



European
Commission



OVERVIEW OF HEATING AND COOLING

PERCEPTIONS, MARKETS AND
REGULATORY FRAMEWORKS FOR
DECARBONISATION

Deliverable 5: Overview of the existing EEOS,
recommendations for improved design and analysis of the role
of district heating and heat pumps in EEOS (Task 5)

N° ENER/C3/2019-487



CELEBRATING
525 YEARS
1495 – 2020



Imprint

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European Commission, DG Ener, Brussels, Belgium

Published: August 2022 - Deliverable 5.1, 5.2 and 5.3

PDF ISBN 978-92-76-61534-7 doi:10.2833/991474 MJ-03-22-284-EN-N

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1 Executive Summary

The objective of this study is to analyse the role of heating and cooling in the context of energy efficiency obligation schemes (EEOS). The energy efficiency obligation schemes (EEOS) are market-based instruments and should be applied to generate the final energy savings as recommended and mandated in Article 7 of the Energy Efficiency Directive (EED). The EEOS are applied in the majority of EU Member States, either as sole policy measure or accompanied by alternative measures (see Task 5.1).

Regarding the overall design of EEOS, a proposal to harmonise the Member States' schemes along best practice cases and experiences is developed in this study (Task 5.3). However, this does not mean by default that these recommendations should be applied uniformly across the European Union. The EEOS are often adapted to national circumstances and used to tackle other national policy objectives. Therefore, these recommendations should not be seen as a fixed blueprint that every member state must comply with, but rather as guidelines to alleviate some of the problems encountered in the past and to profit from best-practice examples.

An EEOS is designed for optimal exploitation of cost-effective energy efficiency potentials. However, these economic potentials are often not aligned with overall climate mitigation targets, in particular with regard to heating and cooling, since the technologies most expedient for the fight against climate change are often more expensive than their alternatives. As a result, EEOS need to be adapted to better incentivise the measures that support the necessary heat decarbonisation and to give the technologies required for this a competitive edge. Main recommendations are:

- Reducing the savings obligation for district heating (DH) operators, in order to stimulate the diffusion of the technology.
- Upholding the eligibility of connecting buildings to the DH network as a measure within EEOS.
- Adjusting the accounting of savings from heating replacements in the EED guidance. Instead of crediting the difference between the mandatory minimum standard of the newly installed heater and the installed unit, crediting should count the difference between the mandatory minimum standard of the previous heating and the newly installed unit. This is pivotal for the incentivising of heat pumps.
- Making EEOS compliant with centralised local heat planning, in order to use economies of scale. In particular, heat planning should allow for the designation of areas where specific heating technologies (e.g. heat pumps in designated DH areas) are ineligible within EEOS. This would also need more specific provisions in Article 23 EED, which encourages municipalities of more than 50 000 inhabitants to create heat plans.
- Funding and incentivising of DH measures outside the scope of EEOS. While it can be fruitful to address DH measures with a more centralistic approach, it is paramount to further invest in this key technology to further decarbonise the heat supply and prevent lock-in effects.

2 Background and objective

In order to decarbonise Europe's heat demand, a shift in heating technologies is paramount. This means replacing ubiquitous fossil fuel boilers relying on gas or oil by systems using renewable energy sources. This can generate energy savings and contribute to Member States meeting related targets, notably defined in the European Energy Efficiency Directive (EED). Such a switch mainly concerns heat pumps and district heating as the target systems, the latter associated with the opportunity to change the energy sources centrally to a renewable one.

In order to achieve the mandated energy savings, more than half of the EU Member States have opted to implement Energy Efficiency Obligation Schemes (EEOS). These delegate the savings obligation to companies in the energy sector, then inciting households as well as to industry and tertiary sector actors to generate additional energy savings through eligible measures.

However, although widely included in EEOS, the diffusion of heat pumps and district heating has not been significantly fostered by this policy instrument (Broc et al., 2019). Therefore, reasons and improvements for this issue are proposed within this report.

The first part of the report examines the role of heat pumps and district heating (DH) in the Member States' EEOS (Section 4). Then, a proposal is made for how to harmonise Europe's white certificate schemes, discussing the individual characteristics encompassed in an EEOS (Section 5). Finally, the report provides an additional analysis of how to enhance the role of heat pumps and district heating in EEOS (Section 6).

3 Methodological approach

This report is based on an extensive and thorough literature review. To generate an overview of EEOS characteristics, a template was designed mainly based on Schlomann et al. (2021a), which shows the design features and key characteristics of the EEOS in terms of assessments, monitoring and verification (M&V), and certificates. Since the work carried out in this task formed the basis for the following analysis of district heating and heat pumps in EEOS, these two topics were also covered in the template.

The template was then completed for each European country with an EEOS in place. More than 30 sources were consulted including journal articles, reports of national and European projects and databases. However, the EEOS vary strongly in terms of their time of introduction and their treatment in the literature. As a result, the available data vary and there were more data gaps for some countries. Annex A.2 contains the list of sources as well as the detailed characteristics of the EEOS. The collected data mainly concerned the period 2014-2020; whenever possible, data for the period 2021-2030 were also collected.

These sources were also used in Tasks 5.2 and 5.3. However, the latter mainly relied on Schlomann et al. (2021a), who described and discussed the central design features of EEOS in a policy proposal for Germany. In addition, six interviews with national experts were conducted to complement the literature review and to base the recommendations on experiences from countries across Europe that have already implemented EEOS. The interview partners were Samuel Thomas (Regulatory Assistance Project (RAP), expert for UK and Ireland), Dario Di Santo (Federazione Italiana per l'uso Razionale dell'Energia (FIRE), expert for Italy), Peter Bach (Danish Energy Agency (DEA), expert for Denmark), Jean-Sébastien Broc (Institute for a European Energy & Climate Policy (IEECP), expert for France), Gregor Thenius (Austrian Energy Agency (AEA), expert for Austria), and Mia Dragovic (Institute for a European Energy & Climate Policy (IEECP), expert for Croatia and Slovenia). In addition, several informal interviews were carried out with experts from Fraunhofer ISI in the fields of EEOS, district heating, and heat pumps.

These semi-structured interviews lasted an hour on average and took place between the 10th and 18th of February 2022. They focused on general experiences with the relevant EEOS as well as the status quo and inclusion of district heating and heat pumps in the scheme. A general interview guideline comprising 13 guiding questions was created and slightly adjusted for the different interviewees and the defining characteristics of their respective EEOS (see Annex 2).

4 Overview of the existing EEOS (Task 5.1)

Member States shall meet their energy saving targets under Article 7 of the Energy Efficiency Directive (EED) (soon to be Article 8 according to the proposed EED recast) either by introducing energy efficiency obligations schemes (EEOS), alternative policy measures, or a combination of both. Table 1 gives an overview of the policy mix used by different Member States, reporting to Article 7 for the obligation periods of 2014-2020 and 2021-2030. For the obligation period 2014-2020, four Member States use only EEOS, 13 use only the alternative measures and the remaining 11 use a combination of EEOS and alternative measures to reach their energy saving targets. This report focuses only on the countries with an EEOS.

Table 1: Overview of Art.7 instrument types in the EU-28

Country	Implementation period 2014-2020		Implementation period 2021-2030	
	EEOS	Alternative measures	EEOS	Alternative measures
Austria ¹	•	•	•	•
Belgium		•		•
Bulgaria	•	•	•	•
Croatia	•	•	•	•
Cyprus	•	•	•	•
Czech Republic		•		•
Denmark	•			•
Estonia		•		•
Finland		•		•
France	•		•	
Germany		•		•
Greece	•	•	•	•
Hungary		•	•	•
Ireland	•	•	•	•
Italy	•	•	•	•
Latvia	•	•	•	•
Lithuania ²		•		•
Luxembourg ³	•		•	
Malta	•	•	•	•
Netherlands		•		•
Poland	•		•	•
Portugal		•		•
Romania		•		•
Slovakia		•		•
Slovenia	•	•	•	•
Spain		•	•	•

¹ Policy mix for the period 2021-2030 is likely a combination of an EEOS and alternative measures, however it is not explicit in the final NECP.

² Two measures of Lithuania's policy mix for the period 2021-2030 correspond to agreements with energy companies that are similar in practice to EEOS.

³ For the period 2021-2030, the EEOS might be complemented by alternative measures, but this was still to be decided at the time of submission of the NECP.

Country	Implementation period 2014-2020		Implementation period 2021-2030	
	EEOS	Alternative measures	EEOS	Alternative measures
Sweden		•		•
United Kingdom	•	•		

Source: own illustration based on Schlomann et al. 2021b

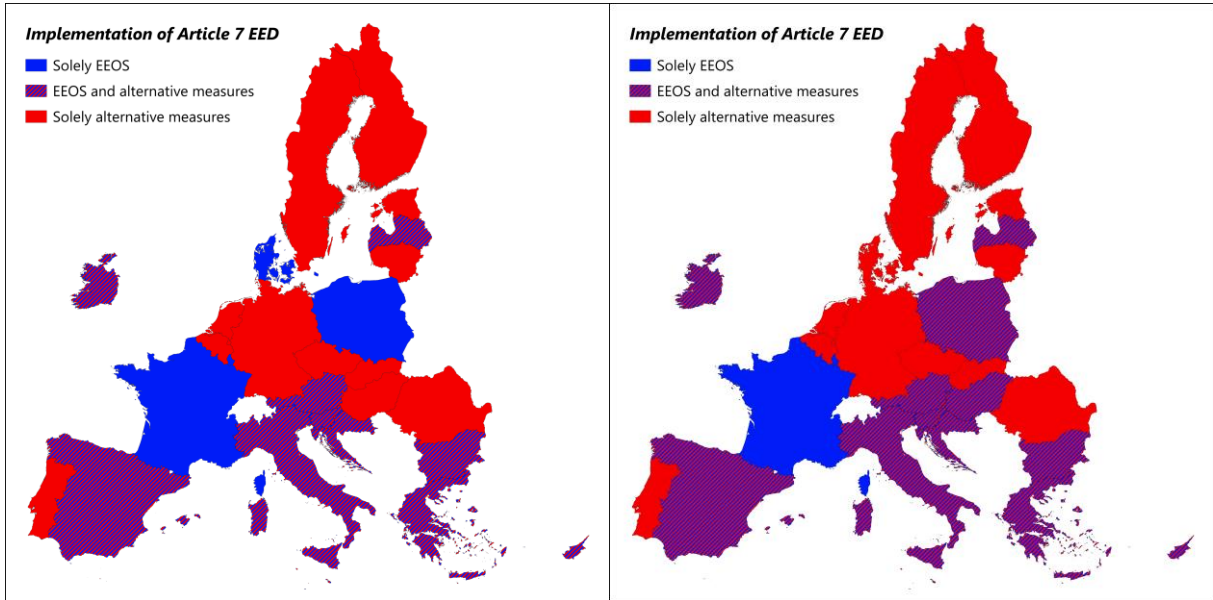


Figure 1: Implementation of Article 7 EED in the periods 2014-2020 and 2021-2030

5 Design elements of EEOS (Task 5.3)

5.1 Introduction

Across the European Union, more than half of the Member States have introduced EEOS to contribute to the national targets set out in Article 7 of the EED. Their specified objectives vary strongly from country to country, and address different issues and sectors. While Italy focuses mainly on the industrial sector, other countries predominantly target energy-poor households. While some Member States such as France meet a major share of their Article 7 targets with the savings accrued within their EEOS, in others, the schemes merely complement a variety of regulatory measures.

In the following, recommendations are made for an improved EEOS design. In particular, these include trading specifications, which differ significantly between Member States. Therefore, the following specific characteristics of EEOS trading systems are discussed and complemented with a recommendation⁴:

- Permissibility of trading
- Inclusion of a central trading platform
- Duration of the commitment period and flexibility mechanisms
- Permissibility of cross-border trading

Additionally, more general characteristics of EEOS are also discussed, in order to cover all aspects comprehensively. These cover the central design features of the schemes⁵:

- Obligated sectors
- Obligated energy sources
- Obligated parties
- Addressees of the system
- Reference value
- Differentiation of the savings target
- Level of the savings target
- Allocation of the savings target
- Eligible measures
- Type of verification
- Choice of baseline
- Determination of savings and consideration of service life
- Dealing with double funding
- Allocation of the scheme's costs
- Monitoring, reporting, and verification of the scheme

A definition and description is provided for each of the listed EEOS characteristics, followed by different implementation possibilities and national examples. This is rounded off with a discussion of the advantages and disadvantages, recommendations as well as a related explanation. This is based on the literature review as well as the responses and suggestions of the interviewees.

⁴ The definitions of the EEOS design features concerning tradeable elements are mainly based on Schlomann et al. (2021a).

⁵ The selection and definitions of the general EEOS design features are mainly based on Schlomann et al. (2021a).

5.2 Design elements of EEOS concerning trading of savings

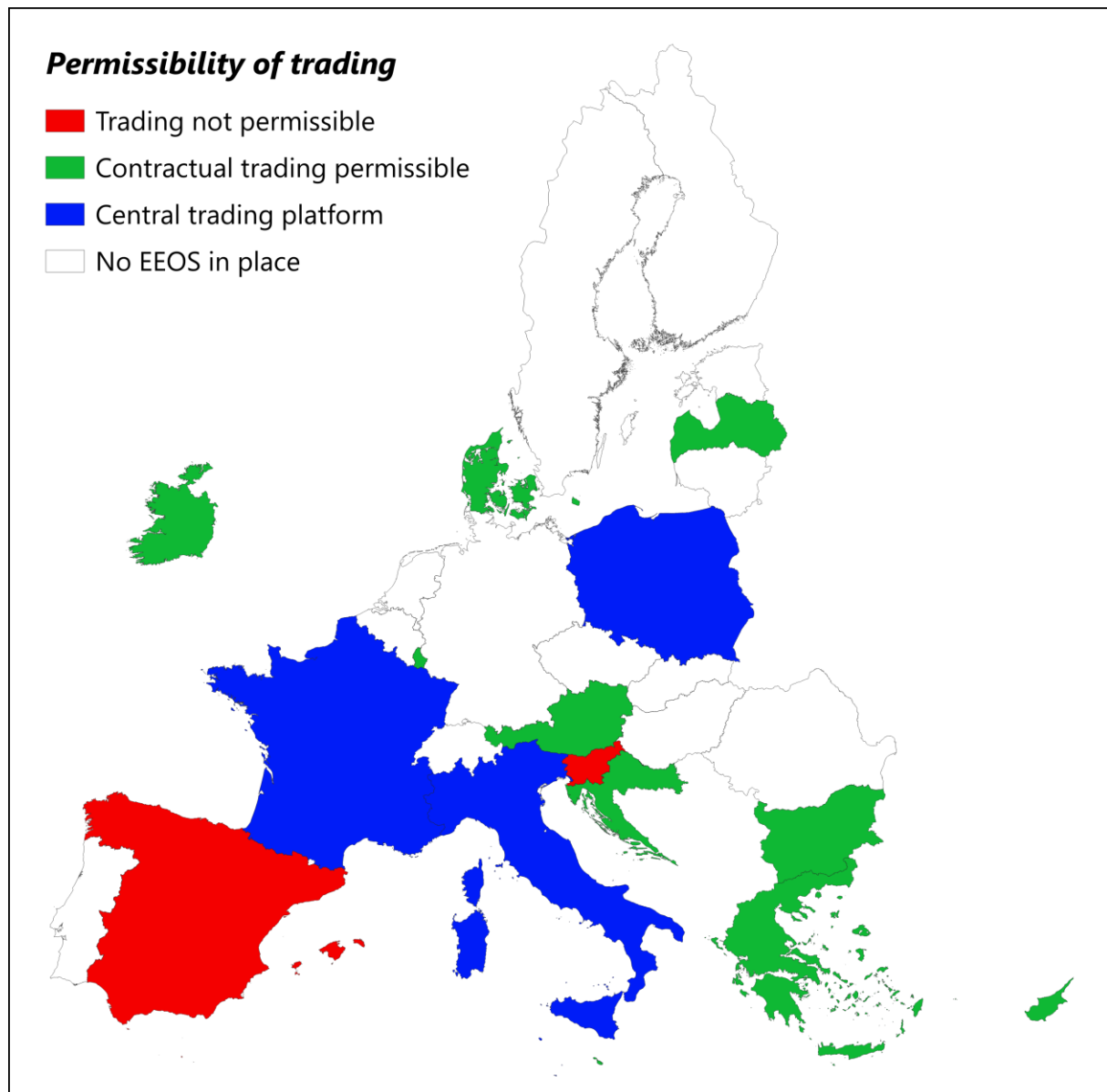


Figure 2: Permissibility of trading in the Member States' EEOS

5.2.1 Permissibility of trading

If trade is permitted within the framework of an obligation, a distinction can be made between horizontal and vertical trade. Horizontal trade describes trade between the obligated parties. It is the only possible type of trade in systems where only the obligated actors can generate savings. If third parties can also implement measures to meet the targets and generate savings titles, these can (and must) be traded with the obligated parties (vertically).

All trading programmes generally create additional complexity and costs for consumers that may exceed the benefits. Trading with direct competitors can be deliberately omitted so that a complete market does not emerge. Horizontal trading results in a risky business model for efficiency providers, which can have a prohibitive effect on the market. In contrast, opening up and allowing vertical trade can encourage new players to enter the market and thus improve the search mechanism.

In Italy, only vertical trading is permitted due to antitrust legislation. Trading takes place via bilateral agreements as well as via the trading platform. In France, all types of trading are permitted, but the trading volume is limited to date. In Great Britain, only horizontal trading is possible due to the EEOS design, but is hardly used.

Vertical trading forfeits using the close link and communication between energy users and their energy suppliers. This affects the chance of showing customers easily and convincingly how energy efficiency can benefit them in terms of their energy bills as well as additional advantages (health, air pollution, etc.).

An energy savings obligation system does not necessarily have to include a trading component. However, a system with a trading component is proposed here to stimulate the market for energy efficiency applications and to emphasise the market-based nature of the instrument. Including Energy Service Companies (ESCO) increases the propensity to seize "low-hanging fruits".

Recommendation: Permit general horizontal and vertical trading. Savings can be traded between third parties (non-obligated parties) and obligated parties. Also permit bilateral trading between obligated parties.

5.2.2 Inclusion of a central trading platform

Creating a central platform for trading white certificates⁶ is one way to make further use of the market mechanism in order to lower the costs of energy savings. It can facilitate market access for new ESCOs, as no bilateral contracts are necessary.

However, this setup also creates a certain degree of uncertainty for ESCOs. Whereas in ordinary vertical trading, ESCOs enter a contract with the obligated parties agreeing on a price for the provided energy savings, with a central trading platform, they are exposed to the volatility of the market at the time of selling. This can lead to windfall profits and losses for ESCOs and obligated parties, effects that market-based instruments inherently attempt to reduce as they run counter to a cost-based pricing mechanism. Furthermore, the associated risks in a very competitive market can deter potential market entrants.

One way to alleviate this issue would be the introduction of futures. ESCOs could offer savings for a specified time in the future at a price that covers their costs while still being competitive. This would also reduce the risk of volatility for obligated parties. However, the central trading platform would converge with the stock market, presenting significant benefits to larger energy corporations. As was the case in France, the creation of a central trading platform especially favoured large obligated parties with dedicated trading units. Normally responsible for the purchase of electricity on energy markets, these traders outdid their competitors from smaller energy suppliers. Introducing futures or even options would probably only reinforce this advantage and impair competition on the energy market through the internalisation of costs into end-user energy prices.

A central trading platform also assigns a more important monitoring role to the controlling authority while weakening the accountability of the obligated parties. In an ordinary trading setting, obligated parties can be held accountable for the savings generated by ESCOs on their behalf. Therefore, a certain due diligence can be expected, since unfulfilled savings or fraudulent certificates imply the need for the obligated party to generate additional savings. In contrast, with a central white certificate trading platform, the origins of energy savings are obfuscated. If obligated parties purchase certificates from a wide

⁶ A central white certificate trading platform is a system similar to a stock exchange for energy saving obligations. Instead of relying on bilateral contracts, a central market is created generating the stock price through the overall demand and supply of white certificates. It is generally run by a governmental authority or agency, ensuring that the traded energy savings have actually been generated.

range of efficiency suppliers, they cannot realistically be expected to verify all the acquired white certificates. Thus, the verification of credited energy savings rests solely with the controlling authority, scrapping the obligated parties' need for due diligence and shifting the costs for the EEOS from the private to the public sector. As a result, the propensity for fraud is higher, as demonstrated by important examples in Italy and France.

Recommendation: Introducing a central trading platform is not recommended. However, trading savings is permitted as described in Section 5.2.1.

A central trading platform for white certificate schemes waters down the obligated parties' interest in and due diligence towards the efficiency providers. The state is left as the sole controlling instance, which increases the propensity for fraud. The additional market effects due to a central trading platform do not outweigh these disadvantages.

5.2.3 Duration of the commitment period and flexibility mechanisms

This characteristic determines which period is decisive for proof of compliance with the obligation or in which period the obligated actors must generate the savings certificates. It also determines which mechanisms and which degree of flexibility are implemented.

A long commitment period gives the obligated companies greater flexibility and encourages long-term strategic orientation. However, it is much more difficult to control and adjust the system. In the event of undesirable developments in the market, there is a risk of significantly missed targets and the stabilisation of erroneous trends. In contrast, a short commitment period offers the companies less incentive for strategic orientation.

The three main flexibility mechanisms are buy-out, banking, and borrowing. A possible buy-out comes at the expense of target accuracy and increases uncertainty about the steering effect, as the market-based search process, which is what the EEOS is all about, is abandoned. This is particularly the case if the buy-out price is set too low, so buy-out prices should include a penalty premium in addition to the costs that would have accrued within the EEOS. However, funds from a buy-out can be used in a targeted manner for accompanying measures and the possibility of a buy-out can help to stabilise the system. Without a buy-out, target fulfilment is ensured, but the certificate price has no dampening element.

The transfer of savings to subsequent trading periods (banking) offers the obligated companies a high degree of flexibility, especially in the case of short commitment periods, and has a dampening effect on the certificate price. It is also beneficial to the climate if measures are implemented as early as possible. However, there is the risk of a few large players "clearing" the favourable savings potentials and "bunkering" certificates. Furthermore, banking can allow companies to capitalise on a scheme's early loopholes that are amended in following commitment periods to feather their nests at low cost. With too much banking allowed, companies in Austria and the UK could have covered their obligations for several commitment periods, while very "low-hanging fruits" like lighting were still eligible.

Borrowing allows obligated parties to transfer their obligations into the next obligation period. This can also have a dampening effect on prices at the end of commitment periods and prevent windfall profits for ESCOs at the expense of consumers. However, it also delays the implementation of energy efficiency measures with the associated negative impact on the climate. Furthermore, it can encourage underperforming obligated parties to carry over obligations and avert the penalties for failing their targets.

Recommendation: 3-year commitment period. Flexibility mechanisms (buy-out, banking, and borrowing) should be permitted. However, banking should be limited to 20%-30%, whereas borrowing should

be limited to 10% with an obligation addition of 50% on the carried-over savings. Any savings beyond the banking limit lose their validity at the end of the commitment period.

Shorter commitment periods are considered sensible, as long as the savings target and other design components can be adjusted in the next commitment period. This should be done based on an external and independent evaluation of the system. A commitment period of three years seems appropriate, because the next commitment period according to Art. 7 EED is 9 years (2021-2030) and the system could therefore be adjusted twice.

There are two main mechanisms to make quantity control instruments such as an EEOS more flexible: compensation payments in case of non-compliance (buy-out) and transfer rules between the commitment periods (banking and borrowing). Both mechanisms should be allowed in principle. However, in order to avoid the risk of excessive overachievement in one period, banking should be limited to a certain percentage of the overall target (for example 20%-30%). In order to set a sufficiently high incentive for all obligated parties to fulfil the savings obligation within the current period, the buy-out price should be significantly higher than the anticipated marginal costs of the implemented savings measures in this period.

5.2.4 Permissibility of cross-border trading

If EEOS were harmonised across Europe, theoretically, the trading of obligations across national borders would be possible. This could particularly accommodate the caveats voiced by energy efficiency front-runners during the course of the EED recast and the associated raising of annual savings quotas. Member States criticised the lack of cost-effective measures left in their countries due to prior policy interventions and autonomous energy efficiency efforts. Thanks to cross-border trading, companies from these Member States could support measures in underperforming countries.

However, such a solution could be linked to an array of issues. First of all, the marginal costs of energy efficiency measures differ across the EU, with lower prices in financially more constricted Member States. Therefore, cross-border trading would be more lucrative for obligated parties in countries with higher marginal costs, whereas domestic companies would face greater competition in the search for cost-effective measures⁷. Thus, energy consumers in poorer countries would see higher marginal costs passed on via their energy bills. Effectively, ESCOs would work transnationally and offer their savings to the highest bidder across the EU and the surcharge accruing through the implementation of energy efficiency measures would converge across Europe's EEOS, regardless of the respective national purchasing power.

Another issue concerns the form of verification and controlling. Since it is to be expected that large savings would be generated in a few countries with significant cost-effective potentials, the relevant authorities would have to assess and verify savings considerably exceeding their national obligations. Since the countries that have underperformed so far with regard to energy efficiency are often also financially constricted ones, these MRV costs would be burdens on their budgets.

Recommendation: Cross-border trading is generally not permitted. Exceptions are only possible within the framework of bilateral agreements between countries, possibly with accompanying compensation.

In order to make trading certificates across national borders possible, EEOS would need to be harmonised. The marked disparity in the marginal costs of energy savings across the EU reveals how far from harmonisation Member States currently are. Even if harmonisation were to take place, this would not alleviate the problem that cross-border trading would predominantly benefit wealthier countries, with

⁷ Marginal costs in countries with EEOS in Europe were assessed by Broc et al (2020).

costs accruing in poorer Member States, further exacerbated by the MRV duties delegated to the latter's authorities. Bilateral agreements between countries might offer a solution here, allowing for compensation mechanisms or payments and ensuring a fair and expedient solution for both parties.

5.3 General design elements of EEOS

5.3.1 Obligated sectors

This design feature determines in which final consumption sectors (private households, trade, commerce, services, industry, and transport) measures may be implemented. The broader the design of the EEOS, the more the market component of the system can unfold and cost-efficient savings can be stimulated throughout the entire economy. On the other hand, restricting the scheme to a few or to only one sector allows more targeted steering of savings, e.g. in order to compensate missed sectoral targets.

Recommendation: All sectors should be subject to the obligation, i.e. private households, industry, tertiary sector, and transport. This means that the entire building sector (residential and non-residential buildings) is also covered by the system as a cross-cutting sector.

This sectoral delineation has been adopted in the majority of existing EEOS because of the possibility to set a higher savings target and to have a larger number of actors shouldering the cost burden of the scheme. It should also be easier to achieve the target because a large number of savings options can be addressed. However, such a broad approach requires careful design of the other elements in order to include the diversity of savings options across sectors in terms of payback periods, lifetimes, and durability of savings. Otherwise, there is a risk that, despite the fundamentally broad approach, savings measures will mostly be implemented where payback is quickest (presumably this is especially the case for cross-cutting technologies in industry and the tertiary sector).

5.3.2 Obligated energy sources

For this characteristic, it must be decided whether the system is very broad and covers all final energy sources or whether it is limited to selected energy sources and, for example, only grid-bound energy sources are obligated or renewable energies are excluded. Once again, a broad design approach offers obligated parties the greatest flexibility in implementing measures and distributes the cost burden across multiple shoulders. However, this prevents targeted control, for instance based on the climate intensity of the energy sources. A variety of design variants can be found in the EEOS already existing across Europe.

Recommendation: In principle, all energy sources supplied to end customers should be covered. These include renewable energy sources.

In most existing systems, renewable energies are included in the obligation. A general exemption would increase the complexity of the system and be difficult to communicate. Instead, the expansion of renewable energies should be incentivised through other policy instruments, since the overriding aim of the EEOS is to reduce energy demand, regardless of the energy source used to meet it.

5.3.3 Obligated parties

Which actors are obligated also depends on the coverage of the obligated energy sources. In the majority of existing EEOS, the obligation relates to end-use energy providers. The idea behind this is that

they can make use of their communication channels and proximity to customers to push for energy efficiency measures. However, this has also led to extreme practices such as in Austria, where commercial and industrial customers were practically forced to implement energy efficiency measures, risking to be billed for suppliers' alternative energy efficiency measures in case of refusal.

The alternative is to obligate energy distributors, as is the case in Italy. Although this move was linked to the incomplete but pending liberalisation of the energy supply market in Italy, it can provide wider benefits. With an expected significant increase in electrification of domestic heating (i.e. heat pumps against the backdrop of fossil fuel import dependency) and industrial processes, obligated companies would be able to steer energy efficiency measures to comply with their intrinsic aim of grid stability. Furthermore, it would alleviate the conflict of interest inherent in energy providers reducing their own customers' energy consumption, which has led energy suppliers, inter alia in the UK, to try and implement measures in the homes of their competitors' customers. In Italy, however, these potential benefits were not exploited, as the obligation had to be delegated to ESCOs for antitrust reasons. Furthermore, grid stability can be approached more expediently with other policy instruments.

Regarding the threshold at which parties become obligated, different models have been adopted across Europe. While Austria already obligated energy providers with the equivalent output of a single petrol station, the UK and Croatia only targeted a handful of major energy corporations. The former is easier to justify and seems fairer. However, the resulting administrative burden is disproportionately higher for smaller entities. In addition, the costs are passed on rather directly to energy consumers, since the whole market is affected.

The latter option has the advantage that the administrative burden is concentrated on major corporations with large management departments benefitting from economies of scale. Therefore, the expected costs per saved energy unit are expected to be lower. On the other, the cost burden is then shouldered by fewer obligated parties, potentially disproportionately affecting their prices. This also implies that costs cannot be completely passed on to customers without impairing the competitive position and reducing the saving costs for end-users. This was a key intention in Croatia, given the significant profit margins of the large incumbent companies. However, on an EU-wide scale, this would probably spark competition-related caveats.

Recommendation: The actors to be obligated should be close to the end customer. This means for the energy carriers defined in the previous section:

- For grid-bound final energy sources: obligation of gas, electricity, and heat suppliers;
- For fuels, heating oil and coal: obligation of the supplying companies;
- For renewable energy sources: obligation of the supplying companies.

In order to reduce the high number of obligated actors resulting from this design, the following measures (alternatively or in combination) could be taken:

- Setting a threshold for the obligation, based for example on customers, sales or turnover figures, as is also practised in some other countries with EEOS.
- By ensuring the system is administered not by the individual obligated parties themselves, but by associations acting as "umbrella" organisations on behalf of the obligated parties, as for instance practised in the French and Austrian EEOS. This reduces the administrative costs of the system and increases its efficiency. Such an approach could also reduce resistance to its introduction.

Any exclusion of an energy source means a distortion of the market and unequal treatment, which should be avoided as far as possible. This should only be used if there is a justified interest in favouring and

thus indirectly subsidising a certain energy source. Other options should be used to reduce the administrative burden. In particular, the French and Austrian approach of using associations to bundle the administration on the part of the obligated parties has proven fruitful.

5.3.4 Implementing actors in the system

This characteristic defines who is allowed to implement the savings measures and be credited with savings certificates. On the one hand, it is possible to allow the implementation of measures only by the obligated companies. The advantage of a manageable number of actors is offset by possible market restrictions in the energy services market through the exclusion of third parties. Expanding the participants results in higher trading intensity, an improved search process and better exploitation of "low-hanging fruits". On the other hand, extending the range of implementing actors comes at a price and increased effort in terms of M&V as well. Again, all design variants can be found in already existing EEOS in different countries.

Recommendation: Access to the system should not be restricted, i.e. in principle, eligible energy savings or certificates should be generated and traded by the obligated parties themselves and by independent third parties.

Restricting access to certain groups of actors would reduce the intended downward pressure effect on prices. Since this is a key element of an EEOS, the scheme should allow for accredited third parties to implement savings.

5.3.5 Reference base

The choice of the reference base, whether CO₂ emissions, final or primary energy consumption, has significant impacts on the incentive effect of the obligation, for example with regard to fuel switching and absolute energy consumption. While a final energy target is closely related to the actual incentive effect, a CO₂ or primary energy target may better reflect the energy and climate policy target framework. There are also differences with regard to operational implementation, as final energy savings are usually achieved at the implementation level, while CO₂ or primary energy savings often also include the transformation sector.

Recommendation: The reference value for the savings target in the EEOS should be final energy consumption.

