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ENERGY SAVING OBLIGATIONS AND TRADABLE WHITE CERTIFICATES

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1. Introduction

With the increasing importance of establishing long-term synergies between end-use energy efficiency and energy market opening a number of EU Member States have embarked on implementing energy efficiency policy portfolios that consist of energy saving obligations imposed on some category of energy market operators eventually coupled with a trading system for energy efficiency measures resulting in certified energy savings (tradable white certificates, TWCs). The *energy saving obligations* are also known as *supplier obligations*, *distributor obligations* or *utility obligations* and, in the US context, energy efficiency resource standards. Obligations can be coupled with various trading options: trading of certified energy savings, trading of eligible measures without formal certification, or trading of obligations.

The present study is carried out by the Joint Research Centre of the European Commission. The study:

- Provides a review of the experiences with implementing energy saving obligations and tradable white certificates as introduced in the European Union as of October 2009 and assesses the performance of supplier and distributor energy savings obligations and white certificate schemes in terms of results delivered (Section 2);
- Provides a set of conclusions on the impact and significance of different design options in implementing energy saving obligations and tradable white certificates for their performance (Section 5).
- Provides a set of recommendations on possible principles of harmonisation of energy saving obligations (Section 5).
- Presents the arguments for and against a Community-wide white certificate scheme (Section 3);
- Evaluates the options for linking white certificate and emission markets, in particular carbon trading (Section 4).

The report is provided in light of the Commission's assessment of white certificates, utility and supplier obligations, as stipulated in Article 4.5 of Directive 2006/32/EC on energy end-use efficiency and energy services (ESD). Article 4.5 of ESD specifies that the Commission shall, after having reviewed and reported on the second National Energy Efficiency Action Plans and the first three years of application of the Directive, examine whether it is appropriate to come forward with a proposal for a directive to further develop the market approach in energy efficiency improvements by means of white certificates. This work is an update and continuation of a previous report prepared at the JRC [1].

2. Analysis of the implementation of energy supplier savings obligations and white certificate schemes in the European Union

A number of Member States of the European Union have introduced market-based policy portfolios that build on suppliers' obligations to foster energy efficiency improvements. These portfolios are usually based on quantified energy savings obligations imposed on energy distributors or suppliers, possibly coupled with certification of project-based energy savings (via white certificates), and the option to trade either certified energy savings resulting from energy efficiency measures, or energy efficiency measures or energy saving obligations.

The obligations – often referred to as supplier obligations, utility obligations, energy saving targets or saving obligations – can be introduced as a stand-alone policy. Unless otherwise specified, in this report all energy saving obligations imposed on energy market actors are referred to as "supplier obligations" (even if some are imposed on distribution grid companies) or simply as "energy saving obligations". Certification and trading of project savings is an additional policy feature of energy saving obligations, which under certain conditions may be expected to increase their cost efficiency. Certification and trading under an obligation is referred to as compliance market.

2.1 Energy saving obligations: targets and obliged parties

In the European Union energy savings obligations imposed on different categories of energy market actors exist in the UK[1], Italy, France, Denmark, and the Flemish region in Belgium. Italy and France have energy savings obligations in combination with tradable white certificates[2]. Obligations or projects can be traded without formal certification in the UK and Denmark. In its National Energy Efficiency Action Plan (NEEAP) under the ESD Poland declared its intention to introduce a white certificate scheme from 2009; as of October 2009 preparatory work on the design of the scheme has advanced, but no legislation has been adopted. The Irish government is to go for public consultation on "Energy Demand reduction Target" program, which may involve supplier saving obligations[3].

The first scheme in the world with a white certificate trading element has been introduced in New South Wales (Australia). It is however a GHG trading system that has an end-use energy efficiency element. A number of states in the United States have policies that create long-term energy efficiency obligations; out of these five

[1] The scheme only covers Great Britain.

[2] In Italy certificates are called Energy Efficiency Titles. In France they are referred to as Certificates of energy savings.

[3] In addition, in Ireland the Electricity Supply Boards (ESB) each year agrees on an energy efficiency programme the Commission on Energy Regulation (CER). Targets are set for savings in energy use which can be achieved though promotion of energy efficient products and education of customers on energy efficient practices.

states have TWCs[4], but only in Connecticut are TWCs being actively traded for compliance purposes [2] (see Annex I for further details).

Table 1 at the end of section 2.1 summarises the quantitative parameters of each scheme with respect to overall size and unit of targets, target apportionment, duration of compliance period, restrictions in complying with the target, obliged parties and sectoral coverage of obligations in terms of eligible end-use sectors.

2.1.1. Legal basis of existing schemes

While the legislative basis for all operational schemes in the EU was introduced before Directive 2006/32/EC was adopted, all MSs that have energy saving obligations make reference to their schemes in the first NEEAP under Directive 2006/32/EC.

In Italy the obligation has been introduced with the implementation of the first European directives on the liberalization of the electricity and natural gas market[5] in the form of a public service obligation on distribution companies. The definition of the obligation and introduction of the white certificates market in Italy dates back to two Ministerial Decrees of 2001: the market-based component and the certificate trading component has been introduced by the government in mid-2001, together with the definition of the level of the obligation and of the other elements of the policy package.

In the following three years the regulatory authority for electricity and gas (AEEG) has designed the implementing technical and economic regulation governing the system through an extensive public consultation. In 2002 and 2003 technical revision and definition of implementing regulation was passed, followed by legislative provisions in July 2004[6] (in force in January 2005). The scheme became operational in January 2005. The scheme was extended and revised in December 2007[7].

In France the scheme has been established by law (No 2005-781 of 31 July 2005, articles 14 to 17), which defines the main principles (obligation, additionality, RES

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[4] In the United States white certificates are referred to as energy efficiency certificates or credits, white certificates or tradable white certificates, or white tags. In individual markets the titles are based on specific policy language, such as Class III Renewable Energy Credits (Connecticut), Portfolio Energy Credits (Nevada), Tier II Alternative Energy Credits (Pennsylvania).

[5] Ministero dell'Industria, del commercio e dell'artigianato. Legislative Decree of 16th March 1999, n.79, 1999; Ministero dell'Industria, del commercio e dell'artigianato. Legislative Decree of 23rd May 2000, n. 164, 2000.

[6] Decreto del Ministero delle attività produttive 20 luglio 2004, "Nuova individuazione degli obiettivi quantitativi nazionali di risparmio energetico e sviluppo delle fonti rinnovabili, di cui all'art. 16, comma 4, del d.lgs attività produttive 164/2000" (G.U. n. 205 del 1 settembre 2004); d.m. attività produttive 20 luglio 2004, "Nuova individuazione degli obiettivi quantitativi per l'incremento dell'efficienza energetica negli usi finali di energia, ai sensi dell'art. 9, comma 1, del d. lgs industria, commercio e artigianato 79/1999" (G.U. n. 205 del 1 settembre 2004); d.m. attività produttive 20 luglio 2004 "Modificazione del d.m. attività produttive 20 luglio 2004, recante nuova individuazione degli obiettivi quantitativi per l'incremento dell'efficienza energetica negli usi finali, ai sensi dell'art. 9, comma 1, del d.lgs. industria, commercio e artigianato 79/1999 (G.U. n. 2 del 3 gennaio 2007).

[7] Decreto del Ministero dello sviluppo economico del 21 dicembre 2007 "Revisione e aggiornamento dei decreti 20 luglio 2004, concernenti l'incremento dell'efficienza energetica degli usi finali di energia, il risparmio energetico e lo sviluppo delle fonti rinnovabili", G.U. n. 300 del 28 dicembre 2007.

acceptance, penalty). Details, such as precise thresholds, are provided in three Decrees (2006/05/23) – one on obligations, one on certificates, and one on registry. Five sub-decrees set the implementation details, namely Cumac kWh definition and eligible bodies conditions (2006/05/30), 93 standarized actions methodologies (2006/06/19 and 2006/12/19), administrative rules to obtain certificates (2006/06/19), and list of obliged bodies and individual obligations (2006/09/26).

In the UK supplier obligations date back to a 1994 household energy supplier levy[8]. The gas and electricity supplier obligation in its current form in 2002. The obligation on suppliers is set by Government under powers in the Utilities Act 2000 and the Electricity and Gas (Energy Efficiency Obligations) Order 2001.

A broad political agreement of June 2005 set the framework for energy saving initiatives in Denmark with an objective to reduce overall energy consumption via initiatives to achieve concrete energy savings corresponding to an annual average of 7.5 PJ during the period of 2006-2013. These should to a large extent be achieved by means of greater savings delivered by the grid and distribution companies in the electricity, natural gas, district heating and oil sectors. In the autumn 2005 these initiatives were implemented through an agreement with the electricity grid, natural gas, district heating and oil companies. The agreement sets the general framework for the initiatives and the methods of calculating the effects. In relation to commercial enterprises a part of the activities must be completed through the use of tenders.

In Flanders the REG public service obligations on the electricity distribution system operators for household final customers was imposed in 2003. Initially the obligations were introduced at federal level with the scope of reducing autonomous demand growth by 8 TWh in the period 1995-2005. Flanders Region converted generic energy saving objectives, imposed on Belgian electricity grid companies and electricity suppliers since 1995, into specific and mandatory saving targets to be achieved by its electricity grid companies through the Flemish decree of 17.07.2000 and decision of 29.03.2002[9]. This regulation takes account of the full liberalization of the Flemish electricity and gas markets and of the regionalization in the Belgian management of the energy sector.

2.1.2. Energy versus carbon targets

Energy savings may embody different commodities, such as primary energy, final energy or CO_2 content of energy saved. Some Member States have expressed the obligations in primary energy (Italy and Flanders region in Belgium) and some have

[8] Energy Efficiency Standards of Performance (EESoP). EESoP ran from 1994 to 2002 and was jointly developed and managed by the regulator Ofgem (initially Offer) and the Energy Saving Trust. EESoP1 ran from 1994 to 1998 and set targets for electricity suppliers, with the majority of measures being provided to disadvantaged customers. EESoP2 ran from 1998 to 2000 with targets set for electricity suppliers. EESoP3 ran from 2000 to 2002, and extended the targets to gas, as well as electricity, suppliers. In both EESoP2 and EESoP3 the suppliers were required to focus around two thirds of their expenditure on disadvantaged customers.

[9] Decree of the Flemish Government of 29 March 2002 promoting rational energy consumption [Besluit van de Vlaamse Regering van 29 maart 2002 ter bevordering van het rationeel nergieverbruik] and Decree of the Flemish Government of 2 March 2007 promoting rational energy consumption [Besluit van de Vlaamse Regering van 2 maart 2007 ter bevordering van 23 het rationeel energieverbruik] (replaces the decree of 29 March 2002).

expressed them in final energy (Denmark and France). The target under the new phase of the supplier obligation in the UK (CERT) is expressed in CO_2; previously it was expressed in final energy, fuel standardised to take into consideration the carbon content of fuels saved.

The choice of unit of obligation ultimately depends on the main policy goal under which an obligation is introduced (security of supply, reliability of supply, etc.). Setting targets in terms of CO_2 reduction may complement the EU Emission Trading Scheme by covering sectors that are outside the ETS[10]. On the other hand CO_2 reduction is not the only benefit of end-use energy efficiency.

Whether to set a target in primary or final energy is a national choice, among other related to the decision whether and under what conditions to credit as end-use energy efficiency options certain supply side solutions, such as cogeneration or small-scale renewables. A target expressed in primary energy gives a strong bias towards electricity savings. In this respect, primary energy targets may form part of a general security and reliability of supply strategy.

2.1.3. Annual versus multi-annual targets

Some Member States have fixed multi-annual targets and compliance is to be demonstrated at the end of the period (UK and France), while others have annual targets and annual compliance (Denmark, Italy and Flanders). Annual targets give the system administrator the possibility to correct for any implementation flaws.

To ensure policy stability in Denmark, Italy and Flanders annual targets are established in the framework of multi-annual obligation periods (3 years on average). This relatively short period allows adjustments of the targets or the operational modalities of the scheme, while in combination of long-term policy commitment, long lifetimes of measures and certificate validity and banking ensuring investment stability. In addition, in the UK, obliged companies must report on annual progress even if they have to only demonstrate compliance at the end of the period.

2.1.4. Cumulative versus annual targets

The UK and France express their targets in cumulative terms, i.e. in the final year of the period. Italy has progressively increasing annual targets for electricity and gas distributors by 2012. When added up, these annual targets give the cumulative value of savings to be achieved in 2012. See Table 1 for the exact target values.

