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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

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Preface

Directive 2012/27/EU, are the Energy Efficiency Directive EED, requires each Member States to apply an energy efficiency obligation scheme (EEOs) or alternative policy measures that would deliver a certain amount of end-use energy savings over the 2014-2020 obligation period. The ENSPOL project's main aim is to support member states who intend to set up new EEO schemes. Starting from experiences of existing obligation schemes is one corner stone to reach this objective. Therefore, this deliverable describes and analyses the existing EEO schemes in the European Union: Flanders (Belgium), France, United Kingdom, Denmark, Poland and Italy. Based on the results and the lessons learned, member states opting for EEOs can further improve the design of their new EEO in order to be more effective in reaching the energy efficiency objectives.

Table of Contents

Figures

Tables

1 Summary

1.1 Design and results of existing EEOs

This deliverable describes and analyses the existing EEOs within the European Union; i.e. those of Belgium (Flanders)[1], Denmark, France, Italy, Poland and the United Kingdom. Some of these EEOs are already well documented in the peer reviewed literature and in national evaluation reports; some others not, such as the scheme of Flanders and Poland. This task starts from the existing literature, updates it and completes it based on stakeholder consultation in order to present an actual snapshot of the existing EEOs.

The next table summarizes important characteristics of the current schemes. In the following chapters, the schemes are described in detail for each country individually. The results of the schemes, like the realized savings, the cost effectiveness are also discussed in these country chapters.

[1] The Flemish EEO scheme ended in 2012: the energy savings targets for electricity distributors were eliminated and replaced by action obligations.

	UK (since 1995)	France (since 2006)	Italy (since 2005)	Poland (since 2005)	Flanders (2003-2012)	Denmark (since 1990)
Design EEO						
Target setting	Mt CO_2 savings over lifetime Heat cost reduction for vulnerable households	kWh "Cumac" final energy savings over lifetime taking an in-use factor (4%) into account	2005-2013: Mtoe yearly , primary energy savings Since 2013: million of white certificates, incl. lifetime	TWh yearly, final energy savings	First-year, primary energy savings	First year, final energy savings
Type of measures	Mainly subsidies	Energy Saving Certificates; incentives to consumers as low interest loans or primes	White Certificates	Energy Efficiency Certificates	Financial support (premiums) and information campaigns	Mainly advice and subsidies
Scope sector	Households	All final consumers, but mainly households.	All final consumers, except electricity generation. Mainly industry.	Households, commercial and industry	All final consumers, but mainly households	All final consumers, , but mainly industry and households
Obligated parties	Gas and Electricity suppliers	Suppliers of gas, electricity, LPG, heating oil and district heating/cooling. Also wholesalers of autogas	Electricity and natural gas distributors	Energy companies selling gas, electricity and heat	Electricity distributors	Grid and distribution companies for electricity, gas, district heating and oil

		and gasoline/diesel				
Administrator	Ofgem, regulatory body electricity and gas market	DGEC (Directorate General for Energy and Climate) and PNCEE (National Authority for Energy Saving Certificates)	GSE operating WhC scheme, GME providing WhC market platform	MoE (Ministry Economy): general supervision, ERO (Energy Regulation Office): operational role	VEA (Flemish Energy Agency)	Technical Working Group
Flexibility	Transfer between suppliers or between scheme phases	Fungibility; eligible parties; trading; bankability between periods; transfer between parties	Trading, bankability	Trading, substitution fees	Transfer between years	Transfer between years and between parties
Results EEO	See detailed description per member state					

1.2 Lessons learned and what can be improved

Based on the detailed information described for each obligation scheme, we can summarize some strong characteristics and areas for improvement of obligation schemes in general.

First of all, the EEO have delivered in general very substantial improvements in energy efficiency within the member states. They have demonstrably been a factor in a large fraction of the energy efficiency improvement achieved. Placing obligations on energy suppliers in a competitive market has been successful in that targets have, with rare exceptions, been delivered. In addition, EEOs have developed incrementally and grown steadily in scale, resulting in growing targets over the years (higher savings realized). Many of the existing schemes started with low targets, but were increased over time, allowing a "learning" period for subject under the obligation. In the UK and Denmark, EEOs have been in place for around 20 years, and became an important component of the national policy mix.

Overall, the majority of savings have come from relatively low cost energy measures in the buildings sector. This has meant that the EEOs have delivered very cost effective savings, which have reached large numbers of householders and organisations. The approach has been different in Denmark and Italy, where most savings have come from the industrial sector. This illustrates the flexibility of EEO as a policy instrument, and its adaptability to national circumstances and policy priorities. The challenge for EEOs is adapting to continue to deliver savings, as the low-cost mass market technological savings opportunities reduce. It is difficult, for example, to see how EEOs could support deep and complex refurbishment. Can they support technical innovation or behavioural change, or are EEOs unsuited to this?

One option is to move focus from the buildings sector, and look to delivering savings from industry and transport. Denmark and Italy have realized strong savings in the industrial sectors, France is one of the few that obliges suppliers of automotive fuel to achieve energy savings. Including them in the scope of the EEO, allows targeting a much more ambitious objective, while increasing the competition between obligated parties and the diversity of offers and business models developed to reach final consumers.

A financial support system by means of premiums, closely linked to extensive information and awareness raising campaigns is an effective way to save energy as well as to sensibilize many (non)-households. It also raises the awareness of Energy Efficiency. In some countries, the EEO scheme is still quite unknown or misunderstood by end users (eg. Denmark and France). It is then key to improve the communication around the scheme

towards all its potential beneficiaries. Public campaigns and giving advice do not necessarily trigger direct energy savings but are a prerequisite to increase the awareness and understanding of energy efficiency. Moreover, having a strong focus on low income groups enables all income groups to benefit (eg. UK, Flanders). On the other hand, the element that obligated parties can fully recover their costs (tariff reimbursement) has been crucial in order to remove economic risk from the obligated parties.

An effective scheme needs to achieve a balance between rules and procedures that are simple enough for obliged parties to work with, while being complex enough to meet requirements for additionality, flexibility, auditability and transparency. Having a catalogue of standardized actions listing best practices in terms of energy efficiency measures and deemed savings that can be expected from these measures can be very effective. These deemed saving projects can be fundamental during the first years of the scheme. Besides simple rules, it is important to work with a continuous improvement approach (re-design) and to monitor the evolution of the scheme and of the market. Increasing the transparency (eg. calculation methods, detailed results per sector), besides a proper evaluation of the scheme (cost effectiveness) can result in a higher effectiveness of the scheme. So far, no quantitative ex-post evaluation was run on most of the schemes, like in Flanders and France.

Member States which are later adopters of EEO schemes can benefit from other countries' experience. Before designing its own EEO, Poland studied the schemes in Italy, France and Denmark. However, learning from experience does not necessarily ensure that the EEO will be problem-free. In Poland's case, there has been a negative reaction to the EEO scheme introduced in 2012, and it is currently being extensively re-designed. So this illustrates that schemes also have to reflect national peculiarities. No two EEOs are the same. They differ in many respects, including the number and type of obliged parties (distributors or retailers; type of energy supplied: electricity, gas, heating oil, district heating, transport fuel), eligible sectors, eligible projects, monitoring, the fund raising mechanism, and the metrics used for target setting.

2 Methodology

The already existing Obligation schemes are described and analysed for different topics, which we can cluster in three main themes:

- Policy objectives
- Design of the EEO to realize these objectives
- Results of the EEO so far

In this Methodology chapter, we explain the different topics that are discussed for each of the existing Obligation schemes. This methodology starts from "Best Practices in Designing and Implementing Energy Efficiency Obligation Schemes, IEA, 2012 (Task XXII)". To describe these topics, the ENSPOL partners started from their own expertise within the EEO domain, completed it with a literature study and national stakeholder consultation.

Policy objectives of EEO

Determining and stating the policy objectives is an important stage in designing an EEO scheme because these objectives define what the obligation is intended to achieve and will significantly affect all the other parameters of the scheme. There is a range of policy objectives that can be achieved through establishing an EEO scheme, for example:

- to acquire cost-effective energy efficiency as an energy resource
- to reduce primary and/or final energy consumption
- to reduce CO_2-emissions
- to assist low-income households with their energy bills
- to stimulate the development of an energy services industry (eg. ESCOs);
- …

The chosen policy objectives will strongly influence how the EEO scheme is designed and implemented.

Design of EEO

Type of measures

Obligation schemes differ strongly between countries, not only in scope, but also in the way they are implemented. Some countries prefer the prevalence of the market forces and introduce a trading system between the involved parties to reach the energy efficiency objectives (eg. white certificate system). Other countries promote energy efficiency by means of financial incentives (eg. subsidies, lower interest rates, tax reduction) or by providing information on energy saving opportunities (Source: IEA, 2012).

Scope - sector related and technology related

Although the objectives can be the same in different countries, the range of targeted sectors as well as the supported technologies can differ strongly between the member states. Moreover, the EEO schemes vary in how they determine the energy efficiency measures that will be eligible to produce energy savings that contribute to the energy saving target. These differences are also important to understand the actual implementation of an EEO (Source: IEA, 2012). The targeted sectors (eg. households, industry, transport) as well as the type of technologies (eg. insulation, energy audits, priority for deep renovation) in the existing EEO schemes are listed in this report.

Obligated parties

In EEO schemes, obligated parties are the entities that are required to meet the scheme target. Most often these are the providers of the fuels covered by the scheme. It is necessary to decide which type of energy provider will be obligated. This decision should be based on whether a particular type of provider has relationships with end-users, has the infrastructure and systems necessary to manage the delivery and/or procurement of eligible energy savings etc. Obligated energy providers may include: energy retailers and/or transmission and distribution system operators, road transport or heating fuel suppliers and energy utilities (Source: IEA, 2012).

All countries set a lower limit of energy sales, below which companies do not have obligations. This is to ease the administrative burden on small companies and to remove barriers to new market entrants. This lower level varies considerably between countries. The number of obligated parties varies from less than 10 (UK) up to thousands (e.g. Denmark).

Target setting

Setting the energy saving target is an important stage in designing an EEO. The target defines the path to achieving long-term energy saving goals. There are several decisions to be made when setting the energy saving target. The first decision involves setting the actual level of the target. The level is set in the light of the overall policy objectives for the EEO scheme. The second decision requires determining whether the target will be set in terms of primary energy or final energy. Although final energy relates most closely to the energy quantities familiar to end-users and energy providers, targets set in primary energy may be preferable for EEO schemes that cover a range of fuels with different conversion factors from primary to final energy. The third decision entails choosing the units that will be used for denominating the target, for example, energy savings in megawatt-hours (MWh), megajoules (MJ), or tonnes of oil equivalent (toe), or GHG emission reductions in tonnes of carbon dioxide equivalent (tCO_2_e). The fourth decision involves determining the timeframe over which the target will be in place (Source: IEA, 2012).

The actual targets of the different existing schemes are described in this report, including their evolution over time.

Calculation method savings

EEO schemes vary in how they determine the expected savings from eligible measures that contribute to the scheme energy saving target. EEO schemes can establish a list of preapproved energy efficiency measures. Frequently each of these measures is assigned a deemed, ex-ante energy saving value that can be claimed each time the measure is implemented. Deemed values are usually assigned to simple energy efficiency measures and are calculated from estimates of the energy saving typically achieved by the measure. Deemed energy savings values can range from simple engineering estimates to (usually lower) values which reflect empirical evidence of in situ savings. Schemes may also establish procedures for calculating the energy savings from measures not on the approved list, or for calculating, on a case-by-case basis, the energy savings from complex energy efficiency projects that employ a range of energy efficiency measures (Source: IEA, 2012).

It is also important to set the time period over which eligible energy savings from energy efficiency measures will be calculated. The two major options are first-year savings or savings over the lifetime of the measure. If lifetime savings are used, then the lifetime of measures is also 'deemed', based on empirical evidence. These lifetimes are not necessarily the same in different countries (Source: IEA, 2012).

In this section, the estimation methods of the expected savings are described in detail for each Obligation scheme.

Additionality

EEO schemes can require that eligible energy savings must be additional (i.e., energy savings that would not otherwise have occurred). In the member states, different types of additionality are taken into account (Source: IEA, 2012):

- Energy savings additionality, in which energy consumption is actually reduced compared with the situation before the energy efficiency project was implemented;
- Policy additionality, in which the energy savings are in excess of any other policy, regulatory, or legal requirements to reduce energy consumption;
- Business as usual additionality, in which the energy efficiency project is in excess of what could reasonably be expected to occur in the relevant sector(s) (= business as usual or baseline situation); and
- Financial additionality, where the energy efficiency project would not have taken place if revenue from the sale of energy savings were not available.

EEO schemes vary in how they actually determine whether particular energy savings are additional or take this into account in the ex-ante savings.

Verification & Monitoring

EEO schemes rely on the establishment of robust systems for monitoring, verifying, and reporting the energy savings to guarantee a proper and effective implementation of the measures. Claimed energy savings may be verified by carrying out audits on energy efficiency projects. The results from monitoring and verification processes can also be used to (Source: IEA, 2012):

- track progress towards long-term goals;
- monitor cost effectiveness;
- inform the calculation and revision of deemed energy savings values; or
- identify problems requiring programme changes or additional regulatory action.

The verification and monitoring process and its involved parties are described in detail for the existing EEO schemes.

Control and Compliance

An EEO scheme requires a compliance regime to determine whether obligated energy providers have met their individual scheme targets and to apply sanctions eg. financial, if they fail to do so. The procedure of control and compliance is described in this section.

Administrator - Institutional set up

Key ongoing functions involved in the administration of an EEO scheme include (Source: IEA, 2012):

- approving eligible energy efficiency measures and (where required) assigning them deemed energy saving values;
- accrediting parties that produce eligible energy savings through implementing energy efficiency projects;
- conducting measurement and verification of actual energy savings, including auditing the results of energy efficiency projects;
- enforcing compliance with the obligation, including reviewing the performance of obligated parties against their targets and administering any penalties;
- making and operating a trading market for energy

In this section the responsible administration and the institutional set up ('what are the responsibilities of the involved parties?') are described in detail.

Flexibility

The set-up of an EEO scheme can include different flexibility mechanisms for the obligated parties to comply with their energy savings targets, like (Source: IEA, 2012):

- Obligated parties can transfer an over- or under coverage of the savings targets between years
- Some EEO schemes allow trading of energy savings among obligated parties, and between obligated parties and accredited third parties (eg. ESCOs). The purpose of trading is to broaden the pool of opportunities to produce eligible energy savings and to enable market forces to identify the most cost-effective opportunities.

Results of EEO

The results or outcome – so far – of the existing schemes can be evaluated by different parameters. These parameters are listed below and described in detail for each Energy Efficiency Obligation scheme in this report. We want to stress that the EEO documentation of (publicly available) results is varying strongly between countries – some countries have a strong history of ex-post analysis in contrast to other countries; some type of information (eg. costs made by the obligated parties) is considered as confidential.

Total costs of the EEO

Description of the costs linked to the administrator and policy overhead; costs linked to the obligated parties and other actors.

Total expenditures

If available, description of investment costs linked to the end users; society (in comparison to a baseline) resulting from the EEO scheme.

Total savings

Realized savings compared to targets (per sector or technology); Compliance of obligated parties to targets

Cost effectiveness

Total costs and, if available, total expenditures per unity of realized savings. This parameter is difficult to compare between schemes, for example some schemes consider lifetime energy savings versus first year savings; primary versus final energy savings versus CO_2 reduction.

Other stakeholders

Other important stakeholders (i.e. not administrator or obligated parties) having an impact on the implementation and (re)design of the scheme (eg. ESCOs, industry associations). The roles of these parties are described.

Adaptation of EEO

EEOs are often redesigned during life showing the flexibility to adapt to changing markets and perceptions. Those changes are interesting points to understand, because they make

clear what's triggering an effective, implemented EEO. Countries planning to implement an EEO, induced by Article 7 of the Energy Efficiency Directive, can learn from these aspects. In this report, following aspects are described:

- Frequency of redesign describing the history of the scheme
- Reasons of redesign to help to understand important enables and barriers of an effective EEO scheme
- Manageability of the scheme reflecting how schemes can be redesigned (eg. introduction of weighting factors to correct lifetime)

Social equity

Social Equity focuses on issues of fairness, justice, and equity in a variety of public contexts. In the context of Obligation Schemes, equity of the scheme is evaluated by describing the financial contributors to the scheme; the (financial) beneficiaries besides the impact of the EEO on the energy prices or tariffs over time. Special attention is paid to fuel poverty in this report.

Lessons learned and what can be improved?

The final paragraphs of the evaluation indicate strong characteristics as well as areas for improvement for each existing scheme. These lessons learned contain valuable information for member states planning to implement a new scheme and are therefore the starting point of our overall Summary in this report.

3 United Kingdom

Great Britain (England, Scotland and Wales) has had an EEO since 1994 (England and Wales) and 1995 (Scotland). There is also an EEO in place in Northern Ireland – the Northern Ireland Sustainable Energy Programme, which focusses very largely on fuel poverty objectives. This document refers to GB rather than the whole UK. The GB objectives, measures, savings, costs and mechanisms have varied over time. Where possible we will provide brief details for each phase of the EEO, but with most focus on the current (ECO) and predecessor (CERT & CESP) designs.

Table 1: GB EEO schemes and a summary of their characteristics, 1994 - 2005

Name of scheme	Energy Efficiency Standards of Performance 1	Energy Efficiency Standards of Performance 2	Energy Efficiency Standards of Performance 3	Energy Efficiency Commitment 1
Abbreviation	EESoP 1	EESoP 2	EESoP 3	EEC 1
Period*	1994 – 1998	1998 – 2000	2000 – 2002	2002 - 2005
Coverage	Domestic electricity customers & businesses with a demand up to 100 kW	Domestic and SME electricity customers	Domestic and SME gas & electricity customers	Domestic gas & electricity customers
Implicit annual target	1.5 TWh (lifetime)	1.4 TWh (lifetime)	5.5 TWh (lifetime)	21 TWh (lifetime)
Annual expenditure	£25 million €31 million	£24 million €30 million	£55 million €69 million	£167 million €209 million

** Period of schemes from 1 April in start year to 31 March in end year, except for CERT, CESP and ECO (see subsequent sections).*

Table 2: GB EEO schemes and a summary of their characteristics, 2005 to present

Name of scheme	Energy Efficiency Commitment 2	Carbon Emissions Reduction Target	Community Energy Savings Programme	Energy Company Obligation
Abbreviation	EEC 2	CERT	CESP	ECO
Period	2005-2008	2008 – 2012	2009-2012	2013-2017
Coverage	Domestic electricity & gas customers	Domestic electricity & gas customers	Domestic electricity & gas customers	Domestic electricity & gas customers
Implicit annual target	43 TWh (lifetime)	Approx. 104 TWh (lifetime)	Approx. 15 TWh (lifetime)	Approx. 30 TWh (lifetime) (prior to redesign in 2014)
Annual expenditure	£400 million €500 million	£911 million* €1139 million	£234million* €292 million	Figures not yet available

*From: (Rosenow, 2012), and (Rosenow et al., 2013) except * from Ipsos et al 2014*

Currency conversion: In this document, where Euro figures are given, they are based on an exchange rate of 1£ = 1.25€.

Savings metrics: A key feature of the GB schemes is that the savings metrics, whether energy or carbon, have always been based on **lifetime** savings. Lifetime savings are cumulative carbon or energy savings over the agreed lifetime of a measure. All figures are presented as lifetime savings, and for energy as final energy (i.e. delivered rather than primary energy).

3.1 Policy objectives of EEO

The basic concept of the EEO is that the government imposes an energy savings target on the energy companies (in this case, large suppliers of gas and electricity to households in GB) that has to be achieved at the customer end, which may relate to energy consumption or

carbon emissions. The target is set in relation to a baseline and does not require a reduction of final energy use or actual carbon emissions. Rather, it is defined as the savings (in this case the lifetime savings) achieved by the measures, promoted via the obligation. The detailed policy objectives have changed between phases of the EEO, those of the most recent and current scheme designs are described below.

CERT and CESP (2008/9 – 2012)

The policy objectives of CERT were to:

- Reduce household carbon emissions by overcoming barriers to uptake of cost-effective energy efficiency measures, across all households in Great Britain;
- Promote the delivery of micro-generation and other measures for reducing the consumption of supplied energy (see Table 5 for examples of eligible, non-energy efficiency measures);
- Introduce new approaches for innovation and flexibility;
- Keep costs at a reasonable level (and thereby minimise the cost passed through to consumers);
- Maximise cost-effective carbon savings;
- Maintain equity and contribute to the delivery of statutory fuel poverty objectives; by ensuring that low-income households benefit; and
- Collect and report on numbers of measures delivered.

In addition to the objectives set out for CERT, CESP aimed to:

- Reduce the fuel bills of low income households across Great Britain;
- Pilot new approaches to delivering energy efficiency measures, including: area based street-by-street approach to delivery; partnerships; tackling hard to treat homes; whole house retrofits involving major measures; and targeting disadvantaged areas.

(Ipsos MORI et al., 2014b) - Box A1 and A2

CESP was designed to incentivise solid wall insulation (SWI) for hard to treat homes, to complement CERT and to build the supply chain for solid wall insulation.

Both programmes aimed to help vulnerable households or low income households. Under CERT, the ‘priority group’ (PG) and ‘super priority group’ (SPG) sub-groups, were used as a

proxy for vulnerable customers and under CESP, 'low income households' were targeted by focusing the programme on areas with high concentration of low income households. (Ipsos MORI et al., 2014b) p 16. The PG and SPG are defined with respect to specific welfare benefits. Energy companies reported that targeting SPG households was difficult, and they developed ways of finding these households by, for example, working with social housing providers (where these households tend to be concentrated), and with the central government Department for Work and Pensions (Ofgem E-Serve, 2013a).

ECO (2013 – 2017)

Original design of ECO

ECO was designed to be different from all previous EEOs, where carbon goals could be achieved across all households.

This policy was specifically designed to work with the 'Green Deal', a loan scheme, which was expected to establish a new market for energy efficiency measures from 2012. Green Deal aimed to place the emphasis for paying for energy efficiency measures with the beneficiary, with loan charges paid via electricity bills. In order to ensure that customers would have lower bills for the same energy services, packages of measures allowed under the Green Deal must satisfy a 'Golden Rule' that projected energy saving benefits exceed the loan charges. ECO was also designed, in part, to take account of the ending of the Government funded energy efficiency programme designed to reduce fuel poverty, Warm Front, in 2011.

ECO was designed to be roughly the same financial size as CERT (£1.3bn /€1.6bnpa), operate on a similar basis and share some features of the scheme it replaces, but with a much lower carbon saving target (Table 2).

It has two main objectives:

1. to support insulation measures in any household that are too expensive to meet the 'Golden Rule', such as solid wall insulation, and
2. to provide support for a wider range of measures to vulnerable customers, largely people on benefits who would be expected to be unable to take on Green Deal Finance. (DECC, 2011)

Other policy objectives, are:

- Alleviating fuel poverty

- Reducing carbon emissions
- Supporting the growth of the solid wall insulation industry
- Delivering on an area-basis (for example offering discounted or free insulation measures to all households in particular geographic communities)
- Delivering to rural communities

The objective of ECO to tackle fuel poverty marks a major shift from previous supplier obligations that have focused primarily on reducing carbon emissions.

ECO has three separate strands, each of which meets different policy objectives.

Carbon Emissions Reduction Obligation (CERO)
CERO focuses on hard-to-treat homes and measures that cannot be fully funded through the Green Deal. Solid wall insulation and hard-to-treat cavity wall insulation are the primary areas for focus under this target.

Community Obligation (CSCO)
CSCO focuses on the provision of insulation measures and connections to domestic district heating systems supplying areas of low income. This target has a sub-target, which states that at least 15 per cent of each supplier's Carbon Saving Community Obligation must be achieved by promoting measures to low income and vulnerable households living in rural areas.

Home Heating Cost Reduction Obligation (HHCRO)
Energy suppliers are required to provide measures which improve the ability of low income and vulnerable households (the 'Affordable Warmth Group') to heat their homes. This includes actions that result in heating savings, such as the replacement or repair of a boiler for example.

Revisions to ECO design

Following the very low take-up of the Green Deal and substantial lobbying about the costs of ECO delivery, ECO has been re-designed to "ensure it is easier and cheaper to deliver, and to reduce the 2015 CERO obligation by 33 per cent" and extended to 2017 (DECC, 2014a). For details of the changes see Section 3.3.2.

3.2 Design of EEO

3.2.1 Type of measures

During all phases of the EEO, the vast majority of qualifying measures have been technologies. The list of allowable technologies has varied over time. For example, from 2011 CFLs were no longer included in the EEO because the government judged that this market had already been transformed, and the energy suppliers had given away more than 300 million CFLs in previous EEO phases. For details of measures allowed in CERT, CESP and ECO see Section 3.2.2.

3.2.2 Scope - sector related

Table 3: Scope of GB EEOs

Scheme	Sectors
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

3.2.3 Scope - technology related

CERT and CESP (2008/9 – 2012)

There is quite a long list of technologies which were applicable under the CERT and CESP schemes (Table 4 and Table 5). However, in reality the majority of savings were delivered by a small number of technologies.

Table 4: CESP list of measures

Type of measure	Allowable measures
Insulation	Loft insulation, cavity wall insulation, solid wall insulation, draught proofing, double glazing, flat-roof insulation, under-floor insulation
Heating	Replacement boiler, heating controls, fuel switching
District heating	Connection to a district heating scheme, upgrade of a district heating scheme, district heating meter for individual home billing
Behavioural	Home energy advice package
Micro-generation	Heat pump, biomass boiler, solar hot water, wind turbine, micro-hydro, other micro-generation (heat / electricity), micro-CHP

Table 5: CERT list of measures

Type of measure	Allowable measures
Insulation	Loft insulation, cavity wall insulation, solid wall insulation, draught proofing, double glazing, flat-roof insulation, under-floor insulation, hot water tank insulation
Heating	Replacement boiler, heating controls, fuel switching, shower regulators
Lighting	CFLs, energy efficient halogens, luminaires, LEDs (all except LEDs disallowed after April 2011)
Appliances	cold appliances rated A+ or A++ (excluding chest freezers, for which A-rated appliances are permitted), energy efficient TVs, standby savers and energy efficient kettles
Micro-generation & CHP	small scale biomass boilers, wind turbines, heat pumps, solar photovoltaic, small hydro, solar water heating, large and small scale

	Combined Heat and Power and other micro-generation
Behavioural	Home energy advice package, real time displays
Demonstration actions	trials for measures to which a quantified carbon saving could not be attributed, but which were reasonably expected to lead to a carbon saving.

Based on (Ofgem E-Serve, 2013a)

For CESP the number of different types of measures was influenced by the detailed scheme rules, which incentivised the installation of some measures, and limited the use of others. Two key measures in CERT, cavity wall insulation and loft insulation, were disincentivised in 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[2]. The amount saved via behavioural measures was close to zero, with very few home energy advice packages delivered By far the most important measure was external solid wall insulation, which delivered 49% of all savings (Ofgem E-Serve, 2013b).

For CERT, the percentage of carbon savings achieved by different types of measure, across all the years of the programme were: 66% from insulation, 17% from lighting, 8% from heating, 6% from appliances, 1.5% from behavioural programmes, 0.85 from micro-generation and CHP, and 0.1% from demonstration actions. The contribution of insulation was enhanced by the 'insulation obligation' part of the target, introduced in 2010. Total numbers over the period of some of the key technologies installed are: 2.6m cavity wall insulation; 50,000 solid wall insulation; 3.9m professional loft insulation; 304m CFLs; 1.5m heating controls; 4.4m energy efficient cold and wet appliances (Ofgem E-Serve, 2013a).

[2] Note that different percentages are given in Ipsos et al 2014 – which says its figures are from the same source. Their percentages are: insulation 71.5%, heating 22.6%, district heating 4%, micro-generation 2.9%.

Almost one in five (19%) of all domestic properties in Great Britain received a CERT measure over the course of the programme (Ipsos MORI et al., 2014b).

ECO (2013 – 2017)

Table 6 summarises the measures which are allowed under each strand of ECO.

Table 6: Summary of allowable measures under ECO

Type of measure	Allowable measures	CERO	CSCO	HHCRO
Insulation	Loft insulation, cavity wall insulation, solid wall insulation, draught proofing, double glazing, flat-roof insulation, under-floor insulation, hot water cylinder insulation, insulation of primary pipework	✔	✔	✔
Heating	Boiler replacement / repair, electric storage heaters & warm air systems , heating controls			✔
District heating	Connection to a district heating scheme, upgrade of a district heating scheme, district heating meter for individual home billing	✔	✔	✔
Micro-generation	Heat pump, biomass boiler, solar hot water, wind turbine, micro-hydro, other micro-generation (heat / electricity), micro-CHP			✔

Based on (Ofgem E-Serve, 2014) Table 4.24

The Carbon Emissions Reduction Obligation (CERO) originally focussed on the insulation of solid and hard-to-treat cavity walls. However, as a result of changes to ECO from April 2014 onwards, lower cost insulation measures, such as loft and cavity wall, are also included (see Section 3.4.2 for further details).

CSCO focuses on the installation of carbon saving measures within an area of low income or rural area. 15% of a supplier's total CSCO must be achieved by promoting carbon saving community qualifying actions to members of the Affordable Warmth Group living in a rural area. This percentage is being changed to 25% (see Section 3.4.2).

Under HHCRO, suppliers must deliver measures which result in cost savings and improve the ability of a householder to affordably heat their home. HHCRO focuses on low income and vulnerable householders, living in private housing (generally), where residents are in receipt of specific benefits and meet other related conditions (the 'Affordable Warmth Group').

3.2.4 Obligated parties

Table 7: Obligated parties in different phases of GB EEO

Scheme	Sectors
EESoP 1 & 2 (1994 – 2000)	Public electricity suppliers – the 14 companies when the electricity market in the UK was privatised 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)	Licensed gas and electricity suppliers that, in any relevant year, have 250,000 domestic customers or more, and supply more than 400 gigawatt hours of electricity or 2,000 gigawatt hours of gas. (In practice, the six obligated companies as per CERT, and one new entrant, First Utility).

Remark: Years begin 1 April and finish 31 March unless otherwise stated. Only the larger suppliers are included within the GB schemes, with the qualification for entry generally rising over time. The argument for this is that the obligation is an administrative burden on

suppliers, and applying it to smaller firms (prospective new entrants) would create too much of a barrier to market entry.

3.2.5 Target setting

ECO

For ECO obligated suppliers are allocated a proportion of the overall targets, depending on each supplier's relative share of the domestic gas and electricity market.

Table 8: ECO targets (as revised in 2014) – all figures are lifetime savings

ECO Component	1 Jan 2013 – 31 March 2015	1 April 2015 – 31 March 2017
CERO	14.0 $MtCO_2$	12.4 $MtCO_2$
CSCO	6.8 $MtCO_2$	6.0 $MtCO_2$
HHCRO aka Affordable Warmth	£4.2 billion savings €5.3 billion	£3.7 billion savings €4.6 billion

From (DECC, 2014f)

The actual amount of carbon savings that the obligated suppliers have to deliver to 31 March 2015 under CERO and CSCO is less than the targets that will be introduced in legislation. This is due to the impact of the carry-forward of excess actions from CERT/CESP (4.1MtCO2 excess actions in total are assumed to be carried forward to CSCO and CERO 31 March 2015 targets) and the early action weighting mechanism (estimated to reduce the 31 March 2015 CERO target requirement by 2.26MtCO (DECC, 2014f).

3.2.6 Calculation method savings

ECO

For each measure that a supplier notifies, it must provide the cost or carbon saving associated with that measure. A supplier must calculate the cost or carbon saving, using one of the following methodologies:

- 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.

The suppliers must also take account of In-Use Factors (IUF) and lifetime of measures – standard figures for which are supplied by Ofgem. An In-use Factor is the percentage by which theoretical savings (calculated under SAP or RdSAP) should be reduced, in order to reflect actual in situ performance. The difference between theoretical and actual performance can be due to technology under-performance, poor quality installation, poor quality controls, changing energy use practices by residents (aka 'comfort taking' or 'rebound effect') or a combination of these. These factors vary between 10% for district heating connections to 35% for cavity wall insulation. All standard energy efficiency measures have an In-use Factor, which has been developed based on data and research, and which is subject to periodic review. Lifetimes are similarly based on analysis, and range from 10 years for draught-proofing and hot water cylinder insulation to 42 years for loft and cavity wall insulation. Using standard lifetimes is an essential component of the GB system which sets targets in terms of lifetime carbon savings. Thus all savings are ex-ante estimates, but these estimates are based on analysis of empirical data.

Where SAP or RdSAP do not include data on particular measures, the supplier needs to submit proposed savings figures to Ofgem. (Ofgem E-Serve, 2014)

3.2.7 Additionality

Additionality is taken into account in a number of ways

- At the measure level, measures have only been allowed if the technology has an expected energy efficiency performance exceeding the minimum required by law and the average efficiency in the market. For example, B-rated boilers were disallowed at the point they were made mandatory in the UK in 2005. In ECO, with the exception of the HHCRO part of the obligation (whose aim is to help reduce heating costs), all measures are either insulation or connection to a district heating scheme (Table 6). Because there is no obligation on householders to either improve the insulation of their building fabric or connect to district heating, this aspect of additionality is no longer of concern.
- At the building fabric measure level, measures are not usually included in the list of eligible measures, where there would be very high levels of deadweight, e.g. double glazing.

- At the measure level, savings are discounted by an 'in use factor' based on the savings observed in monitored installations compared to those from engineering calculations.
- At the programme level, the expected savings of the policy as a whole are reduced to take into account a modelled counterfactual, i.e the number of installations expected without the EEO.

3.2.8 Verification & Monitoring

ECO

The text in this section is based on Chapter 13, (Ofgem E-Serve, 2014)

Suppliers are required to submit monthly totals of the number of measures installed to Ofgem. Ofgem attributes savings to completed qualifying actions on the basis of this information. They have a system of checks to confirm that the information provided by suppliers is reliable. This system includes audits and technical monitoring. They conduct audits of a sample of notified measures. An audit may look at any or all aspects of the promotion of the measure. Suppliers are required to conduct technical monitoring of a sample of notified measures to ensure that they are installed in the right location to the right standard. Technical monitoring does not include measuring energy use (which would be impractical as a spot check)

Measure installers must be certified as meeting standards set out in PAS 2030:2012 – a Publicly Available Specification for the installation of energy efficiency in existing buildings.

Technical monitoring is focussed on the standards of installation of measures, and must be undertaken by a suitably qualified third party, independent of the supplier. Suppliers are required to undertake technical monitoring of 5% of all installations under ECO. This level of monitoring is required for the first three quarters of ECO, beginning 1 July 2013. Subsequent monitoring rates are set with reference to the standard achieved in these quarters, with the possibility of moving to a 1% sample, if failures of less than 5% are found in the initial quarters. Unaltered technical monitoring reports must be submitted to Ofgem on a quarterly basis.

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.

There is a dedicated Fraud Prevention and Audit team assigned to the ECO programme. Suppliers are required to demonstrate steps taken to eliminate fraud, and their fraud protection proposals are reviewed by Ofgem on an annual basis. There was some experience under CERT of unscrupulous operators making false claims with regard to loft insulation, and a high standard of checks for loft insulation has been retained in ECO (DECC, 2014e) .

3.2.9 Control and Compliance

The EEOs are a licence condition for suppliers (above a certain size). 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 licence condition is 5% of company turnover. In practice, penalties are likely to be substantially smaller, as Ofgem's stated policy is that the 'quantum of penalty must be reasonable', taking into account a number of factors, including the harm to customers and the gain to the licensee. In practice, a penalty would be likely to be larger than, but of the same order of magnitude as, the additional costs that would have been incurred to meet the target.

The penalty mechanism has recently been invoked for the first time due to missed targets under CERT and CESP. Of the ten companies with obligations, four met their targets but six did not (Ofgem E-Serve, 2013b). Three of the vertically integrated energy companies did not meet their targets: British Gas, SSE and Scottish Power. They have all now been fined. British Gas has been ordered to pay £11.1m to benefit vulnerable customers after Ofgem's investigation found the company failed to meet its environmental obligations under the Community Energy Savings Programme (CESP) and Carbon Emissions Reduction Target (CERT) by the 2012 deadline. Following the missed deadlines, British Gas installed energy efficiency measures equivalent to the volume of its CERT and CESP shortfalls, which it completed in February and August 2013 respectively. The particularly late installation of CESP measures was one of the factors that was taken into account when setting the level of penalty. (Ofgem, 2014b). SSE was fined £1.75m and Scottish Power £2.4m.

Three generators, who had obligations under CESP, have also been fined for their failure to deliver targets on time. Intergen was fined £11m, Drax Power £28m and GDF Sues/IPM £450,000 (Ofgem, 2014a, c) The money levied in fines will be used to deliver benefits to customers for whom the schemes were designed.

3.2.10 Administrator - Institutional set up

Central government sets targets. The scheme is administered by Ofgem, the regulatory body for electricity and gas markets. This has been the case since 2002. Previously targets were set and administered by Ofgem and its predecessor bodies. Ofgem's role includes calculating the individual targets of qualifying energy companies, approving energy companies' proposals for complying with their obligations, determining the reduction in carbon emissions resulting from energy companies' activities, reporting to the Secretary of State and initiating enforcement action where appropriate.

3.2.11 Flexibility

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. (Ofgem E-Serve, 2014) (Chapter 10, 1.1).

In contrast to earlier phases of the EEO, ECO has introduced a 'brokerage' mechanism, in which potential providers of measures (largely insulation) can make them available to obligated suppliers in a periodic auction. There is no fixed price for ECO measures sold via brokerage. It is a market based platform. Brokerage has been designed to drive down the costs by encouraging competition. Contracts worth £402 million have let via this mechanism since the beginning of ECO (DECC, 2014b). This compares with the expected annual expenditure of around £1.3bn on ECO as it was originally designed, and of around £900m after the 2014 re-design.

3.3 Results of EEO

3.3.1 Costs to obligated parties

Cost figures in this section come from the independent report on CERT and CESP commissioned by the UK government (Ipsos et al 2014). Energy suppliers are obliged to report their costs to Ofgem, but costs per company are confidential and data is presented in aggregate only. These costs relate only to the obligated parties, and do not include any co-funding of efficiency measures by householders, or the cost to government and the energy

regulator of administering and regulating the EEO system (see section 3.3.2 on costs to other parties).

Table 9: Estimated Total Costs Reported Incurred by Obligated Parties, CERT and CERT Extension, 2012/13 prices

Cost Element	CERT (2008-2011)	CERT Extension (2011-2012)	Total
Administration costs	£47.8m	£62.5m	£110.7m
Delivery Costs	£2,175m	£1,361m	£3,535m
Total	£2,222.8m (€3874m)	£1,423.5m (€1778m)	£3,645.7m (€4556m)
Costs anticipated in impact Assessment	£3.4bn	£2.0bn	£5.4bn

Source: (Ipsos MORI et al., 2014a)

Administration costs are those incurred through the delivery of the programme, and include internal costs of the energy companies for management and delivery, including the cost of developing the scheme and other marketing costs. Delivery costs are all other costs of installing energy efficiency measures in homes.

Administration costs represented around three per cent of total costs to obligated parties (although this varied from one per cent to six per cent). The submissions received covered 88% of the total delivery costs reported by obligated parties. Assuming that the final supplier incurred administrative overheads in line with other parties, it is estimated that these costs totalled £107m (€134m) across all suppliers in nominal terms (£111m in 2012/13 prices).

It is estimated that, overall, CERT was delivered at an average cost to obligated parties of £13.17 (€16.46) per tonne of CO2 (lifetime) saved in nominal terms (£13.79 in 2012/13 prices). The original CERT obligation was delivered at an estimated average cost of £11.60 (€14.50) per tonne of CO2 saved (£12.44 in 2012/13 prices) and the CERT Extension at £15.00 (€18.75) per tonne of CO2 saved (£15.08 in 2012/13 prices). This is compared to £18.40 (€23.00) for the CERT and CERT Extension Impact Assessment.

In contrast to CERT, the costs incurred by obligated parties associated with the delivery of CESP were substantially higher than anticipated (Table 10). Experience with CESP has influenced the design of the Community Savings (CSCO) strand of ECO, although the formal evaluation of CESP was not delivered until after ECO was introduced.

Table 10: Estimates of the costs incurred by obligated parties in the delivery of CESP

Cost Element	Costs (nominal prices)
Administration costs	£37.1m
Delivery Costs	£665m
Total	£702.1m (€877m)
Costs anticipated in impact assessment	£332m (2012/13 prices)

Source: (Ipsos MORI et al., 2014a)

CESP was achieved at a price to obligated parties of £32.85 (€41.06) per tonne of CO_2 saved (estimated on the basis of reported start dates of schemes as this will provide the best estimate of the time at which prices and contracts were agreed).

Prices rose substantially over time, from just under £20 per tonne of CO2 saved to a peak of almost £50 per tonne (before falling again for mitigation measures). Average costs per tonne of CO_2 were some 2.5 times higher than for CERT.

3.3.2 Costs to other actors

Detailed data on costs of other actors (owner occupiers and landlords) are not available from the CERT evaluation. However, the initial impact evaluation estimated that these contributions would be expected to be approximately 10% in the priority group and 50% otherwise, implying customer contributions averaging 30% (see also Section 3.5.1). There is no equivalent assessment in the ECO impact assessment.

The costs to Ofgem of enforcing various phases of EEO are estimated ex ante in the policy Impact Assessment documents. These costs are minor in comparison with the costs to obligated parties, e.g.:

- CESP – one off cost of £400,000, annual cost of £350,000 (DECC, 2009)
- CERT extension (2011-12) – annual cost of £1.7m (DECC, 2010a)
- ECO (as originally planned) – set-up costs £1.3m, plus annual costs of £2.5m (DECC, 2012)

Note that Ofgem's operating costs are paid by the energy suppliers.

There does not appear to be any information on costs to the Government civil service of undertaking the other research, consultation, negotiation and drafting tasks associated with this legislation.

3.3.3 Total savings

Table 11: Targets and savings achieved

Scheme	Target	Savings Achieved	Target met?	Data source
CESP	19.25 MtCO2 lifetime	16.31 MtCO2 lifetime (84.7% of target)	No	(Ofgem E-Serve, 2013b)
CERT	293 Mt CO2 lifetime	296.9 Mt CO2 lifetime (101.3% of target)	Yes	(Ofgem E-Serve, 2013a)

3.3.4 Cost effectiveness

It is estimated that, overall, CERT was delivered at an average cost to obligated parties of £13.17 per tonne of CO_2 saved in nominal terms (£13.79 in 2012/13 prices). The original CERT obligation was delivered at an estimated average cost of £11.60 per tonne of CO_2 saved (£12.44 in 2012/13 prices) and the CERT Extension at £15.00 per tonne of CO_2 saved (£15.08 in 2012/13 prices). This is compared to £18.40 for the CERT and CERT Extension Impact Assessments (Ipsos MORI et al., 2014b).

The CERT evaluation does not calculate p/kWh costs of the programme. 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. For comparison, the average price per kWh (in nominal terms) in 2008 was 12.5p/kWh electricity, and 3.4p/kWh gas (DECC, 2014g). Assuming a 30% customer

contribution (i.e. supplier contribution of 70%) and an average carbon intensity of energy saved as 250 gCO_2/kWh, the CERT cost (to obligated parties) of £13.79/tCO_2 is equivalent to 0.5 p/kWh (0.625 Euro cents / kWh)[3].