The reference to final energy consumption makes the system simpler and is compatible with the target definition in Art. 7 EED. In principle, primary energy (as in Italy) or CO₂ (as partly in the UK) could also be chosen as a reference. The really important issue is to ensure consistency between the defined target and the metric for measuring energy savings.

5.3.6 Subdivision of the savings target

The savings target can also be subdivided, for example by using quotas for different sectors, energy sources or measures' degree of innovation. A subdivided target can enhance the incentive effect in the sectors, by energy source or by degree of innovation. Secondary energy, economic or social policy objectives can also be pursued. However, a subdivided target also restricts the open search process of the market for optimal solutions and increases the system's complexity.

There are a multitude of possible design variants in already existing EEOS in other countries. Italy, for instance, has a primary energy target that is differentiated by electricity and fuels. France has a final

energy target that is not differentiated by energy source but does feature quotas, inter alia regarding energy poverty. The UK has a CO₂ target with special quotas for low-income households.

Any subdivision (e.g. by sector, energy source or specific group) complicates the system and raises the political issue of unequal treatment. This can also have an impact on the acceptance of EEOS. With subdivision, the obligated actors are free to decide where and how they implement savings measures. The diversity of savings options in the individual sectors must be taken into account, otherwise there is a risk of savings being limited to certain highly cost-efficient technology options (such as industrial cross-cutting technologies).

If the savings target is subdivided in existing EEOS, this is usually based on specific political objectives such as closing instrument gaps in certain application areas or combating energy poverty. For example, the systems in the United Kingdom and France implement a savings quota for low-income households to help accelerate retrofitting in this segment.

However, the question arises whether an EEOS is the right instrument to tackle these issues, in particular energy poverty. Explicitly including this in an EEOS means acknowledging the magnitude of the issue and the deprivation it causes, only to then leave it to market-based economics to determine whom to help. This leaves people with homes that are too expensive to retrofit without the support from obligated parties, due to the high specific costs of energy savings. This effect has widely been observed in the UK and will probably be addressed in the British EEOS' next recast. Such social objectives are better addressed through funding programmes that support all eligible and affected households. Therefore, the recommendation is not to subdivide the savings target.

Recommendation: In principle, no subdivision of the savings target should be made.

5.3.7 Level of the savings target

The level of the savings target depends on how the instrument fits into the overall context. The obligation can be used as the sole instrument to fulfil the entire savings target. This results in a simple instrument landscape with good economies of scale. Alternatively, the obligation can be established as an additional instrument in the mix of instruments promoting energy efficiency. In this way, individual barriers can be addressed more specifically, but the then significantly smaller target limits the market-oriented search process.

Recommendation: The EEOS should be the central tool to achieve the savings obligation determined in Article 7 of the EED. However, it should be flanked by additional policy instruments in order to address other issues concerning energy efficiency, which cannot be addressed via an EEOS. These include aspects such as energy poverty, fuel switches or heating choices that are more efficient when planned centrally.

The volume of savings dedicated to the EEOS enable economies of scale without jeopardising other policy objectives. It is difficult for the EEOS to address these objectives, due to its market-based approach and thus, the unpredictability of the implemented measures.

5.3.8 Allocation of the savings target

For an EEOS to work efficiently, each obligated party must know and understand their energy savings volume. The allocation of obligated savings should generally be based on the supplied share of final energy consumption.

To increase the incentive to reduce emissions, a weighting based on carbon intensity can be added. However, this should only partly influence the allocation, as nuclear power would be exempt from saving obligations despite its burden for future generations and its immense societal costs.

Recommendation: The allocation to the obligated parties is based on their respective market shares in final energy consumption, but weighted by the carbon content.

Considering the carbon content of the final energy sources is intended to incentivise suppliers to switch to renewable energy sources. In particular, this gives more sustainable energy suppliers a competitive advantage in the heat as well as in the electricity market, and encourages others to follow their example. So far, there is no such weighting in any of the existing EEOS, but this approach found approval among the interviewed experts, as it also contributes to the achievement of greenhouse gas reduction targets to a greater extent than is the case in existing EEOS.

5.3.9 Eligible measures

There is a high possible range of eligible measures in a savings obligation. The obligation can be limited to standardised measures, which simplifies implementation in many areas, but severely restricts the market-driven search process. Moreover, with such a restriction, the incentive effect is limited and the obligation would have less impact in buildings and industry. In contrast, if "user-defined" measures are permitted, a broader scope is possible and the market-driven search process can unfold its effect. However, verification and monitoring are significantly more complex with such a design.

If measures in the area of information, motivation and behavioural change are also permissible, it is more difficult to evaluate the savings and prove the criteria of additionality and materiality. Nevertheless, such measures are an important building block in the mix of measures and can help, especially as accompanying measures, to open up further savings potentials and to reduce barriers.

It is also possible to restrict eligibility to sectors, energy sources or technologies. A narrower scope can facilitate targeted control, but significantly restricts the flexibility of companies and the search process. In contrast, a broader scope offers maximum flexibility, but does not enable detailed control from a political perspective. This can also lead to very cost-effective measures covering large shares of the obligation, thereby impairing the dissemination of other more expensive but necessary energy efficiency actions. It is a very contested issue whether these very cost-effective measures bring any additionality and the participation of obligated parties in their diffusion is material. Since payback times are one or two years, these savings would be profitable for users even without the support of companies. This was, for instance, the case in Austria and the UK, where LED bulbs and water-saving caps for taps were widely distributed without insuring their installation, and covered a large share of the credited savings. Whether these light bulbs and tap attachments were actually installed and used is another matter.

All the countries with existing systems have chosen a rather broad approach to standardisation. However, there are some limitations on the energy sources for which creditable savings can be generated. In the UK, the measures are limited to the building sector. Some countries have removed lighting from the list of eligible measures.

Recommendation: Both standardised measures (e.g. efficient electrical appliances in households or electric motors in industry) and heterogeneous measures that cannot be standardised (e.g. industrial processes) are eligible. However, energy-efficient lighting and measures concerning motivation or information (e.g. energy advice or information campaigns) are not eligible. Furthermore, heating installations that obstruct dedicated heat planning in clearly designated urban areas are also excluded from EEOS.

The creditability of both standardised and non-standardised measures is recommended, as the search process for the most favourable savings potentials - and thus the market-based justification for an EEOS - is strengthened or initiated in the first place by an expanded range of measures. This outweighs the disadvantage of a more complex verification process for heterogeneous measures (see section 5.3.10). On the other hand, especially in the start-up phase, the interviewed experts also recommended not allowing motivation and information measures. This is because the savings generated from these measures are difficult to prove in an EEOS, as experience in other countries has shown. This applies in particular to the criteria of additionality and materiality required by Article 7 of the EED. However, since measures aimed at behavioural change are fundamental for achieving ambitious energy and climate targets, it is proposed that pilot projects should be carried out in the first phase of the system, in order to allow them in later periods as required.

Given the efficiency boost from central heat planning in urban areas, new installations that operate counter to the designated energy source should not be eligible under EEOS. Since supply networks, such as gas, district heat, and in the future potentially hydrogen, benefit from economies of scale, installations jeopardising these advantages should not be funded within the schemes. This point is discussed in greater detail in Section 6.2.

5.3.10 Type of certification

There are basically two ways to provide evidence in the context of an EEOS. In the first case, the obligated actor proves the savings directly to the monitoring authority, which stores the verification documents and allocates the savings to the respective company. Such a system can be implemented quickly, but trading is complicated, since verification documents and allocated savings must be transferred centrally to the buyer. Thus, all transactions need to go through the monitoring authority.

In the second case, certificates are issued to the ESCO or obligated party implementing the measures and thus generating the savings. Once issued by the monitoring authority, these certificates merely represent a certain amount of savings. The certificates are then independent of the concrete measure and can be easily traded. However, this means that those implementing the measures are responsible for proving the concrete savings and not the actual obligated actors. This reduces the due diligence of the obligated parties (see Section 5.2.2) and requires the establishment of a central certificate registry. Due to the trading component of their EEOS, there are central registers inter alia in Italy and France, while direct verification through the respective authority is implemented in the UK.

Recommendation: Standard values to estimate savings should be specified for standardised measures. Proof is generally provided by submitting the invoice, and it must also be proven that the person implementing the measure was in contact with the obligated company or an independent third party prior to implementation. In the case of measures that cannot be standardised, proof of the savings is provided by calculation or measurement, and proof of receipt of the support must be provided. An additional "savings meter component" should be included even in the case of standardised measures to encourage the provision of evidence through the direct measurement of savings. In return, a certificate is issued, simplifying the trade with savings.

The additional proof of contact for standardised measures is intended to certify the additionality and materiality of the savings required by Article 7 of the EED. This is not possible by submitting an invoice alone. The proposed savings meter component is intended to increase the share of measured savings, also with regard to a possible later approval of advisory programmes and other measures aimed at behavioural change.

5.3.11 Choice of baseline

The choice of baseline describes which proportion of the savings achieved by the measures is actually creditable. A wide range of options is conceivable, from the status quo ante to a "Best Available Technology" (BAT) approach. However, depending on the type of measure, not all baselines are possible or meaningful. If the baseline is too high, creditable savings can only be generated by very few measures. If, on the other hand, the baseline is too low, the ambition level of the measures may be too low and the risk of deadweight and lock-in effects increases. A hybrid approach is also possible because it makes sense to choose different baselines for renovation and for new construction in the building sector, for instance.

Article 7 in the current EED defines the baseline for creditable savings as the mandatory minimum or market standard. While the EED itself does not specify whether this concerns the standard of the replaced or of the new technology, the guidance provided by the European Commission emphasises the latter.

One problem associated with the use of market or mandatory minimum standards of the newly installed technology concerns the difficulty to fund material upgrades from obsolete technologies and fuel switches to sustainable energy sources, since it is only possible to account for the difference between the standard and a new installation. This is particularly problematic in the case of heat pumps, where the savings compared to other heating technologies are much higher than between different generations of heat pumps.

The majority of EEOS use the market average and mandatory minimum standards, but some countries deviate from this approach. In Ireland, savings from switching to a heat pump are partly accounted for in the crediting system. In Italy's EEOS, if the energy source of district heating changes from a fossil fuel to electricity, the fossil fuel savings are fully creditable in order to support this important change.

Recommendation: The baseline should be set using the mandatory minimum standard (EU Ecodesign Directive, minimum standards for buildings) or - if no minimum standard is available - using the market average. Regulations deviating from this apply to:

- Buildings: for new buildings, the building standard is used as baseline; for refurbishment of existing buildings, the minimum standard for individual measures (e.g. for heating and air-conditioning devices and systems); if not available, status quo ante.
- Industrial and commercial processes: Process-specific benchmarks should be defined as the baseline; if not possible, status quo ante.
- Heating: for heating replacements, the minimum standard of the previously installed technology is used; if not available, status quo ante.

The baseline only sets the minimum level above which savings may be counted to ensure additionality. The ambitiousness of the eligible measures should be taken into account in this criterion. If the reference line is set very ambitiously - as in the case of an orientation towards Least Life Cycle Costs (LLCC standard) or Best Available Technology (BAT standard) - only limited creditable savings can be generated in the system. An EEOS aims primarily at the cost-efficient exploitation of savings potentials and not at the promotion of highly efficient technologies. These can be promoted more efficiently using other energy and climate policy instruments, e.g. through more ambitious minimum standards for energy consumption-relevant products, ambitious energy consumption labelling or special funding programmes for highly efficient, innovative technologies. Furthermore, given the current political push to boost heat pump installations, the European Commission should modify its guidance on the accounting accruing from heating replacements. This means recommending using the mandatory minimum standard of the previously installed technology as the baseline.

5.3.12 Determination of savings and consideration of service life

The energy savings effect can be determined in three different ways: through measured savings, through technical calculations in individual cases, or through the use of previously determined anticipated savings. The use of anticipated savings promotes good planning certainty with regard to creditable savings and is easy to use. Depending on the application, however, projected savings can significantly exceed or fall short of actual savings. Measured savings might be difficult to determine depending on the technical infrastructure. With the increasing spread of intelligent measurement infrastructures, this effort can be significantly reduced in the future. Technical calculations in individual cases may be less complex than measurements, but allow more specific results than anticipated savings.

Italy uses all three approaches. France only uses the two calculation approaches. The UK now uses metering as the predominant method after sample checks discovered that savings were systematically over-estimated.

In terms of considering service life, a distinction can be made as to whether savings are only credited in the first year or years, or over the entire lifespan. Crediting over the entire lifetime tends to favour long-lasting measures, for example in the building sector, and provides incentives to implement more complex measures as well. However, this approach is harder to implement, as assumptions have to be made about the service life. It is easier to credit savings in the first year, but this approach focuses on short-lived measures, has a rather short-term incentive and harbours the risk of lock-in effects.

Great Britain and France allow crediting over the lifetime, while Italy only credits the savings of the first five years. In an attempt to alleviate this shortcoming, which was preventing effective financing of long-lasting actions in Italy, lifespan was additionally taken into account within the five creditable years using suitable coefficients. However, this led to a rapid saturation of obligated savings in the commitment period, a watering down of the scheme's ambition, falling prices for white certificates, windfall profits for obligated parties, and deficits for ESCOs currently selling previously generated savings. Several energy efficiency measures were no longer cost-effective given the new market price. Therefore, this amendment was quickly revoked, followed by legal challenges with some still pending verdicts. However, the problem here was not considering the entire lifetime of the measures, but rather that the savings were concentrated on five years, the target volume not adjusted, and the amendment introduced in the middle of a commitment period.

Recommendation: Savings should be allocated over the lifetime of the measures, but with an easy-to-handle graduation (e.g. 2, 5, 10, 15, 20, 25 years). The calculation and allocation of the savings target should be based on the longest service life (here 25 years). To assess savings, a measuring approach should be used where possible. Alternatively, calculated, deemed or scaled savings can be used for appliances and lighting or in cases where actual savings hardly differ from the estimated ones.

The service life should be included in the calculation of savings in order to avoid favouring the implementation of short-term measures and disfavours measures with a longer payback period. This would not be desirable, especially from a long-term climate protection perspective. For the obligated actors, the proposed crediting mode means that in order to achieve the same savings with a reduction of the service life, correspondingly more measures must be implemented. This crediting mode is more difficult to manage, which should be addressed by the proposed staggering of the service life. Discounting savings is no longer considered sensible for energy efficiency measures. Another disadvantage of the lifetime variant compared to one-off crediting of savings in the year of implementation is the lower investment security for those implementing the measure due to the dependence on certificate prices that may fluctuate in the future. In addition, the baseline can also change over time, for example if new minimum

standards are introduced. However, from the point of view of the interviewed experts, these disadvantages are more than compensated for by the better consideration of the long-term climate protection perspective.

5.3.13 Dealing with double funding

Double funding describes a situation in which a measure generating savings and thus white certificates under an EEOS is also additionally funded under another subsidy programme. A ban on double funding simplifies the processing and clarity of the system and offers advantages in terms of legal conformity. However, compliance with a ban would have to be traceable. If double funding is permissible, an obligation could even have an invigorating effect on existing programmes and reduce specific obstacles. It could also support fuel switches and the replacement of obsolete technologies, which are inadequately addressed within the proposed EEOS design (see Section 5.3.11).

However, this may be associated with competition law hurdles and the additional savings effect of the instrument is uncertain.

In Italy, France and the UK, double funding is not deliberately prevented or is actively desired. In France, in particular, this possibility is actively exploited.

Recommendation: Double funding of saving measures should not be permitted. Proof is provided as part of the certification.

In some EEOS, double funding of measures is permissible. This could be relevant, especially for high-priced measures in the building sector. However, the recommendation is to not allow double funding, since this makes it more difficult to assign savings to a specific instrument and thus to prove materiality under Art. 7 EED. Double funding can also lead to a strong increase in deadweight effects within the system and to obligated parties playing merely the intermediary role of stimulating energy savings using public subsidies. This would impair the desired effectiveness of the system as well as its acceptance, while merely passing on the costs to the public hand.

5.3.14 Allocation of the scheme's costs

Although they are often cheaper than using subsidy and funding programmes, the energy savings generated within EEOS come at a certain price. These costs can be allocated in several ways. The simplest option is not to regulate. This tends to result in costs being passed on to customer segments with the lowest elasticity of energy demand. In extreme cases, this could lead to low-income private households cross-financing measures in the industry sector and thus to a cost reduction in industry. It is also conceivable that the obligated actors pass on their costs completely to energy prices. This directly encourages the implementation of cost-effective measures in order to gain competitive advantages and can lead to additional autonomous savings in customer segments with higher demand elasticities. However, such a design can hinder the implementation of more expensive but longer-term effective measures. With a mandatory levy, disadvantages in terms of demand elasticity can be avoided. This can be further optimised by distributing the costs based on system benefits (e.g. customer segments). Partial or full financing from tax revenues or a pay-as-you-go fund is also conceivable (especially if double funding is permissible).

The French system in particular, but also the Italian system, make use of the last option. In Great Britain, the exclusive allocation to energy prices was standard for a long time.

Recommendation: The costs of issuing certificates should be borne by those implementing the measures; the administrative costs for correctly recording energy savings should be borne by the obligated actor. From the beginning, the obligated actor should be required to report all the system costs, i.e. both administrative and programme costs, confidentially to the state institution responsible for controlling the EEOS (ministry, subordinate authority). The allocation of costs to end customers should not be restricted.

The proposed approach is the usual standard in most EEOS. The obligation to report system costs confidentially is highly recommended by one of the interviewed experts to ensure that they can be published in aggregated form by the responsible authority. In the British EEOS, guidance on the level of system costs is available from the national energy regulator Ofgem (2017). The experience from older EEOS is that the direct programme costs account for by far the largest share of the system costs (approx. 80 %), which also occur in the usual funding programmes. Administration and recording savings account for about 20 % of the costs.

5.3.15 Monitoring, reporting, and verification of the scheme

On the one hand, reviews can be carried out bottom-up by a governmental or semi-governmental institution such as the environmental authority, the energy agency, a dedicated agency for energy efficiency or even an authority with the sole purpose of managing the EEOS. These have different experiences in handling comparable systems.

On the other hand, top-down monitoring based on energy statistics is also possible. Such a top-down monitoring would be easy to implement, but no verification of target fulfilment would be possible at the level of the obligated parties.

In France, Italy and the UK, governmental organisations are entrusted with the verification of compliance.

Recommendation: At the end of each commitment period, the obligated companies must demonstrate the validation of a sufficient number of certificates in the certificate register. The institution responsible for the EEOS should carry out the monitoring. There should be an accompanying internal monitoring and an external independent evaluation for each of the three commitment periods in order to make possible modifications to the design on this basis.

The experience of countries with an EEOS shows that the administrative effort is comparatively low. The main effort is in operating the platform and above all issuing certificates after verifying compliance using the formal criteria, i.e. through sample checks and monitoring. A reliable compliance and monitoring concept is considered essential to ensure the trust of all stakeholders in the instrument. Misuse should be prevented as far as possible.

As the example of Denmark shows, even a well-functioning and fruitful EEOS can be overshadowed by a few negative examples, leading to public pressure to replace the existing scheme with an auction system. Negative experiences can also have disrupting effects as observed in Italy, where 300 million fraudulent white certificates were uncovered within a few months. This resulted in a disequilibrium in the market, a surge in certificate prices, and a shift from a position in line with the EEOS's targets to one completely out of reach of any objective.

The following measures have proven particularly effective in existing systems:

- Additional physical inspections based on regular spot checks. Following the British example, these can be increased, if there are indications of misuse. These checks do not have to be carried out by the body responsible for monitoring, but also by external auditors.

- The cases of misuse that have occurred in Italy or Denmark in the past suggest that not only the measures themselves should be examined, but also the companies behind them, insofar as the measures are not carried out by the end-users themselves.

5.4 Summary

Experiences with EEOS to date have revealed several shortcomings that should be addressed to improve this market-based instrument. The recommendations concerning both general and trading-related characteristics of EEOS are summarised in Table 2.

Table 2: Recommendations concerning both general and trading-related characteristics of EEOS

Design feature	Recommendation
Design elements of EEOS concerning the trade of savings	
Permissibility of trading	Trading should be generally permitted, horizontally and vertically. Savings can be traded between third parties (non-obligated parties) and obligated parties. Bilateral trading between obligated parties should be also permitted.
Inclusion of a central trading platform	The introduction of a central trading platform is not recommended.
Duration of the commitment period and flexibility mechanism	3-year commitment period. Flexibility mechanisms (buy-out, banking, and borrowing) should be permitted. However, banking should be limited to 20%-30%, whereas borrowing should be limited to 10% with an obligation addition of 50% on the carried-over savings. Any savings beyond the banking limit lose their validity at the end of the commitment period.
Permissibility of cross-border trading	Cross-border trading should generally not be permitted. Exceptions should only be accepted within the framework of bilateral agreements between countries, possibly with accompanying compensation.
General design elements	
Obligated sectors	All sectors should be subject to the obligation, i.e. private households, industry, tertiary sector, and transport. This means the system covers the entire building sector.
Obligated energy sources	In principle, all energy sources supplied to end customers should be covered, including renewable energy sources.
Obligated parties	Obligated actors should be close to end customers. This means that the supplying companies for all energy carriers above a certain threshold should be obligated.

Design feature	Recommendation
Implementing actors in the system	Access to the system should not be restricted, i.e. in principle, eligible energy savings or certificates may be generated and thus traded by the obligated parties themselves and by independent third parties.
Reference base	The reference value for the savings target in the EEOS should be final energy consumption.
Subdivision of the savings target	In principle, no subdivision of the savings target should be made.
Level of the savings target	The EEOS should be the central tool to achieve the savings obligation determined in Article 7 of the EED. However, it should be flanked by additional policy instruments to address other issues relevant to energy efficiency, such as energy poverty, fuel switches or heating choices that are more efficient when planned centrally.
Allocation of the savings target	The allocation of the obligation to obligated parties should be based on their respective market shares. It is based on the market share for final energy, but weighted by its carbon content.
Eligible measures	Both standardised and heterogeneous measures. EEOS should not include motivation and information measures, energy-efficient lighting or heating systems that obstruct dedicated heat planning in clearly designated urban areas.
Type of certification	Standard values should be specified for standardised measures. Proof is generally provided by submitting the invoice, and it must also be proven that the person implementing the measure was in contact with the obligated company or an independent third party prior to implementation. Proof should be provided by calculation or measurement for measures that cannot be standardised, and proof of receipt of the support must be provided. An additional "savings meter component" should be included to encourage the provision of evidence based on the direct measurement of savings. In return, a certificate is issued, simplifying the trade with savings.
Choice of baseline	The baseline should be set using the mandatory minimum standard or the market average. For heating replacements, the standard of the previously installed technology should be used.
Determination of savings and consideration of service life	Calculation and allocation of savings over the lifetime of the measures, but with an easy-to-handle graduation (e.g. 2, 5, 10, 15, 20, 25 years) based on the longest service life (here 25 years). A measuring approach should be used where possible. Alternatively, calculated, deemed or scaled savings can be used for appliances and lighting or where the actual savings hardly differ.

Design feature	Recommendation
Dealing with double-funding	Double funding of saving measures should not be permitted. Proof should be provided as part of the certification.
Allocation of the scheme's costs	The costs of issuing certificates should be borne by those implementing the measures; the administrative costs for correctly recording energy savings should be borne by the obligated actor. From the beginning, the obligated actor should be required to report all the system costs, i.e. both administrative and programme, confidentially to the state institution responsible for controlling the EEOS. The allocation of costs to end customers should not be restricted.
Monitoring, reporting, and verification of the scheme	At the end of each commitment period, the obligated companies must demonstrate the validation of a sufficient number of certificates in the certificate register. Monitoring should be carried out by the institution responsible for the EEOS. There should be an accompanying internal monitoring and an external independent evaluation for each of the three commitment periods in order to make possible design modifications.

However, **this should not mean by default that these recommendations should be applied uniformly across the European Union.** The EEOS are often adapted to national circumstances and used to tackle other national policy objectives. These adjustments range from quotas for energy poverty, coefficients for measures in deprived regions to the inclusion of renewables. Therefore, these recommendations should not be seen as a fixed blueprint that every member state must comply with, but rather as guidelines to alleviate some of the problems encountered in the past and to profit from best-practice examples.

6 Analysis of the role of district heating and heat pumps in EEOS (Task 5.2)

District heating and heat pumps play a central role in heat decarbonisation. Therefore, it is important for EEOS to support the diffusion of these sustainable heating technologies. This chapter assesses these possibilities.

The first part examines the role of heat suppliers as potential obligated parties within EEOS and makes proposals to support the expansion of district heating that consider the necessary switch to renewable heat generation.

The second part regards eligible measures within EEOS related to district heating and heat pumps and discusses how these should interact with strategic heat planning in municipalities given the higher system efficiency of central heat planning. Possible eligible measures are discussed and how to account their credited savings to foster the diffusion and improvement of district heating and heat pumps.

6.1 District heating operators as obligated parties

6.1.1 Background

In several European Energy Efficiency Obligation Schemes (EEOS), district heating (DH) operators are the parties obligated to generate energy savings. This decision can be justified by the dormant energy efficiency potentials in households, which are addressed most easily by their heat supplier, i.e. their DH operator. This also means the obligated savings resulting from the target set in Article 7 of the EED can be distributed across more shoulders. Furthermore, it allows fairer competition between DH and other heating technologies.

If DH operators are not obligated parties, the supplier-customer relationship which has proven so fruitful in several EEOS cannot be capitalised on. This is often the case in smaller networks in countries that have high thresholds regarding the minimum number of customers for companies to be obligated. This can be particularly problematic in countries or regions with widespread DH networks such as Poland, as there is the risk of not exploiting high energy efficiency potentials. In order to alleviate this issue, a stronger involvement of Energy Service Companies (ESCO) should be considered, either through vertical trading, mandatory delegation to ESCOs (as is the case in Italy) or a central white certificate trading platform (see section 5.2.2). ESCOs can ensure that energy efficiency potentials are evenly harnessed across the country, independently of energy suppliers.

If DH operators are exempted, households that consume fossil fuels, biomass and electricity would face additional costs. However, the decision to switch to DH is not solely in the hands of these households, because the necessary infrastructure is not yet widely available in some countries. This exemption would enable DH companies to expand, but would also imply increased energy costs for the other obligated parties involved, some of which would not even be able to switch to DH if they wanted to. Furthermore, it would increase the price of electricity at a time when electrification is being hailed as a solution for the energy transition, and would therefore act as a disincentive for the installation of heat pumps. This could be alleviated, at least in part, by the proposed emission-weighted obligation allocation. The effects might be marginal in countries with low DH shares, but they would have significant impacts in countries such as Poland or Denmark, where many households use DH.

Every type of energy supplier can implement “self-sustaining” energy efficiency measures. In the past, to keep their customers and maintain their turnover, electricity and gas suppliers were more inclined to install heat pumps and gas boilers. However, DH operators are often not able to implement measures themselves, such as connecting buildings to the network. Under the revised Energy Efficiency Directive, eligible measures do not include improving the generation process or replacing the heat source. As these measures only affect primary and not final energy consumption, they would then no longer be eligible within EEOS schemes.

More generally, the case of DH operators as obligated parties begs the question concerning the inherent objective of energy saving obligations. Should EEOS be designed to merely be invested in achieving energy savings or should they first and foremost reduce Member States’ climate impact?

If the latter is the case, DH should be incentivised for a multitude of reasons. On average, it has a lower primary energy factor (PEF) than other energy sources. This effect becomes even clearer when heat from cogeneration or even industrial waste heat is used, resulting in PEFs of 0.6 and lower⁸. Thus, approximately twice the primary energy necessary for generation is provided in the form of consumable heat.

Moreover, the connection of buildings to DH networks averts the risk of lock-in effects. The DH energy source can be changed centrally, preventing lock-in effects at household level. Such central energy source switches have been widely implemented in Denmark, where specific policies addressed the relative carbon intensity of older district heating networks. In contrast, house owners replace their heating only when broken, substantially obsolete or if its operation is more expensive than a replacement. Therefore, heaters installed now will probably be in place for more than a decade, which is particularly problematic if they use fossil fuels. This pattern of decentralised heating choices leads to significant lock-in effects. While it is simple to ban certain technologies for new installations, as France and Germany did with oil boilers, it would be significantly more complicated to force homeowners to replace installed gas boilers.

6.1.2 Recommendation

DH operators should be exempted from energy saving obligations, as there is a societal interest in a broad diffusion of this technology in order to achieve the EU's climate change mitigation targets. Excluding DH would grant them a competitive advantage and enable them to cover the huge expenses necessary for reactivating neglected and underfunded networks or expanding existing ones.

Alternatively, the energy saving obligation of DH operators should be determined using the DH network’s primary energy factor (PEF) as coefficient. An upper coefficient threshold of 1 should be specified, so that DH operators do not end up shouldering more savings than other energy suppliers. Furthermore, coefficients of 0.2 and 0 should be used for DH using the general electricity mix and electricity from renewables, respectively, as large-scale heat pumps represent the gold standard of sustainable DH (David et al. 2017). Since it prevents lock-in to fossil fuel-based technology, the electricity mix’s current PEF should be neglected in order to incentivise the electrification of heat generation.

Given DH’s low PEFs, this would significantly reduce heat suppliers’ obligations, depending on their network’s sustainability. This would still engender a competitive advantage, while at the same time incentivising companies to reduce their PEF by making use of cogeneration, industrial waste heat, large-scale heat pumps or network efficiency improvements. This could be implemented rather easily, since DH networks in several Member States already need to report their PEFs.

⁸ In comparison, the average EU electricity mix has a PEF of 2.49, electricity from renewables a PEF of around 1.1, and electricity from nuclear power a PEF of 3.50 (Poredos et al, 2017).

Furthermore, a lower threshold would protect small as well as new and emerging DH grids. Not shielding them from the administrative and cost burden associated with energy-saving obligations could jeopardise their potential to challenge incumbent market actors, given the considerable investments involved for DH. In addition, an exemption would increase the number of new potentially high-efficiency DH networks complying with the cost-effectiveness criterion of Article 23 in the EED recast.

This exemption is not recommended for countries and regions that already have widespread DH systems (e.g. Denmark, Lithuania, Estonia, Finland, Sweden and Poland). Nonetheless, in order to harness the energy efficiency potentials in DH networks, policy measures beyond Article 7 EED should be deployed to ensure maximum utilisation of their competitive advantage.

6.2 District heating- and heat pump-related measures in EEOS

The variety in possible heating choices leads to a multitude of diseconomies of scale. While heat pumps merely require the pre-existing and also otherwise necessary electricity grid, DH as well as gas boilers rely on separate supply infrastructures, impairing the overall system efficiency.

As a result, a commitment to one heating energy for every municipality or district in the long run would significantly improve the chosen system's efficiency through economies of scale, thereby cutting consumers' costs. Which heating energy is best suited to any given locality should be examined in the course of an extensive assessment. This should result in a local heat plan, with rural areas predominantly relying on heating independent of dedicated infrastructure (e.g. biomass or heat pumps) and urban areas capitalising on the benefits of pipeline networks in densely populated quarters (e.g. district heating or gas). This would disproportionately benefit DH, since the massive pipeline costs could be distributed across more shoulders with every additional connected household, and the relative transport distances and losses would decline considerably.

As demonstrated in the new Article 23 of the proposed EED recast concerning heat planning, the EU is well aware of the benefits of central heat planning for residential heating. In this sense, the proposed strategic heat plan in municipalities of more than 50 000 inhabitants is an important step in the right direction. This proposal should also be extended to smaller municipalities, which could be bundled to facilitate implementation. This proposed requirement could ensure that local and national governments act in a way to support the outlined heat strategies through adequate funding programmes and regulation.

However, EEOS' non-deterministic approach risks adversely affecting these heat strategies, as obligated parties and ESCOs could support contradictory measures in these municipalities. Thus, an integration of the planned heat strategies into EEOS is necessary.

In order to ensure this, heat planning should be entitled to designate areas where only certain heating technologies are eligible within the EEOS, with some cases only allowing one heating technology. Similar approaches have been successfully applied in Denmark. For these restrictions to be directly applicable under Article 7, adequate prerequisites in Article 23 have to be determined.

Given the political desire to move away from gas and oil as heating fuels, such a central planning of heating options is bound to benefit the diffusion of heat pumps and DH. Furthermore, it would enhance the EEOS' overall effect of improving the energy efficiency of residential heating, transmission and infrastructure efficiency.

