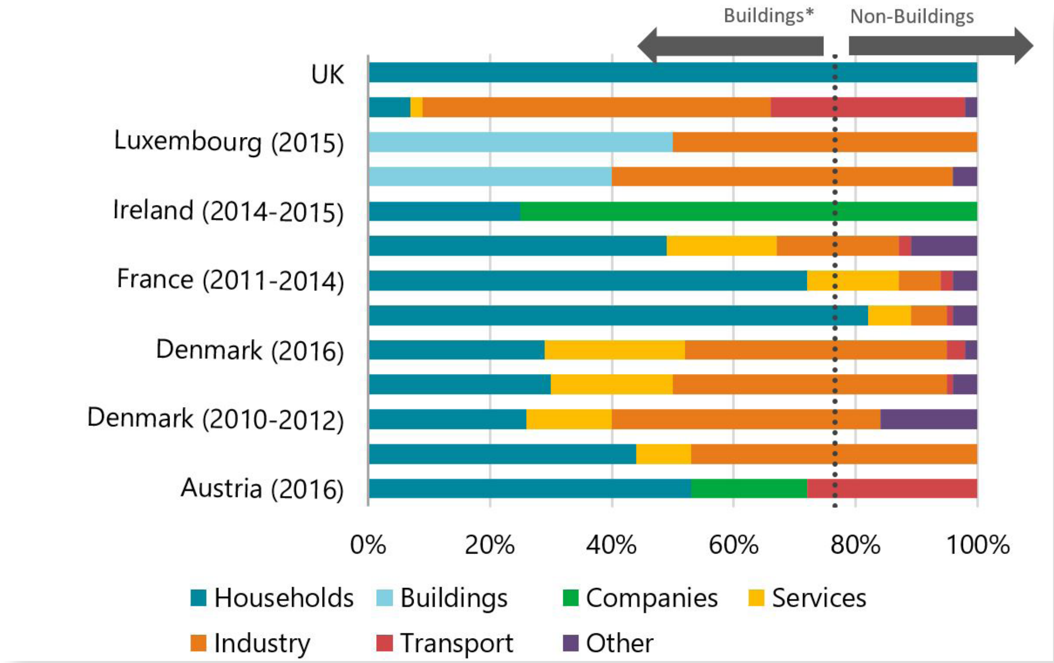


Note: AU = Austria, AUS = Australia, BR = Brazil, CAN = Canada, CAN, ON = Ontario, CAN, NS = Nova Scotia, CN = China, DE = Germany, FR = France, GB = Great Britain, IT = Italy, PL = Poland, PT = Portugal, US = United States, ZA = South Africa, NSW = New South Wales, CA = California, MA = Massachusetts, NY = New York, TX = Texas, VT = Vermont.

Source: Based on IEA (2017b)

Figure 8. **Distribution of energy savings in energy company obligation schemes in selected countries in Europe**

Figure 8 illustrates the sectors in which energy savings have been delivered in Europe under obligations for which data are available. Households and other buildings make up the majority of savings in many programmes, followed by companies, services and industry.

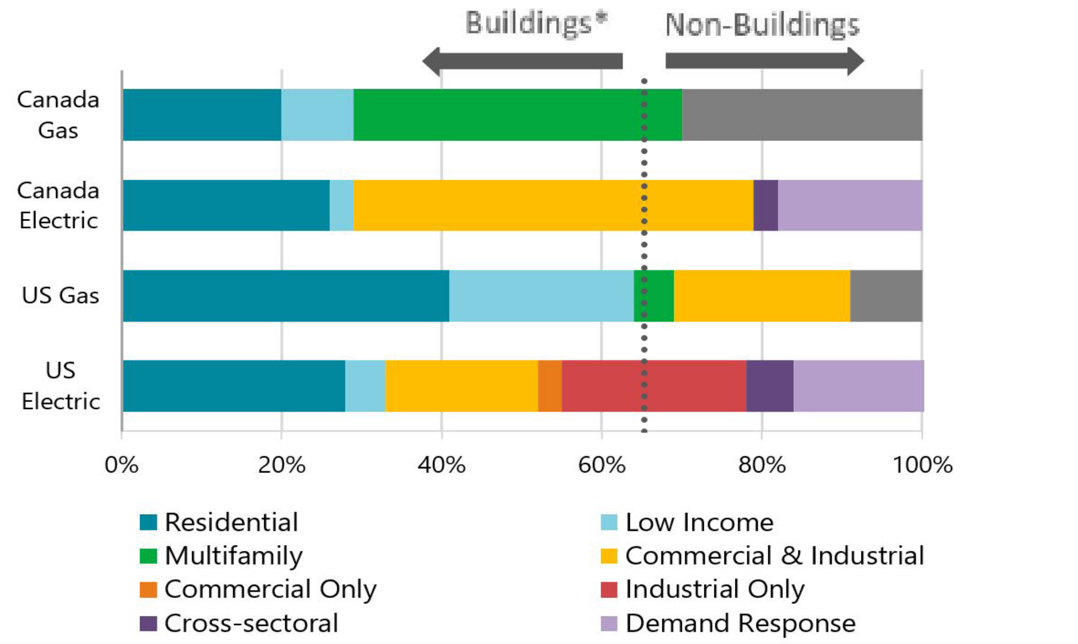


* For purposes of illustration, programmes in households, buildings, companies and services are assumed to be 100% focused on buildings, while industry programmes are assumed to be 50% focused on buildings and 50% on other measures (such as motors and processes).

Source: Adapted from ATEE (2017)

In the US and Canada, aggregate data for energy efficiency expenditures by sector are compiled for all utility energy efficiency and demand-side management programmes (falling in all four quadrants of Figure 1). The pool of programmes included, therefore, is broader than energy company obligations.[6] In North America, a significant portion of energy savings has been implemented in buildings as well, as illustrated in **Figure 9.**

Figure 9. 2016 Canadian and US expenditures on utility demand side management programmes



* For purposes of illustration, programmes in residential, low income, multifamily, and commercial sectors are assumed to be 100% buildings, while commercial & industrial and industrial only are assumed to be 50% buildings, 50% other measures.

Source: CEE (2018)

While it is difficult to find more specific data on the types of measures installed in each sector, there has been some analysis. In the United States, Lawrence Berkeley National Laboratories have developed a database that classifies and categorises energy savings measures being implemented under utility-funded programmes throughout the country.

From 2009-2015, lighting rebates accounted for 20% of total expenditures and 45% of savings in residential programmes. Whole home upgrades accounted for 24% of spending and 11% of savings, while HVAC and other prescriptive rebates accounted for 20% of both spending and savings.

Lighting rebates cost utility administrators on average six times less per kWh saved than whole home retrofits. However, within whole home retrofits, there was a much broader range of costs per kWh saved, reflecting diversity in programme design and measures implemented (LBNL, 2018).

6 Enegy company obligations are known as Energy Efficiency Resource Standards in North America.

3 PROGRAMME DESIGN TO DELIVER ENERGY SAVINGS IN BUILDINGS

case studies from Great Britain and Portugal

How might policy makers design energy company obligations to deliver energy savings beyond simple measures with short payback, like lighting? The following case studies describe the experience in Great Britain and Portugal. While these case studies do not provide a comprehensive review of the policy design options, they serve to illustrate the objectives, design strategies, and results of programmes in these two countries. Great Britain is interesting given the evolution of its energy company obligation programme over more than two decades and its focus on residential buildings. Portugal is interesting due to its long history of energy company-funded programmes and its move towards competitive tenders for delivery of energy savings within pre-defined priority areas.

3.1 Innovations to deliver building retrofits in the Great Britain

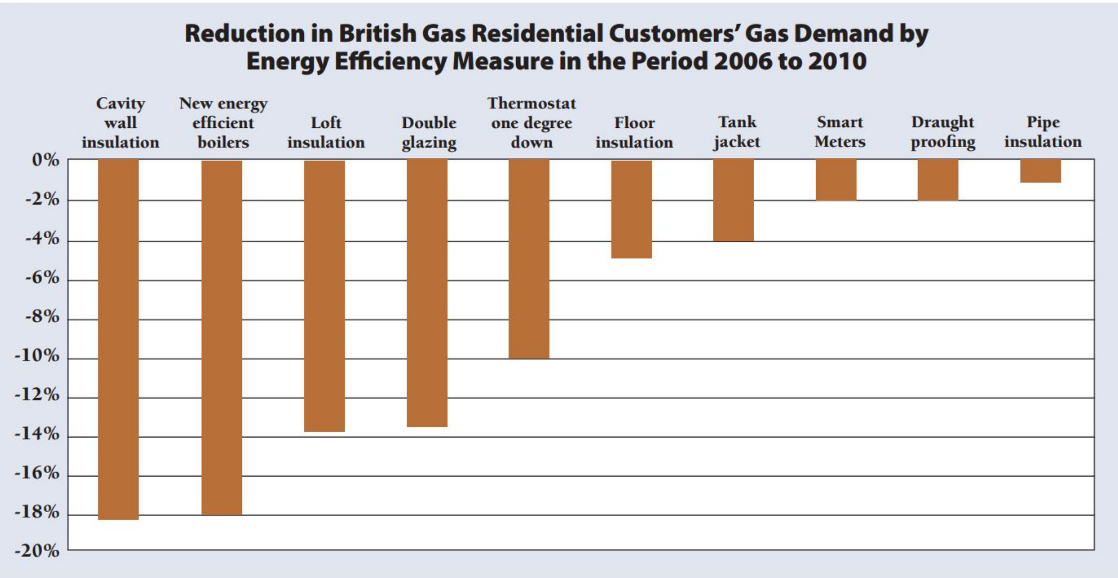
Great Britain (GB) introduced one of the first energy company obligation programmes in the world in 1994. The programme has changed shape over time, and can be divided into five programmes with multiple phases:

- Energy Efficiency Standards of Performance programme (EESoP), 1994-2002, three phases
- Energy Efficiency Commitment (EEC), 2002 – 2008, two phases
- Carbon Emissions Reduction Target (CERT), 2008 – 2012, one phase
- Community Energy Savings Programme (CESP), 2009-2012, one phase
- Energy Company Obligation (ECO), 2013 – ongoing, currently in its third phase.

