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# Best Practices in Promoting Utility-based Energy Efficiency and Renewable Energy: Policy Options for Ukraine

**October 2018**

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U.S. DEPARTMENT OF ENERGY

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## Executive Summary

In 2014, Ukraine embarked on a path of reforms in all sectors, including energy. Over the last three years, the Ukrainian Government, in cooperation with the international community, has achieved significant progress in developing a legislative framework and creating an enabling environment for strengthening national energy security. While Ukraine is actively shaping the legislative landscape that will enable energy efficiency improvements in the residential and public sectors, the implementation of utility-based instruments, common in developed countries, can further accelerate development of Ukraine's energy efficiency market.

This report summarizes best practices in utility obligations and energy efficiency resource standards, drawing lessons that can be helpful for the Ukrainian government in its ongoing reform efforts. This report describes the experience of the United States and European Union member states with instruments such as energy efficiency obligations, energy efficiency resource standards, and renewable portfolio standards.

This report consists of two parts. The first part covers the utility-based energy efficiency requirements (called energy efficiency obligations in Europe and energy efficiency resource standards in the U.S.). Structurally and conceptually, energy efficiency obligations and energy efficiency resource standards are similar even though they carry different names in different countries. These mechanisms place obligations on utilities to find energy savings equivalent to a certain percentage of their energy sales; depending on the program design, utilities can invest in end-use efficiency with their customers, or purchase energy savings from third parties. Some schemes also allow for trading of the energy savings. The report provides an overall description of these mechanisms, key elements as well as best practices in program design. The second part of the report provides a brief overview of U.S. renewable portfolio standards, which are structurally similar to utilities' energy efficiency requirements, but for renewable energy. This part starts with a general overview of promotion of utility renewable energy requirements and proceeds with a description of the main components of the scheme.

An Energy Efficiency Obligations (EEO) scheme mandates utilities in respective jurisdictions to achieve specific annual energy saving targets within a certain multi-year period. EEO is a market-based instrument to promote energy efficiency in generation, transmission, and end-use energy consumption. Design of EEO schemes varies significantly across jurisdictions, but several elements are crucial for any EEO scheme. They are policy objectives of the scheme, obligated parties, sectors and facility coverage, eligible energy conservation measures, time period, compliance regime, measurement and verification, funding. EEO's enabling regulation typically provides obligated parties with some flexibility to achieve their energy savings targets utilizing best available energy efficiency opportunities. This allows utilities to achieve the required energy savings in the most cost-efficient way. Depending on policy objectives, policymakers can target specific sectors (residential, industry, transport or combination), energy sources (such as electricity, natural gas, or district heating), and even mandate a certain portion of savings to be achieved from particular energy efficiency measures.

In the United States, many states also have a similar policy to promote renewable energy. As is the case with energy efficiency resource standard schemes, which oblige utilities to achieve certain energy efficiency savings at end-use energy customers, renewable portfolio standards (RPS) mandate utilities to achieve a certain minimum share of electricity supplied by eligible renewable energy technologies. Design and main elements of the RPS are similar to the structure of EEO schemes. States and local jurisdictions with active RPS schemes report multiple benefits of RPS's to utilities, end-users, and society. An RPS allows a state to increase the share of renewable energy in its energy supply in a cost-effective way because utilities will find the lowest cost solutions to meet the requirements, and there is no lock-in contracts with high payments when renewable costs come down.

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## Introduction

Many countries have recognized energy efficiency as a valuable resource, which can provide multiple benefits to society and the economy. These benefits include strengthening energy security, boosting economic growth, creating new jobs, decreasing vulnerabilities to energy price shocks, alleviating poverty, reducing pollution and many others. The International Energy Agency specifically identified energy efficiency as a global policy priority because of its enormous untapped potential (IEA, 2014).

The role of energy efficiency is especially important for Ukraine. Energy efficiency investments in all sectors will help Ukraine decrease energy imports, boost its economy, reduce unemployment, and improve its trade balance. Millions of households will benefit from increased living standards, reduced utility bills, and a cleaner environment. A number of reports demonstrate enormous potential for reducing energy use in general and natural gas imports in particular (IEA, 2015; MinRegion, 2016).

Sustained governmental commitment and a well-designed regulatory regime play an important role in achieving this potential. Ukraine has started shaping its legislative landscape for energy efficiency improvements by enacting laws on issues such as energy performance contracting and an Energy Efficiency Fund. Implementing utility-based instruments, such as Energy Efficiency Obligations (EEO), can foster energy efficiency improvements in times when the government faces financial constraints.

This report will describe the experience in the United States and European Union member states with instruments such as energy efficiency resource standards (EERS) and energy efficiency obligations (EEO). Conceptually and structurally, utility obligation schemes implemented in the U.S., EU, and other countries are similar – utilities have obligations to achieve certain energy savings by implementing energy efficiency measures for end-users within a certain timeframe. Another common feature of these schemes is that utilities have flexibility in choosing the energy efficiency measures to meet the targets. The design of utility obligation schemes across countries largely varies only in terms of the policy objectives of the scheme, which have a direct influence on the targeted end-use sector, fuels and other key elements of the scheme. While in different countries this policy instrument can have different names, here and after we will use term Energy Efficiency Obligations ("Схеми зобов'язань з енергоефективності") and its acronym EEO. This term is consistent with the terminology of the EU Energy Efficiency Directive 2012/27EU (European Union, 2012)[1].

Additionally, this report will describe mechanisms to promote renewable energy in the electricity and district heating sectors. A Renewable Portfolio Standard (RPS) in the United States is a state-level policy that obliges utilities to achieve a certain share of renewable energy in their retail sales. Some EU member states also enacted similar instruments under different names.

Despite the fact that EEO and RPS mechanisms focus on different types of clean energy, they share common features. Both instruments require utilities (or other obligated entities) to achieve certain

[1] In Ukrainian: saee.gov.ua/sites/default/files/UKR_Directive_27_2012_2.doc

targets for clean energy relative to their energy sales. For example, a state RPS can mandate utilities to achieve a certain share of energy supply from renewable energy within a specific timeframe and demonstrate compliance on an annual basis. Likewise, an EEO scheme can require utilities to achieve a certain amount of energy savings (typically electricity and natural gas) by a specific deadline. Most schemes also have penalties for non-compliance, measurement and verification protocols. Some may also create tradable certificates.

The idea behind this report came from a request by the Ukrainian Parliament, which is evaluating potential options for reforming the energy sector to build a reliable energy system with affordable services, provided in an environmentally friendly way. Specifically, members of Parliament's Committee on the Fuel and Energy Complex, Nuclear Policy and Nuclear Safety expressed interest in best practices in the promoting energy efficiency and renewable energy through electric and district heating utilities. This report has been prepared with the support from the U.S. Department of Energy (U.S. DOE).

## PART 1. Best Practices in the Development of Utility Energy Efficiency Obligations

Utility EEOs are a market-based instrument to promote energy efficiency in generation, transmission and end-use energy consumption. While in different countries, this policy instrument has different names[2], conceptually they are similar and share many common features. Specifically, structure and key elements of these policy instruments are common across countries and jurisdictions, as described in detail in the next section. The primary differences among these schemes are the policy specific objectives.

The EEO scheme has been an effective instrument in achieving cost-effective energy efficiency improvements in the United States, European Union, and Australia (Nadel et al., 2017). As of the beginning of 2017, about 50 EEOs are active in different parts of the world. Twenty-six of these are in the United States (ACEEE, 2017b). The Energy Efficiency Directive in the European Union (EU) has led to an increasing number of EEO schemes in EU member states. In March 2017, fourteen EU member states had active EEOs, while Greece and the Netherlands are planning to enact EEOs in the near future (Fawcett et al., 2017). Australia, Canada, South Africa, Thailand, and China also have adopted EEOs at the national or sub-national levels (Lees and Bayer, 2016).