6.2.1 Heat pumps

In all implemented EEO schemes, heat pumps are an eligible measure. However, the European Commission's guidance accompanying the EED recommends merely accounting for the additional energy savings of an installed heater compared to that technology's mandatory minimum standard. This means that merely the better efficiency of the installed heat pump compared to the mandatory minimum standard heat pump is creditable, not the efficiency accruing from the shift from a less efficient technology such as gas, heating oil or biomass boilers. This is particularly problematic for heat pumps, as they constitute by far the most efficient decentralised heating technology and stand to benefit from an accounting method that considers this (Table 3). Given the fact that the investment and operation costs of heat pumps are still higher than those of other heating technologies in most countries, the relative incentive to install heat pumps for obligated companies is comparatively low, even more so for fossil fuel suppliers risking a decline in their customer base.

One way to alleviate this issue would be to compare the energy consumption of the installed technology with the mandatory minimum standard of the replaced heating technology. In order to do this, the EC guidance would need to be adjusted in this regard (Table 3). For new buildings, the mandatory minimum standard of the market average should then be used. This would consider the efficiency difference between heating technologies and incentivise the installation of heat pumps, which is societally very expedient due to the greater reduction in overall energy consumption and the avoidance of fossil lock-in. Ireland employs a comparable approach by crediting the installation of a heat pump with more than three times the savings of an installed high-efficiency gas boiler.

Table 3: Creditable savings in the example of replacing a gas boiler by a heat pump⁹.

Heat demand: 10 000 kWh	Conversion efficiency	Final energy demand	Achieved final energy savings	Savings creditable under:	
				EC guidance	Proposed guidance
Status quo ante: gas-fired boiler	0.95	10 526 kWh			
Minimum standard heat pump	3.1	3 225 kWh	7 301 kWh	0 kWh	7 301 kWh
Installed heat pump	3.5	2 857 kWh	7 669 kWh	368 kWh	7 669 kWh

This would disincentivise the installation of biomass boilers, as they tend to have comparatively poor degrees of efficiency. However, this is a minor issue given the disputed use of biomass in the energy transition.

6.2.2 District heating

The majority of EEOS include measures benefitting DH infrastructures, inter alia regarding network and heat generation efficiency. However, from 2024 on, such actions will result in creditable savings under

⁹ Based on the Annex to Commission Recommendation on transposing the energy savings obligations under the Energy Efficiency Directive (2019), page 115

the EED. Although this makes sense as such measures affect primary and not final energy consumption, this also sidelines EEOS as instruments to promote DH.

Member states could still uphold the eligibility of these actions by increasing the EEOS' total savings volume. For instance, connecting oil- and gas-heated buildings to the DH network is particularly important in the case of heating replacements in existing networks. However, such measures are less attractive to electricity and gas suppliers, since it means losing potential customers. Therefore, the installation of a gas boiler or heat pump was often the preferred option to ensure their customer base.

The measures eligible under an EEOS are not adequate to promote the expansion of DH networks, since piping work beyond the connection of buildings is not creditable in any European EEOS. Instead, as is the case for instance in Ireland and Slovenia, the buy-out fund is able to finance large-scale actions to expand the DH network. This requires a deliberate decision by the member states, since the energy savings accruing through these measures will not be eligible under Article 7 (soon-to-be Article 8) from 2024 on and thus require setting a higher savings target in the EEOS than determined in the EED.

Regarding the sustainability of the DH generation, all efficiency measures will be ineligible under Article 7 EED. Therefore, alternative legislation is required for the switch to renewable energy sources, as is the case in Denmark and for the additional eligible measures in the Italian EEOS. The proposal in Chapter 6.1.2 to include a DH network's PEF in companies' obligated savings volumes would also incentivise more sustainable heat generation.

Overall, it can be said that the position of DH in EEOS in the coming years will be complicated, as all measures improving DH networks are ineligible under Article 7 of the EED. Unless this is modified, which is not to be expected since the passage was explicitly removed in the EED recast for the 2024-2030 period of the savings obligation, the diffusion of DH will have to rely on additional regulation. This could allow more centralised planning and benefit from economies of scale. Either way, the new recast Article 8 EED (currently Article 7) sidelines EEOS as instruments to promote DH.

6.3 Summary

An EEOS is designed for optimal exploitation of cost-effective energy efficiency potentials. However, these economic potentials are often not aligned with overall climate mitigation targets, in particular with regard to heating, since the technologies most expedient for the fight against climate change are often more expensive than their alternatives. As a result, the scheme needs to be adapted to better incentivise the measures that support the necessary heat decarbonisation and to give the technologies required for this a competitive edge.

A central pillar in the decarbonisation of heating is the expansion and decarbonisation of DH, as this technology prevents fossil fuel lock-in effects in households. Furthermore, when combined with cogeneration, industrial waste heat or renewables, DH results in primary energy factors significantly below fossil fuel and biomass boilers. In order to promote the diffusion of this technology, the recommendation is to exempt DH operators from energy savings obligations. Alternatively, a reduced obligation proportional to the network's PEF is proposed, which would also incentivise sustainable heat generation, while still providing operators with a competitive advantage.

Regarding the support of measures linked to DH within EEOS, based on this report, we recommend upholding the eligibility of connecting buildings to the network. Other actions concerning heat generation or transmission could also be creditable, as they also contribute to heat decarbonisation. In addition, large-scale actions should be carried out using the EEOS' buy-out funds.

Although installing a heat pump is an eligible action in all member states with an EEOS, the generally employed accounting mechanism does not reflect this technology's efficiency benefits. Typically, only the difference between the installed heat pump and a mandatory minimum standard heat pump is creditable as savings, which does not take efficiency disparities between the different technologies into account. As a result, heat pumps have not yet managed to oust gas boilers from their incumbent position. The recommendation is therefore to credit the difference between the mandatory minimum standard of the replaced technology and the actual consumption of the installed technology as savings. The Commission should implement this adjustment by issuing updated guidance for the EED and the accounting of savings.

Furthermore, in order to exploit economies of scale, EEOS should include a handle to enable specific heat planning intervention. This should build on the planned Article 23 in the EED, which encourages municipalities of more than 50 000 inhabitants to create heat plans. To strengthen this measure, the EED recast should include an obligation instead of a recommendation for strategic heat planning. This should also be extended to smaller municipalities, allowing voluntary bundling to reduce the administrative burden. Another issue is the high inefficiency of funding measures that run counter to local heat plans. Including the possibility to declare the installation of certain heating technologies in designated areas ineligible within the EEOS would be a very fruitful option. This would significantly increase the overall efficiency of residential heating.

However, some of the proposed measures do not fall within the scope of the current version of the EED recast, as they would not generate eligible energy savings under soon-to-be Article 8. Therefore, they would require increasing the EEOS's overall savings target, in order to fulfil the obligation of soon-to-be Article 8. This would come at the price of higher overall system costs and thus higher energy costs as well. While declaring measures in the generation, distribution, and transmission sectors as ineligible is a deliberate decision to enhance genuine end-use reducing actions compensated with several other articles in the EED focusing on the promotion of DH, the disadvantageous savings crediting system for heat pumps does not fall under this category. Combined with the planned ineligibility of fossil fuel heating installations to contribute to savings targets in the EED recast, the proposed adjustments could give heat pumps the decisive push they need to become the favoured heating technology for obligated parties, in line with its efficiency and lock-in prevention benefits.

7 References

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A.1 Interview guideline

How are the EEOS in COUNTRY and other countries performing?

- What were the problems of the EEO scheme in COUNTRY and why has it been replaced?
- Were there major misunderstandings or loopholes?
- What kind of thresholds regarding the size of obligated parties do you think is suitable for EEOS?
- What advantages and inconveniences do you see in relation to trading, in particular with third parties?
- Should voluntary participation be allowed with regard to additionality?
- Is obligating grid companies instead of energy supplier more expedient due to their size, monopoly, and lower prevalence of conflicts of interests?

How could DHC operators better be included as obligated parties?

- What reasons do you see for the exclusion of district heating from EEO schemes and where should be the threshold?
- Should the used energy source be considered for DHC in EEOS?
- What impact could an expansion of obligations to small district heating companies have on them? What kind of challenges would an obligation pose for them?
- Could EEOSs be an issue with regard to efficient central heating planning?

How could heat pumps and district heating be included more expediently in the supported measures?

- Are there incentives for the obligated parties to increase the penetration of heat pump technology and to push the connection of buildings to district heating systems?
- Are there differentiations regarding heat pump type or electricity mix? Should there be?
- Should all district heating systems be eligible or merely DHCs using sustainable energy sources?

A.2 Characteristics of the EEOS

This section provides a comprehensive overview of the data collection material and the results of Task 5.1. The template shown in Table 4 was used for extracting the information for the EEOS. The first two columns list the design elements and items that characterise the EEOS. Since data was collected for more than one obligation period, this was also noted in the template. Several sources were used for collecting the data for each row of the template. Therefore, the identification number of the sources are noted in the last column. The consulted sources are listed in

Table 4: Template with the design elements of the EEOS

Characteristics of the EEOS	Details	Implementation period	Source
Superordinate base-line and target	Instrument types		
	Cumulative object		
	Reference		
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures (Expected) cumulative energy savings		
Evaluation	Strengths and weaknesses		
Key design features	Objective		
	Starting date		
	Sectors to be obliged		
	Energy carriers to be obliged		
	Selection of obligated actors		
	Eligible measures		
	Role of the involved stakeholders		
	Evolution of the indicators		
Assessments (savings/costs)	Flexibility rules		
	Setting of the baseline		
	Reference of the savings target		
	Differentiation of the savings target		
	Level of the savings target		
	Allocation of the savings target		
	Crediting period		
	Energy saving calculation methodologies		
	Determination of savings		
	Selection of the accounting period		
	Differentiation of the crediting of measures		
	Admissibility of double funding		
	Avoidance of double funding		
	Additionality ensured/Materiality		
Overlaps with other measures			
CO ₂ emission reduction			
Annual savings			

Characteristics of the EEOS	Details	Implementation period	Source
	Total annual savings		
	Cumulative energy savings		
	Allocation of system costs		
	Cost-effectiveness		
Certificates	System addressees		
	Admissibility of trade		
	Lifetime of certificates		
Monitoring	Length of the obligation period		
	Compliance und Monitoring		
	Verification		
	Penalties		
	Rulebook for M&V		
District heating/Heat pump	District heating		
	Heat pumps		

Table 5: Consulted sources for Task 5.1.

ID	Source	Link
1	Bertoldi et al. (2015). How is article 7 of the Energy Efficiency Directive being implemented? An analysis of national energy efficiency obligation schemes	Link
2	Bertrand et al. (2020). Evaluation du dispositif des Certificats d'Economie d'Énergie	Link
3	Broc et al. (2020). Snapshot of Energy Efficiency Obligation Schemes in Europe (as of end 2019)	Link
4	CA EED (2021 a). Bulgarian obligation scheme - Bulgaria	Link
5	CA EED (2021 b). New energy efficiency obligation scheme - Greece	Link
6	dena-fe (2012). Steigerung der Energieeffizienz mit Hilfe von Energieeffizienz-Verpflichtungssystemen. Kurz: Energieeffizienz-Verpflichtungssysteme (EnEffV Sys).	Link
7	Di Santo (2018). White certificates in Italy: lessons learnt over 12 years of evaluation	Link
8	Di Santo (2019). White certificates in Italy: will it overcome the huge challenges it has been facing in the last three years?	Link
9	Ecofys-Wuppertal (2012). Ausgestaltung und Bewertung eines marktbasierenden und haushaltsunabhängigen Verpflichtungsansatzes zur CO ₂ -Minderung im Wärmemarkt (fe 22/12)-Kurzfassung	Link
10	ENSMOV (2021). Cost-effectiveness and financial aspects of EEOs	Link
11	ENSPOL (2015). Energy Saving Policies and Energy Efficiency Obligation Scheme-Policy brief	Link
12	ENSPOL (2015a). Energy Saving Policies and Energy Efficiency Obligation Scheme D2.1.1: Report on existing and planned EEOs in the EU – Part I: Evaluation of existing schemes	Link
13	ENSPOL (2015b). Energy Saving Policies and Energy Efficiency Obligation Schemes D5.1 Combining of Energy Efficiency Obligations and alternative policies	Link
14	ENSPOL (2015c). Energy Saving Policies and Energy Efficiency Obligation Scheme D2.1.1: Report on existing and planned EEOs in the EU – Part II: Description of planned schemes	Link
15	Fawcett et al. (2019). Energy efficiency obligation schemes: their future in the EU	Link
16	Forster et al. (2016). Study evaluating progress in the implementation of Article 7 of the Energy Efficiency Directive	Link
17	ISI et al. (2012). Kosten-/Nutzen-Analyse der Einführung marktorientierter Instrumente zur Realisierung von Endenergieeinsparungen in Deutschland-Langfassung	Link

ID	Source	Link
18	Schlomann et al. (2021). Technical assistance on assessing progress in implementing Article 7 of energy efficiency directive and preparing the policy implementation in view of the new obligation period 2021-2030	Link ¹⁰
19	Larsen et al. (2013). Energy Efficiency Obligation Schemes in the EU - Lessons Learned from Denmark	Link
20	Malinauskaite (2019). Energy efficiency in industry: EU and national policies in Italy and the UK	Link
21	MKULNV (2015). Marktmodelle zur Steigerung der Energieeffizienz	Link
22	multEE (2015). Synthesis report on M&V schemes and coordination mechanisms in EU countries	Link
23	MURE Database	Link
24	Oeko-ISI (2012). Energieeinsparquote für Deutschland? Bewertung des Instruments der Energieeinsparquote (Weiße Zertifikate) auf seine Eignung als Klimaschutzinstrument für Deutschland	Link
25	Rosenow and Bayer (2017). Costs and benefits of Energy Efficiency Obligations: A review of European programmes	Link
26	Rosenow and Thomas (2020). Rewarding energy efficiency for energy system services through markets: Opportunities and challenges in Europe	Link
27	Rosenow et al. (2015). Study evaluating the national policy measures and methodologies to implement Article 7 of the Energy Efficiency Directive	Link
28	Rosenow et al. (2017). Market-based Instruments for Energy Efficiency. Policy Choice and Design	Link
29	Santini et al. (2020). Experience and lessons learned from P4P pilots for energy efficiency	Link
30	UBA (2016). Kompatibilität des Europäischen Emissionshandels mit interagierenden energie- und klimapolitischen Instrumenten und Maßnahmen Marktknappheit durch stringente Zielbestimmung und flexible Steuerung des Zertifikate-Angebots – UBA-Positionspapier –	Link
31	UBA (2021). Mögliche Ausgestaltung eines Energieeinsparverpflichtungssystems für Deutschland	Link
32	Wiese et al. (2018). Interaction effects of energy efficiency policies: a review	Link

¹⁰ The report has been finalised, however not published yet.

A.2.1 Austria

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	Top 4 measures: Energy efficiency obligation scheme for energy suppliers, Provincial support for housing construction, energy support and environmental support, and private sector renovation vouchers, Domestic Environmental Support (Umweltförderung im Inland, UFI), Energy Taxation; in total: 9 measures	18
	Cumulative object	Cumulative energy savings target for the period 2014-2020 notified by MS: 5.200 ktoe	18
	Reference	Annual final energy consumption (averaged over 2010-2012): 26.570 ktoe/year (based on national data, Austria's energy balance) Adjusted baseline: 16.508 ktoe/year Energy consumption excluded from the baseline: Transport (8.565 ktoe/year) and energy production for own use (1.497 ktoe/year)	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	25% (1.733 ktoe); use of option (d) (early actions)	18
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 4.142 ktoe (80 % of the 2014-2020 target) Assuming the current trend in new annual and total annual energy savings are continued over 2019-2020, Austria will very likely achieve its 2014-2020 target. The measures notified at the beginning of the obligation period 2014-2020 have delivered energy savings over expectations.	18
Evaluation	Strengths and weaknesses	The Austrian policy mix provides a good sectoral coverage (buildings, industry, transport), combining cross-cutting and sectoral measures. This mix has relied on policy measures that were already implemented before 2014 (e.g. UFI scheme, energy efficiency programs). The monitoring and verification system in Austria stands out through its quality, precision and transparency. However, this comes at a high cost in terms of administrative burden. That is why in the post-2020 period some changes will be introduced to enhance streamlining of the monitoring and verification process (at least) for the EEOS, without losing the high quality assurance.	18
Key design features	Objective	42% of overall Art. 7 target to be achieved by EEOS (159 PJ); Final energy consumption in 2020 of 1050 PJ. 159 PJ savings through efficiency commitments. 151 PJ through other strategic. 310 PJ according to article 7 measures.	16, 18

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Starting date	Targets are set in line with the Article 7 EED energy savings obligation, with targets for cumulative savings set from 2014 (or the beginning of the scheme if later than 2014) until the end of 2020 Second source: Austria introduced a voluntary obligation scheme in 2009 (replaced with an obligatory scheme in 2014) Third source: The EEOS has been launched in 2015, but, before the EEOS, there were voluntary agreements with energy companies which made that the EEOS has delivered energy savings from its start.	18, 27, 18, 16, 3
	Sectors to be obliged	all sectors	18, 25
	Energy carriers to be obliged	No restriction to specific energy sources	
	Selection of obligated actors	All energy suppliers with more than 25 GWh of supply to Austrian customers. Second source: all retailers of energy including motor fuels and biomass, excluding small retailers; Retail energy sales companies are obligated on an individual basis. Smaller, obligated retail energy sales companies (selling between 25 and 150 GWh in the previous year) can form a pool and achieve their obligation jointly. Any obligated party above sales of 150 GWh in the previous year cannot participate in such a pool but has to achieve its obligation individually.	27, 14
	Eligible measures	No fundamental restriction on the admissibility of measures. Measures must be implemented in Austria and concern final energy savings. Measures must go beyond the legal minimum standards. Behavioral measures are eligible within the framework of the EED requirements. Art. 7: Actions concerning renewables are only included if they concern own generation AND own use. In future, some of the currently eligible actions may no longer be allowed, e.g. adding additives to fuels. One requirement is that for each obligated party 40% of yearly savings have to be achieved with measures at households. The remaining 60% of savings can be achieved in any end use sector (households, services, industry, transport, agriculture).	18, 13
	Role of the involved stakeholders		
	Evolution of the indicators	Austria has not changed its policy mix reported to Article 7 EED over the period 2014–2020. As the results achieved have been higher than the planned trend, Austria did not have to report new policy measures compared to the ones initially notified.	18
	Flexibility rules	Compensation payment is possible; the funds from the compensation payment flow into a funding pot to support efficiency measures. The obligation can be fulfilled by joining an industry agreement. Borrowing not allowed. Buy-out: A compensation fee of 20 Eurocents per kWh of not achieved savings can be paid.; other sources: Bilateral trading between obligated parties; banking and borrowing not proposed at this stage; implicit borrowing of up to 3 months; All public and private companies can get an energy savings account, and can transfer their energy savings to	16, 3

Characteristics of the EEOs	Details	Implication period 2014-2020	Sources
		OPs through civil contracts (no trading/market). Companies with no obligation are allowed to bank implemented energy savings until the 14th of February of the subsequent year in order to be able to transfer them to OPs within the period from 2015 to 2020. Instead of proving the implementation of energy efficiency actions, OPs may fulfil their obligation by carrying out energy efficiency actions for the respective year by a tender for the appropriate energy saving. If the OPs over-achieve their obligation in one year, banking is allowed to transfer the excess savings to following years of the obligation period (2015-2020). In the case of not achieving the obligation of a given year, borrowing is not allowed. But OPs have the possibility to buy new energy efficiency actions from the same year on the market or they have to pay a compensation fee of 0.2 €/kWh.	
Assessments (savings/costs)	Setting of the baseline		
	Reference of the savings target	The source of data used is not specified in the NECP.	18
	Differentiation of the savings target	40 % of measures in private households (buildings and private mobility) or public transport. No further restriction on sectors, energy sources, etc.	16
	Level of the savings target		
	Allocation of the savings target	Savings amounting to 0.6% of the previous year's turnover must be demonstrated.	
	Crediting period	2014-2020	18
	Energy saving calculation methodologies	Detailed methodology document for standard measures available. It contains standard measures with default values and calculation rules. If there is no calculation methodology for the savings specified by the monitoring body, the obligated actor must prove the savings achieved individually. This can be done by calculation or before-after measurement. deemed and metered savings; other sources: deemed savings; engineering estimates; metered savings. In principal all methods according to Annex V 1. of the EED (deemed savings, metered savings, scaled savings, surveyed savings) are possible. A mix of all four methods is expected with differences between sectors. For example it is expected that for standardized measures at rather homogenous customers (e.g. household appliances) deemed savings will be the method mainly applied. For measures in industry it will most likely not be possible to apply a deemed savings approach but to calculate savings based on metered consumption or engineering estimates. The applied methods in all sectors will eventually depend on the availability of deemed savings methods. The energy savings of energy efficiency actions can be calculated either with standardized or specific methods. 42 categories and more than 250 standardized methods (formula + deemed savings) are available. In addition a guideline for the calculation of energy savings for individual actions is available (for specific methods).	18, 25, 14, 3
Determination of savings			

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Selection of the accounting period	Only the first year's energy savings are rewarded	18
	Differentiation of the crediting of measures	Uplift factor of 1.5 for savings achieved in fuel poor households	16
	Admissibility of double funding		
	Avoidance of double funding		
	Additionality ensured/Materiality		
	Overlaps with other measures	Financing schemes; The main concern is about double counting between grants for energy efficiency in buildings and building regulations.	18
	CO ₂ emission reduction		
	Annual savings	Final energy savings per year in household and industry sectors in the time period 2015: 136 ktoe; another source: Final new annual energy savings amounted to 2.9 PJ in 2014, 6.6 PJ in 2015, 6.2 PJ in 2016 and 3.2 PJ in 2017.	25, 23
	Total annual savings		
	Cumulative energy savings	Minimum by state: 11878, by art. 7: 12414; EEOS 42% share of cumulative energy savings reported for 2014-2018 (4142 ktoe); The cumulative contribution between 2014 and 2017 amounts to 47,1 PJ.	18
	Allocation of system costs		
	Cost-effectiveness	Weighted average EEO cost of lifetime energy savings for the time period 2015: 0.5 cent/kWh	25
Certificates	System addressees	The M&V scheme in Austria is administered and coordinated by the Austrian Energy Agency	22, 3
	Admissibility of trade	Horizontal and vertical trading.; bilateral trading between obligated parties; Energy retailers will be permitted to comply with their obligations via savings delivered by third parties.	16, 1
	Lifetime of certificates		
Monitoring	Length of the obligation period		
	Compliance und Monitoring	Monitoring is carried out centrally by the Austrian Energy Agency, which gathers data from all the policy measures reported Reporting is carried out annually by the obligated actors. Austria has implemented a centralized monitoring system gathering data from all the policy measures reported, and coordinating with the authorities in charge of each policy measure The M&V scheme in Austria is administered and coordinated by the Austrian Energy Agency, which qualifies	18, 22, 3

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>as a third party non-governmental contractor.</p> <p>Energy savings are credited for the first year of the action. The owner of the energy savings is usually the final customer. The OP has to document its role in the context of the carried out energy efficiency action and has to provide in most cases a document signed by the final customer that transfers the ownership of the energy savings to the OP.</p> <p>OPs can report the energy savings in the provided online database throughout the year in which the action was carried out and additionally until mid-February of the following year. The detailed documentation of the savings must be kept for checks carried out by AEA. The OPs have to report the achieved energy savings by means of an IT-application called "Anwendung zum EEffG".</p>	
	Verification	<p>IT system developed for measurement and verification of all measures for article 7. The monitoring and verification system in Austria stands out with its quality, precision and transparency;</p> <p>The energy savings reported are verified by means of plausibility checks and in depth sample checks of statistically significant proportions of the implemented energy efficiency projects. Moreover, selected projects will be verified through on site visits; Obligated parties have to prove on a yearly basis whether they have fulfilled their stipulated yearly savings target.</p>	18, 22
	Penalties	<p>In the event of non-compliance, a grace period of three months (from the date of detection) is granted, during which the savings quantity is provided or immediately put out to tender. The "subsequent performance" can also take the form of payment of the compensation payment. Art. 7: Penalties are mentioned in the Energy Efficiency Act § 31. If energy suppliers miss their targets, they face a penalty of €50,000 to €100,000. Energy suppliers can opt to pay a levy of 20 Eurocent per kWh instead of delivering their targets fully. This is significantly above the typical costs of delivering EEOS in Europe (less than 2 Eurocent per kWh).</p> <p>Second source: Instead of proving the implementation of energy efficiency actions, OPs may fulfil their obligation by carrying out energy efficiency actions for the respective year by a tender for the appropriate energy saving. OPs can also use the "pay to save" option which means paying a compensation fee (0.2€/kWh of first-year energy savings). If the OPs over-achieve their obligation in one year they are allowed to transfer the respective excess savings to following years of the obligation period (2015-2020). In the case of not achieving the obligation of a given year they have the possibility to buy new energy efficiency actions from the same year on the market or they have to pay the compensation fee of 0.2 €/kWh. If an OP does not comply with the regulations of the Austrian energy efficiency act the extent of the administrative penalty can be up to 100,000 €.</p>	18, 10
	Rulebook for M&V	M&V system in place	16
District heating/ Heat pump	District heating	<p>Retailers of all fuel types are included - electricity, gas, liquid and solid fuels, including transport fuels and district heating;</p> <p>The policy measure "Regulations for district heating" should deliver 430 ktoe cumulative energy savings;</p>	1, 27, 22

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		Improvements of the heating systems (31.9%), including measures related to installing energy efficient boilers, heat pumps, solar thermal plants and connecting buildings to the district heating grid are included	
	Heat pumps	According to Austria's latest National Energy Efficiency Action Plan, a substantial part of energy efficiency gains results from ... improvements of the heating systems (31.9%), including measures related to installing energy efficient boilers, heat pumps, solar thermal plants and connecting buildings to the district heating grid.	22

A.2.2 Bulgaria

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	EEO and 4 Alternative measures including Individual energy saving targets for owners of industrial systems, and government and municipal buildings, National program for energy efficiency of multi-family residential buildings; To achieve the savings target and close the gap, Bulgaria introduced two new alternative measures that will be reported in 2019: § AM3 – Operational Program "Innovation and Competitiveness" - Procedure "Increasing energy efficiency in large enterprises" § AM4 – European Economic Area Financial Mechanism 2014-2021 - program area "Renewable energy, energy efficiency, energy security"; another source: considers only EEOs for Bulgaria	27, 18, 3
	Cumulative object	Cumulative energy savings target for the period 2014-2020 notified by MS (ktoe): 1,943; The overall target for the EEOS has been set as the difference between this target and the savings expected from alternative measures (AM). The EEOS target in 2019 thus represents 63% of the article 7 target.	27, 18
	Reference	Annual final energy consumption (averaged over 2010-2012): 9.116 ktoe ktoe/year (based national data from the National Statistical Institute). Adjusted baseline: 6.167 ktoe/year Energy consumption excluded from the baseline: Transport (2.956 ktoe ktoe/year) (no exclusion of energy production for own use)	
	Approach used to calculate the obligation		

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Use of exemptions in implementation of measures	25% (647 ktoe); use of options (a) (slow start), (b) (excluding energy sales to the ETS-industry) and (d) (early actions).	18
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 496 ktoe (26 % of the 2014-2020 target). Assuming the current trend in new annual and total annual energy savings are continued over 2019-2020, Bulgaria will very unlikely achieve its 2014-2020 target. The achieved savings have been much lower compared to the linear trajectory notified by Bulgaria (expected cumulative savings of 1008 ktoe for 2014-2018), showing an important savings gap (about 50%).	18
Evaluation	Strengths and weaknesses	<p>The Bulgarian EEOS was in place before the EED entered into force, as part of the policy measures to achieve the objective set according to the Energy Services Directive. The scheme was then modified in accordance with the requirements of Article 7 EED in 2014, and then again in 2016 with the introduction of alternative measures supplementing the EEOS.</p> <p>However, the expected rates of energy savings for the EEOS were highly over-estimated (compared to what the obligated parties have been able to deliver). The proposed policy mix was therefore not sufficient to achieve Bulgaria's savings target. Misconceptions among the obligated parties with regard to responsibilities and opportunities have hindered the operation of the EEOS.</p> <p>Some concern also remains with regard to the M&V system considering the lack of effective enforcement. A stricter monitoring and verification system is foreseen and is currently developed for the next period (2021-2030).</p> <p>The main lesson learnt from the last period could be the introduction of a mixed approach to the implementation of Article 7 to share efforts between the State and the obligated parties.</p>	18
Key design features	Objective	100 % of the cumulative energy savings target should deliver EEOS (1,944 ktoe)	27
	Starting date	Different indications: <ul style="list-style-type: none"> - 2011; - obligation period started in January 2014 but the EEOS have not been in place then. Presumably, the obligated parties would need to achieve the savings retrospectively. - EEOS since 2008; - The scheme first started in 2008 with a different approach until 2014. 	6, 27, 16, 3
	Sectors to be obliged	Different indications: <ul style="list-style-type: none"> - Exclusion of transport sector fuel coverage; - all final customer sectors - industry, transport, households, commerce, civil society organizations, agriculture, forestry and fishery, services, etc; incl. energy transformation, distribution and transmission sectors; - all sectors (incl. transport). 	18, 23, 16, 3
	Energy carriers to be obliged		

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Selection of obligated actors	<p>Traders with a sales volume of more than 75 GWh per year (electricity, heat, gas, liquid and solid fuel), traders with more than 10 employees or turnover of more than 1.99 million EUR;</p> <p>other sources:</p> <ul style="list-style-type: none"> - having a turnover or end-of-year balance for the previous year of more than BGN 3.9 million; transport fuel retailers are not obligated to participate in the scheme; - electricity retailers and heat transmission companies selling more than 75 GWh in the previous year, to natural gas traders selling more than 8 million cubic meters, liquid fuel traders selling more than 6,500 t, and solid fuel traders selling more than 13,000 t.; - all energy distributors and/or retail energy sales companies, including transport fuel distributors and transport fuel retailers. - end suppliers, suppliers of last resort, traders with issued Operating license "electricity trading", selling electrical energy to final consumers more than 20 GWh per year; district heating companies and suppliers, which sell heat to final consumers more than 20 GWh per year; end suppliers and traders of natural gas selling to end consumers more than 1 million m3 per year; liquid fuels traders selling to the end consumers more than 6.5 kt liquid fuels per year, with the exception of fuel for transport purposes; solid fuel traders who sell to end consumers more than 13 kt solid fuels per year. <p>Retailers of transport fuels are not included as obligated parties, but savings can be made in the transport sector.</p>	27, 23, 1
	Eligible measures	<p>Eligible individual actions are defined in Regulation No E-RD-04-3/04.05.2016 (published in SG No 38/2.05.2016) and cover all sectors except transport.</p> <p>Technical, organizational and behavioral measures can be included in the scheme.</p> <p>Actions include thermal insulation; the replacement of process equipment power transformers; and fuel switching in industry as well as 35 standardized actions for which scaled savings methods are provided. Actions can also be delivered through energy services (e.g. energy audits, energy management, inspection of boilers) and awareness raising (in the household sector).</p> <p>The obligated parties may implement measures that achieve energy savings in the energy transformation, distribution and transmission sectors, including by means of efficient district heating and cooling systems infrastructure.;</p> <p>Actions can for example be delivered through energy services (e.g. energy audits, energy management, inspection of boilers) and awareness raising (for households).</p>	18, 1, 23, 3
	Role of the involved stakeholders		

Characteristics of the EEOs	Details	Implication period 2014-2020	Sources
	Evolution of the indicators	In the period 2010-2016, Bulgaria had an EEOs, covering more obligated persons – public buildings' owners and Industrial systems' owners	23
	Flexibility rules	Banking and borrowing allowed, buy out: Contributions can be made to the Energy Efficiency and Renewable Sources Fund which acts as a financial intermediary to manage energy efficiency projects	18, 3
Assessments (savings/costs)	Setting of the baseline	Savings achieved due to introduction of the new EEO scheme shall be at least equivalent to achieving new savings each year from 1 January 2014 to 31 December 2020 of 1,5 % of the annual energy sales to final customers of all retail energy sales companies by volume, averaged over the 2010 – 2012 period. The basis for calculating the obligation under Article 7 of the EED on energy efficiency is 6 167 ktoe, set as a baseline excluding the non-energy and transport use for the average of 2010-2012. On top of that, the 1.5% target set implies that Bulgaria must achieve 92.50 ktoe of new savings annually for the period 2014-2020, which in cumulative figures amounts to 647.50 ktoe. Furthermore, next to the EEO scheme, Bulgaria targets at 25% energy savings, through making use of the provisions of Article 7	14
	Reference of the savings target	Source of data used not mentioned in the final NECP	18
	Differentiation of the savings target		
	Level of the savings target		
	Allocation of the savings target	The overall savings target is 1.5 % of annually of the average energy sales of obligated parties	1
	Crediting period	2014-2020	18
	Energy saving calculation methodologies	Scaled savings; alternative approach, as allowed by Article 7 EED (2). Bulgaria will make use of the possibility to gradually increase the target (from 0.7% to 0.92%) by reaching the target of 4 357 ktoe in 2030. The target calculated by Bulgaria this way is equivalent to the amount of energy savings required in line with Article 7 EED(1).	18
	Determination of savings		
	Selection of the accounting period	EEOs targets on the basis of first year energy savings over periods ending in 2020	18
	Differentiation of the crediting of measures	The EEOs does not include provisions specific to energy poverty.	3
	Admissibility of double funding		
	Avoidance of double funding		
	Additionality ensured/Materiality		
Overlaps with other measures	Regarding the alternative measure 'Individual energy saving targets for owners of industrial systems, and government and municipal buildings' there is a potential of overlap with the EEOs. This measure will be discontinued in the next period.	18	

