Review of the Energy Efficiency Improvement Scheme

Part 3 – Comparative analysis

Prepared for:

ACT Environment Planning Sustainable Development Directorate

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1 KEY MESSAGES

- The market based EEO scheme approach (whether certificate or non-certificate based) is still widely used to incentivise energy efficiency, but GHG is usually seen as a co-benefit rather than a central objective across international schemes.
- In the majority of the European EEOs, most savings have been delivered through industry. In Australia, all schemes cover residential and SME businesses. However, only the NSW ESS and the VEU allow large businesses and industrial energy users to participate in their schemes.
    - The argument for including large energy users is that there are still significant opportunities to reduce energy consumption at these sites.
    - Local governments have been significant 'large business' beneficiaries of the schemes in ESS and VEU and there are no equivalent parties in the ACT.
    - However, there is an argument that allowing these sector users to participate may reduce the quantum of savings that is delivered for participants that need it most, as energy retailers find it more cost-effective to deliver activities in these sectors.
- While some schemes have a GHG metric, the majority have an energy metric. Recently, both the NSW ESS and the SA REES changed their focus to energy savings rather than emissions. Where additional objectives, such as GHG emissions reductions, are directly included in energy efficiency scheme design, there is a higher potential for tension and duplication between objectives of different policies/scheme, lowering efficiency and reducing policy clarity.
- The use of sub-targets for low-income households varies between schemes. Internationally, and in Australia, some schemes set sub-targets, while others do not.
    - In the UK EEO scheme, a sub-target focusses on the delivery of insulation measures in rural areas, another on insulation activities and other activities targeting the reduction of lifetime heating costs in low-income and vulnerable households and efficient heating systems.
    - In total, five European EEOs include specific provisions that can either be attributing a bonus factor for actions implemented in low-income households (bonus approach) or requiring obligated parties to achieve a minimum share of energy savings in low-income households (mandatory approach).
- Deeming methods are a popular way to calculate energy savings from activities, with many schemes around the world, such as the UK and Massachusetts, and all four Australian schemes use these methods.
- The types of activities offered by mature schemes have changed over time. For example, the UK ECO scheme does not offer lighting opportunities for the residential sector (OFGEM, 2015), while previous iterations of the scheme did. The scheme now has more of a focus on activities with greater energy saving impacts, such as insulation and heating activities for households. In addition, the NSW ESS and VEU have recently wound back or are in the process of winding back scheme support for lighting – Victoria is now applying a discount factor of 70-80% for commercial lighting upgrades.
- Long-standing schemes in Europe have faced challenges because of concerns over increasing scheme costs, meaning schemes needed to be reviewed and redesigned. Therefore, questions arise as to whether there is a political limit to the scale of EEO schemes, or at least the scale of revenue that can be recouped through customers' bills. Both the mature UK and Denmark schemes have had to reduce their level of ambitions over time due to pushback from obligated parties and concerns over costs to bill payers.
- Comparing the cost-effectiveness of EEO schemes is fraught with uncertainty. Given measurement and comparison challenges across jurisdictions, perhaps the most accurate statement that can be made about the comparative cost-effectiveness of the EEIS is that it delivers energy savings with similar order of magnitude costs, as the majority of schemes.

2 INTRODUCTION

The purpose of the literature review and comparative analysis is to provide some definitions and insights into the use of energy efficiency schemes across jurisdictions.

2.1 Structure of this analysis

This comparative analysis reviewed best available literature sources to develop a detailed understanding of the role of energy efficiency obligation schemes such as the EEIS in the international and Australian context. In addition, the key energy efficiency scheme elements e.g. objectives, coverage, targets and metrics and types of activities were compared to provide an understanding of the effectiveness of the EEIS in a broader context. Finally, the cost-effectiveness of the EEIS in an international context was identified, taking account of administrative costs for all parties, as a portion of the total costs.

2.2 Definition of energy efficiency

Energy is an essential input in the production of energy services like heating, lighting or mobility. Energy efficiency differs from energy conservation.

- **Energy efficiency** measures the amount of energy services produced relative to the amount of energy inputs. Energy efficiency can be measured from the level of an individual appliance to the level of a national economy (Gillingham, Newell, & Palmer, 2009).
- **Energy conservation** refers to a reduction in energy consumption measured in absolute terms with reference to a defined baseline (Linares & Labandeira, 2010).

Improvements in energy efficiency do not necessarily lead to energy conservation—rising demand for energy services can cause absolute energy consumption to increase alongside energy efficiency improvements. Similarly, declining energy services demand can lead to reductions in absolute energy consumption without improvements in energy efficiency (Gillingham, Newell, & Palmer, 2009) (Linares & Labandeira, 2010).

Improvements in energy efficiency can be targeted on the supply-side (improving primary energy conversions in power generation or industrial activities) or the demand-side or in reducing the losses associated with energy transport (Ryan, L & Campbell, N, 2012). The energy systems transformation required to meet the greenhouse gas emissions reductions targets required under the Paris Agreement requires efficiency improvements in all three areas (International Energy Agency, 2017d). However, most energy efficiency policies are focused on efficiency improvement of energy end-use on the demand-side (Ryan, L & Campbell, N, 2012).

The EEIS is part of the latter category. **The implication is that the EEIS cannot be expected to target and achieve policy objectives beyond the reduction in end-use stationary energy demand.**

3 ENERGY EFFICIENCY IN A BROADER POLICY CONTEXT

This section provides a description of the benefits of energy efficiency actions, the barriers to the widespread uptake of energy efficiency activities, and the policy instruments that are available to tackle these barriers and promote the adoption of energy efficiency measures.

3.1 The role of energy efficiency in the energy and climate change mitigation policy context

Energy efficiency is a key contributor to shaping the entire energy system, and more than ever before, governments across the world are seeing energy efficiency as central to the achievement of a range of policy goals, including energy security, economic growth and environmental sustainability. In 2016, it was estimated that the world would have used 12% more energy, had it not been for energy efficiency improvements since 2000, which is equivalent to adding another European Union in the global energy market (IEA, 2017a).

The role of energy efficiency is typically framed as a contributor to a range of energy and climate policy objectives. These objectives range from reducing greenhouse gas emissions, energy costs and fuel poverty to increasing energy security and managing peak demand in electricity networks (International Energy Agency, 2017a; International Energy Agency, 2017b; International Energy Agency, 2017d; Rosenow et al. 2016; and International Energy Agency, 2015).