The obligation programmes have focused exclusively on the residential sector, save for a small period when energy savings in small businesses qualified during the EESoP (Fawcett, Rosenow and Bertoldi, 2019). Since 2018, the scheme has narrowed further to focus only on low-income households.

GB's energy company obligations resulted in significant benefits to consumers. One measure of these benefits is the reduction in energy demand, which translates into bill savings. From 2006-2010, residential gas demand fell by 22% - equivalent to a 4.9% reduction per year. The biggest factors affecting this reduction were behaviour, lifestyle changes and energy efficiency measures. Energy efficiency measures accounted for 3.3% of the annual reduction in the period, driven by reductions in demand for the end-uses illustrated in **Figure 10**.

Figure 10. Reduction in residential gas demand from 2006-2010



Source: Lees and Bayer (2016)

The GB obligations have incorporated various design features over time to shape the direction of investments.

- **Programme focus.** The EESoP was a spending programme. Obligated companies had an expenditure allowance of £1, and later £1.20 for every customer. Under the EEC, the programme design transitioned to define an overall energy savings target (62TWh in phase 1 and 130TWh in phase 2), divided proportionally among obligated energy suppliers. The purpose of the EEC was to contribute to meeting the Government's Climate Change Programme and to support social equity by including a low-income carve out within the programme. From then, until recently, the obligation served the dual purpose of reducing carbon emissions and supporting low-income households.

- **Unintended outcomes.** Under the EESoP and EEC, energy savings were calculated ex-ante, based on deemed savings calculations. For lighting, a problem arose when obligated suppliers realised that they could meet their targets easily and cheaply by sending energy efficient lightbulbs to customers, quickly accumulating credit for the deemed savings per bulb. Bulk procurement led to a drop in the market price of CFLs, allowing utilities to meet their targets at lower cost than anticipated, but without a control mechanism to ensure that the new bulbs were actually replacing older less efficient ones. Another problem arose when the deemed savings calculations under-estimated the market penetration of A-rated refrigerators, giving credit to refrigerator replacement projects that did not in fact deliver additional savings above the market average. Subsequent programmes corrected for these issues by restricting the eligibility of lighting measures over time, and adjusting the deemed savings for refrigerators to ensure that only additional measures were credited (OFGEM, 2018).

- **Complementary policies.** In the second phase of the EEC, suppliers were able to integrate social programmes (Warm Front, Welsh HEES and Warm Deal) to deliver more comprehensive measures than the programmes alone would have provided (OFGEM, 2018). The CESP measures were nearly all delivered through partnerships with social housing providers or by direct promotion to private households (OFGEM, 2013b). In this way the programmes helped amplify the effectiveness of related programmes.

- **Use of uplift factors.** Several phases of the GB obligations introduced uplift factors to incentivise delivery of certain measures. Uplift refers to a percent increase in the carbon savings attributed to a measure. Under the EESoP, measures delivered as a package were eligible for extra credit, with a limit for uplift measures to 10% of each supplier's target. Under the EEC2, packaged measures and innovative measures qualified for a 50% uplift, by were also capped at 10% of all savings. Under CERT, energy companies could receive an uplift of 245% for ground source heat pumps, 95% for internal solid wall insulation, and 175% for external solid wall insulation. Nearly all of the uplift measures implemented were external solid wall insulation. Under the CESP, uplifts were available for more expensive measures such as solid wall insulation, heat pumps and boiler replacement as well as for each additional measure where more than one measure was installed at once (IEA 2017b).

Transition to the ECO and Green Deal Finance scheme

In 2013, the energy company obligation programme in the UK changed considerably. The volume of low cost measures, such as loft and cavity wall insulation, decreased as the focus turned to more expensive insulation measures and low-income and rural households.

Until introduction of the ECO, the GB energy company obligation programme had largely served two purposes (within the overall goal of reducing carbon emissions):

1. To overcome barriers to low cost energy efficiency measures in households – largely cavity wall and loft insulation and (for the first few years) inefficient lighting
2. To support energy efficiency improvements among vulnerable households.

Under the ECO, the first goal was largely taken out of the programme and shifted to an on-bill financing mechanism administered by the Green Deal Finance Company. This was part of a flagship government policy that focused on reducing government funding for cost-effective programmes. Under the Green Deal, able-to-pay households were expected to be attracted to the availability of loans for energy efficiency measures that would be paid back through energy bills.

Without the support of targets and incentives to drive uptake of insulation measures, and with high interest rates relative to mortgage rates, the Green Deal fell far short of its aspirations. Uptake of insulation measures under the programme was only 5% of anticipated demand. The low uptake stalled progress on energy efficiency and eroded much of the core client base for the GB insulation industry. In 2015, the Green Deal was halted for failure to deliver on its goals of delivering low-cost insulation measures in the able-to-pay sector (UK, 2015).

Figure 11. **Evolution of energy company obligations in GB**

	EESoP (1994-2002), 3 phases			EEC (2002 2008), 2 phases		CERT (2008-2012)	CESP	ECO (2013 – present)		
Objectives	**Social & environmental**			**Social & Carbon**		**Social & Carbon**	**Social & Carbon**	**Social & Carbon**		
Targets (TWh lifetime unless otherwise specified)	6.1	2.7	4.9	62	130	293 $mtCO_2$ (~494 TWh)	19 $mtCO_2$ (~32 TWh)	21 $mtCO_2$	25.7 mt CO_2	£8.253 billion in lifetime savings
% dedicated to low-income customers[7]	30%	60%-80%	67%	At least 50%		At least 40% + Super Priority Group	100%	Since ECO3, 100% low-income		
Main measures	Cavity wall & loft insulation, lighting			Cavity wall & loft insulation & lighting		Cavity wall & loft insulation, lighting, heating	External solid wall insulation, heating controls and boilers	Cavity wall & loft insulation, boiler replacements (ECO1), Cavity wall, loft, solid wall insulation (ECO2)		
Innovative design	Uplift for package measures			Uplift for package measures & innovation		Insulation obligation & uplift for innovative measures	Uplift for expensive measures and package measures; separate, parallel scheme targeted at most vulnerable customers*	Transition to low-income programme; focus on hard-to-treat cavity wall insulation and solid wall insulation[8]		

EESoP (OFGEM, 2003), EEC (phase 1) (OFGEM, 2005), EEC (phase 2) (OFGEM, 2008), CERT (OFGEM, 2013a), ECO (OFGEM, 2019), and for Target levels (Rosenow, 2012).

* Households at the bottom 10% of the Index of Multiple Deprivation (IMD)

7 Low-income customers are referred to differently under different phases of the scheme, including disadvantaged customers, low income customers, and Priority Group customers (defined as those in receipt of certain income-related benefits and tax credits).

8 There are three categories of hard-to-treat cavity measures: (1) narrow cavities, (2) cavities requiring remedial work, and (3) cavities requiring the use of non-standard materials and techniques.

Since the end of the Green Deal, no policy has stepped in to replace the earlier role that the CERT had played in defining and delivering on clear targets for low-cost insulation measures at large scale amongst able-to-pay households. Following a large reduction in ECO targets in 2014, there were interim attempts to increase uptake of solid wall insulation under the Green Deal Home Improvement Fund, which held three rounds of funding in 2014-2015. The fund offered households up to 7,600 GPB in non-repayable grants for installing solid wall insulation and other measures. However, the scheme was capped at a maximum of GPB 120 million over the course of one year. In the first phase of the programme, the funds were spent in 6 weeks, and in the second phase, were spent in one day (Rosenow and Eyre, 2016).