3.3.5 Other stakeholders

In early phases of UK EEOs (EESOP, 1994-2000), a large part of the costs of designing the EEOs was undertaken by the Energy Saving Trust (EST), a non-profit company jointly owned by the Government and leading energy companies, and largely funded by the UK Government between 1997 and 2011. In this arrangement, some costs fell upon Government. Until 1998 the obligated parties were monopoly electricity companies responsible for both distribution and retail supply. Obligations were, at that time, set by the regulator, with advice from the EST.

Following complete market liberalisation in 1998, the Utilities Act 2000 passed the responsibility for setting obligations to the Government (Defra then DECC), with administration and regulatory oversight by Ofgem. To the extent that these activities of Ofgem are funded by energy supplier licence fees, all costs now fall on the obligated parties, directly or indirectly.

Other stakeholders remain important in influencing policy design. Energy companies have typically argued for obligations to be smaller than those eventually imposed, but were unsuccessful until 2012, with each obligation period having a higher obligation than the previous period. Opposing influence has been exerted by energy efficiency trade organisations, notably the Association for the Conservation of Energy (ACE) and National Insulation Association (NIA). They have been supported by specialist energy efficiency organisations, notably the EST, but also by broader environmental NGOs.

Social NGOs concerned with fuel poverty (e.g. National Energy Action, NEA) and the Government's own advisory body, the Fuel Poverty Advisory Group, have been broadly supportive of larger energy efficiency programmes, although critical in principle of raising

[3] This calculation is based on lifetime carbon savings from measures (as for all GB targets) and does not include any discounting of future carbon savings.

funds for them through consumer bills, and have been influential in retaining a high focus on low income groups throughout successive re-designs of EEOs.

Energy company concerns about the scale of EEOs reached a new peak in 2012, because of the original requirement of ECO to support more expensive insulation measures, instead of the lower cost measures supported under previous EEOs. They argued that targets could not be delivered at the costs suggested by Government. In 2013, they were successful in having ECO substantially changed, with a reduction in the target and even larger reductions in expected costs, due to the change to re-allow low cost insulation measures.

In terms of delivering measures, obligated parties have worked with different types of organisations. For example, to meet their CERT obligations, in addition to offering measures (principally CFLs) direct to consumers, energy suppliers have partnered with social housing providers, and to a lesser extent with retailers, manufacturers and third sector organisations. They have also worked in conjunction with government programmes such as Warm Front (a fuel poverty reduction programme).

3.4 Adaptation of EEO

3.4.1 Frequency of redesign

The EEO began in 1994, when GB was the first country in Europe to impose energy efficiency obligations on energy suppliers. Suppliers were allowed to raise money from a charge on residential and SME customer bills and had to use this to meet energy savings targets. The obligations started at a relatively low level but eventually became a major climate change mitigation policy for the domestic sector. The details of the scheme have been re-designed approximately every three years, some of these being major redesigns (e.g. change from CERT (2008-2012) to ECO (2012-2017), others being less significant (e.g change from EESoP 1(1994 – 1998) to EESoP 2 (1998 – 2000)). Four different names have been employed since 1994.

3.4.2 Reasons for redesign

Re-designs prior to 2012 were primarily aimed at increasing the savings delivered. The success of early phases of the scheme led to confidence that suppliers could reach higher targets.

EESoP 1 to EESoP 2

There were few changes between these phases. A higher percentage of measures in EESoP2 was expected to go to priority groups, but this targeting was not mandatory.

EESoP 2 to EESoP 3

The obligation was widened to include suppliers of gas (phases 1 and 2 applied to electricity only). This was enabled by central government taking powers to enable them to impose energy savings targets on gas and electricity suppliers. Previously the energy regulator (now known as Ofgem) had the power to set targets, rather than just administer and enforce targets as at present. The institutional change that occurred in Britain resulted from a lengthy political debate about the role of the energy regulators and their unwillingness to increase expenditure for energy efficiency measures.

Funding was no longer raised from SMEs in EESoP3 although measures could still be installed in this sector. SMEs had only been a minor part of EESoP 1 &2, with just 5% and 4% respectively, of energy savings delivered from the sector (Ofgem and Energy Saving Trust, 2003). Larger businesses were never included in the scheme as it was believed the competitive energy market would deliver ESCOs and energy efficiency. At the time EESoP 1 was introduced, full competition was not in place for residential customers and SMEs. Once full competition existed for these sectors (from 1998 onwards), SMEs were removed from the next iteration of the EEO, in the belief that the market would provide energy saving services. This assumption was not made for the residential sector.

EESoP 3 to EEC 1

EEC 1 introduced a target with fuel weighted kWh, i.e. it depended on the carbon intensity of the fuel saved how much it would count towards the target. So effectively, EEC 1 introduced a carbon target. From EEC 1 onwards, climate change policy appears to be the strongest driver and the UK carbon targets put pressure on the government departments to deliver a substantial contribution to the targets via the EEO.

EEC 1 to EEC 2

Annual savings target approximately doubled from EEC1 to EEC2. Other than that, there were no significant changes.

EEC2 to CERT & CESP

In order to align the EEO with the wider climate policy landscape, the metric of the EEO changed from TWh to carbon emissions when CERT & CESP commenced in 2008. The Climate Change and Sustainable Energy Act 2006 gave powers to the government to set the obligations in the form of a carbon emissions reduction target.

CERT & CESP to ECO

There were a number of significant changes from CERT & CESTP to ECO, not least a significant lowering of expected annual carbon savings. ECO was designed to complement the government's other new policy, Green Deal. It was intended to "underpin the Green Deal and focus on those properties and households which could not make energy savings without extra financial support or qualify for Green Deal Finance" (Hough et al., 2014). As such it targets higher cost measures and lower income households. Measures which were very significant in delivering CERT targets, including loft and cavity wall insulation, were largely excluded from ECO initially (apart from 'hard to treat' cases). The expectation was that these measures would continue to be installed, but with householders accessing Green Deal finance, rather than relying on EEO-funded subsidies. There is also a strand of ECO which focuses only on reducing heating energy costs, and to which no carbon saving targets are attached.

Changes to ECO since its introduction

The government decided to make change to ECO to "to reduce pressures on consumer bills and ensure ECO provides value for money for energy consumers; whilst continuing to help tackle fuel poverty, support the development of a sustainable energy efficiency supply chain and improve the energy efficiency of our housing stock" (DECC, 2014a). In practice the changes have been driven by a combination of factors. Very high levels of public concern about energy prices have led to pressure on Government to reduce 'levies'. The lack of EU targets for energy efficiency has led to these programmes being targeted. Reducing cost effective energy efficiency programmes will clearly increase bills overall and most respondents to the Government consultation opposed any reduction, but Government chose to cut the CERO part of ECO by 33% from March 2015.

At the same time, the take-up of Green Deal has been very low, so that the markets for low cost insulation measures (loft and cavity wall insulation) originally excluded from ECO have been severely damaged. Government therefore conceded to pressure to allow these measures to be reintroduced into ECO from April 2014.

Table 12: Summary of changes to ECO

ECO element	Changes
All	The ECO scheme will be extended to March 2017 with new targets imposed for CERO, CSCO and Affordable Warmth at a pro rata of the new March 2015 levels.
CERO	March 2015 Carbon Emissions Reduction Obligation (CERO) target will be reduced by 33 per cent, with the inclusion of loft insulation, cavity wall and District Heating Systems as eligible measures if installed on or after 1 April 2014.
CSCO	Eligibility is extended from 15 per cent to approximately the 25 per cent lowest areas on the Index of Multiple Deprivation.
HHCRO	Electric storage heaters to be included as measures from 1 April 2015. Some changes to calculated savings from other measures.

Source: (DECC, 2014a)

3.4.3 Manageability

The rules for allocating savings to (standard) measures installed are very clearly set out by Ofgem, with a procedure for agreeing savings figures for new measures / situations.

3.5 Social equity

The EEO was never intended to be a fuel poverty policy and provisions for targeting low-income customers were built into the design of the EEO as a means to offset its regressiveness with regards to raising revenue via energy bills (in the UK, lower income householders spend a greater percentage of their income on energy bills than higher income groups, thus price increases affect them disproportionally). In practice all income groups have benefitted from EEOs (Eoin Lees Energy, 2008)).

A specific objective of ECO is to tackle fuel poverty, thereby marking a major shift from previous supplier obligations that have focused primarily on reducing carbon emissions.

3.5.1 Contributors

Local authorities and some householders did make contributions to the costs of CERT and CESP. However, there is a lack of data on these contributions, and a reliable estimate cannot

be made (Ipsos MORI et al., 2014a). Contributions of householders varied by whether they were a member of a Priority Group, by measure and by scheme. The only data is based on a small number of respondents reporting what their contribution was – data which is felt to be insufficiently robust to use quantitatively.

3.5.2 Beneficiaries

The UK is unique in EEOs worldwide in restricting the policy measure to the household sector.

EESoP 1, 2 & 3 did not set mandatory targets on what proportion of revenue raised should be spent on low-income consumers, but for EESoP 2 & 3 around two-thirds of expenditure (and half of energy savings) was expected to be directed to those on low income. EEC 1 was the first scheme that put in place an obligatory target for vulnerable customers – 50% of all savings had to be made with Priority Groups. The same target was used for EEC 2. Under CERT the target was reduced to 40%. With the CERT extension from April 2011 to December 2012 a Super Priority Group (SPG) was introduced, requiring suppliers to meet 15% of their total CERT target (37.5% of their PG target) from a subset of low-income households that were considered to be at high risk of fuel poverty.

Who is and is not included in the PG depends on the definition of it. The PG definition changed over time. Until EEC2 it included people receiving certain benefits, most of which were still included in the PG definition used in CERT. An important change from EEC2 to CERT was the inclusion of all people over 70 years old .

3.5.3 Impact on energy prices or tariffs

EESoP 1 and 2 obliged energy suppliers to spend a certain amount of money, later versions of the EEO only provided indicative figures that were non-binding. Suppliers passed on the costs of the EEOs to their customers via energy bills. Some efficiency measures were given to householders for free, in other cases householders had to contribute part of the cost., Expenditures were subject to supply price control (and the 1998 supply price restraint) in earlier versions of the EEO (EESoP 1 and 2), prescribing the maximum that could be charged. However, expenditure in later versions did not fall under such tight control and only indicative figures were provided (Rosenow, 2012). (Throughout this report a clear distinction has been made between estimated costs, and actual costs - which since EEC 1 (2002 - 2005) have only been available after each phase of the EEO is complete.)

Table 13: Customer costs for different GB EEOs

Scheme	Costs
EESoP 1 & 2 (1994 – 2000)	£1 (€1.25) per franchise customer per year allowed through the supply price control
EESoP 3 (2000 – 2002)	£1.20 (€1/50) per customer per fuel per annum (estimated cost based on energy saving targets set)
EEC1 (2002 – 2005)	£3.60 (€4.50) per customer per fuel per annum, (estimated cost based on energy saving targets set) indicative in target setting model
EEC 2 (2005 – 2008)	£9 per customer per fuel per annum, (estimated cost based on energy saving targets set). Actual figures reported as £7 (€8.75) per fuel per annum and around £5 (€6.25) for the low income group (Eoin Lees Energy, 2008). These costs work out as 2.1 p/kWh (2.6€c/kWh) electricity and 0.6 p/kWh (0.75€c/kWh) gas
CERT (2008 – 2012)	£51 (€64) per customer per annum (estimated cost based on carbon saving targets set) (DECC, 2010b). However, actual costs were only 2/3 of those expected (Ipsos MORI et al., 2014b), suggesting costs per customer of £34 (€42.50) per year (depending how energy suppliers passed on costs).
CESP (2009 – 2012)	£3 (€3.75) per customer per annum, (estimated cost based on carbon saving targets set) (DECC, 2009). However, costs were more than twice those expected, so annual impact on bills likely to be £6-7 (€7.50-8.75).
ECO (2013 – 2017)	Estimated at £59 (€74) per customer per year for 2013-2014, and £36 (€45) per customer per year from April 2014 onwards, as ECO reforms take effect (DECC, 2014d)

Sources: (Rosenow, 2012) unless otherwise referenced in the table

3.6 Lessons learned and what can be improved?

3.6.1 Areas for improvement

The UK is unique in restricting its EEO to the household sector. The only cited reason is the risk of cross-subsidy between the household and business sectors. However, this has not proved a significant issue in any other country, and therefore is not an entirely convincing reason for such a major restriction.

Historically EEOs successfully supported a range of household energy efficiency measures, but ECO rules focus attention on insulation. There is there a risk of inadequate support for energy saving in lights and appliances.

Tradability of savings has historically been low and therefore there is a concern that costs may be higher than if there were a more liquid market encouraging companies with different models to participate more. ECO brokerage is an attempt to address this issue. However, energy suppliers do already have an incentive to deliver as cheaply as possible: delivering ECO at lower cost allows them to offer lower priced energy to customers, or increase their profit margin, or both. .

As in most countries, EEOs have been used primarily to deliver relatively low cost energy efficiency measures. This clearly maximises benefit cost ratios, but does not support technical innovation or behavioural change, and therefore risks not bringing new generations of energy efficiency products to market. This may prove particularly important in the context of the need to deliver very substantial change in the built environment, as it is difficult to see how EEOs will support deep and complex refurbishment. The last concern is exacerbated by the essential nature of EEOs in placing control of large scale energy efficiency programmes in the hands of energy supply companies.

The recent experiment with ECO, ceasing support for low cost measures and focussing on a more expensive measure, solid wall insulation, has not been successful and is now essentially being abandoned.

3.6.2 Strong characteristics

EEOs have delivered very substantial improvements in energy efficiency in UK households. They have demonstrably been a factor in a large fraction of the energy efficiency improvement achieved, particularly in the period of large obligations, 2002-2012. They have been a major contributor to the significant reduction in household energy demand in this period (a reduction of 11.2% from 2004 to 2013 - see Figure 1).

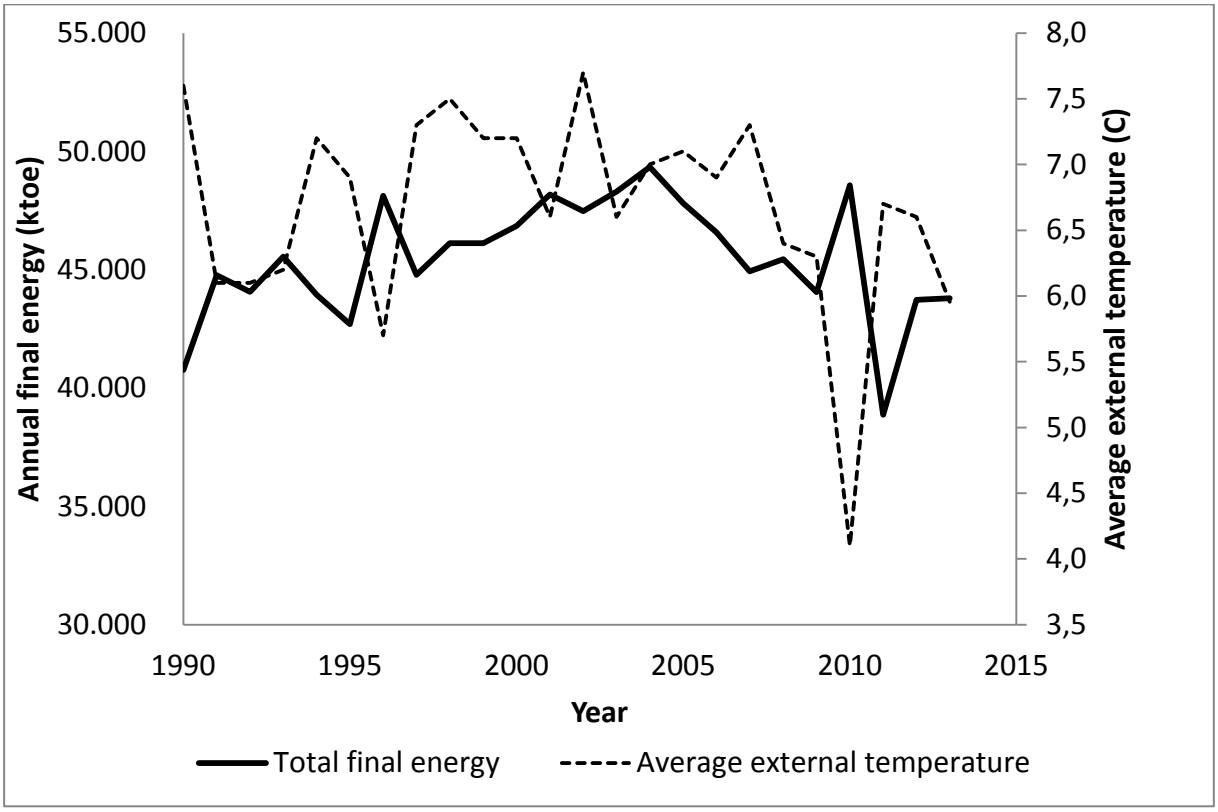


Figure 1: Total final energy (not temperature corrected) and average external temperature, residential sector UK, 1990 – 2013

Source: (DECC, 2014c)

Until the sudden and unsuccessful changes adopted in 2012 to accompany the Green Deal, EEOs had developed incrementally and grown steadily in scale, resulting in general support as a policy mechanism across changes in political administration and market structure.

Placing obligations on energy suppliers in a competitive market has been successful in that targets have, with rare exceptions, been delivered.

The approach of requiring a strong focus on measures in low income groups has been characteristic of UK EEOs. This has enabled all income groups to benefit.

3.6.3 CERT and CESP in more detail (strengths and weaknesses)

The independent assessment of CERT and CESP (Ipsos MORI et al., 2014a) has assessed the strengths and weaknesses of each scheme, and a summary of that analysis is reproduced below.

Table 14: The strengths and weaknesses of the design of CERT 2008 - 2011

Element of design	Strengths	Weaknesses
Flexibility	Flexible means of delivery: options through different sectors including insulation, lighting, micro-generation, appliances, behavioural measures, etc.	Flexibility led to unintended consequences, such as the 'over-distribution' of CFLs
CO2 scoring system	Simple scoring system created certainty	A perception among some obligated parties that deemed carbon savings were an oversimplification
Delivering CO2 savings	Supported high volumes of measures at lowest cost	No mechanism to distribute the carbon savings to the most vulnerable Hard-to-treat measures not promoted: primarily focused on 'low-hanging fruit'
Beneficiaries	Inclusive, wide scope: potential for most households to benefit	A lack of equity: hard-to-treat homes, private rented sector and less accessible areas all under-represented
Link to predecessor schemes	Evolution from previous supplier obligation helped to smooth transition	
Administration	Administrative systems simple	

Table 15: The strengths and weaknesses of the design of CESP

Element of design	Strengths	Weaknesses
Objectives and scoring	The objectives and principles of CESP were widely supported by stakeholders	A complex scoring system: promoted lack of certainty and increased the administrative burden of the scheme
Focus on measure types	Successfully promoted delivery of SWI and multiple measures	Not truly a 'whole-house' scheme as some key measures not eligible or applied
Timescale		Short delivery timescale and inelastic demand led to rising prices
Area based	Promoted area-based delivery (one of the aims of the scheme - see Section 3.1)	The administrative areas designated for delivery of measures cut across community boundaries
Partnerships	Promoted partnership working	But timescale and complexity hindered consistent development of effective partnerships
Pilot	Promoted as an opportunity to pilot new ways of delivery	Obligation not actually run as a pilot: flexibility not built into the design - making it harder for suppliers to experiment with new delivery pathways

4 France

4.1 Policy objectives of the EEO

The Energy Policy Act of 13 July 2005 introduced Energy Saving Certificates (ESCs or white certificates) in France as a means of **reducing final energy consumption in sectors with dispersed activity**. While the main focus of this policy is to reduce energy uses in residential, commercial, and public buildings, the scheme also includes light industry, agriculture and transport activities.

The ESC scheme is a tool designed to trigger new investments in energy efficiency. Through the incentives obligated parties provide to beneficiaries, the ESC scheme introduces a new financial leverage that makes energy saving investments more affordable for households and local authorities and more profitable for businesses, while reducing energy bills.

Since its launching in 2005, the ESC scheme is **France's main policy to reach its 2020 energy efficiency target**. It will permit to reach most of the savings expected under article 7 of the Energy Efficiency Directive.

Beyond achieving concrete energy savings, the ESC scheme aims at:

- Finance innovation programs in energy efficiency,
- Fund energy savings training and communication programs, and
- Reduce fuel poverty.

4.2 Design of the EEO

4.2.1 Type of measures

Under the French ESC scheme, obligated energy companies or "obligated parties" must demonstrate they facilitated the achievement of energy savings in order to gain ESCs. These ESCs will then be applied towards the achievement of their obligation under the law.

Obligated parties can fulfil this obligation by either:

- Deploying energy saving measures on their own facilities/operations;

- Incentivizing energy users to invest in energy efficient equipment or services (measures);
- Providing financial contributions to "programs" that reduce energy poverty or to educate people about energy savings *(Programs are explained in greater detail under Section 3.2.11 - Flexibility)*; or
- Purchasing ESCs on the market that were generated by another obligated or "eligible" party *(the ESCs market is explained in greater detail under Section 3.2.11 - Flexibility)*.

The majority of the obligation is met via incentives to consumers. These incentives take different forms depending on the strategy of the obligated part, including:

- Low interest loans for investments in ESC eligible measures;
- Direct subsidies that reduce the price of eligible measures;
- Rebates or "primes" to beneficiaries that declare a measure they installed was a result of the obligated party; and
- Bonuses (primes) to installers who promote the measures to energy users on behalf of the obligated party.

In addition, the ESC scheme excludes energy saving measures that do not yield additional energy savings:

- Operations achieved in an installation subject to the EU Emissions Trading System (EU ETS), e.g. major industrial sites and large boiler plants. These installations include all the equipment and processes covered by the ETS. Thus, an industrial site can receive ESCs for operations implemented on equipment or buildings that are not covered by the ETS, such as warehouse, offices…
- Operations already required by regulations: ESCs are allocated only to measures that will achieve a higher performance than what is required by any applicable norms;
- Simple "fuel switching": i.e. changing the type of final energy (electricity, gas, heating oil, automotive fuel) used in an operation.

Finally, operations that received a financial support from ADEME in the investment phase are not eligible to ESCs (financial supports from ADEME at the decision-making phase can be cumulated with ESCs). A project holder will thus have to choose between benefiting from ADEME's financial support for investing in energy efficiency or applying for ESCs.

4.2.2 Scope - sector related

The French ESC scheme targets **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. Indeed, the building sector is by far the largest energy consumer in France and the residential sector represents 2/3 of its energy consumption.

At the same time, energy suppliers have a direct relationship with households that allow them to reach this dispersed target more easily than other actors.

4.2.3 Scope - technology related

Generally speaking, ESCs are allocated to hard investments in energy-efficient equipment or materials. The scheme promotes the deployment of best available technologies and favours those measures that yield the highest energy savings:

- For households: Attic or Roof Insulation, Wall insulation, Individual-Unit Condensing Boiler and Independent wood-burning heating devices;
- For the industry: Variable Speed Drive System on an Asynchronous Motor
- For the agriculture sector : Open-buffer Hot-water Storage Tank
- For the transport sector : Intermodal Transport Unit (ITU)

To encourage best practices, the scheme rewards additional ESCs ("bonus ESCs") for operations undertaken within a broader efficiency strategy: for instance an Energy Management System (EMS) or an Energy Performance Contract (ECP). For instance, a company committed to an Energy Management System and certified ISO 50 001 receives twice the ESCs allocated for all standardized and special operations that it implements. Measures implemented in French territory that is not linked to the national electricity grid (Corsica, the Islands of Molène, Ouessant, and Sein, as well as the French territories overseas) are also eligible for additional ESCs because energy generated from fossil fuels imports and local electricity production are both expensive and GHG intensive.
These bonuses are supposed to channel energy efficiency operations towards these strategic targets and to encourage the implementation of EMS and EPC.

In coherence with its focus on efficient equipment and material, for which energy savings can be thoroughly estimated, the scheme does not reward operations related to individual behavior change, even though this is a source of considerable energy savings.

4.2.4 Obligated parties

Due to the inherently direct relationship between dispersed energy users and their suppliers, the French ESC scheme has chosen to target those suppliers as the obligated parties.

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:

- 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 m^3 of domestic heating oil.

In addition, from the beginning of the 2nd period onward, wholesalers supplying to the French territory over:

- 7,000 tons of autogas (transport LPG); and
- 7,000 m^3 of automotive fuel annually (gasoline/diesel);

are also under the obligation.

Taking these thresholds into account results in the following group of obligated parties for the 2nd period of the scheme:

- 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.).

4.2.5 Target setting

Energy saving units: kWh cumac

Energy savings targets and operations are recorded in kWh "cumac" of final energy. "Cumac" is the controperation of "cumulative and actualized", meaning that the certificates

awarded to a project take into account the savings generated over the individual measure's lifetime with an in-use factor:

- Energy-saving materials, equipment and measures are characterized by the energy savings that they generate over the lifetime of their operation: these are cumulative energy savings.
- to account for a measure's reduced saving potential over time, the lifetime savings are "actualized" by applying a 4% discount coefficient: this discount is both financial and technical because 1) the economic value of savings diminishes in the future, and 2) the actual efficiency decreases due to rising standards and aging materials/equipment.

As such, to calculate a measure's savings and thus the amount of ESCs to which the operation is entitled, the calculations are done as follows:

- **Energy savings (kWh cumac) = Annual savings (kWh) x Ca (Cumac coefficient)**

$$\textbf{Ca} = \frac{n}{(1+a)^n}$$

Where a is the standard discount coefficient of 4%
and n is the measure's lifetime

1 Energy Efficiency Certificate (ESC) = 1 kWh cumac

Determining the global savings target

The French energy efficiency obligation (EEO) is implemented over individual "periods" which are set to run over 3 years.

For the 1st period (July 2006 – June 2009), the French authorities set the savings target to 54 TWh cumac for the 3 year period. 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. The obligated parties for this period included significant suppliers of: electricity, natural gas, liquefied petroleum gas (LPG), district heating and cooling, and domestic heating oil.

Between the 1st and the 2nd period, the scheme known a transitory phase (2010) during which no obligation was in place but participants could continue to generate ESCs with the idea that these would be applied towards the obligation set in the 2nd period.

For the 2nd period (January 2011-December 2013), the French authorities set a more ambitious savings target totaling 345 TWh cumac:

- 255 TWh cumac attributed to the obligated parties of the 1st period (suppliers of electricity, natural gas, liquefied petroleum gas, heating / cooling, heating fuel); and
- 90 TWh cumac assigned to a newly obligated group of automotive fuel wholesalers.
-

In determining the target for the second period, 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.

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. This extension allowed the stakeholders of the scheme to continue to produce energy savings while providing policy makers with the extra time they needed to prepare the groundwork for a 3rd period that would meet the requirements of the newly passed European Energy Efficiency Directive.

Target sharing

For the obligated parties who participated in the 1st and 2nd periods, the obligation target is distributed per energy by taking into account both the sales (in euros) and the volume sold (in TWh).

The sales are obtained by taking into account:

- the annual energy sales (in TWh) to households and tertiary enterprises over the 3 year period;
- annual reference energy prices (per kWh) per energy.

$$\text{Sales energy}_{\,i} = \sum_{n=2011}^{2013} \text{Volume i} * \text{Average unitary price i}$$

We can then obtain the contribution of each energy to the global saving target:

$$\textbf{Contribution}_{\,\textbf{energy i}} = 0.75\% * \frac{\text{Sales (energy i)}}{\text{Sales (all energies)}} + 0.25\% * \frac{\text{Volume (energy i)}}{\text{Volume (all energies)}}$$

This distribution of the 2nd period obligation between obligated energies led to the following breakdown of savings:

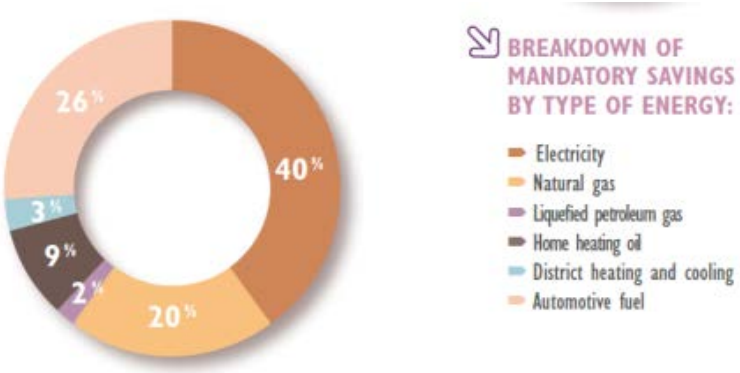


Figure 2: Breakdown of the saving target per type of energy for the 2nd period

This contribution per energy allows calculating one "obligation coefficient" per energy (kWh cumac per unit sold):
Obligation coefficient $_{energy\ i}$ *= Contribution* $_{energy\ i}$ */ Volume* $_{energy\ i}$
where Volume $_{energy\ i}$ corresponds to the volume of sales over the period.

For the automotive fuel wholesalers who entered the obligation in the 2nd period, their obligation was calculated separately.

The resulting "obligation coefficients" for each energy type (kWh cumac / unit sold) for the 2nd period are as follows:

- Automotive fuel: 594 kWh cumac/m^3
- Automotive liquefied petroleum gas: 594 kWh cumac/ton
- Domestic heating oil: 1.050 kWh cumac/ m^3
- Heating LPG: 0.159 kWh cumac/kWh
- Electricity: 0.168 kWh cumac/kWh
- Natural gas: 0.095 kWh cumac/kWh
- Heating/cooling: 0.103 kWh cumac/kWh

To calculate an individual supplier's obligation for the period, one simply multiplies that supplier's sales throughout the previous year by the corresponding "obligation coefficient"

for each type of energy they supply (for example, EDF sells electricity and natural gas and thus has obligations related to each activity).

At the beginning of a period, an obligated party can only an estimate its obligation since the final figure will depend on its actual sales throughout the period.

4.2.6 Calculation method for savings

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.

Standard operations are common energy saving measures that can be valorized under the scheme using pre-determined calculation formulas. The average annual savings for standard measures are determined as compared to a baseline energy use scenario using an ex-ante methodology. This baseline average can be calculated from either 1) the energy use attributed to the existing stock of similar installed measures in France (i.e. a "stock" average, for instance for operation on buildings 'envelope), or 2) the energy use attributed to new equipment of that type available on the French market (i.e. a "market" average, for instance for the installation of certain lighting equipment).

In both cases, the attributed savings are based on what the measure is "deemed" to achieve above and beyond this baseline. The annual savings and the lifetime calculations are derived from data collected from a wide selection of stakeholders participating in the efficiency sector. When applicable (e.g. for measures in the building sector), the annual savings attributed to an operation will vary depending on one or more factors, e.g. the geographic location/climate, the type of housing, or the type of energy consumed by the measure.

Once the standard savings are determined, a technical information sheet is written up for the "standard" operation. The technical sheet outlines how to calculate the savings that can be attributed to that type of measure in kWh cumac by multiplying one or more annual savings estimates (depending on the factors above) by the lifetime and applying the discount rate as described previously. This methodology provides a single flat-rate value for savings from common operations, which simplifies calculations for scheme participants. As a consequence, the savings reported do not reflect the exact savings achieved by each operation but instead represent an estimated average for that operation.

Individual information sheets for measures are developed and proposed by different stakeholders participating in the ESC scheme (professional bodies, industrials etc.). Once the proposed operation is accepted and verified for technical accuracy by ADEME, it can be sent

for validation by the Ministry and then published for official use in the scheme in a ministerial decree in the French "*Journal Officiel*".

At present, there are 304 possible standard energy saving operations included in the official catalogue. A full list of standard operation information sheets is available in French here: http://www.developpement-durable.gouv.fr/1-le-secteur-du-batiment.html.

The French administration regularly updates the list so as to account for technical progress by 1) removing measures that no longer provide significant savings as compared to the regulated standard, 2) modifying existing measures to better represent the present circumstance, and 3) adding newly approved measures.

As of July 2014, standard operations represent 95% of the ESCs delivered since the launch of the French scheme. Moreover, the following 10 standard operations make up 66% of the ESCs attributed to standard operations under the scheme.

Table 16: Breakdown of the ECSs attributed for standard operations as of July 2014

Sector	Reference	Standard operation	% of attributed kWh $_{cumac}$
Residential	BAR-TH-06	Individual-Unit Condensing Boiler	15.29%
Residential	BAR-EN-01	Attic or Roof insulation	9.63%
Residential	BAR-EN-02	Wall insulation	7.21%
Residential	BAR-TH-07	Collective-Unit condensing boiler	6.28%
Residential	BAR-TH-12	Independent wood-burning heating devices	5.87%
Tertiary	BAT-EN-01	Attic or Roof insulation	4.88%
Residential	BAR-TH-08	Individual low temperature boiler	4.57%
Residential	BAR-EN-04	Window with insulating glass	4.33%
Residential	BAR-TH-07-SE	Collective-Unit condensing boiler with a contract guarantying the energy efficiency	3.84%
Industry	IND-UT-02	Variable Speed Drive System on an Asynchronous Motor	3.81%

Special operations:

Beyond the catalogue of standard measures, ESCs can also be awarded for non-standard energy saving operations as long as the operation complies with the rules of the scheme. Case-by-case requests to valorize savings are known as "special operations" and are typically deployed by beneficiaries in the industrial sector. However, these types of operations have been awarded a mere 3% of the ESC delivered since the scheme's launch.

Project proponents applying for ESCs under the "special" category must complete a number of technical procedures, namely the following six requirements:

(i) Performance of an energy audit
(ii) Establishment of the energy use situation prior to the operation
(iii) Determination of a baseline and justification of the chosen saving measures
(iv) Calculation of savings expectations for the project after the operation, based on hypothetical energy use scenarios before and after the operation
(v) Justification of the savings (ESCs) claimed by the project, in particular the hypotheses used for equipment lifetimes
(vi) Justification of the IRR (return on investment must take longer than 3 years)

Special operation requests are sent to the National Authority for Energy Saving Certificates (PNCEE) which validates the requests for ESCs with support from ADEME on the highly technical portions of the project. To ensure that special operation requests are properly drafted and to optimize the appraisal process, a methodological guidance was published during the 2nd period to help project proponents and decision-makers formalize the process for claiming ESCs from special operation (http://www.ademe.fr/sites/default/files/assets/documents/87411_7736-cee-op-specifiques-2013-gb.pdf).

So far, special operations represent 4% of the ESCs delivered and 90% of ESCs delivered for special operations were implemented in the industrial sector.

This low uptake of special actions is directly linked to the higher level of difficulty and lesser level of safety of special operations compared to standard ones (where energy savings are known in advance with little risk of refusal). Specific operations usually represent large amounts of investments and energy savings so the risk is even higher in case of refusal. The expertize process also takes much longer than in the case of special operation (a couple of years instead of months).

4.2.7 Additionality

Energy savings additionality

Within the French EEO scheme, all measures must be proved to have "energy savings additionality" and this is taken into account and dealt with on two levels. A measure is additional if the savings achieved were not already required and would not have taken place if it were not for the promotion of the measure. In other words, additionality is the exact opposite of windfall effects. As such, 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.

The first aspect of this requirement is "policy additionality" meaning that ESCs are only awarded for measures that achieve higher energy saving performance than what is required under national and European regulations. This means that ESCs cannot be attributed for operations taken to comply with a regulation (e.g. compulsory energy diagnostics or audits, EU ETS etc.). Moreover, ESC cannot be cumulated with any other financial support proposed by ADEME.

However, submitting domestic projects for ESCs does not prevent the domestic energy user from also applying for the national tax credit or zero-interest loan programs that are designed to support efficiency-based renovations (not all measures edible for ESCs can receive this kind of fiscal incentive).

ADEME performed a qualitative study on the ESC scheme in 2013 and found that out of over 4,000 households surveyed, more than half pursued projects under the ESC scheme without receiving any other public incentives.[4]

[4] Study led in 2013 on 4,400 households that benefitted from the ESC scheme for refurbishing their home: http://www.ademe.fr/evaluation-qualitative-dispositif-cee-2e-periode-2011-2013.

Business as usual additionality

Within the ESC scheme, regardless of whether the measure's performance is judged against the existing "stock" or the "market" average, the energy savings must prove "business as usual" additionality in that they must go beyond what is considered to be readily available in order to be taken into account. This is particularly true for the energy performance requirements on insulation materials.

During the 1st period, when all enterprises were eligible parties, they could only receive ESCs for operations that went beyond their core activities (ie: boiler manufacturers could not receive ESCs for selling performant boilers). This rule was set to avoid large windfall effects, and for instance to prevent the creation of enterprises whose business models would only rely on the ESC scheme.

«Obligated parties' active and leading role»

The French ESC scheme mandates, as mentioned in the previous section, that obligated parties prove that their operations led to a project's taking place. This requirement exists to minimize the risk of obligated or eligible parties taking credit for projects that would have been implemented without their incentive. To formalize this rule, the Ministry of the Environment requires all parties applying for ESCs to document and prove:

- A direct contribution to the implementation of the energy saving measure, either by raising awareness about the energy saving potential or by facilitating the measure's installation;
- The said contribution was done either by them directly or by an intermediary linked to them via a formal contract; and
- The contribution took place prior to the measure's installation.

As such, every time that an obligated or eligible party submits energy savings projects to received ESCs, they must also include a detailed description of their contribution and an affidavit signed by the beneficiary attesting to their participation and to their right to the resulting ESCs.

4.2.8 Verification & Monitoring

Verifications

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[5]) validates the eligible energy savings.

Once an eligible project is complete, the request for ESCs must be submitted, along with all of the required supporting documentation (e.g. a receipt for the works to prove that they were completed by a professional, proof that the party applying contributed, attestation that the project is complete, etc.), to the PNCEE.

Since the beginning of the 2nd period, ECS requests must concern a minimum of 20GWh cumac. Each eligible and obligated party is authorized to send once a year a request below this threshold. Eligible parties may regroup in order to reach this threshold

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.

The PNCEE reserves the right to audit works that have received ESCs at a future time but to date, no such audits have been completed. As such, beyond the desk based verifications at the PNCEE, there is no on-site verification of the energy savings to ensure that the equipment is properly installed and that the savings are actually being realized. The only certitude is that the installer and beneficiary attest that the energy saving measure has been implemented.

Monitoring

[5] In October 2011, creation of a "National Authority for Energy Saving Certificates" (PNCEE) to centralize the attribution of all ECS, controls and sanctions. Prior to the creation of this authority, the ESC claims were appraised by the regional direction for the environment (representatives of the Ministry for the Environment in each region).

The goal of the predefined calculations of the "standard operations" is to simplify the declaration process and eliminate the need for precise monitoring of an installation. Given that the savings attributed to the project are based on an average established by the installers and users of that technology mean that there is no need to spend time measuring every single instance of that technology being installed and the exact amount of savings generated. For this reason, standard project proponents are not require to submit usage data or savings measurements for the operation when requesting ESCs.

However, "special projects", while not explicitly required to submit usage data to back up their savings hypotheses, are asked by the PNCEE to send data as support for their file. As a result, most submissions of "special" projects tend to include from 2-3 months' worth of monitoring data to justify their calculations. Given that these submissions require one year to be treated and can often involve a significant volume of ESCs, the project proponents prefer to submit the data to ensure their submission is as complete and transparent as possible. This means that the submissions typically take place at least 3 months after the project is completed, to allow time for this data to be collected. As such, this is the only monitoring that takes place in the French scheme. The national registry Emmy allows to extract different types of data: the number of ESC attributed per obligated party, per operation, per region etc.

It shows that so far, most ESCs are attributed for measures in the building sector, with a high concentration on a few operations: 10 measures represents 66% of the ESCs attributed so far, 9 of them concerning the building sector.

Between July 2013 and July 2014, we can also observe that 14.8 TWh cumac were attributed per month, compared to the 8.75 TWh cumac attributed per month between July 2012 and July 2013.

Quality

Since there is no ex-post evaluation of the energy savings reached thanks to the operations implemented within the frame of the ESC scheme, it is vital for the scheme to demand a high level of quality for the implementation of the energy saving measures it supports. Achieving high quality installations helps to ensure that the savings realized closely mirror the savings estimated in the ex-ante evaluation upon which the standard project's technical sheet is based.

As mentioned previously, ESCs are only attributed for measures implemented by professional installers or technicians. This requirement also holds true for projects applying for assistance from other government schemes, such as the sustainable development tax

credit and zero interest loan program. The requirement to have a professional installer perform the operation ensures that a certain level of quality can be expected for the works – including specialized certifications such as for gas boilers given the risks represented by that kind of product if improperly installed. Moreover, the addition of a third party other than the beneficiary and the obligated or eligible party adds another assurance that the project was in fact completed by an existing entity (the installer must be associated with a declared business).

France has recently introduced a principle of "eco-conditionality" for public support programs that help finance energy efficiency-driven renovations. The program is based on an "RGE" label that stands for *"Reconnu Garant environnement"* or recognized environmental guarantor, i.e. the installer carrying the RGE label is certified to install a particular measure. The RGE label distinguishes qualified professionals and certifies that they received the adequate training in order to perform the works properly and the label builds upon an existing quality certification standard in France that is in place for numerous installation types – some of which are required for all installations of that type (e.g. boilers) while others are not mandatory under normal circumstances (i.e. projects not applying for public assistance).

As of September 2014, the French administration requires RGE certified installers to perform all projects applying for the public zero interest loans for sustainable development program (Eco-PTZ). From January 2015, the RGE label is also required for installers performing operations applying for the sustainable development tax credit. The final details of how the RGE requirement will apply to the ESC scheme is still under review at this stage but it is planned to apply at least to works implemented in the individual residential buildings.

4.2.9 Control and Compliance

Penalty

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. As mentioned, their precise obligation is based on energy sales during the period so an obligated party can only know the exact volume of ESCs required of them after the period is completed. Nevertheless, obligated parties are still able to estimate fairly accurately what their target will be prior to the end of the period and plan their operations/programs accordingly.

Obligated parties incur a **penalty** for any short-fall in ESCs at the end of the period. The verification process by the PNCEE and the calculation/establishment of each obligated party's target only begin once the period has finished so the results and any associated

penalties are announced months later (e.g. results are expected in mid-2015 for the 2011-2014 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.

With an average actualized lifetime of 13.4 years over the 2nd period, this represent a penalty of 268€/MWh.

By comparison, the energy prices paid by households in 2014 are close to 74€/MWh for natural gas and 140€/MWh for electricity, according to the Ministry for the Environment.

Regarding the costs to produce electricity, they go from 49.5€/MWh for nuclear production to 93.6€/MWh on average for renewables.

Controls

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

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.