3.1.1 Cost-effectiveness of energy efficiency opportunities

The reason energy efficiency occupies a specific space in energy and climate policy is that existing energy efficiency opportunities are typically large and cost-effective, provided barriers can be overcome:

- The International Energy Agency (IEA) has emphasised energy efficiency's importance by classifying it as the "first fuel" (International Energy Agency, 2015). This classification was formally endorsed by the Group of Seven (G7) countries in 2016 (International Energy Agency, 2017c).
- In the climate change context, IEA and International Renewable Energy Agency (IRENA) studies suggest that an optimal combination of renewable energy technologies, electrification of sectors with high fossil fuel dependency, and energy efficiency could deliver the vast majority of energy sector greenhouse gas (GHG) emissions reductions required by 2050 to meet the Paris Agreement's targets (International Energy Agency, 2017d).
- However, work by the IEA and many other energy analysts also suggests that there are a number of important barriers to realising the majority of energy efficiency improvements. Even where energy efficiency improvements are economically viable, markets are unlikely to deliver them without government policy intervention (Rosenow, Fawcett, Eyre, & Oikonomou, 2016) (International Energy Agency, 2015) (Ryan, Moarif, Levina, & Baron, 2011).
- Despite the importance of energy efficiency policy, IEA concluded in 2017 that "governments are not coming up with new policies fast enough, relying on existing regulations instead, precisely at the time when a pipeline of new efficiency policies should be coming into force. There is a risk that efficiency gains could take a step back (International Energy Agency, 2017a)."
- Australia's National Energy Productivity Plan promotes energy efficiency as part of its whole of system approach to energy policy. The NEPP work plan includes the provision for work to "align activities and reduce red tape where appropriate, while ensuring that schemes continue to deliver the high quality outcomes that consumers expect" (https://www.energy.gov.au/government-priorities/energy-productivity-and-energy-efficiency/national-energy-productivity-plan)

3.1.2 Benefits of energy efficiency

In addition to the above, the IEA identifies a broad range of benefits that can arise from energy efficiency improvements. These benefits suggest that improvements in energy efficiency have a wider impact than energy savings alone (International Energy Agency, 2015; and Ryan, L & Campbell, N, 2012). Examples of benefits across four

"benefit areas" identified by the IEA are set out in Table 1. However, accurately quantifying each of these benefits and clearly attributing them to specific energy efficiency policies can be very difficult and will be highly dependent on policy design and evaluation.

Table 1. Benefits from energy efficiency (International Energy Agency, 2015)

Benefit area	Examples of specific benefits
Enhancing energy system security and reliability	Reduced exposure to volatility in energy markets; reduced fuel costs; reduced peak electricity demand and associated transmission, distribution and generation costs; lower balancing costs for integrating variable renewable energy (VRE) resources into electric power systems; reduces total demand for new low-carbon energy sources reducing total energy systems transformation cost.
Economic development	Indirect macroeconomic benefits from lower energy expenditure and increased consumer and business spending (which may include additional energy consumption) (International Energy Agency, 2017e), increased employment following increased investment in energy efficiency improvements and development of new industries (e.g. Energy service companies (ESCOs)); reduced government expenditure on energy and increased tax revenues through increases in economic activity.
Social development	Increases in energy affordability and consequent reductions in fuel poverty; improved health and well-being for low-income households through improvements in thermal comfort in homes and lower energy bills.
Environmental sustainability	Reduced GHG emissions and reduced local air pollution; complementary with carbon prices, may improve political acceptance of carbon pricing policy; and improved climate resilience.

Two of these particular co-benefits that the EEIS promotes are economic development and health benefits.

Economic development

Before an electricity retailer or authorised installer can undertake eligible activities, they must complete training on the EEIS and the individual activities they will be undertaking. The EEIS Induction Training covers industry standards, legislation, compliance, quality, health and safety, risks and other relevant aspects regarding each specific activity delivered under the scheme. Retailers, abatement providers and installers who deliver activities under the EEIS have to comply with high standard health and safety requirements, as well as offer high quality products, installations and customer service. Since 2013, 86 EEIS induction training sessions have been delivered to more than 540 installers across a range of EEIS activities, which include:

- installation of energy efficient light globes;
- door seals;
- exhaust fan sealing;
- decommissioning of refrigerators and freezers;
- installing high efficiency ducted gas heaters;
- installing high efficiency electric room heaters; and
- installing high efficiency water heaters.

Health benefits

The co-benefits of improved energy efficiency of low income households is widely recognised and several studies from around the world have found that health and well-being benefits outweigh the energy benefits by as much as 3:1. The most frequently observed multiple benefits of energy efficiency are improved health outcomes, improved productivity, reduced excess winter mortality, and improved mental health. The financial benefits of these are shown to be significantly higher when improvements are applied to low income households. Whether this applies in the ACT

would need to be further explored, as it mostly depends on what kind of upgrades have been implemented in the households and whether the beneficiaries' health were vulnerable. This would be only relevant for households receiving upgrades such as draught proofing, insulation (not offered at this stage) or heating upgrades (which started in 2017).

3.1.3 Barriers to energy efficiency

Multiple analyses point to a substantial energy efficiency "gap" between observed levels of energy efficiency and the most economical options (International Energy Agency, 2017; McKinsey & Company, 2009; ClimateWorks Australia, 2010; IPCC, 2014). These studies suggest that the present discounted value of the future savings available through making energy efficiency improvements is vastly more than the initial capital cost (Gillingham & Palmer, 2014). This energy efficiency gap between actual energy use and optimal energy use is seen across the whole economy. While the economic literature continues to debate the reasons for this energy efficiency gap and its scale, a large number of market failures and barriers are usually identified as preventing full realisation of the potential offered by cost-effective energy efficiency improvements (Gillingham, et al., 2009; Ryan, et al., 2011; Grubb, et al., 2014). Some of the more important market failures and barriers are described below:

- **Access to capital:** Many households, particularly low-income households do not have access to the capital required to purchase energy saving equipment upfront.
- **Potential behavioural failures**
  - Bounded rationality and organisational failures: Due to limitations on people's time and ability to understand what the best energy saving option is for them, optimal uptake of energy efficient products may not occur. Market behaviour analysis shows that consumers place greater emphasis on upfront costs rather than whole-of-life costs which means they are more likely to choose cheaper (often less efficient) appliances. The concept of bounded rationality states that sub-optimal outcomes may be achieved through markets as individuals have a limited ability to process information, and therefore, make decisions that may produce adequate results but do not maximise the energy efficiency opportunity.
- **Potential market failures**
  - Public good information, information spill-overs and information asymmetry: In spite of considerable investment by governments and other parties in explaining the benefits of energy efficiency, householders' understanding of the benefits of energy efficiency remains limited. One reason for this is the time lag between energy consumption and receipt and payment of energy bills, meaning that the time lag may affect the ability of price information to influence a change in consumer energy use behaviour. In addition, electricity and gas bills show only the cost of operating a wide range of appliances within the home, meaning that the household's understanding of how an individual appliance may impact an energy bill is limited.
  - Split incentive problems (landlord/tenant, builder/owner, maker/user): This barrier refers to the frequent misalignment of incentives and goals facing landlords, tenants and building managers, resulting in sub-optimal outcomes for energy users. These problems occur when the economic benefits of energy efficiency do not accrue to the person who is trying to reduce energy consumption. For example, water and space heating are generally the most expensive items and the highest energy consumers in a household, therefore tenants will want to increase the energy efficiency of this equipment if possible. However, this equipment is provided by the landlord who is primarily concerned with the upfront capital costs, not the ongoing running costs which are incurred by the tenant.