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	CO ₂ emission reduction		
	Annual savings	807; new savings 2019: 3.5 ktoe	28
	Total annual savings	Cumulative annual savings (PJ): 2014: 1.22, 2015: 2.1, 2016: 4.2, 2017: 5.9, 2018: 7.1, 2019: 2	23
	Cumulative energy savings	Notified by state: 15907; art. 7: 1567; EEOS 41,7% share of cumulative energy savings reported for 2014-2018 (496 ktoe); other source: cumulative savings 2014-2019: 275.4 (ktoe)	18, 23
	Allocation of system costs		
	Cost-effectiveness		
Certificates	System addressees	SEDA is the responsible institution for the monitoring and verification of the individual targets implementation; SEDA is issuing energy savings certificates (ESC) to the project holder (OPs or third parties), under the responsibility of SEDA's Executive Director. SEDA systematically verifies the savings calculations before issuing the ESC.	4, 3
	Admissibility of trade	Horizontal trading	18
	Lifetime of certificates		
Monitoring	Length of the obligation period	2014-2016	27
	Compliance und Monitoring	There is no major concern with regard to the overall compliance with Annex V for the EEOS; The energy audits are realized by professionals (for example engineers, architects, etc...) who are certified and registered in the public register. (Methodology for the operation of the energy efficiency obligation schemes from Republic of Bulgaria, Ministry of Economy and Energy). Compliance with the requirement in the second subparagraph of Article 7(1) will be ensured by introducing various types of mechanisms and obligations to promote the implementation of energy efficiency measures leading to measurable energy savings.	18, 14
	Verification	The reported savings should be validated by qualified energy auditors registered with SEDA. They should be independent vis-à-vis the actions (i.e. not involved in ex-ante audit or any other service related to the action evaluated)	3
	Penalties	An administrative penalty is applied in case of non- achievement of OP's annual target. The sanction does not revoke the obligation. If an obligated party fails to meet its individual annual energy savings target, a fine of BGN 1,000-5,000 (EUR 510-2,550) or a financial sanction of BGN 5,000-500,000 (EUR 2,550-255,000) can be levied. The wide range of the potential financial sanction allows for proportionality.	18, 3
	Rulebook for M&V	M&V system in preparation	16

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
District heating/ Heat pump	District heating	The obligated parties may also implement measures that achieve energy savings in the energy transformation, distribution and transmission sectors, including by means of efficient district heating and cooling systems infrastructure. Obligated Parties (OP) are all companies selling energy to final customers (96 OPs in 2019), including all types of energy sold (excluding fuels for transport), beyond a threshold depending on the energy type: 20 GWh/a for electricity and district heating	14, 3
	Heat pumps		

A.2.3 Croatia

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	13 measures: EEOS and alternatives Top 5 measures: EEOS, Systematic energy management in the public sector, Program of energy renovation of multifamily housing, Program of energy renovation of family homes 2014 – 2016, Program of energy renovation of public sector buildings Four alternative measures have been newly reported in NEEAP 2017: systematic energy management in the public sector, measure combating energy poverty, energy efficiency in manufacturing sectors and city bicycle system. Some of these measures have been running in previous years, but were not previously reported for article 7. At the opposite, the policy measure about individual heat metering initially notified is no longer reported.	18
	Cumulative object	Cumulative energy savings target for the period 2014-2020 notified by MS (ktoe): 1,295; Cumulative energy savings target for the period 2014-2020: 1.296 ktoe	27, 18
	Reference	Annual final energy consumption (averaged over 2010-2012): 6.150 ktoe/year (based on national data, Croatia's energy balance) Adjusted baseline: 4.113 ktoe/year Energy consumption excluded from the baseline: Transport (2.037 ktoe/year) (no exclusion of energy production for own use)	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	25% (432 ktoe); use of options (a) (slow start) and (b) (excluding energy sales to the ETS-industry).	18

Characteristics of the EEOs	Details	Implication period 2014-2020	Sources
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 588 ktoe (45 % of the 2014-2020 target) Assuming the current trend in new annual and total annual energy savings are continued over 2019-2020, Croatia will unlikely achieve its 2014-2020 target. The target set in the 4th NEEAP for EEOs is cumulative savings of 27.07 PJ for the period 2014-2020.	3
Evaluation	Strengths and weaknesses	Croatia has a good policy mix of measures and it is commendable that the EEOs is not prescribed but rather left to the obligated parties to suggest. The information seems to reveal there is a clear understanding of the obligations and rules (besides the target calculation which was done before the guidance was published) which the recast EED brings, but some issues still need to be clarified, and particularly: sampling and verification methods, M&V rulebook update including the calculation of energy savings from RES, as well as an explanation of what was the basis for the savings from the EEOs to start occurring in 2014 when the scheme officially commenced only in May 2019. The bottom-up measurement and verification of energy savings through the national M&V system for energy efficiency (SMiV) are exemplary, but only under condition that there is sufficient capacity and experts in place to run, operate this information system and verify the savings. However, the expected rates of energy savings for the EEOs were highly over-estimated (compared to what the obligated parties have been able to deliver). The proposed policy mix was therefore not sufficient to achieve Bulgaria's savings target. Misconceptions among the obligated parties with regard to responsibilities and opportunities have hindered the operation of the EEOs. Some concern also remains with regard to the M&V system considering the lack of effective enforcement. A stricter monitoring and verification system is foreseen and is currently developed for the next period (2021-2030). The main lesson learnt from the last period could be the introduction of a mixed approach to the implementation of Article 7 to share efforts between the State and the obligated parties.	18
Key design features	Objective	41 % of the cumulative energy savings target should be delivered by EEOs--> 529 ktoe; NEEAP 2017 mentions that 40% of the cumulative savings target was supposed to be achieved from the EEO scheme, while this was increased to 49.9% in the annual report 2020 that has included retrospectively achieved savings from the EEOs that were not reported in the previous annual reports.	27, 18
	Starting date	Targets are set in line with the Article 7 EED energy savings obligation, with targets for cumulative savings set from 2014 (or the beginning of the scheme if later than 2014) until the end of 2020; implementation started in 2019, EEOs was first introduced in late 2014	18, 27, 23, 3
	Sectors to be obliged	Different indications: - exclusion of transport sector; - all sectors	18, 16

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Energy carriers to be obliged		
	Selection of obligated actors	Obligated entities are supplied by energy suppliers. The system has been operational since 2019, when it was entered by suppliers that have delivered more than 300 GWh of energy to the market during 2017. In 2020, the suppliers who delivered more than 100 GWh of energy to the market in 2018 enter the system of obligations, and from 2021 onwards all those suppliers who supplied more than 50 GWh of energy to the market during the previous year.	23
	Eligible measures	<ul style="list-style-type: none"> • Renovation measures for existing residential buildings and service sector buildings • Measures for renovating insulation applied to building components • Installation or replacement of heating and hot water generation systems in residential buildings and service sector buildings • Installation of systems for individual metering of consumption (until it becomes legally required) • Installation of solar collectors and heat pumps in residential buildings and service sector buildings • Installation or replacement of air-conditioning systems in several areas of indoor premises (under 12kW) in residential buildings and service sector buildings • Installation or replacement of electric cooling systems in buildings in the services and industrial sectors • Installation or replacement of kitchen appliances • Installation or replacement of office equipment • Installation or replacement of domestic lighting fixtures • Installation, repair or replacement of lighting systems or parts thereof in buildings in the services sector and industrial sector • Measures for renovation of street (public) lighting • Replacement or purchase of new energy-efficient vehicles • Training on and promotion of eco-driving • More energy-efficient electric engines in industry • Energy audits <p>Obligated parties may propose measures and calculation methodologies for measures not included in the Rulebook</p>	18
	Role of the involved stakeholders		
	Evolution of the indicators	Four alternative measures have been newly reported in NEEAP 2017: systematic energy management in the public sector, measure combating energy poverty, energy efficiency in manufacturing sectors and city bicycle system. Some of these measures have been running in previous years, but were not previously reported for Article 7 EED. At the opposite, the policy measure about individual heat metering initially notified is no longer reported.	18

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Flexibility rules	Banking allowed between any years upon approval from Ministry; borrowing allowed to be compensated in the next year, if not higher than 10% of the annual target between any years upon approval from Ministry; buy-out: payments can be made into an Energy Efficiency Fund, buy-out: Payments can be made into the Environmental Protection and Energy Efficiency Fund. Payments are mandatory in cases where annual targets, including any borrowing, are not met. The Fund is obliged to use the payments to co-finance alternative measures. The fee per PJ is calculated annually, based on the costs of achieving energy savings through alternative measures.	18
Assessments (savings/costs)	Setting of the base-line	4 113 ktoe/year	18
	Reference of the savings target	based on national data, i.e. the national energy balance done according to the EUROSTAT method; the difference with Eurostat data is not significant	18
	Differentiation of the savings target	special measures for energy poverty: Croatian EEOS Rulebook states that energy savings in areas with developmental difficulties will receive a 10% uplift, while energy savings in "endangered customer" households will get a 20% uplift	18
	Level of the savings target		
	Allocation of the savings target		
	Crediting period	2014-2020	18
	Energy saving calculation methodologies	deemed, surveyed savings	18
	Determination of savings		
	Selection of the accounting period	EEOS targets on the basis of first year energy savings over periods ending in 2020	18
	Differentiation of the crediting of measures	OPs are especially encouraged to tackle energy poverty. If EE measures are implemented in underdeveloped areas, energy savings achieved may be increased by 10%, while when implemented in vulnerable energy consumer's household, they may be increased by 20%.	3
Admissibility of double funding			
Avoidance of double funding			

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Additionality ensured/Materiality	Energy savings from the EEOS have only been reported in the annual report 2020, most likely including energy savings from previous years, whereas the legislation enforcing the EEOS was only adopted in 2019. It is therefore unclear how materiality could be ensured for energy savings achieved before the adoption of the legislation.	22
	Overlaps with other measures		
	CO ₂ emission reduction		
	Annual savings	energy savings from the EEOS have only been reported in the annual report 2020, most likely including energy savings from previous years	18
	Total annual savings		
	Cumulative energy savings	Notified by state: 1290, art. 7: 2994; EEOS 57,9% share of cumulative energy savings reported for 2014-2018 (588 ktoe)	18
	Allocation of system costs		
	Cost-effectiveness		
Certificates	System addressees		
	Admissibility of trade	Vertical trading; Apart from own actions, OPs may fulfil their obligation through purchase of energy savings from third parties. It is expected that this possibility will trigger the ESCo market. One possibility for OPs to fulfil their obligation is to pay a prescribed fee to the Environmental Protection and Energy Efficiency Fund. The payment is mandatory in case of non-compliance with the annual target. The Fund is obliged to use the gathered financial means to co-finance alternative measures. The fee is calculated annually, based on costs encountered by the Fund to achieve savings with alternative measures.	18, 3
	Lifetime of certificates		
Monitoring	Length of the obligation period		
	Compliance und Monitoring	Croatia uses a centralized M&V system plus obligating all parties delivering energy savings to input them in the national System for M&V of energy savings (SMiV); All measures undertaken must be entered in the M&V platform (SMiV). The platform calculates energy savings, based on the Ordinance on monitoring, measurement and verification of energy savings, using dominantly deemed savings or engineering estimates.	18, 3

Characteristics of the EOS	Details	Implication period 2014-2020	Sources
	Verification	IT system developed for measurement and verification of all measures for article 7; The measured energy savings are being verified through specific algorithms in the SMIV.	18, 22
	Penalties	The Energy Efficiency Act prescribes different punishments for obligated parties ranging from 20.000 to 500.000 kn (3.000 to 75.000 EUR) and also punishments for the physical person in charge of the obligated party (300 to 2.000 EUR).	18
	Rulebook for M&V	M&V system in place	16
District heating/ Heat pump	District heating	The types of investments include eco-driving, energy audits, heat pumps, air conditioning, efficient housing appliances, cooling, heating, office equipment, solar thermal heating, photovoltaics, electric motors, integral renovation of buildings, thermal insulation of envelope, investments in industry, advanced metering system. Obligated parties have also reported some measures in energy production/transformation such as energy efficient transformers or use of waste heat, measures in district heating systems etc.	10
	Heat pumps	Main measures are set out in the Rulebook for M&V: Installation of solar collectors and heat pumps in residential buildings and service sector buildings. The types of investments include eco-driving, energy audits, heat pumps, air conditioning, efficient housing appliances, cooling, heating, office equipment, solar thermal heating, photovoltaics, electric motors, integral renovation of buildings, thermal insulation of envelope, investments in industry, advanced metering system.	18, 10

A.2.4 Cyprus

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	In total 23 measures: top 4: Taxes on fuels, PV systems for own consumption, Supplementary taxes on electricity, Grant Scheme "Saving Energy- Upgrading of Households"	18
	Cumulative object	Cumulative energy savings target for the period 2014-2020 notified by MS(ktoe): 242	27
	Reference	Annual final energy consumption (averaged over 2010-2012): 1.863 ktoe/year (based on Eurostat data) Adjusted baseline: 767 ktoe/year Energy consumption excluded from the baseline: Transport (1.023 ktoe/year) and energy production for own use (73 ktoe/year)	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	Use of exemptions (Article 7(2) of EED2012): 25% (81 ktoe); use of the options (a) (slow start) and (b) (EU ETS)	18
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 162 ktoe (67 % of the 2014-2020 target). Assuming the current trend in new annual and total annual energy savings are continued over 2019-2020, Cyprus will very likely achieve its 2014-2020 target.	18
Evaluation	Strengths and weaknesses	Cyprus has planned a variety of measures, mainly subsidy/grants, addressing all sectors. The calculation of energy savings from the taxation measures is based on a clear method for calculating elasticities and counterfactual scenarios. Moreover, Cyprus has adopted an transparent approach to avoid double counting between measures, by removing from the total energy savings reported the energy savings from policy measures that might overlap with the energy taxes. Cyprus makes use of two taxation measures that generate the majority of the reported cumulative savings over 2014-2018 (over 90%), while the various financial schemes have generated small energy savings and the EEOS is not operational yet. Furthermore, there are several ambiguities and clarifications would be required for the support schemes that finance directly and indirectly RES actions (e.g. PV for own consumption).	18
Key design features	Objective		
	Starting date	Changes in the policy mix: NEEAP2017 announced that new measures were to be reported from 2017 on, as Cyprus was not on track to its energy savings target at that time. The annual report 2019 included revised estimates of expected total cumulative savings over 2014-2020 for all policy measures reported by then, showing a trajectory to achieve the target. This annual report also announced an EEOS to be started by the end of 2020	18

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Sectors to be obliged		
	Energy carriers to be obliged		
	Selection of obligated actors		
	Eligible measures		
	Role of the involved stakeholders		
	Evolution of the indicators		
	Flexibility rules		
Assessments (savings/costs)	Setting of the baseline		
	Reference of the savings target		
	Differentiation of the savings target		
	Level of the savings target		
	Allocation of the savings target		
	Crediting period		
	Energy saving calculation methodologies		
	Determination of savings		
	Selection of the accounting period		
	Differentiation of the crediting of measures		
	Admissibility of double funding		
	Avoidance of double funding		
	Additionality ensured/Materiality		
	Overlaps with other measures		
	CO ₂ emission reduction		
	Annual savings		
	Total annual savings		
Cumulative energy savings			
Allocation of system costs			

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Cost-effectiveness		
Certificates	System addressees		
	Admissibility of trade		
	Lifetime of certificates		
Monitoring	Length of the obligation period		
	Compliance und Monitoring		
	Verification		
	Penalties		
	Rulebook for M&V		
District heating/ Heat pump	District heating		
	Heat pumps		

A.2.5 Denmark

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	EEOS only	27
	Cumulative object	Different indications: - Cumulative energy savings target for the period 2014-2020 notified by MS(ktoe): 4,130; - Cumulative energy savings target for the period 2014-2020: 3.841 ktoe	27, 18
	Reference	Annual final energy consumption (averaged over 2010-2012): 15.086 ktoe/year (based on national data, official Danish energy statistics reported to Eurostat) Adjusted baseline: 9.833 ktoe/year Energy consumption excluded from the baseline: Transport (4.973 ktoe/year) and energy production for own use (277 ktoe/year)	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	7% (289 ktoe); use of option (c) (counting energy savings from the supply-side).	18
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 3.187 ktoe (83 % of the 2014-2020 target) Assuming the current trend in new annual and total annual energy savings are continued over 2019-2020, Denmark will very likely achieve its 2014-2020 target. Denmark's achieved savings have exceeded so far the expected savings.	18
Evaluation	Strengths and weaknesses	<p>The EEOS in Denmark was successful in the industry sector and the overall social-economic evaluation is positive. The target of the EEOS has been raised several times, and the obligated parties were over-achieving. As a result of the increased obligation from 2010 onwards in the Danish scheme, there have been significantly more energy savings realized in the industry sector.</p> <p>The successive evaluations raised some concern that some of the energy savings could include a share of free-rider effect (energy efficiency actions that would have been done anyway), in the industry sector and probably even more in households. The Danish system was initially characterized by lesser controls compared to other European EEOS, and was guided by flexibility and trust in the correct reporting by the companies. Controls were performed sample wise.</p> <p>The successive increases in the target of the EEOS has put the obligated companies under a lot of pressure, especially in 2015. Which might have led to overestimation of energy savings and frauds. More means have then been dedicated to monitoring and controls. However, too strict definitions, over-controlling, and high administrative burden were perceived by the stakeholders as ending the possibility of cheap energy savings. The example of Denmark's EEOS scheme shows the difficulty to balance monitoring and verification on the</p>	18

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		one hand, and the associated cost and administrative burden on the other hand. The EEOS in Denmark will not be continued in the period 2021-2030. However, experience from the Danish suggests that EEOS might be relevant and cost-effective to achieve savings in industry.	
Key design features	Objective	<p>Primary energy consumption -20% (745 PJ) compared to referential development, -4% compared to 2006; final energy consumption: -10.5% (68 PJ) compared to average of 2010-2012. Increase energy efficiency at 1.5 %/a. Among the top 3 OECD countries in terms of energy intensity.</p> <p>other sources:</p> <ul style="list-style-type: none"> - Reduce PEV by 7.6% by 2020 compared to 2010. - Energy savings target for the period 2014-2020: 3.841 ktoe 12.2 PJ/a annual savings target; -2006-2013: 1,5TWh/a final energy saving; -2013-2014 10.7 PJ final energy/year, after 2015: 12.2 PJ final energy/year, 100% of the cumulative energy savings target should be delivered by EEOS (7,908 ktoe) 	6, 17, 27
	Starting date	2005: obligation scheme with white certificates (in place 2006-2013); Second source: In 1995 (although at that stage it was more a demand side management scheme)	6, 27
	Sectors to be obliged	<p>Different indications:</p> <ul style="list-style-type: none"> - All sectors possible except transport; - Residential, public & private business and industry end-users.; - Savings in final energy consumption (end use) realized in all sectors may be included Currently, in the transport sector only the effects of the following initiatives may be included. <p>Replacing a vehicle fleet with energy-efficient cars. (ix) Replacing a vehicle fleet with energy-efficient vans. (x) Fitting fuel-saving tyres. (x) Fitting automatic tyre pressure control systems. (xii)</p>	6, 19, 12, 25
	Energy carriers to be obliged	electricity, gas, heating oil and district heating	6
	Selection of obligated actors	Network operators or electricity, gas and district heating networks, distributors of heating oil (in total approx. 70 electricity network operators, 3 gas network operators, 400 district heating suppliers and the oil industry).; second source: The grid and distribution companies for electricity, natural gas, district heating and oil are the obligated parties. There are three gas companies, six oil companies, 74 electricity companies and 417 district heating companies.	6, 12
	Eligible measures	Open, selected measures are explicitly excluded. For example, white goods and behavior change measures are no longer eligible. Art. 7: Many types, including energy audits, subsidies for efficient appliances, equipment and retrofitting and small-scale renewables:	6, 18, 17, 12

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<ul style="list-style-type: none"> • An energy saving achieved through activities which increase efficiency and thus reduce energy consumption can be taken into account. Examples include improved insulation or the installation of more energy-efficient windows. Energy-efficiency improvements in terms of the energy consumption of industry also fall within this category. Replacing old energy-efficient boilers with new high-efficiency boilers can therefore be regarded as an energy-saving measure. • Energy savings in connection with converting from one type of energy to another also count if this leads to lower energy consumption. This might, for example, include converting from an oil-fired boiler to district heating or a heat pump. • Energy savings are also allowed in the energy transmission and production sectors, from which savings have been counted. However, these savings fall comfortably within 25% limit on supply side savings. Direct or indirect participation of the obligated actors is necessary. This participation can be advice, an audit or subsidies.; <p>other sources:</p> <ul style="list-style-type: none"> - All measures in the final energy sector (except transport), grid-related measures (since 2010); measures must be preceded by information/advice from obligated parties. Supply-side and network-related measures are only permissible to a limited extent. In general, only measures that have been preceded by information and consulting offers on the part of the network operators and that are carried out by the end customer can be credited.; - no measures are excluded as long as the effect can be documented. 	
	Role of the involved stakeholders	<p>Companies are only allowed to carry out their obligations themselves to a limited extent and must do so through third parties, such as their own subsidiaries or contracts with Ener25.;</p> <p>Second source: Mainly third parties (service providers), but obligated parties must be directly or indirectly involved. No certificates are generated, but the implementation takes place on behalf of the obligated party.</p>	6, 17
	Evolution of the indicators	<p>There was no change in the policy mix over the 2014–2020 period: Denmark relies on a single cross-cutting measure, its EEOS.;</p> <p>other sources:</p> <ul style="list-style-type: none"> - In 2000, the gas distribution companies joined the scheme. From 2006, the scheme was changed radically, with savings targets being introduced which were two to three times higher than previously. The focus moved to implementation of energy savings. At this stage, the oil companies joined the scheme, and district heating companies either joined voluntarily or were required to realize energy savings under the same conditions as the companies that joined the agreement. In 2010, the EEOS target was doubled, and it has continued to increase over time. The 2015–2020 target is equivalent to saving 3% of final energy in Denmark, excluding transport. A more detailed account of the development of the EEOS is available elsewhere.; - The overall policy objective has not changed significantly, but how to secure the energy savings has 	18, 15, 12

Characteristics of the EEOs	Details	Implication period 2014-2020	Sources
		<p>changed radically. One of the main decisions in 2006 was whether to count lifetime or first year savings. First year's savings were chosen in order to avoid uncertain estimations of the lifetime of a given project. At the same time experience from the earlier scheme indicated that the majority of the gas, district heating and oil savings had a long lifetime and electricity savings had a shorter lifetime. Moreover, the impact on primary energy consumption was estimated larger for electricity savings compared to other energy savings. Because of this it was assumed that the differences in lifetime were balanced out by the differences in impact on primary energy consumption. Altogether it was considered reasonable and simple to count first year savings.;</p> <p>- From 2006, the scheme was changed radically, so that the number of savings to be implemented was predetermined. The EEO 2006 targets were two to three times higher than the implemented savings under the previous scheme. In 2010, the EEO target was doubled. From 2006 to 2009, the number of companies under the EEO was 259. From 2010, the number increased to 509 companies – this is due to the fact that all 428 district heating companies now are under the EEO. From 2006-2009 small district heating companies were exempt from an obligation. The oil industry has joined the scheme voluntarily in 2009.</p>	
	Flexibility rules	No buy-out, banking up to 3 years. Measures outside the own supply area must be carried out by third parties. Borrowing allowed (up to 35%);	27
Assessments (savings/costs)	Setting of the baseline	9 833 ktoe/year; The choice of baseline is based at least on current standards.	18, 24
	Reference of the savings target	Final energy; based on Eurostat data	6
	Differentiation of the savings target	Half of the final energy savings (1,7 TWh) should be accomplished in the electricity sector; uplifts to energy savings are applied for actions with longer lifetimes	6, 18
	Level of the savings target		
	Allocation of the savings target	Individual target values for electricity and gas distribution system operators are regulated by negotiations and an association agreement (according to market shares). Long-distance gas network operators, which are obligated, receive individual targets by ordinance. Specific targets for heating oil suppliers. The voluntary agreement allocates the savings target to the sectors/companies. Within the sectors, the allocation is the responsibility of the sectors. Whereas with electricity and gas network operators the obligation is negotiated with the sector associations and the sector targets (electricity and gas) are allocated to the obligated parties according to market shares, the district heating network operators receive individual obligations via an implementing regulation.	6, 17
	Crediting period	Only savings in the first year of the measure will be credited. The resulting systematic disadvantage of savings measures with medium- to long-term effects is at least partially compensated by the application of the weighting factors.	24

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Energy saving calculation methodologies	<p>Top-Down: calculation of the savings achieved using a combination of data from the Danish energy statistics and data from the EU Odyssey database. Combination of minimum indicators and preferred indicators. Bottom-up: annual reports by transmission and distribution system operators as a data basis. The calculations are based on standard values for general measures in households, such as energy refurbishment of buildings, and by means of specific calculations for larger and one-off projects.</p> <p>other sources:</p> <ul style="list-style-type: none"> - default values or calculations, standardized specifications are available for both methods. - deemed savings are applied in case of smaller, standardized activities, mainly in the buildings sector. Scaled savings are used where no standard values exist and tend to be in larger, integrated projects in commercial firms or public institutions, while surveyed savings are used when energy savings result from specific market impacts - Deemed ex-ante energy savings are used mainly in households. Wherever deemed savings are not available, specific calculations of the effect of the measure must be used. The level of detail on the specific calculation must be adapted to the specific project. The larger the project, the greater the requirements for the accuracy of the calculation.; - deemed savings; engineering estimates; metered savings 	6, 18, 12, 25
	Determination of savings		
	Selection of the accounting period	Only savings in the first year of the measure will be credited. The resulting systematic disadvantage of savings measures with medium- to long-term effects is at least partially compensated by the application of the weighting factors.	24
	Differentiation of the crediting of measures	<p>Weighting factor (1.5) system that favors (the realization of) long-term measures; factor 0.5 for projects < 4 years.;</p> <p>other sources:</p> <p>Initially there was no differentiation of the lifetime of measures and no weighting of different energy sources with regard to target achievement. Starting from 2011, according to the Danish Energy Agency, weighting factors will be introduced to take into account different lifetimes and primary energy savings. Although all technologies are allowed, the following technologies are favored by applying a "prioritization" factor of 1.5 to the first year savings: Connection of oil and gas-heated buildings to district heating, Installation of heat pumps replacing non-ETS oil or gas consumption. Furthermore in the factors applied to the conversion from one fuel to another, district heating is favored.</p>	6, 17, 12
	Admissibility of double funding	Multiple instrumentation is deliberately designed and intended in the system. Measures that are supported by the Danish savings fund can also be taken into account under the savings quota.	17
	Avoidance of double funding	No exclusion of multiple instrumentation.	