4.2.10 Administrator - Institutional set up

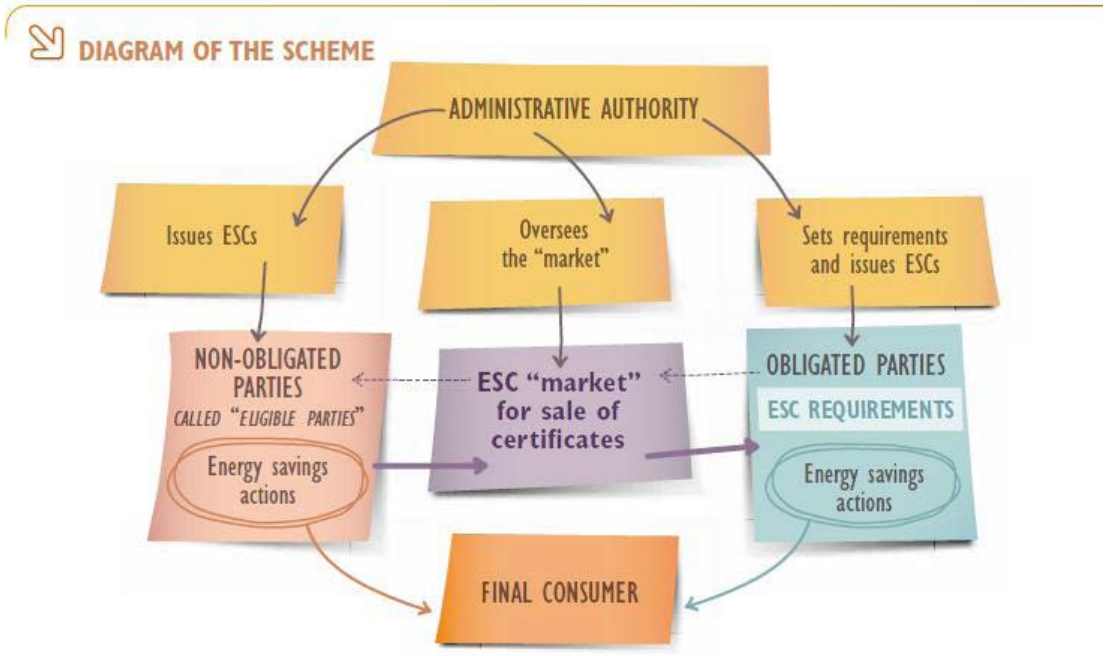


Figure 3: The ESC scheme set up

The ESC scheme is implemented and overseen by the Directorate General for Energy and Climate (DGEC) within the French Ministry of Ecology, Sustainable Development, and Energy. To oversee scheme operations, the DGEC created the PNCEE on October 1, 2011 which leaves the DGEC to manage the high level policy aspects of the scheme. In its role managing the scheme, the PNCEE also elicits assistance from ADEME (on technical issues e.g. saving calculations and the validation of special operation declarations) as well as a group known as the Energy & Environment Technical Association (ATEE) (for general issues e.g. for the proposal of new standard measures and development of the technical sheets). The ATEE is a stakeholder group that includes energy suppliers, energy service companies, equipment manufacturers, engineering and technical consulting firms, local authorities and district heating networks.

The role of these main actors is summed up below.

DGEC:

- Sets the scheme rules, characteristics and obligation target
- Defines how the scheme functions,
- Determines the portion of the obligation assigned to each participating party;

PNCEE:

- Validates submissions for ESCs, verifies individual operations and awards ESCs to eligible submissions.
- Applies penalties to obligated parties who fail to meet their targets.

The PNCEE is maintained by 14 members of staff.

ADEME:

- Assists the Ministry by ensuring the more technical aspects of the administrative work required to maintain the scheme (technical analysis and expertise of new Standard operations and of Special operations, evaluation of the impacts of the scheme;
- Inform and advise final recipients and stakeholders on the scheme.

At ADEME, 3 full time equivalent employees ensure the leadership and expertize required by the ESC scheme.

ATEE:

- Collects and reports on data from various participants in the scheme,
- Provides feedback as to how the scheme is impacting participants and stakeholders,
- Defends the interests of its members,
- Formalizes the proposal process for new standard energy saving operations.

4.2.11 Flexibility

As is highlighted by the existence and the importance of the stakeholder group ATEE in the scheme, the ESC scheme has been designed to allow for flexibility and evolution so as to accommodate the various needs, constraints, requests, suggestions, and feedback – not only of obligated parties, but also from installers, beneficiaries, and intermediaries who help to organize and define the administrative and technical aspects required for the scheme to function.

Fungibility

The French ESC scheme is based upon a single obligation with a single unit to account for savings achieved (TWh cumac). In addition to the ability of individual obligated parties to achieve their portion of the obligation by performing a variety of operations as previously

mentioned, the operations they engage in can generate **savings from any kind of energy and in any sector**, meaning they are not limited to their own customers or their own sector. For example, automotive fuel wholesalers can receive ESCs for supporting operations that lead to reduced electricity use in the building sector and electricity suppliers can gain ESCs for providing home owners incentives to install a more efficient gas boiler. This principle of fungibility allows for a high level of fluidity in the French ESC market and pushes participants to truly search out and identify the most cost effective operations rather than being forced to focus on individual measures or energy types.

Eligible parties

Obligated parties are not the only entities that are allowed to submit requests for ESCs in exchange to measures they have performed or supported. As mentioned throughout this report, the ESC scheme is also open to another type of participants, called "eligible" parties, which can undertake energy savings operations and have them certified in exchange for ESCs without having an obligation to fulfil.

At present, **« eligible parties »** can claim ESCs for operations they or a third party perform on buildings they manage and include:

- **Regional, territorial, and local authorities and the public organizations under their authority,**
- The **National Agency for Housing** (ANAH)
- Social housing agencies or **social landlords**

At the 1st period of the scheme, individual companies from any sectors were eligible to request ESCs for savings they generated on their own building, process or site. However, due to a change in scheme rules for the 2nd period, such companies are no longer "eligible" on their own but can still obtain ESCs for their operations by establishing partnerships with obligated parties. This change in rules was made in order to limit the number of potential applicants for ESCs.

Trading

As explained previously, validated savings are awarded ESCs, which are allocated to the generating entity via a national online registry named Emmy. The Emmy registry is a public service, managed by a private firm called Locasystem, and accessible at www.emmy.fr.

Obligated and eligible parties alike hold individual electronic accounts on Emmy, which maintains official records of all ESCs issued.

At the end of the obligation period, the amount of White Certificates required from each obligated party is deducted directly from their Emmy account by the PNCEE.

In addition, Emmy serves as a marketplace for private trans-operations where ESC buyers and sellers (account holders must declare themselves as "buyer" or "seller") can meet, negotiate and trade. Under the scheme, eligible and obligated parties alike are able to trade certificates they generate via Emmy, as can certain participants who cannot generate their own savings, e.g. traders.

A sale price is set between two parties by mutual agreement after an initial negotiation. Then the "over the counter" or OTC exchange is then confirmed in an order signed by the two parties and sent to Locasystem asking for the transfer certificates between the two account holders. The Emmy website provides a running sale price or "**spot price" based on the average price of all ECSs** traded with a declared price between participants enrolled on the registry. However, in many cases, trans-operations on Emmy (which again is a registry and thus serves more as a bank than a market) do not declare the price and so the official spot price on the Emmy website may not reflect the actual market price.

Table 17: Monthly prices and volumes of ESC exchanged in 2014

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Average weighted price (c€/kWh cumac)	0,296	0,322	0,32	0,313	0,306	0,312	0,307	0,307	0,316	0,314	0,315	0,32
Average weighted volume (GWh cumac)	73	189	92	150	144	113	120	151	131	129	143	208
Total volume (TWh cumac)	3.5	8.1	4.9	6.1	5.5	5.8	6.5	2.4	6.7	6.3	8.9	20.2

(Source: Emmy - https://www.emmy.fr/front/accueil.jsf)

Nevertheless, this spot price is used throughout the market as a reference price – for official ESC trans-operations as are registered on Emmy, but also for other services such as the amount given as incentive for measures to beneficiaries or installers. All ESC transoperations must take place via Emmy but in some cases, individual declaration files can be traded

between parties prior to those measures being validated by the PNCEE (*see Partnership between obligated parties and third parties*). *Remark:* This kind of unofficial transoperation is similar to how the entire system works in the UK, where no official white certificates exist and third parties must provide obligated parties with the entire declaration for an operation in order to be compensated.

Timing and Bankability

When an operation is completed in the context of an ESC submission, the paperwork for that operation must be submitted within one year from the date when the installer and the beneficiary attest all works were completed. After the files are sent to the PNCEE and submission has been processed, the date when the operation is validated and ESCs are awarded to the obligated or eligible party's account on Emmy is considered the creation date for those ESCs. These ESCs are bankable, meaning that they **are valid, for the duration of the period in which they are issued, but also for the two following periods**. This prevents the energy efficiency services market from collapsing due to an obligation target being reached prior to the end of the period because it allows obligated and eligible parties to "bank" (i.e. stock) extra ESCs and use or trade them in the future. Banked ESCs can then be used by obligated parties to fulfill their obligation in one of the two periods after their creation, even if the measures for which they were awarded are no longer eligible under the new period.

Collective structures

As was mentioned previously, under the first period of the French ESC scheme, companies as "eligible" parties could request ESCs directly for qualified measures they supported. However, under the second period, companies lost the ability to be eligible parties under the scheme. This proved to be problematic to ESCOs who based their activity on servicing the ESC scheme and on smaller obligated companies like domestic heating oil suppliers who depended on service companies to manage their responsibilities under the scheme.

Under the scheme rules, individual obligated parties may transfer their obligation to another obligated party making that party legally and financially responsible for the fulfillment of that obligation.

Rather than forcing small suppliers to go to larger companies for assistance, the scheme also allows any suppliers who want to work together to collectively fulfil their total obligation, to create a collective structure. In order to form a structure, two or more obliged parties must agree to contractually transfer their individual obligations to the structure. By accepting such

a transfer, the collective structure becomes in effect a new obligated party, with an obligation equal to the sum of its creators' obligations.

Transfers are completed by the two parties involved notifying the DGEC.

Once created, the collective structure becomes a normal obligated party and any number of other obligated parties may contractually transfer their individual obligations to be held by the structure. It may also directly submit works for validation with the PNCEE and generate ESCs to use towards its obligation or sell to other obligated parties.

The collective structure cannot delegate its obligation to a third party.

In case of default from the collective structure, individual obligations return to each delegating party.

The flexibility that this policy allows under the scheme proves to be very useful for small domestic heating oil suppliers who did not have the resources to deal with their obligation by themselves as well as for ESCOs who are able to continue their participation under the scheme.

By the 30th January 2014, 34 collective structures were active. The list of collective structures at that date is available here: http://www.developpement-durable.gouv.fr/IMG/pdf/Liste_des_structures_collectives_au_30-01-2014.pdf

Today, collective structures generate one out of five ESCs under the French scheme.

Energy saving operation plans

At the beginning of the scheme, the amount of work implied by the necessity for the PNCEE to check all of the documents submitted for standard operations was overwhelming. In order to ease the demands on the PNCEE submission process, the DGEC introduced the possibility for obligated parties to use Energy Saving Operation Plans (PAEE) for similar Standard Operations.

The required contents and structure of individual PAEEs was established by the DGEC on 29 December 2010. To be approved, a PAEE must include:

- The **scope** of the plan: e.g. geographical distribution of the operations, predicted volumes, types of standard operations included, incentives given to beneficiaries or installers etc.;
- The **means**: i.e. all the documentation and systems used to ensure that the procedures defined in the PAEE are followed (e.g. supporting documentation to be submitted under the PAEE: templates for any declarations to be signed by the

beneficiary or the installer carrying out the work, various proofs of the operation and the materials used, technical documentation);

- A **quality** assurance program: i.e. a commitment by the entity applying for the PAEE to perform quality audits on any files submitted under their PAEE (these audits must be reported to the PNCEE by 31 March of each year).

The PNCEE examines individual PAEE requests and may request additional information. An approval decision is sent to the applicant within six months from the date on which it receives a full request by post, after which (if no reply is received) the request is deemed to have been refused.

Once approved, PAEEs help simplify the standard operation submission process for both obligated parties' and the PNCEE by accelerating the ESC awarding process. Technically, the PNCEE can then audit individual files submitted under a PAEE but this has been rare. Nevertheless, operations can still be submitted outside a PAEE but this means they will be subject to a full audit by the PNCEE. In addition, individual submissions (regardless of whether they are submitted via a PAEE or not) must include at least 20MW of savings to be accepted by the PNCEE.

Programs

In addition to standard and special operations qualifying for ESCs under the French scheme, obligated parties can receive ESCs for supporting (directly or indirectly) special "programs" that are designed to address a specific energy efficiency related issue.

Program proposals can either relate to:

(vii) Fuel poverty alleviation; or
(viii) Innovation, communication and training about energy efficiency (operations of this type can represent a maximum of 7.2% of the national obligation).

The full list of eligible programs is drawn up and published by the DGEC, following a call for proposals. The programs received following the 2012 call for proposals are available here (in French): http://www.developpement-durable.gouv.fr/1er-appel-a-projets-CEE-selection.html.

4.3 Results of EEO

The national registry Emmy collects data on the number of ESC generated by each obligated party, the type/number of operations declared, and the operations by region. The following graphs provide a breakdown of operations valorized under the scheme by.

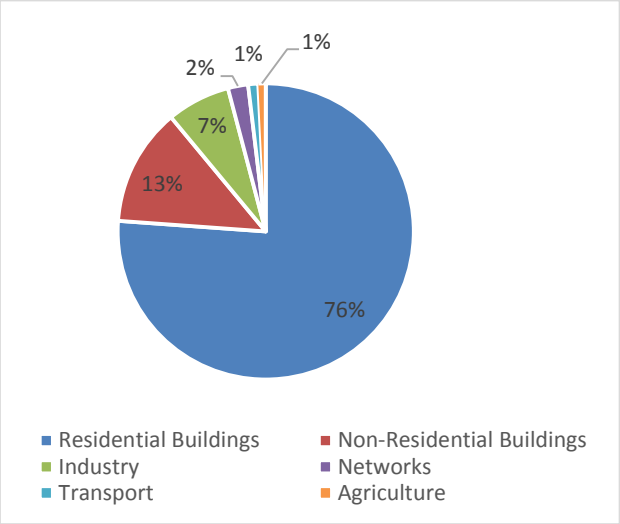


Figure 4: Breakdown of ESCs awarded by end-use sector (July 2006 - May 2014)

Source: MEDDE (French Ministry of Ecology, Sustainable Development and Energy)

Analysis of the data collected so far reveals that most ESCs are awarded for measures performed in the building sector. Most activity focuses on only a few standard operations, i.e. 10 standard measures account for 66% of all ESCs attributed thus far, 9 of which being for the building sector.

Overall, the scheme is accelerating in terms of number of projects performed each year. From July 2014 to July 2013, 14.8 TWh cumac were awarded on average each month, as compared to 8.75 TWh cumac per month the previous year (July 2012 to July 2013).

Between 2011 and 2014, 390 TWh cumac have been delivered, representing some 24 billion euros investments in energy efficiency and 2 billion euro of savings per year for consumers. Per sector, this represents:

- Residential sector:
  - 1 million of individual unit condensing boiler,
  - 480,000 wood-burning heating device installed,
  - 116,000 heat pumps,

- 260,000 m² / 50,000 dwellings equipped with solar panels in overseas French territory,
- 45 million of m² insulated (300,000 dwelling with either the roof or attic insulated and 125,000 with walls insulated)
- 3 million windows with insulating glass
- 25 million of A class light bulbs

- Tertiairy sector :
  - 20 million m² of roof insulated,
  - 87 kilomètres of hot water pipes insulated
- Industry sector :
  - 950 000 kW of engine power equipped with variable speed system and asynchronous motor
  - 330 000 kW of compressor power equipped with heat recovery system
- Agriculture : 2,5 million m² of greenhouses equipped with efficient heating systems and 6 million m² of greenhouses equipped with climate computers
- Public lighting: 250,000 lamps refurbished

4.3.1 Total costs[6]

Costs for obligated parties

Obligated parties prefer to keep their ESC scheme costs confidential, which makes the exercise of calculating such costs difficult as there is only limited knowledge of the actual costs of the scheme.

Market Estimates

[6] Data of this part are translated from the Report of the Cour des Comptes on the ESC scheme, from October 2013.

Using the reported market price from EMMY can help provide an estimate but again, this estimate will be very rough because most operations are done directly by the obligated parties themselves to fulfil their own target - meaning no ESC transoperation took place on EMMY for those operations. Moreover, the prices paid in transoperations are often unreported. All these reasons call for the utmost prudence when considering the market price.

Nevertheless, in spite of these limits and given no other reliable and transparent cost data exists, the average price throughout the 2nd period up through November 2014 , 0.372 euro cents/kWh cumac (3.72€/MWh cumac), is a first indicator of ESCs production costs. This average price is more than 5 times less than the penalty.

With an average actualized lifetime of 13.4 years over the 2nd period, this represent a cost of 49.8€/MWh.

By comparison, the energy prices paid by households in 2014 are close to 74€/MWh for natural gas and 140€/MWh for electricity, according to the Ministry for the Environment.

Regarding the costs to produce electricity, they go from 49.5€/MWh for nuclear production to 93.6€/MWh on average for renewables.

Academic Estimates

1st period costs:

Going beyond the reported market prices, in 2009, the French organizations ADEME and CIRED organized a workshop that brought together the main obligated parties (EDF, GDF and ECOFIOUL) with the Ministry for Environment so as to analyze the ESC scheme costs. This workshop concluded that the direct cost for obligated parties under the 1st period was 210M€ for 54 TWh cumac - corresponding to a unitary cost of 0.39 euro cents/kWh cumac.[7]

The study broke down these costs further to release that:

[7] These results were not validated nor questioned by obligated parties.

- 35% of the cost corresponded to direct costs, i.e. the financial support provided by the obligated party to the realization of the project (subsidy or "prime" to the beneficiary or the installer, subsidized loans, etc.),
- 65% of the costs were due to indirect costs, i.e. the internal or "back office" requirements for obligated parties complying with the scheme (networking, installers, communication, administrative management…).

2nd period costs:

The Cour des Comptes led a survey in 2013 that provided insights on the true costs supported by obligated parties. Their calculations estimated an average unitary cost to be slightly over 0.4 euro cents/kWh cumac. This discounts the costs reported by the largest obligated party, EDF, due to the significantly higher costs they reported.

The global result was an estimated cost of 1.4 billion euros to obligated parties for the 345 TWh cumac target – or **300 M€ per year.** Again, these figures are obtained by adjusting EDFs reported unitary cost to more closely represents the average unitary cost reported by other obligated parties.

For an average unitary cost of 0.4c€/kWh$_{cumac}$, incentives granted to beneficiaries represent some 0.3c€/kWh$_{cumac}$.

Indirect costs include both administrative costs and other costs, among which networking, partnership, information, communication… Administrative costs are thought to represent a maximum of 20% of global cost: 60M€/year for the 2nd period.

Evolution between the 1st and 2nd period

Since 2006, the average unitary cost remained quite stable, as a result of several factors:

- The 2nd period target was easily reached;
- Obligated parties from the 1st period have industrialized and improved their ESC collecting processes;
- New obligated parties (automotive fuel distributors) have introduced innovative collecting processes less expensive than the previous ones: while historic energy suppliers (EDF, GDF) chose to rely on large professional networks of installers in order to reach households, fuel distributors such as Carrefour and Auchan proposed primes directly through a website, primes that were actually purchase vouchers to be used in their supermarkets

For both period, these costs are far below the penalty (2c€/kWh cumac).

Costs for the scheme administration

The ESC scheme involves little administration costs for public authorities since the incentives distribution and advising is implemented by obligated parties. Only remains under their responsibility the strategic management and control of the scheme and the writing of all legislative text.

Within the Ministry for Environment, the PNAEE, in charge of the operational management of the scheme (processing of cases, approval of operation plans…), relies on 14 persons (11 operators, 2 managers and 1 secretary).

The Emmy register costs are entirely covered by those using the register, through:

- A fee for opening an account, set at €106
- Registration fees for ESCs proportional to the number of certificates in the account: €6.86 per GWh cumac in 2014.

Within ADEME, 3.5 full-time equivalents are dedicated to the ESC scheme. ADEME also annually finances studies and evaluations for a few hundred thousand euros.

ATEE receives subsidies from ADEME and the Ministry to finance its activities supporting the ESC scheme (workshops, conference, publications, working groups…) for amounts in the range of €70,000 – €80,000 per year.

Cost of the scheme for the public budget

Operations implemented in the residential sector, which represents over 75% of the ESCs attributed over the first two periods, are eligible to the Sustainable Development Tax Credit, a tax credit on income tax provided for households implementing energy efficiency measures.

Over the 1st period, the CIRED assessed that 64% of the total ESC scheme costs were supported by the State, through this tax credit, representing 1,305 M€ (69% of direct costs). In the meantime, the subsidies provided by energy suppliers represented less than 4% of the scheme direct cost.

When looking at the 10 most implemented standard operations (66% of ESCs attributed for standard operations), we can assess that around 52% of ESCs attributed for standard operations are related to measures eligible to the tax credit.

During the 2nd period, a study from ADEME assessed that less than 50% of measures[8] implemented in the residential sector within the frame of the ESC scheme and eligible to the tax credit had benefited from another incentive such as the tax credit.

In addition, the tax credit rates decreased noticeably between 2008 and 2011. Taking into account these new tax credit rates (between 20 and 30% on average) and the standard operations that probably benefitted from the tax credit, we can assume the State supported less than 5% of the direct costs resulting from the ESC scheme's 2nd period.

4.3.2 Total expenditures

1st period:

The CIRED/ADEME workshop mentioned above also looked at the investments costs supported by customers.

During the 1st period, customers invested some **1.8 billion euros** (of which 1.3 billion euros were reimbursed through the sustainable development tax credit), resulting in a 4.3 billion euros energy bill reduction over the lifetime of the measures.

2nd period:

There is no public evaluation available on the total expenditures resulting from the ESCs scheme's 2nd period.

During the discussions led in 2012 for preparing the scheme's 3rd period, ADEME assessed that within the residential sector, a target of 560 TWh cumac would lead to over 33 billion euros of investments.

8 These measures only concern main renovation work in the residential sector: wall and roof insulation, window replacement, condensing boiler, and independent wood-burning heating devices.

With the same order of magnitude in mind, we can assume that the 2nd period obligation (345 +115 TWh cumac) over 2011-2014 will lead to 27 billion euros of investments.

4.3.3 Total savings

So far, both the 1st and 2nd period obligation were easily met.

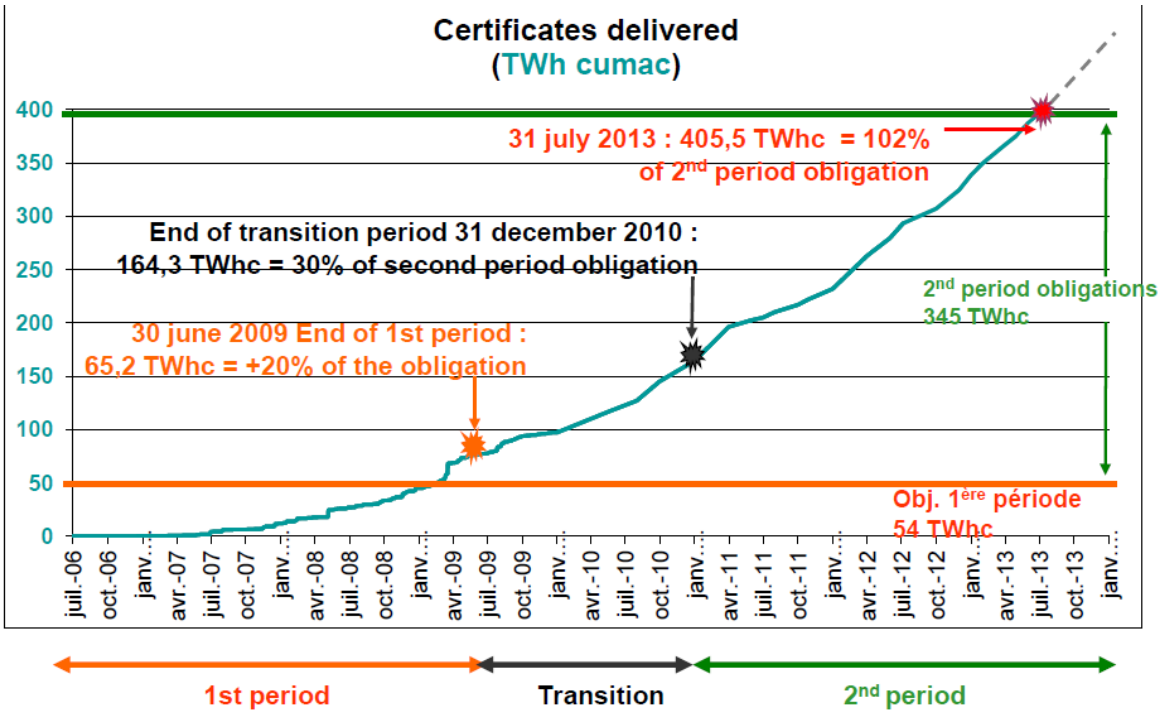


Figure 5: ESCs delivered between July 2006 and January 2014

Impact of the ESC scheme resulting from Standardized operation up to 31/12/2011:

ADEME has led several studies to assess the impact of the ESC scheme. The following results were obtained based on the energy savings resulting from Standardized operations and according to the deemed savings define in each operation's information sheet.

Table 18: Impact of the ESC scheme standardized operations up to 31/12/2011 (* 98% of ESCs delivered at that date)

ESC attributed to standardized operations	Energy savings between July 2006 and December 2011			Energy produced from RES	GHG emissions avoided
TWh cumac	**Total TWh**	**TWh elec**	**TWh fuel**	**TWh (thermal)**	**Mt_{eq} CO_2**
226.5*	31.9	6.7	25.2	3	8

Source: ADEME

According to this study, the ESC scheme permitted to save 31.9 TWh between July 2006 and December 2011, cumulating the impact of ESCs attributed each year and of those of ESCs attributed the previous years.

Extrapolated until the end of 2013, we obtained cumulated final energy **savings of 78.8 TWh and 19.9 Mt CO_2**. These represent:

- 10% of the annual consumption of the building sector;
- 20% of the annual emissions of the building sector.

Remark: the emission factors used to assess avoided emissions were those displayed within the French Base Carbone (http://www.basecarbone.fr/, over 7,000 emission factors available) which provides emission factors for all French actors wishing to assess their carbon footprint.

Regarding the evaluation of the windfall effect, the only data available so far come from a qualitative study launched by ADEME in 2013 and covering 4,400 households that benefited from the scheme for their refurbishment projects, with the following results:

- 75% consider that the ESCs have had an incentive effect,
- 95% think their energy bill went down,

More generally, this study shows that the ESCs scheme had an active role in multiplying the number of energy efficiency operations implemented and in pulling the market for energy refurbishment towards more efficient works.

4.3.4 Cost effectiveness

The ESC scheme was designed to be cost effective:

- It is based on a market mechanism and a large choice of standardized energy saving measures, among which obligated parties can chose to target their incentives towards the least expensive and/or the most profitable ones, regardless of the sector or energy considered; this allows a high level of flexibility and promotes cost effective investments.
- While obligated parties encourage their customers to save energy, they also enrich the content and added value of their customer relationship, and even for certain develop new activities/business models;
- Obligated parties that would not manage to fulfil their obligation at a reasonable cost can still pay the penalty.

This scheme also permits to limit the promotion, management and administrative costs by relying on a pre-existing channel: the relationship between a client and its energy supplier.

Still, the costs assessed for obligated parties and beneficiaries of the scheme are not negligible.

The 1st period

Table 19: Direct and indirect costs of the ESC scheme over the 1st period (2006-2009)

1st period	Direct costs (M€)	Indirect costs (M€)	TOTAL (M€)
Obligated parties	74 (4%)	136	210
Beneficiaries	504		504
Public cost **(through the tax credit)**	1,305		1,305
TOTAL investment costs	1,883	136	2,019

Source: Study ADEME-CIRED « costs and benefits of white certificates schemes », 2009

Moreover, the energy bill reduction for consumers is estimated around 4.32 billion euros for this period (calculated over a weighted average lifetime of the measures implemented during the first period).

Then, during the 1st period, the following cost-efficiency indicators can be considered:

- 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

With the savings and costs presented above, the following cost-efficiency indicators can be considered: 0.4 c€ spent per obligated parties per kWh cumac saved[9], 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.

4.3.5 Other stakeholders

Apart from the ESC scheme administrators and obligated parties, the scheme implementation relies on several stakeholders, involved either in its daily operation or in its redesign phase:

- Eligible parties such as local authorities, represented by their associations (AMORCE, FNCCR, AMF, ARF), social landlords and ANAH (National Agency for Housing) participate actively to the scheme, either by contracting with obligated parties or directly through the ESCs market. They also defend their interests and lobby for an ambitious and efficient scheme.
- Installer trade associations such as the CAPEB and FFB are tremendous stakeholders of the scheme since several obligated parties rely heavily on installers to promote energy savings and collect ESCs.
- Product manufacturer trade associations such as GIMELEC and UNICLIMA also follow closely the scheme evolution, since the creation or suppression of a standardized operation on one type of product can affect tremendously their members' business.

[9] Report from the Cour des Comptes, October 2013

- ESCOs, ESCO trade associations (FEDENE) and ESC consultancies (CERTINERGY, ALMA CONSULTING GROUP, CEELIUM, GEOPLC, ECONOMIE D'ENERGIE…) are more and more involved upstream and downstream ESC projects, for energy audit and energy consumption monitoring for instance, or in the implementation of operations leading to the attribution of ESCs.
- Consumer associations (Que Choisir, CLCV, 60 millions de consommateurs, FNE) and environment NGOs communicate on the scheme and fight for increasing its benefits for consumers and the environment. Their communication activities participate to the ESCs scheme promotion towards households, a scheme that households only started to get aware of during the 2nd period.

4.4 Adaptation of EEO

4.4.1 Frequency of redesign

The ESC scheme is typically organized into **3 year** periods and up to now, redesign has been discussed only at the end of each period. This organization has led to a kind of transition phase between periods, which provide the time needed to re-discuss the level of obligation and the characteristics of the scheme and put the political structure in place to account for any changes. However, to conform to the requirements of the European Energy Efficiency Directive, the upcoming 3rd was announced along with the 4th period, which will bring the ESC scheme through to 2020.

History of the Scheme

- **1st period: 1st July 2006 - 30th June 2009**

As was mentioned previously, the 1st Period of the French ESC scheme (2006-2009) was largely regarded as a trial period where obligated parties were given a low target (54 TWh cumac) so that they could acclimate to the system and build relationships with the various stakeholders needed to perform the necessary operations. In this first period, any company could generate ESCs and sellers of transportation fuels were not obligated. Again, it is important to bear in mind that all target volumes must be considered while taking into account that the final target will be based on the energy sales throughout that period and thus such values are merely estimates subject to recalculation at the end of each period.

The 1st period showed that, even with a low target, the ESC scheme was very complex to run, especially since it involved so many actors (all enterprises and local authorities being

eligible, over 2000 obligated parties). This diversity of applicants for ESCs and the number of requests received made it impossible for the administration to manage them within a reasonable period.

Given the success of the 1st Period, the French authorities decided to continue the scheme for a 2nd period. However, there were numerous changes needed and a new group of obliged parties to consider (transportation fuel wholesalers), which made the political implementation process very complicated and long. As a result, the authorities put in place a "transition period" where from June 2009 through December 2010, despite the lack of an official obligation, obliged and eligible parties from the 1st period could continue to generate ESCs in preparation for the expected obligations under the upcoming 2nd period.

- **2nd period: 1st January 2011 – 31th December 2013**

The "Grenelle" Act II, which served as the regulatory text defining the 2nd period, was finally passed in July 2010. This law put in place the 2nd period to start from January 2011 up to December 2013. It also established the fuel wholesalers as obligated parties with a small "introductory" obligation - in addition to an augmented target for the original 1st period obligated parties. It also ended (with immediate effect) the ability of companies to generate certificates on their own – creating the need for service companies to use the collective structure as a means to continue their participation as generators of ESCs under the scheme.

The major changes in the 2nd period included:

- A much higher target for the original obligated parties (255 TWh or 4.7 times greater than the obligation under the 1st period)
- New obligated parties (automotive fuel suppliers) with their own separate target of 90 TWh cumac to allow these companies time to learn the system
- New rules defining eligible parties – eliminating companies as eligible ESC generators under the 2nd period and leaving only certain organizations such as social landlords, local authorities, and the national housing renovation authority (ANAH) as eligible parties, to both limit the number of potential applicants to ESCs and channel the scheme financial supports towards dedicated targets: local authorities and social housing.
- A new requirement for obligated and eligible parties to prove their "active and leading role" in the decision by a beneficiary to engage in the energy saving operations prior to commencing the project being submitted for certification under the scheme, in order to reinforce the scheme additionality and limit free-rider effects.

- The PNCEE was created as a new authority to manage operation of the scheme – e.g. the control of submissions and the issuance of ESCs.
- The option of submitting operations via a PAEE (as explained previously) was added for obligated parties.
- A limit of 12 months for the declaration of works performed under the scheme to gain ESCs.
- In order to limit the number of requests received, a new minimum volume of 20 GWh cumac (up from a previous threshold of 1 GWh) for the total savings contained in an ESC declaration to the PNCEE of any measure type (both standard and special) regardless of whether the declaration is made within the context of a PAEE or not. Each obligated party is allowed one "Joker" declaration annually that can be less than the 20 GWh cumac thresholds.
- The introduction of programs that allow to finance, via the ESC scheme, dedicated operations such as building professional trainings or energy efficiency programs targeting fuel poor households.

At the end of the 2nd period, the details for next period had still not been worked out politically. As a result, rather than enter a second "transition" period, the government decided to extend the 2nd period by one year i.e. through December 2014. With this extension the authorities added 115 TWh cumac to the overall target to be achieved over the 4 years, which effectively maintained the same annual obligation level in 2014 as existed over the three previous years. Likewise, 30 TWh of the new 115 TWh were reserved for the new transport fuel wholesalers.

- **3rd period: 1st January 2015 – 31st December 2017**

The 3rd period was launched in January 2015 and will run until December 2017. Moreover, the 4th period has also been announced for 2018 to 2020. The energy saving targets for this 3rd period are even more ambitious than the precedent at approximately 700 TWh cumac. This is in part to comply with the EU Energy Efficiency Directive, but given that the goals surpass the amount required by EU regulation, the other reason is because the scheme has proved very successful at delivering energy savings. Also, the 3rd period represents the first time that the transport fuel wholesalers will be given an obligation on par with the rest of the obliged parties – which makes those obligated parties some of the largest by volume under the 3rd period with 48% of the overall target.

4.4.2 Reasons of redesign

The original goal of the ESC scheme was to obligate energy companies to engage their customers in pursuing opportunities to save energy, while achieving those savings in the most cost-effective way. Thus when the scheme was first introduced, the goal was one of acclimating the energy companies to the scheme and not of achieving significant savings. Rather the level of the scheme's ambition would adapt to the stakeholder's level of experience – increasing only once all stakeholders understood and had provided feedback on the scheme.

There are many reasons that lead to changes and redesign when building the next iteration of an EEO. Specifically, for the ESC scheme, these changes can come from several key areas:

- Energy efficiency policy objectives:
    - Ensuring that the national energy savings objectives are met by reviewing results from previous years/periods
    - Adapting to regulatory evolutions at the national (e.g. Grenelle) and European level (e.g. EU Energy Efficiency Directive of 2012) by improving reporting standards, monitoring requirements, etc.
    - Addressing all energy use by targeting new/complex energy use sectors (e.g. transport)
- Secondary policy goals:
    - Addressing fuel poverty by introducing special funding and training programs targeting poor households who would not have otherwise benefited from the scheme due to economic barriers
    - Driving sustainable economic activity in the building sector by increasing demand for renovation works and maintaining that demand
    - Driving improvements in the technology sector and lowering prices by increasing demand for best available technologies
    - Creating financial value for the energy efficiency measures implemented by local authorities and social housing actors.
- Administrative process complexity and cost management:
    - Increase the processing speed for submissions for ESCs by standardizing documentation and streamlining declaration processes
    - Decrease the costs borne by the administration in treating and verifying submissions by setting minimum declaration amounts, pre-validating quality

policies, and limiting the eligible parties who can interact with the scheme authorities (i.e. requesting ESCs from the PNCEE)

- Encourage efficiency in the market by allowing obligated and eligible parties to seek assistance from third parties in completing their obligation or declaring projects they have supported.

- Technical changes and improvements:
  - Incorporating new technologies into the scheme
  - Removing support for technologies that become standard/non-additional

Due to the significant impacts changes can have on stakeholders, these redesigning phases result in large consultation periods with all stakeholders – hence the importance of groups like the ATEE mentioned previously. These policy design phases usually require a long time because they demand in-depth policy evaluations for the previous period, broad discussions between stakeholders and obligated parties, at the end, political decisions at multiple levels within the government.

4.4.3 Manageability

The French ESC scheme recognized from the beginning a need to compensate a wide range of energy saving measures so as to avoid a narrow focus on measures that yielded high short-term savings that disadvantages technologies such as insulation that take longer to pay off. As explained above, the French ESC scheme savings calculation is based on the lifetime savings of each measure with a 4% discount rate to account for reduced efficiency/value over time. This helps maintain liquidity in the market by somewhat equalizing the savings potential between different measures.

In addition to the lifetime considerations built into the French scheme, it is important to consider the bonus coefficient (mentioned earlier in this report) afforded for the implementation of certain priority measures, e.g.:

- Savings measures deployed within the context of comprehensive refurbishment/energy efficiency approach (energy management system, energy performance contracts…);
- Savings measures deployed in zones which are not interconnected to the metropolitan electricity network (e.g. the islands of Corsica, Molène, Ouessant, and Sein, as well as French territory overseas).

These additional incentives take into account and reward more intangible operations such as energy operation plans as well as more expensive and polluting energy sources – such as electricity consumed in small off-grid or island communities which tends to be generated using petroleum fuel.

4.5 Social equity

4.5.1 Contributors

As explained earlier, the ESC scheme implementation relies on several contributors:

- **Obligated parties** promotes energy savings and provide incentives (reduced interest rates on loans for efficient equipment, direct subsidies, coupons). As a result of their entry into the scheme under the 2nd period, transportation fuel companies were forced to be creative in their efforts to encourage customers they could access to engage in savings operations. One technic was to partner with supermarkets, who often sell transportation fuel to their customers at their various retail locations. The result was incentive programs that would give either store credit or cash for operations declared via the supermarket – typically using a designated web portal. This has served as an effective means of communicating about the scheme and this technique is now being adopted by home improvement stores who offer similar store credit or cash back schemes to customers declaring energy savings with them and in parallel promoting their energy efficient products and installation services.
- **Beneficiaries** such as households, enterprises, social landlords or local authorities, support a large part of investment costs and contribute to financing the scheme through their energy bills.
- The **State** also supports a significant part of investment costs:
    - Businesses and industrial operations are supported by government "green" loans, which provide additional incentive to certain particularly interesting savings operations.
    - The main support provided goes to households and comes in the form of tax relief or zero interest loans for investments in energy efficiency renovations. The "sustainable development tax credit" can cover up to 30% of certain qualifying investments (not all operations eligible for ESCs qualify for tax credits). Otherwise, individuals can also elect to take out a zero-interest loan to complete the renovations, which they can then pay back over time while benefiting from the cost savings gained in the renovation.

In the residential sector, state incentives have typically served as the primary motivation for beneficiaries because the support from ESCs was fairly small in comparison (representing closer to 5% of the installation costs vs. 15-30% from the loans/tax incentives). Prior to the arrival of individual websites that now offer individuals direct access to ESCs for projects they declare themselves, the role of completing the necessary documentation sat with installers – who as a result received a more direct benefit from ESCs. In the short-term, the subsidy from ESCs would end up as a bonus paid to the installer that he might or might not share with the customer.

However, over time, the incentive to perform such projects has driven up competitively between **installers and equipment distributors/manufacturers** and thus led to price decreases for common installations such as high efficiency gas boilers and insulation. As such, ESCs also serve as an incentive for installers to promote efficient technologies and their eligibility for government support (loans or tax credits). Increased knowledge of the scheme has led many installers and manufacturers to promote the ESCs, along with additional "eco" reductions directly on the invoice for eligible installations.

- Being **eligible** under the scheme allows **social landlords, local authorities, and social housing authorities** to provide advising, networking and/or financial support for energy refurbishment.

4.5.2 Beneficiaries

The ESC scheme was initially designed to benefit to all energy end-users (households, local authorities and enterprises of all sector activities) through their energy suppliers. However, in practice, the ESC scheme mainly benefits to households who account for 80% of ESCs awarded under the scheme, as compared to tertiary buildings at 10% or the industrial sector at 6%.

The adoption of "programs" under the 2nd period allow for targeted campaigns to improve energy efficiency for certain types of difficult to target beneficiaries – for example fuel poor families. Programs such as Habiter Mieux (Live Better) and the Pacte Energie Solidarité (Energy Assistance Promise) use the money gained from ESCs to fund efficiency projects in low-income homes while asking for little or no monetary contribution from the residents. The participating manufacturers in such programs also provide materials at a reduced price. Other efforts include campaigns like SoliNergy that use proceeds from ESCs to fund proposals selected from organizations and associations that apply to conduct various education or communication efforts to help individuals in energy poverty to better address

their situation and engage in energy saving behaviors. Contributions to such approved efforts qualify as tax-deductible charitable donations.

However, they were no minimum obligation to fulfill through these programs, usually more expensive to implement for obligated parties than standardized or special operations, and less than 2% of the ESCs attributed so far have contributed to such programs.

4.5.3 Impact on energy prices or tariffs

The scheme's impacts on energy prices are difficult to measure due to a complex regulatory structure. While for many of the smaller obligated parties and even for the larger transportation fuel wholesalers, the costs from generating ESCs can be passed directly on to their customers (though this was not quite noticeable, especially in comparison with the high fluctuation of oil prices), the situation is more complicated for regulated energy providers like EDF and GDF whose main electricity and gas prices are controlled by the State. According to a report released by Cour des Comptes (the French Chamber of Commerce) using data from the CRE (the French Energy Regulatory Commission), the direct cost of ESCs to obligated parties under the 2nd period is €300 million per year. Using the costs reported by EDF, which are higher than those typically reported by other ESC generators, the impact on their regulated electricity price according to CRE remains slight representing a mere 1% of the price charged to customers. For gas from GDF, this is even smaller, at 0.5% according to the CRE[10].

Again, transportation fuel wholesalers are free to pass their costs on to prices but their obligation under the 2nd period was minimal, which would suggest that the impact of ESC generation under the 2nd period should also be negligent. Under the 3rd period where they will be held accountable for a share of the obligation that truly represents their contribution to French energy supplies – this cost could be more significant. According to Jean-Louis

[10] http://www.lemoniteur.fr/137-energie/article/actualite/22599457-certificats-d-economie-d-energie-utiles-pour-la-renovation-energetique-pas-une-fin-en-soi

Schilansky of UFIP (the French Petroleum Trade Association)[11], ESCs should represent 2.7 cents per liter of diesel purchased at the pump in 2016 – diesel fuel being the main transportation fuel consumed in France. This is in comparison to an estimated impact of 4 cents per liter in 2016 from the carbon tax introduced in 2014.

4.6 Lessons learned and what can be improved?

4.6.1 Areas for improvement

After 2 three-year periods of obligation, numerous studies were led, partly to prepare the 3rd period. These studies and the numerous discussions between the scheme stakeholders permit to identify the following areas of improvement:

- So far, no quantitative ex-post evaluation was run on the ESC scheme, meaning we have no concrete knowledge on the actual savings triggered by the scheme. A goal of the next period could be to better evaluate the actual impact of the ESC scheme. At the same time, the catalogue of standard actions will need to be regularly updated and entirely revised every three years to take into account these evaluation feedbacks but also technological progress and regulatory evolutions.
- In order to ensure an appropriate level of quality for the refurbishment work implemented, the building professional training (FEEBAT program) will have to be continued on the middle term and the principle of “eco-conditionality” based on the RGE label will have to be extended to the ESC scheme.
- All stakeholders agreed that the ESC scheme administrative management is too complicated and requires a lot of simplifications to make the ECS request process more efficient. A declarative and dematerialized system based on standardized

[11] http://www.lefigaro.fr/flash-eco/2014/02/05/97002-20140205FILWWW00194-carburantles-prix-vont-fortement-augmenter.php

documents and with ex-post controls would significantly lighten the administrative charge on both obligated parties and the PNCEE.