The initial idea and concept of utility energy efficiency programs emerged in the United States in the mid-70s. The oil crises in the 1970s resulted in sharp increases in energy prices, which forced utilities to help their customers to reduce utility bills. In the 1980s, state regulators started to require utilities to implement an integrated resource planning (IRP) concept, which led to further development of utility energy efficiency efforts. IRP is a long-term planning tool, which allows utilities to forecast future energy demand and identify their least-cost options to provide reliable energy services in the future; energy efficiency and supply-side option are compared on equal footing (Shenot, 2011). While IRP can require a significant amount of time and resources from utilities, it provides considerable benefits to customers and as a result, more state public utility commissions started to require utilities to introduce IRP (Wilson and Biewald, 2013). Demand-side management is closely linked with IRP. IRP indicates how much energy efficiency is cost-effective; demand-side management the provides a mechanism to achieve that level of energy savings (Kushler et al., 2006). Altogether, these led to growth in utility investment in end-use energy efficiency. As states deregulated their power sectors in the early 1990s, they were concerned that they would no longer have a mechanism to support energy efficiency. Demand side management could not work in the same way in a deregulated context since public utility commissions would no longer approve utility investments and operation plans. As the result, utilities started to roll-back their energy efficiency programs and annual utility investments in energy efficiency dropped by half, from $1.8 billion in 1993 to about $900 million in 1998 (York and Kushler, 2005). In response to these trends, some states recognized the role and public benefits of the utility efficiency programs and introduced a ratepayer-funded mechanism for energy efficiency, which was deemed a public benefit (Nowak et al., 2011; York and Kushler, 2005). States' commitments to energy efficiency improvements resulted in an increase of efficiency spending in both traditional and restructured utilities. Today these new,

[2] In European Union, Australia and other countries, this scheme usually called Energy Efficiency Obligations, Energy Savings Obligations and White Certificates.

mandatory utility-based energy efficiency programs in the United States are known as Energy Efficiency Resource Standards (EERS).

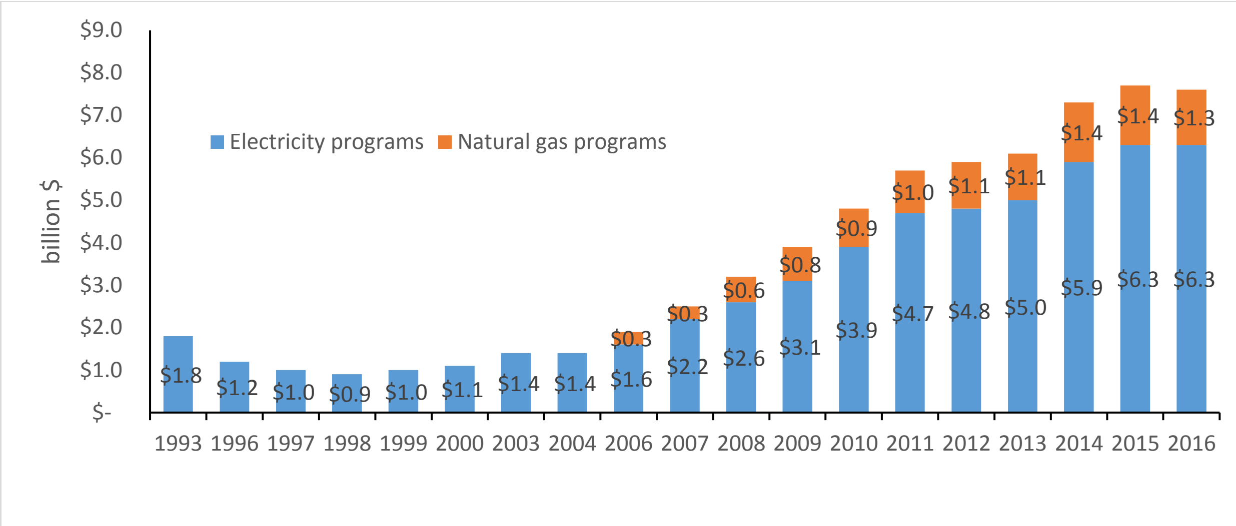


**Figure 1.** Utility energy efficiency investments from 1993 to 2017. Note: investments in natural gas efficiency programs during 1993-2004 are not available.
**Source:** (ACEEE, 2017a).

In Europe, this instrument is usually called an Energy Efficiency Obligation (EEO). Different countries had different reasons to adopt these schemes. In Denmark, for example, the introduction of an EEO scheme and its predecessor, a demand-side management program, were mainly driven by environmental, economic and social justice reasons. Liberalization of energy markets in Italy during 1999-2001 focused on lowering energy costs, increasing competitiveness and reducing emissions under the Kyoto Protocol. The United Kingdom introduced EEO schemes in the mid-90s as a tool for least-cost energy supply planning. Later, however, the primary motivations for the scheme have become energy security, emission reductions goals, and protecting socially vulnerable households from fuel poverty (Nadel et al., 2017).

This policy instrument has a good track record of stimulating energy efficiency investments. In the United States, in 2015 alone, obligated utilities invested $7.7 billion in energy efficiency, higher than any previous point in the U.S. Of that amount, investments in electric energy efficiency accounted for $6.3 billion, while the remaining was spent on natural gas efficiency programs (ACEEE, 2016a).

This instrument can be implemented on the national or subnational level, and both in liberalized and vertically integrated markets (IEA, 2014), which makes it a realistic policy option for Ukraine. The next section describes key elements of this policy mechanism.

## Key elements of energy efficiency obligation schemes

The structure of utility energy efficiency obligation schemes is similar across the countries and jurisdictions, which have implemented them (Nadel et al., 2017).In this section, we used an analytical framework, provided in the Regulatory Assistance Project report, done in collaboration with the

International Energy Agency (Crossley, 2012). We use this source for its comprehensive overview of these schemes implemented across many countries and regional jurisdictions. Specifically, this source compares energy efficiency obligation schemes enacted in 19 jurisdictions globally, drawing key features, similarities, differences, and best practices in designing and implementing energy efficiency obligations. We contribute to this framework by providing the most recent data, including country-specific features and program results with a particular focus on the experience of the United States and several European countries.

Utility energy efficiency obligations mandate utilities to achieve a certain multi-year level target in energy savings. A Regulatory Assistance Project report recommends considering the following program elements and requirements: policy objectives of schemes, legal authority, fuel and sectoral coverage, energy saving goals, obligated parties, compliance regime, measurement and verification, performance incentives, eligible measures, scheme administration, and certificate trading. Below are summary recommendations for each element.

**Policy objective**. A scheme should clearly and precisely state what goals it intends to achieve. An EEO program can pursue different goals depending on country-specific circumstances. For example, policy objectives can include:

- Decrease dependency on imported energy;
- Reduce energy bills for consumers;
- Protect low-income or vulnerable households from high energy bills;
- Improve reliability and stability of energy infrastructure, e.g., the power grid;
- Facilitate development of an energy efficiency industry and markets;
- Reduce greenhouse gas emissions and other energy-related pollutions

Since policy objective will have a direct impact on specific sectors, facilities, obligated parties, and fuels, it is one of the most important elements of the scheme, which requires careful consideration.

For example, the Commonwealth of Massachusetts in its “Green Communities Act” requires natural gas and electric utilities to mitigate capacity and energy costs by providing first all available energy efficiency and demand reduction resources that are cost-effective or less expensive than the cost of supply (Commonwealth of Massachusetts, 2016).

The states of Arizona, Hawaii, and Michigan also require utilities to achieve cost-effective energy efficiency improvements, while the states of Illinois, Pennsylvania, Nevada, and New Hampshire are pursuing energy efficiency improvements with a particular focus on low-income utility customers (ACEEE, 2017a).