As of 2018, the ECO completed a transition announced in 2015 to focus exclusively on low-income households. The graphic below demonstrates the evolution of the ECO towards serving as a programme to deliver "affordable warmth." In practice this means that targets are set in notional lifetime energy bill savings (rather than carbon) and delivered primarily to households in receipt of social benefits. This evolution is laid out in **Table 1.**

Table 1. **Change in design of GB energy company obligations over time**

	ECO 1*	ECO2+ECO2t	ECO 3
CERO[1], $MtCO_2$	14.2	19.7	0
CSCO[2], $MtCO_2$	6.8	6	0
Total, $MtCO_2$	21	25.7	0
HHCRO[3], £billion, lifetime savings	4.2	6.46	8.25

*Under ECO1, the target under CERO was reduced from 20.9 to 14 Mt CO_2 in Dec 2013 (Ofgem, 2017).

1. CERO (Carbon Emissions Reduction Obligation) covered installation of cavity wall insulation in hard-to-treat properties and solid wall insulation.
2. CSCO (Carbon Saving Community Obligation) focused on low income areas, 15% to be delivered in rural areas.
3. HHCRO (Home Heating Cost Reduction Obligation) focused on reducing heating costs for consumers on certain types of benefits as a way of targeting vulnerable households. Also known as Affordable Warmth.

3.2 Energy efficiency auctions in Portugal

Like GB, Portugal has designed its energy company funded energy efficiency programmes[9] carefully to prioritise certain sectors and categories of measures. However, it has done this in a very different way from the UK.

From 1998 – 2006, regulated electric utilities in Portugal were required to develop Demand-Side Management Plans, referred to PGP – Plan de Gestão da Procura. In 1998, the tariff regulation code established that the costs of demand-side projects were to be included in electric distribution company revenues. In 2001, the tariff regulation was amended to allow cost-recovery for demand-side programmes and to allow utilities to keep 50% of the benefits associated with these programmes. Public distribution companies were required to develop annual Demand Side Management Plans, though no specific spending or energy savings targets were set. The PGPs themselves identified specific measures to be implemented that would promote energy efficiency among end-users.

The experience with utility-funded energy efficiency programmes from 1998 prepared the market for the roll-out of the more ambitious and complex programme under the energy efficiency tenders introduced in 2007.

Since 2007, the Portuguese energy regulator has administered a voluntary auction scheme for electric energy savings called the Electric Demand-Side Efficiency Promotion Plan (PPEC – Plano de Promoção da Eficiência no Consumo de Energia Elétrica). The auction programme is paid for through a charge on customer bills; however, a broad set of actors can bid projects into the auction. The auctions are conducted within a carefully designed budget, with separate auctions for each budget category.[10] The budget is set by the Energy Services Regulatory Authority (ERSE), Portugal's energy regulator, and then sent to the Ministry of Energy for approval (DRE, 2013a).

The programme has had six auction periods, starting in 2007. Each period begins with a tender for energy efficiency programmes, followed by an implementation period. The most recent period for 2017-2018 is currently under implementation, and has been extended to the end of 2019.

Table 2 lists the categories of promoters who are eligible to participate in the auctions. The promoters are divided into two categories – industry sector promoters and non-industry sector promoters.

9 Note that ultimately, the budget for the programmes comes from tariffs, and is therefore paid for by all customers.

10 The categories are: intangible measures (financing measures to change consumer behaviour) and tanglibe measures (financing energy efficient equipment). Tangible measures can have three categories (residential, industry and agriculture, and commercial and services).

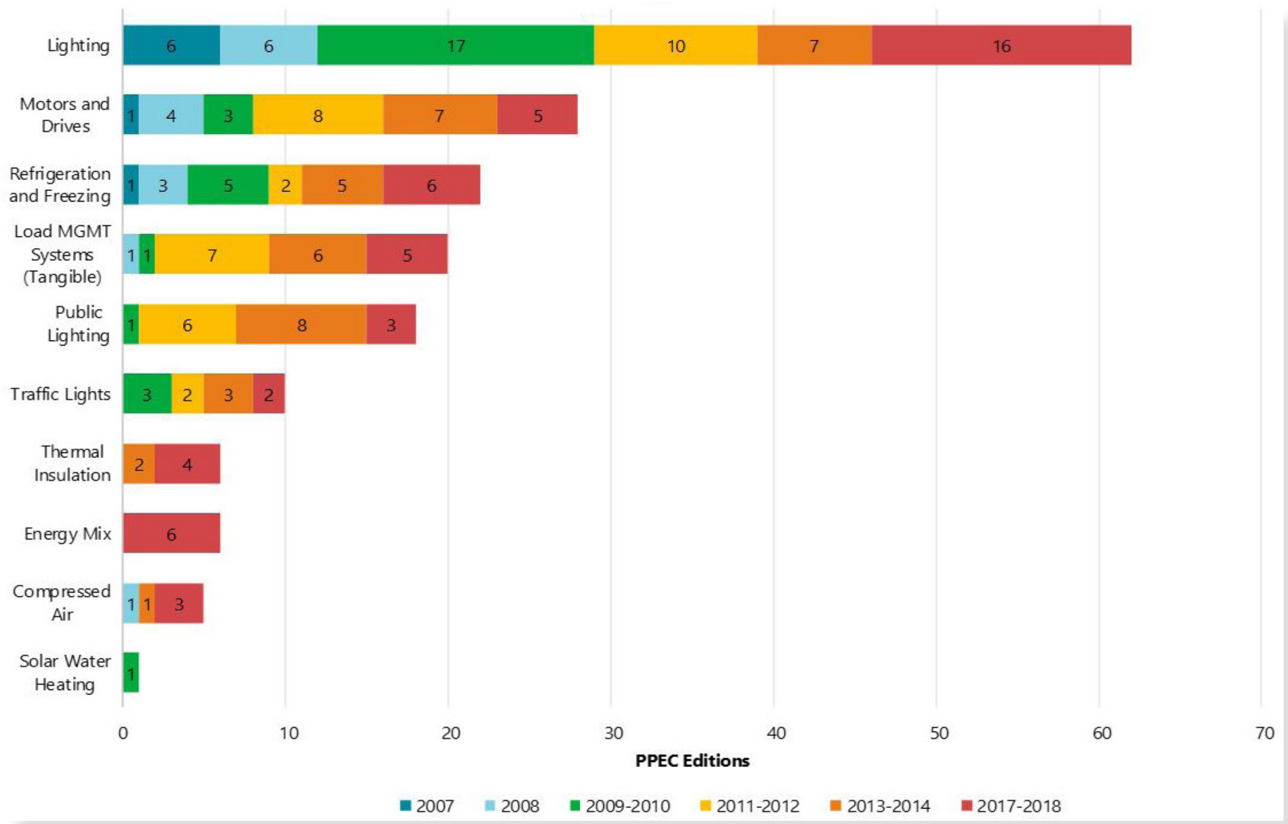
Table 2. Eligible promoters under Portugal's PPEC

Industry Sector Promoters	• Electricity suppliers • Distribution and transmission network operators
Non-Industry Sector Promoters	• Consumer organisations • Business associations • Energy agencies • Municipal agencies • Higher education and research and development institutions

Sectoral coverage

The six auctions carried out to date have delivered a range of energy savings measures, as illustrated in **Figure 12**.[11] The evolving design of the auction schemes has helped diversify the energy savings measures and grow the number of market actors bidding into the auctions.

Figure 12. Number of tangible measures implemented under the first five auctions and cleared in the 6th auction



Source: Sousa and Martins (2018). Information on intangible measures implemented is available at http://www.erse.pt/pt/planodepromocaodaeficienciaeficiencianoconsumoppec/Paginas/default.aspx

The focus of the first six auction periods was to promote efficiency and reduce electricity consumption among different consumer segments (DRE, 2013b). Separate auctions were held for each budget category set out in **Table 3.**

11 This figure refers to tangible measures. Information on the types of intangible measures implemented can be found on ERSE's website: http://www.erse.pt/pt/planodepromocaodaeficiencianoconsumoppec/Paginas/default.aspx

Table 3. **Budget allocation, per year, PPEC 2017-2018**

Type of measure	Percentage of spending	Euros (mil)
Tangible (all promoters)	61%	7
Industry and Agriculture	30%	3.5
Commercial and Services	17%	2
Residential	13%	1.5
Tangible (non-industry sector promoters)	17%	2
Intangible (all promoters)	9%	1
Intangible (non-industry sector promoters)	13%	1.5
Total Programme		11.5