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Additionality ensured/Materiality	<p>Additionality ensured by the rules of the scheme;</p> <p>The question of additionality is addressed in two ways: increasing the activities of the energy companies and by taking steps to actually increase additionality. The most important measure to actually seek increase of additionality is through the requirement of the "chain of agreements";</p> <p>About materiality, there are 3 prerequisites for savings to be counted:</p> <p>(1) an agreement must be made with the end user before the action is done</p> <p>(2) the obligated parties must document how they are involved in the decision to take the action (specific advice, financial aids, or a combination thereof)</p> <p>(3) Records of the project implementation (invoices, completion confirmation, etc.) must be kept</p> <p>Moreover, the ex-post evaluations of the scheme have investigated the additionality of the energy savings using various methods (see EPATEE case study). The results of these evaluations have been used to update the deemed savings of some action types, and even remove some action types from the eligible action types (e.g. household appliances removed in 2010).</p>	18, 12
	Overlaps with other measures	As the EEOS is the single policy measure reported by Denmark to Article 7 EED, there is no risk of overlap between policy measures.	18
	CO ₂ emission reduction		
	Annual savings	1,7 TWh final energy second source: Final energy savings per year in all sectors in the time period 2015: 291 ktoe	6,, 25,
	Total annual savings		
	Cumulative energy savings	Notified by state: 6414, art.7: 6483; As EEOS is the only measure 3187 ktoe (83% of the 2014-2020 target) was saved for 2014-2018	18
	Allocation of system costs	Allocation to end consumers through final energy prices; The costs are estimated at 90,000 €/a. In case of non-compliance, the obligated party is prevented from passing on the costs to the end customers. In addition, higher targets are set for the respective actor for the following year.	6, 17
	Cost-effectiveness	<p>In 2008 the Danish Energy Agency commissioned an evaluation of all energy savings measures at the time. As part of the evaluation the socioeconomic cost of the measures including investment cost at the end-user side were estimated. The EEO is the second most cost effective policy measure in socio-economic terms at the time, providing 1.6 times more socio-economic value than the total cost of the energy savings being realized. The 2012 evaluation confirms this level of socio-economic benefits.</p> <p>other sources:</p> <ul style="list-style-type: none"> - Weighted average EEO cost of lifetime energy savings for the time period 2015: 0.5 cent/kWh - 0.45 cent / kWh 	12, 25, 16

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Certificates	System addressees	Annual review as well as approval of the measures by the Ministry of Energy and Transport. The Climate, Energy and Building Ministry is responsible for the administration and coordination of the M&V scheme.	12, 19
	Admissibility of trade	Almost no trading activity, but horizontally permitted; no trading mechanism, but the possibility of transferring savings titles between the obligated actors. Once an energy saving is realized it cannot be traded between market players such as operators or subcontractors. This is to avoid speculation in the value of energy savings. However, the end user is free to survey the market for the highest subsidy, best consultancy service etc. prior to entering a contract. Thus a market for energy savings de facto exists. Energy savings can be traded between DSO within the calendar year of realization, but the DSO cannot profit from the sale because the income is taken into account when The Danish Energy Regulatory Authority set the tariffs (full cost recovery). Danish EEO ensures a high degree of flexibility and at the same time takes precautionary measures against speculations. Encourages the use of third party involvement by requiring the obligated companies to include a third party in order to realize savings outside their own distribution area or energy form, the third party does not have to be a part of the contract chain, but may receive a payment directly from the end-user.	17, 12
	Lifetime of certificates	Only the first year's energy savings are rewarded, no certificates	17
Monitoring	Length of the obligation period	8 years with annual update of savings targets; Second source: 7 years	24, 17
	Compliance und Monitoring	The obligated actors verify and report the savings. Annual random sample with third party verification.; The M&V system has been reinforced in the recent years to tackle increasing rates of errors and frauds.;	18, 17, 22
	Verification	Top-down (all sectors except from industry) methods as well as bottom-up (analyze effects of transmission and distribution system operators, sectors general cross cutting households, public) methods developed specifically for Denmark. All savings achieved must be proven and verified by an independent body. Standard approach and calculation approach (industry). The measures are verified by the energy statistics and specific targets are set for the implementation of the monitored and verified energy efficiency measures.	6, 22
	Penalties	In case of non-fulfilment, the target is adjusted for the entire sector in the following year, no further penalization due to voluntariness. Art 7: The level of the penalty is decided by Danish courts so there appears to be no set minimum or maximum penalty level.;	18, 27
	Rulebook for M&V	M&V system in place	16
District heating/ Heat pump	District heating	Network operators and distributors for C18 gas, heating oil and district heating are required to implement certain energy efficiency measures. As announced in its Energy Agreement from June 2018, Denmark will terminate its EEOS by the end of 2020. A subsidy scheme is dedicated to replace oil burners with heat pumps in buildings outside the district heating	6, 18, 17, 12

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>and gas grids; For district heating, individual targets are set by regulation; Although all technologies are allowed, the following technologies are favored by applying a “prioritization” factor of 1.5 to the first year savings: Connection of oil and gas-heated buildings to district heating, Installation of heat pumps replacing non-ETS oil or gas consumption. Furthermore in the factors applied to the conversion from one fuel to another, district heating is favored.</p>	
	Heat pumps	<p>Energy savings in connection with converting from one type of energy to another also count if this leads to lower energy consumption. This might, for example, include converting from an oil-fired boiler to district heating or a heat pump.</p>	18, 12

A.2.6 France

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	EEOS (white certificate scheme) only	18
	Cumulative object	Different indications: - Cumulative energy savings target for the period 2014-2020 notified by MS(ktoe): 30,570; - Cumulative energy savings target for the period 2014-2020: 31.384 ktoe	27, 18
	Reference	Annual final energy consumption (averaged over 2010-2012): 153.850 ktoe/year (based on national statistics) Adjusted baseline: 99.567 ktoe/year Energy consumption excluded from the baseline: Transport (49.380 ktoe/year) and energy production for own use (4.903 ktoe/year)	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	25% (10.461 ktoe); Use of option (b) (excluding energy sales to EU ETS sites) and option (d) (early actions).	18
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 17.429 ktoe (56 % of the 2014-2020 target) Assuming the current trend in new annual and total annual energy savings are continued over 2019-2020, France will likely achieve its 2014-2020 target.	18
Evaluation	Strengths and weaknesses	<p>The French strategy relies on a single policy (white certificates scheme) that has been in place since 2006. This avoids any risk of double counting between policy measures and enabled France to have a high level of new annual savings from the start of the period (2014).</p> <p>The scheme covers all end-use sectors, makes possible to generate large amounts of investments in energy efficiency actions, to cover a large number of beneficiaries and to generate large volumes of final energy savings. The specific target for low income households has ensured that low income households overall get more benefits (cf. actions and savings) than costs (cf. higher energy prices).</p> <p>The use of a trading scheme has made it easier for third parties to enter the market. And it provides a price signal and a proxy to assess the costs borne by obligated parties (even if the price of white certificates on the market does not completely reflect these costs). In the meantime, the market of white certificates might be difficult to manage. In recent years, this market has seen large ups and downs in the prices of certificates (reflecting liquidity problems). This price volatility can put at risk market players. Moreover, frequent changes occurred in the features of the scheme over the years. Which might create a lack of visibility for stakeholders to develop their business strategies on a longer term.</p> <p>The M&V system has been improved over time, to ensure reliability while limiting the risk of bottlenecks in</p>	18

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>processing the demands for white certificates. The increasing amount of money involved in the scheme (due to increasing targets) has generated a lot of interests among a wide range of stakeholders, including sometimes opportunists or fraudsters. This led to the development of frauds, quality problems and abusive marketing practices. Which has increased the needs in controls.</p> <p>The scheme strongly relies on deemed savings to monitor the results. The M&V system has increased the means dedicated to control the data used to demand white certificates and to fight frauds. However, it is unclear how the deemed savings ratios per action type would have been verified.</p>	
Key design features	Objective	<p>Primary energy consumption: -20% (9.333 PJ) compared to referential development. Final energy consumption: -10,5% (698 PJ) (compared to average of 2010-2012) Reduction of Energy intensity (energy consumption / GDP) by: 2 %/a by the end of 2014, 2,5 %/a 2015-2020;</p> <p>other sources:</p> <ul style="list-style-type: none"> - 89 % of the cumulative energy savings target should be delivered by EEOS (27,212 ktoe, 01 Jan 2011 - 31 Dec 2013: 345 Twh cumac 01 Jan - 31 Dec 2014: 115 Twh cumac); - For the 1st period (July 2006 – June 2009), the French authorities set the savings target to 54 TWh cumac for the 3 year period. For the 2nd period (January 2011-December 2013), the French authorities set a more ambitious savings target totaling 345 TWh cumac. In 2013, the 2nd period was extended to the end of 2014 and 115 TWh cumac were added (representing a constant effort compared to the 3 year target of 345 TWh cumac) for a new 4 year target of 460 TWh cumac.; - EEO, which should cover 314 out of the 355TWh to be saved over the 2014-2020 period (88.5% of the obligation) 	6, 27, 12, 13
	Starting date	2014, but first implementation in 2006	16
	Sectors to be obliged	<p>CEE: all energy sources, explicit inclusion of transport sector;</p> <p>other sources:</p> <ul style="list-style-type: none"> - Households, industry, GHD, transport. (...) All final energy consumers: i.e. the residential, commercial, public, industrial, agricultural, and transportation sectors. Nevertheless, buildings remain the primary focus of the scheme, and in particular individual households.; - all sectors except facilities subject to the European Emissions Trading System 	6, 17, 12, 13, 25
	Energy carriers to be obliged	<p>Electricity, gas, heating oil, district heating;</p> <p>Second source: no district heating, but all final energy sources</p>	6, 17
	Selection of obligated actors	<p>Different indications:</p> <ul style="list-style-type: none"> - CEE: high number of targeted actors: 2500 companies; providers are obligated. 1. period: energy suppliers (electricity, gas, heating oil, cooling and heating of stationary appliances) if they provide a certain level of power. 2. period: extension to suppliers of fuels for the transport sector. 3. period: no new actors.; 	6, 17, 27, 12, 11

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>- All final energy suppliers (around 2500 companies) that exceed a sales volume of 400 GWh/a (electricity, natural gas, district heating) or 100 kWh/a (LPG, heating oil, from 2011 also fuels) are obliged to do so; The majority of the commitment is held by two companies: EDF (approx. 55% of the total commitment in phase 1) and GDF SUEZ (> 25% of the total commitment). In the second period Oil companies with gas pumps (e.g. Total, Esso, Shell) and large retailers (e.g. Carrefour, Leclerc) will also be required to comply. By raising the thresholds, the total number of obligated companies is to be reduced. Plants that are subject to European emissions trading are excluded from the system.;</p> <p>In 2015: individual suppliers of domestic fuel oil no longer belong to obligated parties.</p> <p>- The obligation is only placed on energy suppliers selling energy volumes above a certain threshold, which varies depending on the type of final energy sold. Suppliers are obligated if their annual sales to households and enterprises of the tertiary sector exceed:</p> <ul style="list-style-type: none"> • 400 GWh of electricity, natural gas or heating/cooling (e.g. district heating and cooling plants); • 100 GWh of heating liquefied petroleum gas (LPG); or • 500 m3 of domestic heating oil. <p>In addition, from the beginning of the 2nd period onward, wholesalers supplying to the French territory over:</p> <ul style="list-style-type: none"> • 7,000 tons of autogas (transport LPG); and • 7,000 m3 of automotive fuel annually (gasoline/diesel); <p>are also under the obligation.</p> <p>Taking these thresholds into account results in the following group of obligated parties for the 2nd period of the scheme:</p> <ul style="list-style-type: none"> • 20 electricity suppliers (e.g. EDF); • 12 natural gas suppliers (e.g. GDF); • 20 heating LPG suppliers (e.g. Butagaz); • 11 district heating/cooling suppliers (e.g. CPCU); • 1,900 domestic heating oil suppliers (e.g. Caldeo); • 6 autogas wholesalers (e.g. Antargaz); and • 40 automotive fuel wholesalers (e.g. Total, SIPLEC, BP, etc.); <p>- Suppliers of gas, electricity, LPG, heating oil and district heating/cooling. Also wholesalers of autos.</p>	
	Eligible measures	<p>CEE: wide range of measures, no restrictions, focus on standardized measures. ETS-measures are not allowed.</p> <p>Art. 7: Two main possible ways for obligated parties to get white certificates (in addition to buying them on the market)</p> <p>(1) Standardized operations (all sectors) defined by ministerial order, with descriptions (including requirements) available in French on the Ministry website (about 200 types of actions covering all end-use sectors).</p>	6, 18, 12

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>Energy performance should be higher than the minimum requirements in current regulations (including ecodesign regulations and building codes) and quality requirements (e.g. implementation by a qualified professional). In practice, the top 20 actions represented more than two thirds of the certificates issued over 2011-2017 (2019 ex-post evaluation). The top 6 actions represented 67% of the certificates issued over 2018-2019.</p> <p>(2) Specific operations (all sectors) with guidelines specifying the requirements for eligibility and calculating energy savings (guidelines available in English on ADEME website). An energy is required before deciding on the action/project and the payback time should be longer than 3 years.</p> <p>Incentives for consumers to invest in energy-efficient equipment and appliances. Also, financial contributions to educational initiatives or for programs to reduce energy poverty. However, soft measures may account for a maximum of 7.2% of the commitment.;</p> <p>Standardized measures account for around 96% with a focus on residential and non-residential buildings. Standardized measures also includes consulting/ information activates limited to 25 TWh or 7% of an obligated party's actions may be performed in this area.;</p> <p>The scheme does not reward operations related to individual behavior change.</p>	
	Role of the involved stakeholders	<p>In the first commitment period, there were no restrictions on the range of actors. However, the non-obligated actors were subject to certain restrictions regarding the eligibility of the measures. In the second commitment period, only obligated parties, municipalities and social housing agencies are permitted as actors.;</p> <p>Participation of the obligated parties required; In the second commitment typical EDL providers are generally excluded from the system, as now only energy suppliers, local and regional authorities, owners of social housing and the Agence Nationale pour l'Amélioration de l'Habitat (ANAH = government housing agency) can implement reliable savings measures.</p>	24, 17
	Evolution of the indicators	<p>1. period (2006-2009): 54 TWhcumac;</p> <p>2. period (2011-2013): 345 TWhcumac;</p> <p>3. period (2015-2017): 700 TWhcumac.;</p> <p>other sources:</p> <ul style="list-style-type: none"> - There has been no change in the policy mix reported for 2014–2020. France is reporting savings from a single policy measure, the EEOS (white certificates scheme). And the NECP clarified that France does not plan to report any alternative measure for the moment (nor for the 2021–2030 period).; - another period 1. Jan -31 Dec 2014: 115 TWh cumac; -the NEEAP2017 explained that the target of the French white certificates scheme has been almost doubled for the 2018-2020 period compared to the 2015-2017 period. This should be sufficient to meet the article 7 target if the obligated parties meet their own targets. 	18, 3

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		- The fourth period (2018-2020) is planned to be extended to 31 December 2021, with an overall obligation of 2,133 TWh cumac for 2018-2021 (same annual target applied to 2021 as in 2018-2020).	
	Flexibility rules	CEE: buy-out is possible (2ct./kWh cumac)/ Art. 7: borrowing not possible. Certificates can be used during three periods (banking). Up to 2019 banking allowed for 9 years. From 2020 banking allowed into the next period but not beyond. Borrowing and buy-out not possible; In the second commitment period (2011-2013), it was also possible to generate certificates without an individual official certificate by submitting an individual "Energy Efficiency Action Plan" in case relevant qualifications can be demonstrated.	6, 18, 17
Assessments (savings/costs)	Setting of the baseline	99567 ktoe/year	18
	Reference of the savings target	Final energy; The reference value for the savings target is the specially defined unit of TWh cumac ("cumulé actualisé"). The savings measures are added up over the entire service life. Future savings volumes are discounted by 4% per year. A direct comparison of the savings in TWh cumac with other quantities is therefore not possible.	6, 24
	Differentiation of the savings target	Geographical differentiation, no differentiation according to energy sources. Special differentiation for energy poverty. The savings target is differentiated by energy source (electricity, natural gas, oil, liquefied petroleum gas, heating and cooling) and then divided among the obligated actors on the basis of their market shares. For several measures in the building sector, a regional differentiation takes place depending on the climatic conditions. Savings targets Commitment period 1 (2006 - 2009): 54 TWh cumac, of which electricity: 31 TWh cumac (20 committed companies) natural gas: 13.9 TWh cumac (12 committed companies) oil: 6.8 TWh cumac (2,452 committed companies) LPG: 1.5 TWh cumac (7 committed companies) heating and cooling: 0.7 TWh cumac (11 committed companies); since mid of 2010 Grenelle law -> in period 2 of the White Certificates System measures against "fuel poverty" (= 13% of households that spend more than 10% of their income on energy costs) --> saving target specifically tailored to this consumer group.	6, 18, 24, 17
	Level of the savings target	For the 1st period (July 2006-June 2009) the obligation was kept low intentionally so as to allow all participants in the scheme (e.g. obligated and eligible parties, public authorities, beneficiaries, installers, etc.) to acclimate to the system, gain experience, build networks, and propose improvements/provide feedback. In determining the target for the second period (January 2011-December 2013), the authorities took into account the potential savings opportunities for the scheme as assessed by ADEME, the experience developed by the existing obligated parties, as well as the inexperience of the newly obligated automotive fuel wholesalers.	12

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Allocation of the savings target	90 TWh cumac (of 345 TWh cumac) should be generated by fuel suppliers. Targets are distributed among obligated parties based on revenue (75%) and energy sales (25%). To determine turnover, the volume sold over a three-year period is determined and multiplied by an annual energy reference price.	6, 17
	Crediting period	EEOS (White Certificate) targets on the basis of lifetime energy savings, with future energy savings discounted at a rate of 4% per year (a social discount rate reflecting the trade-off between present and future welfare). This has the effect of reducing the eligible energy savings from actions with long lifetimes.	18
	Energy saving calculation methodologies	<p>Top-Down: application of all minimum, preferred and alternative indicators suggested by the EU. Bottom-Up: special evaluation tool (SceGES evaluation tool) based on annually actualized and detailed sectoral energy data;</p> <p>deemed savings for standardized operations represent most of the energy savings achieved so far, with scaled savings (possibly combined with measurements) used for specific operations, with mandatory guidelines for calculating the energy savings, including the requirement to do an energy audit and establish the baseline before implementing the action(s);</p> <ul style="list-style-type: none"> - ESCs are awarded for energy savings achieved in projects that can either be 1) from a catalogue of "standard operations" or 2) case-by-case i.e. "special operations" where the savings must be calculated more precisely.; - deemed savings; engineering estimates 	6, 18, 12, 25
	Determination of savings	Each measure has a predefined theoretical savings value (no ex-post calculations of actual savings achieved).	17
	Selection of the accounting period	Cumulative discounted final energy over lifetime in the year of measure implementation.	17
	Differentiation of the crediting of measures	<p>For some measures in the building sector, a geographical differentiation of the eligible savings value takes place. This is based on the definition of three regions that are characterized by different climatic conditions. There is no targeted promotion of innovation.;</p> <p>Second source: option for obligated parties to contribute to 4 programs on fuel poverty (no mandatory requirement); third source: A bonus is granted for actions for "very low income" households to meet the "fuel poverty" target.</p>	17, 16, 3
	Admissibility of double funding	Double funding is likely to happen	6
	Avoidance of double funding	Double funding is not deliberately prevented or is intentional, the option of double funding is used extensively.	31
	Additionality ensured/Materiality	<p>Additionality ensured for individual measures; Based on market average, for individual measures the criterion of additionality is applied;</p> <p>Second source: All deemed savings per action type have been revised early 2015 to ensure additionality to</p>	31, 18, 12, 2

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>EU legislations (mostly EcoDesign regulations), with further updates when needed. Additionality is also ensured by other criteria in place since 2006 (e.g. energy performance of the actions needs to be higher than the minimum requirements in current regulations);</p> <p>Third source: all obligated or eligible parties applying for ESCs under the scheme must prove that the operations they submit 1) went above what is legally required and 2) took place because of that party's participation in the project.</p> <p>About materiality, the obligated party must demonstrate in their applications for white certificates that they had an active and motivational role before the actions were implemented. In order to prove this, they have to hand over the following types of proof:</p> <p>(1) The description of the active role and the incentive of the applicant,</p> <p>(2) The justification that this contribution is direct and held before the implementation of the actions,</p> <p>(3) A declaration signed by the beneficiaries of the actions stating the active role and incentive of the applicants in the implementation of the actions, and that they did not transfer the ownership of the white certificates to anyone else.</p> <p>For actions in households, a standard template has to be used to present the type of intervention (e.g. type of financial incentives).</p> <p>The controls made by the public authorities of the files submitted by obligated or eligible parties include a control of the compliance with these materiality requirements, including looking at evidence of the contacts between the obligated parties (or its contractor(s)) and the final customers.</p>	
	Overlaps with other measures	Large overlap with other instruments	18
	CO ₂ emission reduction		
	Annual savings	<p>CEE: 345 TWh cumac;</p> <p>other sources:</p> <p>The average rate of new annual savings reported from the EEOS to Article 7 over 2014-2018 has been 1360.4 ktoe/year;</p> <p>Final energy savings per year in all sectors in the time period 2011-2013: 377 ktoe.</p>	6, 18, 25
	Total annual savings	<p>The average rate of new annual savings reported from the EEOS to Article 7 over 2014-2018 has been 1360.4 ktoe/year, well above its revised target of 1120 ktoe/year. However, France applies a 4%/year discount rate to the energy savings. When taking into account this 4%/year discount rate, the average 1360.4 ktoe/year of achieved new annual savings should be compared with a target rate of 1213 ktoe/year.</p>	18
	Cumulative energy savings	<p>Notified by state: 65179, art.7:65180;</p> <p>other sources:</p>	18, 12

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		2014-2018: 17.429 ktoe; July 2006 to December 2011: 31.9 TWh	
	Allocation of system costs	Obligated parties, government; partial allocation to end consumers through final energy prices; Direct costs of the obligated actors are passed on to the end consumers (household customers) through the energy prices. Obligated players must also monitor, at their own expense, the impact of the system on their internal cost structure and additional costs incurred, and pass on the findings to the relevant authorities. Energy prices for residential customers are regulated by the government. It is up to the government to find out what the additional costs are so that they can be taken into account when approving tariffs.	6, 17
	Cost-effectiveness	First period (2006-2009): administration costs 1 300 Mio €, direct and indirect costs of obligated actors 74 Mio+ 136 Mio; costumer 504 Mio, subsidies (financed through taxes): 1305 Mio; other sources: - The average price per kWh of savings over the last year is 0.7 € cents. This is well below the costs of energy in France.; - 1st Period: 3.74 c€ spent in total (10% obligated parties, 25% beneficiaries, 65% government) per kWh-cumac saved which represents 50 c€/kWh with an average actualized lifetime of 13.4 years ; by comparison, the electricity price for households is 14c€/kWh and electricity production costs from 4.95c€/kWh for nuclear production to 9.36€/kWh on average for renewables. 2.14€ saved by beneficiaries (over the lifetime of the measures) per € spent in total, and 8.6€ saved by beneficiaries per € they spent. The 1st and 2nd period: 0.4 c€ spent per obligated parties per kWh cumac saved, which represent a cost of 5.36 c€ per kWh (with an average actualized lifetime of 13.4 years) while electricity production costs from 4.95c€/kWh for nuclear production to 9.36€/kWh on average for renewables. - Weighted average EEO cost of lifetime energy savings for the time period 2011-2013: 0.4 cent/kWh.	26, 12, 25, 16
Certificates	System addressees	Energy Saving Certificates (ESC) are issued by the Ministry for the Environmental Transition to eligible parties.	23
	Admissibility of trade	Horizontal and vertical trade of certificates between companies is permitted, not much made use of (below 4%); below 2 % because EDF and GDF SUEZ hold the majority of the total savings obligation. As long as the two companies are able to generate sufficient certificate volumes for themselves through their own measures, there will continue to be no truly liquid market; France has used trading of White Certificates since 2008	6, 17
	Lifetime of certificates	The certificates have a lifetime of three commitment periods.	24
Monitoring	Length of the obligation period	3 years, the commitment periods do not directly follow each other; As far as the ESC scheme is concerned targets are set for each obligated party for a three-year period.	24, 22

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>Within this period, there are no annual deadlines to be respected, the targets being verified only at the end of the period.</p>	
	Compliance und Monitoring	<p>The PNCEE reviews each request and awards ESCs only to the operations that respect all the eligibility requirements according to the type of operation performed i.e. standard or special (e.g. minimum level of performance, equipment certification, installer's certifications...). Once validated, the requested certificates are added to the requester's account on the electronic ESC registry named "Emmy", which is run by a private service provider named Locasystem. Second source: DREAL (Directions Régionales de l'environnement, de l'aménagement et du Logement) with responsible units for each of the 26 regions in France. DREAL can seek assistance from ADEME on technical issues. For example, the calculation of energy savings values for standard measures is done by experts from ADEME and ATEE. For the additional measures, the calculation of the savings effect is made by the operator and verified by an independent expert. At the end of the commitment period, DREAL obligated parties must demonstrate compliance. In the second commitment period (2011-2013), however, it will also be possible to generate certificates without an individual certificate from the authorities by submitting an individual "Energy Efficiency Action Plan", provided the relevant qualifications and access to data can be demonstrated. However, the competent authority has the right to inspect the relevant evidence at any time.;</p> <p>Second source: In terms of controls, there are a few different checks that take place or can take place for an obligated party. As mentioned under verification in the previous section, individual files are checked by the PNCEE to ensure they contain all of the required documentation; that is unless the file is submitted under a pre-approved operation plan. If an operation plan is used, the method that the obligated party uses to check individual submissions is in a sense "certified" by the PNCEE and as a result the file does not need to be rechecked for completeness by the administration. This process is explained in greater detail in the section</p> <p>In any case, whether an operation plan is used or not, all submissions are checked against a database to ensure that there are no double declarations where the same installation is claimed by multiple obligated parties or twice by the same party. In addition, for special operations, once the PNCEE has checked to ensure the documentation is in order and that no duplicate exists, the project is transferred to ADEME to check the technical content and the validity of the savings predictions and calculations.</p>	12
	Verification	<p>Ex-ante verification and case-by-case. (Industry): documentation requirement (perform energy audit, develop baseline and documentation, calculate anticipated savings, justification for applying for white certificates, evidence of internal rate of return > 3 years).</p> <p>The M&V system includes basic (and partly automatized) checks of all application files before issuing white certificates. This is complemented with random and targeted controls, with an increasing number of on-site inspections since 2018 (through sub-contracting to independent auditors). Moreover, from March 2020 on,</p>	6, 18, 12

Characteristics of the EEOs	Details	Implication period 2014-2020	Sources
		<p>obligated parties are required to commission controls by accredited auditing companies, with a rate of control that depends on the action type.</p> <p>Energy Savings Certificates (ESCs) are only awarded to a qualified project proponent (an obligated or eligible party) after a professional installer finishes the operation and the National Authority for Energy Saving Certificates (PNCEE) validates the eligible energy savings.</p> <p>Validation by a state institution (PNCEE). Standardized implementation of the calculation method is intended to streamline the process and replace monitoring. Affected parties are not required to provide data on savings. For individual measures, however, the provision of data is necessary. ADEME (Agency for Environment and Energy) supports the Ministry in all technical aspects (including the evaluation of the system), DGEC (Directorate General for Energy and Climate) determines the savings target and the allocation of the target to the obligated parties.</p>	
	Penalties	<p>CEE: companies do not have to fulfil their goals if a penalty of 2ct/kWh is paid; Art. 7: Penalty payments are set at 1.5 eurocents per kWh cumac of the shortfall to the targets. Other penalties or sanctions can apply in case of errors or frauds identified along the verifications and controls. The most common sanction is that the errors or non-compliances detected (e.g. missing documentation) lead to the cancellation of the white certificates. Depending on the type of error or fraud, the applicant can be subject to financial penalties or be removed from the list of eligible parties, either temporarily or definitively (i.e. they cannot submit applications for white certificates and cannot trade white certificates either). The financial penalties cannot exceed 4% of the turnover of the company sanctioned. In case of severe frauds, criminal sanctions might apply. The organization that submits files remains responsible for the provision of the related evidence in case of control, even if the resulting certificates have been sold to other parties.</p> <p>The current owner of the certificates bears the risk in case the certificates are cancelled after a control. This is why service providers have developed services such as quality labels, so that buyers of certificates can know if organizations selling certificates are implementing reliable quality processes.</p> <p>In case of fraud or non-compliance, sanctions can be decided and certificates cancelled.</p> <p>other source: At the end of each period, the PNCEE verifies that each obligated party holds at least the amount of ESCs (in kWh cumac) on their Emmy account (the registry) as is required by their obligation. Obligated parties incur a penalty for any short-fall in ESCs at the end of the period. For the second period, as for the first, obligated parties that fall short of their individual targets must pay € 0.02 for each missing kWh cumac (20€/MWh cumac). However, paying the penalty fulfils their obligation for that period and the target is not carried over to the next obligation period as is true in some schemes.</p> <p>With an average actualized lifetime of 13.4 years over the 2nd period, this represent a penalty of 268€/MWh.</p>	6, 18, 12

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Rulebook for M&V	M&V system in place	16
District heating/ Heat pump	District heating	Commitments relate to domestic fuel oil, LPG, electricity, gas and district heating (p. 49) Previous design proposals for Germany "energy carriers to be made mandatory"; All final energy suppliers (around 2,500 companies) that exceed sales of 400 GWh/a (electricity, natural gas, district heating) or 100 kWh/a (LPG, heating oil, from 2011 also fuels) are obligated.; The obligated parties (OP) are the energy suppliers of electricity, natural gas, oil products, heat (district heating) in the residential and service sectors and in transports.	31, 17, 3
	Heat pumps		

A.2.7 Greece

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	EEOS and alternative measures	18
	Cumulative object	Different indications: Cumulative energy savings target for the period 2014-2020 notified by MS(ktoe): 3,301; Cumulative energy savings target for the period 2014-2020: 3.333 ktoe	27, 18
	Reference	Annual final energy consumption (averaged over 2010-2012): 18.400 ktoe/year (based on Eurostat data) Adjusted baseline: 10.580 ktoe/year Energy consumption excluded from the baseline: Transport (7.328 ktoe/year) and energy production for own use (427 ktoe/year)	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	25% (1.111 ktoe); use of options (a) (slow start) and (b) (excluding energy sales to the ETS-industry).	18
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 1.355 ktoe (41 % of the 2014-2020 target) Assuming the current trend in new annual and total annual energy savings are continued over 2019-2020, Greece will unlikely achieve its 2014-2020 target.	18
Evaluation	Strengths and weaknesses	Five policy measures have brought about 88% of the cumulative savings so far. The policy mix covers all sectors, with a significant share of savings from transport. The EEOS in place since 2017 has delivered the highest share of cumulative savings. It was based on the experience gained from other schemes in the EU	18

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		and include all suppliers. It was launched after stakeholders' consultation, enabling a quick start. The MRV process consists of three standardized steps and the energy savings calculations are mainly through deemed savings with bottom-up formulas per action type. The taxation measure on oil products has been introduced in 2017 to cover the savings gap and already generates higher new annual savings than the other policies. Some policy measures that were under consideration (e.g. in the NEEAP2017) have not yet been implemented. It is unclear whether Greece will consider that the oil tax and the EEOS are enough to fill the previous savings gap, or launch new policy measures.	
Key design features	Objective	The first period will last until 2020, while an energy efficiency target has been appointed equal to 333 ktoe of cumulative final energy savings representing 10% of the total target for EED article 7 The annual targets have been specified with a minimum threshold to be achieved in the target year: 100 ktoe and 30% in 2017, 133 ktoe and 50% in 2018, 67 ktoe and 50% in 2019, 33 ktoe and 100% in 2020.	3
	Starting date	2017	15
	Sectors to be obliged	All sectors; Second source: exclusion of transport and energy production for own use	18
	Energy carriers to be obliged	All fuels	18
	Selection of obligated actors	Energy retail sales companies; The obligated parties (OP) for the reference year 2017 consist of electricity (4 companies), gas (4 companies) and oil products (LPG, gasoline, diesel and heavy fuel oil; 24 companies) suppliers or retailers, whose market share is higher than 1% and representing in total at least the 95% of the sold energy for each fuel separately. The number of the OPs in 2018 and 2019 was equal to 29 (4 electricity, 4 gas and 21 oil products companies) and 35 (6 electricity, 4 gas and 25 oil products companies) correspondingly.	5, 3
	Eligible measures	All interventions (whether technical or behavioral) that can lead to final energy savings. The list of indicative measures to improve energy efficiency in the residential, tertiary, transport and industrial sectors is available on the Administrator's website. In practice most actions have been behavioral so far.	18
	Role of the involved stakeholders		
	Evolution of the indicators		
Flexibility rules	OPs have the option either to implement measures themselves or to assign their obligation to third parties or to use the "buy out" option. Exchange of energy savings among OPs is allowed under the prerequisite the units of energy savings have been verified. Banking allowed for four years, borrowing allowed from any of the three following years, buy out allowed once a minimum threshold has been reached;	18, 3	

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Assessments (savings/costs)	Setting of the baseline	10 580 ktoe/year	18
	Reference of the savings target		
	Differentiation of the savings target	Special measures for energy poverty	18
	Level of the savings target		
	Allocation of the savings target		
	Crediting period		
	Energy saving calculation methodologies	Deemed, scaled, metered savings; Second source: Energy savings are evaluated utilizing either 26 predefined standard bottom-up methods or other methods for scaled or metered savings. The OPs can apply for using new methods, which are then controlled, edited, improved and then publicized by CRES.	18, 3
	Determination of savings		
	Selection of the accounting period		
	Differentiation of the crediting of measures	Bonus of 40% (i.e. uplift factor of 1.4) to energy savings from actions tackling energy poverty.	18
	Admissibility of double funding		
	Avoidance of double funding		
	Additionality ensured/Materiality	The deemed savings and the EPCs (with specific processes that eligible parties must demonstrate that they made use of the policy to implement the measure) can guarantee to a large extent the additionality of the savings. The main remaining concern deals with the additionality of energy savings from the two schemes to replace vehicles (cf. additionality to EU standards on emission levels).	18
	Overlaps with other measures	Grant schemes for existing buildings, EEOS and heating subsidies.	18
	CO ₂ emission reduction		
	Annual savings		
Total annual savings			
Cumulative energy savings	Notified by state: 7299; Art. 7: 7203	18	
Allocation of system costs			
Cost-effectiveness			
Certificates	System addressees	CRES (Centre for Renewable Energy Sources and Energy Savings) verifies the submitted files and performs checks sampling on them, including on-site verification when it is required. 87% of the achieved savings	3,

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		has been verified through on-site verification of the respective control items regarding the realization of the energy efficiency measures.	
	Admissibility of trade	Horizontal trading	18
	Lifetime of certificates	Greece sets its EEOS targets on the basis of lifetime savings. Lifetimes cannot extend beyond 2020 to ensure accounting alignment with the Article 7 EED energy savings obligation.	18
Monitoring	Length of the obligation period	Specific targets have been set for the monitored and verified energy efficiency measures on an annual basis during the establishment of the energy savings targets within the context of Article 7 of the EED.	22
	Compliance and Monitoring	The main MRV process is centralized for most policies, where measures are being pre-defined in the form of deemed savings, and also the EPCs (Energy Performance Certificates) are used for all subsidy measures in buildings; The Ministry of Environment and Energy is responsible for the implementation of the ESD and EED at national level for the design, facilitation and monitoring of the implemented energy efficiency measures and for the establishment, administration and coordination of the required M&V schemes. The monitoring of the energy efficiency measures is performed through the establishment of specialized bottom-up procedures. These procedures were developed from the Ministry of Environment and Energy. The foreseen approaches were improved according to the requirements of the Article 7 of the EED.	18, 22
	Verification	The measured energy savings are verified within the framework of the M&V schemes through the conduction of random inspections to a representative sample of the participating either building or vehicles.	22
	Penalties	Penalties are foreseen in the case that an OP do not manage to fulfil its annual target.	3
	Rulebook for M&V		
District heating/ Heat pump	District heating		
	Heat pumps		