Several European countries consider energy efficiency as a tool to reduce energy consumption and achieve long-term climate and sustainability targets. For example, Denmark aims to reduce total energy consumption by 7.6% in 2020 compared to 2010 and become fully independent from fossil fuels by 2050. To achieve these ambitious targets, the government of Denmark will pay particular attention to energy efficiency improvements in buildings (Bundgaard et al., 2013; Danish Energy Agency, 2018).

**Legal Authority.** Usually, countries use two main approaches to enact EEO schemes: legislation or regulation (Crossley, 2012). With the first approach, the purpose of enabling legislation is to remove any uncertainty on the legal authority and clearly state that energy efficiency is a valuable, cost-effective energy resource. Once enabling legislation is active, however, it might be difficult and time-consuming to change it. Therefore, policymakers should thoroughly plan, design, coordinate, and discuss the planned rules and program elements with all stakeholders.

Alternatively, an EEO can come in force with regulation, drawing on existing legal authority. Compared to new legislation, regulation provides more flexibility and makes it easy to adopt and, if necessary, to change the EEO rules.

As of September 2017, in the United States, 20 out of 26 fully-funded EEO programs, called energy efficiency resource standards, have been enacted through legislative authority, while the remaining six enforced via regulation(ACEEE, 2017a).

**Fuel and Sector Coverage.** In the United States, the majority of existing EEO schemes usually cover electricity and natural gas. However, EEO schemes can also target district heating, transport fuels, and LNG. This is especially the case in Europe, where several countries with active utility energy efficiency requirement schemes focus on all or specific fuels and sectors. The choice of fuel coverage largely depends on the specific policy objectives, as well as on the economically feasible energy efficiency potential for the targeted fuel.

In the United States, rapidly growing electricity demand and the resulting need to increase the capacity of power plants have forced utilities to seek less expensive options to meet energy demand. That is why most of the utility programs initially focused on electricity. Later, however, when utilities and state governments recognized the benefits of utility energy efficiency programs, they included natural gas in the requirements. In the European Union’s Energy Efficiency Directive, energy savings targets are set as a percent of all fuels and some programs target not only power and natural gas utilities. For example, schemes in Austria and Denmark also cover district heating utilities, while France covers all fuels (Nadel et al., 2017).

A scheme may focus on specific sectors and facilities. Depending on the policy objectives and targeted fuels, schemes can target different sectors. For example, many energy efficiency resource standard programs in the United States allow utilities to decide in which end-use sector to implement energy efficiency measures. This gives utilities greater flexibility to meet their targets in the most cost-effective way. In other countries, energy efficiency programs cover specific sectors. For example, the utility energy efficiency requirement program in the United Kingdom covers only residential sector (Rosenow and Bayer, 2016).

**Energy Saving Goals.** Setting energy savings targets is one of the most important elements in designing an EEO scheme. When making a decision and setting binding targets for utilities, policymakers should balance between making real progress on efficiency improvements with what is possible to achieve. In other words, targets should be aggressive, but at the same time realistic and economically feasible.

Depending on overall policy objectives and the targeted fuels, the energy saving goals can use a variety of units. Most common are MWh, MJ, or a ton of oil equivalent (toe). If the main policy objectives of the scheme are to improve efficiency and decrease emissions, then the units can be $tCO_2e$.

However, the EEO scheme that covers several fuels with different conversion factors (for example converting natural gas to electricity), usually has energy saving targets expressed in terms of primary energy. For example, under Article 7 of the EU Energy Efficiency Directive, member states should achieve 1.5% energy efficiency savings from annual energy sales to end-users through implementation of energy efficiency obligation schemes and/or other alternative policy (European Union, 2012). Member states should notify the European Commission about their specific plans to achieve these targets. Several countries decided to target several sectors in their schemes. Austria and Denmark, with a high share of district heating in their total energy use, decided to include district heating utilities in their energy efficiency obligation schemes. Since their schemes cover several fuels and sectors, they expressed savings target in terms of primary energy. Specifically, under Article 7, the cumulative energy savings target for the period 2014 to 2020 is 172.93 PJ for Denmark and 279 PJ for Austria (European Commission, 2013a, c).

**Setting energy savings targets in the United States and European Union.**

*The process of setting energy savings targets for utilities is similar in the United States and European Union (Article 7 of the EU's Energy Efficiency Directive). Suppose that policy makers require utilities to achieve a 1.5% annual energy savings target. This target does not mean that next year's energy sales will be 1.5% less than the baseline. Rather, this means that utilities should achieve next year savings that equal 1.5% of energy sales in the baseline year. Hence, if total energy sales next year would increase by 3.5% and utilities will save 1.5%, then overall energy sales will increase next year by only 2%. When designing an EEO, it is important to specify clearly what baseline energy sales are, as annual and cumulative energy savings targets will be linked to baseline energy sales. In the European Union, for example, baseline energy sales are calculated as average energy use during three-year period prior to the first year, when utilities should demonstrate compliance with annual energy savings targets. Therefore, if the three-year average annual energy use in Member State is 100 Mtoe and the annual savings target is 1.5%, then during first year savings should be 100*1.5%=1.5 Mtoe. If an EEO scheme lasts for 10 years, then total savings during this period will be 1.5 Mtoe * 10 years= 15 Mtoe.*

*Source: (DOE, 2011; European Commission, 2013b)*

Usually, jurisdictions with EEOs have targets for the next 10 to 20 years, which gives obligated parties a clear sense of the policy environment for long-term investments.

There are two approaches to calculating energy savings during the target period: first-year or lifetime savings. The first approach – the so-called "the first year" savings – is more suitable for simple, relatively low-cost energy conservation measures (ECM) with short payback periods. On the contrary, the second approach - calculating energy savings over the lifetime of the ECM – is preferable for more complex and expensive ECMs, such as comprehensive weatherization of a building.

Some countries established EEO schemes with additional sub-targets. These sub-targets can focus on additional policy objectives that might be relevant for a country's current social and economic conditions. For example, policymakers can require utilities to achieve a certain amount of their savings in low-income or other socially vulnerable households. Alternatively, an EEO can mandate some share of savings to come from weatherization or whole house retrofits.

**Obligated parties.** One of the distinctive features of an EEO scheme is that it directly mandates obligated parties to achieve a certain amount of energy savings within the fixed period. A decision on obligated parties largely depends on the policy objectives and fuels covered by the scheme. For example, if EEO schemes target primarily natural gas, then obligated parties should affect utilities that supply customers with natural gas. If a scheme aims to achieve energy efficiency improvements in the power sector, then energy savings requirements should affect the power utilities that sell electricity.

Obligated entities can meet their energy savings targets themselves or use third-party contractors. Usually, larger obligated energy utilities have more technical, financial and infrastructure capabilities to implement ECMs. Alternatively, obligated parties can involve private contractors, for example, Energy Service Companies (ESCOs).

Apart from identifying obligated entities, an EEO scheme should allocate specific energy saving goals for each individual party (for example a district heating company or an electricity retailer). Commonly, the EEO scheme assigns an energy savings target to each entity in accordance with its market share.

**Compliance regime.** It is important that a scheme administrator has all relevant information about the performance of the EEO scheme, both from the perspective of the overall program and from each obligated party. Hence, the compliance regime usually consists of several elements:

- Each obligated party reports to the scheme administrator on progress toward its energy saving goal;
- Obligated parties also must share measuring and verifying results;
- The administrator sets levies and penalties for non-compliance.