3.2 A wide range of policy instruments are available to encourage energy efficiency

To overcome barriers and encourage the uptake of energy efficiency policies, a wide range of energy efficiency policies and programs have been tested across the world. Some policies directly address broader policy objectives such as climate change (e.g. a carbon price mechanisms) while other instruments focus on energy efficiency (e.g. tax rebates or retailers' obligation schemes such as the EEIS). **The appropriateness of a policy must be considered in the broader context of the suite of policies implemented within a jurisdiction.**

A selection of energy efficiency policy options is outlined in Table 2 below.

Table 2. Energy efficiency policy options and functions (Rosenow, Fawcett, Eyre, & Oikonomou, 2016)

Policy type	Policy function	Theory of change (for end user)	Policy class
Energy or CO_2 taxes	To increase the price of energy or carbon-based energy in line with the polluter pays principle.	Response to economic incentives (dependent on elasticity of demand)	Taxation
Energy Efficiency Obligations	To reduce the price of energy efficient options.	Response to economic incentives	Purchase subsidy
Grants	To reduce the price of energy efficient options.	Response to economic incentives	Purchase subsidy
Tax rebates	To reduce the price of energy efficient options to tax payers.	Response to economic incentives	Purchase subsidy
Loans	To give people / organisations access to capital so they can buy energy efficient options	Lack of access to capital / high cost of capital as a barrier to investment	Access to capital
On-bill finance	To give people / organisations access to capital so they can buy energy efficient options	Lack of access to capital / high cost of capital as a barrier to investment	Access to capital
Regulations	To set legally enforceable minimum standards of energy efficiency for products, vehicles & buildings.	Inefficient options no longer available.	Minimum standards
Voluntary agreements	To set minimum or fleet average standards of energy efficiency for products, vehicles & buildings.	Inefficient options no longer available.	Minimum standards
Standards and norms	To enable other efficiency policies to work.	n/a	Underpinning measurement standards
Energy labelling schemes	To enable individuals and organisations to take account of energy in their purchase decision-making.	Relevant information / advice provided at the right time can influence choices	Information & feedback
Information, advice, billing feedback, smart metering	To enable individuals and organisations to take account of energy in their purchase decision-making and/or habitual behaviours / practices.	Relevant information / advice provided at the right time can influence choices	Information & feedback

The following section provides a detailed overview of market-based energy efficiency obligation (EEO) schemes, such as the EEIS, and a comparison of the prevalence of different types of EEOs, and the key elements integral to their design.

4 FOCUS ON MARKET-BASED INSTRUMENTS USED FOR ENERGY EFFICIENCY SCHEMES

4.1 Types of market-based instruments used

Market-based instruments (MBI) for driving energy efficiency improvements have become increasingly popular over the last 20 years. The International Energy Agency estimates more than 50 MBI are operating worldwide as at 2016 up from less than 20 in 2005 (International Energy Agency, 2017c).

The common feature of both these forms that differentiates MBI from other instruments is that policymakers set a target (e.g. energy savings) and allow obligated entities and sometimes other market actors to choose the energy efficiency measures they will invest in to meet the obligations linked to the target. Theoretically, this approach should enable market forces to drive the discovery of the most cost-effective set of actions to meet the energy efficiency objectives required by policy-makers (International Energy Agency, 2017c).

There are two primary forms of MBI:

- **Energy Efficiency Obligations** (EEOs), that require energy utilities to deliver efficiency improvements in the geographical areas they serve; and
- **Energy Efficiency Auctions**, that invite bids from third parties for delivering efficiency improvements in a defined geographical area (International Energy Agency, 2017c).

EEO schemes can be further split into:

- **Certificate Trading** schemes; and
- **Retailer Obligated** schemes.

The EEIS falls in the second category.

In **retailer obligated schemes**, an obligation is placed on energy retailers to deliver energy efficiency outcomes to their clients. A specific target for improvement in energy savings is set and various types of scheme design exist to guide the delivery of the benefits (see Section 4.3.3 for a description of how sub-targets can be used to direct benefits to specific groups). Retailers achieve their targets by driving the implementation of above business as usual energy saving measures for residential and business energy customers, sometimes contracting specialised companies to deliver this, and/or sometimes providing incentives to their own customers to reduce their energy use. The target is generally set in proportion to the volume that energy retailers sell in the jurisdiction of the scheme. Retailers have to demonstrate compliance of the commissioned activities with the requirements of the scheme.

The resulting cost burden for the obligated retailer is generally recovered by applying an additional levy in the energy bills of energy users. It is generally assumed that 100% of costs are passed on evenly to energy customers within the jurisdiction of the scheme. In reality, obligated retailers can pass on costs at their own discretion, meaning costs may be spread unevenly across customers, potentially putting the burden on customers who do not take up the energy efficient options on offer (Rosenow J. & Bayer E., 2017).

Certificate-based schemes still work by placing an obligation on energy companies in terms of the number of certificates they must surrender each year, which are typically measured in energy or GHG savings, based on market share. Third-party abatement providers then identify and deliver energy efficiency activities that lead to the creation of energy or GHG abatement certificates. The cost of demonstrating compliance falls back on those abatement providers. Certificate based schemes are meant to encourage competition between certificate providers and innovation, and energy savings at least cost due to market competition between certificate providers. Typically, a certificate-based scheme is most beneficial where there are many obligated parties or efficiency supply businesses, putting greater emphasis on competition and price transparency.