- The ESC scheme is still quite unknown or misunderstood. It is then key to improve the communication around the scheme towards all its potential beneficiaries, for instance households. To this end, it seems appropriate to make the ESC scheme coherent with the other existing scheme such as the Sustainable Development Tax credit or the zero rate eco-loan, for instance regarding eligible technologies. This will be true from January 2015, within the frame of the ESC scheme 3rd period.
- Unlike other European obligation schemes such as the UK's, the French ESC scheme did not deliver lots of support to fuel poor households. Channelling a part of the energy efficiency obligation towards this specific target could be an improvement of the scheme for the 3rd period; the ESC scheme is well designed to reach fuel poor households since energy suppliers are in direct contact with them.
- So far, the French scheme is one of the few targeting energy savings in the transport sector. Over the first two periods, this relied first on introducing standardized operations in the transport sector, and second in making fuel automotive distributors obligated parties. Over the 3rd period, operations in the transport sector could be developed through new standardized operations and programs, for instance targeting modal shift.
- The current operation of the Emmy register would require more transparency and security around ESC transactions, for instance by separating the activities of registration of ESCs and the transaction management.

4.6.2 Strong characteristics

The French Energy Saving Scheme is one of the few that targets all energy consuming sectors, including Transport or Agriculture. If the building and industry sector have gathered most of the ESCs delivered so far, these two sectors show interesting growth regarding the numbers of standard operations available and ECS attributed, especially over the last couple of years.

Since the 2nd period (2011-2013), this scheme is also one of the few that obliges suppliers of automotive fuel to achieve energy savings. In the 3rd period, because of the tremendous importance of oil sales in France and of the link between energy sales and obligation, these automotive fuel wholesalers represent the biggest share of the obligation. Including them in the scope of the EEO then allows targeting a much more ambitious objective, while

increasing the concurrence between obligated parties and the diversity of offers and business models developed to reach the final consumers.

The French scheme also relies on eligible parties: local authorities, ANAH (National Agency for Housing) and providers of social housing. This restricted eligibility allows these key actors of energy efficiency in public buildings and social housing to finance a share of the large investments they implement for their patrimony and people through the ESC scheme. It also creates the conditions for an exchange of ESCs between obligated and non-obligated parties.

Programs are a true specificity of the French scheme. In parallel with standard and special operations, the ESC scheme allows valuing actions dedicated to information, training and innovation and action dedicated to alleviating fuel poverty. The first ones do not trigger direct energy savings but are prerequisite, for instance in order to change behaviours through information or to ensure an adequate quality of work through trainings. Fuel poverty programs do generate energy savings. However, since this particular target group requires a high level of subsidy, they are financially attractive for obligated parties. The ESC scheme then gives bonus for financial support granted to fuel poverty programs. Both information/training/innovation and fuel poverty programs are meant for all final consumers to make the most of the ESC scheme.

Another strong characteristic of this scheme is its original set up, which includes the Ministry, ADEME and ATEE (representing obligated parties) in the scheme's governance. Each new period of the scheme is prepared and discussed for months with all the scheme's stakeholders through a website, dedicated meetings and an open consultation. At the beginning and during each period, ADEME and ATEE organize several events, such as regional and national workshops, in order for all actors to exchange on the scheme features and share good practices and future prospects.

Finally, the catalogue of standardized operations listing 304 best practices in terms of energy efficiency measures and the savings that can be expected from these measures is a strong characteristic of the French ESC scheme. It has proven to be easy to implement, cost-efficient and flexible regarding the scheme needs for evolution.

5 Italy

The Italian white certificates scheme (WhC) was introduced by the Ministerial Decrees D.M. 24 aprile 2001[12] in connection to the laws related to the electricity and gas market liberalization that requested a policy measure for DSOs to implement energy efficiency projects.

Since the beginning the idea was to consider all the energy efficiency technologies (apart from the improvement of the energy performance for electric power plants) and all the sectors (industry, services, transport, agriculture, and residential). Two other key elements were the willingness to develop the ESCO model, by allowing ESCOs to play as voluntary parties, and the presence of a tradable market.

The difficulties in setting up such an innovative scheme delayed the effective start-up of the scheme, which took place in 2005, according the D.M. 20 luglio 2004 decrees. The first phase was characterised by an excess of certificates, determined by the large number of deemed saving projects presented, mainly linked with CFL lamps and aerators. This suggested a target revision starting from 2008 (due to D.M. 21 dicembre 2007 that also introduced end-user companies with an appointed energy manager as voluntary parties). The second phase was dominated by a scarcity of white certificates, due to the progressive reduction of the additionality of measures like CFL lamps and aerators and the insufficient contribution from other deemed saving projects combined with the steady but slow growth of monitoring plans projects. This suggested in 2011 the introduction of the *tau* coefficient – a multiplier that takes into account not only the yearly savings for the first five year of the project, but also the savings related to its technical life[13] – in order to stimulate the participation of ESCOs and large end-user companies to the WhC scheme. The last phase, regulated till now

[12] Some abbreviations used for the Italian regulation: D.Lgs. Legislative decree (a parliamentary act), D.L. Law decree (a governmental act that need to be converted in a law to remain valid after 60 days), D.M. ministerial decree (a ministerial act that implements some legislative act).

[13] Usually WhC are given for the first five years of the project. The exception are the projects related to the building envelope (8 years) and high efficiency cogeneration (10 years).

by D.M. 28 dicembre 2012, is characterized by a situation of equilibrium or slight excess of certificates and, more than this, by a predominance (above 80% in terms of issued certificates) of monitoring plan projects in the industrial sector. A new regulation shall enter into force in 2015, to keep into account the development of the market and of European legislation (e.g. the effect on the scheme of the European guidelines on state-aids).

Considering the effective start-up in 2004, the WhC scheme has been in place for ten years and a lot of experience has been gathered. The Italian scheme shows that such type of EEO scheme can work even including all sector and all technologies and aiming at covering around 60% of the 2020 energy efficiency target. Deemed saving projects are important in the first phase, whereas monitoring plans and more structured projects become fundamental when the targets start to increase. A side effect of this is the availability of measured and monitored savings and the collection of useful information about the development of industrial processes[14].

The following chapters explain in detail how the scheme works. In order to simplify the document and to make it easily readable, here a synthetic glossary is provided, together with the role of the main involved stakeholders:

- EEO (energy efficiency obligation): policy scheme that provide energy efficiency or energy saving mandatory targets for a certain category of operators or end-users (usually DSOs or energy traders).
- WhC (white certificates): in this report this acronym both refers to the scheme in general and to the issued certificates.
- Obliged DSO (distributed system operator): an electricity or gas distributor with more than 50,000 end-users.
- ESCO (energy service company): energy service company that offers energy services with energy performance contracting and third party financing in line with the

[14] That is because monitoring plans requires that the proponents give a thorough description of the implemented projects.

definition of 2012/27/EU directive, but also energy service provider or energy consultancy firm.

- EMCO (company with energy manager): end-user organization – usually of medium or large dimensions – with an appointed energy manager[15], which is allowed to present projects and obtain WhC without the intervention of a DSO or an ESP.
- MiSE: Ministry of economic development, in charge of the definition of the scheme rules.
- AEEGSI (Autorità per l'energia elettrica, il gas e i servizi idrici): Italian Regulatory Authority for Electricity, gas and water services that defines the rules for allowing DSOs to recover part of the costs needed to purchase certificates through the electricity and gas tariffs and applies penalty in case of non conformities;
- GSE (Gestore dei servizi energetici): state-owned company that promotes and supports renewable energy sources in Italy. Since 2013 it also operatively manages the WhC scheme.
- GME (Gestore dei mercati energetici): state-owned company that manages the Italian Power Exchange and the Emission Trading, Green Certificates and WhC markets.
- ENEA (Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile): public agency that within the WhC scheme supports GSE in the evaluation of energy efficiency projects and is in charge of information activities.
- RSE (Ricerca sul sistema energetico): the state-owned company that within the WhC scheme supports GSE in the evaluation of energy efficiency projects.
- FIRE (Italian federation for the rational use of energy): private non profit association that promotes energy efficiency and manages the Italian energy manager network on behalf of MiSE.

[15] In Italy an obligation to appoint an energy manager exist for industries with an annual consumption higher than 10,000 toe as primary energy and for other organizations with a consumption higher than 1,000 toe.

- DSP: deemed savings projects (“progetti standard”).
- SMP: simplified monitoring projects (“progetti analitici”).
- MPP: monitoring plans projects (“progetti a consuntivo).
- PPPM: monitoring plan project proposal (it is the proposal by which proponents require the approval of a monitoring plan project; if accepted it is followed by an RVC).
- RVC: request for verification and certification of savings (it is the proposal by which proponents apply for obtaining WhC through deemed saving, simplified monitoring plans, or monitoring plans with an approved PPPM).

5.1 Policy objectives of EEO

The main target of the Italian WhC scheme is the reduction of primary energy consumption through the implementation of energy efficiency projects. This is ensured by means of national targets that are split among the obliged DSOs and that increase over time, as illustrated in Figure 6.

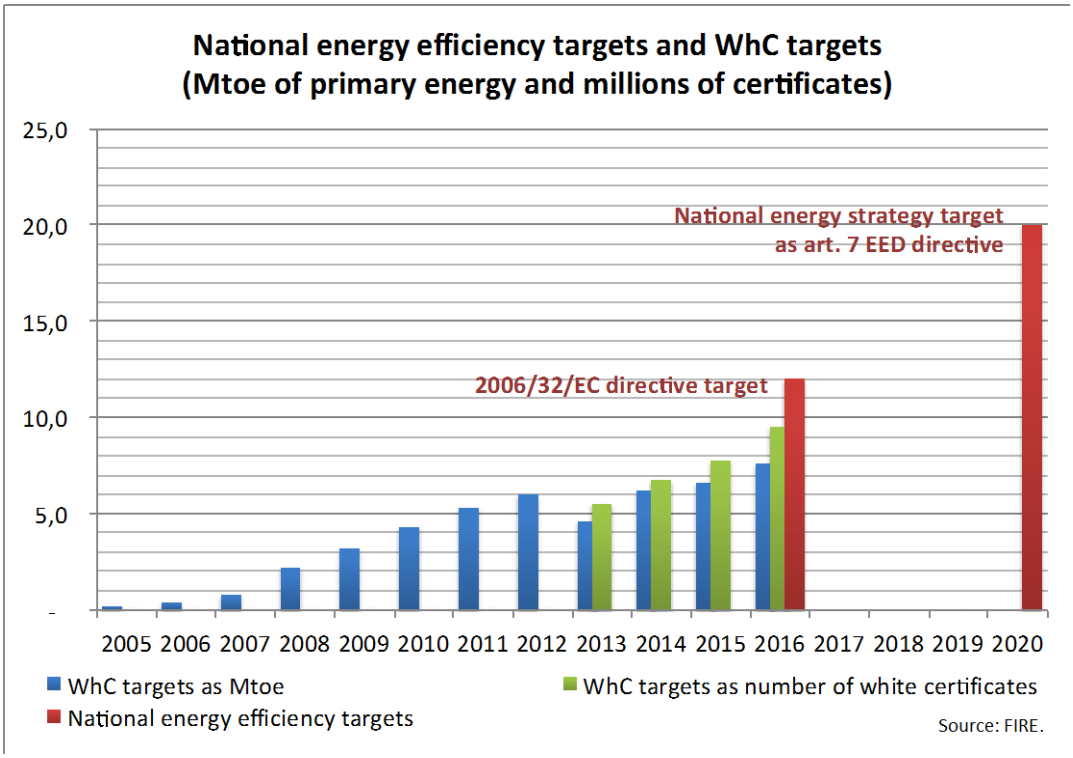


Figure 6: National WhC primary energy saving targets (in toe) VS 2016 and 2020 national targets

The national notification of the methodology on the application of art. 7 of the EED directive indicates that at least 60% of the energy efficiency target has to be reached by means of the WhC scheme.

Other co-benefits related to the implementation of the WhC scheme and sought through the WhC mechanism rules are:

- the development of the ESCOs market and the improvement of the role of energy managers;
- an effective accountability system for energy savings at national level.

5.2 Design of EEO

5.2.1 Type of 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.

As the following figures shows DSOs are the obliged parties and should present each year within the 31st of May a number of certificates consistent with their previous year targets. They can either obtain directly the certificates by presenting energy efficiency projects implemented among their assets or an end-user, or buy certificates from a market platform hosted and managed by GME[16].

Figure 7: Basic Italian WhC schematics.

Source: FIRE

All type of energy efficiency measures, apart from the improvement of energy efficiency in power plants, and all sectors are covered. The energy efficiency projects can be implemented among all end-users and energy efficiency measures realized among different users can be joined together in order to reach the minimum thresholds of 20, 40, and 60 toe (for deemed savings, simplified monitoring plans, and monitoring plans, respectively)[17].

[16] Both a spot market and a bilateral platform are available.
[17] These thresholds were introduced to limit the administrative costs related to the evaluation and verification activities.

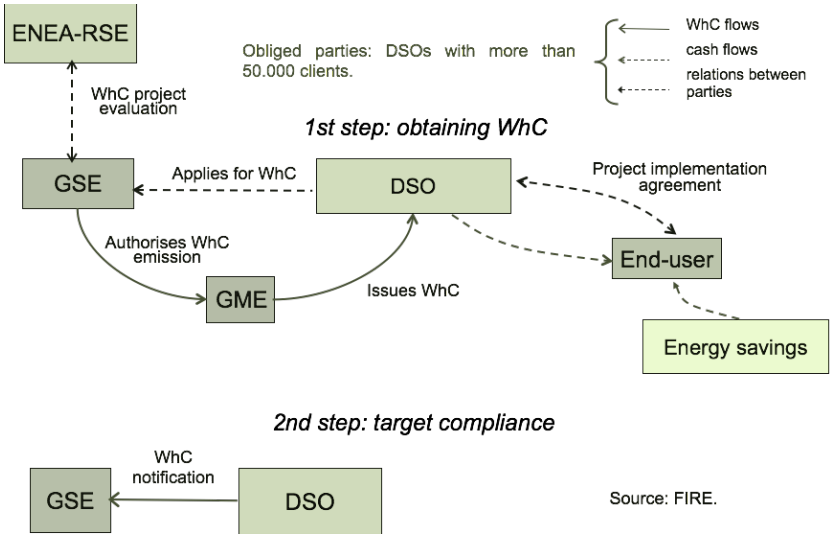


Figure 8: WhC scheme with obliged parties as project proponent.

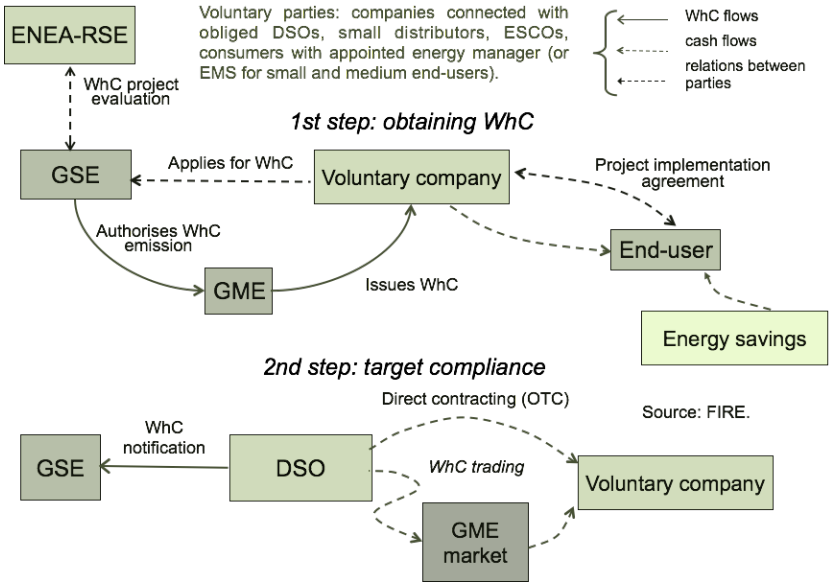


Figure 9: WhC scheme with voluntary parties as project proponent

Obliged parties are DSOs with more than 50,000 users connected to their grid. Targets are split among them year by year depending on their distributed energy with respect to the total distributed energy.

Voluntary parties are:

- Companies and public administrations with an appointed energy manager as requested by law 10/1991[18];
- Companies and public administrations with a voluntary appointed energy manager[19] (EMCOs);
- Companies and public administrations with an ISO 50001 energy management system;
- ESCOs, energy service company that offers energy services with energy performance contracting and third party financing in line with the definition of 2012/27/EU directive, but also energy service provider or energy consultancy firm (starting from July 2016 all the companies shall be certified according to the Italian standard UNI CEI 11352 for the certification of ESCO);
- DSOs with less than 50,000 users;
- Companies controlled or linked to obliged DSOs (e.g. same corporate ESCOs or traders).

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%).

[18] Industrial companies with a yearly primary energy consumption higher than 10,000 toe and companies in the other sectors with a yearly primary energy consumption higher than 1,000 toe have to appoint an energy manager each year according to law 10/1991. FIRE is in charge of managing their network.

[19] Since 2013 end-user companies that are not covered by the obligation of law 10/1991 can participate to the scheme as voluntary parties provided they appoint an energy manager with the same rules of companies obliged by law 10/1991.

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.

The trading can be done through the GME spot market, which is usually held once a week, or through bilateral contracts registered on the GME's platform. The spot market works like any exchange: certificates owners place offers (price per quantity) and if there are buyers that accept the offers the transactions are concluded. Everything is transparent and the process ensures that the WhC suppliers are paid almost immediately. The bilateral contracts platform allow WhC suppliers and buyers to finalize transactions that have been contracted previously by the two parties. Prices are not publicly available, but GME publics monthly reports with aggregated prices breakdown by price intervals and quantities. Bilateral contracts offer the flexibility to ensure to WhC suppliers a price for all the five years, eventually indexed to the spot market trend, and is particularly interesting for large quantities. During the years the basic ratio between WhC exchange through the spot and the bilateral platforms has varied between 1:1 and 1:3.

The following figure shows the trend of WhC price on the spot market. The average prices on the bilateral platform are slightly lower, due to some transactions at price zero between DSOs and their ESCOs[20].

[20] Bilateral contracts' prices are public in Italy as aggregates divided by price ranges (i.e. number of transactions in the 0-10 euro, 10-20 euro, 20-30 euro, etc. intervals). Some transactions between companies under the same parent company are at 0 euro.

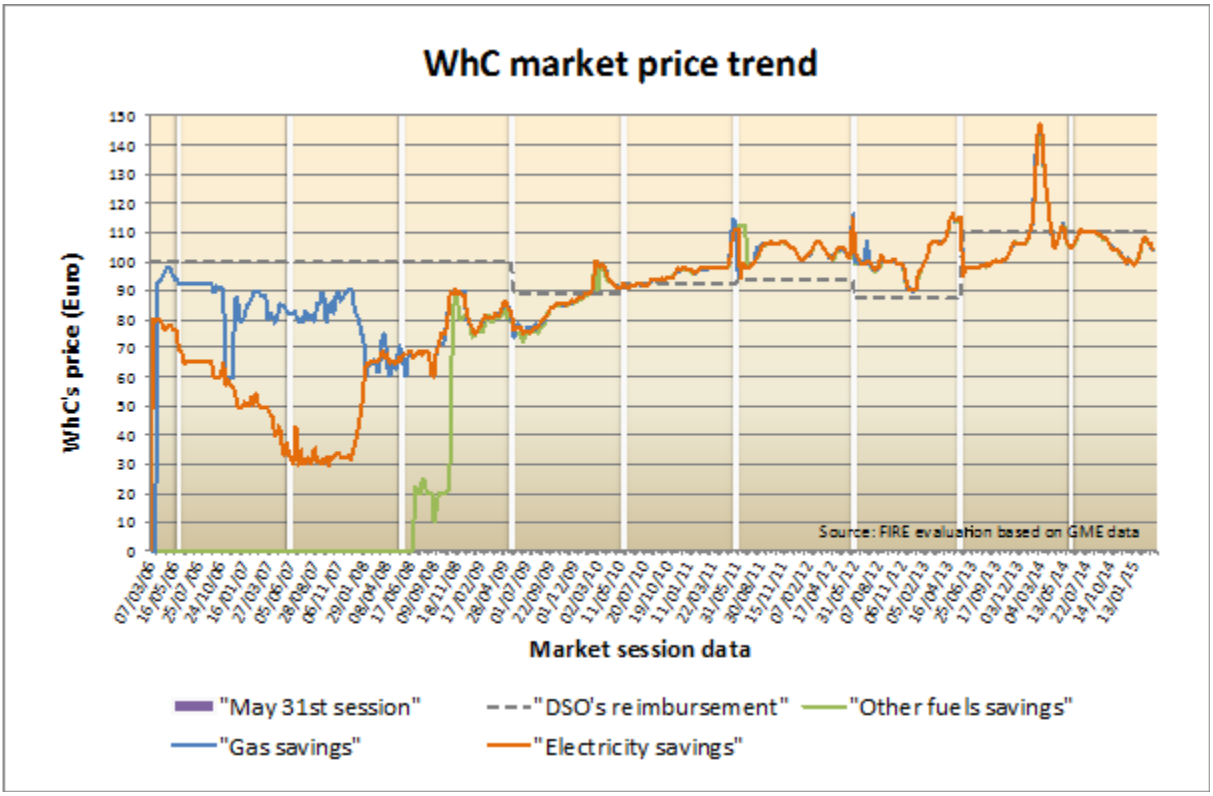


Figure 10: WhC spot price[21].

5.2.2 Scope - sector related

Almost every project involving an improved efficiency in the final consumption of energy is eligible under the scheme – from boilers to lighting systems, from solar thermal to cogeneration, from electric motors to industrial process projects – with the exception of

[21] Type I, II, and III refer respectively to electricity, natural gas, and other fuels savings. Presently this differentiation exist due to differences in the allocation of costs among electricity and gas tariffs. In 2005-2007 there was also a price difference due to the obligation for electricity (gas) DSOs to produce at least 50% of the savings from electricity (gas), a request eliminated by D.M. 21 dicembre 2007 since it produced only a penalization for the gas DSOs, which had to buy certificates on the market at a higher price (type I certificates were cheaper due to the large availability of low pay-back time electrical projects, such as CFL lamps).

projects aimed at increasing efficiency in electricity generation. So all the sectors can be involved: residential sector, service sector, industrial sector, agriculture, transports.

In 2013 around 95% of the certificates due to new projects has been related to energy efficiency in the industrial sector.

During the first two phases of the scheme most of the projects were related to the residential and service sectors, due to the predominance of deemed saving and simplified monitoring plan projects, and in particular of CFL and high efficiency public lighting lamps, aerators, condensing boilers, and district heating.

The following figure show the recent evolution of WhC related to the different sectors (previous data are not shown due both to a different breakdown methodology and to the introduction of the *tau* coefficient).

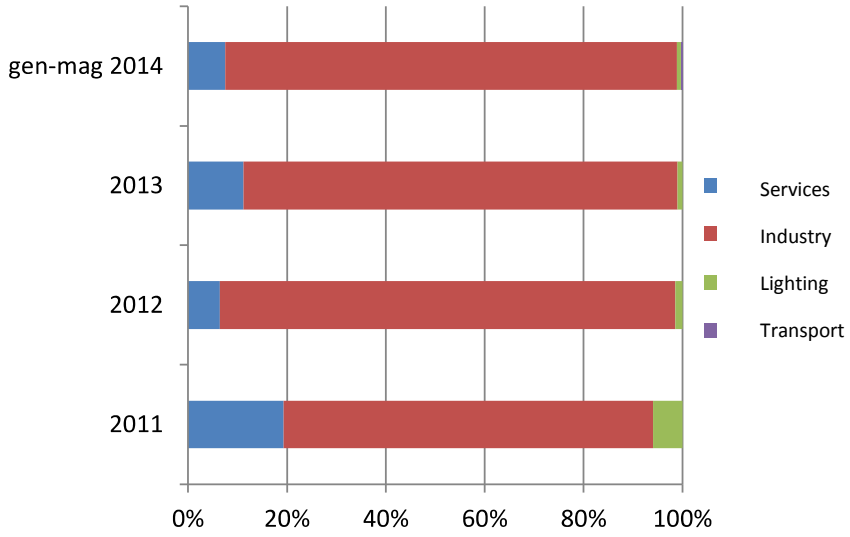


Figure 11: Breakdown of WhC per sector.

Source: AEEGSI

Going more in detail about industrial projects, Figure 12 shows that among EMCOs the steel industry is the larger one in terms of expected savings. It is worth noticing that 92% of the 278 ktoe are linked to nine large PPPM projects presented by one proponent.

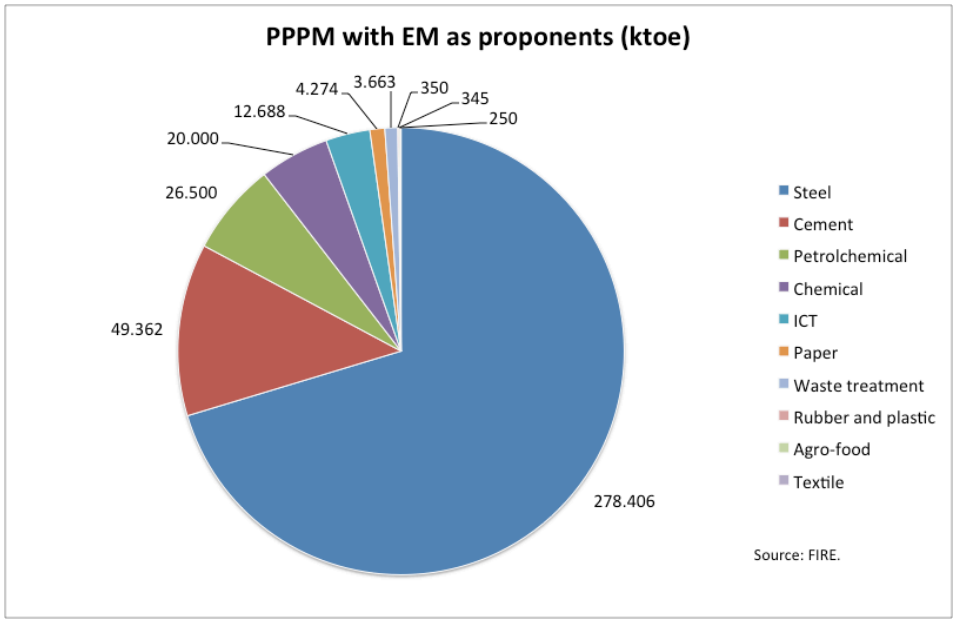


Figure 12: PPPM with company with energy manager as proponents (ktoe).

Source: FIRE on ENEA data 2005-2012.

5.2.3 Scope - technology related

All technologies that ensures an increase in energy efficiency can obtain WhC, provided they respect the additionality requirements discussed in the dedicated chapter. The only exception is related to energy efficiency improvements in power plants without high efficiency cogeneration. Table 20 illustrates the issued certificates for available deemed saving files[22].

[22] CFLs and other technologies that played a big role in the first years are not covered, since they are not available anymore together with many other files; as a reference, by 31st May 2011 almost 5 million cumulated toe for CFLs and over 1 million cumulated toe for aerators and low flow shower taps kits had been issued.

Table 20: Available deemed saving files breakdown.

File #	Technology	Available since	Issued WhC	% on the total
2T	Electric DHW boiler -> gas DHW boiler	January 2005	1,183	0,1 %
3T	High efficiency boilers	January 2005	169,628	17 %
4T	Gas DHW boiler -> high efficiency gas DHW boiler	January 2005	5,743	1 %
5T	Double glazed windows	January 2005	115,718	11 %
6T	Walls and roof insulation	January 2005	240,064	24 %
7T	Photovoltaic	January 2005	12,046	1 %
8T	Solar thermal for DHW	January 2005	334,015	33 %
9T	VSD electric engines for industrial pumping systems	January 2005	5,247	1 %
15T	Air to air domestic heat pumps	January 2005	684	0,1 %
17T	Public lighting control systems	May 2005	58,348	6 %
19T	Air conditioners < 12kW$_f$	May 2005	5,428	1 %
20T	Walls and roof insulation for cooling	May 2005	16,022	2 %
27T	Heat pumps for DHW	January 2011	372	0,1 %
28	High efficiency tunnels' lighting	July 2011	8,707	1 %
29a	High efficiency public lighting	July 2011	7,565	1 %
29b	High efficiency lamps for public lighting	July 2011	30,823	3 %
30	High efficiency electric motors	January 2005	3,250	0,3 %
36	UPS systems	April 2013	2,315	0,2 %
37	Biomass powered boilers	April 2013	1,590	0,2 %
39	Insulation for greenhouses	April 2013	8	0,1 %
40	Biomass heating for greenhouses	April 2013	232	0,1 %

Source: FIRE.

Considering monitoring plan projects, the sector breakdown (Figure 13) shows a wide application, with all the energy intensive sectors represented. Petrochemical, building materials and agro-food are characterised by larger project sizes.

The technology breakdown shows an homogeneous situation, with most of the available solutions presented. Energy efficiency involving heat consumption tends to have a larger project size, as it can be expected.

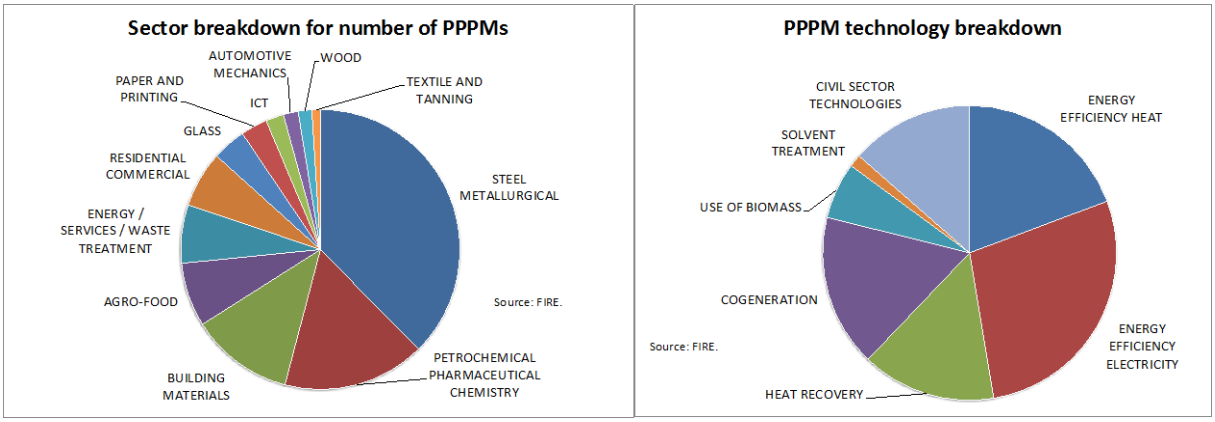


Figure 13: Sector and technology breakdown in terms of presented PPPMs.

Source: FIRE on ENEA data 2005-2012

Figure 14 shows the breakdown of projects presented in 2013.

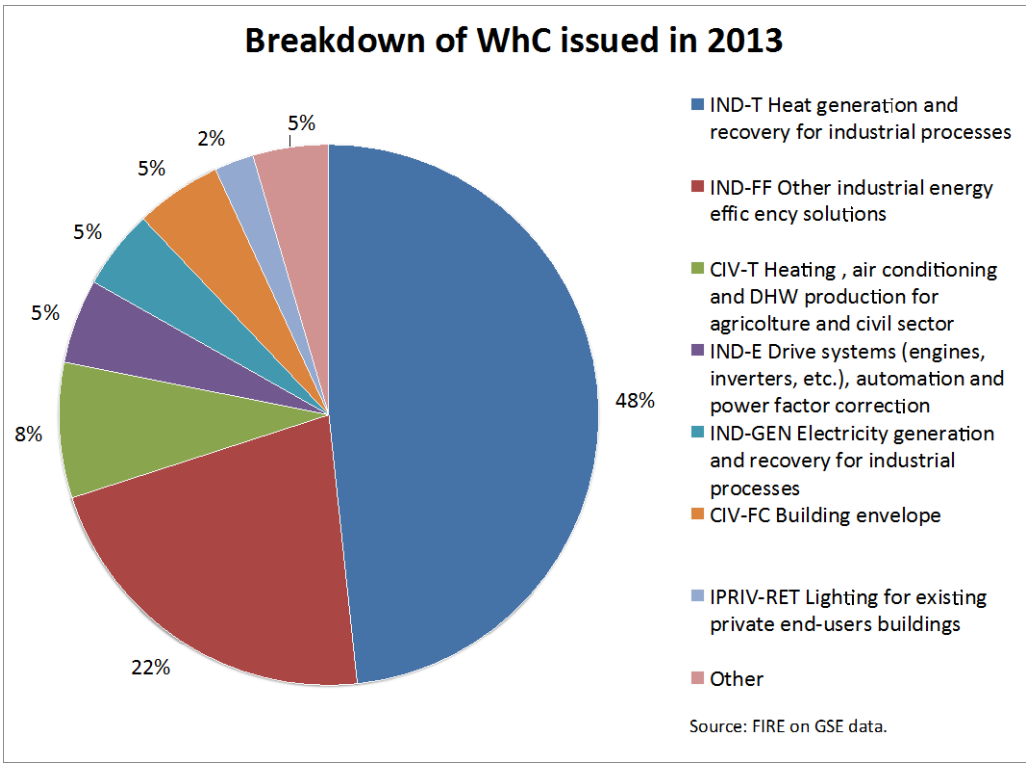


Figure 14: Breakdown of WhC issued in 2013.

5.2.4 Obligated parties

The system is based on the obligation, imposed on electricity and natural gas distributors with more than 50,000 customers, to meet specific targets, expressed as primary energy

savings and increasing over the years as shown in Figure 6. Obliged DSOs cover 85% and 89% of the total distributed energy for electricity and gas respectively. These savings can be achieved through energy efficiency actions among end-users and are assessed using primary tons of oil equivalent (toe) as measurement unit.

The number of distributors may vary every year, according to the energy they distribute. For the year of obligation 2013 the number of electricity distributors involved was 13, whereas the number of gas distributors involved was 50. In the electricity sector one distributor has more than 80% of the obligations, while in the gas sector two distributors cover around the half of the obligation (see the following two figures).

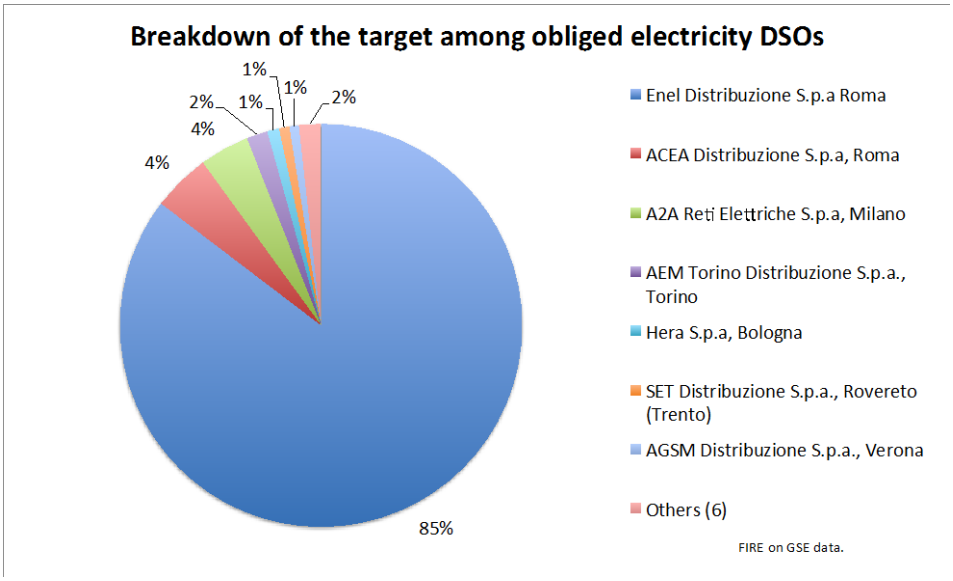


Figure 15: Obliged electricity DSOs.

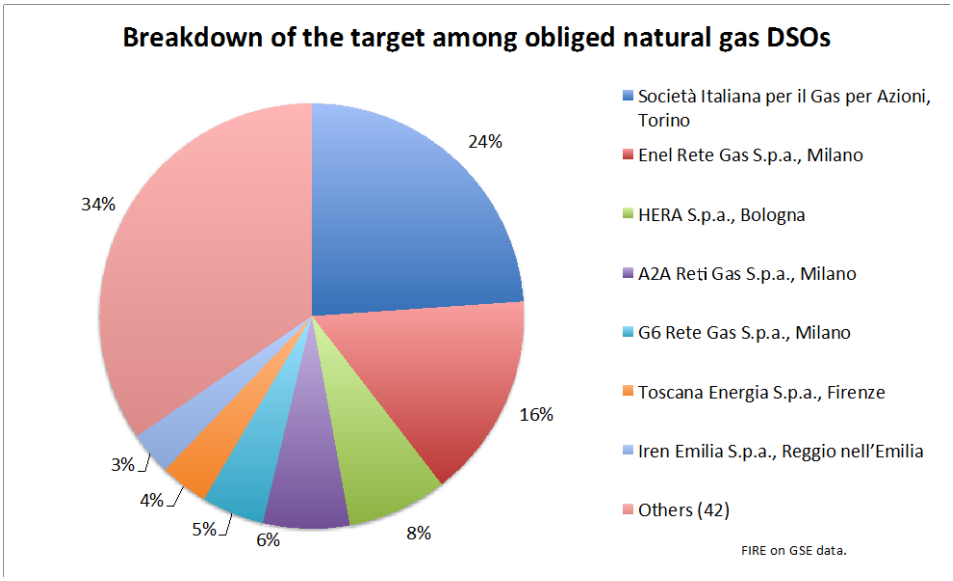


Figure 16: Obliged natural gas DSOs.

5.2.5 Target setting

The cumulative targets expressed in Mtoe are indicated in Table 21. Figure 6 illustrates the targets, starting from 2005 till 2016, comparing them with national energy efficiency targets at 2016 and 2020.

Table 21: Yearly savings expressed in primary Mtoe

Year	Savings (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

Targets needed a first reformulation in 2008 (D.M. 21 dicembre 2007), in order to keep into account the strong excess of certificates on the market. Then a second reformulation was introduced in 2013 (D.M. 28 dicembre 2012) in order to consider both the effect of the *tau* coefficient and the scarcity of certificates on the market.

Since 2013 the targets that affect demand and supply of certificates, and on which the effective obligations are calculated, are expressed in million of white certificates. That is due to the presence of the *tau* coefficient that includes also future savings, and not only the yearly ones.

The overall number of certificates to be achieved yearly for both electricity and gas sectors is then summarized in table 2. The obligation for each DSO in terms of number of WhCs is defined on the basis of this targets and of the amount of energy distributed on their own network.

Table 22: Yearly target expressed as million of certificates (2005-2012 data corresponds also to Mtoe of annual savings)

Year	Electricity (mln WhC)	Gas (mln WhC)
2005	0.10	0.06
2006	0.19	0.12
2007	0.39	0.25
2008	1.20	1.00
2009	1.80	1.40
2010	2.40	1.90
2011	3.10	2.20
2012	3.50	2.50
2013	3.03	2.48
2014	3.71	3.04
2015	4.26	3.49
2016	5.23	4.28

It is worth noticing that the ratio between the targets expressed in Mtoe and the targets expressed in million of WhC is not the average *tau*, which in fact is higher and considered equal to 2.5% in the D.M. 28 dicembre 2012, due to the possibility to account, with respect to the primary energy targets, the savings linked to high efficiency cogeneration that opt for a fixed price reimbursement[23]. These projects couldn't obtain tradable white certificates and thus can't be used by obliged DSOs to fulfill their targets.

The following figure illustrates the contribution from the white certificates to the 2020 Italian target according to the notification on the art. 7 of the EED directive. The minimum overall saving target is 25.58 Mtoe of final energy. The proposed schemes should generate cumulative savings of 25.83 Mtoe, approximately 62% of which should result from the white certificate mechanism.

[23] High efficiency cogeneration obtains white certificates, but the proponents can decide whether to trade

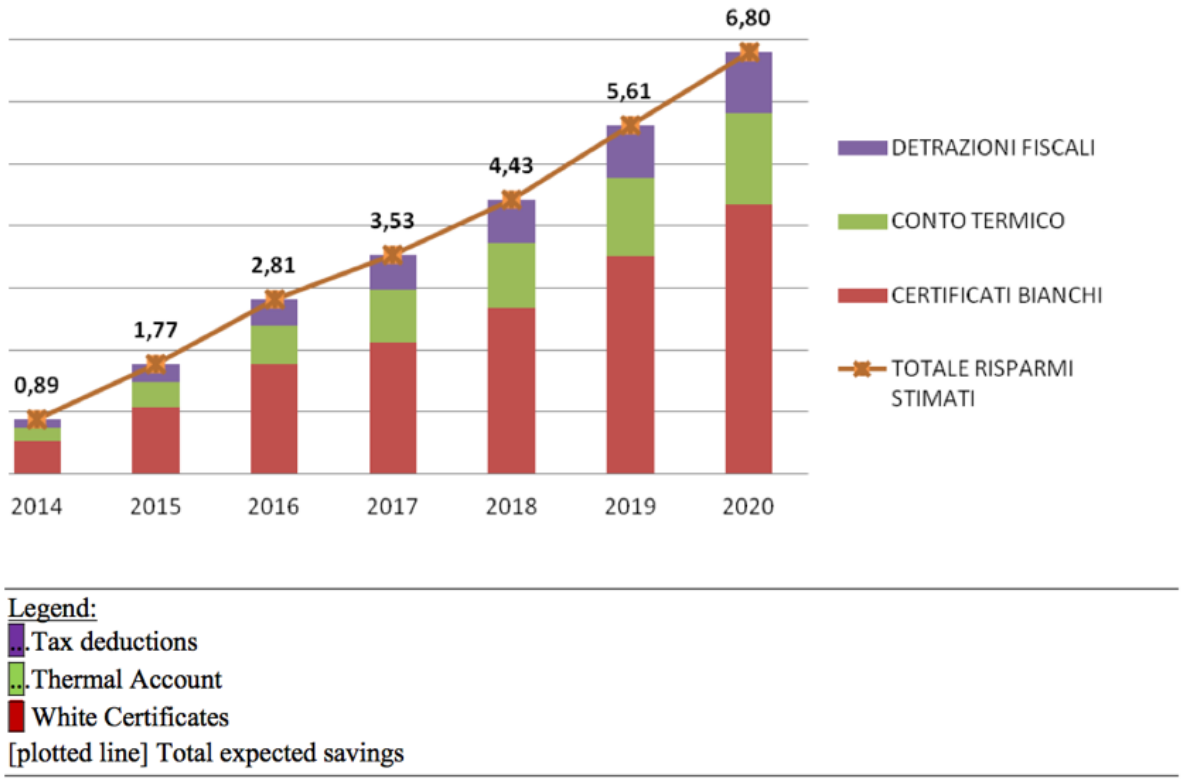


Figure 17: Contribution from the Italian incentive schemes to the 2020 target

Source: MiSE notification on art. 7.