Regulators impose financial penalties against obligated parties, which fall short against its individual energy saving target and/or any sub-target within EEO. Penalties are critical to ensuring high levels of compliance. Moreover, the level of penalties for non-compliance should be high enough to motivate the obligated parties to meet their energy efficiency targets. In other words, it should be cheaper for utilities to meet targets than pay penalties for non-compliance.

For example, Washington State imposed a flat administrative penalty of $50 for each 1 MWh of the shortfall, which automatically adjusted for inflation (Washington State Legislature, 2018). Similar provisions exist in the State of California, where obligated utilities should pay penalties if their compliance with savings target is 65% or below. Utilities should pay 5¢ for every kWh, 45¢ for every therm and $25 per kW for each unit below the savings goal. Penalty rates increase when compliance with targets is below 50% (CPUC, 2007).

**Performance incentives.** While financial penalties motivate obligated parties to meet their targets, financial incentives motivate them to go beyond their targets and/or achieve additional sub-targets. Usually, obligated parties are eligible for performance incentives if they:

a) Achieved higher energy efficiency savings;
b) Implemented particular types of ECMs;
c) Conducted whole-building energy retrofits instead of single, simple efficiency measures;
d) Targeted hard-to-reach energy consumers.

The primary goal of performance incentives is to achieve energy savings and other sub-targets ahead of the established deadline of the scheme. Apart from achieving targets ahead of deadlines (for example, achieving the annual target in just nine months), performance incentives can also provide obligated parties with an additional source of revenue.

In the U.S., the majority of states with energy efficiency resource standard programs have implemented some form of incentive mechanism to motivate utilities to achieve and overachieve energy savings targets. To illustrate, in the state of Minnesota, utilities get a financial incentive of $0.07 for each kWh between the minimum compliance level and 100% compliance. If utilities overachieve savings targets by up to 25%, the incentive rate increases up to the maximum level of $0.0875/kWh. To accumulate funds for incentive payments, state public utility commissions usually set aside some funds from ratepayers' charges (NREL, 2014).

**Eligible energy savings.** Usually, there are several options available for obligated parties to meet their targets:

- Plan, organize and implement eligible energy efficiency measures (see next sub-section below) and projects;
- Involve third-party contractors (usually energy service companies) to implement energy efficiency projects;
- Procure verified energy savings from a third party.

While allowing obligated parties to engage third-party contractors in implementing ECM on their behalf can increase schemes' administrative and financial burden (mainly because of the need for robust M&V systems), it will provide more flexibility in achieving the energy saving targets. However, it will be the sole responsibility of obliged utilities to achieve the energy savings targets, regardless of whether they can involve third-party contractors or not.

Energy efficiency measures implemented by third parties on behalf of obligated utilities require robust measurement and verification of savings. In some countries, non-obliged parties can generate and trade eligible energy savings. For example, in Italy, France, and Australia, EEO schemes allow non-obliged parties, such as ESCOs, to implement energy efficiency measures, as well as generate and trade eligible energy savings with obliged utilities. However, the majority of existing schemes allows trading of savings only between obliged parties (Lees and Bayer, 2016).

**Evaluation and M&V.** Measurement, verification, and evaluation are very important elements of the EEO schemes. A robust and clear M&V system prevents utilities from reporting overstated savings and other frauds, which can reduce overall performance and cost-effectiveness of the program (NREL, 2014). In addition, a comprehensive M&V system allows scheme administrators, such as utility commissions or regulators, to:

- Track overall progress of the scheme;
- Evaluate the economic efficiency of the scheme;
- Change the design of the scheme based on experience gained and changing circumstances.

There are two general approaches to energy savings measurements:

a) Deemed savings method for predefined ECMs;
b) Measurement-based method (EPA, 2015).

The deemed savings method assumes verification of pre-calculated energy savings from measures with well-known and documented performance characteristics. Such measures can be the replacement of lighting equipment, refrigerators or other equipment with well-known and proven savings characteristics. Although this method is not precise and accurate compared with direct measurements it can be used for verification of single and simple energy conservation measures. It also simplifies evaluation and M&V processes, while reducing administrative costs and burden (EPA, 2015).

While deemed savings is more suitable for single and simple energy savings measures, more complex and comprehensive energy efficiency projects require a measurement-based approach to evaluate and verify achieved savings. The most common and widely used measurement-based method is the International Performance Measurement and Verification Protocol (IPMVP).

Evaluation and M&V can be carried out by the regulator (or program administrator), but the most common approach is to involve an independent third-party company (NREL, 2014). For example, the State of Vermont requires verification of energy and capacity savings, reported by the responsible utilities (State of Vermont, 1999). In Denmark, the EEO scheme requires energy distributors to verify, document, and report savings. The country's energy authority inspects submitted documentation every year (Crossley, 2012).

**Trading of energy savings and White Certificates.** To increase the overall efficiency of the EEO scheme, some countries establish an energy savings trading system. The world's first energy savings trading mechanism has been implemented in State of New South Wales in Australia (Nadel et al., 2017). In

Europe, responsible utilities can trade energy savings in Denmark, United Kingdom, Italy, France, and Ireland (Lees and Bayer, 2016). Trading of savings in the United States is not common, as regulators focus more on achieving targets within utility service areas and among end-users who are paying for the utilities' energy efficiency programs through additional charges on their bills (Nadel et al., 2017). At the same time, as was mentioned earlier, utilities in some states have performance incentives for overachieving savings target and penalties for non-compliance, which can be viewed as an alternative to the trading of energy savings.

In some countries, obligated entities as well as non-obligated third parties can generate and trade energy savings. For example, in Italy, even non-obligated parties can generate and trade savings, but this approach is not common worldwide. As different parties can achieve the same amount of energy savings at different costs, the trading system engages market forces and achieves eligible energy savings in the most cost-effective way. Parties can trade energy savings either bilaterally or through the established market administrator. The EEO scheme administrator or, more commonly, a third-party organization can carry out functions of the energy saving market administrator (Crossley, 2012).

The energy savings trading system usually involves creating and trading energy efficiency certificates or White Certificates (hereinafter termed "certificates"). The market administrator issues and tracks certificates to represent a specific amount of energy savings achieved. Each certificate is unique and provides property rights. This allows the market administrator to avoid double counting (Crossley, 2012).

Establishing and operating a market for energy savings certificates can increase the overall administrative cost of an EEO program. For example, in Europe, administrative costs of EEO schemes are usually less than 0.5% of total program costs with the exception of Italy, where administrative costs account for almost 1.5%. One of the possible reasons for high program costs in Italy compared with other countries is a high share of traded certificates, which leads to an increased administrative burden (Rosenow and Bayer, 2017).

In addition to the extra cost of the certificate trading system, this element of the scheme requires some experience and administrative capacity to be effective. It can take years to build a successful EEO trading system.

**Funding.** To meet EEO targets, obligated parties incur certain costs. The choice of the cost recovery mechanism largely depends on whether obligated parties are operating in regulated or unregulated markets.

In regulated markets, the energy regulatory authority establishes methodologies and procedures for obligated parties' to recover their costs of meeting energy savings targets as well as compensation for decreased energy supply. For example, if responsible companies under the EEO scheme are distribution companies, which is common in the United States, the program costs are collected through end-users' bills (Nadel et al., 2017).

In unregulated energy markets, there are two main options for obligated parties to recover costs:

1) Obligated parties adjust their prices in accordance with the costs incurred, passing costs on to end-users;
2) The government provides financial support in the form of direct budget appropriations or through energy sales surcharges, collected by regulated energy utilities, such as network system operators and operators of district heating networks (Crossley, 2012).

For example, in some European countries and Australia, where obligated parties are energy retailers, they decide whether or not to pass costs to meet savings obligations to end-users. In countries where obligated parties are energy suppliers, the suppliers tend to focus on simple, low-cost energy efficiency measures, rather than comprehensive energy efficiency projects (Nadel et al., 2017).