In Italy projects contribute towards the achievement of the target for 5 years only (in some exceptional case 8 years, see discussion later) and there is no discounting of the savings over this lifetime. In the UK and France the technical lifetimes of measures are used in calculating lifetime savings: in the UK, for example, technical lifetimes range between 8 and 40 years. In Denmark and Flanders only first year savings count towards the target, i.e. the implicit lifetime of a measure is only 1 year. Only allowing first-year savings to count towards the target ensures that each year only new measures will be accredited. Allowing for first year savings only or allowing

[10] Note that in the case of electricity savings there is an overlap between the ETS and white certificate schemes.

only short lifetimes of savings may have the impact of promoting only measures with short payback times instead of comprehensive solutions that are likely to have longer payback times. At the same time allowing for first year savings only ensures that new projects will be implemented each year.

To demonstrate the impact on complying with a target using cumulative lifetime savings versus first-year annual savings, it has been shown that the annual savings for cavity wall insulation under the CERT is roughly 3.01 MWh in year 1 to 0.75 MWh in year 40. This results in lifetime savings of approximately 65 MWh, which is 21 times the first year savings [3][11].

In summary, due to the fact that in the UK and France obliged parties only demonstrate compliance with their targets after 3 years (at the end of the compliance period) and that technical lifetimes are used to calculate project savings, it is difficult to compare directly the targets of the UK and France with the annual targets in Italy, Denmark and Flanders, where projects only generate savings for 1 year (Denmark and Flanders) or 5 years (Italy).

2.1.5. Grid-bound energies only versus wider scope

Some Member States only cover energy providers of certain size of grid-bound energies (electricity and gas in the UK and Italy, electricity in Flanders) or also other energy providers (e.g. heating, cooling, heating oil, LPG, as in France and Denmark). At present none of the energy saving obligations targets transport fuel distributors or suppliers. According to an official French press release in May 2009, the new French obligation would be increased significantly and the new system would include transport fuel suppliers. As of October 2009 no further official information is available.

In addition, obligations can target only regulated sectors that are being liberalised (electricity and gas), or also other energy market segments that have traditionally not been under heavily regulated (e.g. heating oil).

French suppliers under the obligation have pointed to possible market distortions of putting under the obligation both market actors subject to some form of price regulations (e.g. electricity and gas prices in the residential sector in France) and market actors that are not subject to such price regulations (e.g. heating oil suppliers or transport fuel suppliers). The concerns voiced are that heating oil suppliers or transport fuel suppliers may have a competitive advantage in terms of passing through in end-use prices all costs incurred in complying with the energy saving target, while regulated entities are not allowed to do this. Since no scheme in the EU covers market segments that are subject to profoundly different regulatory treatment, there are no data to verify this issue.

2.1.6. Obliged parties and definition of individual targets

The UK and France have chosen to impose the obligation on suppliers (retail companies). Italy, Denmark and Flanders have placed distributors (distribution network operators) under the obligation.

[11] Note that this example is purely illustrative. For instance it is unclear if the lifetime savings reported have been discounted.

Suppliers have strong links to the final consumer and may have the motivation to offer value-added services. Obligations may encourage them to transform their business model away from pure commodity sales and towards energy service sale. Suppliers are uniquely placed to provide information about consumption through billing and metering processes and to inform consumers about measures on offer.

On the other hand distributors are more stable regulated organisations, which are natural regional monopolies and will not go out of business (as may happen with suppliers). With proper tariff regulation, they do not have the strong push to sell 'more kWh', as is in the case of suppliers; however this is not universally the case across the EU at present[12]. One example of such tariff regulation is the Multiple Driver Target Regulation applied in Italy, where admitted total revenues coming from certain customer classes are no more entirely proportional to energy units sold. In the electricity sector the regulator has set a maximum level for total revenues deriving from distribution to non-eligible customers that may vary proportionally 75% with the number of customers and 25% with the amount of sales. This regulation reduces the extra-profits connected with increasing energy sales beyond the expected levels used in setting unit prices by the regulator [25].

Yet, while distributors do not have the market push to sell more, in fully open markets they are disconnected from the end-user and thus may lack motivation to do end-use energy efficiency. Nevertheless, distributors may get engaged in energy efficiency activities via partnerships with other market actors (e.g. ESCOs). Partnerships have also been common between obliged suppliers and third parties.

The issue of factoring in foregone sales of obliged parties is not so relevant in the discussion of choosing where to impose the obligation. As indicated above in Italy there is partial decoupling of distribution tariffs from sales in the form of price cap regulation, whereby the price cap is also linked to number of customers. In contrast, evaluating suppliers' lost revenue may pose complexities in common cases of obliged parties saving in carriers other than the one supplied by them or in another company's customer basis, or when certificates are purchased from third parties.

One important issue to consider in choosing an obliged party is the maturity of each of these segments: the distribution segment is a mature one, while (in many countries) supply market is in its infancy and remains an unstable market with complex evaluation of lost revenue.

Target apportionment among obliged parties can be based on market share or number of consumers. The size of the target can increase linearly or not linearly with the obliged party size. In all existing schemes in the EU target apportionment is linear.

In the UK the target apportionment into individual companies' targets is based on the number of domestic customers served. In Italy it is based on the market share of each company, while in the first obligation period in France it was based on turnover (75%) and market shares of energy sales (25%) in the residential and tertiary sectors. In the UK suppliers with more than 50,000 domestic customers in 2007 are

[12] In the EU different distribution tariff regulation regimes have been applied. In addition, regulated end-user prices continue to co-exist in many EU countries along with market prices. A 2008 study by the European Regulators' Group for Electricity and Gas shows that in 15 countries of the EU more that 85% of electricity and 90% of gas household customers are still supplied under regulated prices. More than 80% of customers across all market segments remain on regulated prices [23].

under CERT. In Italy annual targets are imposed on distributers with more than 50,000 customers two years before (e.g. in 2007 for the 2009 targets)[13]. In France suppliers above 0.4 GWh/y are under obligations (0.1 GWh/y in the case of LPG and no threshold in the case of heating oil).

In Denmark the targets are set as an agreement between the Minister of transportation and energy and the Danish Energy Association, the Danish Petroleum Industry Association, Dong Energy, Naturgas Midt Nord/HNG and Naturgas Fyn. The targets are set at sectoral level for electricity and gas and are subsequently apportioned on the basis of average market share in the three preceding years. In the case of district heating, there is no voluntary agreement; instead every single DH has follows an executive order and has an individual target set.

In Flanders individual targets are defined annually based on 2% of the amount of electricity supplied to household customers two years previously and 1.5% for the non-residential sector, i.e. the kWh distributed in the residential and non-residential sector carry different weight in defining the annual target[14]. This approach is very common in the EERSs in the US.

2.1.7. Eligible sectors

The scope of the scheme is defined in terms of end-use sectors covered (e.g. residential, tertiary and industry), types of projects and/or technologies eligible under the scheme and modalities under which projects are allowed (e.g. lifetime of the energy efficiency measures). It is considered that this policy tool should be limited to **measures in end-use sectors**, excluding generation projects and network losses[15]. The focus of all energy saving obligations and white certificates schemes operational in the EU has been on measures in end-use sectors.

None of the schemes operational in the EU as of November 2009 allows measures related to reduction of network losses. Some supply-side options are allowed in some schemes, in particular measures that are 'in-between' supply and end-use options: micro cogeneration, photovoltaic installations and solar water heaters that replace end-use technologies. In Italy also grid-connected cogeneration and new district heating (generation plant and network) are eligible measures. Projects in large-scale generation plants – e.g. fuel switch in power plants or refurbishment of power plants - are not included in any of the schemes operational as of November 2009[16]. Fuel

[13] Prior to the legislative changes in 2008, the threshold was set at 100,000 customers. As a result of this fairly high threshold, approximately one fifth of the total obligation in Italy was not been distributed, which corresponded to the volume of small suppliers.

[14] The previous Flemish government has approved a proposal to increase the result obligation to 3,5% primary energy savings as from 2010 without distinction between residential and non residential customers. As of September 2009 this proposal still was still to be approved by the current Flemish government.

[15] Power plant efficiency is addressed by other policy tools, including the EU ETS. The authors of this report consider regulatory tools – such as distribution tariff regulation that caps the share of network losses that can be passed in the tariff – to be a more appropriate tool to address network losses.

[16] Poland has indicated that it plans to place a strong focus on refurbishment of power plants and reduction of network losses in the scheme that it designs at present. While no legislation has been adopted to date (early November 2009), preliminary discussions point that the design preferred by Poland is of a tendering scheme, i.e. without energy saving obligations.

switch in end uses is allowed, for example in Italy (replacing an electric water heater with a gas water heater).

To meet their obligation companies in Italy are allowed to implement projects in all end-use sectors, while in the UK projects can only be implemented in the residential sector. In the UK 40% of the target must be achieved by measures in the priority group, defined as vulnerable and low-income households, including those in receipt of certain income/disability benefits and pensioners over 70[17]. In Denmark all end-use sectors apart from transport are allowed; no supply side and network-related measures are allowed at present and fuel switch is only allowed if it reduces final consumption. Transport-related projects are not allowed, unless they concern internal transport consumption of a company. In Flanders residential, non-energy intensive industry and service sectors are allowed. The French system only excludes projects in sectors under the ETS.

In terms of coverage (e.g. obliged and eligible actors, sectors, energies, project types), there is a trade-off between harnessing the full potential of a market-based instrument and managing the complexity and cost of administering the system. Theory suggests that the wider the scope in terms of types of projects (compliance choices) and the fewer limitations in terms of compliance routes, the greater the benefits of the scheme, especially in terms of trading. Wide coverage implies more diverse marginal costs of compliance among trading parties and greater benefits of trading in terms of lowering the overall cost of compliance. On the other hand, extensive scope may result in difficult and expensive administration of the scheme.

Table 1 summarizes the formulation of energy supplier savings obligations in the European Union.

[17] A new scheme – called Community Energy Saving Programme (CESP) – runs in the UK from September 2009 until the end of 2012 targeting homes in areas of low income. This is a new obligation (though based on CERT) on suppliers and generators. The six largest suppliers account for 96% of the obligation expected to target around 90,000 households in about 100 projects across Great Britain.

Table 1. Energy saving obligations in the European Union: current features

* Obligations on energy suppliers since 1994

	UK (CERT)	Italy	France	Denmark	Flanders region (Belgium)
Obligation period	2002-2005 (EEC-1)* 2005-2008 (EEC-2) 2008-2012 (CERT)	2005-2012	2006-2009 (second period to be announced later in 2009)	2006-2013	2003 –
Compliance with the target	3 years	Annual	3 years	Annual	Annual
Target size (ongoing phase)	185 $MtCO_2$ lifetime savings in 2012 (EEC-2: final energy in MWh, carbon weighted, see details in text)	Cumulative savings of at least 22.4 mtoe in 2012	54 TWh lifetime discounted in 2009 (over the period July 2006-July 2009)	2.95 PJ annual (first year savings) As of 2010: 5.4 PJ/y	Approx. 580 GWh (2008 target) 2% of the amount of electricity supplied to household customers two years previously and 1.5% for the non-residential sector.
Target in annual end-use energy savings (TWh)[a]	3.5[b] (EEC-2)	4.5[c]	1.3[d]		
Target unit (ongoing phase)	Carbon Lifetime Cumulative Previously: final energy, carbon weighted	Primary energy Annual target 5-year lifetime Cumulative	Final energy Lifetime Cumulative	Final energy Annual target 1-year lifetime	Primary energy Annual target 1-year lifetime
Target apportionment	For the period, on the basis of number of domestic customers supplied	Annual, on the basis of market share. Annual targets increase over time	For the period, based on turnover and market share in residential and commercial	Sectoral targets (el. and gas) annually apportioned on the basis of 3-year average market share	Annual, based on the amount of electricity supplied two years previously
Restrictions in achieving the target	40% priority group (EEC-1 and EEC-2: 50% priority group)	Until 2008 50% on own energy source	None specific	None specific	The actions must always consist of financial contribution and an awareness-raising element
Obliged parties	Electricity and gas suppliers with at least 50,000 domestic customers as of the end of 2007	Electricity and gas distributors (grid companies) with at least 50,000 customers two years previously	Suppliers with sales above 400 GWh/y for electricity, gas and heating/cooling. 100 GWh/y for liquefied petroleum gas. No threshold for heating oil	All electricity and gas distributors (grid companies), Approx. 250 out of 350 DH companies	Electricity distributors Separate targets for low and high voltage consumers (before) Separate targets for residential and non-residential (2008 on)
Sectoral coverage	Residential (40% priority group)	All	All excl. ETS	All except transport	Residential and non energy intensive industry and service

[a] Source of the entire row: [8]

[b] Based on evaluation of 2005-2008

[c] Based on 2005-2007 certified savings

2.2. Compliance routes and practices

In most supplier obligation schemes obliged parties may choose one of the following actions to comply with the target or otherwise pay non-compliance or under compliance penalty:

(a) Implement energy efficiency projects directly;

(b) Implement energy efficiency projects via daughter companies;

(c) Purchase certificates from third parties (bilateral trades or spot market);

(d) Establish partnerships with contractors (installers, retailers, etc.);

(e) Tender out the implementation of projects;

2.2.1. Eligible measures and economic actors

Illustrative or open lists of eligible measures are usually defined in advance by the authority administering the scheme based on the relevant legal provisions.