5.2.6 Calculation method savings

There are three methods to evaluate the savings[24]:

- Deemed savings projects (DSP) are projects that do not require meters because the savings are recognised 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

[24] A comprehensive list of deemed saving and simplified monitoring plan projects is available on the GSE's web site: www.gse.it. The guidelines about monitoring plans projects are available on ENEA's WhC blog: http://blogcertificatibianchienea.weebly.com.

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.

- 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.
- 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).

Savings are calculated by keeping into account production volumes in industry and the use of buildings, besides weather, building use, and other parameter that affects the energy consumption baseline. For DSPs this is achieved by means of normalised tables, whereas for SMPs and MPPs these variables are included in the energy saving algorithm. The baseline is calculated as an average for DSPs and SMPs, in case normalised on the basis of the just mentioned parameters, whereas is evaluated on a project by project basis for MPPs[25]. All the evaluation methods have been used during the years. In the first and second phases DSP and SMP were by far the most used procedures, like in most of the white certificates

[25] The proponent shall identify its *ex-ante* consumption, the market baseline (through existing studies or statistics, or through a dedicated survey among technology suppliers), and in case the legislative baseline (e.g. requirements for BATs, minimum requirements, etc.). The additionality is then evaluated considering the lower level of energy consumption for the considered technology among these three options. It means that *ex-ante* consumption can be assumed as a baseline only in particular situations, when legislative requirements doesn't exist and the market baseline has a very low efficiency. In practice this can happen for particular industrial projects, where the existing process can represent the effective baseline.

schemes around the world. In the third phase, which started in 2013, MPP became the driving force of the Italian scheme, as Figure 18 shows. The are two reasons behind this change: the diffusion of awareness and knowledge on how to present a proposal among large users and ESCOs starting from 2008[26], and the economic effect due to the introduction of the *tau* coefficient starting from 2012. The first effect is much higher than the second one, considering that from 2012 the indicated savings take into account the *tau* coefficient, and this explain the steep rise of savings from 2011 to 2012 (continuous orange line in Figure 18).

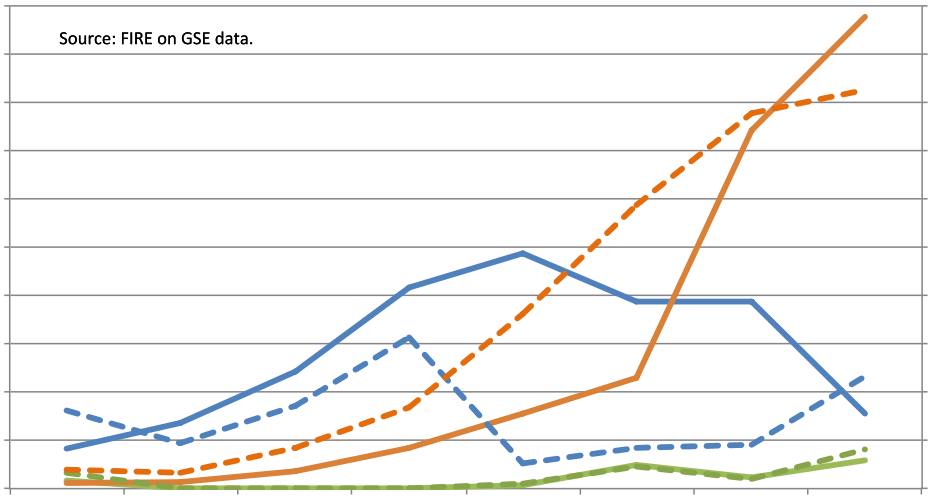


Figure 18: Breakdown of the issued white certificates by saving evaluation methodology

5.2.7 Additionality

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

[26] Dedicated training courses organized by FIRE in cooperation with ENEA played an important part in this results.

reduced if the *ex-ante* level is below the baseline, as shown in Figure 19. The market baseline is defined with reference to the solutions available and sold in the market, not to the installed solutions[27].

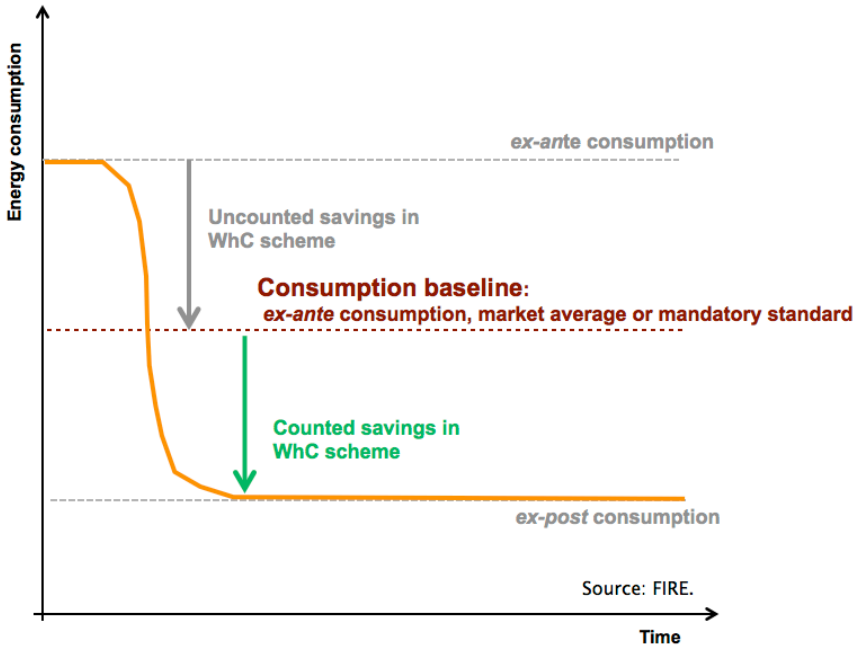


Figure 19: Definition of additionality

Additionality aims to account only the savings due to the availability of the WhC scheme – excluding the ones that would have been obtained in any case because of technological improvement, mandatory standards, or market developments –, thus theoretically ensuring that the incentive is both cost-effective and able to promote a real increase in energy efficiency.

[27] For deemed savings and simplified monitoring plans the baseline and the additionality are evaluated by the Ministry of economic development, with the support from national agencies, on the basis of the average efficiency of solutions sold in the market and of existing minimum requirements. For monitoring plan both the baseline and the additionality are evaluated by the proponent on the same basis (and eventually modified by ENEA/RSE if not sufficiently motivated).

Unfortunately, the identification of the baseline is often complex, due to the lack of reliable market data, and this represents a constraint to the definition of simplified M&V methods and the implementation of energy monitoring plans.

ENEA implemented a series of guidelines for the main industrial sectors and civil uses, in order to support the proponents in evaluating the market baseline and the additionality[28]. Nevertheless, this remains one of the most complex issue to deal with, both for proponents and evaluators.

5.2.8 Verification & Monitoring

The body in charge of monitoring and control is GSE, which can act with the support of ENEA and RSE. In the past, until 2012, the responsibility was of AEEGSI. Controls are conducted on two levels: on the documentation and on-site. Documental control are always implemented before the approval of the proposals. Besides, in the last two years there has been an increment in the information required by GSE, in order to avoid frauds and double incentive (white certificates, heat account, and tax deductions are alternative support measures).

D.M. 28 dicembre 2012 introduced the obligation of on-site control on all the projects with an annual saving higher than 3,000 toe, whereas smaller projects can be checked on-site on a sample basis. Presently there are no public data on the activity of on-site controls.

In case of non conformities penalties are provided, together with the requisition of the undue certificates and, in case of frauds, the possibility to exclude the proponents from all the state incentives for ten years.

5.2.9 Control and Compliance

If a DSO does not fulfil at least 60% of its annual target, AEEGSI will inflict a fine, calculated with a case by 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

[28] The guidelines are available at: http://blogcertificatibianchienea.weebly.com/guide-settoriali.html.

fine. In both cases the following year target of the defaulting DSO is increased by the amount of lacking certificates. In 2012 two defaulting DSOs were fined for an overall amount of 239,000 euro (respectively 189,000 euro and 40,000 euro). More details can be found in AEEGSI delibera 413/2012/S/EFR and 414/2012/S/EFR.

In terms of controls related to the release of WhC for projects that are effectively producing the savings, two approaches are considered. For simplified monitoring plan projects and monitoring plan projects the communicated measures ensure that the projects are in place and are producing savings (no savings: no measures nor certificates; reduced savings: reduced measures and reduced certificates). For deemed saving files on-site verifications should deal with the possibility of frauds (the law requires the proponents to communicate if for any reason the project ceases to produce savings).

5.2.10 Administrator - Institutional set up

The rules of the scheme and its guidelines are defined by the Ministry of Economic Development (MiSE) in cooperation with the Ministry of Environment (MATTM), with the support (for specific competencies stated in the decrees) from the Italian Regulatory Authority for Electricity Gas and Water (AEEGSI).

GSE is in charge of the operative management of the scheme since 2012, with the support of ENEA and RSE for activities related to the evaluation of proposals. The WhC market platform is provided by GME. Besides ENEA provides information activities.

In the past AEEGSI used to define the scheme guidelines and to manage the mechanism operatively, but with D.M. 28 dicembre 2012 MiSE decided to re-appropriate most of the rule definition and to assign to GSE the operative management of the scheme, considering that GSE already managed all the renewable energy incentive scheme.

With the current policy design MiSE, in cooperation with MATTM, will define the new scheme guidelines in 2015, in order to keep into account the development of the market and some issues still present. It is possible that some change will occur with the *tau* coefficient and with the distribution of activities among the involved bodies.

5.2.11 Flexibility

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. This

opportunity is widely used, since in 2013 72% of the certificates came from ESCOs and 25% from EMCOs.

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. This possibility has been widely used in the period of scarcity of certificates on the market[29].

A flexibility option for the supply side is the possibility to retain the certificates and to sell them in the following years. This gives them the opportunity to try to obtain an higher value for the certificates if the market conditions make that possible.

It is worth mentioning that 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.

Finally, D.M. 21 dicembre 2007 introduced the possibility for the end-users to apply for white certificates, provided they have an appointed energy manager (in the first years only ESCOs and consultancy firms were allowed to present projects, together with non obliged distributors). This decision has helped the development of the market and gave an improved role to some energy managers, supporting them in promoting energy efficiency solutions within their organizations.

5.3 Results of EEO

5.3.1 Total costs

The costs of the mechanism are covered thanks to the withdrawn from the electricity and natural gas users bills as explained in paragraph 5.5. According to the present regulation,

[29] Distributors can not overachieve their targets. In case excess certificates are kept in their GME's account to be used in the following years.

SMEs and residential users are paying for this more than large users that can obtain reduced tariff fees provided they are recognised as energy intensive[30].

Figure 20 shows the yearly overall costs for the electricity users (grey bars), and natural gas ones (blue bars).

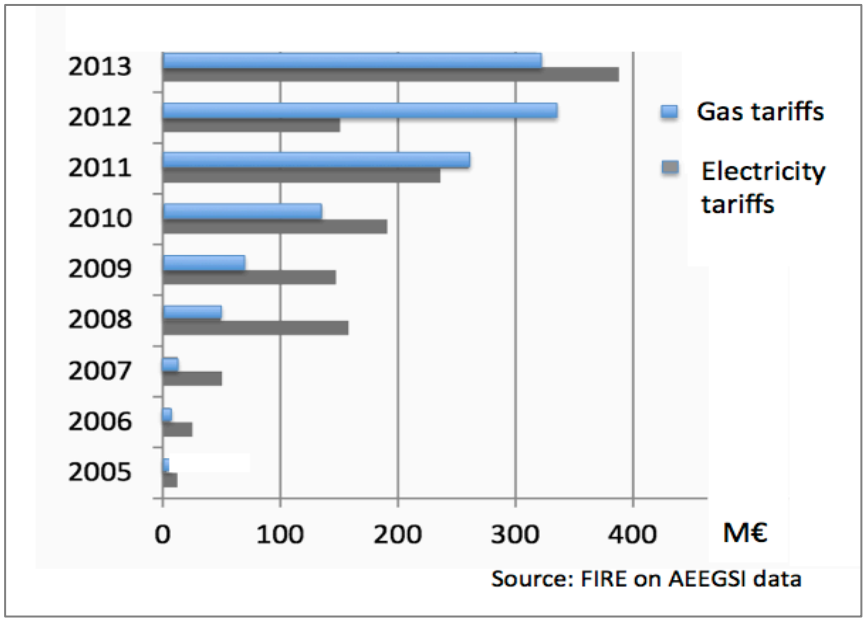


Figure 20: Impact on electricity and gas tariffs of the WhC scheme cost per year.

Basically the yearly cost of the scheme can be estimated by multiplying the target for a given year and the current average market price. The effective cost will differ depending on the number of notified and obliterated[31] certificates and the effective average market price.

[30] The conditions for being recognised as energy intensive consumers are an energy cost intensity of more than 3% and energy consumption over 2 GWh/year. The cost reductions that apply are in the range 3-35 euro/MWh (larger for high energy cost intensity users).

[31] When a DSO notifies its certificates to the GSE in order to verify the fulfilment of its target, the certificates are obliterated and thus are no more tradable on the market, nor available for further notifications.

For the administrative costs it is possible to estimate an expense of around 10 million euro in 2014. The costs vary strongly every year depending on the amount of projects to be evaluated, with consequent allocation of personnel and costs (evaluation and verification activities are remunerated on the basis of the effective number).

Starting from January 2015 GSE's activities and the evaluation activities carried on by ENEA and RSE are covered by a small fee the proponents should pay when presenting a project or communicating the measures year by year for simplified monitoring plan and monitoring plan projects[32]. Previously also these costs were covered through the tariff components.

5.3.2 Total expenditures

Unfortunately till now no mandatory information on the cost of the implemented energy efficiency projects has been requested. There are some data available from some PPPM, but their number doesn't allow to present reliable and comprehensive information.

Basically the impact of the WhC on the capital expenditures can vary from some percentage points (low additionality and/or long investment pay-back times) to more than 50% (particular projects with 100% additionality and very low pay-back times). This is normal for baseline and trade schemes. High impacted measures tend indeed to see a fast reduction with time of the additionality.

No information are available on the extra cost of the implemented measures with respect to the baseline technologies, but it would be very difficult to collect such data for a scheme that allows all type of energy efficiency solutions in all sectors.

[32] Fixed fee in the range 100-2,500 euro depending on the size and type of project and variable fee of 1.1 euro per issued certificate for projects above 100 certificates per year.

5.3.3 Total savings

Figure 21 shows the number of issued certificates compared with the WhC yearly targets and an estimate of the minimum number of certificates to be expected in each year considering the number of certificates issued in the previous year and the 5 years lifespan of most of the projects (there are not enough data to split them among 5, 8 and 10 years duration)[33]. The figure shows that the 2014 target will be easily overcome, since most of it will be covered by certificates linked to already existing projects and all the new proposals will add certificates to the blue bar. The record result linked to the 2013 target (yellow bar) allowed to recover the certificates missing from the previous years (green bars).

An important modification introduced by D.M. 28 dicembre 2012 is the fact that if the number of certificates exceeds the yearly target by at least 5%, next year target will be increased of the corresponding certificates surplus. That is a market condition that most probably will take place in 2015.

Figure 21 shows also that the targets needed some reduction in order to being met. The global trend is nevertheless in line with the 2020 target set by the notification on art. 7 of the EED directive.

There are no analysis on the windfall effects that obviously have taken place during the years. For a scheme that addresses all the technologies and all the sectors it is almost impossible to ascertain the effective entity of this issue and to manage it correctly. For sure windfall gains have been present especially for industrial monitoring plans till 2013. Since 2014 there is the need to present the PPPM before the start-up of the projects, and this limits the possibility of windfall gains, but can't eliminate them. With deemed saving projects usually the windfall effect is high, but it is worth noticing that the amount of money given

[33] The number of issued certificates for the existing projects can of course vary depending on their yearly performance, due to industrial production, weather conditions, technology performance, etc.

through the WhC scheme in this case is usually low[34] and that these projects represent less than 20% of the issued certificates.

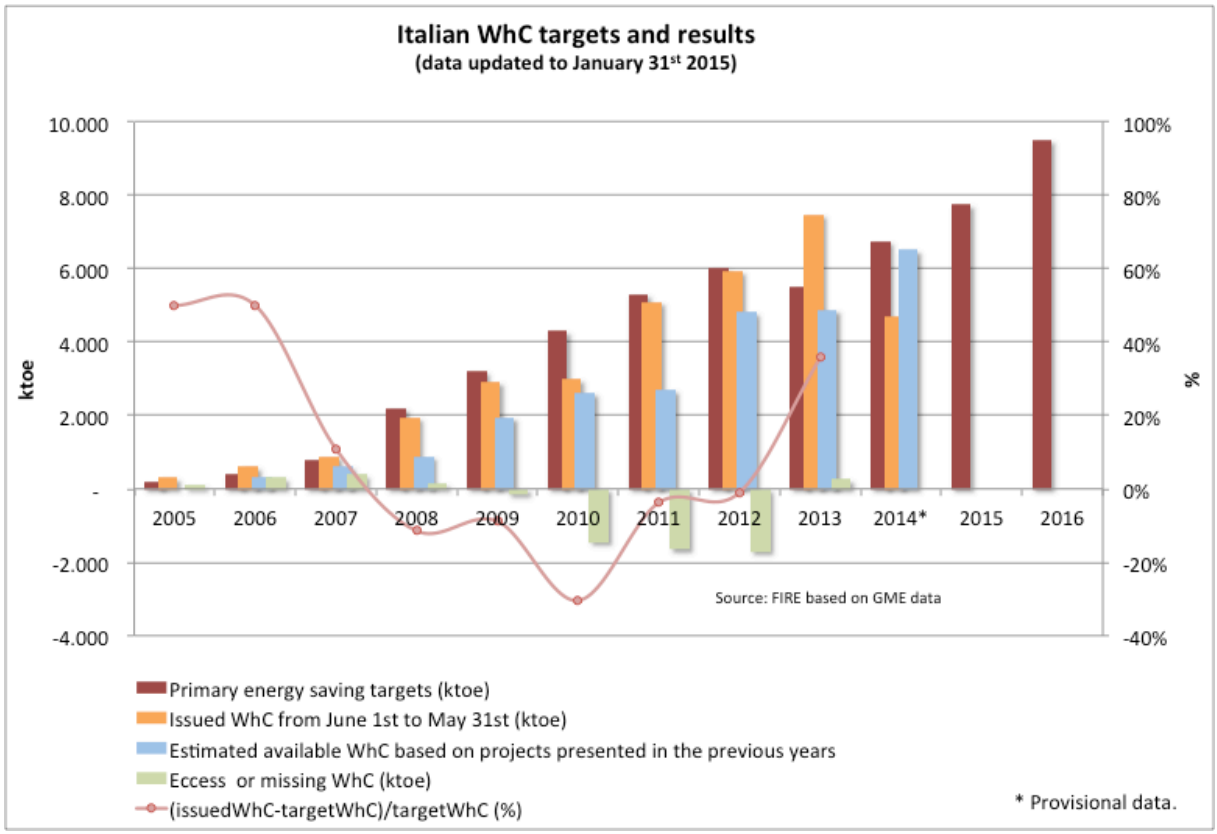


Figure 21: DSO's targets (in number of white certificates since 2013) and issued certificates

5.3.4 Cost effectiveness

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

[34] When the amount of money has been high, like for example for CFLs in the first years, the windfall effect has been negligible or has contributed to a very fast development of the market with benefits for everybody.

compares favourably with a cost per toe of the certificates of about 110 euro (DSOs' reimbursement) to be multiplied by the *tau* coefficient and divided by the additionality coefficient that takes into account only the additional savings[35].

Considering the cost of the scheme (paragraph 5.3.1) and the number and typology of issued certificates the cost effectiveness expresses as global cost on additional savings is about 0.01 euro/kWh (80 euro/toe)[36].

The capability of the WhC scheme to promote the implementation of projects that otherwise would not be realised varies a lot depending on the economic performance of the considered technology and its additionality.

The ratio between the incentive cumulated on the 5 years lifetime and discounted at 5% and the capital cost of the energy efficiency investment (CAPEX) can be used as an indicator of this type of performance:

$$EI_{WhC} = \frac{\sum_{i=1}^{5} \frac{WhC_{year}}{(1+R)^i}}{CAPEX} = \frac{4.33 \times WhC_{year}}{CAPEX}$$

where WhC_{year} is the annual cash flow granted from white certificates, which is assumed to be constant (even if it can vary depending on the normalized annual performance of the considered project), and R the discount rate that is assumed equal to 5% in the calculations.

The EI_{WhC} indicator is usually in the range 5%-20% for projects in the civil sector. It is usually low both for the typical medium term pay-back time of the investments in this sector and

[35] Considering for example an household (energy cost: 850 euro/toe), in case of full additionality (that is the certificates are recognised for all the saved toe) and *tau* equal to one there is a cost of the scheme of 110 euro per saved toe against a saving for the user of 850 euro, with a leverage of 1:7.7. Considering an additionality equal to 50% (that is the certificates are recognised for half of the saved toe) and a *tau* coefficient equal to 2.65, the calculation is 110 x 2.65 * 0.5 equal to 146 euro per saved toe, with a leverage of 1:5.8.

[36] According to FIRE evaluation, considering a cost of 110 euro per certificate and an average *tau* of 2.8 the cost per yearly saved toe is about 310 euro, whereas the total discounted cost per the lifetime savings (around 16.5 years as average) is around 80 euro/toe that corresponds to 0.01 euro/kWh.

since minimum standard requirements, ecodesign criteria, and legislative obligations set a high baseline for energy efficiency and thus a low additionality. For industrial processes, for which pay-back times are often short and the baseline often coincides with the *ex ante* situation especially for measures related to the production process, EI_{WhC} can even exceed 50% in particular situation. This happens when the additionality is full and the economic performance of the adopted technology or process modification is excellent.

A brief example can be useful to understand this point and how the scheme can reward cost effective technologies. According to evaluations from FIRE, an industrial user with a cost of energy of 500 euro/toe that considers a project with a pay-back time equal to 3 years (a typical threshold for industrial investment outside the core business) should afford an investment of 1,500 euro per saved toe. If fully additional, this project will get 1 x *tau* x 100 euro/toe/year, considering a price of WhC of 100 €/toe. That is 100 x 4.33 x *tau* = 433 x *tau* euro in five years if discounted at 5%. A 20 years lifespan project – typical for industrial projects linked to the process[37] – will then get 433 x 3.36 = 1,455 euro, which is an EI_{WhC} equal to 97%.

The actual value can be quite different depending on the baseline and usually, according to a study conducted by FIRE on the PPPMs implemented until 2012, EI_{WhC} is in the range 5-40%. Unfortunately, the investment cost field in the PPPMs has been optional till now, so there are no enough data to determine the ratio on a solid basis. This nevertheless represents a point to be investigated in order to avoid to over incentive certain solutions, also considering the *state aid* discipline when applicable.

5.3.5 Other stakeholders

Other stakeholders that can be considered – in addition to the involved institutional bodies and DSOs, ESCOs, and their associations – are:

[37] In case of electrical motors and variable speed drives the *tau* is 2.65.

- Confindustria and other industry associations (e.g. ANIE, ANIMA)38 that should be kept satisfied;
- energy consultants, consumers, and installers associations, municipalities, SMEs, citizens that should be keep informed about the ENSPOL project.

The first group can have an impact on policy decisions through lobby activities driven from specific interests linked to the WhC scheme (both as technology producers and potential beneficiaries of the energy efficiency projects). The second group can participate in the benefits by being involved in the projects implementation activities and by getting discounts on the installed technologies besides by paying for the cost of the scheme through the electricity and gas tariffs.

5.4 Adaptation of EEO

5.4.1 Frequency of redesign

The frequency of redesign is every 3-5 years, with small adjustments more frequent (1-2 years). This is the list of the legislative and regulative measures that has affected the scheme until now:

- D.M. 24 aprile 2001 (first phase targets and WhC scheme definition);
- Delibera AEEGSI 103-2003 (guidelines);
- D.M. 20 luglio 2004 (first phase targets time shift and design improvements);
- D.M. 21 dicembre 2007 (second phase targets and design improvements);
- D.Lgs. 30 maggio 2008 n. 115 (small improvements);
- D.Lgs. 3 marzo 2011 n. 28 (requirements for new WhC regulations);

[38] Their members can benefit from the scheme both as technology producers and as beneficiaries of energy efficiency projects (as EMCOs or ESCOs clients).

- Delibera AEEGSI EEN 9-2011 (introduction of the *tau* coefficient);
- D.M. 28 dicembre 2012 (new WhC scheme regulation, with third phase targets, GSE as management body and many design improvements);
- Delibera AEEGSI 13/2014/R/efr (new rules for DSOs tariff reimbursement).

An important point is that such schemes are complex and require a continuous improvement approach in order to carry good results. Even if a scheme is well designed since the beginning, market changes and boundary conditions reflect in the need of modifications for the scheme. For this reason it is advisable to invest a small amount of the global scheme costs in monitoring activities, in order to closely monitor the evolution of the scheme and of the market.

5.4.2 Reasons of redesign

The main factors behind the redesign of Italian mechanism are:

- The modifications of the yearly targets to keep into account both the effective evolution of the market, the scheme cost, and the policy trend connected to energy efficiency. As showed in Figure 6 and Figure 21 the targets are characterized by two discontinuities in 2007-2008 and 2012-2013. If the scheme is wide like the Italian one in terms of technologies and sector it is advisable to consider the possibility to adopt a flexible approach on target management.
- The introduction of new subjects as voluntary parties (such as EMCOs and companies with an ISO 50001 EnMS), in order to have an higher basis of organizations capable to contribute to the scheme by implementing energy efficiency projects and presenting WhC proposals, considering the challenge that the constant increase of the yearly objectives imposes.
- The changes in the government and management of the scheme. The main change has been the handover of the management of the mechanism from AEEGSI to GSE at the beginning of 2013.
- The need to improve specific rules based on the collected experiences or on the evolution of the scheme and the market, such the introduction of a multiplying coefficient for technologies with a high lifetime, the modification of the DSO reimbursement tariff to link the reimbursement to the WhC market trend (thus ensuring an improved coverage of DSOs and system costs), or the introduction of compulsory on-site verifications for projects with a saving larger than 3,000 toe/year.

5.4.3 Manageability

After the first phase characterized by an excess of certificates on the market, the WhC entered a phase of scarcity the made it difficult to cover the targets. As Figure 18 illustrates monitoring plans were rising, but not enough, whereas deemed saving projects – after the end of the CFL era with the closure of the most cost effective technologies of the first phase based on the modification of the market baseline[39] – presented a very low impact of the incentive with respect to the capital cost of the projects (with a EI_{WhC} index usually below 5%). In order to stimulate the market, and trying to boost the most structured projects, AEEGSI, which has been in charge of the guidelines till 2012, introduced with the EEN 9/2011 delibera a multiplier (the *tau* coefficient) that integrates the energy savings by taking into account the technical life of the action, discounting them with a 2% coefficient to consider wear and other causes of performance reduction over the years.

So, for example, if an energy efficiency measure saves 100 toe/year and has an expected life of 15 years, the basic multiplier will be 15/5=3 (five is the number of years in which WhC are obtained), which becomes 2.65 once discounted, and the integrated savings will be 265 toe/year. In this example the energy efficiency measure will get in its "WhC life" 265x5=1,325 toe VS 100x5=500 toe/year obtained with the previous rules that considered only yearly savings. The *tau* coefficient varies depending on the kind of technology and/or process, ranging from 1.00 to 4.58. For a graphic explanation of the tau coefficient see Figure 22.

[39] When introduced, CFLs got 0.0146 toe/lamp/year, regardless the power and the connection type. In 2008 the baseline was modified and the CFL deemed saving file distinguished between E14 and E27 connections (additionality respectively at 42% and 22%) and different lamps' powers (from 9 to 23 W), thus the recognised savings fell in the range 0.00073-0.00471 toe/lamp/year. In January 2011 the additionality was set to zero and the file was retired.

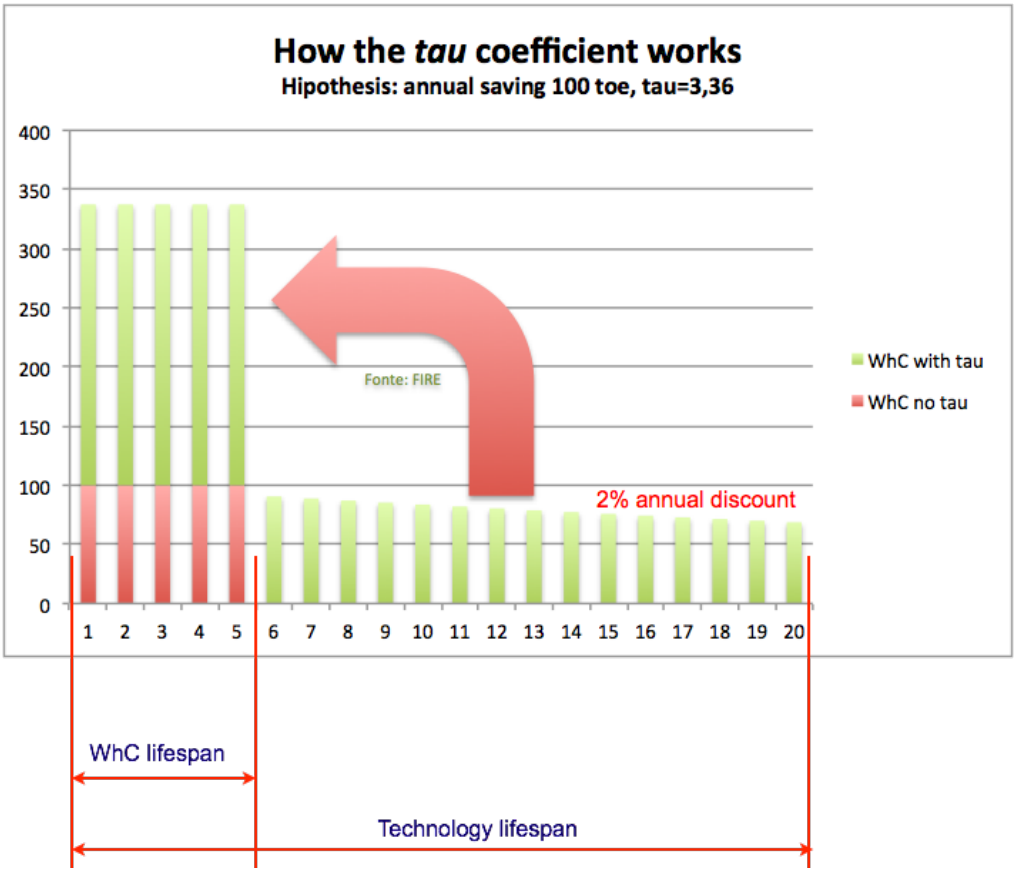


Figure 22: How the *tau* coefficient works.

In order to provide an idea of the *tau* coefficient associated to the main industrial categories of technologies and processes, table 3 shows the *tau* coefficients for different categories and measures. The complete list of *tau* coefficients has been approved by AEEGSI delibera EEN 9/11.

Table 23: *Tau* coefficients for some industrial sectors.

EE Measure	Technology lifespan	*tau*
IND-T Industrial processes: generation or heat recovery for cooling, drying, burning, melting, etc.	20	3.36
IND-GEN Industrial processes: electricity generation from renewable sources, heat recovery, or cogeneration	20	3.36
IND-E Industrial processes: efficient drive systems (motors, etc.), automation and power factor measures	15	2.65
IND-FF Industrial processes: interventions other than the above, for the energy optimization of production processes and plant layout designed to achieve a lasting energy consumption reduction normalized by quantity and quality of production	20	3.36

5.5 Social equity

5.5.1 Contributors

Most of the costs in which the obliged DSOs incur are recovered through tariff components. Obliged DSOs obtain a reimbursement when they present WhC to GSE for the annual obliteration[40]. AEEGSI is in charge of defining the value of the reimbursement. Figure 10 shows the value of the tariff reimbursement through the year. In the first phase it was defined as a constant in order to give a price signal to the market, but this approach didn't work and ensured to the most active DSOs windfall gains due to the possibility to buy certificates on the market even at 30 euro while receiving 100 euro as reimbursement. AEEGSI decided then to link the reimbursement to the price of electricity, gas and other fuels. This produced an opposite effect, with a diminishing reimbursement due to the rising energy prices and a rising WhC price due to the rising targets. DSOs find themselves

[40] WhC are obliterated when they are presented to fulfil each DSO target, in order to avoid the possibility to use them again.

spending much more than they were reimbursed[41]. Finally, starting from 2013, AEEGSI introduced a new regulation that links the reimbursement to the market trend and ensures that the maximum difference between the reimbursement and the weighted average spot market price remains below 2 euro/certificate. Figure 23 illustrates how the value of the reimbursement changed through the year according to the new regulation set by AEEGSI direttiva 13/2014/R/efr. Figure 10 shows the value of the tariff reimbursement over the years (for example DSOs will receive 110.39 euro per each certificate they will submit to GSE to cover their 2014 targets).

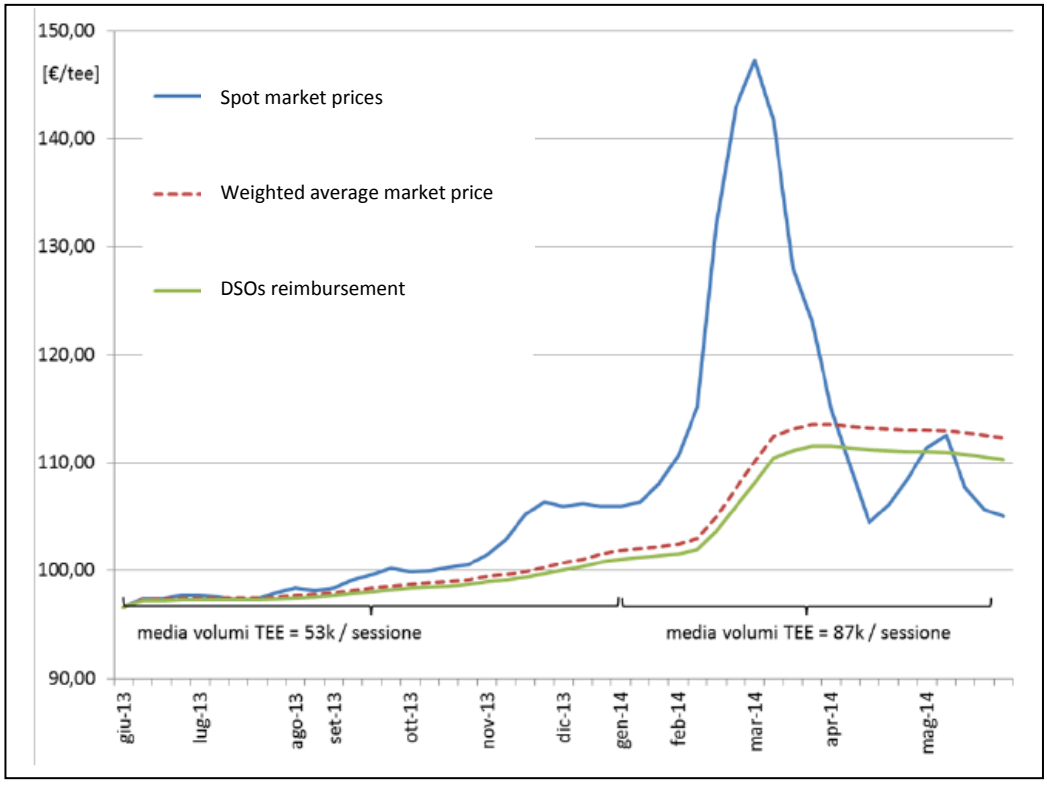


Figure 23: DSOs reimbursement trend for the 2013 target expressed as euro/certificate

Source: AEEGSI.

[41] It is worth noticing that the difference between the spot price and the reimbursement was higher with the first approach, but the traded volumes where much higher in the second phase.

Every end-user contributes to the system costs related to the DSOs reimbursement through a specific component in the electricity and gas tariffs. The tariffs components are the following ones:

- UC7 for electricity bills.
- RE and RET for gas bills.

The Italian electricity bill is composed by four main parts: services for sale, network services, general system charges and taxes. The UC7 component lies in the general system charges component and it is around 1% of it. The overall cost of WhC on the electricity bills for year 2014 is around 400 million euro. To give and idea of the expenditure and of the weight of the different components in the bill of a domestic user, we can consider the previsions of AEEGSI for the first quarter of 2014. The average annual expenditure for a family is about 518 euro, divided as follows:

- Services for sale: 266 euro (51.25% of the total bill) for the costs of energy supply and retail marketing;
- Network Services: 76 euro (14.71%) for network services (transmission, distribution and metering);
- General system charges: 107 euro (20.75%) for general system charges set by law (UC7 equal to 1.12 euro and 1.05% of system charges);
- Taxes: 69 euro (13.30%) for taxes that include VAT and excise duties.

The natural gas bill is instead composed by three main parts: services for sale, network services, taxes. The RE and RET components lie in the general system charges. The overall cost of WhC on the natural gas bills for year 2014 is around 350 million euro. To give and idea of the expenditure and of the weight of the different components in the bill of a domestic user, we can consider the previsions of AEEGSI for the firs quarter of 2014:

- Services for sale: 498.05 euro (equal to 41.24% of the total bill) for natural gas supply and related activities; 11.90 euro (0.98%) for the gradual implementation of the reform of economic conditions for natural gas service and the mechanism for renegotiating long-term supply contracts; 68.47 euro (5.67%) retail sales;
- Taxes: 425.74 euro (35.25%) for taxes including excise tax (17.72%), additional regional tax (2.35%) and VAT (15.18%);
- Network services: 165.15 euro (13.67%) for distribution and metering; 38.48 euro (3.19%) for transport.

5.5.2 Beneficiaries

Direct beneficiaries: ESCOs, energy efficiency technologies producers, other market operators, professionals and installers involved in energy services, banks, end-users (especially in the industrial sector).

The most active consultancy firms that participated in the scheme since the beginning have been able to use the revenues from WhC to grow and to transform in ESCOs. Presently some of them are able to offer energy performance contracts (even for industrial process projects) and advanced financial services, both for third party financing and for WhC trading activities. The scheme has been able to promote the growth of the ESCO market, but only for a limited number of companies. In 2016 the Italian standard UNI CEI 11352 for the certification of ESCOs becomes mandatory to being able to present projects. This should improve the WhC support for ESCOs.

Technology producers and other market operators, professionals and installers involved in energy services are benefitted since the existence of the scheme facilitates or makes possible the acceptance of feasibility studies by end-users and banks. Banks consider the scheme as a source of extra guarantee on the project and consider WhC cash flows in the evaluation of the DSCR (debt service cover ratio, an index used to verify the capability of a project to repay its debt through the generated cash flows) for each project.

End users profit both for the possibility to implement energy efficiency projects with better economic performance and for the indirect benefits (environmental, employment, energy security, etc.).

5.5.3 Impact on energy prices or tariffs

The following figures represent the impact of the Italian WhC scheme on consumers. Figure 24 shows the economic impact on both electricity and natural gas bills. Figure 25 shows, on a yearly basis, the impact of the mechanism on average family (electricity consumption of 2,700 kWh/year and natural gas consumption of 1,400 m^3).

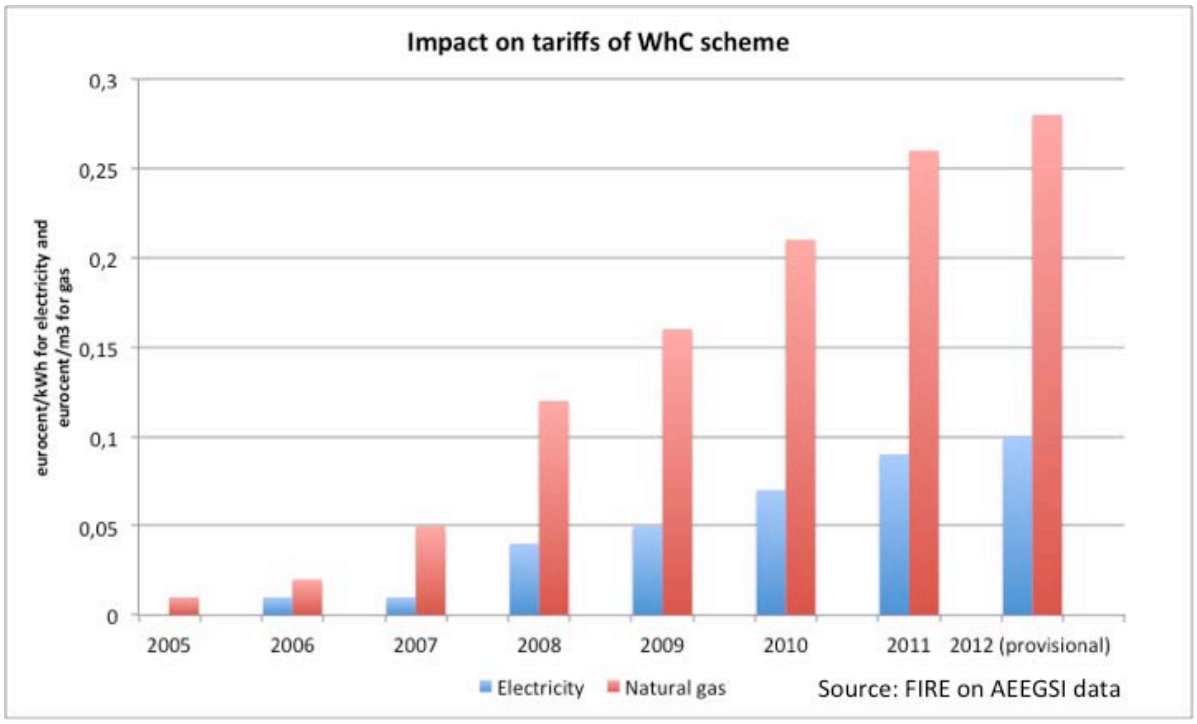


Figure 24: Impact on tariffs

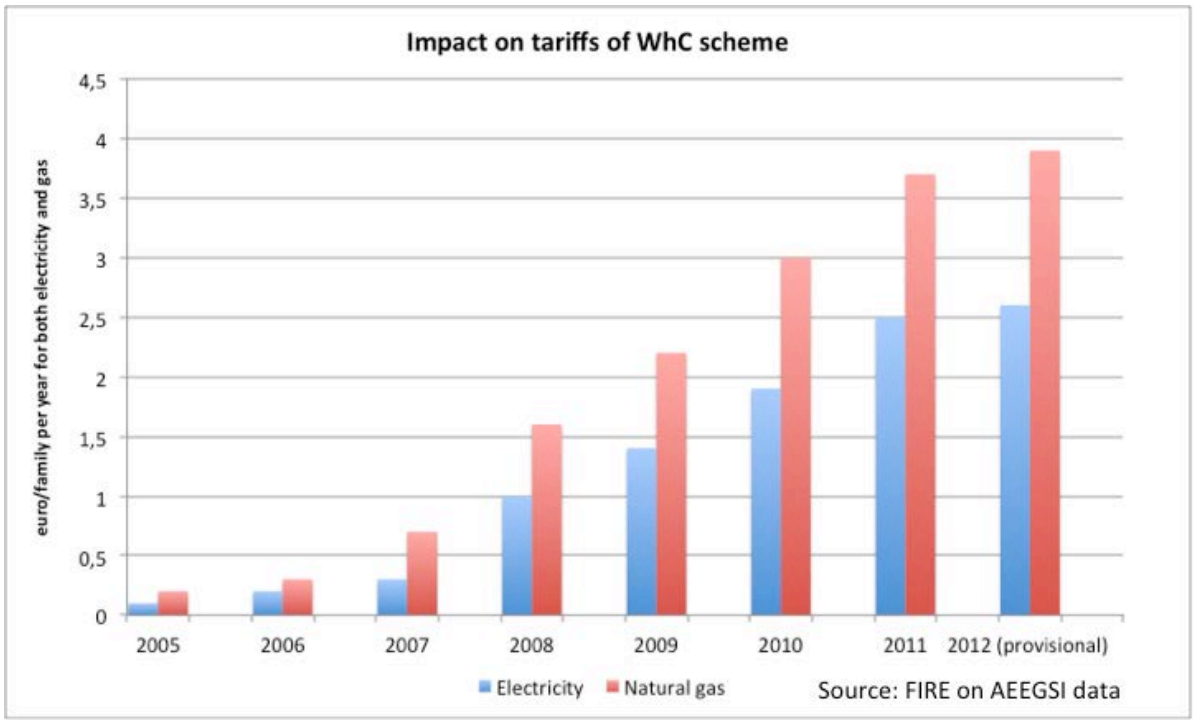


Figure 25: Yearly impact on the tariffs of the average family

5.6 Lessons learned and what can be improved?

Lessons learnt:

- Such a complex scheme can give interesting results, both in promoting energy efficiency technologies and the development of market operators (such as ESCOs). In order to achieve positive results it is important to work with a continuous improvement approach and to monitor the evolution of the scheme and of the market.
- Such schemes can be designed in order to support the growth of ESCOs and the development of third party financing, provided some measures are introduced in order to limit the WhC price volatility.
- It is possible to design such a scheme in order to have mostly monitoring plan projects implemented, ensuring an effective saving account and the collection of many useful information on the market development. Deemed saving projects are nevertheless fundamental in the first years of the scheme.
- The choice of not spending many resources on information activities implies that even nowadays many end-users, especially SMEs, don't know the scheme and its benefits. The suggestion is consider since the beginning the possibility to spend resources (2-5% of the total cost of the scheme) on accompanying measures (i.e. information, training, sectorial studies, monitoring, verification).