**Role of EEO Administrator**. Effective implementation of an EEO scheme fully depends on the scheme administrator. It should have legal authority, as well as strong technical and administrative capacity. Administrator functions can include:

- Setting eligible ECMs and (if needed) deemed energy saving values;
- Organizing random energy audits to verify claimed energy savings;
- Monitoring compliance against the targets; enforcing and if necessary penalizing obligated parties for non-compliance;
- Issuing, registering and tracking energy certificates;
- Managing the energy savings market;
- Reporting the annual performance and scheme results to the government and public (Crossley, 2012).

In the United States, public utility commissions usually administer and evaluate the performance of the EEO schemes (EPA, 2015). In Europe, energy regulators administrate EEO schemes only in the United Kingdom, Portugal and to some extent in Poland, while in many other cases, a government ministry or energy agency administers the program (Lees and Bayer, 2016).

Appendix 1 provides the description of the EEO schemes in Denmark, France, Poland, the United Kingdom, and some states of the U.S. It shows that countries enact EEO schemes for different reasons, according to country-specific circumstances. For example, in France and Poland energy efficiency improvements are a primary policy objective of their schemes, while the government in the United Kingdom also aims to achieve certain climate and societal targets, such as reduction of carbon emissions and protection of socially vulnerable households. Because of these differences in policy objectives, the EEO schemes in these countries cover different fuels and target different sectors. Another striking difference is how countries set their targets. Specifically, Denmark established its targets in primary energy, France in cumulative TWh during the compliance period, Poland in TWh by a specific date, and the United Kingdom in lifetime savings in $MtCO_2e$. Overall, the design of EEO schemes varies greatly across countries and largely depends on local circumstances and overall policy objectives.

## Results of EEO schemes

In the United States, EEO schemes provide society and stakeholders with multiple benefits. First, this instrument gives flexibility to utilities to achieve their savings targets. Second, EEO schemes set defined savings goals for the utilities, which allow them to integrate efficiency investments into their long-term operation plans while enabling regulators to track the performance of the schemes. Third, the flexibility of the schemes allows utilities to minimize the cost of saving energy hence increasing cost-effectiveness and societal benefits of the program. Finally, the mandatory nature of the EEO schemes ensures steady progress in energy efficiency improvements, which in turn provides other economic, environmental and health benefits (NREL, 2014).

For example, in 2015 alone, utilities in Texas invested $123 million in energy efficiency projects, which saved almost. These programs also reduced load by 390 MW (Texas Efficiency, 2015). Overall, EEO programs in the United States resulted in a 1.2% increase in electricity savings, compared with just 0.3% in states without an EEO (ACEEE, 2017b). In addition, the EEO schemes demonstrated high-cost effectiveness for ratepayers. For example, the State of Vermont's EEO program reports savings of $2 for each $1 spent on electricity demand reduction programs. Moreover, the cost of saved energy (measured as the levelized cost of electricity for energy efficiency programs) is only 1.9 cents per kWh of electricity demand, which is almost 5 times lower than 9.4 cents per kWh of the average cost of electricity supply (Efficiency Vermont, 2017). In the State of Massachusetts, obliged distribution companies delivered electricity savings at a cost of 3.4 cents/kWh, while the average cost to supply that electricity would otherwise be 16.9 cents/kWh (Massachusetts EEAC, 2015). Overall, as of 2016, the average cost of electricity saved across the United States was 3 cents/kWh, while electricity supply from new fossil-fueled power plants would cost 7–13 cents/kWh (ACEEE, 2016b).

The experience of the EU member states demonstrates similar results. EEO programs in the United Kingdom, Denmark, France, Italy, and Austria found these schemes were highly cost-effective. The cost of saved energy varies from 0.4 Eurocents/kWh in France to 1.1 Eurocents/kWh in the United Kingdom, which is significantly lower than retail electricity prices (Rosenow and Bayer, 2016).

**Table 1.** Comparison of cost of saved energy and retail prices.

| | Time Period | Weighted average EEO cost of lifetime energy savings (Eurocent/kWh) | Weighted average retail prices (Eurocent/kWh) | Incremental annual savings compared to final energy use |
|---|---|---|---|---|
| **Vermont, Unites States** | 2012-2014 | 3.2 | 11.57 | 1.7% |
| **California, United States** | 2009-2011 | 2.1 | 12.24 | 1% |
| **United Kingdom** | 2008–2012 | 1.1 | 10 | 0.5% |
| **Denmark** | 2015 | 0.5 | 13 | 4.2% |
| **France** | 2011-2013 | 0.4 | 9 | 0.4% |
| **Italy** | 2014 | 0.7 | 9 | 0.4% |

| | | | | |
|---|---|---|---|---|
| **Austria** | 2015 | 0.5 | 8 | 0.9% |

**Source:** (Rosenow and Bayer, 2016).

The cost of compliance with the EEO scheme in these countries accounts for only 1-5% of the average energy bill.

**Table 2.** Comparison of costs of EEO schemes as a share of energy bills.

| | Cost as a share of the average energy bill | | |
|---|---|---|---|
| | **Residential sector** | **Industry sector** | **All sectors** |
| **Vermont, Unites States** | 6% | 6% | N/A |
| **California, United States** | 1.5% | 1.4% | N/A |
| **United Kingdom** | 2% | N/A | N/A |
| **Denmark** | 2% | 5% | N/A |
| **France** | N/A | N/A | 0.5-1.0 % |
| **Italy** | 1% | N/A | N/A |
| **Austria** | N/A | 0.9% - 1.4% | N/A |

**Source:** (Rosenow and Bayer, 2016).

Therefore, the EEO programs in both the United States and the EU member states demonstrated a high level of cost-effectiveness. Despite the difference in scheme design, policy objectives, and regulatory environment, the cost of compliance with EEO targets has not exceeded 6% of the average energy bill for energy users (Rosenow and Bayer, 2016).

## PART 2. Best Practices in the Development of Utility Renewable Energy Requirements

In the previous part, we described how utility energy efficiency requirements have helped many countries and states increase their level of energy efficiency. A similar policy instrument, utility renewable energy requirements, exists for renewable energy. In many countries, this instrument is called a renewable portfolio standard (RPS).

While EEO and RPS programs have different areas of focus – energy efficiency and renewable energy, respectively – structurally they are similar and share common features. Both EEO and RPS programs provide utilities with the flexibility to achieve their targets. Depending on the policy objectives of the schemes, policymakers can target specific sectors and/or fuels. As is the case with EEOs, RPS programs can provide utilities with several compliance mechanisms, such as renewable energy certificate trading, financial penalties for non-compliance and incentives for exceeding targets. While an EEO requires utilities to achieve certain energy efficiency improvements, an RPS mandates utilities to meet a specific share of energy supply from eligible renewable energy sources. To comply with renewable energy targets, obligated utilities should meet established annual targets. At the same time, policymakers can design the RPS program to promote specific renewable energy technologies.

Jurisdictions adopt RPS's because they would like to increase the share of renewable energy in their energy mix in a cost-effective way.

There are three commonly used instruments to support the development of renewables worldwide: feed-in-tariffs, Renewable Portfolio Standards (RPS) and competitive auctions. In 2016, 110 countries and sub-national jurisdictions had an active feed-in-tariff mechanism, while 100 countries and sub-national jurisdictions had an RPS. Thirty-four jurisdictions globally held renewable energy auctions for renewable capacity in 2016 (REN21, 2017).

This part of the report focuses only on RPS for several reasons. First, structurally they are very similar to EEOs. Similarities and common design features of EEO and RPS can make it easier for policymakers to design and enact these schemes for the first time. Second, simultaneous deployment of both instruments can improve policy interaction between two instruments and thus increase the overall efficiency of the schemes, while achieving policy objectives. Both instruments facilitate progress in energy improvements and renewable energy deployment. Finally, RPS programs have proven to be a cost-effective option for increasing renewables in the energy mix.