4.2 Prevalence of schemes across jurisdictions

In 2016, there were 50 Energy Efficiency Obligation (EEO) schemes operating around the world – four in Australia, as well as in Brazil, Canada, China, Korea, South Africa, Uruguay, 11 European countries and 26 in the United States of America (USA) (Bayer, 2016). In the US most EEO schemes were rolled out between 2004 and 2011, while in Europe, current schemes were rolled out from 2002 onwards (Figure 1). It should be noted that the first iteration of both the UK and Denmark schemes were first rolled out over 20 years ago (Fawcett et al., 2017).

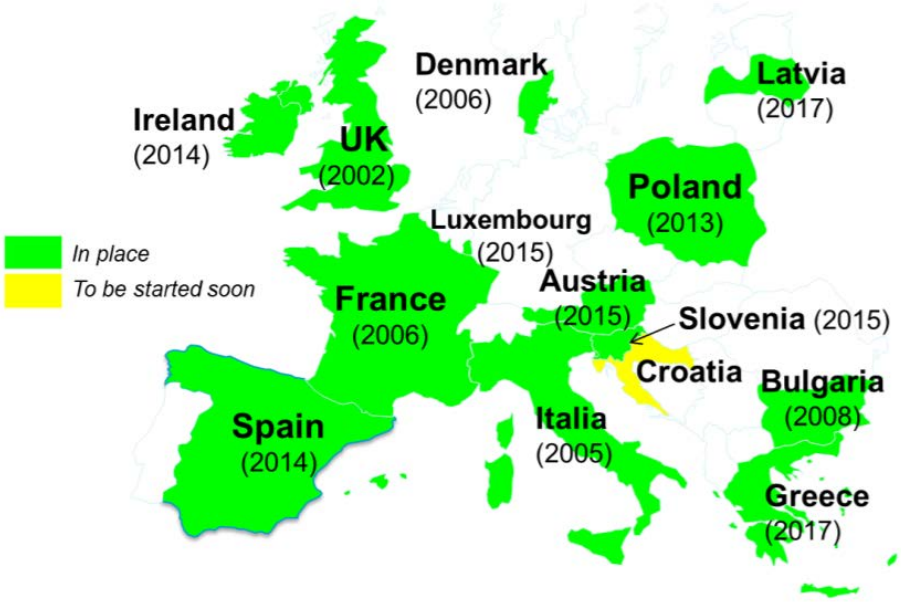

Figure 1. Starting year for each EU EEO (ATEE, 2017)

In Europe, only three countries have a trading market of certificates – France, Italy and Poland, with 11 countries using a retailer obligated scheme only (ATEE, 2017). In the US, there are currently 26 states with EEO (referred to as Energy Efficiency Resource Standards) schemes, with no certificate trading and retailers obligated to achieve specific energy savings based on energy sales (Nadel & Cowart, 2017).

In Australia, the four EEO schemes are the:

- ACT Energy Efficiency Improvement Scheme (EEIS) – established in 2013.
- NSW Energy Saving Scheme (ESS) – established in 2009.
- Victorian Energy Upgrade (VEU) program – established in 2009.
- SA Retailer Energy Efficiency Scheme (REES) – established in 2009.

The EEIS and SA REES are retailer obligated schemes, while the NSW ESS and VEU are certificate-based schemes.

These two latter schemes are nearly unique in the international context, and are most similar to Texas, Poland and Italy, in enabling third party abatement providers to implement energy savings activities and then sell certificates to obligated energy retailers (Nadel & Cowart, 2017). This has stimulated the development of an energy services industry that was virtually non-existent before the establishment of the precursor greenhouse gas emissions trading scheme in NSW in 2003.

4.3 Comparison of key elements of scheme design

The following sections provide a comparison of key elements of EEO scheme design:

- Objectives
- Scheme coverage: energy types and sectors
- Targets and metrics

- Energy saving activities delivered

4.3.1 Objectives of the schemes

Globally, EEOs have a broad range of policy objectives. The most common objectives aim at bridging the energy efficiency gap and delivering cost-effective energy savings that would otherwise not have occurred. An objective to reduce energy bills or the impacts of energy price rises is often coupled with this primary energy saving objective (Bayer, 2016).

Given most EEOs draw funding from cost-recovery mechanisms that raise all energy bills in the relevant jurisdiction, they are often seen has having a regressive effect on low-income households. Consequently, a number of schemes have special provisions to minimise the impact on low-income households. A number of schemes include assisting low-income households or addressing fuel poverty as a primary objective.

Other less common objectives include improving energy security, stimulating energy services markets, tackling geographically-specific distribution and transmission constraints, and GHG emission reductions. The majority of schemes see many of these objectives as co-benefits not primary objectives (Nadel & Cowart, 2017).

Most EEO schemes' primary focus on bridging the energy efficiency gap and delivering energy savings, results from recognition that such schemes are a first-best response to the specific market failures causing the gap. EEO schemes designed with reference to a jurisdiction's broader climate and energy policy landscape can play an important complementary role to broader social equity, energy security and climate policy objectives. However, where these additional objectives are directly included in energy efficiency scheme design, there is a higher potential for tension and duplication between objectives of different policies/scheme, lowering efficiency and reducing policy clarity. For example, energy efficiency policies are usually a second-best policy for GHG emissions reductions because they rarely provide broad-based coverage of emissions reduction opportunities, do not directly incentivise energy conservation and usually retain high levels of uncertainty surrounding delivery of actual reductions (Gillingham, Newell, & Palmer, 2009) (Productivity Commission, 2005). In addition, when objectives include a provision to deliver savings in low-income households, this can increase total scheme costs and reduce carbon savings from individual actions, as has been seen for the UK scheme. For this scheme, total costs increased because low-income households required a greater level of subsidy and were less able to make co-payments. Carbon savings were reduced because low-income households primarily use energy efficiency improvements to increase their demand for energy services to increase comfort levels, increasing the rebound effect. This is because low-income households tend to under underutilise energy services (heating, cooling, lighting) when under financial stress. The increases in scheme cost can mean that if schemes are not very carefully designed and targeted, provisions for low-income households can increase regressive outcomes. The debate over the extent to which this is the case continues in the UK (Rosenow Platt & Flanagan, 2013).

Table 3. Examples of policy objectives in EEO schemes (Bayer, 2016)

Policy objective	Austria (AT)	Bulgaria (BG)	Denmark (DK)	Spain (ES)	France (FR)	Ireland (IE)	Italy (IT)	Lithuania (LT)	Poland (PL)	Slovenia (SI)	United Kingdom (UK)
Deliver cost-effective energy savings/reduce energy bills	X	X	X	X	X	X	X		X	X	
Environmental/CO2 reductions								X			X
Improve energy security by reducing imports							X				
Assist low-income households to install efficiency measures						X					X
Tackle fuel poverty					X	X					X
Stimulate energy services market	X						X	X			

Historically in Australia, all schemes' primary focus was reducing greenhouse gas emissions, with the EEIS and SA REES also having a focus on delivering savings for low income households. However, over time, the focus of the NSW and SA schemes has switched to energy savings, with both schemes now having energy reduction metrics, rather than carbon (see Section 4.3.3 for more information).