Other considerations:

- It is advisable to require from the beginning information about the capital cost of the implemented projects, even if a baseline and trade mechanism theoretically promotes the most cost effective measures, so the ratio between the incentive and the investment cost is not a fundamental information. Nevertheless having such data helps policy makers in addressing market issues and avoiding or reducing both excessive incentives and windfall gains. The complexity behind the definition of a market baseline for every solution in a "all solution accepted" scheme suggests to invest a small part of the total cost of such scheme in accompanying measures, like information, sectorial studies, training, and monitoring.
- Even if for some years the consultancy firms that could access the scheme as voluntary parties used to present proposal related to projects already implemented (thus feeding windfall gains), the information they acquired in doing so contributed to make them energy expert in the industrial sector and even ESCOs. After some

years such companies were able to support other end-users in finding and implementing energy efficiency projects related to the production process. This expertise is helping many companies in improving their energy efficiency. Such a result would have been very difficult to obtain with a traditional approach, considering the limited availability of operators with a know-how about energy efficiency in industry and the scarce availability for industrial users to admit third parties on their sites.

- The windfall effect cannot be avoided in a complex scheme, but it can be reduced by modifying the additionality, excluding particular solutions, and requiring that monitoring plans are presented before the implementation of the projects.
- Most DSOs didn't like the scheme in the first years, both because they didn't see a link with their core business, but only rising costs which could only be partially recovered, and because they feared the possible impact of penalties on their balance sheets in case of non conformities. This has changed in time due to many reasons. The first one is that the new rules about tariff reimbursement and flexibility limit the most negative options. The second one is that many integrated electricity and gas operators understood the importance of energy efficiency and began to offer energy efficiency technologies and services bundled with electricity and gas. This development favoured some pressure on the distribution companies under the same corporate to support this process and at the same time made it easier for them to obtain certificates from the other corporate companies involved in energy trading and energy services. That means that the negative effects of choosing DSOs as obliged parties can be reduced or even overcome thanks to the development of the market.

5.6.1 Strong characteristics

The main impact characteristics of the Italian WhC scheme:

- The innovative concept of the scheme, a starting point also for other countries.
- The capacity to enhance the scheme with a continuous improvement approach, implying the availability of policy makers to discuss some of their choices and to adapt the targets to the situation, maintaining the medium time target clear.
- The high number of consultants and ESCOs born or grown thanks to the scheme and capable after some years to contribute effectively to the diffusion of energy efficiency solutions.

- The prevalence of monitoring plans projects that ensures the accountability of effective additional savings and gives many information to policy makers and ENEA as the national energy efficiency agency on the modifications of the industrial processes.
- The availability of a tradable market that has been operating without particular issues since 2005 in a mixed mode, both with a spot exchange market and with a platform dedicated to bilateral contracts, thus offering flexibility to DSOs and other operators to exchange the certificates.

6 Poland

6.1 Policy objectives of EEO

I Stage 2012-2015

In Poland the energy efficiency obligation (EEO) was implemented in the form of White Certificates System (WCS). The system was introduced into the Polish legal system by the Energy Efficiency Act of April 15, 2011 (EEA).

In the preamble to the draft of EEA sent by Poland's government to the Parliament in 2010 it was said that Poland made a real progress in reducing energy intensity of national economy as it dropped by almost 30% - the GDP energy intensity fell from 0,561 ktoe/euro00 to 0,383 ktoe/euro00. It was however remarked that the energy intensity of Poland's economy remained two times higher than the EU average and therefore an act stimulating further energy efficiency improvement is required.

The choice of the WCS as the most suitable form of EEO was mainly due to its solid market nature and its apparent similarity to other support schemes being operated in Poland, e.g. "green certificates" for renewable sources (RES), "red certificate" for high efficient cogeneration (CHP), and "yellow certificates" supporting CHP on gas. However, the prevailing criterion set before the newly designed instrument was to introduce such an energy efficiency supporting instrument that would secure reaching the energy saving national goal at a minimum cost for the state budget.

Since the Polish WCS was mainly established to meet the quantitative savings goal set in the Directive 2006/32/EC on energy end-use efficiency and energy services (ESD), therefore it aims at the indicative energy saving cumulative target of 9% in the ninths year after the ESD came into force, e.g. in 2016. The cumulative target for Poland was set at 53 452 GWh till 2016.

The WCS is also indirectly supposed to contribute to meet one of the goals of the EU climate and energy package, namely the 20% energy savings compared to the „business as usual" scenario in 2020. In general the EEA is not considered by public as an instrument of climate change policy. There are also no other objectives set for the WCS system in Poland, e.g. social considerations.

The WCS was assessed by Poland's government as the most favourable measure of those mentioned in the ESD for the following reasons:

- produces the lowest strain on the national budget,
- enables to achieve the largest energy savings in the shortest time,
- if properly used, it enables to control precisely the process of meeting the national energy efficiency target in time, therefore allows for sufficient flexibility over years,
- covers a broad group of users, mainly those not covered by the EU ETS,
- gives possibility to choose initiatives from a broad scope of Initiatives Aiming at Increasing Energy Efficiency which are most effective in terms of energy saving and economic effectiveness,
- provides incentives for enterprises to invest in Initiatives Aiming at Increasing Energy Efficiency.

In the report entitled "II Stage 2016" were introduced new elements pertaining the EEO, or specifically the existing WCS, are proposed by the government to come into force beginning of 2016. Only major differences are - if relevant - described. Where no changes are envisaged the new subclauses are omitted.

II Stage mid 2016

The general political and public assessment of the functioning and modest results brought by the EEA made in 2014 received some criticism. Therefore a draft of new EEA was prepared by the government in late 2014. That is in practice a complete revision of the EEA in force now, and it is mainly driven by:

- The need of implementation of the Directive 2012/27/EU on energy efficiency (EED),
- The problems or even failure of the WCS in its first phase of operation, and the following widespread consensus of main actors on the necessity to reshape the system into more flexible and less bureaucratic.

Especially the auctioning mechanism was found too complex and difficult to manage, involving many specialists and therefore too expensive, and as such not deserving further development or refinement. Thus it is proposed to remove auctioning as mechanism of granting WC. Now all energy efficiency improvements, even at the stage of being planned, by request of investors obtain "automatically" WC although they may be used as eligible means in the process of meeting the obligation (redemption) when the investment is completed and brings verified energy savings not lower than declared.

6.2 Design of EEO

I Stage 2012 - 2015

In the EEA when introducing the EEO a term "Initiatives Aiming at Increasing Energy Efficiency" was defined as undertaking an introduction of changes or improvements in an object, technical device or installation which brings about energy savings. This definition is very much like the term "energy efficiency improvement measures: all actions that normally lead to verifiable and measurable or estimable energy efficiency improvement" defined by the ESD. However it on purpose excludes economical, e.g. structural development impact on energy consumption or energy prices fluctuations, and behavioural changes as eligible in the WCS. This limitation was manly inspired by the wish not to grand WCs for "soft" measures, with impacts difficult to estimate, and therefore not very highly praised by the government. Thereafter the term "energy efficiency improvement measure" will mainly be used to remain consistent with the ESD nomenclature (in some places interchangeable with "initiative" or "investment" for short).

It has also to be noticed that the EEA does not use the name White Certificate (WC), instead it introduces its equivalent name as "energy efficiency certificate". But the term meets the requirements of the definition of WC provided in the ESD as "white certificates': certificates issued by independent certifying bodies confirming the energy savings claims of market actors as a consequence of energy efficiency improvement measures", thereafter for simplicity the term "White Certificate" will consequently be used throughout the report.

The WCs refer to primary energy savings and can be granted for both planned and finished energy efficiency initiatives. In the case of the planned ones the respective WCs may be traded on the Power Exchange only after the investment has been completed.

The introduction of WCS in Poland was preceded by comparative studies of similar systems in Italy, France and WC-like system in the UK.

In the course of WCS preparation, to fulfil the principal goal of minimising costs for the state budget, it turned out that the WCS shall possess some original elements not used in the other states where similar WCS had already been in used. This led among others to the introduction of the auctioning system (tender procedure) described below.

The Polish WCS was built on the following basic rules that all projects must be in line with:

- The tender rule - the right to obtain WC is through an open public tender for energy saving improvement measures (energy saving investments).

- The list rule - the system sees only those actions from the list of eligible energy saving measures published by the Minister of Economy (MoE) in the Official Gazette of the Polish Government.
- The tangibility rule - the list covers only those energy saving measures for which a precise, tangible result can be determined in the form of an average amount of energy saved annually, assuming the typical (normalised) conditions of functioning and usage.
- The audit rule - each energy saving measure submitted for tender must have its energy efficiency audit attached:
    - for simple actions – obtained in a simplified audit procedure,
    - for more complex cases – obtained in a balance audit (full audit of the energy savings balance).
- The ”ω” (omega) rule - the most important parameter in the tender procedure is the „ω” energy performance coefficient, understood as a ratio of the average annual amount of energy saved as a result of implementing a measure or measures of the same kind, to the value of energy efficiency certificate which a company participating in a tender is trying to obtain.
- The threshold rule – there are the following amounts:
    - a minimum amount, with an accuracy of which WCs are going to be quoted on the Polish Power Exchange (1 toe), one property right traded at stock exchange = 1 toe of primary energy
    - a threshold of minimum amount of average annual savings of primary energy resulting from implementing the measures or combination of similar measures, making the company eligible to participate in a tender, has been set to 10 toe,
    - a threshold of maximum amount of primary energy savings, which does not require an obligatory energy audit (ex-ante measurement) to confirm the actual savings after an energy efficiency initiative completion, has been set to 100 toe.
- Final rules:
    - WCs acquire property rights after the initiative has been completed.
    - WCs are traded on the Polish Power Exchange or on the over the counter (OTC) market under obligatory registration of transactions.
    - Project submitted for tendering procedure shall be launched after 1 January 2011 and must not get any EU or state budget support (details in section 6.2.7).

The WCS's working procedures have been based as far as possible on the already existing systems for supporting high efficient CHP and RES. The main difference lies in the application procedure, which in the case of WC is based on auctioning (as a tender bid has been introduced) whiles in the other support systems certificates are granted "automatically". It means that only a fraction of energy efficiency improvement measures meeting the same requirements are granted, i.e. only the 'winners' at the auction. Thus some savings obtained cannot be registered and notified as a result from the EEO. This competitive approach reflects the government's intention that not all energy efficient oriented improvements are financed from public sources. Thus the amount of the WCs granted does not have to be equal to the energy savings obtained due to all measures implemented within the country.

For the obliged parties there are two legal ways of meeting the EEO:

- to obtain and then to submit WCs for redemption,
- to pay so called substitution fee.

Those who fail to take any of these possibilities shall pay penalties.

The obligated parties shall obtain *a specified number of WCs* (valued in toe), and then submit them to the President of Energy Regulation Office (ERO) for redemption. The required number is equal to 1.5% in 2014-2015 (in 2013 it was 1.0%) of the quotient of:

- income from the sale of electric energy, heat and natural gas to end users generated in a given year, in which the obligation is to be fulfilled, in the case of an energy company selling electric energy, heat or natural gas to the end users,
- the amount of purchase transactions of electric energy, heat or natural gas on the commodity exchange performed in a given year, in which the obligation is to be fulfilled, in case of an end user acting on his own and a commodity brokerage house or brokerage house acting at the request of this user, and substitution unit fee O_{zj}, which is the cost of reduction of one toe set by the MoE.

There are strict rules how to estimate the incomes of the obliged parties which for some may have great impact on the quantitative size of the obligation.

From the income used in determination of the obligation one subtracts the following amounts if applicable:

- income from selling natural gas to energy companies in order to generate electrical energy or heat,
- income from selling natural gas for non-energetic purposes,

- excise tax paid by energy companies levied on electrical energy or natural gas sold to end users,
- costs of the CHP certificates submitted for redemption or costs of substitution fee paid by the energy company stemming from selling electrical energy to end users.
- costs of the WCs submitted for redemption or costs of substitution fee paid by the energy company,
- income from selling electrical energy to large energy intensive end users (described below).

In practice the rules may substantially reduce the required obligation of some parties.

The other option of meeting the legal obligation is *to pay substitution fee* which is estimated as:

$$O_z = O_{zj} \cdot E_p , \quad (1)$$

where,

O_z – substitution fee expressed in PLN,

O_{zj} – unit substitution fee, not lower than PLN 900 (app. €225) and not higher than PLN 2700 (app. €675), for one toe primary energy savings,

E_p – amount of primary energy expressed in toe, equal to the difference between the energy stemming from the obligation, i.e. the EEO, and the energy for which WCs have been submitted for redemption.

The substitution unit fee O_{zj} was set to PLN 1 000 (app. €2 50) per toe. Needless to say that this value sets the market price of the WC.

The substitution fees are directly allocated on a separated bank account in the National Fund of Environmental and Water Protection (NFoEPWM), and are permitted to be used among others for energy efficiency oriented projects funded by the fund only.

To eliminate unfair competition in the WC tenders they are divided into the following categories with pre-set quota in the WC tenders:

- End users (scope of the ESD) - increasing energy savings in end use sector – this category covers natural persons, legal persons and organisational units without legal identity. For this category at least 80% of the total certificate quota in a WC tender

bid shall be guaranteed. The remaining 20% of the quota of WCs are to be divided between the two other categories.

- Energy generation - increasing energy savings in auxiliary equipment of power units, e.g. energy used for one's own energy generating purposes (covering buildings and facilities used for electric energy or heat generation).
- Transmission and distribution of energy or energy carriers - reducing losses of electric energy or natural gas in transmission and distribution systems, and heat in district heating networks.

The bids are carried out separately for each of these categories, e.g. WCs are separately granted in each category up to its quota and are not interchangeable between categories. Division to the categories and the largest quota allocated for end users ensure that investments made by end users can compete with the other delivered by projects in energy sector which are likely to be financially more attractive.

WCs are granted to companies by the President of ERO in a tender procedure (auctioning). At least once a year and at least two months in advance, the President of ERO shall announce and conduct a tender. For each tender, when announcing the tender the President of ERO determines the number and value of certificates to be issued in this tender. The MoE sets the „bid acceptance ratio" (*t*) and is obliged to notify it. In the first tender the (*t)* was equal to 0.5. In subsequent tenders the (*t)* acceptance ratio can reach a level resulting in the rejection of some offers with lower ω values. In the second tender the (t) was equal to 0.4, and in the third tender was calculated at the level of t=0.3.

The aim of the tender is to select energy saving measures using the value of the energy effect (ω) that plays the role of selection criterion. The (ω) is declared by the bidding companies. The higher the energy effect value declared the higher the chances for success.

In the tender, the bids are accepted for which the companies declared (demanded) the energy effect values (ω) within the range:

$$(t \times \omega_{average};\ \omega_{max}), \qquad (2)$$

where the respective symbols denote:

- t – bid acceptance ratio determined by the MoE,
- ωmax – highest declared energy effect value in a given tender,

- ωaverage – average energy effect value – computed as the average value of all values of ω declared in a given tender weighed by the amount of energy saved as a result of implementing the energy efficiency improvement measure submitted for the tender in the total energy saved by all measures submitted to the tender.

The President of ERO issues WCs to the winning bidders (companies) up to the total value of savings envisaged in this tender in an order according to the values of (ω) declared by them.

The Polish WCS system has been designed for the definite time-span set out in the EEA as follows:

- Binding force of the EEA: from 11 August 2011 to 31 December 2016.
- The obligation to obtain WCs: from 1 January 2013 to 31 December 2015.
- Settlement of the obligation for the previous year: until 31 March the next year (2014, 2015 and 2016).
- Tenders for WCs may take place (be announced): from 1 January 2012 to 31 December 2015, at least once a year.
- Completion of energy efficiency measures eligible for tender for WC: from 1 January 2011 to approximately middle of 2015.

It means that the system presently in force ends at 1 January 2017. Moreover all issued WCs are subject to redemption only by 1 April 2016.

II Stage 2016

A new rule of dimensioning the obligation is planned – now the obliged parties shall annually save 1.5% of the total amount of electric energy, heat or natural gas sold to end users, directly or by trade houses.

As previously from the total gas amount sold the amount used for producing electrical energy or heat, and gas used for non-energetic purposes, e.g. by chemical industry.

Following there is a fundamental change in the procedure of granting the WCs: it is proposed to delete the whole auctioning approach. Now the WC is a prove of declared amount of energy saved annually due to implementation of energy saving improvement measure or a set of measures of the same kind. WC is issued by the President of ERO at the request of the implementing company. It is required to provide information on the planned

energy savings, description of the type of the investment and duration of the savings period. The application shall contain an energy audit of the planned investment.

The company who received the WC is obliged to accomplish the investment, and then to make an energy audit to prove in reality the declared savings. Like previously, if the declared energy savings are lower than 100 toe per year, an audit is not required, i.e. small savings are verified at random based on the President of ERO's order. It can be added that the President of ERO remains the right to check all audits, namely those attached to the application of granting WCs and those ex-ante audits. Then he compares the declared and obtained energy savings to check compliance. In the case of attaining smaller saving as declared the company shall provide appropriate number of WCs to cover the gap – this stage of verification of savings is not changed.

The President of ERO redeem the WCs only when they have acquired the trade value, e.g. the investment is completed, the savings are verified and the WC recipient (owner) fulfils all the administrative procedures required by the Power Exchange to convert them into tradable instrument. It is of course also possible to trade WCs bilaterally.

There would be no possibility to pay a substitution fee any longer – obliged parties shall redeem WCs or pay penalties.

6.2.1 Type of measures

According to the definition of the 'energy efficiency improvement measure' it covers an introduction of changes or improvements in an object, technical device or installation which bring about energy savings. Thus the range of the measures is at least theoretically very broad. It had been the intention of the legislator to exclude from the WCS all soft measures like public campaigns, education, trainings or promotion and regard them as not eligible. The list of eligible measures is published in the form of resolution of the MoE and contains specific measures that are in fact subcategories of the general measures mentioned in section 6.2.2. (full list of eligible measures was published in Official Journal of the Republic of Poland, Polish Monitor (M.P. 2013, pos.15).

The list is very much based on the ESD Annex III "Indicative list of examples of eligible energy efficiency improvement measures", narrowed to strictly technical measures. Concerning the areas of application, it focuses on "technical objects" like buildings, devices, installations, machines, equipment in non-specified areas that allows, at least in theory, to expand the scope very broadly, e.g. on industry, households, offices.

6.2.2 Scope - sector related

The EEO covers a broad range of sectors like the residential, commercial, and industrial sectors in respect of:

- end-use energy efficiency;
- energy savings in auxiliary equipment in power stations,
- energy loss reduction in electricity and natural gas transmission and distribution systems, and heat losses in district heating networks.

The WCS addresses energy efficiency both in the public and in the private sectors. In practice individual households are excluded due to the minimum threshold of 10 toe that makes the WCS inaccessible to single users. Although it is possible to bundle (group) similar undertakings which would gather 10 toe of energy savings annually and submit them to the tender announced by President of ERO.

6.2.3 Scope - technology related

Fuels covered by the EEO system are electricity, natural gas, and heat delivered by district heating networks.

WCs may only be issued for the following general types of energy efficiency improvement measures:

1) insulation of industrial installations;
2) refurbishment or renovation of buildings;
3) modernization of:
    a) appliances intended for household use,
    b) lighting,
    c) appliances serving individual needs,
    d) appliances and installations used in industrial processes,
    e) local heating grids and heat sources;
4) energy recovery in industrial processes;
5) curb of:
    a) reactive power flows,
    b) grid losses, e.g. in electrical networks, oil- and gas pipe systems,
    c) losses in transformers;

6) heating or cooling facilities with energy produced in own RES or those connected to the grid (within the meaning of the Energy Law Act of 10 April 1997), useful heat in cogeneration (as above), or waste heat from industrial installations.

Other measures are therefore not eligible for WCs. The list is very general and in practice to find more concrete measures parties refer to Annex III of the ESD that provides examples of areas in which energy efficiency improvement programmes and other energy efficiency improvement measures may be developed and implemented.

The list of measures can any time be modified by the MoE, and then shall be made public.

All Installations within EU ETS, except auxiliary equipment of power stations as well as all military installations and military technical devices are excluded from the Polish WCS. It is worth noting that as auxiliary equipment is also covered by the EU ETS, its inclusion in the WCS is overlapping - the energy sector became in this way a direct beneficiary of the WCS.

6.2.4 Obligated parties

The EEO covers the following parties (thereafter called obliged parties):

- 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 licence for electricity (415), gas (114) and heat (110) trading. The actual number is hard to estimate as some of them possessing an appropriate licence remain inactive.
- 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).

District heating companies supplying no more than 5 MW of heat are exempted from the obligation.

This scope of obliged parties ensures that all entities selling energy (electricity, heat) or energy carriers (natural gas) to end users are covered by the system disregarding the type of the trading transaction.

6.2.5 Target setting

I Stage 2012 - 2015

The Polish national energy saving target as required by the ESD was set by the EEA 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. It is seen that the WCS is considered the main energy efficiency instrument in Poland as it is responsible for almost half of the savings envisaged in Poland's II NEEAP. In NEEAP of 2014 detailed information on establishing EEO in compliance with Directive 2012/27/EU has been described.

II Stage 2016

In the EEA draft it is explicitly stated that obligatory energy saving forced by the WCS should amount to at least 3,675 Mtoe till 2020.

6.2.6 Calculation method savings

Energy efficiency audit shall provide assessment of the current technical state and analysis of energy consumption by the object, technical device or installation, and assessment of the effects to be obtained due to the realisation of the investment, especially the obtained energy savings.

Audits should also contain a description of possible types and variants of energy efficiency improvements accompanied by cost effectiveness analysis and estimation of energy savings possible to achieve.

Different requirements are laid down for energy audit of heat supply systems. It shall cover two variants – audit of a heat centralised system and of an autonomous heat source supplying the building, and shall indicate which supply system has a greater energy efficiency. In this way it is tried to exclude support given by the WCS to autonomous heat system when centralized supply is more energy efficient.

Energy efficiency audits may use different methodologies:

- A pure calculation approach based on e.g. analytical, numerical engineering methods, mathematical modelling and computer simulations, in cases where these methods are verified and commonly regarded as sufficiently accurate and reliable,
- Measurement approach supported by analytical calculations,
- Combination of the two above.

There are two main methods of savings calculation:

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.

Simplified audit can only be done for initiatives listed in the Regulation of the MoE, e.g. for walls, roofs, windows, lighting systems, home appliances, IT equipment, electric motors up to 100 kW The measurement algorithms given there clearly specify the value of savings after fulfilment of certain requirements. This method is applicable to standard, typical energy efficiency improvement measures, and largely simplifies the procedure and reduces costs of energy savings verification.

However, it is always, in every kind of initiative possible to carry out an estimation of savings using *balance audit procedure.* It may happen to be more favourable to beneficiaries of the WCS then simplified audit, because it is more accurate and takes into account actual energy consumption. Its disadvantage is of course the higher costs which is considered in practice as a market barrier. The balance audits are described in the regulation in a very general way, except for buildings and lighting systems for which detailed methodologies are provided. The general guidance on energy auditing is based on recommendations published by EC on bottom-up approach laid down in the ESD Annex IV "General framework for measurement and verification of energy savings". In the *balance audit* it is required to deem (by use of evaluation algorithms) or to measure energy consumption before the energy efficiency investment and deem or measure the energy consumption after finishing the investment. The savings are then evaluated as a difference in the annual energy consumption before and after investment.

6.2.7 Additionality

Projects do not have to be additional.

The procedures of the system of auctions do not check any criteria of additionality, like alternatives to the project activity, its financial attractiveness, economic feasibility without the WCS support, barriers that prevent implementation, extent of diffusion of the practices or technologies proposed. However there is a general requirement that stipulates that WSC projects must not be doubly financed from public sources, EU or national. In practice, there are direct legal restrictions imposed on the WSC projects. Namely, initiatives aimed at increasing energy efficiency cannot be submitted for tender, if they were implemented:,

- with an energy renovation bonus mentioned in Article 3 of the Act of 21 November 2008 on supporting thermal modernisation and renovations

or

- with funds from the EU or the State budget.

The Polish legislator has not ruled out other forms of financing initiatives aimed at increasing energy efficiency, which means that ESCO services and banking loans can be used. Unfortunately, as it is not possible to predict the final financial result of the initiative (i.e. the results of a tender bid) banks are reluctant to give credits in the case when WCs are the only collateral of the initiative.

6.2.8 Verification & Monitoring

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 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.

The detailed rules and methodology for different types of energy audits are specified in decrees and regulations issued by the MoE. These are in principle firmly based on the ESD Annex IV “General framework for measurement and verification of energy savings” and accompanied documents issued by the European Commission. General rules and guidance laid down in “International Performance Measurement and Verification Protocol” are also widely used

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).

6.2.9 Control and Compliance

I Stage 2012 - 2015

The obliged parties shall obtain WCs and to submit them for redemption to the President of ERO or to pay the substitution fee to the NFoEPWM. The fund has the obligation to inform the ERO about the substitution fees paid by these obliged parties who failed to meet the obligation by providing WCs for redemption to the President of ERO . 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.

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.

There is also a catalogue of penalties that are imposed on no obliged companies that realised energy efficiency investments (i.e. not only obliged parties) and applied for WCs only (tender stage) or then obtained them (investment stage). The draconic penalty up to €2 000 000 may be imposed on a company in the cases when:

- provided untrue or misleading information in the tender application,
- not realised the investment despite the obligation,
- not notified the President of ERO of the accomplishment of the investment in the due time required by the law, or notified but provided untrue or misleading information,
- obtained lower energy saving than had been declared what was discovered in the process of energy auditing initiated by the ERO in the ex-ante verification process,
- took part in the tender against the ban imposed by the ERO.

The special category of end users, namely the energy intensive industry, who in the notification provide untrue or misleading information are subject to € 2 000 000 penalty imposed by the President of ERO.

All the penalties alike the substitution fees are located on a bank account of NFoEPWM.

If WCs had been granted for the planned investment and then the investment has not been accomplished (realised), the ERO, as a system operator, may impose severe penalty for non-compliance on the beneficent 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 beneficent 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).

It is also proposed to regard the penalty as direct stated budget income what substantially alters the current rule according to which the penalty is located on the NFoEPWM account with restriction to be only used on energy efficiency projects.

6.2.10 Administrator - Institutional set up

The MoE and the President of ERO are both responsible for functioning of the WCS, though each of them has a different area of activities.

The MoE exercises general supervision of the WCS but every day administrative routine has been allocated to the President of ERO who is in practice responsible for its effective and smooth functioning and the results obtained. Thus he plays the crucial operational role in the whole WCS.

The MoE through regulations sets values of the main parameters governing the system such as the level of the unit substitution fee or parameter *t*, and publishes detailed list of initiatives aiming at increasing energy efficiency. The MoE has also specified, by means of an regulation, a detailed scope, kinds and ways of drawing up energy audit and templets of forms for such audit.

The MoE has the right to issue a regulation in which he sets out detailed conditions and procedures for WC tenders and sets out templates for tender documentation which only in general way have been described in the EEA.

President of ERO is engaged in preparation, organisation of WC tenders, announces their results, and then in all issues related to WCs' issuing, redemption and collecting substitution fee. He also supervised the phase of monitoring and verification of results by establishing proper system of energy audits. In all cases of non-compliance, breaching the rules he enforces the law, and when necessary imposed monetary penalties.

Substitution fees and monetary penalties are paid to the NFoEPWM to support its energy efficiency oriented programs.

6.2.11 Flexibility

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).

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.

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.

On the other hand, when planning an initiative aimed at increasing energy efficiency a potential investor should compare its costs with the savings of energy costs generated by such initiative throughout its lifetime. WCs - an additional injection of public capital – determined by average annual energy savings, make it possible to shorten the simple payback time (SPBT). The amount of substitution fee determines the maximum level of achievable prices of WC. According to market rules the cost of obtaining WC on the Polish Power Exchange should not be larger than the price of the substitution fee.

It is also of value that the WCS in Poland allow for grouping of “small” energy efficiency improvement measures of the same kind or closely similar, and creating packages of more than 10 toe in order to submit them for a tender bid. Also, initiatives can be submitted for tender by an entity which has implemented them or by an entity authorised by it. These solutions should also open possibilities for the development of the ESCO market and give access to the system for smaller investors, in principle even for individuals replacing household appliances by more energy efficient ones.

The obligation shall be settled on one year period basis, and therefore banking or shifting obligation between years is not permitted. This rule directly stems, or even has been directly copied, from other existing Polish support systems i.e. for RES or CHP, and does not take into account that energy saving projects have their specific aspects, e.g. investment cycle for energy efficiency investment may take longer than a year before they result in actual

savings, impact of different levels of productivity and resulting fluctuations of savings that require sufficiently long time interval of averaging.

There are some special regulations applied to end users that used not less than 400 GWh electrical energy in the previous year before the obligation is due, and for which the share of electrical energy costs in the total production costs is not less than 15%. They represent the energy intensive industrial users. In case they completed energy efficiency investments in an installation not covered by the EU ETS no earlier than 1 January 2011, which brought energy savings of at least 1% annually, they submit to one of its electrical energy suppliers a notification of completion together with an energy audit proving the energy savings obtained. The 1% of saved energy must not be less than the amount of energy arising from the EEO. Then the energy supplier can submit the notification to the President of ERO as a prove of meeting its own EEO. Behind this mechanism, one can guess, lies the possibility of negotiation better electric delivery conditions, e.g. lower energy prices, for those large consumers – however it is not officially mentioned in the EEA. In this way a favour was given to the energy intensive industry that received in the final parliamentary discussions the right to substantially reduce its obligation. It was the main argued and questioned element of the EEA in Parliament.

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.

Concerning large energy users the threshold criterion will be reduced from 400 MWh to 100 MWh of electrical energy used annually, while the 15% criterion of minimum energy cost share in final product cost will be retained. Also the minimum annual amount of electrical energy savings will be raised from the current 1% up to 1.5%. Altogether it means that a larger number of end users is declared as "large users" that deserve special treatment, on the other hand they are forced to make large annual savings.

Also the earliest date after which the energy efficiency investment must be completed to be eligible is changed to 1 January 2014.

6.3 Results of EEO

6.3.1 Total costs

I Stage 2012 - 2015

It had been estimated by the government in the preamble to the EEA (2010) that additional administrative burdens in the ERO office would require 20 new employees and total annual spending of PLN 2-3 mln (app. €500 000-750 000).

The total administrative costs of the WCS incurred by the ERO cannot be estimated in a reliable manner. This is due mainly to the short period of functioning of the system and scarce information made public by the ERO. The only available evaluation of the administrative costs incurred by the ERO was presented in the literature and it amounts the costs up to PLN 3 million (app. € 750 000) annually. This figure is likely to be temporary overshot mainly due to the lack of experience of the ERO staff that did the job for the first time having no previous experience in the field of WC at all. Secondly the whole evaluation process was done "manually" with no supporting software employed which is likely to be improved in future bids. Additionally, it took a long time since there were many cases that needed interpretation of the EEA provisions, and the secondary acts were delayed.

II Stage 2016

The draft of new EEA mentions limits on the maximum expenditures from the national budget for covering all duties performed by the President of the ERO. The expenses cannot exceed:

- PLN 1,941 mil (app. €500 000) in 2015,
- PLN 1,811 mil (app. €450 000) in 2016-2024.

6.3.2 Total expenditures

Total expenditures related to the preparation of the bid documents, e.g. energy audits, consultancy are not available. They were neither disclosed by the bidders nor requested by the President of ERO, at least for statistical purposes.

One can guess that they varied largely depending mostly on the size of the project and individual knowledge and experience of the bidders. There were cases reported in which large bidders, e.g. steel foundries hired external consultant to prepare the whole bid documentation and represent him throughout the whole bidding process. On the other hand the majority of bidders, usually small companies, prepared the documents themselves. The latter resulted in a large number of errors, mainly of minor editorial type, that caught during the tender procedures disqualified the applications.

6.3.3 Total 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. This remark refers as well to the count of the total savings. More organised WC bids and a longer period of operation of the WCS are required to be able to draw some firm conclusions or make quantitative estimations.

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. This is surprisingly small fraction of the WC allocated as compared to the whole pool. In general the failure can be explained by the absolute novelty of the WCS in Poland where the knowledge on practical aspects of WCS functioning were very scarce at the moment of launching the WCS[42].

6.3.4 Cost effectiveness

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.

[42] The methodology used in the WCS in Poland is based on savings expressed in primary energy units. Therefore there is an obvious need to express secondary energy saving generated by a given energy efficiency improvement measure in terms of primary energy. The coefficient of transformation between secondary and primary energy is of paramount importance in the case of electrical energy. The ESD in Annex II "Energy content of selected fuels for end use—conversion table" gives a guidance saying that for savings in kWh electricity Member States (MS) may apply a default co-efficient of 2,5 reflecting the estimated 40% average EU generation efficiency during the target period. Since it is also permitted that MS may apply a different co-efficient provided they can justify it, Poland has set the transformation coefficient as 3.0 that should better reflect the average energy efficiency of the electric power sector. Actually taking into account the energy efficiency of the sector is better than 35% it gives a good advantage to saving of electrical energy - due to the triple difference between appropriate coefficients for transforming primary energy into final energy.

6.3.5 Other stakeholders

The draft of the EEA had been submitted to the Parliament by the government after years' long preparation. It finally received political acceptability but was substantially re-written and amended in the Parliament. There were doubts and threats about the costs of the WCS that are finally inevitable passed on the end-users.

So called large energy end-users i.e. the industrial companies that consume high amounts of gas or electrical energy, had their impact on the preparation of the EEO system in Poland, mainly during the phase of the parliamentary discussions. They are well organised in an industrial chamber and executed their power as strong parliament lobbyists. Special solutions committed to them have been designed in order to avoid excessive increases of the prices of the high energy consuming products.

Also the obligations imposed on the public sector were watered in the Parliament and are rather too weak to enable the public sector to play the leading role as energy saver.

There is a marginal if any interest from the organisations representing individual end user, e.g. households.

Local authorities are not deeply involved in any way in the WCS. It can be quested that the authorities are not aware of WCS functioning and potential benefits they can obtain from active participation. However in the second auction few municipalities submitted projects and were granted. Hopefully it is a positive sign of stronger interest at local level.

6.4 Adaptation of EEO

6.4.1 Frequency of redesign

The Polish WC System was redesigned once by the Law on amendments in the Energy Efficiency Act of 10 October 2012. The amendment consisted of an abolition of the requirements that shall be met by the person, who is eligible to perform energy efficiency audits. This amendment therefore made the energy auditor profession absolutely open, not demanding any certification or accreditation from the state.

Late 2014 the government prepared and submitted for public comments a draft of completely new EEA. The main changes proposed are described in the report in the subclauses entitled "II Stage 2016".

6.4.2 Reasons of redesign

The reason for redesign in 2012 of the Polish WCS was the common drive of deregulation of professions in Poland. In this way the planned introduction of the energy efficiency auditor as a profession was abandoned.

The reasons for submitting the new draft of EEA were explained in 6.1 Policy objectives of EEO.

6.4.3 Manageability

What matters in the Polish EEO are average savings of primary energy achieved from one year of implementation of the initiative aiming at increasing energy efficiency and not through total savings for the entire lifetime. Thus, from the perspective of Polish WCS, the most attractive initiatives are those resulting in electricity savings, which are featured by a short simple payback time.

The functioning of the WCS in the longer run should be managed by the proper choice of the parameters like *t*, number of the certificates allocated for each tender pool (toe) and value of the unit substitution fee.

6.5 Social equity

The Polish EEO system does not take into consideration issues of social equity. It disregards its potential role it could play in the process of alleviation of energy poverty.

6.5.1 Contributors

It is eligible for the obliged parties to cover all costs due to the obligation by tariffs. Not only the costs incurred for energy efficiency improvement measures (investments) but also for the substitution fee payment. The second option may encourage the obliged parties being inactive, and is not an incentive to develop own capacity in energy saving projects, technical or only competences in co-operation with third party partners, e.g. ESCO.

In cases of paying substitution fee to the NFoEPWM the funds serves through its energy efficiency programs as project proposer and facilitator.

In general the end-users are not informed and aware of the cost of their contribution to the WCS.

6.5.2 Beneficiaries

When sending the draft of EEA to the Parliament in 2010 the government pointed out that improvements of energy efficiency would bring concrete profits to the national economy estimated at PLN 250-350 mil (app. €62.5-85.5 mln) annually. The estimation was done under the assumption that the price of one toe is PLN 500-700 (app. €125-175) in Poland. It was assumed that in the first year of the WCS functioning the substitution fee would be set at PLN 2 000-2 700 (app. €500-550) and the amount of saved energy would be 0.5 mln toe, the cost would amount to PLN 1-1.5 billion (app. €250-375 mln) annually.

Thus it was awaited that the accomplishment of the national energy efficiency target would - within in a time period of 10-15 years - bring to end-users, including the public sector, total cost savings of PLN 2.5-5.2 billion (app. €625-1300 mln).

6.5.3 Impact on energy prices or tariffs

The impact of the WCS on energy prices is not known mainly due to the fact that the WCS has started very recently, and the current amount of WC granted is negligible compared to the total energy market in Poland. Initial estimations, carried out before the system was launched, had predicted an increase of approximately 1.5-2.0% in electricity price for households.

6.6 Lessons learned and what can be improved?

6.6.1 Areas for improvement

The assessment of the current WCS is presented in the form of SWOT. Some weaknesses of the system have been identified and rectification measure have been proposed in the draft of new EEA. The others remain untouched.

Strengths

It is a market based mechanism that for the obliged parties at least equals costs of the energy efficiency improvement measures with marginal costs of energy.

Tradability of the WCs makes the system highly market oriented instrument.

The competitive system of bids for WCs and their tradability enables meeting the quantitative energy saving objectives at minimal societal costs. As the WCs are given only to

the least costly measures the financial burden transferred via tariffs to end-users is minimal. End-user should also benefit due to lower energy consumption. Environmental benefits are also of value for the society.

Addresses new energy saving areas not covered yet by other energy saving supportive systems. In the EEA only the WCS is mentioned as it imposes obligations and therefore shall be introduced in the legal system. According to the government's position other not compulsory systems are not exclude and even welcome, for example voluntary agreements can as well be implemented.

Energy saving obligation is proportional to the energy income of the obliged parties what makes the system clear and fair - "the more revenues from energy sell the higher the obligation".

It is tight in this sense that it embraces all possible channels of delivering electricity, natural gas and heat in larger installations (greater than 5 MW) to end users, namely directly selling by energy companies to end-user, purchasing by end-users directly from energy producers or energy carriers delivers (OTC) or by an agent, e.g. by brokerage house on the Power Exchange.

Covers many different groups of users, e.g. end-use of energy except for sectors subjects to the ETS; energy used by energy generators for their own production, and transmission and distribution of energy carriers and electric energy.

Can be almost cost neutral, except administrative costs, for the national budget since the cost are transferred to end-users by tariffs.

WCs make the payback period of energy efficiency investments shorter which is an incentive to undertake energy saving oriented investments by different parties.

Weaknesses

Relatively high administrative costs as compared to other supporting schemes reflecting complexity of the system and lack of managerial experience of its administrator.

Tendency to implement the project themselves by the obliged parties instead of making use of market energy services providers, partly due to the weakness of the ESCO market in Poland.

Untested in practice methodology of energy saving measurements and verification.

Insufficient knowledge of costs of different energy efficiency improvements except for very few standard improvements, e.g. lighting, insulation of buildings, windows change. This feature makes it difficult to precisely control the auctioning system since its function parameters, e.g. ω or t, are then difficult to be optimally set.

Small knowledge on the technical parameters used in the WCS to obtain its optimal functioning, e.g. rather arbitrary setting of the "t" or "ω" parameters.

Lack of possibilities to precisely control the WCS, e.g. missing ability to choose among different types of energy, with some preferences for electrical energy.

The auctioning system favours only those energy efficiency investors who ask for their improvements the lowest reward in the form of WCs, i.e. by requesting lower value of ω than the other bid competitors. This mechanism leads to rejecting of some potential or realised investments, which in this way remain outside the system. It has also the consequence that the "unseen" projects, i.e. projects that are taking place anyway but not being notified, do not contribute to the national saving goal as required by the ESD.

The auctioning system may also discourage some of the potential investors if the public opinion considered it as too competitive with low success rate especially for small companies or individuals.

So far, WCS focuses on improvements in electrical energy and short payback time investments, therefore long-term investments are not stimulated, especially in the building sector.

High cost and technically difficult monitoring and verification of the obtained energy savings.

Lack of incentives to exceed the obligatory savings for the obliged parties.

Wide spread convenience among investors that for setting and meeting ambitious energy saving goals – nationally and locally - and for supporting specific investments, a more effective are suitable regulation, besides direct financing is required, e.g. subsidies from public sources., and not a complicated system as the WCS.

High costs of WCS functioning and transaction costs for participants.

Low knowledge on technical aspects of energy efficiency improvement measures and their financing options among obliged parties and potential providers of energy services.

Opportunities

Growing spending on energy efficiency improvements due to politically driven more stringent legislation and public pressure on environmental issues.

Development of the market of low-emission technologies and novel energy services, especially growing ESCO sector.

Steady transformation of the energy volume driven market to energy services market.

Possible lowering of the transaction costs due to better co-ordination and co-operation between the WCS and the EU ETS.

Possibility of technical supporting the WCS by environmental funds, e.g. by providing funding for low cost energy audits.

Large financial resources allocated for energy efficiency investments in the current EU programing period 2014-2020.

Launching of effective promotion campaign on WCS benefits.