A.2.8 Ireland

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	EEOS and alternative measures	18
	Cumulative object	Cumulative energy savings target for the period 2014-2020 notified by MS(ktoe): 2,164	27
	Reference	Annual final energy consumption (averaged over 2010-2012): 11.295 ktoe/year (based on Eurostat data) Adjusted baseline: 6.873 ktoe/year Energy consumption excluded from the baseline: Transport (4.422 ktoe/year) (no exclusion of energy production for own use)	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	25% (721 ktoe); use of options (a) (slow start) and (b) (excluding energy sales to the ETS-industry)	18
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 1.408 ktoe (65 % of the 2014-2020 target) Assuming the current trend in new annual and total annual energy savings are continued over 2019-2020, Ireland will very likely achieve its 2014-2020 target.	18
Evaluation	Strengths and weaknesses	<p>The policy mix covers all sectors and all measures have been in place from the start of the obligation period. A strong M&V system is in place for the main policy measure - the EEOS - in which obligated parties have to implement quality control practices.</p> <p>More clarity could be provided on the materiality of the industry/service sector policy measures and on how potential overlaps with the EEOS are avoided.</p> <p>Ireland allows obligated parties to blend support from SEAI (energy agency) and local authorities when delivering actions. This reduces the costs to energy suppliers (and ultimately bill payers) and allows them to benefit from the ability of local authorities to find beneficiaries most in need of building renovation. The combination of energy suppliers, with the incentive to drive down costs, and local authorities with their local knowledge, may provide the most cost-effective solution to the search for, and installation of, renovation actions.</p> <p>The Large Industry Energy Network and the SME network have a symbiotic relationship with the EEOS – these networks help to identify opportunities, connect with the energy efficiency industry and allow end-users to access EEOS funds. There is also a link to Article 8 audits, whereby auditors flag up opportunities under the EEOS to those being audited. Similarly, the obligated parties may drive the audit process in order to uncover opportunities to meet their obligations.</p> <p>An online energy savings crediting system has been set for actions in the residential sector. Obligated parties must implement an ISO 9001-aligned quality control process, use ISO 50015 or IPVMP for M&V. This</p>	18

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>ensures that the companies doing work for obligated parties have quality assurance regimes in place and that the people doing the work are appropriately accredited. The reassurance that this requirement brings enables the implementing body (SEAI) to target its independent audits on specific areas. The ability to select makes the MRV process more cost-effective.</p> <p>Ireland introduced the Assigned Certifier role in 2014 for each building project covered by building codes. The Assigned Certifier is responsible for declaring that the energy related elements (and other elements) of the project comply with the building codes and must be a registered professional (Chartered Engineer, Chartered Building Surveyor or Registered Architect) with relevant experience and competency in relation to complex construction projects.</p>	
Key design features	Objective	550 GWh per annum, 71 % of the cumulative energy savings target should be delivered by EEOS	27, 16
	Starting date	Different indications: -Ireland introduced the EEOS in 2012 (initially implemented a voluntary scheme now replaced with an obligatory scheme); - obligation scheme started in January 2014, in continuation of a voluntary agreement (2011-2013).	6, 27, 3
	Sectors to be obliged	all sectors	18
	Energy carriers to be obliged	all energy carriers	18
	Selection of obligated actors	Energy suppliers with a sales volume of more than 600GWh importers of road transport fuel;	16
	Eligible measures	Around 50 standardized actions applying to the residential sector (including the energy poverty sector) are in a published list on the website of the SEAI. The list includes insulation and improvements to heating systems. Actions in other sectors are not specified and are "evaluated on a project-by-project basis" using SEAI assessment tools or other methods. These include a range of process-related measures, lighting, cooling etc. The top non-residential measures are processes, lighting and heating. The top residential measures are boilers, heating controls and wall insulation. The top energy poverty measures are wall and attic insulation.	18
	Role of the involved stakeholders		
	Evolution of the indicators	Annual targets were increased in 2017 and 2018; The policy mix reported to Article 7 EED has remained the same over the period 2014-2020.	18
Flexibility rules	Different indications: - banking: annual targets accumulate over the compliance period, meaning that overcompliance in one year automatically counts towards the following years' cumulative targets ; borrowing: in any given year, obligated parties must achieve a minimum of 95% of their cumulative targets; buy-out: allowed up to 30% of the target and sub-targets with prices set at the cost to the State to achieve the savings: 6c/kWh (non-residential), 20.4c/kWh (residential), 88c/kWh (energy poverty).;	18, 3, 14	

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<ul style="list-style-type: none"> - Banking and borrowing does not apply. - The scheme permits the exchange (via the market or bilateral) of validated savings between obligated parties. Obligated parties can buyout up to a maximum of 30% of their total cumulative target, whether or not they have achieved their minimum cumulative target. 	
Assessments (savings/costs)	Setting of the baseline	Primary energy; 6 873 ktoe/year	18
	Reference of the savings target		
	Differentiation of the savings target	25% target for energy savings to be delivered in the residential sector; 5% of the energy savings targets in the 2014-2020 period need to be delivered in energy-poor households; the obligated energy suppliers are required to deliver energy efficiency savings in non-residential (75%), residential (20%) and energy poverty (5%) sectors equivalent to 550 GWh per annum through to 2020.	18, 16, 22
	Level of the savings target		
	Allocation of the savings target	The target was based on final sales by sector and supplier and project could be implemented in all sectors: Residential, Industrial, Commercial and Public Sector. The target allocated to obligated parties is sub-sectoralized as 75 % non-residential, 20 % residential and 5 % fuel poverty residential.	1
	Crediting period	2020	18
	Energy saving calculation methodologies	deemed, scaled, metered savings; Residential measures use deemed savings. Non-residential measures are verified using engineering calculations or using metering data. A simple boiler or lighting replacement would use an engineering calculation, scaled if appropriate; a more complex intervention would use metering data, potentially backed up by computer simulations. Guidance is provided to clarify when each method is appropriate.	18, 3
	Determination of savings		
	Selection of the accounting period		
	Differentiation of the crediting of measures	special measures for energy poverty; 5% of savings need to be achieved in energy-poor households defined as receiving certain welfare transfers or located in RAPID (Revitalizing Areas by Planning, Investment and Development) or Clár area (rural location) and designated areas specified by regulator	18, 16
	Admissibility of double funding		
Avoidance of double funding			
Additionality ensured/Materiality	Additionality concerns are limited to the building regulations, for which savings are claimed before the amending EED came into force. Although, information is lacking for the accelerated capital allowances policy measure on this topic. Ireland has addressed the requirements that the energy efficiency measures must	18, 16	

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		be demonstrably material to the achievement of the claimed savings by demanding a joint declaration of obligated parties and their service partners when carrying out residential projects. This declaration has to be provided before the energy efficiency improvements are carried out. For nonresidential projects the regulator has developed an online platform that needs to be used by obligated parties and includes the need for the beneficiary to sign a declaration confirming that the obligated party has been involved in the execution of the project and has been material to the achievement of the claimed savings.	
	Overlaps with other measures	There are potential overlaps between the EEOS and other policy measures, i.e. the industrial networks, SME program and Enhanced Capital Allowances. There are no eligibility concerns.	18
	CO ₂ emission reduction		
	Annual savings	From 2017 to 2018 period, non-residential savings account for 81% of total saving, residential 16% and energy-poor at 3%. By the end of 2018, the Irish EEOS scheme had delivered a total of 3,293 GWh, delivering over the target by 10% with all three sub-targets exceeded.	3
	Total annual savings		
	Cumulative energy savings	notified by state: 5180; art. 7: 5221	18
	Allocation of system costs		
	Cost-effectiveness	Unregulated cost pass-through	28
Certificates	System addressees	The governmental agency Sustainable Energy Authority of Ireland (SEAI) is responsible for independent verification and audit.	14
	Admissibility of trade	horizontal trading; The EEO is based on a system of Energy Credits for realized Primary Energy Savings. The system is similar to a White Certificate scheme but is not yet described in more detail in the reports that Ireland submitted on the Implementation of Article 7(9). Credits can be exchanged between market parties 'On the counter' but there is no open market for credits.	18, 14
	Lifetime of certificates	EEOS targets on the basis of first year energy savings over periods ending in 2020	18
Monitoring	Length of the obligation period	01 Jan 2014- 31 Dec 2016	27
	Compliance und Monitoring	Ireland uses different M&V approaches for different policy measures.; SEAI is appointed as the monitoring body responsible for the administration and coordination of the M&V schemes. An IT system has been developed for the obligated parties within the EEOS. The responsibility for compliance with the article 7 of the EED rests with the energy supplier responsible for realizing the necessary energy savings credits, backed up by appropriate independent verification and audit	18, 22, 14

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		by the SEAI. In the first instance, energy suppliers will be required to develop and implement a quality control process that will ensure that any energy savings claimed against their target are reliable, verifiable and undertaken to an appropriate standard.	
	Verification	online energy savings crediting system for actions in the residential sector. Obligated parties must implement an ISO 9001-aligned quality control process, use ISO 50015 or IPVMP for M&V; Each EEO party within shall measure and verify the energy savings of projects using an agreed internationally recognized measurement and verification protocol as agreed with the SEAI, and shall report them to the SEAI in the manner and at the frequency required by the SEAI. The obligated parties within EEOS have to provide not more than once each year aggregated statistical information. Finally, the LIEN prepares voluntary annual reports.	18, 22
	Penalties	Ireland introduced a buyout price and a penalty price to provide market certainty and create opportunities for the emergence of trading of energy credits. The introduction of a buyout price is consistent with Article 20 (6) of the EED and will be set equal to what it would cost the SEAI to realize an equivalent amount of energy savings from the market. In any given year OPs must meet a minimum of 95% of their target in any given sector. If this is not achieved, OPs may buy out by contributing to the fund for up to 30% of their target or sub-target. For any remaining underperformance, penalties are then applied at a rate of 1.25 times the buy-out price, which is set at the cost to the State to achieve these savings; the buy-out price varies by sector (6cts/kWh in the non-residential sector, 20.4 cts in the residential sector and 88 cts in the energy poverty sector). Banking and borrowing does not apply. Energy savings that are being rejected following an SEAI audit, will be discounted from an energy suppliers' target, which potentially could lead to the imposition of a financial penalty. If there is a failure rate of greater than 20% across a batch of projects, as audited by SEAI, it will be regarded as an endemic failure and all credits associated with that batch of projects will be withdrawn until the issues are rectified.	18, 16, 10, 14, 3
	Rulebook for M&V	M&V system in place	16
District heating/ Heat pump	District heating	The fund (Ireland Energy Efficiency Investments Plc) is launched in May 2014 and is targeted to €70 million including up to €35 million from the Irish Government. The Fund will invest in projects that reduce energy consumption, recover useful energy from waste streams and distributed renewable energy generation. These types of projects typically include: public and private building retrofit; industrial energy efficiency; combined heat and power; biomass renewable heat projects; and, urban infrastructure, including street lighting and district heating networks.	14
	Heat pumps	Regarding the implementation of measures within the framework of EEOS, SEAI has identified within Energy Saving Credit Table as the most efficient measures the penetration of heat pumps, the installation of efficient heat boilers & heating control upgrades and walls insulation.	22

A.2.9 Italy

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	EEOS and alternative measures The Italian white certificate mechanism is an EEO scheme with a tradable market and works both as an EEO and as an incentive scheme for voluntary parties.	18, 12
	Cumulative object	Cumulative energy savings target for the period 2014-2020 notified by MS(ktoe): 25,502; The Legislative Decree N.102 of 4 July 2014 imposed a cumulative end-use energy savings target of 25 Mtoe/year through energy efficiency measures. The latest National Energy Efficiency Action Plan 2017 approved by the Inter-ministerial decree of 11 December 2017, aims to save 20 Mtoe/year of primary energy and 15.5 Mtoe/year of final energy for 2020.	27, 20
	Reference	Annual final energy consumption (averaged over 2010-2012): 121.961 ktoe/year (based on Eurostat data) Adjusted baseline: 80.960 ktoe/year Energy consumption excluded from the baseline: Transport (41.001 ktoe/year) (no exclusion of energy production for own use)	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	25% (8.501 ktoe); Use of options (a) (slow start) and (d) (early actions)	18
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 12.725 ktoe (50 % of the 2014-2020 target) Assuming the current trend in new annual and total annual energy savings are continued over 2019-2020, Italy will unlikely achieve its 2014-2020 target.	18
Evaluation	Strengths and weaknesses	Italy notified a combination of 7 different policy instruments relying largely on providing financial incentives. The policy mix covers all sectors. The M&V system in place has been modified over the years and is much more robust now. Some of the newer measures are not fully established yet and M&V is not yet undertaken for all measures as it should. Italy is working on this and will notify additional savings. It also seems that the energy savings reported for the White Certificates scheme warrant attention: the way they have been reported to Article 7 would show that they would currently fluctuate significantly with very few new energy savings in some years. Which does not seem to reflect the reality of the scheme. This might be due to issues related to the metrics used to report energy savings to Article 7.	18
Key design features	Objective	Primary energy consumption: -20% (6.449 PJ) compared to referential development. Final energy consumption: -10.5% (548 PJ) compared to average of 2010-2012. TEE: 22.4 Mto primary energy.; other sources:	6, 17, 27, 3

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<ul style="list-style-type: none"> - Cumulative final energy savings (2014-2020) of 1070 PJ, with the help of the white certificate system, the Art. 7 EED target is to be met by about 60 % by 2020; - Annual targets for 2017-2020 (cumulative primary energy savings): 2017: 7.14 Mtoe/a; 5.34 Mcert/a 2018: 8.32 Mtoe/a; 5.57 Mcert/a 2019: 9.71 Mtoe/a; 6.20 Mcert/a 2020: 11.19 Mtoe/a; 7.09 Mcert/a Targets of the white certificate system refer to primary energy consumption and have been increasing annually since 2005 (e.g. 2005: 8 PJ, 2010: 180 PJ, 2015: 276 PJ).; - 2005-2012: 4,5 TWh per year savings of final energy (converted), if certificates are not used in the overall system to meet the savings quota and their volume exceeds 5% of the savings target, the target for the following year is increased by exactly this amount (since 2008); Savings targets commitment period 1 (2005 - 2009): 5.8 Mtoe; - 63 % of the cumulative energy savings target should be delivered EEOS --> 16,030ktoe (2013: 4.60 Mtoe 2014: 6.20 Mtoe 2015: 6.60 Mtoe 2016: 7.60 Mtoe) 	
	Starting date	EEOS since 2005, Saving target has been implemented in 2001, for the current obligation period the legal decision has been made in 2012	6, 3
	Sectors to be obliged	All; In the first two commitment periods, projects were predominantly implemented in the household and service sectors, as a large proportion of the measures were catalogued savings measures or were subject to a simplified review. In the third commitment period, measures are predominantly implemented in the industrial sector. The industrial sector is covered by the EEO and in the last three-four years has become the main sector in terms of certified savings under the Italian EEO scheme.	6, 13, 25
	Energy carriers to be obliged	Gas, electricity	6
	Selection of obligated actors	All electricity (13) and gas retailers (50) with more than 50,000 customers are obliged to introduce energy saving measures. The number of obligated parties can vary each year according to the energy they sell. In 2013, 13 electricity traders and 50 gas traders were obliged. Voluntary actors can participate in certificate trading, as well as non-obligated traders, energy service providers (790 in 2014) and companies with energy managers (169 in 2014).;	17
	Eligible measures	TEE: measures on the supply side, some measures on the demand side such as solar collectors. The measures must basically comply with the specified rules and be approved. Almost all types of energy efficiency projects can receive White Certificates, from the replacement of boilers, lighting systems or motors, but also process technologies to projects promoting cogeneration and waste heat recovery. A large number of energy efficiency actions in almost all sectors is allowed, with particular emphasis on the industrial sector, which has delivered most of the savings during the Article 7 EED energy savings obligation period. A list of non-eligible interventions for lack of additionality has been published. 8 standardized ac-	6, 18, 17, 12

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>tions require M&V on a sample (LEDs for internal and public lighting, electric motors, compressed air generation, smart billing, naval propulsion systems, hybrid and electric vehicles fleets);</p> <p>Energy efficiency measures for different end-users can be combined to reach the minimum threshold of 586 GJ, 1172 GJ or 1758 GJ (for cataloged savings, simplified verification or verification plans, respectively);</p> <p>Other sources:</p> <ul style="list-style-type: none"> - all measures on the demand side and some in the conversion sector (CHP, solar collectors, and PV < 20 KW), in addition to mandatory measurements there are some standard measures. Measures in the field of information/advice are permissible, but only in combination with investment measures (5% premium). In the revision of the system, the 5% premium is now to be abolished; - All type of energy efficiency measures, apart from the improvement of energy efficiency in power plants 	
	Role of the involved stakeholders	TEE: not only committed actors, but also energy providers and third parties can generate and sell certificates; no restriction regarding permissible actors within the framework of the implementation of measures	6, 17
	Evolution of the indicators	<p>The new targets for the period 2013–2016, have been adopted based on the number of White Certificates to be issued (i.e. 3.03 million White Certificates for electricity distributors and 2.48 million for natural-gas distributors by 2013)</p> <p>Italy has reported measures to fill the savings gap:</p> <ul style="list-style-type: none"> • Measures first reported in 2018 include the National Energy Efficiency Fund and the Business Plan 4.0. • Measures first reported in 2019 include the Regional Operational Programs (EU Cohesion Policies), information campaigns and sustainable mobility. <p>Moreover, Italy has stated that the monitoring system for those energy efficiency measures launched by Italy but not yet taken into account is currently being finalized, so that energy savings can be reported for the following measures: grants to municipalities for the implementation of projects relating to investments in energy efficiency and sustainable spatial development, the Bonus for the renovation of building façades and measures related to the implementation of the EPBD (Directive 2010/31/EU).</p>	18, 20
	Flexibility rules	<p>Different indications:</p> <ul style="list-style-type: none"> - TEE: buy-out is not permitted, banking is permitted; - banking and borrowing: up to 40%; - banking: Up to 40%. Obligated parties must obtain at least 60% of their energy savings target every year with certificates of that year. Borrowing: Up to 40%. Obligated parties must obtain at least 60% of their energy savings target every year, compensating for underachievement over the course of the following 2 years. Buy-out: not possible.; - Banking and borrowing only within the obligation period; - two options for purchasing White Certificates are a) through a spot market exchange mechanism b) through bilateral trading between parties; 	6, 18, 17, 12, 3

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		- The main flexibility option for the scheme is the possibility for the obliged parties to seek for certificates on the market, instead of providing directly to present proposals. Another important flexibility for obliged DSOs is the possibility to cover each year 60-100% of their target without penalties, provided they present the missing certificates the following year in addition to next year target. A flexibility option for the supply side is the possibility to retain the certificates and to sell them in the following years. The possibility to trade white certificates both through a spot market and bilateral contracts answers the needs both of large and small players and consents to sell certificates when available, but also by means of long term contracts.;	
Assessments (savings/costs)	Setting of the baseline	80 960 ktoe/year Based on market average, for individual measures the criterion of additionality is applied;	31, 18
	Reference of the savings target	Primary energy	6
	Differentiation of the savings target	The savings target is differentiated according to the two obligated energy sources. The savings target is 3.5 Mtoe for electricity and 2.5 Mtoe for natural gas (value for 2012, which partly includes cumulative savings from previous years). The conversion of final energy consumption into primary energy consumption is based on defined primary energy factors. More than half of the savings must be achieved through measures to reduce final energy consumption.;	24
		Savings targets commitment period 1 (2005 - 2009): 5.8 Mtoe (of which 3.1 Mtoe electricity, 2.7 Mtoe gas); The distribution of targets corresponds to different types of certificates: Type 1: Energy savings from electricity consumption reduction Type 2: Energy savings from natural gas consumption reduction Type 3: Energy savings from other fuel consumption reductions.	
	Level of the savings target	8 years with annual update of savings targets	24
	Allocation of the savings target	The annual savings targets are divided among the obligated actors depending on the amount of energy they sell in relation to the total energy. In 2013, there was one trader in the electricity sector who was obligated with more than 80% of the savings target, whereas in the gas sector two traders had to bear about 50% of the obligation.	
	Crediting period	The anticipated savings that accrue within a five-year standard lifetime (exception: building renovation 8 years, CHP 10 years) are not credited once, but distributed over an assumed lifetime.	17
Energy saving calculation methodologies	Three different calculation methods, which are only used for additional savings: catalogued savings, simplified review and review plans: Catalogued savings: Projects where savings based on average values are multiplied by the number of units installed (e.g. light bulbs, small boilers, hot water collectors). The corresponding assumed savings are published by the GSE. Simplified verification: Projects with a simplified verification. These projects require one or more meters against which, based on a verification plan, the savings targets are approved. Review plan: Monitoring Plan Project Proposal (PPPM) must be confirmed by the GSE. Only	17, 12, 25	

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>then can certificates be issued for it, measured against savings.</p> <p>The introduction of "tau" coefficients in 2011 has led to a strong increase in certificates in the industrial sector. Here, the savings are not only calculated for the normally foreseen five years, but future savings are also included.</p> <p>other sources:</p> <p>The national authority for electricity and gas (Autorità per l'energia elettrica e il gas (AEEG)) has set technical standards for the recording of measures, as well as calibration methods for determining the specific savings values. The distribution system operators can also propose new measures, which can also be added to the list after AEEG's review. In total, there are three different project types and methods: Standard Projects: evaluated with standard methods based on AEEG specifications and defining average savings values Analytical Projects: savings are calculated using specific project-related algorithms with recourse to some specific usage data (e.g. full usage hours). Final Balance Projects: Continuous activity-based monitoring of energy consumption.</p> <p>There are three methods to evaluate the savings:</p> <p>(1) Deemed savings projects (DSP) are projects that do not require meters because the savings are recognized depending on the number of installed units (e.g. number of lamps or small boilers, square meters of solar thermal collectors, kW of installed high efficiency engines, etc.). The corresponding savings are indicated in the related file issued by the GSE, which also set the baseline for the additionality, the corrective factors (e.g. geographical location, climate zone, working hours, etc.), and the documentation that shall be presented by the proponent.</p> <p>(2) Simplified monitoring projects (SMP) are projects that require one or more meters and whose savings are granted based on the monitoring plan indicated in the related file issued by the GSE, which also set the baseline for the additionality, the algorithm to calculate the savings, and the documentation that shall be presented by the proponent.</p> <p>(3) Monitoring plans projects (MPP) are projects for which deemed savings and simplified monitoring projects are not applicable. In this case the proponent shall previously present a PPPM. After the PPPM is approved by GSE the proponent can ask for WhC with an RVC. In this kind of projects (similarly to SMP), the number of WhC is proportional to the real reduction of consumption periodically monitored and measured (at least once per year); deemed savings; engineering estimates; metered savings</p>	
	Determination of savings	The savings of electricity and natural gas are converted to primary energy using fixed conversion factors: 10,000 kWh savings of natural gas (0.86 toe primary energy equivalent) 10,000 kWh savings of electricity (2.2 toe primary energy equivalent)	17
	Selection of the accounting period	TEE: based on Bottom-up as suggested by the EU	6

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Differentiation of the crediting of measures	To compensate for the systematic disadvantage of measures with a long service life (e.g. replacement of boilers), the introduction of so-called "uplift factors" is currently being discussed and introduced in 2011	6, 17
	Admissibility of double funding		
	Avoidance of double funding	Double funding is not deliberately prevented or is intentional.	31
	Additionality ensured/Materiality	<p>Additionality ensured for individual measures;</p> <p>The Italian WhC scheme issues certificates only for additional savings. Savings are first evaluated as the difference between the ex-ante and the ex-post consumptions and then reduced if the ex-ante level is below the baseline.</p> <p>The Italian white certificates scheme has made several changes over time about the additionality requirements, taking into account the experience acquired and the difficulties encountered.</p> <p>A significant share of energy savings have been achieved in industry, with projects in large industries and/or on very specific industrial processes, for which it can be very challenging to define the baseline (e.g. no relevant market average).</p>	31, 12, 8, 7
	Overlaps with other measures	In Italy, in addition to the savings obligation, there are tax breaks and subsidies for various projects in the household sector. The cause-effect relationship is therefore unclear, and double subsidies may occur; Italy has introduced provisions that avoid double counting. With effect from 1 January 2013 it is forbidden to use more than one national incentive scheme for the same project (including EEOS, the tax deductions and the Thermal Account).	17, 16
	CO ₂ emission reduction		
	Annual savings	<p>Primary Mtoe: 2005: 0.2, 2006: 0.4, 2007: 0.8, 2008: 2.2, 2009: 3.2, 2010: 4.3, 2011: 5.3, 2012: 6.0, 2013: 4.6, 2014: 6.2, 2015: 6.6, 2016: 7.6;</p> <p>Final energy savings per year in all sectors in the time period 2015: 500 ktoe</p>	12; 25
	Total annual savings	Cumulative annual savings (PJ): 2013: 185, 2014: 222, 2015: 215, 2016: 254, 2017: 266, 2018: 259, 2019: 260	23
	Cumulative energy savings	<p>Notified by state: 50977; art. 7: 50977;</p> <p>Cumulative total savings for 2019: 2367 PJ;</p> <p>There is an overall decrease in the energy consumption during the period 2007e2016, i.e. 31.5%.</p>	18, 23, 20
	Allocation of system costs	Obligated parties, recipients of measures; allocation to end consumers through final energy prices	6
	Cost-effectiveness	<p>According to Pavan (2008) and AEEG (2008), the total amount for the period 2005-2008 is € 216 million. However, Giraudet et al. (2011) point out that the cost figures provided by the obligated parties were probably higher than the costs of the measures actually implemented (mainly low-cost replacement of light bulbs and installation of water flow limiters) in order to support the certification price.;</p> <p>Analysis of the costs of savings achieved shows a cost of 0.8 €/kWh which is within the range of European</p>	17, 26; 25, 16

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>programs supporting energy efficiency. [...] The government subsequently introduced a price cap in order to control the spiraling costs of the program;</p> <p>The average cost of the saved toe, including taxes, is around 800-900 euro for natural gas and electricity in the residential sectors and for SMEs, and around 400-600 euro for large industrial companies. The cost could almost double in case of diesel oil or LPG. This compares favorably with a cost per toe of the certificates of about 110 euro. Considering the cost of the scheme and the number and typology of issued certificates the cost effectiveness expressed as global cost on additional savings is about 0.01 euro/kWh (80 euro/toe).;</p> <p>other sources:</p> <ul style="list-style-type: none"> - Weighted average EEO cost of lifetime energy savings for the time period 2014: 0.7 cent/kWh; - Italy: 1.7 Eurocent / kWh 	
Certificates	System addressees	<p>Once the savings are confirmed by AEEG, GME (Electricity Market Operator) issues the certificates in electronic form and performs the registration.;</p> <p>The exchange of White Certificates between obligated and eligible parties takes place on a dedicated platform managed by GME</p>	1, 17, 26
	Admissibility of trade	<p>Different indications:</p> <ul style="list-style-type: none"> - System is based on trade of certificate, trading activity: 79%; - only vertical trade is permitted (via trading platforms and bilateral agreements); - horizontal and vertical trading; - The ratio of annual trading volume to total white certificate volume used for compliance purposes in the year has ranged from 70% to 150% in recent years.; - vertical trading via spot market and bilateral trading; initial generation of WCs is 2/3rd by bilateral contracts with EE providers of all WCs; - Both obliged and voluntary parties can request white certificates for the energy efficiency projects that they implement. Most of WhC issued in Italy are related to proposals from voluntary parties (above 90%). If the project is approved the proponent receives from GME a number of WhC corresponding to the recognized savings (one certificate equals to one toe of additional savings). The certificates can then be traded among obliged and voluntary parties or even pure traders. 	6, 31, 18, 17, 27, 12
	Lifetime of certificates	<p>Up to 5 or 8 (building sector) years;</p> <p>other sources:</p> <ul style="list-style-type: none"> - Typically, certificates are issued for five years for the energy saved. For cogeneration projects, this period can be ten years.; - Italy sets its EEOS (White Certificate) targets on the basis annual energy savings. Actions can continue to be credited with White Certificates for between 3 years, for behavioral projects, and a maximum of 10 years, 	6, 18, 3

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>for technology-based projects.;</p> <ul style="list-style-type: none"> - certificates are issued every year over the lifetime; - Certificates are usually credited on an annual basis for 5 years. The period of time over which certificates are credited can anyway vary from 3 years, for behavioral change projects, to 10 years, for more complex projects. 	
Monitoring	Length of the obligation period	<p>5 years;</p> <p>Second source: 01 Jan 2013 - 31 Dec 2016;</p>	17, 27
	Compliance und Monitoring	<p>GSE ("Gestore dei servizi energetici"), a state-owned company that promotes renewable energies in Italy, has been responsible for the state administration and monitoring of the EnEffV Sys since 2013. It is supported by ENEA, a state agency, and RSE, a state company that supports GSE in the evaluation of energy efficiency projects.;</p> <p>The ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development) and the RSE (Ricerca sul Sistema Energetico) provide technical support for the validation and certification of the achieved energy savings.;</p> <p>The reporting requirements have been determined on annual basis.</p>	17, 22
	Verification	<p>Standardized, individual calculation and ex-post monitoring;</p> <p>Verification of the measures is carried out on the one hand by checking documents, and on the other hand by on-site visits for a project size of more than 0.12 PJ (3 000 toe).</p> <p>The generation of White Certificates by third parties opens up programs to the risk of fraud, i.e. claiming of Certificates for non-existent energy efficiency projects. Large scaled fraud was discovered in 2017, causing the removal of a significant proportion of Certificate supply and consequent tightening of market conditions.</p>	6, 26
	Penalties	<p>TEE: if at least 60% of the annual goal is accomplished, the rest can be transferred to the next period without penalty. If less is accomplished or can't be accomplished in the following period, a penalty that is based on the economic situation and the missing amount has to be paid.;</p> <p>The level of penalties is not defined ex ante. In issuing the penalties, the Authority for Electricity and Gas takes into account the following criteria:</p> <ol style="list-style-type: none"> (1) the severity of the infringement, (2) work undertaken to mitigate the infringement, (3) existence of other infringements and (4) economic position of the party. <p>The penalties imposed in 2014 for delayed achievement of the target ranged between EUR 2,500 and EUR 65,000.;</p> <p>If a DSO does not fulfil at least 60% of its annual target, AEEGSI will inflict a fine, calculated with a case by</p>	6, 18, 27, 12, 10

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		case approach on the basis of the lacking certificates and on the market situation (delibera AEEGSI 593/2014/S/EFR). If 60% of the DSO target is reached, there is no fine. In both cases the following year target of the defaulting DSO is increased by the amount of lacking certificates.;	
	Rulebook for M&V	M&V system in place	16
District heating/ Heat pump	District heating		
	Heat pumps	Air to air domestic heat pumps: available since Jan 2005, issued WhC: 684, % on the total deemed saving: 0.1% Heat pumps for DHW: available since Jan 2011, issued WhC: 372, % on the total deemed saving: 0.1%	12

A.2.10 Latvia

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	EEOS and alternative measures	18
	Cumulative object	Cumulative energy savings target for the period 2014-2020 notified by MS(ktoe): 851	27
	Reference	Annual final energy consumption (averaged over 2010-2012): 3.970 ktoe/year (based on national data from the Latvian Central Statistical Bureau (CSB)) Adjusted baseline: 2.702 ktoe/year Energy consumption excluded from the baseline: Transport (1.109 ktoe/year) and energy production for own use (159 ktoe/year)	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	25% (283,7 ktoe); use of options (a) (slow start) and (b) (excluding energy sales to the ETS-industry)	18
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 554 ktoe (65 % of the 2014-2020 target). Assuming the current trend in new annual and total annual energy savings are continued over 2019-2020, Latvia will very likely achieve its 2014-2020 target.	18
Evaluation	Strengths and weaknesses	The most important energy efficiency measures, which are covered by the M&V scheme consist of the energy upgrade of multi apartment residential buildings and public buildings and the energy upgrade industrial buildings and the installation of energy efficient equipment in the industrial sector. Due to the fact that the implemented alternative measures are co-financed by EU Funds or national budget	18

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>(e.g., Climate Change Financial Instrument), there is the obligation to provide information regarding the energy savings achieved if such support is used. Achieved savings are measured using bottom-up methodologies through the deemed-savings and metered-savings method. However, the existing M&V system seems to cover in particular those energy efficiency measures and projects, which are co-financed by the EU Funds or by national public budget.</p> <p>A high share of savings also results from the regular public information and education measures (labelled under 'Warmer living' campaign), whose key objective is to encourage house renovation.</p> <p>Latvia had notified the plan to implement an EEOS from the start of the 2014-2020 period. The EEOS started in 2017 on a pilot scale initially covering nine electricity suppliers. In January 2018, the scope of the obligated parties was widened to include the heating sector. The first results show that a high share of energy savings of the EEOS come from the introduction of information measures. The Energy Efficiency Act does not specify the sectors in which energy efficiency actions should be prioritized by obligated parties. Which might explain the high share of savings resulting from the introduction of information measures in households. However, the EEOS in Latvia have been implemented only recently to draw firm conclusions on its operation.</p> <p>Latvia newly reported savings from an energy tax (excise duties on petrol and diesel fuel) in its annual report 2018. It is however not clear if the Annex V requirements are met. The high share of energy savings from this energy tax might be overestimated. The measure is only valid in a package with the implemented economic measures. However, it is not clear how the energy savings are allocated and how double-counting between overlapping policy measures would be avoided or corrected.</p>	
Key design features	Objective	65 % of the cumulative energy savings target should be delivered by EEOS (851 ktoe*) Though target for the EEOS not yet formally notified by Latvia	27
	Starting date	Targets are set in line with the Article 7 EED energy savings obligation, with targets for cumulative savings set from 2014 (or the beginning of the scheme if later than 2014) until the end of 2020; another source: Latvian EEOS was implemented in 2016 with the first commitment period starting from 2018 to 2020.	18, 23, 3
	Sectors to be obliged	All end-user sectors	1
	Energy carriers to be obliged	Only electricity	18
	Selection of obligated actors	Different indications: -Electricity traders and distribution system operators, district heating companies / system operators (if more than 1 producer and at least 1 is non-dependent), natural gas operators, energy companies with a minimum of 10 GWh per year; - electricity, district heating and gas suppliers;	27, 23