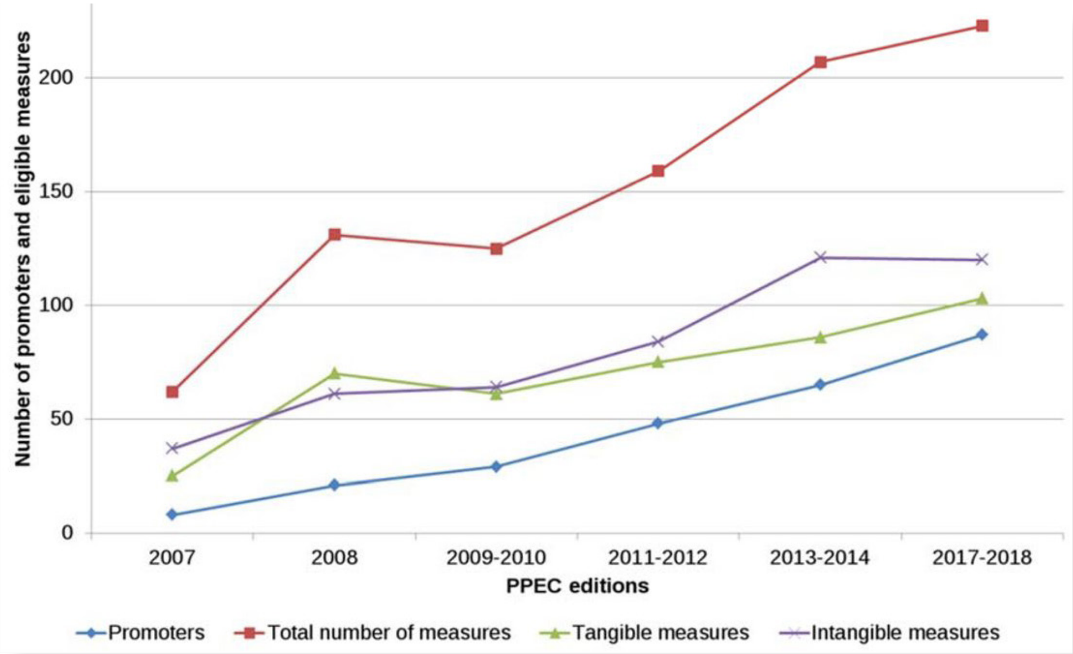
Source: Adapted from ERSE (2016a) .

Four auctions were held for all promoters, including three for tangible measures (industry and agriculture, commercial and services, and residential) and one for intangible measures. Two additional auctions (one for tangible and one for intangible measures) were held that excluded industry-sector promoters. The goal of these two auctions was to expand the participation of market actors outside the energy sector in delivering energy efficiency, and to diversify the types of measures being implemented.

As **Figure 13** illustrates, this strategy seems to have been successful, as the number of candidate promoters and number of candidate measures has steadily grown over six auction periods.[12]

12 Candidate promoters and candidate measures are those that were eligible to receive payment from the tender. In the end, the number of approved measures was lower, as approved measures could not exceed the available budget.

Figure 13. Evolution of the number of promoters and eligible measures under the PPEC auctions



Source: Sousa and Martins (2018)

The last auction period was announced for 2017 – 2018, and an extension to December 31, 2019 added for implementation of approved energy efficiency measures. The new period prioritises energy efficiency measures among low-income households and in the public sector, where the greatest barriers to energy efficiency adoption have been identified (ERSE, 2016b).

Selection Criteria

The auctions are overseen by the energy regulatory authority. The projects are selected based on two main criteria, each given equal weight: (i) technical and economic evaluation criteria regarding the efficiency of electricity consumption from the perspective of economic regulation; and (ii) evaluation criteria related to energy policy objectives and instruments defined by a formal decision of the Government agency responsible for energy (DRE, 2013a). The evaluation from the perspective of economic regulation is performed by the energy regulatory authority. The evaluation related to energy policy objectives is performed by DGEG – the General Directorate for Energy and Geology.

Only projects that have a positive net present value are eligible to tender for tangible measures. The benefit cost analysis takes into account societal benefits (avoided costs and environmental benefits) and full project costs (PPEC costs, consumer costs, promoter costs and other costs) (Sousa and Martins, 2018). The financial incentives for tangible measures cannot exceed 80% of the project cost.

For the auction period 2017-2018, the energy regulator has defined the following criteria for evaluating tangible projects, from the perspective of economic regulation:

Table 4. Criteria for evaluating tangible projects based on the perspective of economic regulation

Criterion	Specific weighting factors within the criterion	Weight
Proportional benefit-cost analysis	Used to compare investments which require different investment amounts and have different lifetimes.	45%
Ordered benefit-cost analysis	Each measure is assigned a score according to an ordered list of RBC* values, where the first measure of the list receives 25 points.	25%
Weight of the investment in equipment in the total cost of the measure	Awards measures that maximise the direct investment in equipment rather than the administrative costs.	15%
Scale risk	Evaluates the variation in average cost of each measure according to the rate of execution of the measure.	15%

* Relação Benefício Custo

Source: ERSE (2016b)

Table 5. **Criteria for evaluating projects based on their alignment with energy policy objectives**

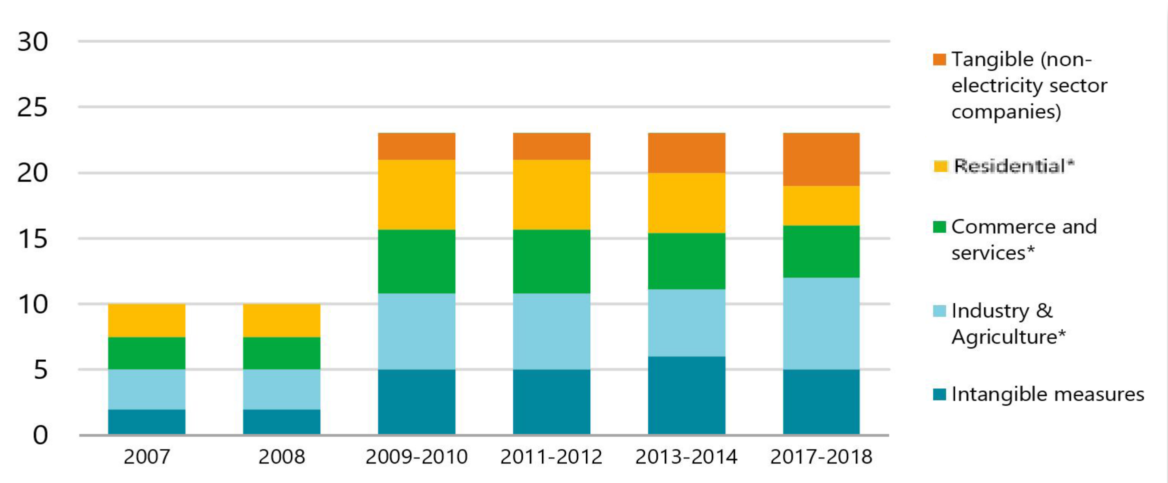
For the auction period 2017-2018, the government has defined the following evaluation criteria relating to energy policy objectives and instruments:

Criterion	Specific weighting factors within the criterion	Weight
Alignment with national energy policy and existing legislation	Priority to national programmes, compared to regional and sub-regional, and to projects that advance more than 1 national energy policy instrument.	15%
Alignment with national energy efficiency policy and existing legislation	Weighted based on projected energy savings and alignment with the national Energy Efficiency Action Plan.	20%
Support in development and implementation of measures to promote energy efficiency	Weighted based on alignment with specific regulatory instruments, including the SGCIE (Management System of Intensive Energy Consumption), SCE (National System for Energy and Indoor Air Quality Certification of Buildings), and Decree nº 68-A/2015 from 30 April on energy efficiency in buildings.	35%
Diversification of promoters	Prioritises promoters outside of the energy sector over those in the energy sector.	20%
Coordination with other instruments incentivising energy efficiency	Prioritises measures that do not have additional support from another financing instrument, over those that are partially incentivised by other instruments.	10%

Source: DRE (2016)

Figure 14 demonstrates the level of spending approved under consecutive auctions:

Figure 14. **Budget allocation under the PPEC, 2007 – 2018, millions of Euros**



* Residential, Commerce and Services, and Industry and Agriculture all represent tangible measures open to all promoters.

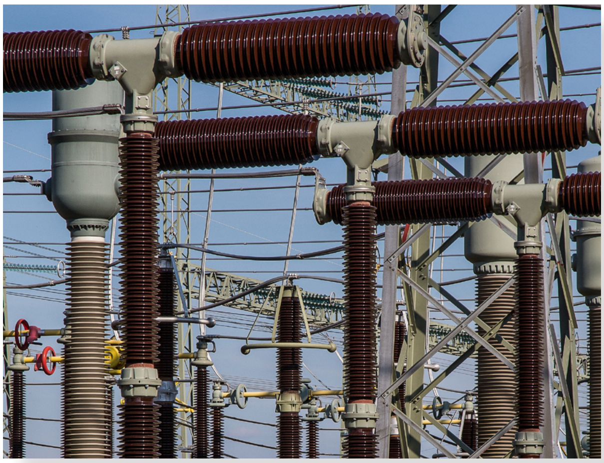
Sources: Sousa and Martins (2018) and ERSE (2016b)

4 EFFICIENCY OBLIGATIONS IN A FEDERAL SYSTEM

case study of Ontario and Nova Scotia

What is the role of energy efficiency obligations within the broader policy framework? Mandatory policies such as building energy codes and appliance standards play a foundational role in setting minimum efficiency requirements. Programmes such as appliance labelling and stretch codes recognise market leaders and enable mandatory policies to increase ambition over time. Energy efficiency obligations and other policies and programmes focused on implementation can help accelerate the transformation of the market towards more efficient technologies and practices. This section considers the role of energy efficiency obligations within the broader policy context in Canada. It considers policy interactions at the provincial and federal level, recognising that in many countries, the policy matrix includes a federal-state dimension.