Organisation of educational and training system supporting potential bidders and beneficiaries of the WCS, especially focused on SMS to assist them in preparation the WC applications.

Restitution of the energy auditor profession or introduction of any qualification system setting minimum level of quality of the audits.

Lowering the penalties to a reasonable level to diminish the business risk for no-compliance that should result among others in stronger political support for WCS and better acceptance by the obliged parties.

Introduction of reasonable insurance system for energy auditors, and the audited parties against auditor's mistakes.

Allocating larger financial resources for the ERO, also for employing more staff.

Take experience form the learning curve to improve the system operation, especially when modifying its parameters.

Support the bid assessment process by employing adequate software and informative system.

Encourage the public sector to get more actively involved and take advantage of the WCS.

Use the WCS to reach the objectives of the EPBD and EED in a low cost synergy way, e.g. by increasing the number of energy audits.

Improve the co-ordination among main stakeholders, especially between the MoE and the ERO.

Create a level playing field for all types of energy and energy subsectors, e.g. create equal opportunities for the industry and building sector within the WCS.

Threats

Growing administrative stiffness of the WCS disenabling the market advantages of WC.

Setting unambitious national energy efficiency target will not induce additional energy efficiency improvement measures beyond the „business as usual" scenario.

Growing complexity and lack of transparency of the WCS.

Lack of political will to extend the time horizon of the WCS beyond the presently limit of 2016.

Late announcement of extension of the period of functioning of the WCS currently in place that may earlier lead to lower interest of parties to invest within the WCS framework.

Conservation of the current ineffective and too restrictive system of monetary penalties.

Lack of or failed attempts to open the WCS to small parties.

Experience based problems with proving the energy saving obtained may discourage potential investors due to high business risk caused by high penalties.

Small, weak, underdeveloped and therefore uncompetitive WC market.

Lack of co-operation between main stakeholders, namely between the MoE as the body setting targets and main WCS's parameters and the President of ERO as the technical operator.

Competition from other energy efficiency supporting programs that may turn out to be more attractive for investors that may finally lead to permanent underdevelopment of the WCS.

7 Flanders – Belgium

Belgium is divided into three regions: the Flemish region, the Walloon region, and the Brussels-Capital region. In Belgium, responsibility for crafting energy policy relating to the rational use of energy falls to these regions. The Flemish region of Belgium introduced an EEO in 2003. The Flemish regional government's Decision of 29 March 2002 concerning public service obligations for the promotion of rational use of energy (RUE Regulation) placed an obligation on electricity distributors as of 2003 to meet annual primary energy savings targets. The RUE Regulation was amended several times, like in 2007, and fully replaced in 2011. The latter amendment changed the RUE obligation completely. As of 2012, the energy saving targets for electricity distributors were eliminated and replaced by specific "action obligations," specific actions set forth by the Flemish Government that distributors must implement. In the following paragraphs, we describe the RUE obligation scheme of Flanders, based on literature and input from the Flemish Energy Agency. In contrast to other member states, like the UK, the general documentation of the scheme is quite limited.

7.1 Policy objectives of EEO

The objective of the RUE obligation is "to encourage the efficient use of energy in a liberalised market." The RUE obligations came into force shortly after the restructuring of the Belgian electricity sector, which legally unbundled transmission, distribution, and generation, and led to the creation of the Flemish Regulator for the Electricity and Gas Market (the so called 'VREG'). After restructuring, responsibility for oversight of the electricity and gas sectors was divided among the federal and regional authorities, with regional authorities overseeing the rational use of energy.

Prior to the establishment of the RUE obligations, Belgian electricity grid companies and electricity suppliers faced federal public service obligations aimed at helping to reduce demand growth in Belgium by 8 TWh in the period 1995 to 2005. The available budget at federal level (about 40.000 k€ between 1996-1999, of which about 24.000 k€ was available for Flanders) was administered by the distribution system operators, but the Flemish government (Department VIREG Flemish Institute for Rational Energy Use) also guided the spending. The following reasons have been cited as driving the decision to go further by developing a RUE Obligation in 2002 (Flemish decree of 17.07.2000 and decision of 29.03.2002): "limited control by the Flemish Government of the existing initiatives on energy

efficiency; no clear energy saving target associated with these initiatives; and limited evaluation carried out of these initiatives." Moreover, in the beginning of the Flemish RUE, protected customers, municipalities and external organizations are indicated in the Decision as those target groups to whom electricity grid companies should pay special attention.

In addition, the Flemish EEO helps to meet the climate obligations that Belgium has agreed to under the Kyoto Protocol, as well as to meet energy efficiency goals under Europe's Directive on energy end-use efficiency and energy services. Under the Kyoto Protocol, Belgium is required to reduce its GHG emissions in covered sectors 7.5 percent below 1990 levels by 2012.

7.2 Design of EEO

7.2.1 Type of measures

Prior to 2012, electricity distributors had to provide both direct and indirect support to energy efficiency measures undertaken. That is, they had to both financially support the implementation of energy efficiency measures and provide information on energy saving opportunities to end-users.

Until 2011, the RUE Law specified, in addition to the energy saving target, "action obligations." Action obligations are specific actions, set forth by the Flemish Government, that electricity distributors must implement. The energy savings from some action obligations counted toward meeting the RUE energy savings targets, while others did not. Before the 2007 amendments, almost any energy saving measure was eligible to count toward meeting the energy saving target. Since 2008, most soft measures no longer counted toward achieving the primary energy saving target. For example, energy savings from measures implemented pursuant to energy scans (i.e. simple energy audits), required of some residential homes, counted toward the energy savings target. Energy savings resulting from the introduction of energy accounting schemes to track energy use of schools and health care facilities did not.

Since the beginning of the Flemish RUE scheme, electricity distributors have been required to pay attention to "protected clients" (i.e., socially vulnerable households). They do this through targeted actions such as giving protected customers higher financial incentives (eg. 20% higher "premiums", as stipulated by the RUE Regulation) than those given to other

customers, providing “discount coupons” for the purchase of A+ or A++ refrigerators or AAA washing machines, or by organizing special information sessions.

The main tools that electricity distributors have employed to stimulate energy savings have been rebates/premiums (proof of installation by means of invoice) to the different sectors targeted and financial assistance to municipalities to invest in energy saving measures, combined with informational campaigns via brochures and the internet, and energy audits/scans. The Flemish EEO scheme does not provide for trading of energy savings.

7.2.2 Scope - sector related

The RUE obligation applies to energy saving measures in a variety of sectors: industry, household, services sector, transport, public lighting, energy sector and agriculture, which can all receive rebates/premiums when implementing energy saving measures. Most of the measures were implemented in the residential sector. The exact numbers on the distribution between sectors are not public available.

7.2.3 Scope - technology related

A variety of measures were possible to implement. The electricity distributors had to specify in their annual submissions their energy savings plans describing also the supported measures. These submissions had to be approved by the Flemish Energy Agency. Typical measures undertaken in the residential sector have included introduction of compact fluorescent lamps, condensing boilers, high-performance glazing, heat pumps, attic/roof insulation, low-flow showerheads, and solar water heating. Typical measures in the non-residential sector include energy efficient lighting, variable speed drives, attic/ roof insulation, and energy efficient boilers. Electricity distributors are the obligated parties, but energy savings made for any fuel can contribute to meeting the energy saving targets.

Until 2011, the RUE Regulation specified, in addition to the energy saving target, “action obligations.” Action obligations are specific actions, set forth by the Flemish Government, that electricity distributors must implement. Following are some of the action obligations introduced:

- In 2004-2005 electricity distributors were required to send to households in their service area a coupon that could be exchanged for a compact fluorescent lamp, energy-saving shower head, or energy meter.

- In 2006-2007, electricity distributors were required to send a voucher for a free energy-saving light bulb to every member of the household.
- As of 2007, electricity distributors were required to carry out each year a certain number of energy scans for every 100 household connections (2 scans/ 100 households). During these scans, energy-saving light bulbs, water-economy showerheads, pipe insulation and radiator foil are to be installed, where advisable (not mandatory to effectively install).
- Electricity distributors must disseminate informational brochures and personalized energy-saving advice to households. This obligation to disseminate isn't translated into savings to the efficiency target.
- From 2006 until 2011, electricity distributors have been required to help set up "energy accounting schemes" on request for schools and health care facilities (>1000 m^2), with costs shared between the buildings and network operators. The distributors are responsible for providing and maintaining the necessary software and training and user support (eg helpline) to these institutions. They also have to provide monthly feedback of abnormal consumption and an annual report with energy savings recommendations. The institutions themselves should enter the monthly meter readings in the energy accounting software.
- Electricity distributors are required to support municipalities in their planning and implementation of local energy policies.

7.2.4 Obligated parties

EEOs applied to the former 16 electricity distributors in Flanders, but as stated earlier, savings made for any fuel can contribute to meeting the energy saving targets. Although the obligations placed on electricity distributors have changed several times since 2002, the obligated parties have remained the same.

7.2.5 Target setting

Before 2008, targets were differentiated for energy supplied to low- and high-voltage end-users. From 2003 to 2007, the primary savings goal for supply to high-voltage users was one percent of the electricity consumed two years earlier. Only first- year primary energy savings were credited toward energy saving targets. The target for low voltage end-users started at one percent, and by 2007 grew to 2.2 percent of electricity consumed two years earlier. In absolute terms, the primary savings goals (low and high-voltage users) amounted 381 GWh

in 2003, 551 GWh in 2004, 606 GWh in 2006, 605 GWh in 2007 (first-year primary energy savings). The more stringent low-voltage target was a response to the active promotion of compact fluorescent lamps in households being carried out at that time. Electricity distributors for whom household electricity consumption was less than ten percent of the electricity consumption of all low-voltage end-users were exempted from these higher targets. In 2008 and 2009, targets were set for residential and non-residential users (instead of low- and high-voltage users). Primary energy saving targets rose to two percent of electricity consumption two years earlier for residential users, and 1.5 percent for non-residential users. In 2010 and 2011, electricity distributors had to comply with one single target, but with the obligation to undertake actions for both residential and non-residential users. The combined single target was set at 3.5% of electricity consumption two years earlier for most electricity distributors and at 2.5% for those distributors with 2,500 end-users or fewer. As of 2012, electricity distributors have no energy saving target. Instead, they face specific "action obligations".

It should be remarked that although electricity distributors were obliged to save energy, energy savings from other energy sources, like natural gas, counted towards the annual targets.

7.2.6 Calculation method savings

The Flemish Energy Agency has not made public its approved energy saving calculation methods and resulting savings. The savings are pure deemed ex-ante estimations, meaning that on-field measurements after implementation were exceptionnel. Only first- year primary energy savings[43] were credited toward energy saving targets. From 2007, energy audits did not count toward the energy saving target, based on the finding that energy audits themselves do not lead to a predictable level of energy savings (because no obligation or follow up to implement saving measures). The only exception to this are mandatory

[43] The conversion factor of final energy to primary energy amounts 2.5, assuming that the average efficiency of the Belgian electricity production **sector** is 41%.

energy scans required from 2007 RUE obligation on, which are seen as yielding some level of concrete savings as they require installation of certain energy savings measures where deemed appropriate.

Electricity distributors were required to submit yearly their energy savings plans and calculation methods to the Flemish Energy Agency for preapproval. They had to submit a description of all actions to be carried out by them to meet the target and include the method of calculation for primary energy savings. The Energy Agency approved the method of calculation. As the Flemish Energy Agency does not make public approved calculation methods, it is not possible to be more specific on this point.

7.2.7 Additionality

The Flemish Obligation scheme didn't pay special attention to additionality (energy savings that would not otherwise have occurred). A strong overlap existed with the tax deduction system for energy efficiency and renewable energy measures (eg. roof insulation, photovoltaic installation) given by the federal government. Therefore, the additional savings linked solely to the RUE policy couldn't be estimated, neither the financial nor the business as usual additionality.

7.2.8 Verification & Monitoring

The electricity distributors reported to the Flemish Energy Agency (the so called 'VEA') annually (by May 1st) on the data (number of supported measures per sector, realized savings per sector) of the preceding calendar year. VEA checked the information and made a summary report. Such piece of information was included in the annual evaluation report on energy efficiency measures implemented and the distributors' compliance with the obligation produced by Flemish Energy Agency by October 1st. The resulting reports are not public available. Besides this check and evaluation report no other ways of verification or monitoring were applied, like checking the correct implementation and realization of EE measures, ex-post evaluation of deemed savings,etc.

In 2010, the Energy Agency was required to prepare a detailed report to the Flemish Government on the results, costs, and effectiveness of energy savings under the RUE scheme. The report was submitted together with the global evaluation of the RUE obligations to the Flemish Government and led to the changed legislation as of 2012 (Final decision by Flemish Government on September 23, 2011). The new RUE obligation legislation no longer includes a predefined evaluation period. Evaluation will, however, take

place along the way, largely motivated by the fact that the Flemish Government decided to compensate electricity distribution system operators for executing the obligatory actions (and paying premiums to the end-users) partially out of the Flemish Government's Budget. Because of this direct link with the Flemish Government's Budget, continuous evaluation of RUE obligations will be necessary.

7.2.9 Control and Compliance

From 2003 until 2011, the Flemish Energy Agency approved annual energy efficiency programmes and calculation methods for energy savings for the next year. Compliance with the targets from the previous year was evaluated annually. As of 2012, action obligations are determined by the Flemish government. Electricity distributors no longer need to submit annual action plans; however, compliance with the action obligations will still be based on evaluation of annual reports prepared by the distribution system operators.

From the beginning of the RUE scheme, the RUE legislation provided fines for non-compliance. A penalty of EUR 0.10/kWh (or 10 eurocents) applied to any shortfall in meeting the energy savings target. The fine was not eligible for recovery through electricity tariffs. Other fines were also possible, for example

- if RUE action plans, RUE evaluation reports, list of actions, list of reserve actions, or application forms were not on time: EUR 1,000 per day;
- if RUE obligatory actions were not executed: between EUR 1,000 and 1% of annual turnover of the obligated distribution company; and
- if RUE action plans or RUE evaluation reports did not comply with regulations: reminder to make adjustments and EUR 1,000 per day.

Electricity distributors complied with their obligations by meeting their annual targets. There was some flexibility built into the RUE targets. Distributors could carry over surplus from a given year to aid in compliance for the same user category in the following years. They could also apply for a change in the baseline for a given year if the total electricity supplied to non-domestic end-users had decreased by more than five percent due to disconnections by non-domestic users from the grid. No applications have been made since the introduction of the system. From 2008 until 2011, the Minister of Energy could loosen the RUE target for grid operators with fewer than 2,500 end-users, provided that the electricity distributors proposed actions or a financing commitment that compensates for the more relaxed target. No such requests were ever made.

7.2.10 Administrator - Institutional set up

The administrator and regulator of the RUE system is the Flemish Energy Agency (VEA). Electricity distributors were required to submit annually their energy savings plans and calculation methods to the Flemish Energy Agency for preapproval. The Energy Agency approved the method of calculation, the financial contribution provided to end-use customers, and the conditions attached to the financial contribution before energy saving activities could commence. Moreover, electricity distributors must provide in the action plans an annual budget for compliance with their energy saving obligation, which must be approved by VEA.

7.2.11 Flexibility

The Flemish EEO scheme does not provide for trading of energy savings (non-market based instrument), but is very much policy controlled. There was some flexibility built into the RUE targets. Electricity distributors could carry over surplus from a given year to aid in compliance for the same user category in the following years. They could also apply for a change in the baseline for a given year if the total electricity supplied to non-domestic end-users had decreased by more than five percent due to disconnections by non-domestic users from the grid. No applications have been made since the introduction of the system. From 2008 until 2011, the Minister of Energy could loosen the RUE target for grid operators with fewer than 2,500 end-users, provided that the electricity distributors proposed actions or a financing commitment that compensates for the more relaxed target. No such alternative actions or financing commitments were ever made.

7.3 Results of EEO

7.3.1 Total costs

From 2003 to 2005 the total budget (incl. budget for premiums and administration/communication) used to meet energy savings targets were less than the total amount budgeted for energy efficiency. In 2003 the budget of the RUE legislation was EUR 11.8 million compared with a EUR 24.8 million energy efficiency budget. Similar results were repeated in 2004 (EUR 17.4 million spent out of EUR 30.2 million budgeted) and 2005 (EUR 18.7 million spent out of EUR 24.5 million budgeted). The total budget for meeting the 2008 obligation in Flanders increased till approximately 48 million Euro. In 2011, the total budget

for all electricity distributors further increased until approximately EUR 72.6 million. The budget was mainly spent to the premiums given in the residential sector, as illustrated in the next graph.

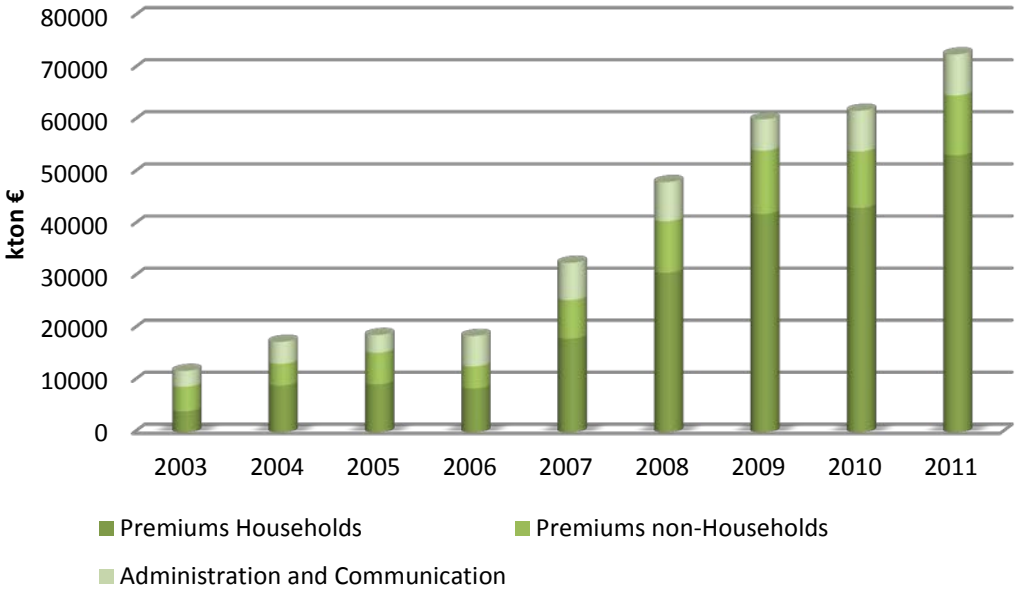


Figure 26: Evolution of total budget of Flemish RUE Obligation between 2003-2011

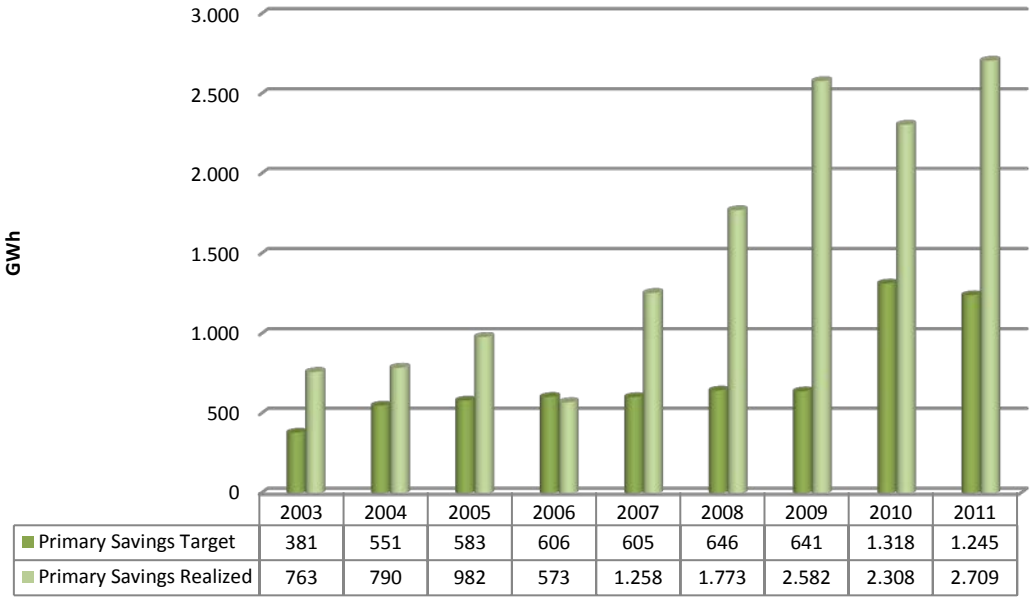
(Source: VEA).

7.3.2 Total expenditures

Given the strong diversity of efficiency measures implemented in a variety of sectors (households, transport, industry,…) and given the lack of evaluation reports about cost effectiveness of the RUE scheme, no information can be provided about the total expenditures resulting from the RUE scheme in Flanders.

7.3.3 Total savings

In general, Flemish electricity distributors have met or exceeded their targets, as demonstrated in Figure 27. During the years 2003 to 2011 the energy saving targets were always met (taking into account the carried-over surplus from previous years), and no fines have been necessary. The specific "obligatory action" for energy scans has not always been met by all distributors. Fines were imposed on those distributors that did not meet the set scan quota. As indicated in the figure, the annual savings amounted on average about 1000 GWh on primary energy consumption, which is about 170 kWh/inhabitant[44].



	2003	2004	2005	2006	2007	2008	2009	2010	2011
Primary Savings Target	381	551	583	606	605	646	641	1.318	1.245
Primary Savings Realized	763	790	982	573	1.258	1.773	2.582	2.308	2.709

Figure 27: Comparison of Targets and Realized Savings for the time period 2003-2011

(Source: VEA).

[44] To determine primary savings for electricity, end-use electricity savings are multiplied by the conversion factor of 2.5 (conversion factor representative for the Flemish electricity system, as agreed in the RUE Regulation), compared to end-use savings from other fuels.

The contribution of share of the different sectors to the realized savings, as well as the contribution of the types of measures isn't public available information. In general the major savings were realized in the residential sector, followed by the industrial sector and the services sector. Concerning the types of measures, most of the measures with large impact on the realized primary energy savings keep the same throughout the years. The RUE-actions of energy audit, frequency converters, roof insulation and condensing boilers appear each year in the Top 7. In 2005, vouchers for free energy-saving light bulbs as well as for saving showers were also popular, but from 2006 onwards the free vouchers were no longer distributed for saving showers; the same holds true for energy-saving light bulbs from 2007 onwards.

7.3.4 Cost effectiveness

Data availability do not allow to calculate instrument cost efficiency for society for several reasons:

- Information on additional investments (additional compared to a baseline situation) of reduction measures is not available
- Information available do not allow to calculate cost savings on energy (information on life-time of measures implemented and long-range marginal system cost of electricity in the different sectors addressed is missing).
- Data available do not permit to calculate net energy savings generated by measures during their whole life time.

So, the only simple calculation that's feasible is the estimation of the cost effectiveness of the efficiency program itself. For example, a simple calculation of dividing the 2008 budget (48 million euro) by the total savings achieved in 2008 (1.773 GWh first-year primary savings) shows cost of conserved energy in the range of 0.027 Euro/kWh. This is a very low cost, given the fact that only first year savings count in the Flemish scheme and the fairly higher cost of measures implemented. The results for other years are illustrated in the next table.

Table 24: Cost effectiveness[45] of the Flemish efficiency program between 2003 and 2011

Year	Primary Energy Savings Target (GWh)	Primary Energy Savings Realized (GWh)	Total Budget[46] (EUR Million)	Cost Effectiveness (EUR/kWh)
2003	381,3	763	11,767	0,015
2004	551,4	789,7	17,374	0,022
2005	583,3	982,4	18,668	0,019
2006	605,8	573	18,507	0,032
2007	604,6	1258	32,556	0,026
2008	646,1	1773,1	48,069	0,027
2009	641,2	2581,5	60,113	0,023
2010	1317,5	2308	61,776	0,027
2011	1244,6	2709,2	72,601	0,027

Source: VEA

7.3.5 Other stakeholders

The role of other stakeholders than the electricity distributors (obligated parties) and the Flemish Government (administrator) was rather limited. Although the installers of energy efficiency measures were strongly influenced by the scheme (increase in number of investments or installations of the subsidized measures), their involvement in the RUE program was small.

The decision to change the RUE towards action obligations was not only based on the evaluation report of 2010, but also on the advice from the SERV (Flemish Social Economic Board - The SERV represents the Flemish employees and employers within Flanders) and the Minaraad (Environmental and Energy Strategic Advisory Board within Flanders).

[45] Cost effectiveness estimated as the total budget divided by the total, realized energy savings.
[46] Total budget includes budget for premiums and the cost related to administration and communication.

7.4 Adaptation of EEO

7.4.1 Frequency of redesign

Amendments were made regularly by the Flemish Government to the initial EEO scheme: some small ones and a few larger ones in March 2007 and in July 2011. Before the 2007 amendments, almost any energy saving measure was eligible to count toward meeting the energy saving target. Since 2008, most soft measures no longer counted toward achieving the primary energy saving target. For example, energy savings from measures implemented pursuant to energy scans (simple energy audits), required of some residential homes, counted toward the energy savings target. Energy savings resulting from the introduction of energy accounting schemes to track energy use of schools and health care facilities did not. The last amendment changed the RUE obligations completely. As of 2012, the energy savings targets for electricity distributors were eliminated and replaced by specific 'action obligations' set forth by the Flemish Government that distributors must implement.

7.4.2 Reasons of redesign

The redesign in the 2011 amendment, resulting in 'action obligations', brought an end to the EEO scheme in Flanders. The main action obligation imposed on the electricity distributors is the requirement to pay premiums for a predetermined list of energy saving measures in the building sector. This major change was based on conclusions from an evaluation report (2010), indicating the following important reasons for completely redesign the scheme:

- Experience shows that the system of targets is unstable because it is extremely difficult to define ambitious, but realistic performance targets for the future based on past trends. Moreover, the system gave rise to differences in approach between the electricity distributors, as the operators themselves could choose their way of meeting the targets. The latter aspect is in contrast to the system of action obligations which apply equally to each distributor. On top, target obligations also required a lot of administrative procedures for the preparation and approval of plans. These procedures were necessary for the proper determination of the energy savings that can be achieved with the proposed action and this had to be done annually for each distributor individually.
- To increase the transparency for the target groups, it was recommended in the evaluation reporg that the number of premiums from the electricity distributors is limited and in line with the policy priorities.

7.4.3 Manageability

No information is available about this topic.

7.5 Social equity

7.5.1 Contributors

Considering that amounts budgeted by grid companies to comply with RUE obligations are entirely charged on end-users as they were incorporated in the electricity tariffs. As of 2009, the obligatory action 'energy scans' was financed directly by the Flemish government. So, saving measures are implemented at the expenses of the end-users (and hence of the society) who pay for the implementation of these measures and finance RUE obligations through electricity bills.

Transparency on the costs recovering mechanism is fundamental in order to accurately be aware of who is paying what. The Flemish financing system is not transparent at this point.

7.5.2 Beneficiaries

Prior to 2012, electricity distributors had to provide both direct and indirect support to energy efficiency measures undertaken. That is, they had to both financially support or promote the implementation of energy efficiency measures and provide information on energy saving opportunities to end-users. The beneficiaries are therefore the households, companies, farmers, etc. who applied for financial support from the distributors.

As indicated earlier, since the beginning of the Flemish RUE scheme, electricity distributors were required to pay attention to "protected clients" (i.e., mostly low-income households). They did this through targeted actions such as giving protected customers higher financial incentives (eg. 20% higher "premiums", as stipulated by the RUE Regulation) than those given to other customers through providing "discount coupons" for the purchase of A+ or A++ refrigerators or AAA washing machines, and by organizing special information sessions.

7.5.3 Impact on energy prices or tariffs

This impact can't be estimated because of the reasons explained in Paragraph 7.3.4.

7.6 Lessons learned and what can be improved?

7.6.1 Areas for improvement

Because of a lack of publicly accessible information, it is difficult to analyze many details of the Flemish EEO scheme, such as the potential to improve measurement and verification, or whether targets could have been set at more stringent levels. Increasing the transparency of the RUE (eg. calculation methods, detailed results per sector), besides a proper evaluation of the scheme (cost effectiveness) can result in a higher effectiveness of the scheme. It is clear that, before 2012, there were no uniform actions within the Flemish region. As of 2012, actions are uniform over the whole region. Moreover, the Flemish Obligation scheme didn't pay special attention to additionality (energy savings that would not otherwise have occurred). A strong overlap existed with the tax deduction system for energy efficiency and renewable energy measures (eg. roof insulation, photovoltaic installation) given by the federal government. It is important that both policies fit together in a sensible way, to avoid too much overlap. Since tax deductions (with the exception of roof insulation for 2012) have been eliminated, overlap with the tax deduction scheme for residential end-users has been reduced to a minimum. In addition, an increased attention for industry and promoting energy scans in all type of buildings (not only limited to schools and health care) could be options to improve the impact of the RUE obligation.

7.6.2 Strong characteristics

In the evaluation report of 2010, the Flemish government, electricity distributors as well as the beneficiaries experience(d) the financial support system by means of premiums, closely linked to extensive information and sensibilizing campaigns as an effective way to save energy as well as to sensibilize many (non)-households. This ingredient is therefore also an important part of the current Action Obligation System. The exceedance of the annual targets illustrates that the financial incentives in combination with communication has a significant impact on the energy efficiency of mainly buildings.

8 Denmark

There have been several phases of the EEO in Denmark, which dates back to the 1990s. The overall policy objective has not changed significantly, but how to secure the energy savings has changed radically. Through the years there has been a long tradition of dialogue between the energy authorities and the energy sector.

The electricity companies were the first to take on the energy efficiency agenda in the 1990's. In the beginning, the focus was on awareness - information, education and campaigns. The scheme covered both private households, industry, trade and services sector and the public sector.

The DSOs carried out their activities on the basis of an "assignment letter" from the Danish Energy Agency. The letter specified certain activities and focus areas e.g. education of children, focus on SME etc. The focus areas changed from year to year. The individual DSOs carried out activities solely at their own customers and only focused on electricity savings.

During this period the energy sector worked closely together e.g. to make nationwide campaigns. They developed standardized methods for e.g. energy audits, which were used nationwide by all energy companies. This resulted in a common understanding of energy savings and in building capacity within the energy companies. This early work has formed a strong foundation that later schemes built on.

Around 2000 the gas distribution companies joined the scheme and began receiving "assignment letters". At the time, the intention was that a well-informed consumer would make the right choice and carry out economical feasible energy savings. However, experiences through the 1990s and early 2000s showed that this did not always happen. Less than one third of the identified economical feasible energy savings were carried out.

The DSOs and the public authorities agreed on a change in the scheme in 2006. Focus moved from awareness and information to implementation of energy savings. The ambition was to build on the long experience and to create a scheme that was administratively simple. A specific target for energy savings was set, namely approximately twice the size of the savings achieved in prior years. At this stage also the oil companies joined the scheme and got their specific goals as well. **Despite being part of the negotiations t**he District Heating Association chose in the end not to join the voluntary agreement on behalf of their members, . About half of the district heating companies chose to join the agreement individually and an Executive Order was issued that required the remaining district heating companies to realize energy savings under the same conditions as the companies that joined the agreement. The

District Heating Association was not part of the Technical Working Group defining the more specific rules (the Technical Working Group is explained in further details below) and hence did not have influence on the rules and interpretation of the rules from 2006-2009. The EEO as we know it today with binding targets had been introduced.

One of the main decisions in 2006 was whether to count lifetime or first year savings. First year's savings weres 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.

Since 2009 there has been changes in the framework but these changes should be seen as a result of gradual improvement of the EEO to ensure the realization of additional, cost-effective savings. One significant change in the new agreement in 2010 was the inclusion of grid savings, solar installation in district heating and the introduction of weighting factors for the conversion of energy sources. These were crucial points to win over almost the entire district heating sector to join the voluntary agreement.

The different phases should not be seen as one EEO replacing another, but rather as a natural development building on experiences and adapting to external factors such as the development of the energy system, technological development, consequences of other policies etc.

The current Danish EEO is based on a voluntary agreement of 13 November 2012 between the Minister for Climate, Energy and Building and the grid and distribution companies for electricity, natural gas, district heating and oil. The agreement is known as "The Energy Savings Agreement" and the obligated parties in Denmark are referred to as DSOs in this report. The agreement runs from 2012-2020 and is renegotiated every three years.

8.1 Policy objectives of EEO

The EEO is to promote cost-effective energy savings for the benefit of consumers, enterprises and society focused particularly on realising savings in end-use consumption; savings that would otherwise not have been realised without the companies' involvement.

The savings are weighted with a simple factor, which reflects the lifespan of the savings, impact on primary energy consumption associated with the implemented saving, as well as the expected CO_2 impact of the savings, including, especially, whether there is a saving inside or outside the ETS area. This is explained in detail in section 8.2.3.

DSO's efforts are to be aimed at existing buildings and businesses (industries), but there is no specific, quantified target for this policy objective.

Further the EEO should promote Best Available Technologies wherever possible. This isdone mainly through deemed savings that set requirements that goes beyond the building code, as it is the case for windows and insulation material.

8.2 Design of EEO

8.2.1 Type of measures

Energy companies have a so called free choice of methods within the legal framework and the energy savings agreement. This means that energy companies can choose whatever measure they expect to be most cost-effective taking into account the provision that the companies' efforts are to be aimed at existing buildings and industries. In other words, no measures are excluded as long as the effect can be documented.

In practice the most common measures are advice and subsidies or a combination of both. "Market influence" or "market impact" such as campaigns and feedback on energy consumption can be included if the effect can be documented. If deemed savings for such measures exist they must be used.

8.2.2 Scope - sector related

Savings in final energy consumption (end use) realised in all sectors may be included as defined in the Danish Energy Agency's energy statistics.

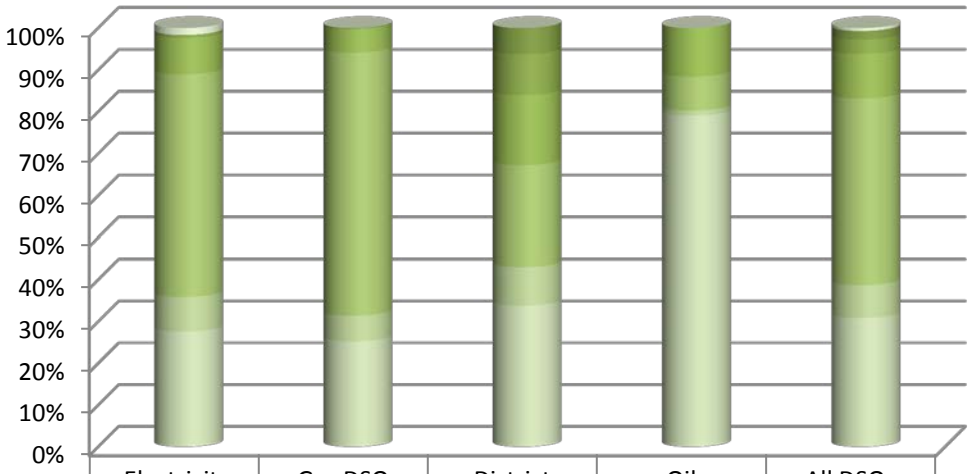
Currently, in the transport sector only the effects of the following initiatives may be included.

(ix) Replacing a vehicle fleet with energy-efficient cars.
(x) Replacing a vehicle fleet with energy-efficient vans.
(xi) Fitting fuel-saving tyres.

(xii) Fitting automatic tyre pressure control systems.

Reductions of losses in transmission and distribution grids, incl. losses in transformers, pumps, gas meters/regulators/pumping stations etc. can be included as well. Furthermore savings from the establishment of collective solar installations in connection with district heating supply are allowed until the end of 2015.

The distribution of energy savings in 2013 between sectors can be seen below.



	Electricity DSO	Gas DSO	District heating	Oil companies	All DSOs
Transportation	1,66%	0,00%	0,00%	0,00%	0,68%
Solar for DH	0,09%	0,19%	6,23%	0,00%	2,08%
Savings in grid	0,63%	0,04%	9,81%	0,00%	3,41%
Commercial sector	8,66%	5,67%	16,73%	11,63%	10,64%
Indstry	53,09%	62,98%	24,22%	8,10%	44,42%
Public sector	8,29%	6,18%	9,24%	1,23%	7,84%
Households	27,59%	25,31%	33,76%	79,04%	30,79%

Figure 28: Distribution of energy savings in 2013 between sectors for each obligated party.

Source: Danish Energy Agency

8.2.3 Scope - technology related

With few exceptions all technologies are allowed to achieve energy savings. Exclusions may occur because additionality is low for a specific technology or the technology is undesirable. E.g. savings from most household appliances and the changeover to CFLs. are excluded (ecodesign, energy labelling etc. is enough to make consumers choose the "right"

refrigerator) as well as savings from new oil-fired installations in areas wherin the connection to either a district heating supply or a natural gas supply is possible.

In 2013 realised savings for different technologies were as follows:

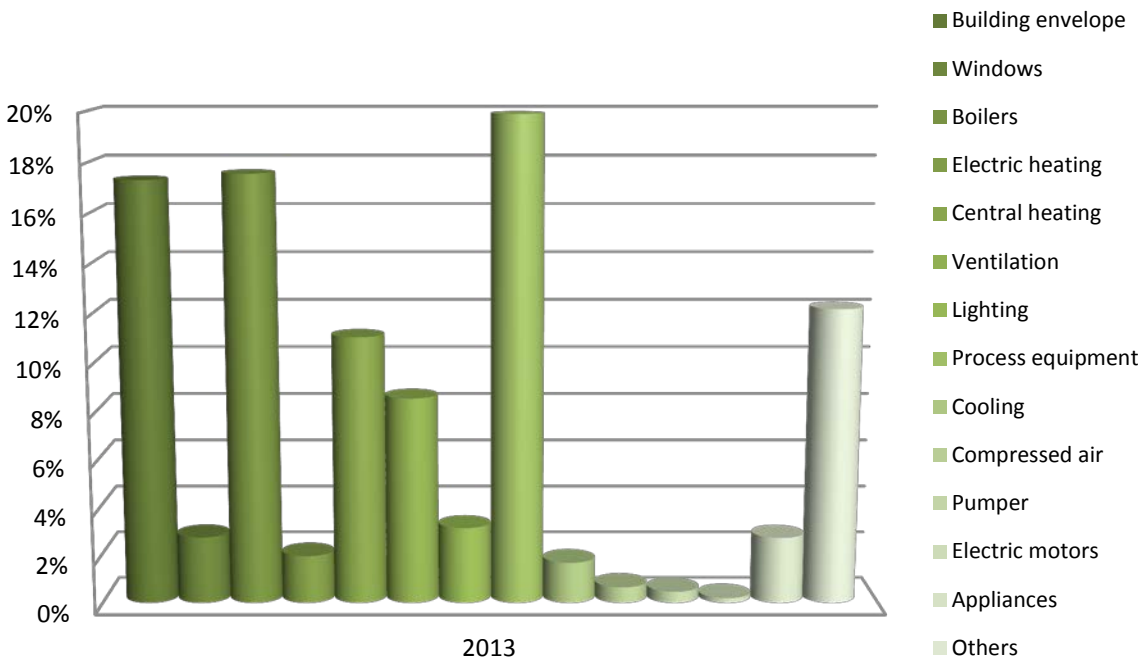


Figure 29: Distribution of savings on technologies.

Source: Danish Energy Agency

Although all technologies are allowed, the following technologies are favoured by applying a "prioritization" factor of 1.5 to the first year savings:

- Increased insulation of floors, walls and ceilings/roofs, which reduces space heating consumption in oil and gas-heated buildings.
- New windows and doors marked with energy class A which reduce space heating consumption in oil and gas-heated buildings.

- Heat recovery from space heating in connection with mechanical ventilation in oil and gas-heated buildings.
- Increased insulation of pipes in connection with space heating in buildings and new tanks for heating of domestic water, when using non-ETS[47] fuels.
- New oil and gas boilers in connection with non-ETS oil or gas consumption.
- Connection of oil and gas-heated buildings to district heating.
- Installation of heat pumps replacing non-ETS oil or gas consumption.
- Solar heating in oil and gas-heated buildings.

Furthermore the factors below apply to the conversion from one fuel to another. The factors favour district heating and to some extent fuels included in the ETS (if used at the end consumer).

[47] District heating for buildings is covered by the ETS in Denmark and hence has a prioritization factor of 1.

Table 25: Conversion factors for converting between energy types:

CONVERSION: From:	To:	FACTORS Energy Converted from:	USED: Energy converted to:
- Electricity	- District heating - Fuel consumption in the ETS sector (oil, natural gas, coal)	2.5	1.0
- Electricity	- Non-ETS fuels (oil, natural gas, coal) - Biomass	1.0	1.0
- District heating - ETS fuels (oil,natural, gas, coal) - Biomass	- Electricity	1.0	2.5
- District heating	- ETS fuels	1.0	1.0
- District heating	- Non-ETS fuels - Biomass	0.8	1.0
- Non-ETS fuels (oil, natural gas, coal)	- Electricity	1.0	1.0
- Non-ETS fuels - Biomass	- District heating	1.0	0.8
- ETS fuels	- District heating	1.0	1.0
- ETS fuels - Non-ETS fuels - Biomass	- ETS fuels - Non-ETS fuels - Biomass	1.0	1.0

Source: Danish Energy Agency

The production by renewable energy technologies are also included as savings (excluding biomass and waste technologies), if they reduce the need for energy supplied from the grid to a specific consumer (or a closed circle of consumers; i.e. block heat). Examples are wind turbines connected to the consumer side of the utility meter. Solar cells are excluded as of 1 April 2013. There is no statistical information available, but the use of renewable energy technologies is very limited.

8.2.4 Obligated parties

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.

8.2.5 Target setting

The total target for energy savings to be achieved by the EEO is determined in "The Energy Agreement" from 2012. The Energy Agreement outlines Denmark's energy policy from 2012-2020 and the target in the EEO is thus part of an integrated energy policy. The vast majority of the Danish political parties in the Danish Parliament have entered this agreement and follow the Danish political tradition in which a party can only withdraw from an agreement prior to an election.

The target amounts to 2% of the total energy consumption measured as the first year savings relative to annual final energy consumption including consumption in the transport sector (3% excluding the transport sector).

The annual energy saving target measured in 1st year's savings of final energy is seen in table 2 bellow.

Table 26: Allocation of energy saving target measured as 1st year final energy savings.

PJ	2013-2014	2015
Electricity grid companies	4.5	5.0
Natural gas companies	2.0	2.3
District heating companies	3.7	4.3
Oil companies	0.5	0.6
Total	10.7	12.2

Source: Danish energy Agency

Electric DSOs were the first energy organizations to accept an obligation in the 1990's and oil companies were the last sector to join in 2006. Because of this historic background the electricity sector has a relatively high target compared to electricity's share in the total energy consumption as seen bellow.