Using lists of measures allows the regulator to implicitly promote certain types of measures (e.g. via longer lifetimes) and to calculate the average cost of these measures. Most countries have open or illustrative lists of measures, mostly related to establishing standard saving values (default values for unitary savings, see later). Other measures need the pre-approval of the regulator on case-by-case basis. In Flanders measures must always consist of financial contribution and an awareness-raising element, based on plans approved by the authorities; even though the obligation is only on electricity distributors, measures are not limited to electricity.

The national systems differ in terms of allowing parties that are not under the savings obligations to get their project savings certified. The UK and the Flemish schemes are closed with savings accredited only to the obliged parties. In Italy and France, subject to various conditions[18], other economic actors or public bodies can receive certificates too. In Denmark distributors are not allowed to directly implement projects other than information and informative bills; they comply with the targets acting via their daughter companies that carry out activities related to meeting the obligations or via contracts with third parties[19].

[18] For example in France economic actors that are not under the obligation cannot certify savings from projects that lead to an increase their turnover. It needs to be pointed out that many energy service providers in France indeed supply energy too and hence are under the obligation. For instance if a retailer is selling discounted CFLs or discounted efficient appliances, the retailer cannot certify these savings as the sales increase its turnover.

[19] The Danish Energy Association tried public tendering to achieve a minor share of its target (around 5%) on two occasions. Industrial companies were invited to bid in projects, but too few bids were received and the amount was not spent. So far direct contracting has worked better [16].

In the UK the supplier obligation has been introduced with the intention of, among other, changing business models in energy supply. It has been observed that the major household energy suppliers have developed their own programs, used to some extent as a marketing tool. Nevertheless, energy efficiency programs have remained separate operation from the core activity of selling energy units. Insulation measures are undertaken through contractors - in the case of insulation in social housing, obliged parties sign contract with social housing providers. Appliance and CFL schemes generally operate through major retail companies [8].

Different is the situation in Italy, where the scheme has boasted the development of a market for energy efficiency services. In Italy the largest share of white certificates – more than three quarters – have been issued to energy service providers. This shows that the major compliance choice of obliged distributors so far is trading. There are more than 200 energy service providers registered with the energy regulator as of 2009. At the end of 2007, more than 140 had at least one project certified by the regulator [8].

In France, the majority of obliged parties have developed new services in the household energy market, such as advice, individual audits, and financial instruments such as zero-interest or low-interest loans. These build on partnerships with retailers, installers, manufacturers and banks. These partnerships have helped to structure and organise installation sector offers in the household sector [8, 9].

2.2.2. Compliance with the targets

In all schemes the targets have been met or exceeded.

In June 2008, on the basis of certificates redeemed the Italian regulator established the compliance with 99.8% of the 2007 targets with 2 obliged parties failing to fully comply with their targets. In 2007 alone the regulator has approved the certification of certificates that amount to approximately 140% of the 2007 target. If one takes into consideration all banked certificates issued in 2005 and 2006, as of June 2008 these amount to 210% of the 2007 target. This is because the ministerial decrees introducing the scheme allow considering saving measures implemented since 2001 for the achievement of the energy saving targets established. As discussed later, banking has been very common in Italy as obliged parties try to hedge against future increase in targets. Automatic adjustment of the target in case of oversupply of tradable white certificates by ESCOs exceeding 5% of the annual target was introduced in 2008 [10].

In the UK suppliers achieved savings equal to 140% of the target under the EEC-1 and banked their surplus savings into EEC-2; the amount of savings banked equal to approximately 28% of EEC-2 target. Some suppliers carried forward savings accounting for more than 30% of their EEC-2 target [11, 12]. Suppliers also over-achieved the target in EEC-2 by 44%, which translated into a carry over of an amount of savings equal to approximately 25% of the original CERT target from EEC-2.

The first period of the French scheme was completed on 30 June 2009. The overall target was exceeded and the total amount of savings delivered equals 65.2 TWh cumac, as compared to a target of 54 TWh cumac. The obliged parties are allowed to use their surplus certificates over three compliance periods.

In the Flemish region of Belgium the 2008 target was approximately 0.58 TWh. Preliminary results indicate that it has been exceeded by a factor of 3 and more than 1.773 TWh of primary savings have been achieved. The grid operators are allowed to bank total over-compliance to the next year.

2.2.3. Dominant measures and end-use sectors

In terms of amount of savings delivered different types of projects have dominated the existing schemes: lighting in Italy, insulation in the UK, heating equipment in France, horizontal technologies in industry in Denmark.

As of 2008 the largest share of certificated savings under the Italian scheme comes from electrical use in the residential sector (59%, mostly compact fluorescent lamps), followed by thermal uses in the residential sector (21%), public lighting (8%), supply side options (cogeneration, PV) (6%), industrial heat (6%) [10]. The reason for this dominance of savings in the residential sector is the relative ease of establishing the amount of savings to be certified due to the existence of deemed savings methodologies. In addition, expressing the target in primary energy provides larger incentives for electricity savings - dominant in the Italian scheme - which deliver larger primary energy savings. This has contributed to the establishment of CFL give-aways as a low-cost compliance option: in the period 2001-2007 almost 21 million CFLs were delivered to comply with the obligations for the period 2005-2007. Prior to the legislative changes of 2008 distributors could get via cost recovery of 7.3 Euro/CFL sold at a discounted price and 3.65 Euro/CFL distributed as a free token, which also explains the interest in lighting measures[20]. The fact that distributors can get 3.65-7.3 Euro/CFL, while they might be able to procure them at half that price, points to windfall profits that distributors get from certifying CFL projects under the Italian scheme and that are paid by end-users. The 2009 cost recovery would allow distributors to receive about 2.1 Euro/CFL[21].

It has been further observed that measures related to building improvements seem to be underrepresented in the Italian scheme. The reason for this is the short lifetime of measures (5 years with some exceptions of 8 years), which makes measures with high upfront costs and longer payback times less attractive for the obliged parties. On the other hand, some measures in the residential sector – such as boiler replacement and insulation – are eligible for substantial income tax deductions that bring much larger financial savings to householders than white certificates could bring. Such measures are also overlooked due to the high degree of fragmentation of the market.

Experience from EEC-2 in the UK shows that in the period 2005-2008 75% of the energy savings delivered came from insulation, 12% from lighting measures (CFL), 8% from heating and 5% from appliances [12]. The heavy emphasis on insulation is driven by working with lifetime savings and using technical lifetimes of measures,

[20] Calculated with cost recovery of 100 Euro/toe, annual savings and lifetimes for CFLs as in force prior to the 2008 legislative changes.

[21] Calculated with 2009 value of cost recovery of 88.92 Euro/toe, annual savings and lifetimes for CFLs in force as of 2009. The marked decrease in the costs recovered from CFL distribution is due to both the lower cost recovery rate and the new deemed estimates for CFL savings that apply as of 2009 (i.e. 0.024 tep/CLF for CLF with nominal power below 15 Watt and E14 lamp fitting instead of 0.073 tep/CFL that were assumed to be averagely saved for each CFL of any nominal power and any lamp fitting distributed before 2009).

which incentivises the use of measures with long lifetimes. It needs to be pointed that cavity wall insulation – the predominant measure so far in the UK – is a very low cost measure. In contrast, elsewhere in the EU solid wall insulation is the predominant technological solution, which is a much more expensive solution.

In France 88% of the savings achieved are from measures in the residential sector, followed by 6% in industry and 4.4% in commercial buildings. Almost two thirds of the certificates issued concern actions in residential heating[22]. The dominant measures – efficient boilers, heat pumps, insulation and window – are eligible for tax credits too. Energy suppliers have directed their programs to take advantage of this support [8, 9].

The most typical measures in the Danish scheme are energy audits, information, subsidies and combinations of those. Measures are undertaken by commercial daughter companies of obliged parties, and are often combined with other activities, e.g. selling electricity to industrial companies. In the period 2006-2008 the largest amount of savings was on electricity. Around half of the electricity savings were achieved via grants to industrial enterprises to improve horizontal technologies, such as boilers, pumps, motors, trigeneration, etc. Natural gas savings – in absolute terms less than half the amount of electricity savings in 2006-2008 – exceed the target by almost a third. It has been observed that while oil and district heating companies, as well as natural gas companies mainly deliver savings in their own energy type, electricity companies have delivered more than half of their savings outside of electricity and have focussed on industrial consumers. District heating companies have decided to work with their own customers and their own energy carrier [13].

The most common interventions in Flanders include super-insulated glazing, condensing and high-efficiency boilers, roof insulation in existing buildings, street lighting refurbishment, thermostatic valves and solar boilers. The distribution system operators undertake energy scans (simple audits): they were obliged to carry out two for every 100 household connections over the period 2007-2009. During these scans, energy saving light bulbs, water-economy shower heads, pipe insulation and radiator foil are installed where advisable [29]. In 2005 energy audits accounted for 22% of energy saving measures, followed by frequency modulation equipment (15%), insulation (12%), low energy light bulbs, other lighting and boilers in the residential sector (10% each) [30].

[22] These numbers reflect the situation as of the end of 2008.

Table 2. Compliance practices

	UK (EEC)	Italy	France	Denmark	Flanders region (Belgium)
Eligible parties	Obliged suppliers only	Obliged and non-obliged distributors Companies controlled by obliged parties Energy service providers Large consumers with energy manager	Obliged companies Local authorities Large companies for action in their building, process or site	Obliged distributors via daughter companies	Obliged distributors only
Eligible sectors	Residential	All end-use sectors plus small PV systems, new DH, small-scale CHP and some measures concerning intermediate natural gas users	All end-use sectors except ETS	All except transport (but internal company transport allowed)	Residential, service sector, non energy intensive industry
Eligible measures	An open list of measures	Illustrative list of eligible measures (other projects assessed on case-by-case basis)	A list of standardised measures (other projects assessed on case-by-case basis)	A list (other projects assessed on case-by-case basis)	List of eligible measures and case-by-case evaluation of compliance plans of distributors
Dominant end-use sectors and carriers	Residential only Natural gas	Residential Electricity	Residential No data on breakdown of savings by fuel	Trade and industry Natural gas	Residential Energy audits, super-insulated glazing, condensing and high-efficiency boilers, roof insulation in existing buildings
Dominant measures in terms of savings	Insulation	Lighting	Heating equipment	Horizontal technologies in industry	Glazing, boilers, insulation
Lifetimes of measures	Differ by measure (discounted physical lifetime)	5 years (8 years for heating and air conditioning measures)	Differ by measure (discounted physical lifetime)	First year savings only (one-year lifetime)	First year savings only (one-year lifetime)

2.3. Certifying project savings and accreditation of implementation schemes

It is important to distinguish between certification of energy savings and trading of white certificates. Trading is not a precondition for certification: in itself a certificate is an instrument that provides a guarantee that savings have been achieved due to a specific project. A certificate can be used as an accounting tool to verify compliance with energy saving targets or with other obligations, or to qualify for e.g. state support (subsidies) or preferential taxation.

A white certificate is both *an accounting tool*, which proves that a certain amount of energy has been saved in a specific place and time, and a *tradable commodity*, which belongs initially to the subject that has induced the savings (implemented a project) or owns the rights to these savings, and then can be registered and traded in line with market rules[23]. Certificates can incorporate estimated savings over the lifetime of the measure (technical or estimated) or to represent savings accrued annually.

The lifecycle of a tradable certificate starts with project planning and implementation (as with any energy efficiency project) and includes the following stages:

- Measurement and verification of savings (see section 2.5.);
- Certificate issuance (see below);
- Certificate trading (optional, see section 2.4);
- Certificate redemption (withdrawal from circulation, see below).

Certificate issuance implies that a public authority issues certificates once energy savings have been verified. Verification implies due submission of the necessary documentation to the public body in charge of project verification. The public body in charge of verification communicates the results of the verification to the body in charge of certification (e.g. in Italy the market operator GME and in France the regional administration) and corresponding certificates are created and place on the account of the eligible economic actor.

Certificates are redeemed (withdrawn from circulation) once used to prove compliance with the individual target of an obliged party. At the end of the compliance period after establishing whether the obligation has been met the public body in charge of overseeing compliance communicates to the body in charge of the certificate registry so that – presuming compliance – the corresponding number of certificates is removed from the account of the respective obliged party.