**What is an RPS scheme?**

An RPS is a policy instrument that mandates utilities to achieve a certain minimum quantity of electricity supplied by eligible renewable energy technologies by a specific date. In different countries, this instrument has different names including Utility Quota Obligations, Renewable Electricity Standard, Renewable Obligations, and Tradable Green Certificates. For simplicity, here and after we use term Renewable Portfolio Standard or RPS.

One of the main differences between a feed-in-tariff and an RPS scheme is who sets the price and quantity of renewable energy. Under the feed-in-tariff scheme, the government sets a fixed price for specific renewable energy technologies and allows the market to determine the quantity of energy supplied by renewable energy. In case of an RPS, it is the opposite. The government sets binding obligations on utilities to achieve a certain share of renewable energy in their portfolio within a specific timeframe (see Table 3).

**Table 3.** Comparison of different instruments to promote renewable energy.

| Instrument | Who sets price/quantity of renewables |
|---|---|
| RPS | Government obliges energy suppliers to achieve a minimum share of renewable supply in their portfolios (quantity)<br>Price is a result of competition between generators to supply the required quantity (in some cases through trading "green certificates") |
| Feed-in-tariff | Government sets price and market defines quantity |
| Competitive procurement (tenders) | Government (or utility) sets quantity; prices awarded on competitive basis. |

**Source:** (World Bank, 2012).

In theory, because of this difference, an RPS scheme should drive more competition and hence should deliver least-cost generation from renewable energy compared with a feed-in-tariff mechanism (CESA, 2012). In practice, however, the cost-effectiveness of both schemes varies from country to country and largely depends on the schemes' design and other external factors.

U.S. states were among the first to adopt an RPS program. According to the most recent data, RPS's have been responsible for about half of the total renewable energy increase in the U.S. since 2000 (LBL, 2017).

RPS programs in the U.S. have generally been cost-effective. In states with an RPS, the cost of compliance with RPS targets constitutes only 1.6% of average, retail electricity prices. Overall, as of February 2017, 29 states, three territories, and Washington D.C. have enacted an RPS (DSIRE, 2017a). Each state has its own targets, timeframes, and eligible technologies. Historically, the majority of RPS schemes focus on renewable energy in the power sector. However, some states are also including requirements for heating from renewable sources in their RPS programs (CESA, 2015).

Apart from the U.S., many other jurisdictions in the EU, Australia, China, United Kingdom, and South Korea have also enacted RPS schemes. Because the U.S. has a long history and the most diverse experience of developing and implementing RPS programs, the following chapter mainly covers design elements based on examples from the U.S.

## Key elements of renewable portfolio standard programs

Before establishing an RPS, policymakers should consider the following aspects:

- Evaluation of resources available and their geographic characteristics;

- Assessment of costs for different renewable energy technologies;
- Appraisal of required power grid infrastructure to meet RPS targets;
- Interaction with other national and sub-national policies.

RPS design can vary significantly across countries. To meet its policy objectives, an RPS requires comprehensive planning and analysis to address a country's specific circumstances. Key elements and characteristics of an RPS are similar to those of EEO schemes, described in the first part of this report.

**RPS targets and timeframe.** When setting RPS targets, policymakers face tradeoffs between economic cost and benefits for society. Setting very ambitious and aggressive targets without proper planning may result in overall scheme failure or rapid increase of energy costs for end-users. At the same time, establishing targets that are only marginally incremental to the existing pace of renewable energy development can lead to inefficient use of resources (for example to run the program).

Countries and local jurisdictions establish RPS targets that fit their respective policy objectives. Generally, there are five main groups of policy goals for RPS programs (CESA, 2012).

**Table 4.** Possible policy objectives for an RPS.

| Groups of goals | Examples |
|---|---|
| **Energy system goals** | • Reduce country's dependence on nuclear energy or fossil fuels<br>• Increase domestic energy supply<br>• Decrease energy imports and strengthen energy security<br>• Protect end-users from energy price shocks on international energy markets<br>• Strengthen grid reliability and stability of power supply |
| **Environmental goals** | • Reduce GHG emissions<br>• Improve air and water quality<br>• Protect forests and lands from deforestation |
| **Socio-economic goals** | • Stimulate green job creation<br>• Boost local and national economy by stimulating development of specific RES industry |
| **Technology development goals** | • Establish enabling regime that favors abundant local, renewable resources |
| **Administrative and political goals** | • Raise public awareness and support for RES<br>• Make the country/region a prominent leader in sustainable energy development |

**Source:** Adapted from (CESA, 2012).

Many countries focus their RPS schemes on the electricity sector and hence establish targets in terms of electricity supply or generation. This is the case in the United States, where most of the state schemes require electric utilities to achieve a certain amount of renewable energy in their supply portfolio within a specific period.

**Table 5.** RPS targets and timeframe in selected states**.**

| | RPS target | Timeframe |
|---|---|---|
| **California** | 50% of electricity supply | 2030 |
| **Vermont** | 75% of electricity supply | 2032 |
| **Nevada** | 25% of electricity supply | 2025 |
| **Massachusetts** | 15% of electricity supply | 2020 |
| **Hawaii** | 100% of its net electricity sales | 2045 |

**Source:** (DSIRE, 2017a).

Usually, RPS schemes have medium- to long-term timeframes to allow obligated parties to meet their targets. The period of the scheme should be adequate to meet the goals. Once parties gain more experience in compliance with RPS targets, the government can revise them and set more aggressive renewable energy goals.

RPS schemes not only establish final targets and deadlines for obligated parties to meet these targets but also a compliance schedule. For example, the RPS enacted in California (DSIRE, 2017b) has interim renewable energy targets for utilities every three years before 2030 (for example 40% of retail sales by the end of 2024; 45% of retail sales by the end of 2027 and 50% of retail sales by the end of 2030).

For an effective RPS scheme, it is critically important that RPS regulations clearly state which obligated parties should achieve the specified amount of renewable energy in their portfolio and by when.

**Eligible technologies.** The RPS should clearly state the parameters of qualified renewable energy technologies and sources. These parameters include source-type, generation technology, capacity thresholds, and the extent to which it is distributed.

Typically, obligated parties will use least-cost technologies to meet their targets. Hence, if policymakers want to promote the development of a specific type of technologies or increase utilization of particular energy sources, they can make these technologies eligible (or even required) for meeting the RPS targets. For example, as of February 2015, 26 states have included combined heat and power technologies as eligible to meet RPS targets (EPA, 2015).

Similarly, some states mandated that a certain portion of their RPS requirement come from renewable thermal energy sources. For instance, New Hampshire requires utility providers to achieve almost 9% of their total RPS target from renewable thermal technologies by 2025. Eligible technologies include heat pumps, biomass, and combined heat and power (New Hampshire Government, 2017).

In addition to traditional renewable energy technologies such as wind and solar, several states define coal mine methane as a renewable energy source, eligible for RPS. Specifically, Utah and Pennsylvania included abandoned mine methane in their RPS and made it qualified for the trading of renewable energy certificates. Other U.S. major coal-producing states, such as Colorado, Ohio, and West Virginia included methane utilized from active coal mines in their RPS. In all cases, this led to an increase in methane utilization, which provides an additional energy source, while providing significant, environmental and safety benefits.

To avoid any confusion and misunderstanding, RPS enabling regulations should clearly state which technologies qualify for RPS.

**Compliance and renewable energy certificates.** There are three common ways for retail power utilities to meet RPS requirements:

- Purchase electricity from a renewable energy supplier via long-term power purchase agreement;
- Purchase renewable energy certificates (REC) from another utility;
- Pay fines for any shortfalls (Cox and Esterly, 2016).