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		- electricity retail sellers which (1) had sold at least 10 GWh of electricity in 2016, or (2) had sold at least 10 GWh of electricity in any of years related to EEOS period. The regulation regarding obligations for the post-2020 period under elaboration.	
	Eligible measures	According to the Regulation No 226 (Art.12) the obligation can be fulfilled by the following activities: (1) providing end-users with information on energy efficiency improvement opportunities (2) making a contribution to the National Energy Efficiency Fund (3) energy efficiency improvement measures on end-users' side. First results show that a high share of savings have been from information measures. The NECP mentions that the EEOS could be broadened from electricity to district heating and transport, which would expand the range of eligible measures	18
	Role of the involved stakeholders	The energy savings can be achieved in all end-user sectors, either directly developing energy efficiency measures or through third parties	1
	Evolution of the indicators		
	Flexibility rules	Banking: the following year's obligation is reduced by the amount of overcompliance; Borrowing: requirements to pay into the National Energy Efficiency Fund only arise if less than 80% of the obligation has been fulfilled; Buy-out: payments into the National Energy Efficiency Fund can be made at 1.5 times the determined value for each unit of energy savings;	18, 3
Assessments (savings/costs)	Setting of the baseline	2 702 ktoe/year	18
	Reference of the savings target		
	Differentiation of the savings target	Majority of measures expected from household sector	16
	Level of the savings target		
	Allocation of the savings target	The allocation of savings is not quite clear.	18
	Crediting period	2014-2020	18
	Energy saving calculation methodologies	Deemed, scaled, metered savings, surveyed savings	18, 16
	Determination of savings		
	Selection of the accounting period		
	Differentiation of the crediting of measures		
Admissibility of double funding			

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Avoidance of double funding	Might be a problem with double counting regarding the “warmer living” information campaign.	18
	Additionality ensured/Materiality	Due to the high share of information measures implemented through the EEOS, there remains some concern about additionality.	18
	Overlaps with other measures	Not addressed	18
	CO ₂ emission reduction	Cumulative annual savings (kt CO ₂): 2014: 0.916, 2015: 3.706, 2016: 4.474, 2017: 17.052, 2018: 21.285	23
	Annual savings	New savings (GWh): 2014: 8.4, 2015: 29, 2016: 35.5, 2017: 142.7, 2018: 158.2	23
	Total annual savings	Cumulative annual savings (PJ): 2014: 0.03, 2015: 0.122, 2016: 0.148, 2017: 0.563, 2018: 0.703	23
	Cumulative energy savings	Notified by state: 1760; art. 7: 1762; Total cumulative end-use savings (Article 7) achieved from 2014 to 2018 are 435 GWh (1.565 PJ), Taking into account the lifetime of the measures, the cumulative annual savings in 2018 is 195 GWh (0.703 PJ). The average annual total electricity end-use consumption in years 2014-2018 was 23.5 PJ.; As of 2019: 329,5 GWh cumulative energy savings were reported from measures implemented in the starting period (2014-2017) (annual report 2019)	18, 23, 3
	Allocation of system costs		
	Cost-effectiveness		
Certificates	System addressees		
	Admissibility of trade	No trading allowed	18
	Lifetime of certificates		
Monitoring	Length of the obligation period	Start period: 29 May 2017 – 31 December 2017, the first period: 01 January 2018 – 31 December 2020	23
	Compliance und Monitoring	The reporting is performed on annual basis. The Ministry of Economics shall by 1 May each year compiles information regarding the energy savings achieved in the State in each of the end-use sectors (Article 11 of the CMR No923).; The responsible ministry invites merchants to submit their annual reports electronically to the Ministry of Economics electronic system for the energy sector https://ener.gov.lv . The responsible ministry has the right to involve experts independent of the obligated parties in the inspection/assessment of the energy savings report of the previous year.	22, 3
	Verification	The CMR No923 sets specific guidelines in order to ensure that the provided information in the energy savings reports is reliable and that the energy savings can be checked and evaluated. Specifically, the involved parties should complete specific forms and utilize documented information (heating and electricity accounts, project reports, notifications, energy audit reports, other documents). Currently, the CMR No382 (2013) established a specific auditing procedure with the involvement of almost 100 independent experts in the area of energy efficiency of buildings.	22

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Penalties	<p>The obliged party of Energy Efficiency Obligation Scheme may choose the alternative to pay in the Energy Efficiency Fund instead of implementing the energy efficiency measures by itself. Currently the amount of this payment is stated 70 EUR per MWh.</p> <p>If the obliged participant in the particular year has fulfilled its duty at least par 80%, the non-filled duty is transferred and added to the next year duty (such transfers are allowed only within the time boundaries of particular EEOS sub-periods).</p> <p>However, if the fulfilment of duty is less than 80%, the obliged participant shall make payment to the National Energy Efficiency Fond for the non-filled amount, the amount of payment for each non-reached 1 MWh savings corresponds to the amount defined by legislative acts multiplied by the factor 1.5 (namely, currently this payment is 70 EUR *1.5 = 105 EUR per MWh).</p>	18, 23
	Rulebook for M&V	M&V system in place	16
District heating/ Heat pump	District heating	<p>Addressees: Electricity traders and distribution system operators, district heating companies; Financial support schemes are the main instruments in order to incentivize local governments for implementing energy efficiency measures. For the EU funds of the programming period 2014-2020 financial support for the implementation of energy efficiency measures in municipal buildings as well as for the improvement of the efficiency of district heating systems is foreseen.</p> <p>Specific actions in order to redesign the implemented energy efficiency measures have been performed during the implementation of the EU Funds for the programming period 2007-2013. Specifically, the program for the renovation of the district heating systems was redesign in order to increase the eligible number of the industrial boiler installations.</p>	16, 22
	Heat pumps		

A.2.11 Luxembourg

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	EEOS only	18
	Cumulative object	Cumulative energy savings target for the period 2014-2020 notified by MS(ktoe): 532; Second source: Cumulative energy savings target for the period 2014-2020: 515 ktoe; Third source: The EEO targets cumulative final energy savings of 5,993 GWh to be reached collectively by these energy suppliers on Luxembourg soil between January 2015 and December 2020.	27, 18, 14
	Reference	Annual final energy consumption (averaged over 2010-2012): 4.267 ktoe/year (based on Eurostat) Adjusted baseline: 1.636 ktoe/year Energy consumption excluded from the baseline: Transport (2.631 ktoe/year) (no exclusion of energy production for own use)	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	25% (171,7 ktoe); use of options (a) (slow start) and (b) (excluding energy sales to the ETS-industry); Luxembourg intends to make use of the option of reducing the volume of energy savings by 25%, by excluding part of the sales of energy used in industrial activities covered by the ETS Directive (Art 7, 2, a). The cumulative energy saving objective for Luxembourg to be achieved by obligated parties then amounts to 5, 993 GWh.	18, 14
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 113 ktoe (22 % of the 2014-2020 target) Assuming the current trend in new annual and total annual energy savings are continued over 2019-2020, Luxembourg will very unlikely achieve its 2014-2020 target.	18
Evaluation	Strengths and weaknesses	Luxembourg relies on a single policy instrument (EEOS) to deliver the savings target which provides clarity and avoids overlaps between policy instruments. However, the EEOS does not deliver on the target and there is up to now a very significant shortfall of savings. The EEOS required modifications: the catalogue of measures was adjusted to include more practicable information.	18
Key design features	Objective	100 % of the cumulative energy savings target should be delivered by EEOS (532 ktoe); The overall target has been set to achieve 100% of the target for the EED article 7: 5 993 GWh of final energy savings cumulated over 2015-2020.	27, 3
	Starting date	Targets are set in line with the Article 7 EED energy savings obligation, with targets for cumulative savings set from 2014 (or the beginning of the scheme if later than 2014) until the end of 2020; obligation period started in January 2014 but the EEOS haven't been in place then. Presumably the obligated	18, 27, 3

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		parties would need to achieve the savings retrospectively.; Another source: The scheme has started in January 2015, for a period up to the end of 2020.	
	Sectors to be obliged	all sectors; residential, service, industrial and transport sectors.; Another source: exclusion of transport	18
	Energy carriers to be obliged	All energy carriers	18
	Selection of obligated actors	All electricity (25) and gas (10) suppliers to residential, service sector and industrial customers are obligated parties by law regardless of size or client base (28 suppliers of electricity and 9 suppliers of natural gas);	27
	Eligible measures	<ul style="list-style-type: none"> • 9 building-related measures • 4 measures on appliances • 1 measure relating to the installation of a block-Strip "cut-sleep" • 4 measures in lighting • 1 measure relating to the installation of high efficiency motors • 2 measures for circulation pumps • 2 ventilation related measures • 4 measures on compressed air • 2 measures for industrial boilers • 2 measures for refrigeration systems • 1 measure relating to the implementation of energy management system ISO 50001 • 2 measures in the transport sector; Another source: obligated parties are free to implement measures in all consuming sectors for all types of energies, including heating oil and automotive fuels.	18, 14
	Role of the involved stakeholders	The obligation scheme will allow the obligated parties to count energy savings achieved through executing parties towards their obligation. Executing parties may, for instance, be installers, energy consultants, etc.	1
	Evolution of the indicators	There was no change up to now in the policy mix over the 2014–2020 period: Luxembourg relies on a single cross-cutting measure, its EEOS.	18
	Flexibility rules	Banking: up to 3 years; borrowing: up to 4 years (up to 40% until 2017 and 20% from 2018); buy-out: not possible in the 2014-2020 obligation period. In the 2021-2030 period, buying out is possible up to a maximum of 1 500 MWh per year per obligated party. The buy-out price is set each year dependent upon the previous year's costs of compliance.	18
Assessments (savings/costs)	Setting of the baseline	1 636 ktoe/year	18
	Reference of the savings target		

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Differentiation of the savings target		
	Level of the savings target		
	Allocation of the savings target		
	Crediting period	2014-2020	18
	Energy saving calculation methodologies	Deemed, scaled, metered savings; Second source: Savings are calculated on a first year savings basis, but the lifetime of the measures are taken into account (for actions with a lifetime going until 2020 or beyond, the whole first-year saving can be accounted; for actions with a lifetime ending before 2020 only a proportion of the first year savings can be accounted).	18, 28
	Determination of savings		
	Selection of the accounting period		
	Differentiation of the crediting of measures		
	Admissibility of double funding		
	Avoidance of double funding		
	Additionality ensured/Materiality	Rulebook for EEOS includes robust additionality requirements	18
	Overlaps with other measures		
	CO ₂ emission reduction		
	Annual savings	In 2015, 162 GWh has been reported by obligated parties and 102 GWh assumed by the ministry.	3
	Total annual savings		
	Cumulative energy savings	Target not notified in the NECP	18
	Allocation of system costs	Obligated parties incurring additional costs could pass these costs on to the final customers, which may lead to an increase in the price of electricity and natural gas	1
	Cost-effectiveness		
Certificates	System addressees		
	Admissibility of trade	Horizontal trading	18

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Lifetime of certificates	EEOS targets on the basis of first year energy savings, with all actions required to continue to deliver savings until 2020.	18
Monitoring	Length of the obligation period	1 January 2014 to 31 December 2020	27
	Compliance und Monitoring	Obligated parties have to report annually (On March 31st of each year) on the energy savings achieved during the preceding year. Supporting documentation regarding the savings declared will have to be retained for ten years by the obligated parties and produced in the event of a control or verification.	28, 14
	Verification	On the initiative of the Ministry of the Economy, a random annual inspection of a statistically significant and representative sample of the energy-saving measures may be carried out by an independent expert.	22
	Penalties	If an obligated party does not realize the minimum value for their targets (60% from the start of the scheme and 80% from 2018) they are obliged to pay a fine of 2 €/MWh that they are below the minimum value. The amount they are short is also added to the following year's target. For the 2021-2030 period, this will be raised to a level that is 1.25 times the buy-out price.	18, 10
	Rulebook for M&V	Luxembourg has a detailed rulebook for its EEOS including robust additionality requirements. The rules of the EEOS ensure compliance with the Annex V principles.	18
District heating/ Heat pump	District heating		
	Heat pumps		

A.2.12 Malta

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	EEOS and alternative measures	18
	Cumulative object	Different indications: Cumulative energy savings target for the period 2014-2020 notified by MS(ktoe): 56; Cumulative energy savings target for the period 2014-2020: 66,55 ktoe; For the period 2014-2020, the total Art.7 target of Malta is specified in NEEAP 2017: cumulative end use energy savings of 774 GWh over 2014-2020.	27, 18, 3
	Reference	Annual final energy consumption (averaged over 2010-2012): 496,53 ktoe/year (based on Eurostat data) Adjusted baseline: 211 ktoe/year Energy consumption excluded from the baseline: Transport (285,23 ktoe/year) (no exclusion of energy production for own use)	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	25% (22.2 ktoe); use of option (a) (slow start) and (d) (early actions).	18
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 47 ktoe (71 % of the 2014-2020 target) Assuming the current trend in new annual and total annual energy savings are continued over 2019-2020, Malta will very likely achieve its 2014-2020 target.	18
Evaluation	Strengths and weaknesses	Malta has a variety of policy mix across sectors, including measures in the water sector as part of the measures in Government-owned industry. Malta is in line with its planned trajectory to meet its target. However, there is no detailed information on how M&V is carried out. And 46% of the expected cumulative target were planned to be achieved through a measure dealing with PV generation for self consumption.	18
Key design features	Objective	18 % of the cumulative energy savings target should be delivered by EEOS (10 ktoe); 10.5 GWh annual saving by 2020	18
	Starting date	2009 smart meter roll out + behavioral change from 2016; 2014 for progressive tariffs; EEOS since 2015 another source: 2014	28, 27, 3
	Sectors to be obliged	The scheme is focused on the residential sector. Exclusion of transport, no exclusion of energy production or own use	18, 27, 3, 14

Characteristics of the EEOs	Details	Implication period 2014-2020	Sources
	Energy carriers to be obliged	Only electricity; another source: electricity and gas	18, 28
	Selection of obligated actors	Electricity supplier (Enemalta Corporation), only one obligated party (monopoly distributor)	18
	Eligible measures	Adopting a “progressive” rising block tariff whereby consumption at higher ranges are “penalized” through higher rates per kWh (measure EMC-2). Adopting a mechanism rewarding economy in consumption of energy. Consumers are granted rebates if their consumption is below a stipulated level (measure EMC-3).	18
	Role of the involved stakeholders		
	Evolution of the indicators	Presentation of the policy measures has been revised from NEEAP2017 on: all policy measures have been grouped in four policy packages (one being the EEOs that has been redesigned). From 2017 on, the annual reports include the details about the energy efficiency measures or projects included in the policy packages: (1) EEOs: obligation on Enemalta plc (Maltese electricity supplier) to implement a progressive tariff and ecobonus on electricity for households (2) Financing schemes and instruments: energy efficiency in Government-owned industry, incentives scheme for low income households, grant schemes to improve vehicle fleet (car scrappage) and for PV self-consumption; (3) regulations and voluntary agreements: energy efficiency measures undertaken by non-SMEs under voluntary agreements, and energy savings resulting from excise duties on motor fuels exceeding EU’s minimum levels; (4) public sector leading by example: retrofitting of public buildings, retrofitting of street lighting.	18
	Flexibility rules	The Maltese NEEAP does not include particular forms of flexibility regarding the EEO scheme.	14
Assessments (savings/costs)	Setting of the baseline	211 ktoe/year	18
	Reference of the savings target		
	Differentiation of the savings target	Special measures for energy poverty	18
	Level of the savings target		
	Allocation of the savings target		
	Crediting period		
	Energy saving calculation methodologies		
	Determination of savings		

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Selection of the accounting period		
	Differentiation of the crediting of measures		
	Admissibility of double funding		
	Avoidance of double funding		
	Additionality ensured/Materiality		
	Overlaps with other measures	Not addressed	18
	CO ₂ emission reduction		
	Annual savings		
	Total annual savings		
	Cumulative energy savings	Notified by state and art 7: 82	18
	Allocation of system costs		
Cost-effectiveness			
Certificates	System addressees	The SEWCU is entrusted with the establishment of the necessary verification protocols specific to each implemented energy efficiency measure.	22
	Admissibility of trade	No trading (only one obligated party)	18
	Lifetime of certificates		
Monitoring	Length of the obligation period	2014-2020	27
	Compliance und Monitoring	details are given on M&V practices for individual measures.; The measured energy savings are verified within the framework of the M&V scheme through independent verification by energy experts according to the requirements of the National Audit Office.	18, 22
	Verification	The Ministry for Energy and the Conservation of Water is responsible for setting up a team of representatives members of the relevant authorities, with the National Statistics Office as leader, responsible for monitoring and verifying the measures of the obligation scheme on Enemalta, those in the public building sector (except the PB-8 and PB-9 for which the Malta Resources Authority is responsible to monitor and verify), those in the residential building sector, as well as in the private sector (except the measures PS-1, PS-2 and PS-3, same as PB- 8). In the public sector the responsible authority for verification is the Ministry for Energy and Conservation of Water, while only for the lighting efficiency improvement throughout the country, Transport Malta Company is assigned with verification responsibilities as well. The latter company is responsible for the	14

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		measures undertaken in the Transport sector too. In the government-owned industries sector Water and service corporation (WSC) is responsible to collect the data to report to the Ministry.	
	Penalties	Penalties are stipulated in Articles 15 and 25 of the legislation LN 196 (2014). According to Article 15, the authority may impose an administrative fine not exceeding €100,000 for each contravention or €600 for each day of non-compliance upon any person who infringes any provision of the regulations or who fails to comply with any directive or decision given by the Authority in ensuring the compliance with the regulations.	18
	Rulebook for M&V	M&V system in place	16
District heating/ Heat pump	District heating		
	Heat pumps	<p>Strategy for the 2021–2030 period: The top5 measures in terms of expected cumulative savings are mostly financial schemes including the Transport Scrappage Scheme, the Financial support schemes for solar PV, the Financing support scheme for services and industry, Energy efficient street lighting and Financial support schemes for Solar Water Heaters and Heat Pump Water Heaters.</p> <p>Policy measures include: Scheme for the Installation of Heat Pumps, Scheme for the Installation of heat pumps of industrial use; Especially for the measure of the energy upgrade of residential buildings is foreseen the installation of double glazing, roof insulation, solar water heaters and heat pumps.</p>	18, 27, 22

A.2.13 Poland

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	EEOS only	18
	Cumulative object	Cumulative energy savings target for the period 2014-2020 notified by MS(ktoe): 14,818	27
	Reference	Annual final energy consumption (averaged over 2010-2012): 64.610 ktoe/year (based on Eurostat data) Adjusted baseline: 47.040 ktoe/year Energy consumption excluded from the baseline: Transport (17.570 ktoe/year) (no exclusion of energy production for own use)	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	25% (4939 ktoe); use of options (b) (excluding energy sales to the ETS-industry) and (d) (early actions)	18
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 8.891 ktoe (60 % of the 2014-2020 target) Assuming the current trend in new annual and total annual energy savings are continued over 2019-2020, Poland will likely achieve its 2014-2020 target.	18
Evaluation	Strengths and weaknesses	After some difficulties in the first years of the scheme, the EEOS is now at risk to having too many certificates in the market. The ministry has already prepared some modifications of the white certificate scheme, but it remains uncertain if those changes will target the problem. One essential problem is, that there is a scarcity of reliable data and costs. No official data on expected savings is available. The values used for savings lifetimes raise issues: the Polish ministry has assumed long lifetimes, which might not be justified, and it is unclear how lifetimes are taken into account in the energy savings reported to Article 7.	18
Key design features	Objective	1.1 Mtoe (expected); estimated to be 25.6 TWh by 2016 80% of target to be met by end use energy savings; 100 %of the cumulative energy savings target should be delivered by EEOS-> 14,818 ktoe Second source: I Stage 2012 - 2015: at the level of 54.5 TWh of final energy consumption, According the II National Energy Efficiency Action Plan (NEEAP) the expected savings from the WCS should amount to 25.6 TWh of final energy. II Stage 2016: energy saving of at least 3,675 Mtoe till 2020. another source: There is a final energy savings target of 2 645 ktoe to be achieved by the end of 2020.	27, 12, 3
	Starting date	2014-2020; other sources: 2012; 2013	6, 27, 23, 3
	Sectors to be obliged	Residential, commercial and industrial end users; also energy efficiency improvements in their T&D business or own energy use; exclusion of transport sector fuel coverage	18, 27, 12

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Energy carriers to be obliged	electricity, natural gas, and heat delivered by district heating networks.	1, 12
	Selection of obligated actors	<p>electricity, natural gas and district heating companies selling to final consumers; members of a commodities exchange and commodity brokerage houses</p> <p>other sources:</p> <p>Energy companies selling electricity, natural gas or heat to end users connected to the grid within the borders of Poland. The number of the obliged parties is in practice estimated at 500-600, consisting largely of small companies possessing license for electricity (415), gas (114) and heat (110) trading. The actual number is hard to estimate as some of them possessing an appropriate license remain inactive.</p> <ul style="list-style-type: none"> • End users connected to the Polish grids who conduct transactions on the Polish Power Exchange on their own. • Commodity brokerage houses and trade brokerage houses making transaction, e.g. buying electricity, gas or heat on the Polish Power Exchange acting on behalf of their clients (acting at the request of their users). <p>- The Obligated Parties (OPs) are the energy suppliers and traders selling electricity, heat, or natural gas to end users, except heating companies that supply less than 5 MWt to final consumers.</p>	27, 12, 3
	Eligible measures	<p>The draft law on energy efficiency did not change the definition of energy efficiency improvement project and laid down an exhaustive list of types of energy efficiency improvement projects. In accordance with that list, the following types of projects are eligible under the scheme:</p> <ul style="list-style-type: none"> • insulation of industrial installations; • reconstruction or renovation of a building, together with installations and technical equipment; • modernization or replacement of: a) lighting, b) devices and systems used in industrial processes or energy processes, c) local heating networks and local heat sources; • energy recovery, including recovery of energy in industrial processes; • reduction of losses: a) associated with the consumption of passive energy, b) of networks associated with the transmission or distribution of electricity or natural gas, c) for transformation in transformers, d) in heating networks; • use, for heating or cooling buildings, of the energy produced in own installations or those connected to networks of renewable energy sources, heat used in high-efficiency cogeneration or waste heat from industrial installations. <p>These categories – hence - apply to all tenders in the past and future and the list includes supply side and distribution related energy savings that cannot be counted against the savings target (only within the 25% exemption that is used fully).</p>	18
	Role of the involved stakeholders		

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Evolution of the indicators	There was no change in the policy mix over the 2014–2020 period: Poland relies on a single cross-cutting measure, its EEOS.	18
	Flexibility rules	<p>Different indications:</p> <p>banking: no information (so far overcompliance has not been an issue); borrowing: obligated parties can postpone the fulfilment of their obligation for up to 2 years; buy-out: substitution fee, predefined each year, can be paid into the National Fund of Environment Protection and Water Management</p> <p>The obliged parties can purchase WC for redemption on the Polish Power Exchange or in OTC transactions (also from their customers, that should give incentives for development of the ESCO services in Poland) or gain the certificates in the tender bid, presenting initiatives performed on their assets (in relation to energy generation sector limited to auxiliary equipment in power plants, and transmission and distribution as well as transfer of energy carriers).</p> <p>Alternatively, the obligated parties can pay so called substitution fees, that equals to the product of the unit substitution fee and the volume of primary energy expressed in toe resulting from the calculation of the obligation.</p> <p>It is also possible to follow a mixed way - divide the obligation between a certain amount of WC presented for redemption and payment of a substitution fee covering the remaining amount of primary energy multiplied by the unit substitution fee. The obligation shall be settled on one year period basis, and therefore banking or shifting obligation between years is not permitted. II Stage 2016: The option of banking the obligatory savings is to be introduced as it is planned that the savings can be reported to the President of ERO in three years' time intervals. Now it is permissible to report one year savings only.</p> <p>OPs can perform the energy efficiency measures themselves, acquire white certificates on the market or pay a substitution fee to the National Fund of Environment Protection and Water Management. The obligated parties can postpone (borrowing) the fulfilment of the obligation for one or two years. The obligation can be lowered through presenting measures implemented by a large consumer from specific industrial groups that consumes at least 100 GWh/a. Those measures follow similar requirements as others (at least 10 toe/a of savings confirmed with an audit), except they can be already implemented but not earlier than 2014.</p>	18, 12, 3
Assessments (savings/costs)	Setting of the baseline	47 040 ktoe/year	18
	Reference of the savings target	primary energy saving	12
	Differentiation of the savings target		
	Level of the savings target		
	Allocation of the savings target		
	Crediting period		

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Energy saving calculation methodologies	deemed, scaled savings; 1) Simplified energy efficiency audits for deemed savings projects.2) Energy efficiency balance audit, i.e. making energy balance of the whole machine, equipment, process or building in which the energy improvement measure has been done.	18, 12
	Determination of savings		
	Selection of the accounting period	only the first year's energy savings are rewarded	18
	Differentiation of the crediting of measures		
	Admissibility of double funding	WSC projects must not be doubly financed from public sources, EU or national. The eligible policy instrument combination is prohibited as far as public financing is considered, e.g. double public financing is forbidden. This comment mainly refers to those instruments involving investments in which there is a rule "only one public source of funding". For example, in all programs it is forbidden to receive joint funding from NFEP&WM and any other domestic or international sources. It also applies for the WCS (EEO) projects and publicly funded grants or loans.	12, 13
	Avoidance of double funding	As the EEOS is the only measure applied for the 2014–2020 period, double-counting might be ruled out. To avoid double-counting, energy savings measures credited under the WCS must not have received support from the Thermomodernization Fund, from the national or the European Union budget, or from any other public sources (e.g., the Norwegian Financial Mechanism or the European Economic Area Financial Mechanism).	18, 12
	Additionality ensured/Materiality	Projects do not have to be additional	12
	Overlaps with other measures		
	CO ₂ emission reduction		
	Annual savings		
	Total annual savings	The WCS put into operation mid 2013 with only first bid results announced end 2013 this short time doesn't enable to make any reliable evaluations of its impact or economic effectiveness. So far, only the results of the first bid are publicly known. The total quota of the WC allocated for the bid amounted to 550 toe primary energy, whereas only 20.7 toe were granted, that makes 3.8% of the total quota.	12
	Cumulative energy savings	notified by state: 30635, art 7: 30727; Cumulative energy savings reported for 2014-2018: 8.891 ktoe (60 % of the 2014-2020 target);	18
	Allocation of system costs	Unregulated cost pass-through	28

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Cost-effectiveness	<p>Per kWh of savings the price paid amounts to around 2.0-3.3 € cents- well above prices for most supplied energy carriers.</p> <p>The shorter the simple payback time is, the relatively higher are the average annual savings of energy costs generated by such investment (calculated as the percentage of investment expenditure). Financial data, such as the amount of investment expenditures incurred or the level of energy costs reduction, is of no importance in this case.</p>	26, 12
Certificates	System addressees	<p>The whole verification and monitoring burden was allocated to the President of ERO. He may carry out audits with his own staff or selected in the process of public procurement an external company. ERO, at least once a year, announces, organizes and conducts a tender. Projects which achieve savings in the amount equivalent to at least 10 toe on average per year, may participate in the tender, including ESCO projects. ERO grants the white certificates only</p> <p>Contents Keywords Authors 2-380-15 BERTOLDI ET AL 460 ECEEE 2015 SUMMER STUDY – FIRST FUEL NOW 2. ENERGY EFFICIENCY POLICIES – HOW DO WE GET IT RIGHT? to the enterprises who win the tender. The enterprises, which obtain white certificates, are obligated to complete the project stated in the tender.</p>	1, 12
	Admissibility of trade	<p>horizontal and vertical trading (through White Certificates); tender procedure certificates can be traded via Polish Power Exchange; White Certificate trading was introduced in 2012 ; third source: Any actor is eligible to submit energy savings projects to obtain white certificates. The certificates can be traded on the Polish Power Exchange or in OTC transactions.</p>	18, 27, 26, 3
	Lifetime of certificates	<p>Poland sets its EEOS (White Certificate) targets on the basis of average annual energy savings over the lifetimes of actions (this is similar to the first year energy savings approach);</p> <p>several price indices for White Certificates that reflect certificates obtained in different years that are still in the market, making a an assessment of the costs using price data not straightforward. This includes certificates issued during the transition period (i.e. 2016-2017), some of which were only granted in 2019 for projects carried out in 2016/2017.</p> <p>There are different types of certificates available on the market depending on their expiration date.</p> <ol style="list-style-type: none"> 1. The certificates granted during the old auction based system that can be used towards the obligation until 31 June 2021. They are marked on the energy exchange as PMEF. 2. Transition period certificates are the certificates granted during the transition period (2016-2017) based on the mix of principles from the old and new system and are valid for the obligation only for the year they were issued in. 3. The certificates granted based on the principles from the new system, which do not have any expiration date and can be used for any obligation period. They are marked on the energy exchange as PMEF_F. 	18, 26, 10
Monitoring	Length of the obligation period	3 years in the period Jan 2013– Dec 2016; 2013 – 2020	27, 23

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Compliance und Monitoring	The President of ERO controls whether obliged parties have submitted for redemption the appropriate number of certificates and /or paid the remaining amount in the form of the substitution fee.	28, 12
	Verification	Energy savings accomplished in energy efficiency projects with average annual energy savings that exceed 100 toe shall ex-post be verified by an energy audit. The audit must not be conducted by the same auditor who carried out the initial audit for the project auction declaration, i.e. for the purpose of the WC auction. Projects that fall below the 100-toe threshold are subject to random sampling verification ordered by the President of ERO to check the compliance between the energy savings declared and accomplished. The results of both audits and statements are verified by the President of the URE.	18, 12
	Penalties	Financial penalties (of up to EUR 2 000 000) are imposed in case of non-compliance (notification). Penalties will be no higher than 10% of the income of the undertaking sanctioned. In fixing the amount of the penalty, the President of the ERO will take account of the scale of the infringements, the repetition of infringements or financial benefit derived. second source: I Stage 2012 - 2015: In case of failure to fulfil the obligation i.e. neither redemption of the WCs nor substitution fee paid, the President of ERO imposes a financial penalty on the obliged party. The penalty may amount up to 10% of the revenue of the company generated in the previous year. The same penalty threatens when the obliged party submits for redemption WCs obtained by providing untrue data. If WCs had been granted for the planned investment and then the investment has not been accomplished (realized), the ERO, as a system operator, may impose severe penalty for non-compliance on the beneficiary of the WC. Similarly, if the achieved results are after ex-ante audit turned out to be lower than it had been estimated and declared by beneficiary in the auction procedure, the beneficiary of the WCS is obliged to buy the missing amount of WC, i.e. equal to the missing savings. The purchase can be done from third parties, e.g. directly from the selling ESCO company or on the Polish Power Exchange. II Stage 2016: The maximum monetary penalty imposed on obliged party for no compliance may not exceed PLN3 000 000 (app. €750 000). another source: Enterprises that sell electricity, natural gas and heat will be obliged to gain a certain number of certificates in order to present them to the Energy Regulatory Office and have them amortized. The companies which do not receive the certificates will need to pay compensatory fees of PLN 900-2700 per toe.	18, 12, 23
	Rulebook for M&V	M&V system in place	16
District heating/ Heat pump	District heating	Fuel coverage: Electricity; gas; district heating; Obligated parties: Electricity, natural gas and district heating companies selling to final consumers; members of a commodities exchange; commodity brokerage houses District heating companies supplying no more than 5 MW of heat are exempted from the obligation.	28, 12
	Heat pumps		