Table 3 summarises some important features of white certificates in Italy and France: the two national schemes in the EU, which actually certify savings. Savings may be

[23] Accreditation of implementation schemes differs from the verification of project savings. Accreditation of implementation schemes refers to regulatory pre-approval of measures or schemes to be implemented by companies under the obligation.

certified at regular intervals – e.g. annually – or for the entire lifetime of the measure[24].

In Italy certificates are expressed in primary energy saved and the unit is 1 toe. While compliance with the targets is annual, certificates are valid for the entire phase of the scheme (extended, since December 2007, to 2012). As already indicated, projects may generate savings for up to 5 years (in some cases up to 8 years). Depending on the measurement and verification approach adopted (see section 2.5.5), different thresholds apply for projects that can be certified, ranging from 25 toe/year for "default approach" (deemed savings or standard savings) to 200 toe/year for obliged actors in the "metered baseline method". In the case of deemed savings and engineering methods for measurement, certificates are issued quarterly without the need of the project proponent to re-submit project documentation to the regulator. In the case of the metered baseline method, savings are certified annually based on project documentation submitted annually by the project developer.

In France the saving are certified ex-ante. The certificates are attributed once a program – meaning project and administrative document that includes all necessary information, including justification of savings – is completed, but before the savings occur. The certificates are attributed with the savings corresponding to the lifetime of the equipment or measure (cumulative savings, like in the UK). The size of the certificate is 1 kWh cumac. Certification is allowed above a threshold of 1 GWh cumac. Smaller projects can be grouped together to reach the threshold for applying for certification. Certificates are valid for three compliance periods, which could amount to 9 years in total with possible banking between periods.

Obliged parties in the UK, Denmark and Flanders have to submit their schemes or implementation plans to the regulatory authorities for pre-approval. In Denmark the savings to be yielded by a project are estimated ex-ante. In Denmark and Flanders only first year savings count (even though there is no formal certification or trading of savings).

Another issue related to certification is attribution of initial property right: the initial property right owner of a white certificate may be the party planning and executing the energy efficiency measure (e.g. a supplier or an ESCO), the party financing it (e.g. a bank, an ESCO or property owner or operator), or the party on whose premises the energy efficiency measure is implemented (e.g. a property owner). For efficiency measures with long lifetimes, the ownership issue can affect the way in which the market works.

In France, certificate ownership has to be defined by a contract among all parties in position to claim the certificates. In order to avoid double counting or disputes, this contract specifies how certificates are divided among obliged and eligible parties involved in a given measure[25]. This contract is then submitted at the time when

[24] The lifetime may be based on the technical lifetime of the measure (eventually discounted) or may be based on a standard value adopted – e.g. 5 or (exceptionally for certain technologies) 8 years in Italy.

[25] For example for the replacement of a collective boiler in a social housing, there may be a situation of three obliged bodies involved: the energy supplier (obliged party), an energy service provider (obliged party) and the municipality (obliged party with a zero target). Other parties such as the housing manager may claim ownership over the certificate too. All these parties have to agree and sign a contract on the certificate ownership

certificates are actually claimed. In France eligible parties – economic actors that have no obligation – can certify savings only if these do not increase their turnover. That means that equipment retailers cannot obtain certificates for promoting efficient appliances and ESCOs cannot obtain certificates for energy service provision. The condition for non-increase in turnover only applies to eligible parties (and not to energy suppliers with obligations); the large majority of ESCOs in France are also energy suppliers and have obligations. Yet there are economic actors – such as 'pure' ESCOs that do not supply energy and equipment manufacturers that want to certify savings but are not allowed to do this directly. They can only establish partnerships with obliged parties who then acquire the certificates – a condition that weakens their position on the certificate market.

Due to these conditions and given the structure of the energy market in France, there are only three major potential buyers on the white certificate market in the first period, who structure the demand for certificates. Therefore, in general the signed agreement allocates the certificate to one of them, usually the energy supplier. This may change in the second obligation period with the expectations that transport fuel will also be included, which would increase the number of potential buyers and hence the liquidity of the market.

In Italy problems linked to the property right of certificates have occasionally occurred, whereby different operators collaborating on the same project claim for property rights of the ensuing white certificates. Italian regulation does not clarify these cases and the problem has to be solved internally and operatively among subjects participating in project implementation.

In the EEC framework and its successor the CERT house owners transfer ownership of their energy savings to a supplier in return for a grant or subsidy. In the UK third parties are not allowed to have savings certified and hence house owners in any case need to transfer the ownership over savings to suppliers.

Attributing certificates to the end-user, on whose premises projects take place, may be a fair solution, but is likely to entitle high administrative costs of registering ownership. Yet, from an equity perspective, it does appear justified to at least inform end-users that they are transferring something with value.

Table 3. Certificate delineation

	UK (CERT)	Italy	France	Denmark	Flanders region (Belgium)
Size of certificate	NA	1 toe	1 kWh cumac	NA	NA
Validity of certificate	NA (compliance in 2011)	The entire phase of the scheme (2005-2012)	3 compliance periods (compliance in 2009)	NA (only first year savings count)	NA
Certification threshold size	NA	25 toe/year for deemed savings 200 toe/year for engineering method	1 GWh cumac (projects can be pooled to reach the threshold)	NA	NA
Accreditation of savings	Ex-ante	Ex-ante (with the exception of the metered baseline method)	Ex-ante	Ex-ante (first year savings only)	Ex-ante + approval

2.4. Trading

Trading can refer to transfer of targets (obligations to comply), of measures or projects (project savings), or of certified savings. There are three types of trading within a system for supplier obligations and white certificates [14]:

- Horizontal trading between obliged parties (possible in Italy, France and the UK[26]);
- Vertical trading whereby obliged parties purchase certified savings or projects from third parties (possible in Italy, France, and the UK);
- Temporal trading, most notably banking, whereby in case of over-compliance participant carry over part of their savings to the next compliance period (possible in Italy, France, the UK and Flanders)[27].

Trading can occur on a spot market or bilaterally (also known as over-the-counter). Certificate trading requires infrastructure to minimise transaction costs. Such infrastructure includes well-functioning market places, registries and low administrative requirements to do trades [4].

To date different systems in the European Union show markedly different degree and patterns of trading. Italy has seen buoyant trading (mostly bilateral, but increasing share of spot market) – more than 75% of the certificates went to non-obliged parties (ESCOs). In Italy banking is possible and has been very common (year-on-year banking): targets and target compliance are annual, while certificates are valid till 2012.

In the UK only energy suppliers may have schemes accredited by the regulator and trading is legally limited to transfer of obligations (or the delivery of these obligations) between suppliers, i.e. horizontal trading. In EEC-1 six suppliers retroactively purchased savings generated under other governmental programs [15]. There have been very few bilateral trades between suppliers: two trades of obligations in EEC-1. In EEC-2 horizontal trades accounted for approximately 0.25% of the target. In the UK horizontal trades can only occur once own targets are met and with the agreement of the regulator. This, along with the limited scope of the supplier obligation in the UK, greatly undermines incentives for horizontal trading. Obliged parties in the UK use largely partnership and there are no large cost differences to justify horizontal trading. Yet, there were differences in insulation prices paid to an insulation installer by different companies and obliged companies had very different portfolios to meet the EEC-1 and EEC-2 targets. In contrast, banking (temporal trading) has been very common in the UK since it was allowed in 2002. Obliged parties banked 28% of EEC-2 target from EEC-1 and 25% of the original CERT target from EEC-2[28].

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[26] In the UK only of obligations, with the agreement of the regulator and only once own target achieved.

[27] The flip side of banking is borrowing, which is not explicitly allowed in any of the schemes. It is implicitly allowed in Italy, where a one-year grace period exists if at least 60% of the annual target is met.

[28] The carry forward from EEC-1 to EEC-2 was also shaped by the change in discount rate from 6% to 3.5%, which considerably increase the lifetime saving of the longer lived measures such as insulation

In France trading is still uncommon and as of January 2009 accounted for less than 4% of all certificates attributed. There is no formal trading platform organized by the national administration, therefore there are only over-the-counter (OTC) bilateral trades between obligated entities, and between project implementers and obligated entities. There is a registry with information on white certificates (www.emmy.fr). Out of the 147 certificate holders in the official registry, only 37 are eligible parties (without obligations). As in Italy, banking provisions apply in the sense that certificates are valid for three compliance periods, which amount to 9 years in total with possible banking between periods.

In both Denmark and the Flemish region of Belgium there is no certification, but banking is allowed.

Table 4 summarises the trading features of the existing EU schemes.

Table 4. Trading options

	UK (CERT)	Italy	France	Denmark	Flanders region (Belgium)
Trading mechanisms	Trading among suppliers	Spot market OTC (dominant)	OTC only	No trading	No trading
Banking, borrowing	Banking of excess savings between phases (EEC-1 to EEC-2, EEC-2 to CERT)	Banking till 2012 Borrowing for 1 year if under compliance below 40%	Banking three compliance periods	Banking till 2011	Banking of excess savings

proportionately more than shorter lifetime products such as appliances. Almost all measures carried forward were insulation measures [12].

2.5. Measurement and verification

A white certificate is an instrument issued by an authority or an authorised body providing a guarantee that a certain amount of energy has been saved as compared to a reference scenario.

Improving energy efficiency and energy savings are two separate concepts, which can exist independently and may be targeted separately by policy intervention. Increased energy efficiency of a system does not always result in energy savings because of factors such as the 'rebound effect' of partially offsetting efficiency improvements with greater usage or improved comfort that accompany the reduced unit cost of energy services. On the other hand energy savings may be disconnected from energy efficiency improvements and result from e.g. behavioural changes (such as turning off equipment when not in use) or changes in system conditions (such as reduced indoor temperature, lower production or occupancy levels).

Policy may support measures that involve either investments or achieved savings (or both) provided that they are measured against the same system conditions. Measures may include:

- investments in energy efficiency evaluated against the same system conditions (i.e. 'hard' measures such as equipment upgrade or installation) as well as
- 'soft' measures (information, good management, education on behaviour changes, such as switching off equipment when not in use).

The former have traditionally been targeted by energy saving obligations and white certificate schemes, while the latter have largely remained outside of these schemes due to inherent difficulty in quantifying their saving impacts.

Denmark is the only country where purely behavioural measures are eligible under the energy saving obligation. Nevertheless obliged parties have chosen to not implement purely behavioural measures because of the relatively higher transaction costs of establishing small amounts of savings. In the UK, real time displays and home energy advice have been proposed by the Department of Energy and Climate Change as stand-alone measures with deemed savings scores (see below discussion on deemed savings). In Italy obliged parties receive uplift of savings if measures have an information component.

There are a number of issues surrounding establishing energy savings in supplier obligations and white certificate schemes. Choosing a verification approach depends on the type of information sought, the value of information, the cost of each approach, the stage and circumstances of project implementation.

2.5.1. Ex-ante and ex-post

The ex-post method implies establishing the amount of savings after they have been realised usually by comparing measurements or estimates of energy use and/or demand before and after implementation of an energy conservation measure. The ex-post schemes may be very costly in terms of measurement, verification and certification costs, but they are more precise guaranteeing more accurately energy saved.

The ex-ante method implies attributing a pre-defined saving value to different types of measures and is usually considered for energy saving actions that are well-understood and replicable. The ex-ante verification schemes are cheaper, but open to uncertainties such as partial realisation of savings. They cannot take into consideration details such as location and operating hours of installed equipment[29]. Although inducing lower transaction costs in comparison to more sophisticated monitoring requirements, the ex-ante approach is based on a series of assumptions and simplifications, which can introduce a significant margin of error in the assessment of energy savings achieved by not taking into account for example side effects (such as free riders, rebound, spill over, market transformations, etc.) [17]. On the other hand ex-ante schemes can be designed in a way to include deadweight and also are easy to be updated with changes of baseline.

2.5.2. Annual certification and lifetime savings

The saved energy resulting from an energy efficiency measure can be measured or estimated at the end of a predetermined period or over the lifetime of the project. The certificate can be equal to the energy saved over the lifetime of the project, or could be continuously issued when a certain amount of energy savings has been achieved (e.g. 1 MWh).

As indicated, in Italy in the case of deemed savings and engineering methods for measurement, certificates are issued quarterly without the need of the project proponent to re-submit project documentation to the regulator. In the case of the metered baseline method, savings are certified annually based on project documentation submitted annually by the project developer. In France the certificates are attributed once the project is implemented, but before the savings are realised with the savings corresponding to the lifetime of the equipment or measure. In Italy in cases where verification takes place (engineering methods and metered baseline) this is done on ex-post basis.