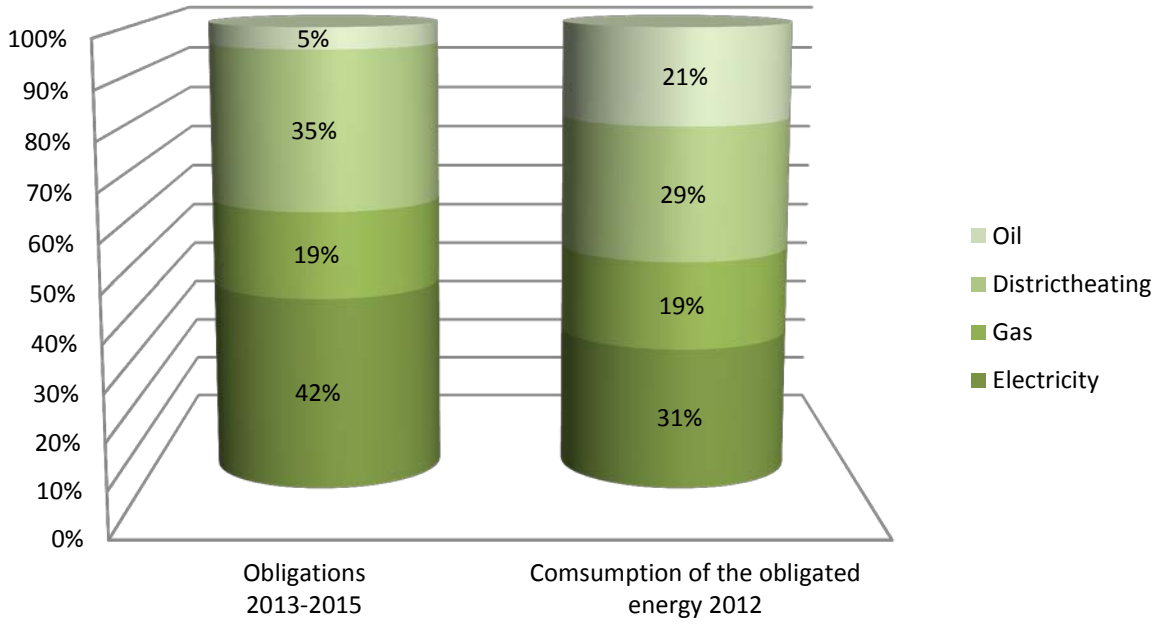


Figure 30: Share of annual savings target compared to final energy consumption

Source: Danish Energy Agency

8.2.6 Calculation method savings

Deemed ex-ante energy savings are used mainly in households. There is approximately 150 deemed savings, which can be found on http://svk.teknologisk.dk/. Deemed savings are compiled by the Danish Technological Institute[48] and approved by the Danish Energy Agency.

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.

[48] The Technological Institute is approved by The Ministry of Science, Technology as a Research and Technology Organisation (RTO).

The calculation must be completed for a representative and comparable production period. This calculation must include as a minimum:

- a calculation of the energy consumption before implementation of the initiative - *the reference;*
- a calculation of the energy consumption after implementation of the initiative;
- a calculation of the effect of the initiative, expressed as the total energy saving in the first service year after implementation of the initiative. Adjustments must be made for any changes to operation hours, production volumes, production mix, etc.

Calculations of the energy consumption before and after implementation of the energy savings and thus, the effect of the initiative, must be based on specific measurements, savings on the main meter, invoices from energy companies, and/or technical calculations. Adjustments must be made for any changes in the production volume and mix as well as hours of operation. If the energy saving initiative includes savings within several energy sources, the reference as well as the savings must be calculated for each energy source. All information in the calculation of energy consumption must be documented with reference to the sources applied, so that data can be tracked and retrieved.

Calculation of the energy consumption after implementation of the initiative is most often done ex-ante to be able to calculate subsidies prior to the consumers' investment decision.

More specific rules for calculation are found for a small number of measures, such as savings in the district heating grid and all measures within transport. The technical working group (the function of this group is explained in detail in section 8.2.10) also approves detailed rules for calculating the effects of market influence, including specific rules pertaining to certain areas/types of market influence. Due to the difficulties in documenting the effect of market influence this type of measures only finds limited use.

8.2.7 Additionality

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 annual target for 2009 has been increased by 15% as compared to the political target set. This is due to some of the determined energy savings that would be implemented all the same. This increase has also been incorporated into the current 2012 agreement, so that when the 2009 target doubled by 2015, the target will be 2 x 115% of the original political set target in 2009. Further a series of deemed savings for replacing oil boilers have been reduced by 10-15% in order to compensate for the fact that some of the activities carried out will be implemented

all the same. The result of both the increased target and the reduced savings that can be notified, is an increase in the number of projects to be carried out. Additionality is not improved, but the total net savings are ensured.

The most important measure to actually seek increase of additionality is through the requirement of the "chain of agreements"[49]. This principle means that there must be a contractual chain from end users where the saving is implemented, to the DSO, via the operator(s)/subcontractor(s) **who** has achieved the energy saving on behalf of the DSO prior to commissioning of an energy saving project at the end user. By entering the contract, the end user agrees to hand over the right to notify the saving to a specific DSO. Time-wise contracts between the DSO and an operator must be entered first, subsequently potentially between operator and subcontractor and finally between subcontractor and end user.

The chain of agreements is also a requirement in households. However, the agreement between the subcontractor and the end user can be entered into verbally. A verbal agreement is most commonly documented bystating in the invoice that the energy saving will be notified by a DSO (invoices are always collected as part the documentation of realization of the energy savings).

Even though the EEO in Denmark has been in existence for a number of years there are still projects that are carried out without subsidies or other involvement of the DSOs. Projects that would have been notifiable if the end user had entered into a chain of agreements prior to the commissioning of the project. Should the end user at a later stage discover that subsidy had been an option at an earlier stage, this is no longer possible because the additionality will be non-existing (at this point in time).

The rules are also designed to prevent the same energy saving from being taken into account by several parties. By requiring the end consumer to approve the notification of a specific energy saving to a specific DSO and informing the end user that, in so doing, the energy saving cannot be sold to other party. Hence, the chain of agreements is an effective tool to increase additionality, it is, however, by no means perfect.

Other steps include the following:

[49] This may be referred to as materiality in other EEO schemes but materiality is being treated as part of the concept of additionality in the Danish understanding of "addtionalitet".

- Most household appliances, CFLs etc., have a deemed saving of zero because the majority of the replacement is assessed to be done as part of a natural replacement.
- Savings from initiatives may not be included if the lifespan of the saving is assessed to be less than one year.
- Subsidies to the end consumer may not lower payback time to less than one year.
- Calculation of savings from replacement of equipment where repair work cost is more than 25% of the cost of replacement, must be calculated as the difference between the efficiency of today's standard of equipment (e.g. average for equipment sold or minimum legal requirements) and equipment that is implemented.

Cost-effectiveness and net impact/additionality are the two aspects of the Danish EEO that receive the highest attention. The debate about additionality is centered around, firstly, the methodological challenges related to assessing additionality and secondly, to which extent uncertain results from evaluations of the additionality should guide decision on improvements.

Particularly, the accuracy of the methodology of the evaluation used in its estimation of additionality in households was heavily disputed. Because of this the methodology used in the 2012 evaluation will be described in some detail. It is worth stressing that even with this level of additionality, the Danish EEO still achieves considerable socio-economic benefits according to this evaluation.

To assess additionality in the 2012 evaluation, interviews with end-users were used as the only methodology. 27 interviews were conducted in individual households and 182 large projects (all projects that are not individual households). Of the large projects, 22 were apartment blocks, 68 in industries, 29 in the commerce and service sector, 38 in the public sector and 4 in the district heating sector. The end-users were asked if they would have carried out the project with help from the operator within one year (175 large projects responded) and within three years (151 large projects responded).

The evaluation in 2012 carried out by the independent consultancy EA Energianalyse on behalf of the Danish Energy Agency showed that there is a large difference in the additionality of different measures. Advice in combination with subsidies had an additionality of 52-61%, subsidy 29-44% and advice 25-31%. These results clearly show that a combination of providing new knowledge and giving a financial incentive is the most succesfull

The evaluation also showed that approx. 45% of energy savings in businesses and some 80% of energy savings in households would have been implemented within three years anyway. The relatively low additionality in households might be due to the fact that payback time of energy savings in industry is much lower. There is no data on average payback time of projects under the EEO, but based on the experience of the obligated parties it is fair to assume that in industry it ranges from 1-4 years and in households it ranges from 5-20 years. In other words, the

investment necessary for end users to save one kWh is relatively low in industries compared to households. Because one kWh of saving has the same value to the DSO the average funds available to realize one kWh is the same in both industries and households. So on a project by project basis, the funds available from the Danish EEO to support the realization of energy saving projects are more significant for projects in the industry sector than in the household sector.

However the methodology used in the evaluation was criticized for a number of reasons. We will only mention two:

- The answers to a counterfactual question should always be treated with some scepticism. In this particular case, decision makers in businesses may tend to refuse the possibility that they would not have carried out a project with payback times, typically, ranging from 1-3 years even without outside help and instead keep running an economic inefficient businesses.
- The numbers of projects analyzed are statistically insignificant. The exact number of projects each year is unknown, but it is (at least) in the tens of thousands. And particular in individual households the population is insignificant, especially, when taking into account that there are approx. 150 deemed savings in 12 different categories for different types of projects in households.

As a result of the methodology used in 2012 The Danish Energy Agency has as part of the tender of the evaluation of the EEO for period 2013-2015 prepared a memorandum discussing the methodological challenges related to measurement of net impact and additionality. The methods discussed are:

- Asking the end-users e.g. “is it likely that you would have implemented the energy saving measure without the involvement (e.g. subsidy or consultancy) of the operator within 1/3 years?”
- Econometric analysis of data - if data on the sales of different technologies related to energy usage and these technologies’ energy efficiency is both available before and after implementation/increase of EEO targets.
- Statistical analysis of a group exposed to a measure (e.g. subsidy or consultancy) and a control group that is not exposed to such measures.
- Statistical analysis without a control adjusting for the impact of changes in e.g. energy prices that would influence changes in energy efficiency.
- Top down approach macroeconomic models are used to isolate the expected changes in energy consumption as a result of firstly economic growth and changes in energy prices using e.g. price elasticity and secondly other trends such as an EEO.

The memorandum does not provide suggestions on which method is preferable – that is decided by the bidders undertaking the evaluation that will be published in 2015. The 2015 evaluation will use both interviews (256 interviews in households) and econometric analysis in the estimation of additionality and net impact.

8.2.8 Verification & Monitoring

DSOs are responsible for ensuring that their documentation of energy savings is correct and meets the requirements laid down. To this end, companies are required to implement quality assurance. This ensures that the company's documentation and reporting, including documentation, concerning savings implemented by subcontractors or third parties acting on the company's behalf are correct and meet the requirements laid down.

As a minimum, quality assurance should focus on:

- That the size of the energy saving is determined in accordance with the applicable rules and specific calculations being professionally substantiated;
- That energy savings are implemented within the allowed energy consumption and can be defined as an energy saving within the framework of the agreement;
- That the company is involved directly, financially or via a third party before the saving is realized;
- That the company has obtained the right to report;
- That senergy savings are realized and correctly documented;
- That energy savings are correctly notified;
- Documentation of the entire contractual chain;
- Compliance with the requirements of the agreement by operators acting on the network company's behalf;
- Any errors linked to individual cases or the company's procedures relating to compliance are corrected.

As part of their quality assurance, obligated companies must each year carry out an audit to ensure and demonstrate that the notified savings have been realized and documented in accordance with the agreement and the Order. In alternate years, the audit may be carried out internally by the company itself, with intervening audits being carried out externally by an independent auditor.

Once a year the Danish Energy Agency carries out a spot check across all the DSOs involved, controlling that they meet the requirements. In practice the spot check is done by an independent consultancy company.

A so called verification unit was established in 2012 with the authority to approve calculation methods for specific projects. Once a method has been approved for a project it cannot be overruled by an auditor, a spot check or the Danish Energy Agency. The Technical Working Group appoints the verification unit and currently technical experts appointed under the voluntary agreement scheme on energy efficiency for energy-intensive enterprises are also used in the verification unit.

8.2.9 Control and Compliance

Should a DSO refuse to be part of the voluntary agreement or fail to follow regulations set by the agreement the Danish Energy Agency will issue an injunction forcing the DSO to follow the requirements in an Executive Order, which in large parts is based on the text in the voluntary agreement. Should a DSO refuse to follow the injunction the Danish Energy Agency can issue a fine. The size of such a fine is not predefined in the Executive Order. In theory it is also possible to revoke the DSO's license to operate their grid**,** should they choose **not** to comply after receiving fines **and thus** effectively put the DSO out of business. There has never been an example of a DSO refusing to follow the agreement once the DSO has accepted to enter the agreement. Futhermore, there has never been an example of a DSO that is not part of the agreement, which refused to follow an injunction.

Costs must be reported to the Danish Energy Agency and the Energy Regulatory Authority. The Danish Energy Regulatory Authority monitors DSOs' prices and costs, and takes regulatory action if the prices of the DSOs are not in line with the non-profit regime – or if they are unfair in any other way.

On the basis of the reported costs, The Danish Energy Regulatory Authority will prepare an annual benchmark showing the individual companies' total costs of meeting the energy saving obligation, as well as costs per kWh reported. To ensure cost-effective fulfillment of the target the Danish Energy Agency may investigate the costs of the 5% most costly energy savings of the population of savings, however, always up to 25 DSOs (meaning if the most expensive DSO has realized 10% of the total savings the following 24 DSO in the top of the list of costs per kWh can be investigated too). In 2013 there were 70 DSO among the top 5 % and the Danish Energy Agency will ask some of these DSOs to account for how they have ensured cost-effectiveness, including their focus areas, methods, costs, and insurance of fair

competition. The Danish Energy Agency may also request the companies with the lowest costs to account for their focus areas, methods and calculation of costs.

On the basis of such accounts, the Danish Energy Agency may establish an agreement with the relevant company on how cost-effectiveness, including use of market terms, will be ensured in future. If an agreement cannot be established to ensure this, the Danish Energy Agency may impose the future terms for the company's implementation of energy saving efforts.

Control of the technical compliance is addressed in the section above. There are no penalties for inaccurate calculation of savings, but the non-valid savings will have to be withdrawn, and thus it will become a problem for the DSO to meet the target for the following year. Further, if subsidies have been paid the de facto cost per kWh saving will increase and negatively influence the benchmark.

8.2.10 Administrator - Institutional set up

The institutional set up is based on both a voluntary agreement and an Executive Order. In practice the voluntary agreement takes precedence over the Executive Order, as the agreement is more detailed and the Executive Order consists of the most important sections of the agreement only and copied directly into the Executive Order with very few minor differences. This also means that the agreement is drafted and signed before the Executive Order is being drafted. From the perspective of the energy companies that join the agreement, the only practical implication of the Executive Order is that it makes it possible to have full-cost recovery.

The Executive Order will come into play if a DSOs choose not to be part of the agreement. In the period 2010-2012 around 15 district companies chose not to join as they did not believe such an obligation was within their area of expertise. The Danish Energy Agency issued an injunction forcing them to follow the same guidelines as stipulated in the Agreement.

This type of forced volunteerism is common practice in the Danish Authorities' regulation/governing of different sectors. It builds on a consensus-seeking tradition in decision making as a way to ensure anchoring of policy objectives among stakeholders and improvement of policy ideas.

The benefit for the obligated parties' point of view, is a very high degree of influence on the rules they have to operate in accordance with when fulfilling the obligation. Actual negotiations take place with those who join voluntarily as opposed to only giving hearing

statements. Each obligated party can prepare suggestion for changes, ideas for compromises etc. during the negation of the agreement. The negotiation phase took around six months when the latest three year agreement was drafted. In the electric and district heating sector negotiation af taken of by the respective commercial organisations and the professionalassociation.

It is important to stress that the obligated parties perceive this type of forced volunteerism as much preferable to a legislative process, because the degree of influence is much higher. The authorities are willing to accept crucial points for obligated parties in a voluntary scheme that would not necessarily be accepted in a normal legislative process.

The so called "Technical Working Group" is the body governing the EEO. It iss constituted by two members from the electricity, district heating and gas sector respectively and one member from the oil sector and the Danish Energy Agency. The Danish Energy Agency holds the chairmanship and performs secretarial functions. Formally, the voluntary agreement is between the DSOs and the Minister directly, but there are no representatives from the Ministry. The energy sectors are represented by one member coming from their respective professional associations and one member from a DSO.

The main tasks of the working group are to contribute to compliance with the agreement, as well as to continuously specify and interpret the rules of the agreement. This includes, but is not necessarily limited to the following tasks:

- Any specification of the guidelines for companies' involvement.
- Follow up on the provisions on market orientation and transparency.
- Clarification of any discrepancies in the use of prioritization factors.
- Ongoing adjustments to calculation methods, including updates to the deemed savings, and drafting of guidelines for how to calculate the effect of market influence, information.
- Follow up on requirements for documentation, reporting and quality assurance, including follow up on annual spot checks.
- Discussion of the framework for and the content of the evaluation in 2015.

The professional organisations assist their members with interpretation of the agreement as well some administrative tasks such as collecting data on fulfilment of the target, distribution of savings in terms of technology etc. and development of **www.energisparesiden.dk**, where endusers can find information related to the EEO (e.g. the target, the amount of realised savings, the cost and the distribution of savings in sectors of each of the 500 DSOs).

DSO must guarantee and may carry out themselves the following tasks:

- Administration of this agreement.
- Documentation of savings.
- Reporting savings.
- Assurance of the quality of savings, including audits.

DSOs may realise savings outside of their own supply area, and outside of their own energy type. Within own area of supply and own energy type DSOs may themselves:

- Advise on energy savings.
- Inform about energy savings.
- Realise savings in own grid system or via meters incl. reading and monitoring equipment.
- Establish agreements with operators/subcontractors.
- Establish contracts directly with an endused on financial involvement, including purchase the right to report a saving (subsidies), provided financing does not include a loan element. This means that endusers can carry out an energy saving project, prepare all the necessary calculations of savings and supporting documentation and apply for subsidies. The involvement of the DSO in this case is purely financial.

Outside of their own area of supply and own energy type DSOs may only:

- Establish agreements with operators.
- Establish contracts directly with a consumer on financial involvement, including purchase of a saving (subsidy), provided financing does not include a loan element.

The grid companies and distribution companies may never:

- Conduct actual implementation of energy savings at consumers, including installation work, technical energy efficiency improvements of equipment and processes, etc. (except in own grid systems and via meters).
- Participate in sales of energy efficient equipment.
- Undertake the financing of the realisation of energy savings.

Operators that are consolidated companies must be corporately separate from the DSO pursuant to the Supply Acts. Contracts with operators, including consolidated companies, must be on market terms pursuant to current tendering regulations.

8.2.11 Flexibility

The politically set target is distributed over the four sectors based on negotiations in the Working Group and achievement is measured at sector level. The professional organisations are responsible for distributing the target into "indicative" sub targets among the sector's DSOs. By indicative is meant that agreement does not have specific targets to be met by individual DSOs. Sub targets are determined based on the amount of energy distributed by the DSO.

over or under coverage may be transferred between individual years. At the end of a calendar year, there may be under-coverage of no more than 35% of the average annual target at sector level. There is no maximum on overachievement that can be transferred to the following years.

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 enduser 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.

The main principle is that the savings must be notified for the year in which the realisation and the documentation of the specific energy savings are completed. However, a grid and distribution company may agree with an operator with whom it has a contract that the transfer of realised and documented savings to the DSO is postponed to the subsequent year on the following conditions:

- As is the case for other savings, a transfer to a subsequent year may only be made to the DSO with whom the market player has had an agreement with prior to realising the saving.
- At the end of the year, the DSO must state the amount of savings the market players with whom they have agreements with have completed, but not transferred. The individual sector reports to the Danish Energy Agency the amount of savings that have been completed, but not transferred to the DSO.

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). The procedures for ensuring compliance with the non-profit regime follow the same procedures as the monitoring of DSO's general prices and delivery terms, and DERA takes regulatory action if the prices and terms of the network companies are not in line with the non-profit regime. There has never

been a case where The Danish Energy Regulatory Authority needed to take such action related to the EEO.

In conclusion the Danish EEO ensures a high degree of flexibility and at the same time takes precautionary measures against speculations.

8.3 Results of EEO

8.3.1 Total costs

The cost in 2013 can be seen in the table below.

Table 27: Total cost in each obligated sector in 2013 including both cost of realization of energy savings and administration.

Obligated sector	Total cost mio. €	MWh, 1st year final energy savings	Cost € cent/kWh 1st year end use savings
Electricity DSO	58.3	960000	6.1
Gas DSO	29.2	538842	5.4
District heating	33.8	719060	4.7
Oil companies	3.7	819510	4.5
Total	125.0	2299853	5.2

Source: Danish Energy Regulatory Authority

The administrative cost paid by the Danish Energy Agency amounts to approximately € 540,000 annually.

8.3.2 Total expenditures

The evaluation of the EEO in 2012 showed that investment costs in households were 1.2 €/kWh (9 kr./kWh) while other sectors had an average investment cost of 0.11 €/kWh (0.80 kr./kWh), both excluding the costs of the measures undertaken by the DSO. So, only the additional part of the investment is included in these numbers.

8.3.3 Total savings

The targets and total achieved savings that meet the requirements of being notified, measured as first year savings are shown in the table below.

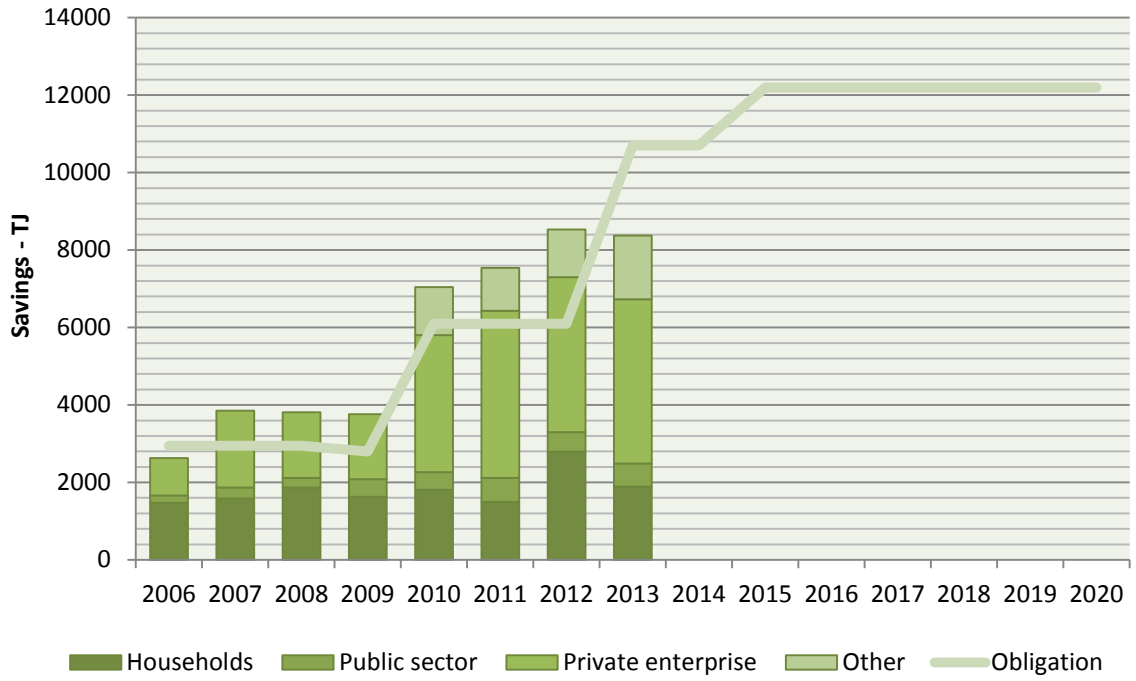


Figure 31: Total annual final energy savings per sector compared to the annual target.

Source: Danish Energy Agency

As can be seen from the diagram above, there has been an overachievement of the target every year since the implementation of quantified targets and requirement to document the realizations in 2006, except for 2013. The explanation for the underachievement in 2013 should be linked to the continued increase of targets. The target increased by 75 % in 2013, making it difficult for the market to absorb the increase in demand.

As can be seen from the table below as of 1 January 2014, there is still a considerable overachievement when comparing the total achieved savings 2006-2013 to the accumulated target 2006-2013. However at the time of writing, significant underachievement in 2014 was also expected.

Table 28: The sectors total overachievement transferred from previous years at the beginning on 2014 compared to 2014 target.

Obligated sector	Total overachievement compared to 2014 target
Electricity DSO	27%
Gas DSO	43%
District heating	53%
Oil companies	6%
Total	38%

Source: Danish Energy Agency

The targets already set up until 2020 have not been changed as a result of the 2013 difficulties. The reason is that it is not surprising that such a considerable increase (by far the highest increase in absolute terms in the EEO's existence) will make it difficult for the market to deliver savings in the first year. The Danish Energy Agency actually considers it as a sign that the flexibility in under- and overachievements between years is being used: the overachievements in the previous years compensate the underachievements in 2013, so that over the period 2006-2013 the target still has been reached.

The Danish Energy Agency estimates that the average lifetime of energy savings is at least 10 years, as written in the notification on article 7 to the European Commission. Conservatively the Danish Energy Agency calculates Denmark's fulfilment of the EED based on an average lifetime of seven years. Using this assumption that the total and real savings over lifetime are as follows:

Table 29: 1st year and lifetime final energy savings from previous agreement periods up until 2013

Unit: TJ	3 year total 2006-2009	3 year total 2010-2012	1 year total 2013	Total 2006-2013
1st year	13,255	23,101	8,377	44,733
Total lifetime	92,785	161,707	58,639	313,131

Source: Danish Energy Agency

8.3.4 Cost effectiveness

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 diagram below shows the results by illustrating the ratio between the total socio- economic cost of energy including the cost of CO_2 emissions (the red line) and the cost of energy savings.

If a measure is under the red line there is a socio-economic benefit of the measure. As you can see, 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.

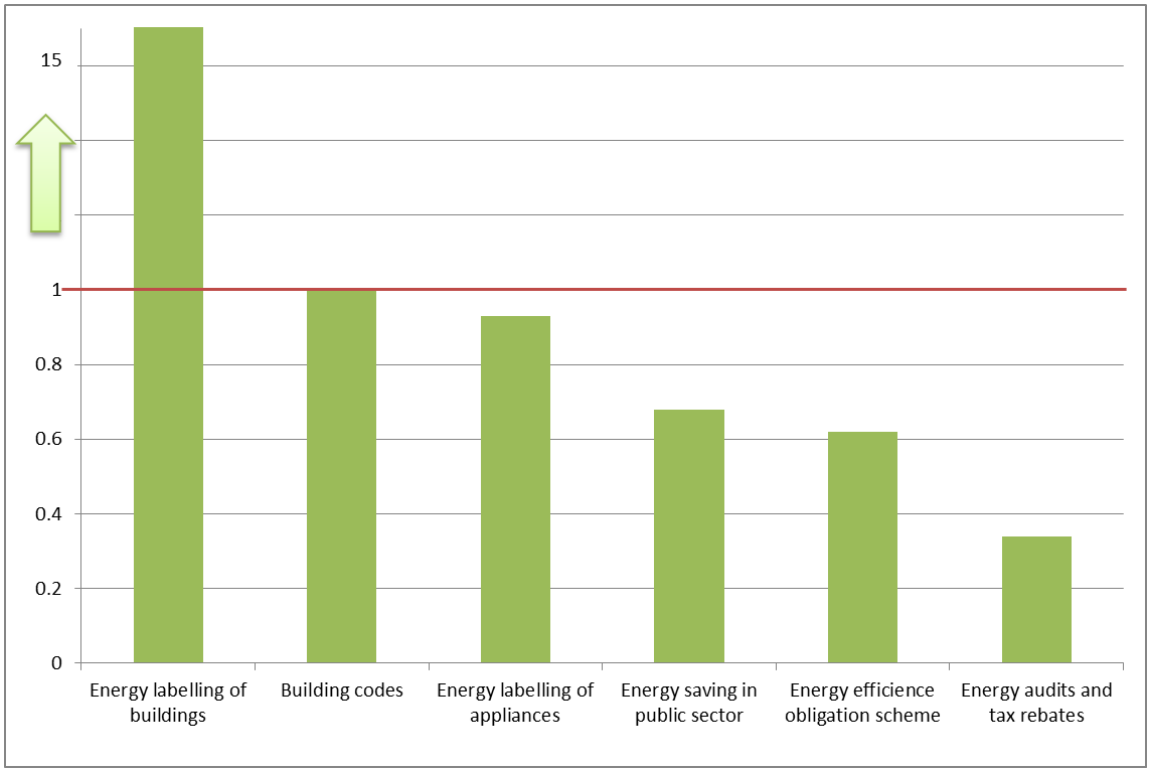


Figure 32: Ratio between socio-economic costs of energy - normalized to 1 - vs. socio-economic costs of energy saving measures

Source: EA-Analysis, 2008 for the Danish Energy Agency

8.3.5 Other stakeholders

Operators and subcontractors have direct contact with end-users in most cases. The freedom of methodology for the DSO is transferred to the market players, and hence it is the creativity that exists in a competitive market that shapes the practical execution of energy efficiency measures under the EEO. In the following paragraph, examples of the measures taken by market players are described.

Constructors, installers, craftsmen, retailers etc. usually operate simply by offering a subsidy to their customers. The subsidy is deducted in the final invoice to the customer.

Wholesalers can sell their products with a subsidy, which is then passed on from the retailer to the customer.

Operators can provide subsidies directly to the end-user if the end-user provides documentation of the purchase of energy saving equipment from an end user.

Consultants can sell the energy savings to DSOs and use the value of the energy saving to either provide completely free advice, a subsidy for investment or a combination to the end-user.

Energy traders can use the value of the energy saving to bundle energy efficiency services together with selling energy. This includes the so called Climate Partnerships where e.g. certificates from RES are included.

Banks can use value of the energy savings to provide special energy saving services to their clients. Firstly, the bank advisor discusses financials matters related to energy saving potentials, then an energy auditor carries out and energy audit of the household and provides a report. The bank and the household assess the potential for a loan of energy renovation based on the report. The cost of the report is split between the household, the bank and the DSO.

8.4 Adaptation of EEO

8.4.1 Frequency of redesign

During the 1990s, many electricity companies began to offer energy consulting services to customers as part of a voluntary agreement. Consulting services were provided to their own customers on their specific type of energy.

Until 2006, the activities were mainly regulated by so called assignment letters from the Danish Energy Agency and followed up by annual reports. The objective was to plan and conduct activities, including comprehensive energy auditing of companies, more focused on consulting, and extensive guidance to households, schools etc. General campaigns and national activities were part of the energy companies' activities as well.

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.

Since 2006 the EEO has been evaluated every 3rd-4th year, and the voluntary agreement that sets the frameworks and specific rules renegotiated. In that way the specific rules are adjusted to secure that the scheme works according to plan e.g. political wishes and market development.

8.4.2 Reasons for redesign

In the 1990s, it was believed that economic incentives (energy prices incl. taxes) and increasing companies' knowledge of opportunities through energy audits would be enough to realise the economic viable energy saving potential. Therefore DSOs did not follow up whether the recommendations in the audits were implemented. Evaluations showed that often only one third of the recommended projects were implemented.

To increase the implementation of recommendations, DSOs had to document that saving measures were actually implemented from 2006. This gave the DSO an incentive to make follow up visits to the customers. The agreement was still not very specific on how to document savings and the regulation of costs.

In 2009 it was decided to make more precise requirements for documentation of savings to ensure alignment between the DSOs and to increase the additionality. Other steps were also taken to increase additionality e.g. chain of agreements (see additionality section for further details). As the size of the obligation grew, there was also an increased focus on costs and clearer requirements on how do document cost were implemented. Finally, the different weighing factors were implemented to steer the measures towards the "best" first year savings.

There was a general understanding between the authorities and the DSOs of the overall need for the changes mentioned above.

8.4.3 Manageability

Please refer to section '8.2.3 Scope - technology related' for details on weighting factors.

8.5 Social equity

8.5.1 Contributors

All-end-users pay for the EEO system through the energy tariffs. There is an obligatory regulation of the tariffs on individual customer groups. However, for gas, electricity and district heating The Danish Energy Regulatory Authority (the oil sector is not regulated by this authority) approves a non-obligatory guideline on how to distribute costs of the EEO on the tariffs.

For the electricity DSOs, the guideline suggest dividing the cost 50/50 on a fixed amount put on the subscription and on kWh consumed respectively. This means that smaller consumers pay more than larger consumers if costs are measured as total cost expressed in Euros/kWh consumption. This principle is in line with differentiation of taxation and levies between different consumer segments in Denmark.

8.5.2 Beneficiaries

There is no category of beneficiaries that is to be targeted more than others due to e.g. social prioritization. Savings will be realized where the cost of the measure is the lowest. Indirectly, households with gas or oil heating will benefit more. The diagram bellow shows the distribution of savings on each sector compared to consumption in 2013.

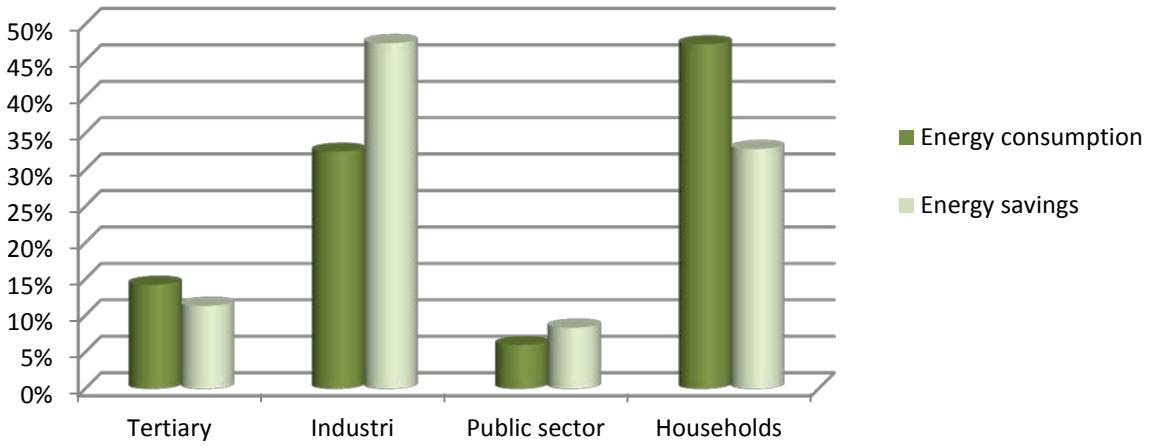


Figure 33: Realized energy savings compared to energy consumption in each sector in 2013.

Source: Danish Energy Agency

As can be seen from figure 6 the fact that industry projects today make up a relative large share of savings compared to the industry's share of energy consumption have the following main reasons:

(i) Projects have a much larger scale, so making it easier to manage your pipeline of energy savings and ensure that targets are being met.

(ii) Many small projects mean more administration compared to fewer larger projects in relation to e.g. documentation, quality assessment. Therefore, many energy companies tend to focus on larger projects rather than smaller projects

(iii) Historically, efforts in households consisted of awareness raising campaigns, teaching school children about energy savings, handing out "sparometers" (measuring device for appliances) etc. (please **see figure 34** "Distribution of savings depending on method of calculation" below). With the increased focus on documented savings introduced in 2010, such campaigns disappeared from notification of savings because their effect is very difficult to document. As individual advice to households is too expensive compared to the savings being realized, the household measures are in practice almost solely limited to subsidies. The actual transaction of the subsidies is most often done by using builders, installers etc. as agents that simply deduct the subsidy in the invoice. First of all it takes years for the DSO to build up a network of such agents/subcontractors and secondly, this way means a large distance between the energy company from the beneficiaries, making it a less desirable way to realize savings.

(iv) Additionality is higher in industry. There are no requirements in the agreement stipulating that DSOs have to take into account additionality when designing their strategy for meeting the target, but some DSOs choose to use the freedom of methodology to focus on sectors where additionality is highest.

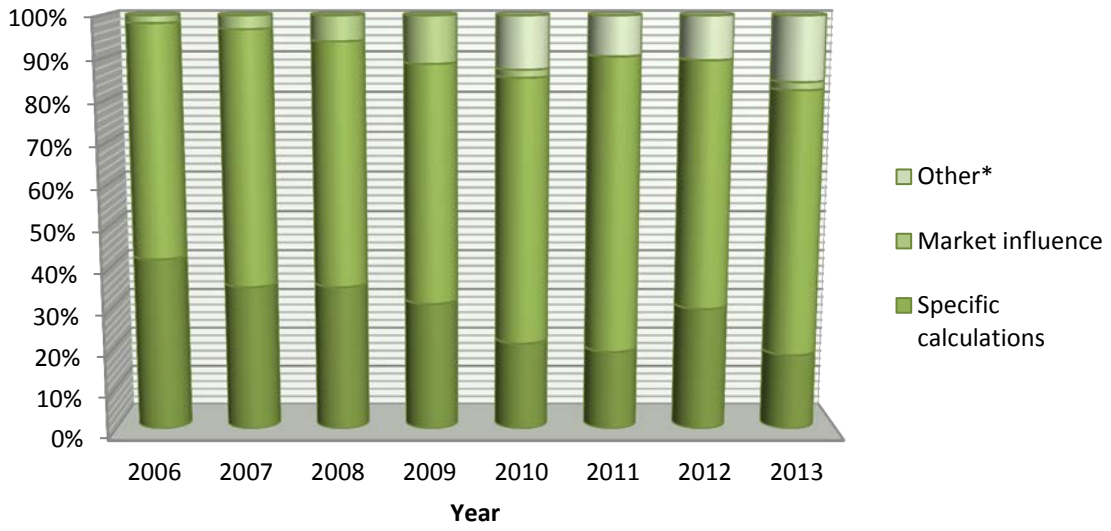


Figure 34: Distribution of savings depending on method of calculation below.

***Other is solar installations in district heating and conversions of energy source.**

Source: Danish Energy Agency

8.5.3 Impact on energy prices or tariffs

The Danish Energy Association has made an estimation of the surcharge on energy bills in households as a result of the EEO for all four of the obligated energy sectors, see table below.

Table 30: surcharge on energy bills in households

2013-2015		Electricity	Gas	District heating	Oil
Surcharge pr. kWh	Eurocent/kWh	0.23	0.17	0.20	0.04
Surcharge pr. household	Euro/year	7.80	29.79	35.92	6.76

Source: Danish Energy Association

8.6 Lessons learned and what can be improved?

8.6.1 Strong characteristics

The Danish EEO is focused on realization of cost-efficiency savings and makes use of the market force and freedom of methodology to achieve this goal. The clear focus on one goal results in a system that performs very well on delivering this particular goal compared to other measures taken in Denmark. This is perhaps the greatest strength of the Danish EEO.

Focus on cost efficiency and market instruments has meant activating the companies who are already in contact with the consumers on a regular basis for instance installers, builders, suppliers of equipment to industry and even accountancy and banks in order to make the consumers invest in energy savings. This keeps the costs of the EEO as an instrument at a very low level. Furthermore it secures a broad support from all involved actors, a diversity in solutions and an increased understanding among the actors for the possibilities for energy saving.

It is worth stressing that historically the EEO did not focus on savings documented at projects level. Instead the EEO focused on building competence for providing advice on energy efficiency and offering free advice to consumers and businesses. The obligated parties where not required to document whether the advice resulted in implementation of the measures suggested and thus the setup was in many ways much looser and simpler than today. In other words the focus on cost-efficiency has grown from a long tradition of involvement of energy companies in energy savings, where the need in the beginning was simply to build the competences rather than focusing on the exact cost or the exact realization of savings.

The cost recovery element has been crucial in order to remove economic risk from the obligated parties when they are given (or in the Danish case voluntary accepting) the task of kickstarting the energy efficiency services. Full cost recovery is obviously only possible when the DSO is the obligated party. Energy companies in Denmark, in particular, the electricity companies that have had the obligation the longest, have also used the new market for energy efficiency services to establish energy service companies that operate on market terms and thus have the possibility of making profit. Particularly, electric companies bundle services to provide optimal service for their customers and capture more of the value related to energy usage.

The Danish EEO has been successful in providing effective, targeted, tailor-made consultancy to businesses. The Danish experience shows that energy efficiency is just as much about innovation in business models and in ways to approach the customer with new technologies. Focus on documented savings and cost-efficiency obtained through the Freedom of Methodology results in innovative approaches to realizing the economically viable energy efficiency potential.

The Danish EEO is based on relatively simple procedures for documentation. It keeps the administration cost at a low level and even more important it means realizing energy savings in industry. In the Danish EEO the requirements for documentation are simple and are not defined in further detail than what is described in the section 8.2.6 on **Calculation method savings.** The agreement states that the level of detail in documentation should be proportional with the size and complexity of the project. The evaluation of the scheme from 2012 estimates a discrepancy of only 6%. In view of the low administrative cost this is an acceptable level according to both the evaluation and the Danish Energy Agency.

The Danish EEO has a simple way to handle the question of additionality. The additionality is evaluated on a regular basis. The question is addressed within the framework in such a simple way that is easy for the executive parties to handle. In the EEO from 2006 the obligated party could only count savings that would not have been carried out without the involvement from the obligated party. Soon, it became clear that it was impossible to document it for the specific cases. When you have the dialog with the customer about a specific project it is counterfactual to try to document the additionality of the project. Instead the rules were changed from 2010. The framework (the voluntary agreement) defines what is an additional saving in the context of the EEO. That means that al savings within the framework counts. Every 3rd year the additionality is evaluated and the framework adjusted to exclude areas with very low additionality or implement corrective measures in other areas with low additionality. At the same time, the obligated parties have to document their involvement prior to the implementation of a specific energy saving project.

8.6.2 Areas for improvement

The Danish EEO was originally focused on advice and not subsidies. There has been a shift toward solely subsidies that tend to have lower additionality than advice in combination with subsidies according to the evaluation in 2012.

Particularly for households subsidies is the main if not only measure used. The subsidies only provide a very small part of the total investment cost at the end user (approx. as little as 2% in some cases), why it can be questioned if the subsidy really is a determining factor in the investment decision and hence the additionality of the saving is questionable. On the other hand the experience in Denmark shows that subsidies in combination with advice are a very strong driver in industry.

Furthermore, the experience in Denmark is that the shift towards subsidies seems to dry out "the acknowledged potential". "The acknowledged potential" is the potential for saving that industry and consumers know of and acknowledge as feasible – not equal to the technical and economically viable potential. When subsidy is the only instrument, the projects that are implemented are the projects that are to a large extend already known by the end-user as potential projects. No new knowledge is added and the possibilities dry out. In the years to come the scheme needs to balance the incentives so that "the acknowledged potential" is maintained. Advice, energy audits and energy management should once again play a major role in the EEO.

The easy answer to flaws in the scheme is to apply more rules for e.g. documentation. More complex and detailed rules on the other hand increase the margin of error without necessarily providing significantly more real energy savings. The Danish EEO has over the years developed more and more specific rules to overcome certain flaws. The first EEO from 2006 was based on a voluntary agreement of 12 pages. The agreement from 2012 counts 50 pages and has roughly 25 pages of explanatory documents and 36 pages of FAQ. When you want a scheme with many active parties like in the Danish EEO, you need to keep the rules simple and easy to understand.

A market based scheme implicates the market operators make profit. Unfortunately, this is not the full understanding of the politicians and the authorities in Denmark. They seem to expect no or very little profit being made in the executing/operating companies. In a true marked based scheme you need to allow profit at the executing level, or no one will deliver the needed energy savings.

In view of the difficulties in reaching the target in 2013 and 2014, contracting parties behind the voluntary agreement are currently looking into the possibilities of realizing more savings in the transport sector and energy production, adjusting the framework to further facilitate energy savings in SME segment and facilitate an increase of the additionality of notified savings in the household and building sector. At the time of writing, ideas on how to do this is still very much on the drawing board, making it premature to suggest specifically how meet these ends.

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ENEA, Italian Agency for new technologies, energy and environment, www.enea.it

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