Introduction to energy company obligations in Ontario and Nova Scotia

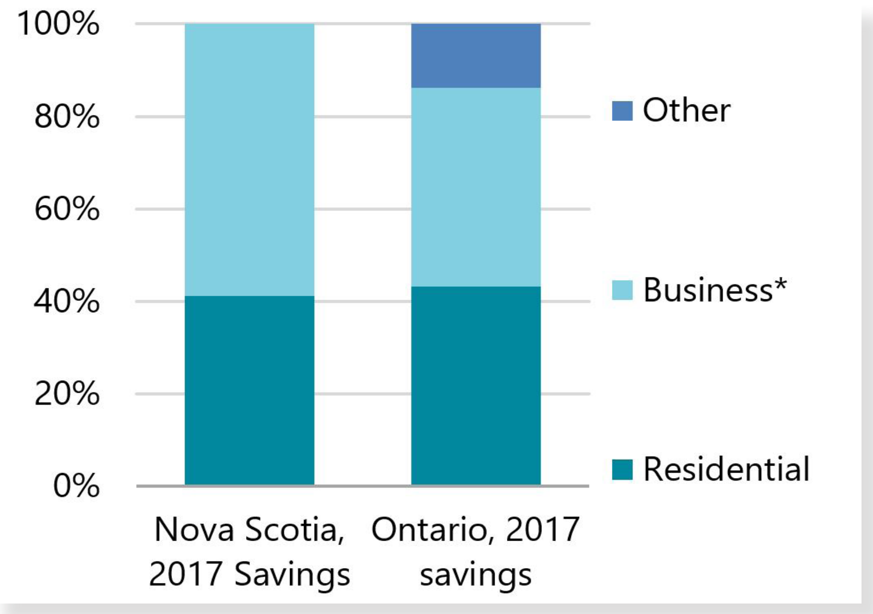


This section focuses on utility-funded energy efficiency programmes in two Canadian provinces, Ontario and Nova Scotia. In Ontario, an obligation in place from 2011-2018 required local electricity distributors to deliver energy (MWh) and capacity (MW) savings. There has been an additional, much smaller obligation on the independent electricity system operator, IESO, to deliver energy savings from large customers.[13] In Nova Scotia, an energy efficiency utility, Efficiency Nova Scotia, delivers energy efficiency programmes that are funded by Nova Scotia's utility company, Nova Scotia Power.

Both programmes have primarily delivered energy savings in the business and residential sectors.

13 With the recent change in government administration, energy efficiency programmes are undergoing major changes. These changes are ongoing, and are therefore not reflected in this document.

Figure 15. Share of energy savings from different sectors



Sources: IESO (2018) (Ontario); EfficiencyOne (2018) (Nova Scotia)
*Nova Scotia includes in this category: Business, Non-Profit & Institutional energy savings

Ontario

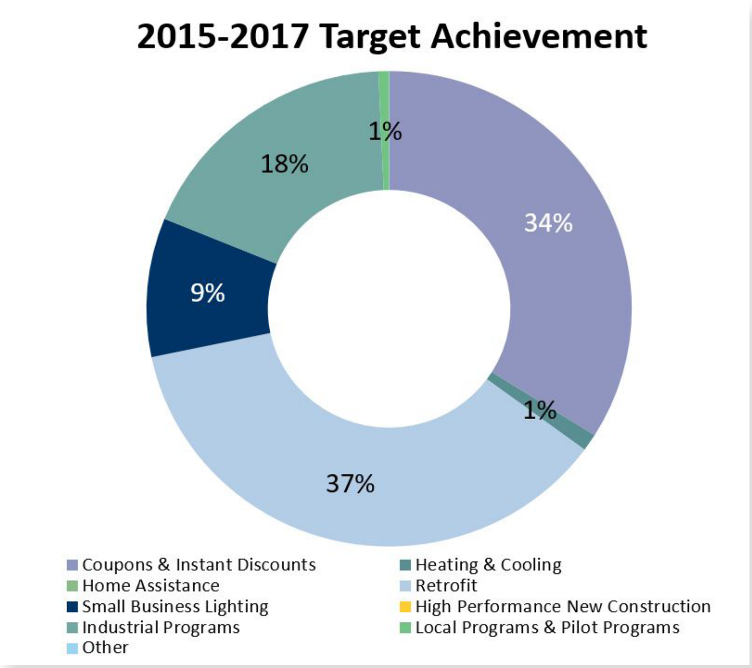
Ontario's obligation fell under the Conservation First Framework. The framework for 2015-2020 laid out the goal to reduce 8.7 TWh in electricity consumption in Ontario by December 31, 2020.

- 7 TWh were to be achieved through conservation programmes delivered by local distribution companies
- 1.3 TWh were to be achieved through conservation projects by large industrial transmission-connected customers
- 0.4 TWh were to be delivered by the IESO.[14]

Between 2015 and 2017, local distribution companies achieved 4,864 GWh of net verified annual electricity savings. **Figure 16** summarises the savings achieved in this period by sector.

14 These programmes are being adjusted pursuant to a Ministerial Directive dated February 8, 2018. For this reason, this section focuses on programmes and policies that were in place before January 1, 2019. Ministerial Decree 380/2019.

Figure 16. Energy savings achieved by local distribution companies in Ontario, by type of measure



Source: IESO (2018b)

Nova Scotia

Nova Scotia has taken a different approach to delivering ratepayer-funded energy efficiency programmes. Since 2015 it has had in place an energy efficiency utility, which is a regulated entity established by law and charged with delivering energy savings programmes. The utility franchise is contracted out to the winning bidder of a competitive tender. The franchise holder has the "exclusive right to supply Nova Scotia Power Incorporated with reasonably available, cost-effective electricity efficiency and conservation activities..." for nine years under the Public Utilities Act (ASHAH, 2016).

EfficiencyOne, a not-for-profit corporation, currently holds the franchise to run the energy efficiency utility, Efficiency Nova Scotia.

Under this model, EfficiencyOne must enter into a Supply Agreement for electric efficiency and conservation activities with Nova Scotia Power. The Agreement is subject to regulatory approval by the Nova Scotia Utility and Review Board. Similarly, the Board can step in to broker an agreement if the two parties cannot reach one. Under the current agreement, between 2016 and 2018, EfficiencyOne had an authorized budget of CAN $102,150,000 with a cumulative energy savings target of 405.9 GWh and a demand savings target of 62.5 MW (Nova Scotia Utility, 2015). In 2019, the budget is CAN $34,050,000 and with incremental annual net energy savings of 127.2 GWh and net annual peak demand savings of 20.2 MW (Nova Scotia Utility, 2018).

In 2017, EfficiencyOne delivered savings in the following sectors and with the following measures:

Table 6. 2017 Energy Savings, EfficiencyOne

Residential Energy Savings		Business, Non-Profit and Institutional Energy Savings	
Appliance retirement	3 GWh	Business Energy Rebates	47 GWh
Instant Savings	20 GWh	Custom	21 GWh
Home Energy Assess-ment	7 GWh	Energy Management Information Systems	1 GWh
Green Heat	3 GWh	Small Business Energy Solutions	8 GWh
Efficient Product Installation	18 GWh		
New Home Construction	3 GWh		
Total	54 GWh		77 GWh

Source: EfficiencyOne (2018)

Interaction between Energy Efficiency Policies and Programmes

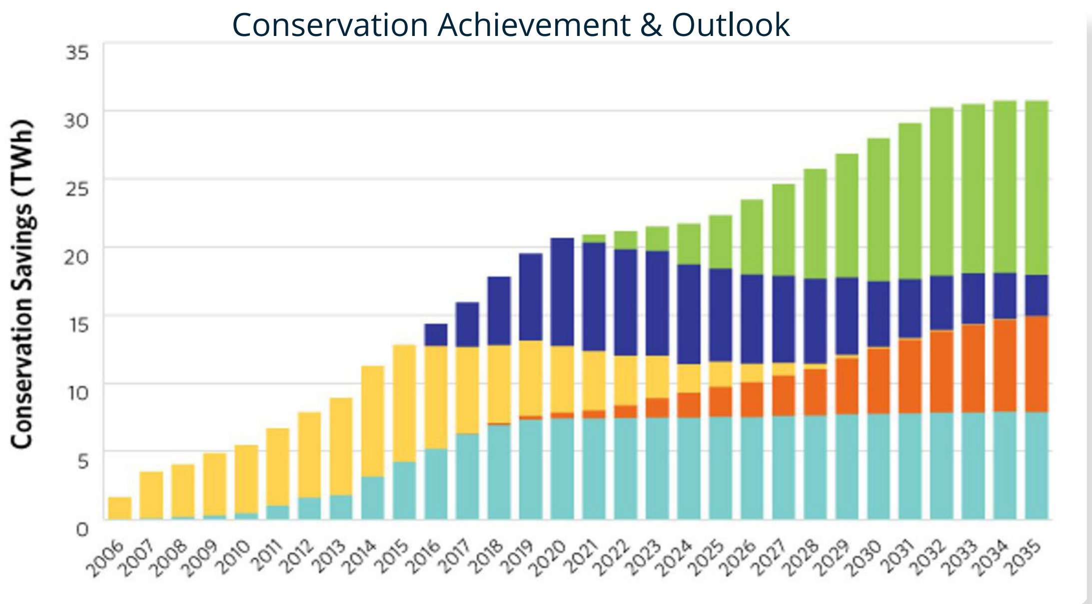
Canada is governed by a federal system, which divides responsibility for energy efficiency between the federal and provincial governments. At federal level, Canada has implemented a combination of targets, regulations, and incentive programmes to transform the market for energy efficiency. Compliance with energy efficiency standards and labelling are mandatory for certain classes of products. Any product governed by a national energy efficiency standard must meet the relevant standard in order to be imported into Canada or shipped between provinces. Product categories covered include: household appliances, water heaters, heating and air conditioning equipment, lighting products, electronic products, and certain other energy-using products.[15] Canada also requires mandatory labelling for certain appliances, carried out through the EnerGuide label, and has also adopted voluntary Energy Star labels for high-efficiency products.