The choice of whether to use estimates of technical lifetimes of measures (e.g. >40 years in the case of some insulation measures) or to use a fixed lifetime of measures (e.g. 5 years in Italy, 1 year in Denmark and Flanders) has implications on additionality of savings. Saving estimates from measures with long lifetimes may be overestimates as in the course of the lifetime of the measure the baseline (e.g. market or stock average) remains at the same level as it was at the time when the savings were attributed.

2.5.3. Discount factors

In the case of multiannual targets, it is often debated whether energy savings should be discounted over time. The role of the discount factors can be seen as accounting for the 'deterioration' of a measure over its lifetime and actualising annual savings for different measures with different life spans.

[29] Even for well-understood technologies, such as CFLs, important factor influence the amount of real savings – location is one of these in the case of CFLs.

In France the discount factor is 4 %. The CERT in the UK has the target in CO_2 lifetime savings and savings are not discounted; however, any financial savings/benefits are discounted at the current Treasury discount rate of 3.5%. Previously the savings were discounted too: in EEC-1 the discount factor used was 6 %, while in EEC-2 the factor was down to 3.5%. It has been decided to remove the discount factor because in CERT targets are expressed in CO_2.

Reducing the discount rate used for savings 'increases' savings coming from projects thus decreasing the size of the target, i.e. making the target easier to achieve. The same target with a lower discount factor is a lower target. In the case of the UK the reduction of discount rates has favoured the measures with longer life cycle.

In the UK saving estimations take into account the likely proportion of the investment to be taken up by improved comfort ('comfort factors' adjustment of carbon benefits), as well as dead-weight factors to account for the effect of investments that would be made anyway (free riders).

In Italy there is no discounting but measures generate savings up to 5 (in some cases 8) years rather than for the estimated physical lifetime of the equipment (as in France and the UK). In Denmark and Flanders only first-year savings are taken into consideration, thus there is no discounting and no acknowledgement of longer-lasting benefits from longer-lasting investments.

2.5.4. Baselines, additionality of savings and policy additionality

To determine the energy savings resulting from an energy efficiency activity, the eventual energy consumption has to be compared to a baseline – a counterfactual reference scenario without additional savings efforts. The choice of the reference scenario – in terms of reference consumption and conditions – raises some challenges related to determining the relevant system boundary, minimizing the risk of producing leakage, the practicality and cost-effectiveness of a baseline methodology.

To ensure additionality of savings projects implemented to comply with energy saving obligations must go beyond current policies or beyond market averages. Thus, additionality refers to certification of *genuine* and *durable* increases in the level of energy efficiency beyond what would have occurred in the absence of the energy efficiency intervention, for instance only due to technical and market development trends and policies in place.

The most common alternatives for **baseline** used in the existing schemes are

- Sales average and performance of the most commonly used appliance on the market ("average-on-the-market" for appliances and equipment or historic rates of retrofit insulation in buildings);
- Average consumption of installed stock (stock average of appliances and buildings)[30];

[30] Appropriate only in the case of retrofits.

Baselines based on *stock average* consumption allow for larger savings than baselines based on market averages, especially for technologies with long lifetimes and low turnover (e.g. buildings), because savings are estimated as compared to the consumption of the existing (inefficient) stock of buildings or appliances. For new buildings having present regulation in the baseline implies that only projects that go beyond regulatory requirements generate savings. For appliances and equipment having present regulation in the baseline is not appropriate: applying regulation is mandatory and putting it into the baseline would imply awarding savings for all sales and not for the sales of most efficient ones only (as all sales anyhow go beyond present regulation). The most accurate indication of baselines is *market average* whereby savings are estimated as compared to the average consumption of appliances on the market.

Due to the very high number of deemed savings values (e.g. 180 in France alone), it cannot be established precisely which baselines are applied for which project types (technologies) in each scheme. Deemed savings values contain an assumption of the baseline, hence project proponents do not establish project baselines whereby deemed saving values apply. For instance in the UK, where the EEC is based entirely on ex-ante measurement, baseline definitions for different measures have been defined and the saving target was set based on including that baseline in the target. For deemed savings and engineering methods the additionality criterion is embedded in the choice of the baseline within the deemed savings calculation (done by the regulator or the national body in charge of developing the saving calculations) and the engineering evaluation algorithm, respectively.

In the UK, suppliers have to demonstrate additionality in each of the schemes they carry out. Additionality can be justified in terms of financial reasons (e.g., energy efficiency measure would not have taken place because of a lack of capital of household owners). The priority (low-income) group is getting 100% additionality, i.e. it is unlikely that low-income households purchase CFLs in the absence of the scheme. Landlords can also give evidence of additionality, i.e. for energy efficiency measures taking place in the priority group, energy suppliers need to receive a letter from the landlord confirming that the landlord would not have carried out the measures outside the EEC.

In Italy savings have to go over and above spontaneous market trends and/or legislative requirements [18]. For projects that are based on the deemed savings and engineering verification approach (see explanation in the next section) there is a case-by-case additionality check performed by the regulator. For example with regard to appliance substitution the consumption of the average-on-the-market appliance is taken into account. For projects based on addition of energy saving/producing device (such as a solar water heater, PV generator) or improvement of thermal insulation in buildings the energy consumption without the added device or insulation is taken into account. For measures in buildings, reference is made to the building codes in force. For some measures exceeding the minimum energy performance standards with a particularly high margin is an eligibility criterion (e.g. heat pumps). For projects not covered by deemed savings or engineering methods, project developers have to demonstrate additionality within their methodological proposal, that has to be approved by the regulator before it can be applied. The accepted technological baseline is the average technology sold at the national level to produce the same level of energy service (unless more stringent legislative requirements exist) [26].

In France, there is a very high number of deemed savings values (approx. 180). The general rule as stated by law is that deemed savings values are calculated with reference to the market average. For building envelopes and fixed heating ventilation and air-conditioning (HVAC) systems the installed stock is taken as a baseline. For projects where no deemed savings values exist the baseline needs to be approved on a case-by-case basis.

In the Flemish region different baselines are applied. If there is regulation, then existing regulation is the baseline. For existing equipment and existing buildings (renovation) stock average is the baseline. For new equipment market average is the baseline. Because the VEA has to approve all annual action plans of obliged companies and due to the fact that this is a regional scheme, it is expected that policy additionality is high.

Policy additionality refers to ensuring that the same energy efficiency intervention is only awarded financially by one policy tool. In terms of policy additionality, in the UK there are ways of avoiding double rewarding of energy efficiency measures. One example is when obliged companies implement measures in social houses where operation of the Warm Front Program is usual. If a Warm Front Agent installs a given group of measures such as boiler installation (for which the agent is funded by the government after presenting an invoice) and at the same time the Warm Front Agent is in partnership with an EEC obliged supplier in performing supplementary measures on the same house (e.g. loft insulation), then for the EEC-related measures the Agent will provide an invoice to the EEC supplier and not to the government. Thus the EEC supplier on his turn will be able gain credits based on the invoice and use them to fulfil its mandatory targets [26].

In Italy the issue of policy additionality and double rewarding of savings – once via white certificates and another time with other financial tools – has not been addressed separately. The regulator does not have an oversight of all financing support schemes in place at regional level. In addition, at national level a package of policy instruments are implemented in Italy, such as personal income tax deductions for measures related to building thermal insulation, installation of solar thermal panels and highly efficient boilers (55% of measure installation costs[31]). There are subsidies for A+ and A++ cold appliances, fiscal incentives for VSDs and efficient electric industrial motors, tax reduction on Gpl, incentives for gas-fuelled cars will be introduced as well.

In France too measures eligible under the white certificate scheme are eligible for personal income tax deductions and indeed have been quite common (e.g. boilers). Obliged parties insist that the two systems – white certificates and tax rebates – should be seen as complementary and point that in France the existence of tax credits has increased the equipment price proportionally.

[31] The maximum tax deduction amount varies between 30,000 Euros (in case of energy efficient boiler installation) and 100,000 Euros (in case of existing building complete retrofitting). Where gross tax deductions apply, these are calculated as a percentage of the amounts remaining payable by the taxpayer as shown on the invoice. Different is the case where subsidies granted by some local authorities to project developers. Revenue streams generated from the sale of white certificates generate additional cash flow for the project proponent, who may decide to pass it on as a discount to the end user.

In general in countries with high level of decentralisation in energy efficiency policy implementation it is increasingly difficult to monitor policy additionality due to energy saving obligations being administered by the central administration, while at local level local energy efficiency programmes (investment subsidies, etc.) may exist. It is thus not prohibited to use additional funding by national and regional governments – but also tax credits available at national level – to implement measures under the supplier obligation. Requiring beneficiaries of energy saving measures implemented by obliged parties to also give evidence of additionality, i.e. by declaring that measures would not have been carried out outside the scheme and that measures have not received support from other public sources may offer a solution.

2.5.5. Methods for measurement and verification of savings

The Italian scheme uses three valuation approaches. The deemed savings approach does not require in-field measurement – it involves 18 technical sheets developed by the regulator AEEG. Deemed savings apply to technologies for which energy savings are well known and do not exceed 25 toe per year; default factors for free riding, delivery mechanism and persistence have been introduced. Examples of measures that are certified using this approach include CFL, m^2 insulated wall, small PV applications and high efficiency boilers.

The engineering approach implies some on-field measurement and applies to measures for which energy savings are known but they may differ depending on a number of restricted factors (e.g. number of working hours). This approach applies to measures that yield up to 50 toe per year (for ESCOs and small distributors) and 100 toe per year for distributors, respectively.

Finally, the metered baseline method applies to measures for which energy savings need to be addressed in a case-by-case basis. It entails direct measurement of energy use, pre-approval of proposed baselines and methodologies. This approach applies to measures that yield up to 100 toe per year (for ESCOs and small distributors) and 200 toe per year for large distributors in savings respectively.

Analysis by the Italian regulator indicates that in the period 2005-2007 more than 90% of certified savings were measured and verified ex-ante with the deemed saving and the engineering approach; the deemed saving approach alone accounted for 70 % of the measures [18]. These measures are probably the easiest to implement and involved insignificant M&V costs caused by the technical sheets developed by the regulator. There are ex-post spot checks.

In the UK the savings of a project are calculated and set when a project is submitted based on a standardized estimate taking into consideration the technology used, weighted for fuel type, i.e. based entirely on an ex-ante approach. There is limited ex-post verification of the energy savings carried out by the government although this work would not affect the way energy savings are accredited in the current scheme. In general the regulator requires that 5% of all measures must be monitored for quality of installation using a standardised questionnaire. 1% of the measures funded by obliged parties must be monitored for customer satisfaction and some do-it-yourself measures must be monitored for customer utilisation using a statistically significant samples of the beneficiaries [3].

In France the French Agency for Environment and Energy Management (ADEME) and the Association Technique Energy Environment (ATEE) are in charge of setting methodologies for calculation of the achieved savings. As of 2009, 180 detailed methodologies associated with all end-use sectors have been published. An interesting feature of the French scheme is the differentiation of energy saving according to geographical region due to large variation of climatic zones (similar development is also seen within the Italian scheme). The French scheme has introduced deemed savings also for four measures in the transport sector: bus driver training, energy efficient tires, vehicles running on cleaner fuels and recuperation on braking [15]. It is also possible to claim savings for non-standardized actions: in this case both the savings and also the methodology have to be approved by the public authorities.

In Flanders each year each distribution system operator must submit an action plan for the following year to the VEA, which describes the actions it wishes to carry out, along with the method for calculating the primary energy saving of the action. The actions cannot be started until the VEA has approved the methods for calculating the primary energy saving, the amount of the financial contribution and the conditions attached to the grant of the financial contribution. The annual action plans of the electricity distribution system operators contain description of actions, the target groups, budget, expected primary energy savings, and data filed for reporting results.

In Denmark energy savings can be calculated as a specific engineering calculation or based on standard values. Unlike in the other national schemes, in Denmark most savings come from projects where specific engineering calculations were used.

Table 5. Measurement and verification

	UK (CERT)	Italy	France	Denmark	Flanders region (Belgium)
Measurement and verification options	Standard values	Standard values Engineering approach Metered baseline method	Standard values (180 measures) Case-by-case approval for other measures	Standard values for approx. 200 measures Specific engineering calculation	Case-by-case approval by VEA
Dominant measurement and verification choice	Deemed savings only	Deemed savings	Deemed savings	Specific engineering calculations	NA
Accreditation of savings	Ex-ante	Ex-ante (majority) and ex-post	Ex-ante	Ex-ante (first year savings only)	Ex-ante approval

2.6. Institutional infrastructure, cost recovery and penalties

Implementing energy saving obligations and tradable certificate schemes involves a set of administrative tasks related to enforcing the scheme, including measurement and verification of project savings (e.g. baseline setting, verifying information about projects and undertaking random on-site audits) and standard registration tasks (e.g. registering eligible parties, issuing and redeeming certificates, registering transactions, managing the cost recovery mechanism for the obliged actors, if any). Whereby trading platforms (spot markets) are organized, there should be a body responsible for the organisation and the maintenance of the white certificate trading platform.