However, if obligated parties are operating in monopolistic, regulated markets, they can also comply with requirements by directly owning power generation from eligible technologies (LBL, 2015).

One REC equals 1 MWh generated from eligible renewable energy sources and delivered to the grid (EPA, 2017). A REC trading market gives utilities more flexibility and allows them to comply with RPS targets in a cost-effective way (Holt and Bird, 2005).

To improve enforcement and increase compliance with targets, RPS schemes usually impose fines for non-compliance. In the United States, these fines are called Alternative Compliance Payments (ACP). The ACP amount depends on the gap in MWh compared to the RPS target. What distinguishes ACPs from traditional penalties is that utilities can pass the cost of ACP on to ratepayers and thus recover the cost of the APC. If the RPS mandates a certain share of the target should come from a specific technology, for example, solar energy, the regulator may set the ACP rate for this technology higher than for general RPS obligations. Hence, for obligated parties, it is cheaper to meet established targets for this technology than to pay the ACP for non-compliance (CESA, 2012).

**Policy interactions.** It is important to consider interactions between an RPS and existing or potential policies to achieve broader policy objectives and outcomes. This is especially the case for energy efficiency improvements. Some states enact combined RPS and energy efficiency targets. For example, Nevada's RPS allows utilities to achieve a certain share of their RPS targets with energy efficiency. Specifically, utilities can achieve up to 25% of their annual RPS targets from energy efficiency measures. Moreover, half of this 25% should come from measures implemented in the residential sector (State of Nevada, 2017). In 2016, two electric utilities met Nevada's RPS targets and saved almost 1.2 TWh of electricity, which represents 20% of the total RPS target for that year (NV Energy, 2016). The States of North Carolina and Hawaii also enacted programs that allow utilities to achieve some portion of their RPS targets with energy efficiency.

Although combined RPS and energy efficiency programs in the United States are not very common, they can provide utilities additional flexibility in achieving targets. This flexibility comes from the key difference between RPS and energy efficiency programs. Namely, constant progress and deployment of renewables under the RPS primarily depend on the availability of resources such as wind, solar, and biomass, whereas energy efficiency measures can be implemented everywhere regardless of resource availability (Dillingham, 2014).

The interaction between national and regional policies can further facilitate sustainable energy development. While RPS programs in the United States drive the development of renewable energy at the state level, federal incentives, such as the Production Tax Credit for wind energy and the Investments Tax Credit for solar energy provide financial incentives for developers. Hence, federal incentives help states achieve their RPS targets by providing financial support.

## Results of RPS schemes

Despite some concerns over the high cost of compliance with an RPS, the real impact of RPS compliance is quite modest. Analysis shows that the average cost of compliance with RPS targets is just 2% of retail electricity bills (LBL, 2017).

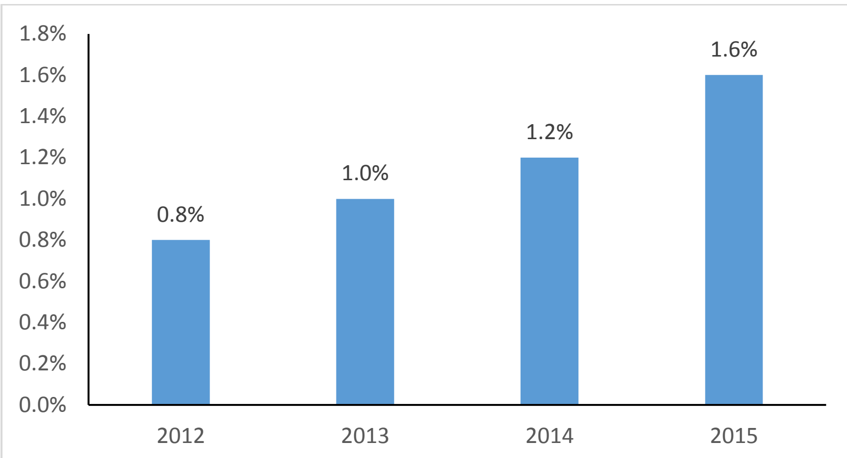


**Figure 2.** Weighted average RPS Compliance Costs across the United States as a percentage of average retail electricity bills.
**Source:** (LBL, 2017).

Even if there will be a phase-out of the federal tax credit programs (Production and Investments Tax Credit), which will lead to an increase in the cost of compliance, part of this increase will likely be offset by a continued reduction in the cost of renewable energy sources.

Figure 3 below provides trends in the levelized costs of energy in North America market from 2009 to 2017.

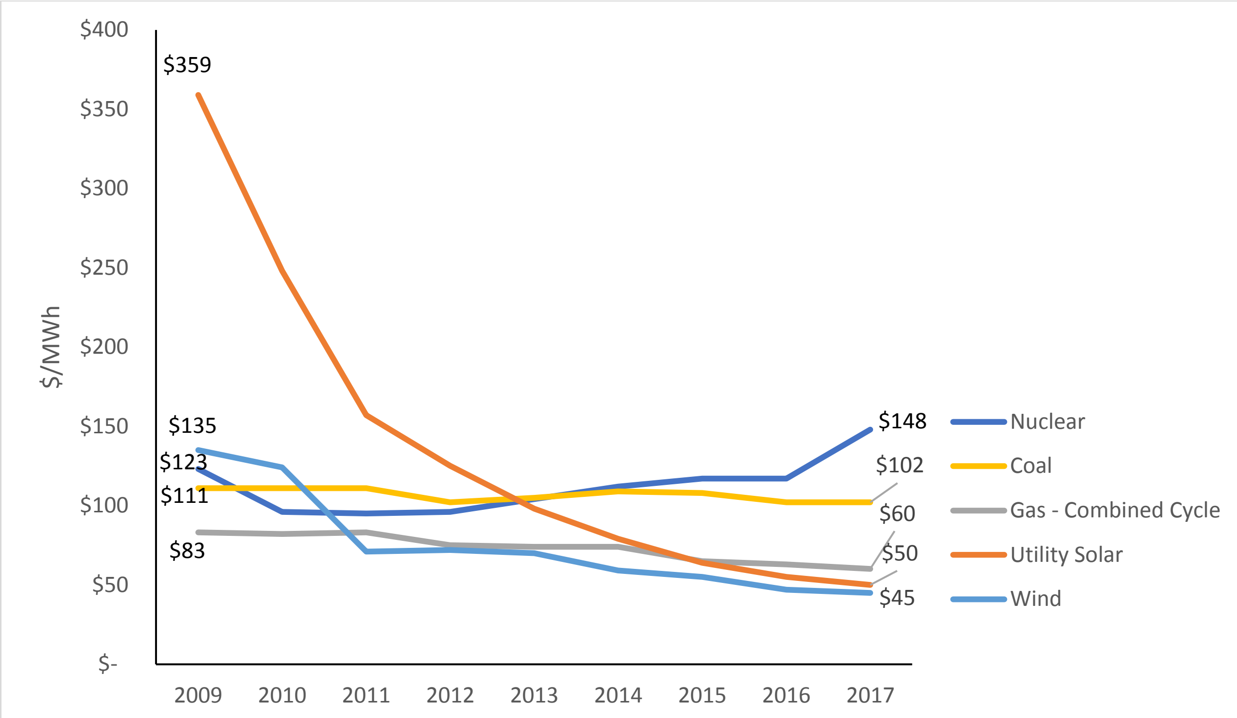


**Figure 3.** Trends in levelized cost of energy of renewables and fossil fuels, 2007-2017.
**Source:** (Lazard, 2017).

## Conclusions

EEO and RPS programs can help improve energy security and reliability, while reducing pollution. This report focuses primarily on EEOs, but because of the many structural similarities between EEOs and RPS's, we describe key features of both.