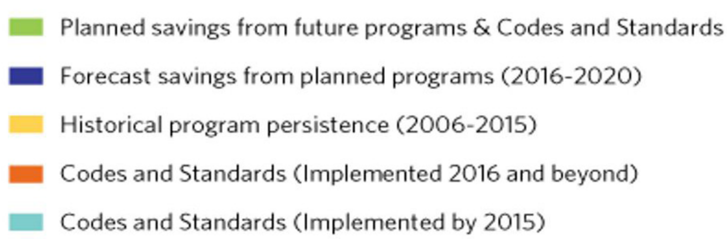
15 A full list of federally regulated products is available here: https://www.nrcan.gc.ca/energy/regulations-codes-standards/6861.

In some cases, including in Nova Scotia and Ontario, certain classes of products are regulated by both a national standard (which sets the national baseline) and more ambitious provincial standards that go beyond the national standard (NRCan, 2019).[16]

Figure 17 demonstrates the interaction in Ontario between existing and planned energy efficiency policies over time.[17] The dark blue represents programmes planned between 2016 and 2020 that include those implemented by local distribution companies (LDCs). The green also includes combined savings from codes and standards, as well as future programmes. It provides a visual representation of how energy efficiency policies stack up to deliver energy savings, and how energy efficiency programmes, including energy company obligations, enable market transformation and improved standards over time.

Figure 17. **Ontario's projected savings from various policies and programmes to 2035**





Source: IESO (2016) and IESO (2018)[18]

16 For a list of Nova Scotia's appliance standards see https://novascotia.ca/just/regulations/regs/eeappliances.htm.

17 Note that projections can change, and do not take into account some of the rollback of energy efficiency policies seen in early 2019.

18 Published prior to the 2018 elections.

Similarly, Nova Scotia has designed its energy efficiency strategy through a series of complementary policy instruments. **Figure 18** depicts the main levers to advance energy efficiency that are set forth in Nova Scotia's Electric Efficiency and Conservation Plan. The strategy includes a combination of codes and standards, financing tools, targeted funding to deliver non-electric energy savings and energy savings among low-income consumers, and savings achieved by Efficiency Nova Scotia, the provincial energy efficiency utility.

Figure 18. **Nova Scotia's Electric Efficiency and Conservation Plan**

- Efficiency Nova Scotia - selling long-term savings in competition with supply-side options
- Enhanced low-income programmes
- Stronger minimum energy efficiency standards
- Going beyond National Energy Code
- Financing tools - expand on-bill financing options
- Funding to support energy savings for heating oil and gas end-uses

Source: Nova Scotia (2014)

5 EMERGING OPPORTUNITIES THROUGH TECHNOLOGY AND POLICY INNOVATION

Within the range of energy company-funded energy efficiency programmes around the world, there are some trends that while not new, are growing. This section focuses on two of these trends:

- Pay-for-performance (P4P) programmes
- Valuing energy efficiency as a resource to transmission and distribution systems

Both of these programme types rely on accurate measurement of baselines and energy savings. Three factors have enabled growth in the importance and accessibility of the technologies needed to roll out these programmes on a broader scale (IEA 2017a).

1. Smart meters, sensors, and advanced data analytics are providing new opportunities to measure and manage energy consumption.
2. Many energy efficiency programmes have now covered the lower-cost, easily replicable measures such as lighting and HVAC. Policymakers, therefore, face the challenge of identifying policies that can deliver deeper savings.
3. Growing capacities of variable renewable energy sources on electricity systems are creating a need for more efficient and responsive demand.

This section focuses on the experience with these types of programmes in the United States and in particular in Illinois, Texas, New York, and California. These examples provide a sense of some of the opportunities that are emerging within the framework of relatively mature energy company obligation programmes in these four US states.

5.1 Pay-for-performance programmes

P4P programmes pay for energy savings as they accrue over time. While some P4P programmes base payments on deemed savings, we focus here on programmes that utilise performance-based payments tied to actual, metered savings.

Several US states with well-established energy company obligation schemes have introduced P4P to help improve the reliability of energy savings impacts, both in aggregate form (such as annual kWh) as well as in terms of peak demand reductions. Two examples are summarised below from Illinois and Texas.

Retro-commissioning programme, Illinois

Illinois has strengthened its energy efficiency obligation on electric and natural gas companies in recent years. In 2017, new legislation required that energy companies with more than 3 million customers meet their obligation by counting "cumulative persisting annual savings" rather than the first-year savings that had been in place previously.[19] Under this new obligation, Commonwealth Edison (ComEd), the largest electric utility in Illinois, is required to meet a cumulative target of 21.5% cumulative persisting annual savings for the year ending December 31, 2030.

ComEd has implemented several programmes to meet this goal. One of the most innovative is the retro-commissioning programme (RCx), the largest RCx programme in the US. Retro-commissioning optimises the energy performance of existing facilities by identifying cost-effective operational improvements for control of major energy-using systems such as HVAC and lighting. The programme includes four options for different-sized customers and different implementation models, as summarised in **Table 7**.

19 "Cumulative persisting annual savings" means the total electric energy savings in a given year from measures installed in that year or in previous years, but no earlier than January 1, 2012, that are still operational and providing savings in that year because the measures have not yet reached the end of their useful lives. 220 ILCS 5/8-103B new

Table 7. ComEd Retro-Commissioning Options

	RCx Building Tune-Up	Retro-Commissioning Express	Retro-Commissioning (RCx)	Monitoring-Based Commissioning (MBCx)
Building size	< 150,000 ft2	150,000 – 500,000 ft2	> 500,000 ft2	> 150,000 ft2
Energy savings	5-10% of usage (average)	5% of usage (average)	5% of usage (average)	15-25% higher than RCx
Incentives	Fully-funded RCx study valued at up to $25,000 Performance-based incentives for verified kWh savings (average $2,500)	Fully-funded RCx study valued at up to $60,000 Performance-based incentives for projects that complete on time and exceed kWh savings target	Fully-funded RCx study valued at up to $100,000 Performance-based incentives for projects that complete on time and exceed kWh savings target	Fully funded MBCx study (including costs of monitoring, software, engineering services)
Project Payback Period:	< 1.5 years for implemented energy improvements			

Source: Commonwealth Edison, 2019.

Over the past three years, the programme has increased spending from under $5 million in 2015 and 2016 to $7 million in 2017. The number of customers engaged in the programme has also increased from 64 to 125 in the same period, yielding net annual electric energy savings of 33,398 MWh in 2017, and annual peak demand savings of 2.2 MW. The programmes also saved 463,307 therms of natural gas (annual net savings in 2017) (ACEEE 2019).