2.6.1. Institutional infrastructure

In all national schemes in the EU the target setting authority is the government. In the UK, Italy and Denmark the national energy regulators administer the scheme, while in France and Flanders this is the task of governmental bodies (national or regional, respectively). System administrators get technical support for a number of tasks: for example in France the French Agency for Environment and Energy Management (ADEME) works on the definition of standard actions, while certificates are issued by DRIRE, a public body in charge of industry and environment at regional level. In Italy the marketplace is organized and managed by the electricity market operator GME.

In terms of certification related tasks, in Italy the regulator AEEG evaluates and approves projects thus establishing savings certification, communicates savings to the market operator GME, verifies compliance with the obligation and has authority over non-compliance penalties. The market operator GME manages the white certificate registry, issues certificates, organises market sessions, registers OTC contracts (bilateral contracts) and communicates market results to the regulator.

In France the Ministry of Energy (MEEDDAT / Direction Générale Energie Climat) sets the rules and the obligation, attributes the energy savings certificates and controls the projects. The regional offices of the Ministry issue the certificates and ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie) performs technical analyses and evaluation and provides information to public bodies and companies. ATEE (Association Technique Energie Environnement) is the platform that gathers economic actors involved in the system.

In the UK the Utilities Act of 2000 gave the duty to set the target to Government (in practice to the Department for the Environment) with the regulator retaining responsibility for the detailed rules under which the energy suppliers work and for monitoring the scheme. There is no white certificate market to regulate, but some bilateral trades to approve [8]

In Flanders the obligation is under the supervision of the Flemish Energy Agency, which approves the annual action plans of electricity distributors (see section 2.5.5.).

2.6.2. Penalties

In compliance markets the maximum cost of compliance or price of certificates can be effectively capped by means of a non-compliance penalty. France and Flanders

set pre-defined penalties, respectively 2 Eurocents/kWh cumac and 1 Eurocent/kWh[32]. Italy and the UK require case-by-case assessment of non-compliance. In the UK, the stated policy is that any financial penalty should exceed the cost of delivery. In Italy, a one-year grace period exists if at least 60% of the annual target is met; if not, the financial penalty does not cancel the obligation. The sanctions for non-compliance have to be "proportional and in any case greater than investments needed to compensate the noncompliance": the choice to not set a penalty has been made to avoid setting of a 'buyout price', which is likely to influence the price of certificates [8].

2.6.3. Cost recovery

It is generally assumed that the costs of energy efficiency measures undertaken as a result of obligations will be passed through in energy prices, whether explicitly in regulated distribution charges or in supplier costs. A cost recovery element can only be applied where the obliged parties operate in a regulated market, i.e. whereby regulated distribution tariffs are applicable. In the context of energy saving obligations, cost recovery is a process whereby an energy distributor is able to recover in full or partially through tariff (network charge) the costs of implementing certain energy saving actions beyond the consumers' meter. In a liberalised market companies should be able to put the energy efficiency costs inside their prices, i.e. via a pass through of eligible costs as may be stipulated in regulation, but without a fixed and guaranteed cost recovery.

In Italy, the policy package includes a cost recovery mechanism that allows obliged parties to benefit from a fixed contribution which is funded via a wire charge. The cost recovery is based on standard allowed lump sum defined by the regulator, i.e. it is not a pass-through of costs incurred to comply with the obligation. In the period 2005-2009 cost recovery of 100 Euro has been allowed for each type I and type II certificate (toe) delivered by the distributor up to the distributor's total saving target for the year under consideration. Costs recovery applies in case of purchased certificates too[33]. From 2008 onward cost recovery has been extended to include savings in other forms of primary energy excluding transport uses. Cost recovery is also allowed when the intervention concerns measures on the customer base of another distributor or measures that save energy on an energy carrier different from the one of the distributor. In line with the latest regulatory changes (December 2007), starting with cost recovery payable for 2009, the amount of cost recovery in year t+1 will be linked to the average cost recovery in the previous year t, corrected by a coefficient reflecting the average residential electricity tariff, the average price of natural gas in the residential sector and the average price of gasoline in year t-1. The first settlement of cost recovery according to the new rules will take place in 2010.

In Italy the cost recovery is administered by a fraction of electricity and gas network tariffs going to a fund disbursed by the regulator. No exact numbers are publicly available about the size of the tariff adder that covers cost recovery. This is

[32] The penalty poses a financial risk estimated at 1.08 billion Euro, according to calculations by ADEME [27].

[33] Obliged parties have been allowed to purchase certificates on the spot market and recover 100 Euro/toe even though they are likely to pay a lower price.

administered as a fraction of transmission and distribution network tariff. Estimates provided to the authors by a representative of the energy regulator AEEG point that in 2008 the average cost to a standard household[34] for covering the cost recovery is **2.68 Euro/year[35].**

Based on market prices of white certificates as of early 2009 the cost of compliance for obliged parties in Italy has been estimated by some authors at 0.26 Eurocent/kWh (gas) and 0.27 Eurocent/kWh (electricity) [8]. Yet, these numbers should be interpreted with great caution due to the distortive impact of cost recovery on certificate prices and because they are based on trades on the spot market only, which account for less than half of all transactions.

In France, as regulated tariffs still apply for most of consumer segments, the law stipulates that the regulator should take in account, in the evolution of tariffs, the cost of complying with the obligation for the obliged energy suppliers. In practice, this evolution takes into account all other factors that have an impact on the tariffs, such as inflation rate, social and renewable energy feed-in-tariff costs, evolution of transport and distribution costs. Therefore, there is no formal cost recovery system in France. As of the end of the first compliance period, no data on the cost of conserved energy are available. The only reliable information is that the cost is **between 0.3 Eurocent/kWh cumac**, which is the average value of the certificates traded during the first period (e.g. certificates registered to one body and subsequently moved into the ownership of another), **and 1 Eurocent/kWh cumac**, which is the maximum price of certificates traded in 2008[36]. Yet, these numbers should be interpreted with caution because of the very low volumes of trading and the low number of transactions: the total amount of certificates traded during the first period was below 4% of the national obligation. The French agency ADEME estimates a global investment of **4 billion Euro** but only 5% of this investment covered by the obliged parties [27].

In Denmark the cost recovery regime is a levy paid by all costumers equal to **0.06 eurocent/kWh** on average in the case of electricity depending on local conditions and historical prices of each company[37]. The average costs for the energy companies to fulfil this obligation has been determined as 36,5 øre/kWh (**0.5 Eurocent/kWh**)[38]. It needs to be emphasised that here only the savings for the first year are included (unlike in all other systems where lifetime savings are used taking either the technical lifetime of measures or a fixed value of 5 years). The cost of compliance for obliged parties Include the companies' costs of documentation and reporting of the savings: in the Danish system the companies have been obliged to ensure verification.

In the Flemish region of Belgium the network operators have to submit yearly a budget that must be approved by the federal regulator in charge of tariffs. The total budget for meeting the 2008 obligation in Flanders has been estimated at

[34] 2700 kWh/year electricity consumption and 1440 mc/year gas.

[35] Personal communication with Marcella Pavan, AEEG.

[36] The theoretical upper bound of compliance in France should be 2 Eurocent/kWh cumac (the size of the penalty).

[37] Source: Richard Schalburg, Danish Energy Association, communication July 2009.

[38] Personal communication with Peter Bach, Danish Energy Agency.

approximately **48 million Euro**[39]. This estimate includes subsidies in the residential and non-residential sectors, as well as overheads and communication. While there is no specific information, a simple calculation[40] shows a cost of conserved energy for obliged parties of **0.027 Eurocent/kWh** (primary). As in Denmark, only the savings for the first year are included.

In the UK it is assumed that costs of delivering the obligation are passed on in full to energy consumers[41]. In total the cost of conserved energy under EEC-2 was 0.6 pence/kWh in the case of gas and 2 pence/kWh of electricity [12]. There have been no rules governing how energy suppliers recover the costs of obligations. However, the regulator is currently discussing the matter with suppliers, but as of October 2009 no formal rules have been finalised

Considering householders in their entirety and assuming that all of expenditure by the energy suppliers in meeting their targets, including indirect costs, is passed directly to the householders, then the average increase per customer per fuel bill is 6.57 GBP (approx. 7.7 Euro) or, including VAT, 6.90 GBP per year. This is 23% below the Defra estimate for EEC-2 [12].

In the UK over the three years of EEC-2 energy suppliers expenditure to comply with the obligation amounted to 775 million GBP (909.8 million Euro[42]) on direct costs of the energy efficiency measures plus 140 million GBP (164.4 million Euro) for the indirect costs. The total expenditure by all parties on energy efficiency measures (i.e. excluding the energy supplier indirect costs) was 1.12 billion GBP (1.315 billion Euro) [28]. In the cost effectiveness for all parties of saving a delivered unit of electricity or gas (sometimes called the national cost effectiveness) under EEC-2 was 0.6 pence/kWh (0.7 Eurocent/kWh) in the case of gas and 2.0 pence/kWh of electricity (2.35 Eurocent/kWh) [28].

Considering householders in their entirety, then assuming that all of expenditure by the energy suppliers in meeting their targets, including indirect costs, is passed directly to the householders, then the average increase per customer per fuel bill is 6.57 GBP (approx. 7.7 Euro) or, including VAT, 6.90 GBP per year. This is 23% below the Defra estimate for EEC-2 [12].

Table 6 summarises some important features related to the administration of national schemes and cost and benefit estimates**. It needs to be emphasised that cost numbers in Table 6 are not directly comparable** due to profound differences in design modalities, such as obligations, sectoral coverage, time span of the obligations, lifetimes of the measures, evaluation methods, etc.

As indicated in the text and in the table some of the available estimates refer to cost of saved kWh based on real or estimated costs of compliance (direct and indirect), or on certificate market prices, while others denote cost recovery.

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[39] Personal communication with Ann Collys, August 2009.

[40] Dividing all first-year savings in 2008 by the 2008 budget approved by VEA in the framework of obliged distributors' compliance plans (the budget includes direct costs plus overheads and communication).

[41] In contrast, in Italy and France the obliged parties are subject to some form of price controls (residential electricity tariffs).

[42] The exchange rate used is 1 GBP = 1.174 Euro (as of 15 June 2009)

Table 6 Administration and cost of the system

	UK	Italy	France	Denmark	Flanders region (Belgium)
System administrator	Regulator OFGEM, target set by government	Regulator AEEG, target set by government	Government	Danish Energy Authority, target set by government	Flemish government
Cost of compliance [8; 12]	0.6 pence/kWh (gas) 2 pence/kWh (electricity) *(cost of conserved energy)*	0.26 Eurocent/kWh (gas) 0.27 Eurocent/kWh (electricity) *(estimates based on market prices for white certificates in 2008)*	0.3-1 Eurocent/kWhcumac *(estimates based on certificate market prices in the first compliance period)*	0.5 Eurocent/kWh (36,5 øre/kWh) *(first year savings only hence would decrease by a factor of 10 if the system would apply 10-year lifetime for measures)*	0.027 Eurocent/kWh primary *(based on achieved savings and approved compliance budgets)*
Cost recovery	No pre-defined cost recovery, pass through in electricity and gas price	100 Euro/toe saved (from 2009 linked to end-use prices and tariffs of electricity and gas in the residential sector and of gasoline). Up to the achievement of the target (incl. cost of purchased certificates)	None	Average 0.06 eurocent/kWh (depends on local conditions and based on historical prices of each company)	The amount of the obligation costs charged to end-users is fixed in advance in the budgets submitted by network operators to implement activities.
Cost to households[a]	In EEC-2: up to 7.7 Euro/fuel bill/year[b]	In 2008: 2.68 Euro/year[c]	No data	No data	No data
Penalties	Legal condition to impose a penalty, but not pre-defined	No pre-defined unit penalty Minimum 25,000 Euro, maximum 155 million. If non compliance is below 40%: 1-year grace period	20 Euro/MWh cumac	Legal condition to impose a penalty, but not pre-defined	10 Euro/MWh

[a] Note that the numbers for Italy and the UK are not directly comparable: the number for the UK assumes total pass through of all direct and indirect costs incurred by energy suppliers to meet their obligations. The number for Italy is only based on the cost recovery size.

[b] Source [12]

[c] Source: Marcella Pavan, AEEG.