Currently, the EEIS has four objectives. Section 6 of the Energy Efficiency (Cost of Living) Improvement Act 2012 (the Act) outlines these as follows:

- a. encourage the efficient use of energy,
- b. reduce greenhouse gas emissions associated with stationary energy use in the Territory,
- c. reduce household and business energy use and costs, and
- d. increase opportunities for priority households to reduce energy use and costs.

4.3.2 Scheme Coverage

Energy types

The energy coverage obligation varies across schemes. All of the Australian schemes cover electricity and natural gas, as do many in Europe and the United States. Around the world, a few schemes also cover transport fuel, district heat, thermal energy and process fuels. Figure 2 provides the energy types covered by European EEO schemes, it is seen that all cover electricity and the majority cover natural gas.

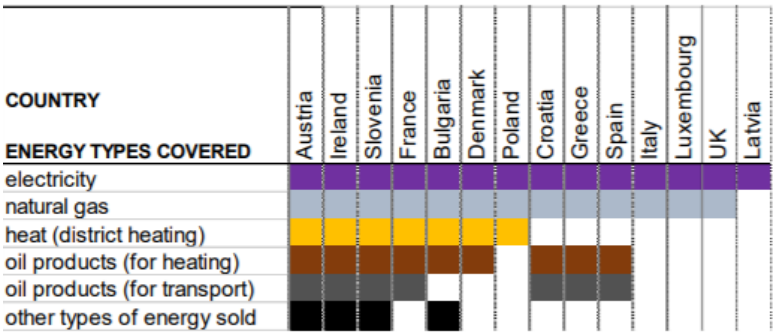

Figure 2. Energy types covered by EU EEO schemes (ATEE, 2017)

It is important to note that including a type of fuel in the coverage of the scheme, does not automatically mean that distributors of the fuel are obligated parties to the scheme or that the target is set by reference of all fuels. For example, the EEIS scheme only obligates electricity retailers and sets targets based on electricity sales only, but the EEIS also delivers savings in natural gas, LPG and wood.

Both the EEIS and NSW ESS base their targets on electricity sales, while the SA REES and VEU base targets on both gas and electricity sales. In the recent review of the NSW ESS, the expansion of the scheme to allow gas saving activities was recommended. As part of this, an option of placing an obligation on gas retailers (in addition to the existing electricity retailer obligation) was investigated. It was determined that a new target on gas sales would require scheme participants to establish new compliance, reporting and cost recovery systems to pass through the costs of new obligations to their customers, increasing red tape for the scheme (NSW Government, 2015). Therefore, it was decided to just increase the existing obligation to purchase sales on electricity sales, as this would avoid introducing a new obligation for scheme participants.

Sectors included

In principle, the broader a scheme's coverage (in terms of participants and sectors), the more likely the lowest costs opportunities will be identified (a larger pool allows maximum flexibility for obligated parties or certificate providers to identify low cost opportunities). However, when schemes have sub-targets for priority households or other policy goals, this is bound to increase the costs of the scheme.

In Europe, the residential sector is always included. Figure 3 shows the sectors covered by the EU EEO schemes: they all cover residential, while the majority cover services and industry.

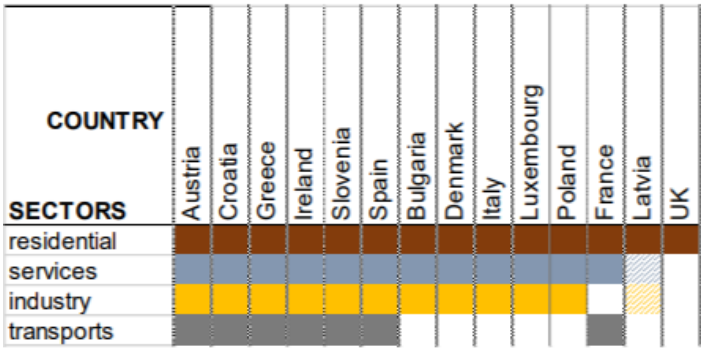

Figure 3. Sectors covered by EU EEO schemes (ATEE, 2017)

In Europe, the economic sectors that are included within different schemes, depend on political objectives, rather than the size of the savings reservoir. Significant savings opportunities are prevalent in the commercial and industrial sectors (Nadel & Cowart, 2017). In the majority of the European EEOs (excluding Austria, the UK, France), the majority of savings have been delivered through industry (Figure 4).

However, there is an argument that allowing these sector users to participate may reduce the quantum of savings that is delivered for participants that need it most, as energy retailers find it more cost-effective to deliver activities in these sectors (through larger projects with smaller relative transaction cost) (ATEE, 2017).

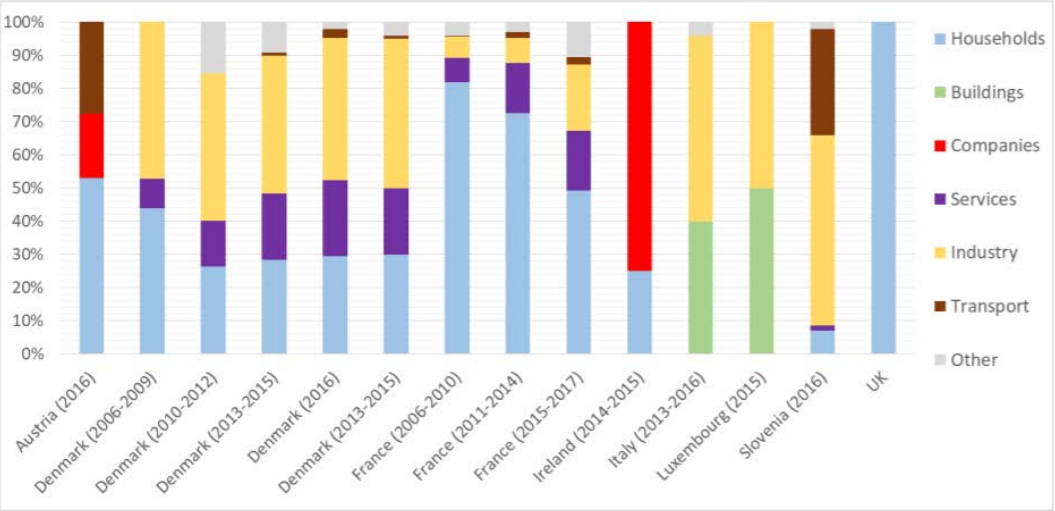

Figure 4. Energy savings per sector for eight EU countries (ATEE, 2017)

In Australia, all schemes cover residential and SME businesses. However, only the NSW ESS and the VEU allow large businesses and industrial energy users to participate in their schemes. The argument for including large energy users is that there are still significant opportunities to reduce energy consumption at these sites. For example, a recent International Standards Organisation survey reported that only 18 Australian sites were certified with best practice energy management standards between 2011 and 2015. This suggests significant room to improve (NSW OEH, 2016).