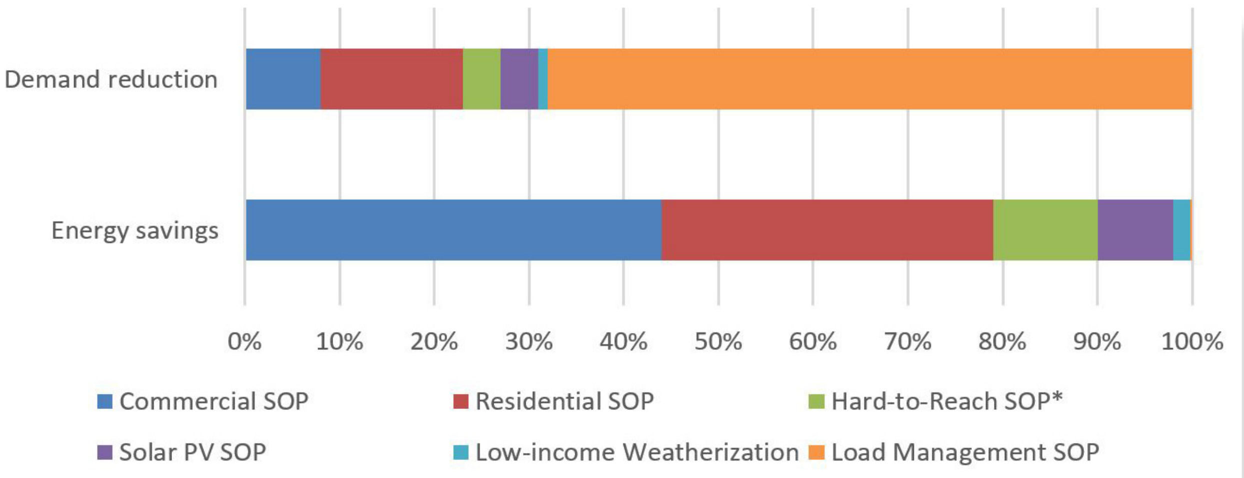
Standard offer programmes for energy efficiency, Texas[20]

Texas has in place an obligation on utilities to administer energy saving programmes through standard offer programmes, market transformation programmes, or direct customer rebates. The original energy savings target in Texas was set at 10% of annual load growth, and over time, this target was increased to reach a goal of 30% of annual load growth in 2013. The programmes also include summer peak capacity targets; that is, utilities with annual growth in peak demand equivalent to at least 0.4% of summer weather-adjusted peak demand for the combined residential and commercial sector, must acquire an equivalent reduction in summer peak demand savings for the combined residential and commercial sectors.

Typically, standard offer programmes set a fixed payment for the amount of energy (kWh) or peak capacity (kW) savings achieved, often through multi-year contracts (NRDC, 2017). In Texas, there are four main types of standard offer programmes: commercial, residential & small commercial, low-income, and load management. At least 10% of an obligated utility's energy efficiency budget must be applied to improvements in low-income households. Load management programmes refer to control activities that result in a reduction in peak demand, or a shifting of energy usage from a peak to an off-peak period or from high-price periods to lower price periods.

Figure 19 summarises the energy savings by sector achieved under standard offer programmes in Texas in 2016.

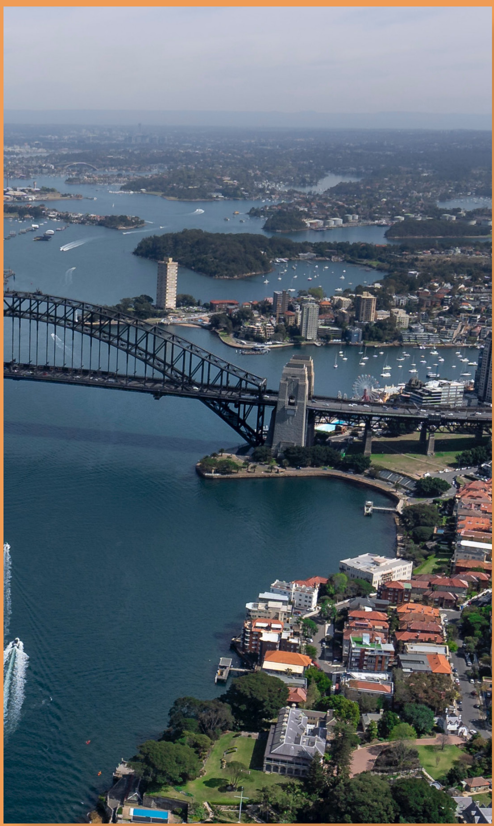
Figure 19. **Demand reduction and energy savings by standard offer programmes (SOP) in 2016**



Source: Texas Efficiency (2016).
*Hard-to-Reach customers are defined as residential customers with an annual household income at or below 200% of the federal poverty guidelines.

20 http://www.texasefficiency.com/images/documents/EnergyEfficiencyRule/25.181texasenergyefficiencyruleeffective1.1.13.pdf

Digitalisation creates opportunities in Australia



In Australia, there is growing recognition of the opportunities that digital meters and sensors offer to reach beyond lighting measures. More accurate end use data can uncover measures that offer the most value to the power system based on their location and usage characteristics. They can also lower transaction costs of monitoring and verification of energy savings.

In New South Wales, the Energy Savings Scheme is entering into a review period to set targets for its next phase (2021-2025). There is an active discussion underway around the possibilities that digitalisation offers to diversify the types of measures under the scheme and link the scheme more closely to the flexibility needs of a power system with high penetrations of solar PV. This would signify a shift towards custom projects with metered savings and away from replicable measures with deemed savings. Metered savings further open the door to business models based on pay-for-performance, where remuneration is based on metered savings.

These developments raise questions about how to evolve the structure of the Energy Savings Scheme and other energy efficiency obligations to continue to drive ambition while aligning with more time and location specific objectives and enabling new business models.

5.2 Energy efficiency as a grid resource

New York and California have been leaders in regulatory innovations that are recognising the time and locational value of energy efficiency and other demand-side resources such as demand response, distributed storage, and distributed generation. Both states have long-standing energy company obligations that have – and continue to – deliver energy savings alongside a portfolio of appliance standards, labelling, and building regulations and other performance-based programmes such as those described above in Texas and Illinois.

At the same time, both states have increased their ambition to transition to low-emissions sources of energy, including increased ambition on renewable energy generation and energy efficiency. As a result, the programmes in New York and California have evolved to value the wider system benefits of energy efficiency, as described below.

New York

In New York, the Reforming Energy Vision (REV) has set 2030 targets of reducing greenhouse gas emissions by 40% below 1990 levels, delivering 70% of electricity through renewable sources, and increasing state-wide energy efficiency to 600 trillion Btu.

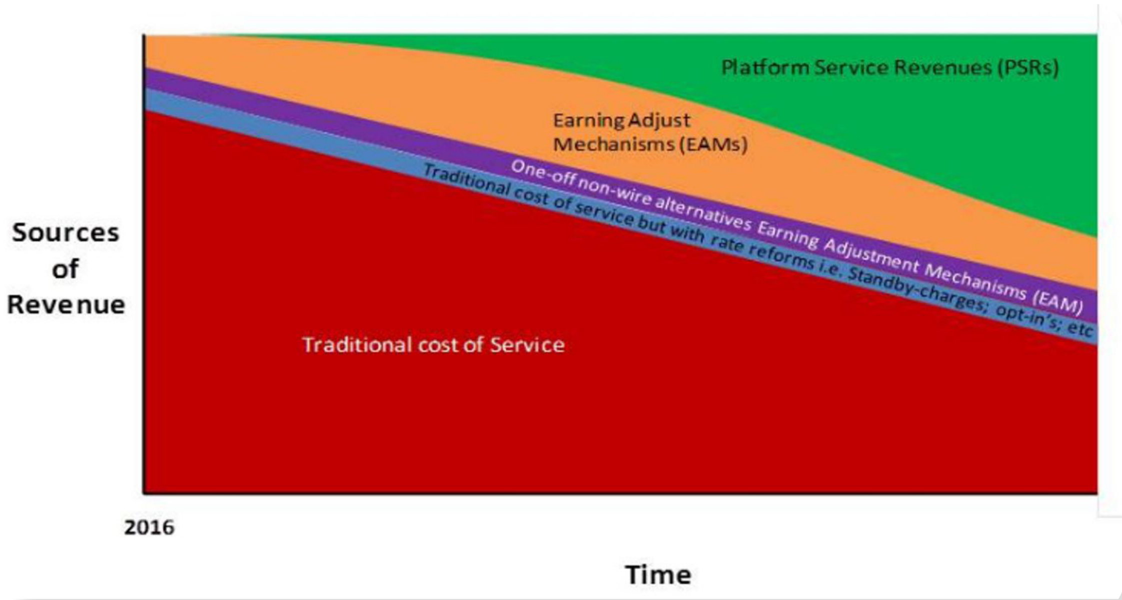
As part of implementing this goal, the state has set a state-wide energy efficiency target of 185 trillion Btu of cumulative annual energy savings relative to forecasted energy consumption in 2025. Within this target is a goal of reducing 30,000 GWh from forecasted electricity sales in 2025, with average savings exceeding 2% of utility sales over 2019-2025.[21]

To help achieve these goals and adapt to an electric system with more variable renewable resources, a number of regulatory reforms are underway. These reforms include incentives for a range of customer-side resources, including energy efficiency, and they build on decades of experience in New York in delivering utility-funded energy efficiency programmes. Notably, two new mechanisms have been introduced to provide new value streams for energy efficiency investments:

- Earning Adjustment Mechanisms (EAMs), which attempt to better align incentives according to the REV objectives, including energy efficiency, as existing rulemaking models are currently not well-aligned with the new policy objectives of the REV[22]
- Platform Services Revenues (PSRs), which are new forms of revenues utilities will earn from displacing traditional infrastructure projects with non-wires alternatives, including energy efficiency.[23]

22 http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BD6EC8F0B-6141-4A82-A857-B79CF0A71BF0%7D
23 Littel, D. et al. (2018).