2.7. Institutional administrative costs

The political feasibility of a policy instrument is affected by the administrative burden (human and financial) faced by public authorities in charge of its management. Institutional administrative costs refer to the costs of implementing, monitoring and enforcing a given policy instrument [15]. These costs include [21][43]:

- program planning, design, analysis, and evaluation;
- activities designed to reach the target group, and deliver services such as marketing, audits, application processing, etc.;
- enforcement, inspections and quality control;
- staff recruitment, placement, compensation, development, training, and transportation, overhead costs;
- data collection, reporting, record-keeping, and accounting.

No comprehensive comparative analysis is available of the administrative burden of various policy tools for energy efficiency, including supplier obligations and tradable white certificate schemes in the EU. It could be expected that regulatory policies like building codes and efficiency standards or emissions trading programs, once adopted, may have lower administrative cost ratios in comparison to more complex programs, such as energy saving obligations and white certificates. Administrative costs are generally higher in the early years of a program, but can be expected to decrease for mature programs.

Administrative cost estimates related to the implementation of supplier obligations and tradable white certificate schemes are rare (in the EU only the UK has such estimates), but so are the administrative burden estimates involved in other energy efficiency policies.

The direct costs incurred by the regulator Ofgem in the UK in administering the *three years* of EEC-1 were **1 million GBP** (1.174 million Euro), or less than 0.3% of Ofgem's total budget. In a comparative perspective. This indicates administrative costs of approximately 0.08% of the total expenditure by all parties on energy efficiency measures[44].

This relatively low burden – roughly 1 million GBP administrative costs in comparison to 1.12 billion GBP total direct expenditure on energy efficiency measures over three years – is due to the very limited scope of the British scheme, e.g. limited number of obliged parties, only one end-use sector covered, limited number of technologies, ex-ante measurement and verification and no real trading options.

In France the administrative cost are estimated at **700 thousand Euro/year** with a total of 13 full-time equivalent positions at the level of the Ministry, the regional services and ADEME[45].

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[43] Administrative costs do not include the costs to participants of complying with policy requirements, which are considered to be private transaction costs.

[44] Based on administrative cost for EEC-1 and total expenditure on energy efficiency for EEC-2.

[45] Personal communication with Evelyne Bisson, DGEC/SCEE.

No administrative cost estimates are available for Italy, where different actors at the level of the regulator AEEG, the Italian National Agency for New Technologies, Energy and Sustainable Economic Development ENEA, and the market operator GME. The authors of this report expect that the administrative costs in Italy will be in the range of **1 million Euro/year**.

One important factor that makes direct comparison of administrative costs of different policies and programs difficult, especially in the case of comparing energy saving obligations and TWC schemes with other tools, is the built-in evaluation of TWC schemes. Once TWCs are redeemed at the end of the compliance period, the administrator has an overview of the results achieved.

Finally, the costs of designing and implementing policies are country-specific and depend, for example, on the institutional context, in which policies are placed. In addition, policy design and implementation is subject to learning. Institutional administrative costs can be expected to decrease over time. The design of a scheme with energy saving obligations and the availability of trading options determine the magnitude of administrative costs.

3. A Community-wide white certification scheme: arguments for and against

A Community-wide white certification scheme may be designed with different levels of harmonisation. Harmonisation can refer to establishing the targets alone, to certification and certificate markets alone, or to both certificates and targets. Thereby the options are:

- *Case 1*: National energy saving obligations following a harmonised set of modalities (common rules for obligation setting, no international trading);
- *Case 2:* National energy saving obligations following a standard set of modalities and full or partial integration of national certificate markets into a Community-wide certificate market (common rules for obligation setting plus international trading – eventually voluntary);
- *Case 3:* European energy saving obligation and an integrated Community-wide certificate market (common European obligation plus international trading).

Case 1 refers to energy market actors being placed under national energy saving obligations designed in accordance with a harmonised set of modalities, most notably sectoral coverage, eligible measures and technologies, measurement and verification principles (e.g. baselines), policy additionality rules.

Case 2 refers to energy market actors being placed under national energy saving obligations designed in accordance with a harmonised set of modalities (same as Case 1), but also allowing obliged parties to either:

(a) undertake measures outside their country and have the savings from these measures certified under their national obligations, or

(b) purchase certificates in other countries (without implementing measures) and use them for compliance with national obligations.

This case requires that national registries are interlinked. There may be a limit on the amount of imported measures or certificates.

Case 3 implies the introduction of a Community-wide supplier obligation, which then needs to be apportioned among Member States (a 'bubble' arrangement). Subsequently, Member States can apportion the national target into individual company ones following common rules, for instance on the basis of obliged parties' market share on national markets. Obliged parties can undertake energy saving measures across Europe and, as in the former case, can undertake measures outside their country and have the savings from these measures certified.

This section looks only at Case 1 and 2 as first steps in harmonisation and/or establishing a Community-wide market. Case 3 is deemed to require a very high degree of harmonisation.

3.1. Arguments in favour of a Community-wide certificate scheme

Economies of learning, increased market liquidity, reduced risk of market power and cost effectiveness for obliged parties in meeting their targets are the main rationales of harmonisation and establishing a Community-wide scheme.

In Cases 1 and 2 setting harmonised Community-wide rules for establishing national energy saving obligations could:

- Reduce the administrative burden for Member States to plan and design energy saving obligations.
- Work towards overall change in business models among energy suppliers in the EU, which are increasingly operating on a cross-border basis. It could assist in product differentiation in the energy markets.
- Act as a strong driver towards the commercial provision of energy services increasing the market for energy efficiency market actors, such as ESCOs.

In addition, establishing a Community-wide market (case 2) can be expected to:

- Increase substantially the number of obliged and eligible parties – a pre-condition for high market liquidity – and reduce the risk of market power because a high concentration of the obligation in only few market parties is less likely.
- Allow obliged market actors who face problems in fulfilling energy saving targets (e.g. due to increasing costs in their customer base or country) to implement projects elsewhere and certify savings or to import white certificates generated elsewhere. Under a set of standard assumptions about perfect markets obliged parties reach their individual targets for energy savings in the most cost-efficient way[46].

3.2. Arguments against a Community-wide certificate scheme

The major national supplier obligations and tradable white certificate schemes in Europe have very different design modalities and very different experiences in terms of trading: there is a flourishing certificate market and many ESCOs on the supply side of the market in Italy, little trade and few ESCOs involved in the schemes in France[47] and the UK, and no trading allowed in the Flemish region.

The strong local benefits of energy saving projects – such as boasting competitiveness, employment generation, improved comfort levels and housing stock, reduced fuel poverty, security of energy supply, reduction in local pollution, market transformation – present the major difficulty related to the establishment of a Community-wide white certificate market. These strong local benefits are likely to raise equity issues of implementing savings projects abroad – or purchasing certificates from projects implemented abroad – because suppliers may cross-subsidise customers in country B, while possibly recovering their costs on their customer base in country A. In principle a Community-wide scheme would be beneficial for Member States that offer high cost-effective energy saving potentials,

[46] Using the Markal model Mundaca shows that a Community-wide scheme focussed on the residential and commercial sectors meets the criteria for cost-effectiveness and environmental effectiveness [15]. Industry outside the scope of the ETS has not been included in this modelling exercise.

[47] In France savings cannot be certified by entities, whereby projects have an impact on the commercial turnover.

i.e. Member States that have historically been less committed to energy efficiency. These equity aspects are relevant because even though obliged parties are responsible for meeting the target from the operational point of view, end-users bear the financial implications. Thus, it appears politically challenging if end users in one MS get the financial benefits of improved energy efficiency, while passing on the costs of investment to end-users in another MS.

In addition, cross-border energy markets are not yet mature, so even multinational companies under a supplier obligation may not be able – at least initially – to benefit from Community-wide energy saving project or white certificate market. There are profound differences across Member States related to important features of energy markets, such as experience with demand-side management and levels of energy taxation.

4. Voluntary white certificates and emission markets

A white certificate is an instrument that provides a guarantee that savings have been achieved. In principle certification of energy savings may be introduced on voluntary basis and may be used for different energy policies, such as tax credits and fiscal incentives. It is essential that each certificate is unique, traceable, and at any time has a single owner. Since CO_2 emissions in certain sectors in the EU are capped under the EU ETS, this section looks at the issue of integrating white certificates into carbon markets as a way of eliciting voluntary demand for white certificates and, at the same time, bringing to the EU ETS low-cost emission reductions from **non-electricity savings from sectors currently not under the EU ETS cap without capping the emissions from these sectors and without hampering the environmental integrity of the carbon cap.**

The benefits of an energy saving project may be viewed as composed of (at least) two separate values: energy and carbon. If a certificate can have different values – e.g. an energy value and a carbon value – then its owner could decide whether to certify savings on a voluntary basis (e.g. ESCOs could do this in order to sell certificates denominated in carbon to companies that aim at carbon neutrality) or on compliance markets (sell into a white certificate market under supplier obligations or on emission market). Carbon traders and companies looking for "external" project-based carbon reductions on voluntary basis may be interested in voluntary white certificates, especially if they can use these under the EU ETS. While certified carbon reduction are being requested for offset initiatives as part of voluntary corporate social responsibility initiatives, certified energy savings do not appear to be very attractive on a voluntary basis.

Energy savings can technically be converted into carbon savings without a burdensome procedure, and could in principle be treated in a way similar to CERs resulting from CDM projects. It needs to be pointed out that the frequently voiced concern of double counting that may occur if certified energy savings are allowed in the ETS only refers to electricity savings and savings related to district heating that have an indirect impact on power generators and DH installations under the EU ETS, but not to non-electricity savings in sectors outside the ETS (e.g. fuel savings in the residential sector)[48]. It needs to be further pointed out that at present energy efficiency programs and measures that save electricity grant *free* carbon credits to

[48] Electricity saving measures or measures that reduce heating consumption on premises heated by DH installations above 20 MW undertaken within the EU cannot be converted in a straightforward manner into CO_2 credits and imported into the carbon market because this would result in the same amount of CO_2 accounted for twice. The same electricity or energy savings has also reduced the emissions of the power generator or the DH installation, respectively. For this reason currently the Linking Directive in principle forbids project credits from JI when they lead *directly* or *indirectly* to emission reductions in installations covered by the EU ETS. In the case of electricity savings, in theory double counting can be avoided if the indirect impact of savings can be *traced back* to the power generator that benefits from emission reductions due to a particular electricity saving project, for example. Consequently it is a corresponding amount of emission allowances would need to be *withdrawn* from the account of this power generator. However such re-adjustments along the way may be impossible to implement. A practical solution of this inherent difficulty to retreat allowances would be the existence of *reserve margin* for implementing projects that generate carbon credits: this can be done via a set-aside quota (see main text).

power generators, i.e. credits from somebody else's efforts on saving electricity beyond the meter.

Different and much less complicated is the case of savings in natural gas or heating oil on non-EU ETS premises (referred to as **non-electricity savings in sectors outside the ETS**). A residential or tertiary building insulation project in a building heated by a gas or oil boiler can bring genuine and additional to EU ETS carbon reduction that are otherwise not covered by the EU ETS and that can be accounted for via a white certificate and converted into a carbon (project) credit.

At present the end-users that contribute to these additional emission reductions cannot get credit for their action[49]. Allowing energy saving projects to get carbon credits may involve:

- Reserving a certain share of the cap for certified energy savings, i.e. setting aside a quota (also referred to as set-aside quota, or reserve margin);
- Allowing companies under the ETS to exceed their individual caps provided that they can show precisely that the amount of excess emissions is offset by certified energy savings. Because energy savings have precisely measurable carbon content[50], this will have no implications in terms of environmental integrity of the ETS as long as the surplus emissions can be covered by white certificates denominated in carbon.

While the primary scope of the EU ETS is to reduce emissions in a cost effective manner, depending on its design ETS could also foster end-use energy efficiency, thus bringing additional and cheaper options to the carbon market[51]. Figure 1 presents the case of surplus emission offsets and set-aside quotas.

4.1. White certificates and emission trading: the case of set-aside quotas

A *set-aside* is a pool of allowances that are kept by the program administrator in charge of emission trading and used to reward energy savings (or renewable energy projects). Energy efficiency or renewables set-aside quotas have been developed and introduced by some states in the NO_x Allowance Trading Program in the USA[52].

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[49] Lowering individual caps means withdrawing of carbon allowances from the allocation of any installation under the EU ETS in relation to whose emissions energy savings (and therefore carbon reductions) have occurred. Tracking the impact of energy savings upstream to generators may be very burdensome – for example, tracking the impact of the sales of efficient appliances in one country on electricity generators. Another alternative is when establishing the overall emission caps to take into consideration the impact of existing energy efficiency policies and measures on future emissions.

[50] Varies by country.