Utility EEOs are market-based instruments to promote energy efficiency in generation, transmission, and end-use energy consumption. EEO programs require utilities to achieve a certain level of energy savings within a specific timeframe. The design of EEO schemes varies across jurisdictions, but several common elements are crucial for any EEO scheme, including defining the policy objectives, obligated parties, sectors and facility coverage, eligible energy conservation measures, timeframe, compliance regime, measurement, and verification approach, and funding. In Europe and the United States, typical EEO programs cost less than does not 6% of the average energy bill, while saving energy-users a significantly larger amount.

In short, an effective EEO scheme requires comprehensive planning and analysis. A few of the specific benefits of comprehensive and well-designed EEO programs include helping to meet electricity demand in a cost-effective way, reducing peak loads, lowering energy bills for participants and delivering other benefits to society.

An RPS is a policy instrument that mandates utilities to achieve a certain minimum quantity of electricity supplied by eligible renewable energy technologies by a specific date. Since 2000, RPS programs have been responsible for about 50% of the total renewable energy increase in the United States. Currently, more than 30 jurisdictions in the United States have active RPS programs. While most of the programs focus on the development of renewable generation in the power sector, some states also have requirements for heating from renewable sources in their RPS's.

The main elements and design features of an RPS are similar to those of EEO schemes. Policymakers have many options in designing an RPS. The programs can target specific technologies, provide several ways to comply with requirements and have penalties for non-compliance. In the United States, the cost of compliance for ratepayers currently represents just 2% of the average, retail electricity price.

The implementation of utility-based instruments can help Ukraine to achieve its targets under the National Energy Efficiency Action Plan and National Renewable Energy Action Plan until 2020. In addition, EEO schemes can help Ukraine integrate EU energy efficiency legislation into the national legal framework.

## Appendix 1. Design of EEO Schemes in Selected Countries and Jurisdictions.

| | Denmark | France | Poland | United Kingdom |
|---|---|---|---|---|
| **Policy Objective** | Reduce total energy use by 2% in 2012 and 4% to 2020 | Utilize available energy efficiency potential in France | Improve energy efficiency in public sector | Reduce energy bills and carbon emissions of homes |
| **Legal Authority** | Legislative framework and voluntary agreements | Combination of legislative and regulatory framework | Combination of legislative and regulatory framework | Legislative and statutory framework |
| **Fuel Coverage** | Electricity, natural gas, district heating, heating oil | All fuels including district heating and cooling | Electricity, natural gas, and district heating | Electricity and natural gas |
| **Sector and Facility Coverage** | Residential, public, private, energy-intensive end-users | Residential and commercial buildings; industry, transport | End-use sectors; savings in obligated parties' own activities | Residential dwellings with focus on low-income groups |
| **Energy Saving Target/ Sub-target** | 2.95 PJ for 2006-09 (0.7% of total energy use); 6.1 PJ for 2010-12 (1.2% of energy use) | 54 TWh cumac for 2006-09; 345 TWh cumac for 2011-13; Sub:90 TWh for transport fuels | 53 TWh by 2016;<br>Sub: 80% of certificates are to be issues from end-use ECMs | Lifetime savings of 293 $MtCO_2e$ for 2008-12; Sub: 40% of target met at low-income/elderly groups |
| **Obligated Parties** | Suppliers of electricity, natural gas, district heating, heating oil | Retailers which supply covered fuels | Electricity, natural gas, and district heating utilities | Electricity and natural gas suppliers and certain power generators |
| **Compliance regime** | Savings must be verifiable by a third party | Surrender of energy efficiency certificates | Surrender of energy efficiency certificates | Determined by regulator based on measurement of carbon reductions by obligated party |
| **Penalty** | 0.1 EUR/kWh of shortfall;<br>the utility can lose license | 0.02 EUR/kWh lifetime final energy shortfall | Max EUR 2 million for non-compliance | May be imposed for non-compliance |
| **Eligible ECMs** | Includes energy audits, subsidies for efficient appliances, equipment, and even small-scale renewables | Standardized and non-standardized ECMs that also focuses on fuel poverty, education, innovations | According to the list of eligible ECMs, otherwise, approval by the ministry needed | ECMs in residential dwellings |
| **Reporting and M&V** | Distributors verify and report savings; can be calculated or deemed savings | Deemed savings for standard ECMs, otherwise regulatory approval needed | Savings of more than 100 toe have to be verified by audit | Deemed savings or estimated savings approved by the regulator |
| **Trading of White Certificates** | Savings can be traded only between obligated parties | Over-the-counter trading of energy efficiency certificates | Fully tradable at the Polish Power Exchange Market | Transfers and trading allowed among obligated parties |
| **Funding/ Cost recovery** | Through tariffs | Through tariffs | Through tariffs for electricity, heat, natural gas | Passed on to the customer through increased prices |

| | California, United States | Connecticut, United States | Massachusetts, United States | New York, United States |
|---|---|---|---|---|
| **Policy Objective** | Achieve 100% of cost-effective energy efficiency and reduce total consumption by 10% within ten years | Achieve all cost-effective energy efficiency | Achieve all available energy efficiency and demand reduction resources | Decrease electricity use by 15% by 2015 and natural gas as efficiently as possible |
| **Legal Authority** | Combination of legislation and regulation | Combination of legislation and regulation | Combination of legislation and regulation | Regulation |
| **Fuel Coverage** | Electricity and natural gas | Electricity, natural gas, propane, and heating oil | Electricity and natural gas | Electricity and natural gas |
| **Sector and Facility Coverage** | New construction; HVAC; and low-income end-users | All sectors and end-users | All sectors and end-users | All sectors and end-users |
| **Energy Saving Target/ Sub-target** | 6,965 GWh (0.9% of sales), 1,537 MW, and 150 million therms in 2010-2012 for investor-owned utilities; 700,000 MWh for publicly owned utilities | Regulator sets targets for each obliged party individually | 1.4% of retail electricity sales in 2010, 2% in 2011, and 2.4% in 2012; 0.6% of retail gas sales in 2010, 0.9% in 2011, and 1.15% in 2012 | 0.5% electricity savings in 2008 increasing by 2% each year through by 2015; 4.34 Bcf annual natural gas savings through 2011, and 3.45 Bcf after 2011 |
| **Obligated Parties** | Investor-owned and publicly owned electricity and natural gas utilities | Electricity retailers, municipal utilities, and natural gas utilities | Electricity and gas retailers | Investor-owned electricity utilities plus large municipally owned electricity utilities |
| **Compliance regime** | Obligated utilities implement approved energy efficiency programs and report the results | Obligated parties must prepare and implement annual plans | Obligated utilities jointly file a 3-year statewide plan; regulator determines compliance | Utilities submit annual plans and reports to regulator |
| **Penalty** | Yes, if achievement is below 65% of target | None | USD 0.05/kWh or USD 1 per therm below target | None |
| **Eligible ECMs** | Measures included in 12 statewide energy efficiency programs | ECMs mentioned in annual plans and approved by regulator | ECMs mentioned in joint 3-year plan and approved by regulator | Defined by regulator |
| **Reporting and M&V** | Comprehensive third-party verification | Deemed savings and technical simulation for comprehensive projects | Conducted by obliged parties | Utilities responsible for setting M&V protocols |
| **Trading of White Certificates** | None | Obligated parties can buy from third-party contractors | None | None |
| **Funding/ Cost recovery** | Public goods charge and natural gas DSM charge; additional funding through rate cases | System benefits charges, funding from carbon, capacity markets | System benefits charges, funding from carbon, capacity markets | Through base rates or cost recovery tariffs |

**Source:** Adapted from Crossley (2012).

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