Figure 20. Sources of Utility Revenue within NY REV



Source: Mitchell (2016).

An example of the new regulatory changes in New York is the Brooklyn-Queens Demand Management Project. The project is being implemented by Consolidated Edison (Con Edison), a distribution utility covering 10 million people in and around New York City. The project began in 2014, when Con Edison requested the New York State Department of Public Service to authorize an investment plan to alleviate forecast overload conditions on sub-transmission feeders in New York City.

The proposal called for 41 MW of load relief through traditional utility-side solutions and 11 MW of non-traditional utility-side solutions to defer more costly investments in the distribution infrastructure. The Department of Public Service approved the proposal with a $200 million budget. The project successfully deferred the need for a substation upgrade that would have cost $1.2 billion through a combination of investments in energy efficiency, demand response, and distributed solar PV.[24] In 2017, the Department of Public Service approved an extension of the programme.[25]

24 E4, PLMA and SEPA (2018), Non-Wires Alternatives, Case sTudies from Leading U.S. Projects, November 2018. https://sepapower.org/resource/non-wires-alternatives-case-studies-from-leading-u-s-projects/

25 State of New York Public Service Commission (2017), Order for Extension of Time to Implement Brooklyn/Queens Demnad Management Program, CASE 14-E-0302, July 13, 2017.

California

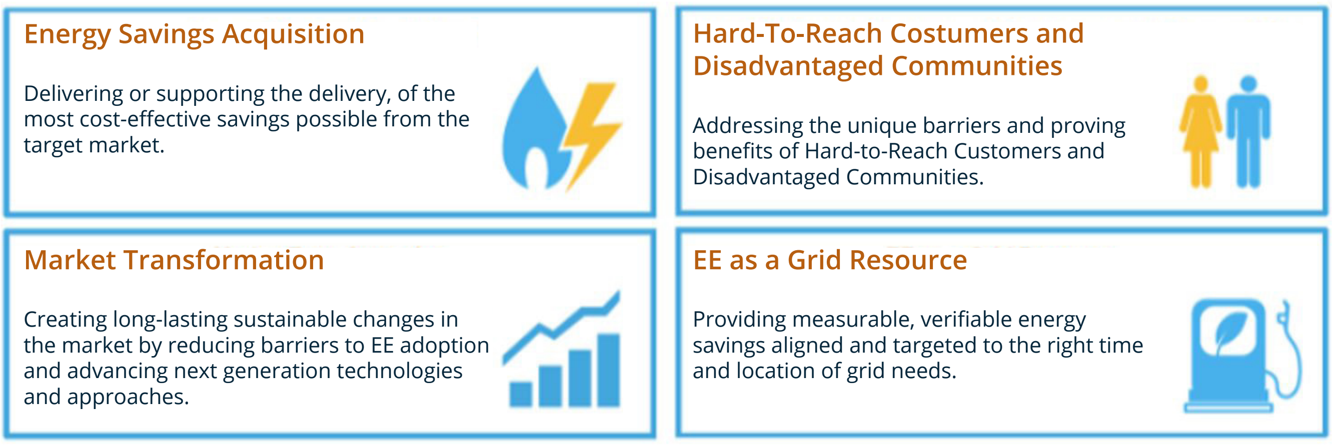
California has one of the longest-standing energy efficiency programmes in the world. Energy efficiency policies in the state are estimated to have saved consumers more than 100 billion dollars over the past 40 years, surpassing 70,000 GWh in cumulative electricity savings by 2017.

From an early stage, California has recognised the energy system value of energy efficiency and incorporated it into its policies and programmes. This focus on energy efficiency has continued as the state has increased its ambition to decarbonise the energy system.

California first adopted its 'loading order' in 2003. The energy company obligations grew out of this loading order, which mandates procurement by Investor-Owned Utilities (IOUs) of energy resources in the following sequence: cost-effective energy efficiency and demand response first, followed by renewables, and lastly clean-fossil generation. Under this requirement, regulated utilities must develop resource portfolios that include all cost-effective energy efficiency as a priority. These portfolios have, over time, matured and stimulated a market for energy efficiency, with a significant focus on energy use in buildings.

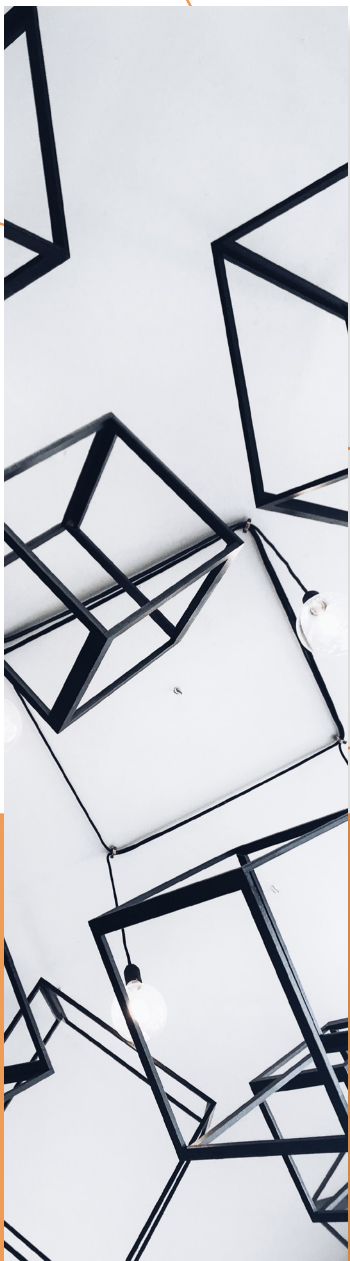
As the share of variable renewable resources in California's power systems rises, new requests for energy efficiency services from the state's investor-owned utilities favour performance-based approaches that will deliver energy savings when and where they are most valuable as a load shaping resource – thus enabling the continued growth of renewables and supporting non-wire alternatives to an increasingly decarbonised grid infrastructure. In fact, providing "energy efficiency as a grid resource" is now an explicit requirement of California's energy efficiency portfolio, along with other targeted, cost-effective energy savings and market transformation requirements (**Figure 21**). To encourage innovation, California has also introduced the requirement that 60% a utility's budgeted energy efficiency portfolio be delivered and designed by third parties by the end of 2022.

Figure 21. **Evolving market opportunities in California**



Source: Golden (2018).

6 CONCLUSIONS AND POLICY RECOMMENDATIONS



Energy company-funded efficiency programmes around the world have been delivering energy savings at lower cost than the average cost of supplied energy for many years. While many of these programmes allow for savings in all or most end-use sectors, most energy savings have been achieved in buildings. Data from programmes across the United States indicate that nearly half of all savings have come from lighting programmes, followed by whole home upgrades and investments in HVAC.

Long-standing energy efficiency programmes demonstrate how mature markets are transforming as opportunities for lighting programmes diminish and ambition for energy efficiency grows. Several lessons can be drawn from the examples presented in this paper:

There is no one-size-fits-all solution to delivering energy savings in buildings, or delivering more comprehensive packages of measures. As the examples in this paper demonstrate, however, different designs have been successful in delivering policy objectives, complementing other policies, and harnessing new technologies to expand business models and applications of energy efficiency to meet energy system needs.

Policy conclusions

Align scheme with broader policy goals targeting the buildings sector	• GB – Initial targets were broader, aligned with GHG reduction policy goals; more recent schemes focused on low-income households to combat fuel poverty. • PT – Auction design included weighting factors based on national energy and efficiency policy objectives; established separate auctions and budgets for priority sectors.
Adapt scheme design to improve measure targeting	• GB – Added weighting factors for certain types of measures, yet risked withdrawing support for most cost-effective programmes. • PT – Established project-specific weighting factors to target key measures and encourage broader market participation.
Accelerate national codes and standards development and revi sion cycles	• CAN – Building codes and appliance standards set at national level, whereas provincial programmes can often target high-er-efficiency measures; provincial programmes also foster market transformation, which can in turn accelerate strength-ening of national codes and standards. • UK – Energy company obligations accelerated improvements in energy efficiency for key measures (e.g., lighting, boilers, and insulation); for example, early lighting programmes enabled a voluntary agreement to phase out incandescent lighting one year before the binding Ecodesign phase-out in Europe.
Reduce key barriers and further enable energy efficiency market development	• GB – Policy structure and weighting factors enabled insulation providers to gain a foothold in the market. • PT – Up to 80% of costs eligible for coverage under scheme rules, enabling scale and broad market participation. • US – Varying coverage of costs based on targeted segments (e.g., higher for low-income, lower for commercial buildings).
Encourage innovation to improve reliability and expand value of energy savings benefits	• IL – Retro-commissioning programmes have evolved to include advanced analytics for measurement & verification purposes. • TX – Energy savings from standard offer programmes mea-sured based on actual performance; recent shift towards targeting peak demand savings. • NY – Recent shift to performance-based regulatory framework has driven innovation in non-wires alternatives. • CA – Future utility portfolios will include specific programmes targeting distribution system benefits.

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