A.2.14 Slovenia

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	EEOS and alternative measures There was no change in the policy mix over the 2014–2020 period: Slovenia relies on two policy measures (EEOS and EcoFund).	18
	Cumulative object	Different indications: Cumulative energy savings target for the period 2014–2020 notified by MS(ktoe): 945; Cumulative energy savings target for the period 2014–2020: 997 ktoe	27, 18
	Reference	Annual final energy consumption (averaged over 2010–2012): 4.974 ktoe/year (based on national data) Adjusted baseline: 2.999 ktoe/year Energy consumption excluded from the baseline: Transport (1.911 ktoe/year) and energy production for own use (64 ktoe/year)	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	25% (332 ktoe); use of options (a) (slow start) and (c) (counting energy savings from the supply-side).	18
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014–2018: 447 ktoe (45 % of the 2014–2020 target) Assuming the current trend in new annual and total annual energy savings are continued over 2019–2020, Slovenia will unlikely achieve its 2014–2020 target.	18
Evaluation	Strengths and weaknesses	The policy mix combining the EEOS and the EcoFund covers all end-use sectors, both measures being cross-cutting. The EEOS has proven to deliver cost-effective actions (e.g. fuel additives). While the EcoFund would be more focused on energy efficiency projects requiring higher investment costs, such as building renovations. However, it remains unclear from the reporting made to Article 7 which energy efficiency measures from the EcoFund are actually counted to Article 7.	18
Key design features	Objective	33 % of the cumulative energy savings target should be delivered by EEOS--> 314 ktoe	27
	Starting date	EEOS since 2015 another source: 2014	28, 3
	Sectors to be obliged	all sectors	18
	Energy carriers to be obliged	all energy carriers	18
	Selection of obligated actors	Utilities (electricity, gas, heat, and liquid and solid fuels); obligation to suppliers of electricity, heat, gas and liquid and	1, 10

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		solid fuels to final customers (estimated 16 electricity suppliers, 19 gas suppliers and several fuel suppliers (n/a); second source: The Obligated Parties (OPs) are the suppliers of electricity and natural gas, and wholesale retailers of oil products and LPG.	
	Eligible measures	<ul style="list-style-type: none"> • Efficient energy use measures and greater use of renewables in heat generation in the public and service sectors and for industry (19 actions) • Efficient energy use measures for single-, double- and multiple-dwelling buildings (12 actions) • Efficient energy use measures in transport (3 actions) • Measures to increase the efficiency of district heating systems (2 actions) 	18
	Role of the involved stakeholders		
	Evolution of the indicators	A new regulation revising the rules for the EEOS entered into force in 2015. New eligible action types were defined, which resulted in large portion of the energy savings achieved then.	18
	Flexibility rules	banking possible, borrowing possible, buy-out: obligated parties can pay into Eco Fund. The fee is set equal to the average cost per kWh saved for Eco Fund programs. Smaller obligated parties (e.g. pellet sellers) have made more use of this facility than larger utilities.	18
Assessments (savings/costs)	Setting of the baseline	2 999 ktoe/year	
	Reference of the savings target	<ul style="list-style-type: none"> • Efficient energy use measures and greater use of renewables in heat generation in the public and service sectors and for industry: • Efficient energy use measures for single-, double- and multiple-dwelling buildings • Efficient energy use measures in transport 	18
	Differentiation of the savings target	special measures for energy poverty	18
	Level of the savings target		
	Allocation of the savings target		
	Crediting period		
	Energy saving calculation methodologies	deemed savings	18
	Determination of savings		
Selection of the accounting period			

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Differentiation of the crediting of measures		
	Admissibility of double funding		
	Avoidance of double funding	many actions are reported together under only two actions – the EEOs and the measures funded by the Eco fund. This makes it impossible to check for double count	18
	Additionality ensured/Materiality	The measures are eligible, additional and material	18
	Overlaps with other measures		
	CO ₂ emission reduction		
	Annual savings		
	Total annual savings		
	Cumulative energy savings	notified by state: 2169; art 7: 2171; Second source: Cumulative energy savings reported for 2014-2018: 447 ktoe (45 % of the 2014-2020 target); The EEOS has delivered more energy savings than expected over 2014-2018 In the period 2014-2020, Slovenia started with new annual savings higher than expected in the first years, especially thanks to the success of the EEOS. However, a significant share of these savings had a short lifetime (e.g. fuel additives in the EEOS)	18
	Allocation of system costs	Unregulated cost pass through	28
	Cost-effectiveness	The EEOS has proven to deliver cost-effective actions (e.g. fuel additives). While the EcoFund would be more focused on energy efficiency projects requiring higher investment costs, such as building renovations.	18
Certificates	System addressees		
	Admissibility of trade	no trading, There is no certificate market	18, 10
	Lifetime of certificates	EEOS targets on the basis of first year energy savings, with all actions required to continue to deliver savings until 2020.	18
Monitoring	Length of the obligation period	2014-2020	18
	Compliance und Monitoring	the information available does not provide details about how M&V is ensured for specific measures;	18
	Verification	The Energy Agency verifies at least a statistically significant proportion and representative sample of measures. Obligated parties have to report annually	28
	Penalties	The Energy Act defines penalties for obligated parties that do not achieve savings or fail to make payments for implementation of the Eco Fund program to increase energy efficiency. The Act also defines penalties for obligated parties that fail to report to the Energy Agency in accordance with the Act. The Member State states that	18

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>the penalties cover a range that enable them to be weighted according to the seriousness of the infringement. Range of penalties: the penalties for failure to comply with the provisions of the EZ on the energy efficiency obligation scheme are laid down in Article 493 EZ. The fines range from EUR 15 000 to EUR 250 000 for legal persons, with additional fines for the responsible person of said legal person ranging from EUR 2,000 to EUR 10,000.</p>	
	Rulebook for M&V	M&V system in place	16
District heating/ Heat pump	District heating	<p>Eligible measures: measures to increase the efficiency of district heating systems</p> <p>In essence, the original fund is made up by the energy consumption fee on solid, liquid and gaseous fuels, district heating and electricity and those who benefit from the fund must pay back the financing, in the forms of energy savings they carry out. The main measures are: efficient energy use measures and greater use of renewables in heat generation in the public and service sectors and for industry and households, efficient energy use measures in buildings, efficiency energy use measures in transport, measures to increase the efficiency of district heating systems and Energy Survey programs.</p> <p>The total funds collected annually will flow into the Eco- Fund and they will originate from charges from district heating, electricity and solid, liquid and gaseous fuels, paid by final consumers on top of the price of energy or fuel to the operator or supplier of energy or fuels, which pays the funds collected to Eco-Fund. In essence, the original fund is made up by the energy consumption fee on solid, liquid and gaseous fuels, district heating and electricity and those who benefit from the fund must pay back the financing, in the forms of energy savings they carry out.</p>	18, 1, 14
	Heat pumps	The most important energy efficiency measures and technologies in terms of energy savings, which are covered by the M&V scheme, comprise the substitution of boilers with more energy efficient ones and the promotion of heat pumps and lighting systems.	22

A.2.15 Spain

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	<p>EEOS and Alternative measures</p> <p>Spain has expanded its policy mix over the years (some of these measures had already delivered energy savings from 2014, even if notified later):</p> <ul style="list-style-type: none"> • 3 measures newly reported in 2018: 2014–2020 ERDF funds – Integrated Sustainable Urban Development (DUSI) multiregional section; National Energy Efficiency Fund – Rail system energy efficiency programme; MOVEA (Plan to promote mobility using alternative energy vehicles). • 6 measures newly reported in 2019: 2013–2017 State plan to promote building renovation (3R); Introduction of environmental criteria and criteria for efficient distribution to central government for urban public transport; Savings resulting from the implementation of the Directorate-General for Traffic’s environmental label; MULTIREGIONAL SECTION (IDAE): central government buildings; CNAE voluntary agreement; AEFGA voluntary agreement. • 10 measures newly reported in the annual report 2020: e-learning course by IDAE; Directing plan of savings and energy ADIF (Spanish administrator of railway infrastructure); Energy Efficiency measures AENA; Energy Efficiency measures Ministry of Defense; Communication campaigns; Energy Efficiency Program in Buildings (PAREER II); ICO IDAE Line of energy efficiency 2017–2018; MULTIREGIONAL SECTION (IDAE): Sustainable Urban Development; MOVALT; State program for the support of renovation. <p>Sums up to 44 measures included in annual reports</p>	18
	Cumulative object	Cumulative energy savings target for the period 2014-2020 notified by MS(ktoe): 15,979	27
	Reference	<p>Annual final energy consumption (averaged over 2010-2012): 85.965 ktoe/year (based on national data)</p> <p>Adjusted baseline: 50.727 ktoe/year</p> <p>Energy consumption excluded from the baseline: Transport (35.239 ktoe/year) (no exclusion of energy production for own use)</p>	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	25% (5.326 ktoe); use of options (a) (slow start) and (b) (excluding energy sales to the ETS-industry)	18
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 6958 ktoe (44 % of the 2014-2020 target)	18
Evaluation	Strengths and weaknesses	The policy mix includes a very large range of policies spanning all end-use sectors and assigning a high priority onto energy efficiency. It is noticeable that a significant share (more than 30%) of the reported cumulative savings have been achieved in transports.	18

Characteristics of the EEOs	Details	Implication period 2014-2020	Sources
		The downside of the large number of measures reported is that double counting is then very hard to assess and no information is given in this matter. Also M&V practices are generally undisclosed.	
Key design features	Objective	71 % of the cumulative energy savings target should be delivered by EEOs--> 11,317 ktoe	27
	Starting date	EEOs has started in July 2014 another source: was expected to start in 2015	28, 27, 3
	Sectors to be obliged	EEOs are implemented in different sectors, mostly focusing on transport, industry, buildings, public services and agriculture. Regarding the residential sector financial and informational measures are mainly implemented on existing buildings, whereas EEOs refers to existing and new buildings; However the EEOs' scope is further differentiated, as obligations also provide financial support to agricultural sector and to public and business use buildings, covering also new buildings.; the transport sector will be included in the EEO scheme implementation as highlighted in the Spanish report of June 2014, but savings of the transport sector are fully excluded from the target calculation. Exclusion of transport sector, no exclusion of energy products for own use;	27, 13, 14
	Energy carriers to be obliged	Electricity; gas; oil products; LPG	28
	Selection of obligated actors	All electricity, gas and oil product retailers, including transport, that sell to final customers obligation will not be imposed on small energy distributors, small retail energy sales companies and small energy sectors	27, 11
	Eligible measures	The following lines of action have been pursued by obligated parties: <ul style="list-style-type: none"> • aid program for the renovation of municipal street lighting • aid program for energy efficiency measures in SMEs and large industrial enterprises • aid program for modal shift and more efficient use of transport modes • communication campaign "Energy Saving and Efficiency" • aid program to improve energy efficiency in railway systems • aid program to improve energy efficiency in desalination plants • aid program to improve energy efficiency of existing buildings 	18
	Role of the involved stakeholders		
	Evolution of the indicators	The cumulative energy saving target for Spain has been set from the initial 21.305 ktoe to 15.979 ktoe within an implementation period starting from 1 January 2014 until the 31st of December 2020. Annual targets have been set to 131 ktoe/year for 2014, and 262 ktoe/year for 2015-2019 (new final annual energy savings).	14, 3
	Flexibility rules	banking and borrowing not allowed, buy out: payment into an Energy Efficiency National Fund; Payments are set at 6.8 Eurocents per kWh, based on energy sales in year 'n-2'. The fee is set taking into account the estimated average costs to achieve energy savings through the EENF	18

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Assessments (savings/costs)	Setting of the baseline	50 727 ktoe/year	18
	Reference of the savings target	final energy consumption	18
	Differentiation of the savings target		
	Level of the savings target		
	Allocation of the savings target	Obligations will be annually set on all legally bound parties on a linear basis over the entire period. Obligated parties will implement the saving objective according to their market shares as a reference, using baseline information that will rely on the sales during tax year 2013. In future years, baseline information for the distribution of the energy savings target shall be the sales in year N-2	1
	Crediting period		
	Energy saving calculation methodologies	The determination of the energy savings is performed with the implementation of various methods (scaled, deemed, surveyed savings methods) depending on the type and the characteristics of each measure separately.	22
	Determination of savings		
	Selection of the accounting period		
	Differentiation of the crediting of measures		
	Admissibility of double funding		
	Avoidance of double funding	no information given	18
	Additionality ensured/Materiality		
	Overlaps with other measures	EEOS (small), Aid programs	18
	CO ₂ emission reduction		
Annual savings			
Total annual savings			

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Cumulative energy savings	notified by state: 36809; art 7: 37289;	18
	Allocation of system costs		
	Cost-effectiveness		
Certificates	System addressees	IDAE	18
	Admissibility of trade	Certificates will be tradable but unclear whether only bilaterally or also vertically	28
	Lifetime of certificates		
Monitoring	Length of the obligation period	2014-2020	18
	Compliance und Monitoring	<p>M&V practices are generally undisclosed.</p> <p>The information given on matters of Annex V are very scarce making an assessment not possible. Concerns arise for all criteria due to a lack of information.</p> <p>As managing authority of the energy efficiency obligation scheme, the IDAE is responsible to inspect and supervise the proper implementation of the energy saving and efficiency measures. The results and the main findings of the implemented methodology have to be reported on annual basis.</p> <p>Annually, at the end of each period, the obligated parties should provide to the IDEA the obtained certificates, confirming the fulfilment of their obligation, or, alternatively, pay the predefined sanctions to the Energy Efficiency National Fund. That ex post repurchase price is based on the ex-ante repurchase price, keeping in mind the financial and the opportunity costs that are associated with the delay in achieving the savings.</p>	18, 22, 14
	Verification	<p>No provisions yet as compliance will be achieved through payments into the National Energy Efficiency Fund</p> <p>The IDAE verifies the implemented energy efficiency measures in order to issue energy efficiency certificates for the obligated parties with the prerequisite that there is the evidence that the measure has led to the final consumers the specific amount of energy savings. The IDAE may be supported from external entities or specialists in order to complete the appropriate verification procedures.</p>	28, 22
	Penalties	The main control and compliance instruments will be the annual financial penalties paid to the Energy Efficiency National Fund for not achieving sufficient energy savings by obliged parties. Second source: All of Spain's EEOS is delivered through the Energy Efficiency National Fund. Fees are set at 6.8 Eurocents per kWh multiplied by obligated parties' share of each year's target, which is set based on energy sales in year 'n-2'.	18
	Rulebook for M&V	M&V system in place	16
District heating/ Heat pump	District heating		
	Heat pumps		

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources

A.2.16 United Kingdom

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
Superordinate baseline and target	Instrument types	EEOS and alternative measures	18
	Cumulative object	Cumulative energy savings target for the period 2014-2020 notified by MS (ktoe): 27,859	27
	Reference	Annual final energy consumption (averaged over 2010-2012): 142.132 ktoe/year (based on national data, UK Energy Statistics) Adjusted baseline: 88.392 ktoe/year Energy consumption excluded from the baseline: Transport (53.740 ktoe/year) (no exclusion of energy production for own use)	18
	Approach used to calculate the obligation		
	Use of exemptions in implementation of measures	25% (9286,33 ktoe); use of options (a) (slow start) and (b) (excluding energy sales to the ETS-industry)	18
	(Expected) cumulative energy savings	Cumulative energy savings reported for 2014-2018: 18469 ktoe (66 % of the 2014-2020 target) Assuming the current trend in new annual and total annual energy savings are continued over 2019-2020, UK will likely achieve its 2014-2020 target.	18
Evaluation	Strengths and weaknesses	The policy mix includes strong policies for households, industry and services. However, very little energy savings in the transport sector have been reported to Article 7. The ECO succeeded the UK's previous EEOS (the Carbon Emissions Reduction Commitment (CERT) and Community Energy Savings Program (CESP)) in 2013. Through the LA Flex Scheme, the UK allows obligated parties to the Energy Company Obligation, an EEOS, to work with Local Authorities (LAs) (municipalities) to better target energy poverty actions and reduce the search costs associated with finding those most in need. The LA Flex Scheme allows LAs to define their own eligibility criteria, providing them with more ownership and increasing the likelihood of collaboration to address energy poverty issues. ECO also introduced an M&V system in which, instead of savings being deemed for insulation and heating system replacements, savings were calculated using the Standard Assessment Procedure (or a reduced form of SAP), which required the input of many data that affect energy performance. In 2018, the ECO moved back to deemed	18

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>savings for these types of actions in order to reduce administration costs and free up funds for investment in energy efficiency technologies. This approach is supported by a strong M&V system (guidance and enforcement). Likewise, very good evaluations are available to inform savings estimates from the current EEOS as well as across a number of other policy measures. Rebound effect is taken into account in the deemed savings used for the EEOS.</p> <p>The energy savings from the Climate Change agreements have been estimated using a methodology similar to the evaluation of taxation measures, which might raise questions. Another issue is a possible misinterpretation of ability to claim energy savings from early action in EEOS (savings should be claimed as if they had occurred in 2014 and not the years in which the actions took place). Likewise, the energy savings claimed for building codes before the revision of the EED raise an issue about their additionality. Calculation of energy savings from taxation measures use long-run elasticities from Year 1 (2014), which might also raise questions.</p>	
Key design features	<p>Objective</p> <p>Starting date</p> <p>Sectors to be obliged</p> <p>Energy carriers to be obliged</p> <p>Selection of obligated actors</p>	<p>Primary energy consumption: -20% (7797 PJ) compared to referential development. Final energy consumption: -10.5% (628 PJ) compared to average of 2010-2012. CERT and CESP: original goal: 154 Mt. (2008-2012), later adaptation. Later: national savings target: 324 TWh;</p> <p>2012- 185 MtCO₂, 3.5 TWh end energy savings; 2002-2008 Energy Efficiency Commitment (EEC): end-use energy-related savings target 1st phase: 62 TWh, 2nd phase: 130 TWh. Since 2009 to 2012 Carbon Emission Reduction Target (CERT) CO₂-related savings target of 293 Mt CO₂.</p> <p>another source: 15 % of the cumulative energy savings target should be delivered by EEOS--> 14,617 ktoe (EEOS-CERT: 9,974 ktoe, EEOS-CESP: 430 ktoe, EEOS-ECO: 4,213 ktoe); Three sub targets: CERO: 14.0 m CO₂ (cumulative lifetime) emissions CSCO: 6.8 (cumulative lifetime) emissions HHCRO: £4.2 billion lifetime savings ; ECO3 has a target of £8.253 billion in lifetime energy cost savings to be achieved by March 2022 (BEIS, 2018) (+ sub-targets for rural areas).</p> <p>EEOs in general: 1994; EEC2 :2005-2008; CERT and CESP: 2008 -2012; ECO1: 01.2013 - 03.2015 ECO2 : 04.2015 - 03.2017; EEO since 1995</p> <p>Specifically for GB: EESoP1: 1994-1998, EESoP2: 1998-2000, EESoP3: 2000-2002, EEC1: 2002-2005, EEC2: 2005-2008, CERT: 2008-2012, CESP: 2009-2021, ECO: 2013-2017</p> <p>only households/ residential For GB: EESoP 1 & 2 (1994 – 2000): Residential and SME electricity customers; EESoP 3 (2000 – 2005): Residential and SME gas and electricity customers; EEC1 – ECO (2005 – 2017): Residential electricity and gas customers</p> <p>CERT and CESP: no restriction concerning energy sources</p> <p>CERT and CESP: six big English energy suppliers and four independent energy production companies with local partners such as local authorities; Suppliers (electricity and gas) with more than 250,000 end customers supplying more than 400 GWh of electricity or more than 2,000 GWh of gas; CERT: All gas and electricity suppliers with</p>	<p>6, 17, 27, 3</p> <p>6, 12</p> <p>24, 12, 25</p> <p>6</p> <p>6, 17, 27, 12, 3</p>

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>more than 50,000 costumers each (Under the EEC Scheme, the limit was only 15,000 customers, but it was set high so as not to make it difficult for small suppliers to enter the market).</p> <p>EESoP 1 & 2 (1994 – 2000): Public electricity suppliers – the 14 companies when the electricity market in the UK was privatized in 1990.; EESoP 3 (2000 – 2002): All licensed gas and electricity suppliers with at least 50,000 domestic customers; EEC1 (2002 – 2005): All suppliers with over 15,000 gas and/or electricity domestic customers; EEC 2 (2005 – 2008): All suppliers with over 50,000 gas and/or electricity domestic customers; CERT (2008 – 31 Dec 2012): All suppliers with over 250,000 gas and/or electricity domestic customers. (In practice this is six vertically integrated companies – British Gas, EON, EDF Energy, RWE npower, SSE, and Scottish Power); CESP (1 October 2009 – 31 Dec 2012): All suppliers with over 250,000 gas and/or electricity domestic customers, plus 4 independent generators (Drax Power, Eggborough Power, GDF Suez/IPM and Intergen); ECO (1 Jan 2013 – 2017)</p>	
	Eligible measures	<p>wide range of permitted measures; The replacement of broken heating systems, the upgrade of inefficient heating systems, and the installation of insulation comprise the overwhelming majority of savings. Microgeneration measures (PV) have been allowed under the policy measure, but only where electricity is the primary heating source and generated heat is used partly or fully for space heating. Upgrades to CHP plants used for district heating are also allowed and can only be counted within Article 7(2). exemptions.</p> <p>Only measures that affect private end users are permitted. At least two thirds of the measures must be implemented in the area of thermal insulation of buildings. 40% of the measures must benefit households affected by or at risk of energy poverty (fuel poverty). In the current system, after initial admissibility of all measures, a restriction of admissibility to standardized measures was implemented starting in 2010. These measures can be carried out comparatively easily using publicly available calculation sheets (Excel).</p> <p>For GB: wide range of permitted measures for each EEO: CESP: measures for installation, heating, district heating, Behavioral, Micro-generation; CERT: measures for installation, Lighting, Heating, Appliances, Micro-generation & CHP, Behavioral, Demonstration actions; ECO: measures for Insulation, Heating, District heating, Micro-generation</p>	6, 18, 24, 12
	Role of the involved stakeholders	Limited to obligated actors; even in the absence of a certificate system, obligated utilities are allowed to transfer energy savings to each other to meet targets (but there is no further provision on this type of exchange mechanism, though exchanges must be notified to and approved by Ofgem).	24, 17
	Evolution of the indicators	<p>the original goal was changed to 293 Mt. CO₂;</p> <p>Six policy measures were added in the annual report 2019 – Re:Fit Cymru, Green Growth Wales, Warm Homes Program, Boiler Plus, Streamlined Energy and Carbon Reporting Framework (SECR) and Small Scale Renewables (FiT). The Re:Fit policy measures was no longer reported in the annual report 2020. Only electricity companies were included in the initial scheme.</p> <p>From 2006, the scheme was changed radically, with savings targets being introduced which were two to three</p>	6, 18

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		times higher than previously. The focus moved to implementation of energy savings. At this stage, the oil companies joined the scheme, and district heating companies either joined voluntarily or were required to realize energy savings under the same conditions as the companies that joined the agreement.	
	Flexibility rules	buy-out price is non-existent, bilateral, banking is possible. OFGEM has the right to take action if all CERO, CSCO and HHCRO targets are not met by the end of the commitment period (31 March 2017) (including fines). Art. 7: A capped amount of banking was allowed between the two most recent periods (in 2018). No borrowing from the current period was allowed to fulfil the previous period's targets. Buy-out not possible. ECO: Suppliers are permitted to transfer a 'qualifying action' or another excess action to another supplier, provided that Ofgem approves the transfer. There is also flexibility in carrying forward 'excess' savings made in one phase to the next phase of the scheme.	6, 18, 27, 12, 3
Assessments (savings/costs)	Setting of the baseline	88 392 ktoe/year; The baseline is defined for the individual measures and taken into account when setting the target.	18, 24, 17
	Reference of the savings target	CO2	6
	Differentiation of the savings target	CERT: 74 Mt CO2 o savings must be accomplished through insulation, 40% of measures have to be realized in low-income households. CSCO: 15% of target must be achieved by supporting measures for vulnerable low-income households in rural areas; Part of the target (CSCO) needs to be achieved in 25% lowest areas on the Index of Multiple Deprivation part of the target (HHCRO) needs to be achieved in households receiving certain welfare transfers At least two thirds of the measures must be implemented in the area of thermal insulation of buildings.	6, 27
	Level of the savings target		
	Allocation of the savings target	allocation is based on the amount of supplied households. Carbon Emissions Reduction Obligation (CERO) 20.9 MtCO2 (adjusted 14 MtCO2) long-term savings (ECO2: 12.4 MtCO2 by March 2017). Carbon Saving Communities Obligation (CSCO) Target: 6.8 MtCO2; (ECO2: 6.9 MtCO2 by March 2017). Home Heating Cost Reduction Obligation (HHCRO)/Affordable Warmth (AW) Target: £4.2 billion (ECO2: £3.7 billion by March 2017) Savings on planned space heating and hot water costs for low-income households.	6
	Crediting period	periodic accounting; long-term orientation, savings can be accredited up to 40 years and depreciated in the year of acquisition, no discounting, extra bonus for innovative measures	6
	Energy saving calculation methodologies	Bottom-Up: based on planned and already implemented programs and services in the UK, for the calculation of the energy savings 20 instruments and measures from all sectors are used. Savings are estimated over time based on the measures provided by the obligated companies. From 2018, deemed savings have been used for all insulation and heating replacement actions while, for district heating systems, energy savings are calculated using the Standard Assessment Procedure, which is also used to calculate Energy Performance Certificates and is a form of	6, 18, 12, 25

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>deemed savings, based on the measured characteristics of buildings and their heating systems In the United Kingdom, 10% of obligated parties' targets can be met through 'innovation and demonstration actions' (non-standard actions) are allowed, for which obligated parties can propose their own methodologies; a further 10% of their targets can be met through actions using modern monitoring technology (metered savings). Obligated parties receive an uplift (a higher score per unit of lifetime bill savings) for all such savings proven to be greater than that assumed through the standard deemed score.</p> <p>other methods:</p> <ul style="list-style-type: none"> • Standard Assessment Procedure (SAP) • Reduced data Standard Assessment Procedure (RdSAP) • In the case of repair or replacement of a boiler, according to a formula provided by Ofgem, the energy regulator. 	
	Determination of savings		
	Selection of the accounting period	Lifetime savings are fully credited in the year of the measure (without discounting).	24
	Differentiation of the crediting of measures	factor 1.5 for innovative measures; current ECO (ECO3): focus on energy poverty alleviation through an expanded HHCRO, with 15% of the target needing to be delivered in rural areas and 8.7% of the target needing to be delivered through solid wall insulation actions. part of the target (CSCO) needs to be achieved in 25% lowest areas on the Index of Multiple Deprivation part of the target (HHCRO) needs to be achieved in households receiving certain welfare transfers	6, 18, 16
	Admissibility of double funding	No interaction; ECO is seen as complementary to the Green Deal.	
	Avoidance of double funding	double funding is not deliberately prevented or is intentional; The United Kingdom uses different M&V regimes for different policy measures, although all policy measures are analyzed together to avoid double-counting.	31, 18
	Additionality ensured/Materiality	Additionality concerns are limited to the building regulation policy measures, for which savings are claimed over the period 2014–2018 (i.e. before the amending EED allowing it). Suppliers must demonstrate the additionality of the measures. This can be done, for example, by demonstrating that measures would not be implemented due to lack of affordability. Additionality is taken into account in a number of ways	18, 24, 12
	Overlaps with other measures	CCAs, CRC, ESOS	18
	CO ₂ emission reduction		
	Annual savings	Final energy savings per year in Household sector in the time period 2008-2012: 237 ktoe	25
	Total annual savings		

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
	Cumulative energy savings		
	Allocation of system costs	obligated parties, households; allocation to end consumers through final energy prices	6
	Cost-effectiveness	EEC2: obligated actors direct costs 1085 Mio € + indirect costs 195 Mio.€, for costumers 325 Mio.€ (own share of investments made) and subsidies 151 Mio. € CERT: an average cost to obligated parties of £13.17 per ton of CO2 saved in nominal terms (£13.79 in 2012/13 prices).The CERT evaluation does not calculate p/kWh costs of the program. The EEC 2 evaluation estimated these as 2.1 p/kWh (electricity) and 0.6 p/kWh (gas) (lifetime figures on a final energy basis, costs to obligated parties), i.e. a large factor below the marginal cost of supply. other sources: Weighted average EEO cost of lifetime energy savings for the time period 2008-2012: 1.1 cent/kWh; UK: 0.7 Eurocent / kWh	17, 25, 16
Certificates	System addressees		
	Admissibility of trade	trading is possible but not much made use of; bilateral trading between obligated parties	6, 27
	Lifetime of certificates	up to 40 years, lifetime energy savings are the basis	6
Monitoring	Length of the obligation period	EEC 1/2 4 years, CERT 5 years	17
	Compliance und Monitoring	CERT: committed actors need to send monitoring reports every three months to the Office of the Gas and Electricity Markets (Ofgem) in order to inform about the number of implemented measures. CESP: committed energy providers need to submit monitoring reports about the amount of implemented measures in the public sector every six months to the Ofgem. ECO: Ofgem approves of suppliers' calculation method, defines CO2" savings form efficiency measures, verifies that a supplier has achieved its obligations under ECO (CERO, CSCO, HHCRO), monthly reports in suppliers' progress and at the end of the commitment period etc. ECO: Suppliers are required to submit monthly totals of the number of measures installed to Ofgem. Technical monitoring is focused on the standards of installation of measures, and must be undertaken by a suitably qualified third party, independent of the supplier. Where technical monitoring shows a measure was inadequately installed, suppliers may remedy it, rather than lose credit for installing the measure. There must then be a re-inspection to show the remedial work has been successful, ideally within two months of the issue being detected. Suppliers are required to demonstrate steps taken to eliminate fraud, and their fraud protection proposals are reviewed by Ofgem on an annual basis. third source: In addition to the monthly reports energy suppliers need to hold detailed paperwork as proof of the installed measures. The paperwork does not need to be submitted to Ofgem but can be audited.	6, 12, 16
	Verification	CERT and CESP: Ofgem verifies the submitted data and calculated the generated CO2 savings; ex-ante verification with randomized ex-post control. introduced an M&V system in 2013 which calculated the energy savings for	6, 18, 3

Characteristics of the EEOS	Details	Implication period 2014-2020	Sources
		<p>their Energy Company Obligation (ECO), a scheme that succeeded UK's previous buildings using the Standard Assessment Procedure (of a reduced form of SAP, instead of energy savings being deemed for insulation and heating system replacements). In 2018, the ECO moved back to deemed savings for these types of actions to reduce administration costs and free up funds for investment in energy efficiency technologies.</p> <p>Technical monitoring verifies if the measure has been installed correctly. A scoring monitoring ensures the correct deemed score has been used. And audits of OPs are done to ensure that OPs have followed the managing authority guidelines.</p>	
	Penalties	<p>Where obligated parties have failed to meet their obligations, Ofgem has the ability to take enforcement action, including imposing financial penalties and making consumer redress orders. Ofgem will consider fines on a case by case basis but can fine licensees up to 10% of their global turnover. Ofgem can take similar action against obligated parties for non-compliance against any relevant requirements of the legislation, for example where statutory quality and standards requirements are not achieved, or where carbon/cost savings scores are inaccurate. Second source: penalties can be as high as 10% of global turnover. Second source: In the event of a failure to deliver the obligation, suppliers face investigation and penalties from the scheme regulator. The maximum penalty for breach of a license condition is 5% of company turnover.</p>	18, 27, 12
	Rulebook for M&V	M&V system in place	16
District heating/ Heat pump	District heating	<p>CSCO focuses on providing insulation measures and connection to district heating networks for residential customers living in a low-income area (15% of the target must be achieved by promoting measures for low-income households in need in rural areas).</p> <p>From 2018, deemed savings have been used for all insulation and heating replacement actions while, for district heating systems, energy savings are calculated using the Standard Assessment Procedure, which is also used to calculate Energy Performance Certificates and is a form of deemed savings, based on the measured characteristics of buildings and their heating systems. The replacement of broken heating systems, the upgrade of inefficient heating systems, and the installation of insulation comprise the overwhelming majority of savings. Microgeneration measures (PV) have been allowed under the policy measure, but only where electricity is the primary heating source and generated heat is used partly or fully for space heating. Upgrades to CHP plants used for district heating are also allowed and can only be counted within Article 7(2) exemptions.</p> <p>For GB: For CESP Insulation measures delivered 57% of all carbon savings, followed by heating measures 21% and district heating (16%) with nearly all of the remainder from micro-generation; Allowable measures under ECO: Connection to a district heating scheme, upgrade of a district heating scheme, district heating meter for individual home billing</p>	31, 18, 12
	Heat pumps		

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