Another consideration is that in both Victoria and NSW, local governments are eligible, and have been significant recipients of savings, through street light upgrades and other activities. This option is not available to the EEIS, since the ACT government is both the scheme administrator and the local government authority. The table below shows that about 75% of emissions from ACT NGERS reporters are from utilities, and/or 'other' reporters including the Australian and ACT governments and two large universities. This suggests that the main impact from excluding NGERS reporters is to avoid the transfer of EEIS savings to a small number of very large public-sector agencies and utilities.

Table 4. NGER reporter emissions and energy by sector 2016/17

Sector	Total Emissions (tCO_2-e)	Energy Consumed (GJ)	# reporters	% of emissions
Other Store-Based Retailing Total	25,867	120,234	12	3%
Property Operators, Real Estate Services and Accommodation Total	70,404	448,449	18	9%
Road Transport and Fuel Retailing Total	9370	79,471	24	1%
Other industry (manufacturing, construction, mining)	20,893	245,471	25	3%
Utilities (electricity, gas, waste, water)	373,411	2,047,603	12	49%
Wholesaling Retail and Material	65,940	286,691	24	9%
All others	190,699	1,313,751	61	25%
Totals	**756,584**	**4,541,670**	**176**	**100%**

4.3.3 Targets and metrics

EEO schemes set emission saving targets that are then allocated to obligated retailers, usually as a percentage of sales. The most common practice is to set energy savings targets as a percentage of consumption as for the NSW ESS, the EEIS and some US schemes, or in absolute terms, as is the case for the SA REES and the VEU (Nadel & Cowart, 2017). However, "*A few obligations have had targets set in CO2-equivalent terms […] But the vast majority of programme goals are set in terms of energy consumption*" (International Energy Agency, 2017c). Of note is that a number of US state, EU states and Chinese schemes use both total energy efficiency savings and demand peak-coincident energy efficiency targets.

At the international level, there is great variability in the way targets are defined. As a result of this variability, it is often difficult to compare targets directly. One of the major differences is whether the target is expressed as lifetime energy savings (as for the EEIS and all other Australian schemes) or first year energy savings (Danish scheme).

Table 5 provides a comparison of targets across the four Australian schemes. Recently, both the NSW ESS and the SA REES changed their focus to energy savings rather than emissions. Some schemes set sub-targets, mainly for low-income priority households, while others do not, in Australia as well as internationally (see below).

Table 5. Comparison of targets between Australian EEOs

Feature	ACT EEIS	SA REES	NSW ESS	VEU
Target metric	tonnes CO_2-e	GJ	MWh	tonnes CO_2-e
2017 target	Percentage; 8.6% of electricity purchased converted to emissions reductions	Absolute: 2,300,000 GJ	Percentage; 7.5% of electricity purchased	Absolute: 5.9M t CO_2-e
Sub-target for low income households	Yes; 20% of emissions reductions in low-income households	Yes; 20% of activities (442,308 GJ) and 5,667 energy audits in low-income households	No	No

Escalating targets are used in many other jurisdictions (US, EU, NSW) as a way of ramping up ambition and driving deeper savings over time. Escalating targets have not been associated with increased cost due to learning-by-doing improvements among providers.

In Europe, the majority of schemes have increased the level of their targets over time. The exceptions are the UK and Denmark:

- In the UK, targets were decreased as there was a concern about the increasing costs to obligated retailers. This was caused by increased emphasis of the scheme on delivering energy savings to low-income households and activities requiring higher investments.
- In Denmark, the costs to obligated retailers rose as targets increased significantly between 2012 and 2015, and the least cost activities were already achieved, or were no longer eligible to due to additionality criteria (ATEE, 2017).

In Australia, the NSW ESS, VEU and SA REES all have had progressively stretching targets, while the EEIS started at 7% in 2013, increased to 13% in 2014 and 14% in 2015, and decreased to 8.6% in 2016, and 2017 (EECCA, 2017).

The use of sub-targets

Sub-targets ensure that some activities and associated benefits occur even when they are not the most cost-effective or are unlikely to be picked by the market, or that a percentage of the target is achieved with specific groups of energy users, primarily low-income households.

Measures in favour of low-income households are the most common example of sub-target:

- The SA REES requires a number of annual energy audits in low-income households, which despite being costly may provide more meaningful savings to participants than cheaper measures.
- In the UK EEO scheme, a sub-target focusses on the delivery of insulation measures in rural areas, another on insulation activities and other activities targeting the reduction of lifetime heating costs in low-income and vulnerable households and efficient heating systems.
- Fuel poverty certificates from the French scheme can command a higher price than conventional certificates in this market (IEA, 2017b).
- In total, five European EEOs include specific provisions that can either be attributing a bonus factor for actions implemented in low-income households (bonus approach) or requiring obligated parties to achieve a minimum share of energy savings in low-income households (mandatory approach) (ATEE, 2017):
    - France has both a mandatory target and a bonus provision, with a bonus factor of 2 granted to actions implemented in very low-income households.
    - In the UK, from 2017-18, approximately 70% of ECO funds will be dedicated towards an affordable warmth target.
    - In 2014 in Ireland, a minimum share of energy savings need to be achieved in households (20%), and 5% in low-income households. One of the key policy objectives is that energy suppliers develop innovative ways to deliver actions to these vulnerable households. In parallel, other energy efficiency programs designed to tackle fuel poverty are implemented by the government (SEAI) with local authorities, and obligated retailers can join these partnerships to meet their fuel poverty target.
    - In Austria, 40% of the final energy savings have to be achieved for households, with actions for households in fuel poverty getting a 1.5 bonus factor.
    - In Austria and Greece, it was found that fuel poverty household targets are more likely to be met when partnerships with intermediaries e.g. social workers, charity organisations, are developed.

Deeming mechanism

Many schemes around the world, such as the UK and Massachusetts (International Energy Agency, 2017c), use deeming methods to calculate energy savings from activities. All four Australian schemes make extensive use of deeming. A recognised risk for schemes with deemed activities is that predicted savings may not eventuate. This can occur either if activities are not properly installed or are rejected and removed by recipients. Examples of the former problem occurred at the start of the NSW and Victorian schemes (Crossley D.J., 2008). For example, in NSW, it was determined that a large number of compact fluorescent light bulbs and low flow shower heads were given away free of charge to consumers in return for a document transferring the white certificates to the abatement provider. These deemed savings were used in calculations of energy savings achieved by the scheme, however follow-up surveys found that many of these products were not installed (Nadel & Cowart, 2017). Scheme administrators responded by

clarifying requirements and increasing the audit and compliance efforts to prevent similar problems going forwards. An example of activity removal occurred with stand-by power controllers in Victoria and the ACT, whereby nearly one-third of participants stopped using the SPCs within two years. Scheme administrators responded by reducing the deemed savings to take account of the empirical records of SPC removal. Overall these responses show the value of post implementation surveys and other research to confirm the accuracy of deemed savings.

Lessons from mature schemes

In Europe, many schemes have had significant redesigns during their lifetime.

- Long-standing schemes in the UK and Denmark have faced challenges because of concerns over increasing scheme costs, meaning schemes needed to be reviewed and redesigned.
- In the UK, the scheme has had four iterations (Fawcett et al., 2017), with the most recent being the policy redesign of Energy Company Obligation (ECO 2013-2017).

As a result of the redesign, which took into account a new 'Green Deal' loan scheme for 'able to pay' customers, and the end of a government funded program designed to reduce fuel poverty, the UK EEO scheme changed from a scheme that supported large scale installation of cheaper measures to a scheme primarily targeting expensive insulation measures. This was not because all cheaper activities had been installed, but rather that the government judged they should no longer be subsidised. In 2015, the energy savings target was reduced by 33% (despite contrary evidence that this would result in net higher energy bills overall (Fawcett et al., 2017), and some cheaper measures were added back into the scheme. The reasons for this included:

- Energy retailers argued that targets could not be delivered at the cost estimated by government, thus cheaper measures were required
- The markets for low cost insulation measures which were excluded from the ECO were severely damaged, leading to job losses, putting pressure on the government to make changes
- High levels of public concern over the costs to customers as a result of ECO

Therefore, questions arise as to whether there is a political limit to the scale of EEO schemes, or at least the scale of revenue that can be recouped through customers' bills. Both the mature UK and Denmark schemes have had to reduce their level of ambitions over time due to push-back from obligated parties and concerns over costs to bill payers (Fawcett et al., 2017).

4.3.4 Energy savings activities

Depending on scheme design, activities need to be pre-approved by the regulator or, as in Denmark, any activity that can demonstrate savings is considered eligible. Depending on the coverage of the scheme, activities rolled out have varied across the schemes. However, low cost measures, such as lighting upgrades, have typically been prevalent in the first few years of roll-out. Typical activities included:

- Insulation
- Building envelope
- Glazing
- Space heating and cooling
- Water heating
- Lighting
- High efficiency appliances.

In the past, across all four Australian EEO schemes, the majority of energy savings activities have been achieved by lighting installations, either for residential or commercial customers depending on the focus of the schemes (EECCA, 2017). Lighting upgrades comprised over 90% of VEECs, 69% of energy savings in SA, 62% of NSW ESCs in 2016 (EECCA, 2017) and 89% of lifetime energy savings in the ACT in 2016.

In terms of next most popular activities (after lighting) delivered by the schemes in 2016 (Australia):

- NSW ESS: project-based methods made up around 30% of the NSW ESS energy savings in 2016 (IPART, 2017).

- SA REES: Standby power controllers and residential showerheads, water heaters (ESCOSA, 2017)
- VEU: Water heating
- EEIS: Space heating and cooling, standby-by power controllers, door and fan seals

Evolution over time

Over time, once the low-cost opportunities are exhausted or rules are revised, the type of activities that are delivered under EEOs evolves:

- In the first few years of the EEO schemes in Denmark and Italy, household savings originated mostly from lighting and appliances. When the energy savings ratios credited to these action types were revised to take into account changes in additionality, they became much less attractive over time or were even de facto excluded from the schemes. This has resulted in lower shares of energy savings in households for the recent years. (ATEE, 2017).
- The UK ECO scheme does not offer lighting opportunities for the residential sector (OFGEM, 2015), while previous iterations of the scheme such as CERT from 2008 to 2012 did offer lighting activities. The scheme now has more of a focus on activities with greater energy saving impacts, such as insulation and heating activities for households.
- In addition, the NSW ESS and VEU have recently wound back or are in the process of winding back scheme support for lighting – Victoria is now applying a discount factor of 70-80% for commercial lighting upgrades (Victorian Government, 2017).
- In the ACT, the trend has moved from residential lighting and standby power controllers at the start of the scheme, to commercial lighting, ducted gas heating and insulated ductwork in later years with gas-to-efficient-electric heating upgrades introduced in 2018.

4.4 Cost effectiveness of EEO schemes

The success of EEO schemes is typically calculated as the percentage reduction in energy consumption targeted in a given year. Globally, the strength of these schemes stood at 0.4% in 2016 across all the final energy consumption covered, with global strength doubling over the last decade (IEA, 2017b).

4.4.1 The cost of running EEOs

The costs of EEOs can be broken up into three broad categories:

- **Programme costs:** These include the costs to obligated retailers of carrying out activities in order to achieve their targets. These typically consist of a grant type payment to program participants to partly or fully fund energy efficiency activities. In addition, programme costs include resources expended on lead generation, internal administration of the programme, contracting installers, and reporting, monitoring and verification of results.
- **Societal costs:** These are made up of pass-through costs and the co-contributions paid by scheme participants for specific activities. Pass-through costs are the costs to obligated retailers passed on to the population where the scheme is located. Co-contributions are typically paid by scheme participants for more costly activities such as building insulation or heating/cooling upgrades.
- **Administrative costs:** These costs are typically borne by regulators or scheme administrators, to establish the rules of the EEO, oversee the running of the EEO, verify/estimate/evaluate what the EEO has actually achieved and report on its results. In addition, the development of new procedures and training of staff/installers would fall under this category. It should be noted that for the EEIS, these administrative costs have been covered by Tier 2 retailer ESCs, based on a government budgetary decision.

4.4.2 The difficulties of benchmarking cost-effectiveness

Many assessments of EEO schemes suggest that most programs save energy for much less than the cost of energy supply in the relevant jurisdiction. For example, a 2017 International Energy Agency (IEA) assessment of EEOs in multiple jurisdictions concludes that: “Across all programmes for which data are available, the average total cost per lifetime kilowatt-hour (kWh) saved is less than USD 0.03 (International Energy Agency, 2017c).”

However, most cross-jurisdictional assessments by organisations like the IEA rely on data provided by governments and policymakers responsible for establishing and maintaining the schemes under analysis. In its most recent cross-jurisdictional analysis, the IEA notes that "drawing conclusions as to the cost-effectiveness of different obligations is challenging as the methodologies used by countries to estimate and report costs and savings are not consistent":

- **Discounting:** Some countries discount energy savings (French Energy Savings Certificate (ESC) Scheme), while others don't.
- **Free-riders:** Estimates for free-ridership varies across countries. A free-rider is someone who would install an energy-efficiency measure without any program incentives because of the return on investment of the measure but receives a financial incentive or rebate anyway (S. Heins & Orion Energy System, 2006).
- **Rebound effects:** This refers to the claims that energy efficiency improvements can actually lead to an increase in energy use. This effect is taken into account to different degrees across schemes. In Australian schemes, algorithms for calculating deemed savings take account of the risk of rebound effects.
- **Lifetimes:** The lifetime of measures are not always the same even for the same measure
- **Units:** Different units of savings from different mixes of fuels and conversions to kWh, GJ or tCO_2eequivalents
- **Evaluation methods:** Some scheme evaluations are ex-ante i.e. results are based on forecasted results before the scheme has finished, others ex-post i.e. results are based on actual results rather than forecast. The rigour of evaluations is not the same across all countries analysed.

Moreover, (M. Molina, 2014) notes that portfolios with a larger share of savings from residential or low-income programs tend to have higher overall Cost of Saved Energy. Additionally, when the scheme targets both electricity and gas savings, as is the case for the EEIS, but only electricity customers pay for the cost of the scheme (as only electricity retailers are obligated parties), then the cost appears higher by unit of electricity saved than it would if costs were adjusted for non-electricity savings.

Given measurement and comparison challenges across jurisdictions, perhaps the most accurate statement that can be made about the comparative cost-effectiveness of these schemes is that the majority of them deliver savings with similar order of magnitude costs.

Notwithstanding, the comparison drawn by the IEA is reproduced in Figure 5 below. It should be noted that for this review, the cost-effectiveness of the EEIS scheme was recalculated as part of the empirical analysis and was based on more recent data provided. However, the method used to calculate the expenditure by obligated parties (USD per kWh lifetime savings) is consistent with the IEA's approach. Using the average USD-AUD exchange rate from the start of 2012 to the end of December 2015, it was determined that the average expenditure by obligated parties per unit of energy saved (USD/kWh lifetime savings) over the life of the EEIS was 0.029 USD/kWh. This is lower than what is presented below by the IEA for the EEIS (0.036 USD/kW. In addition, this cost has been reducing each year as EEIS matures, from approximately 0.041 USD/kWh in 2013, to 0.024 USD/kWh in 2017. Although the expenditure by obligated parties in the EEIS is higher than the weighted average presented below, it is still well within the same magnitude as other schemes, and considerably lower than the more expensive schemes.

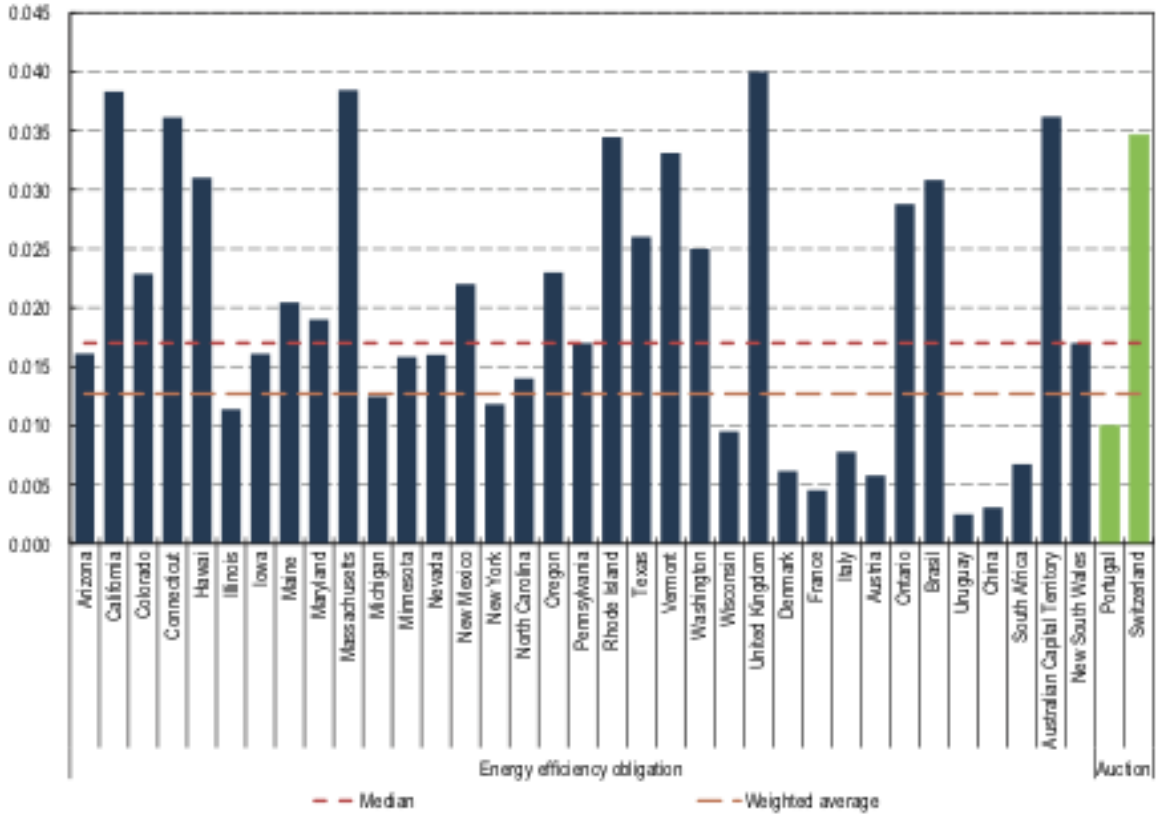

Figure 5. IEA Calculations of Expenditure by Obligated Parties (USD/kWh lifetime savings) (International Energy Agency, 2017c)

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