[51] The principal arguments for and against integration of white and green certificates into the emission market are discussed elsewhere [1].

[52] In applying the Clean Air Interstate Rule (CAIR) – a cap-and-trade program to reduce NOx emissions from large stationary sources developed by the Environmental Protection Agency (EPA) – some states introduce set-asides. For instance Connecticut includes a 10% set-aside for energy efficiency/renewable energy projects starting in 2009 and Missouri allows set-aside allowances for energy efficiency projects, defined as projects that reduce the consumption of electricity or increase the efficiency of electricity use, as well as for renewables.

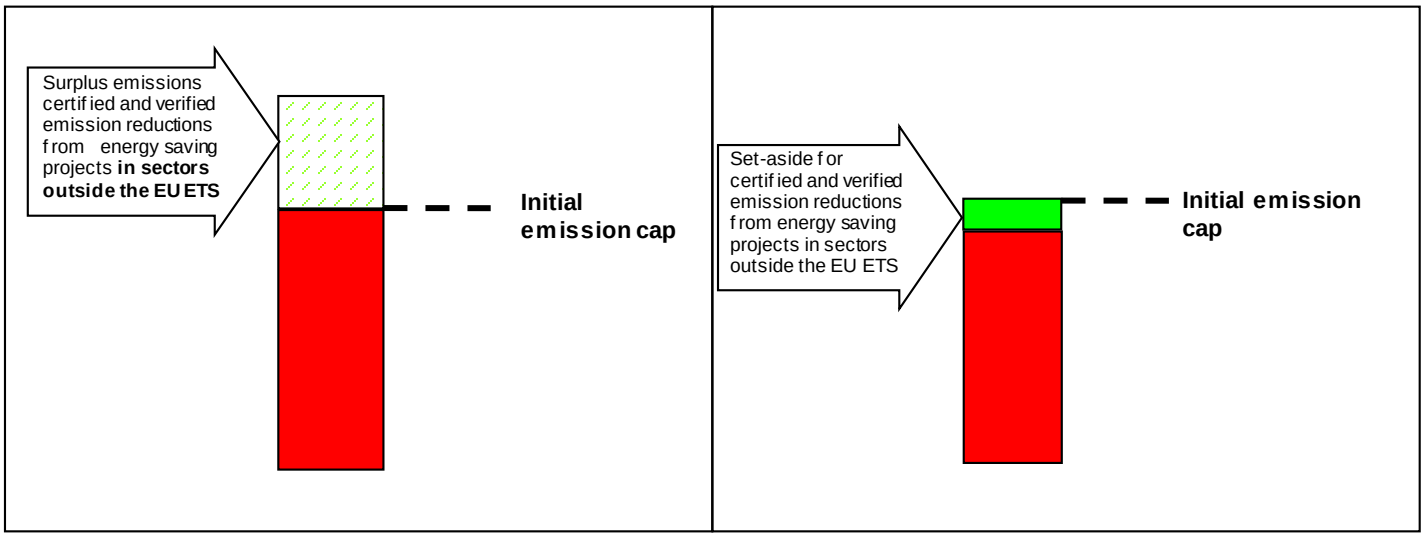
Set-aside quotas could avoid possible problems arising from additional emission allowances generated by energy savings, as these are reserved ex-ante and therefore there is no need for ex-post adjustments of the size of the emission quota (i.e. allowance numbers). Set-aside allows entities outside of formal emissions market to participate in it by allowing certain types of activities to be recognized for the emissions reductions these projects provide.

One way of implementing a set-aside would be to impose on each installation under the EU ETS a total emission cap (like at present) and deduct a fraction of this emission cap 'ear-marking' it for emission reductions coming from energy efficiency. The dedicated set-aside can be optional or mandatory. Under an optional set-aside parties with emissions caps will have the possibility to create or purchase 'special' allowances generated from end-use energy efficiency if they wish to fully utilise their initial emission cap. A variation of this arrangement is to mandate the exact share of the set-aside quota, thus creating a portfolio standard in the emissions trading scheme and making end-use energy efficiency and renewable electricity generate 'tagged' emission allowances. Under such arrangement the program administrator reserves a certain share of allowances that are dedicated only to verified and certified CO_2 reductions from end-use energy efficiency and renewable energy projects (white certificates). This is presented as case 2 in Figure 1.

Figure 2. Emission offsets and set-aside quotas for energy saving projects

Case 1: Surplus emissions **offset** by certified and verified CO_2 emission reductions from renewable and end-use energy efficiency projects in sectors outside the EU ETS

Case 2: NO surplus emissions: a pool of allowances **set aside** to reward energy savings from projects **in sectors outside the EU ETS**



4.2. Voluntary white certificates

When it comes to voluntary markets for white certificates, linkage with emission markets could be an early stimulus for a voluntary market. A voluntary market can also be a tool for corporate social responsibility issues, e.g. for companies that want to move towards carbon neutrality of their products can offset their emissions with certified energy savings.

4.3. Examples from the US

Modified cap-and-trade designs are being developed in the Northeast states, in California and elsewhere in the US, which make efficiency an integral part of carbon-reduction programs and lower the cost of GHG reductions by allocating allowances for consumer benefit and investing allowance values in programmatic efficiency measures [6].

The Regional Greenhouse Gas Incentive (RGGI), which now extends to ten states[53], is the leading regional effort in the US to cap GHG emissions from the power sector. One of the key achievements of the RGGI has been the creation of a formal consumer allocation of carbon credits (allowances) rather than historical grandfathering. Consumer allocation refers to awarding a large fraction of allowances in each compliance period to consumers, represented by their distribution companies or other supervised trustees acting on their behalf. By then selling these allowances on the carbon market to generators, consumers' agents can recapture revenue that otherwise would be windfall for generators. Carbon-credit revenues can be subsequently invested energy efficiency.

In December 2005 the governors of seven of the RGGI states agreed on a provision requiring each state to assign at least 25% of its carbon allowances to a consumer allocation; shortly after Vermont enacted legislation creating a 100% consumer allocation of carbon credits to be applied to energy efficiency. In New York up to 97% of allowances will be auctioned with up to 100% of auction proceeds dedicated to energy efficiency. In Connecticut at least 70% of allowance proceeds will be invested in energy efficiency and conservation programs. Currently most states are in process of rule-making and legislating on how proceeds will be used. Across the RGGI region, approximately 90% of total allowances will be auctioned with as much as 80% of auction revenues dedicated to end-use energy efficiency.

The strategy described above, referred to as “Cap and Invest”, allocates emission allowances to consumer trustees (e.g. distribution utilities, EE program managers) who can sell them to generators and ensure that the revenue is recycled back to consumers via the promotion of end-use energy efficiency. To ensure tangible results, allocation of funds should be performance-based (and not expenditure-based).

[53] Six states in New England, plus New York, New Jersey, Delaware and Maryland. Pennsylvania is an observer state.

5. Conclusions and recommendations

Involving energy companies in energy efficiency offers important benefits [4; 20]:

- They have data on their customers – e.g. how much energy is sold to whom and at what time – and thus can strategically target conservation. They have access to the customer (retail function).
- They have financial and human resources.
- They have competence in marketing and engineering.
- Energy regulators have a clearly defined oversight role and well-understood authority over the energy sector.
- Energy companies can mitigate some of the risks and uncertainty faced by consumers around the value of energy savings and technical risks of the measures installed. They can address financial barriers by providing subsidised measures or finance and through assessing economies of scale in sourcing measures.

A number of MSs have imposed energy saving obligations on energy companies to capture these and other benefits: energy saving obligations **bring together a combination of a mandate to deliver a certain amount of savings from cost-effective projects and a financing channel to (partially) cover the associated investment needs (cost recovery or pass through of costs to the end-user).**

As experience in the EU shows, there are various ways to frame energy saving obligations in terms of level of ambition, treatment of early actions, size and unit of obligation, obliged parties, eligible energies, sectors and measures. The design of energy saving obligations and TWCs inevitably influences their performance and output. Yet, **various implementation set-ups have proved functional and delivered results**. Because design functionalities often reflect national priorities and contexts (e.g. the state of energy market opening), this report does not point to any universally optimal set up for establishing energy saving obligations and tradable white certificates.

This report concludes with a discussion on:

- How different design options in implementing energy saving obligations and tradable TWC affect their performance (section 5.1.)
- What degree of harmonisation may be feasible and desirable at Community level (section 5.2.)
- What role can energy savings play on emission markets (section 5.3)

A final set of recommendations points to some guiding principles of a general framework for establishing a harmonised approach towards supplier obligations in the EU (section 5.4).

Experience in the US shows other possibilities to implement energy savings obligations, such as energy saving obligations financed via public benefit charges (wire charges) and borne by a non-profit organisation under a performance contract (see Annex I). With proper implementation these may increase the cost efficiency of implementation by linking a performance contract and a tendering element.

5.1. Conclusions for the design of the major elements of energy saving obligations and white certificate schemes

European experience shows that energy saving obligations can function both in fully liberalised energy markets and whereby they target monopolistic segments of the energy sector, such as distribution network operators.

Obligations under all existing schemes have been met or exceeded, often at a **cost below the initial expectations** of the administrators of the schemes. In the UK and France obliged parties are moving in the direction of positioning themselves as energy efficiency providers vis-à-vis their clients. Obliged companies in the UK and France have formed partnerships with energy efficiency industries, bringing new activities without significantly modifying their core business of selling energy units. In Italy obligations have been mostly delivered by energy service providers. In the medium term this cooperation may expand the scope of commonly implemented projects to the tertiary and industrial sectors, where ESCOs have more experience, and once 'low-hanging fruits' are exhausted.

To date the largest schemes in the EU have delivered savings in the premises of **end-users** and have been **dominated by subsidy measures** mostly targeting the **residential sector**, where financial incentives play an important role. For the large majority of measures implemented **standardized saving values** have been used reducing transaction and administration costs for well-understood measures. The administrative costs of implementing energy saving obligations and tradable white certificates are a function of the scope and simplicity of the system.

Whether certification of energy savings and **certificate trading** adds value to supplier obligation depends on at least two major factors. First and foremost, certificate trading can potentially contribute to increase in the cost-effectiveness of a supplier obligation scheme and make it a preferable option with respect to other policy instruments for energy saving (e.g. energy taxes) **only when the energy saving target established is sufficiently high with respect to the existing saving potential in the sector(s) covered by the scheme**[54]. In general the more ambitious the saving target gets, and the more variation there is in energy saving unit-costs and end-use energy prices, the greater scope there is for a tradable white certificate scheme to outperform other energy policy instruments [24].

Second, design modalities affect the role of trading. Trading appears essential in a system with a wide scope in terms of sectoral coverage, project types and non-obliged parties allowed to trade in. This is the case of Italy where trading is an important element. In contrast, despite the rather wide scope of the French scheme suppliers have chosen to do projects themselves or via partnerships. This is due to strategic positioning choices of the obliged parties, to the burdensome conditions for non-obliged parties to certify and trade in savings – e.g. not allowing certification in case savings have an impact on commercial turnover, – and because in France

[54] An analysis of the existing energy saving potentials in Finland, Hungary, the Netherlands and the UK has showed that the saving target for a possible tradable white certificate scheme in these countries would need to be at least about 60% of their estimated saving potentials in order to be reasonably sure that positive white certificate prices might occur (Perrels, 2008).

residential tariffs are regulated, there is no explicit cost recovery and obliged parties are reluctant to let other economic actors make profit from 'their' clients.

The role of trading in a scheme that is limited in scope (e.g. residential sector only) is more ambiguous: the additional administration cost of establishing and operating a trading regime may not justify the cost efficiency gains of trading for obliged parties and society. In the UK the policy choice has been to limit the scheme to the residential sector. Since most suppliers work with a number of contractors and retailers, the implementation costs are similar. However, there is considerable variation between energy suppliers in the mix of energy saving measures they employ to meet their targets.

The choice of **primary or final energy** influence the balance between savings on gas and electricity: for example in Italy, where obligations are in primary energy and lifetimes are set at 5 years (8 years in exceptional cases), most savings have occurred in electricity. Long lifetimes for certain measures and the availability of standardised savings values for certain types of projects influence the compliance choices towards such projects or sectors.

In existing schemes the **policy additionality** of supplier obligation and white certificate schemes has not been clear. For example, in France existing generous tax credits for certain energy efficiency improvements seem to be more important in financing most of the interventions. Obliged parties under energy saving obligations rely on local contractors and offer very small incentives (rebates)[55]. In the UK and Italy obliged parties tend to partly subsidise the energy efficiency intervention, especially in the case of low-cost measures (e.g. CFLs). However, starting from mid-2008 tax credits play an important role in Italy too and it is not clear which policy is the driver for a project to be implemented: the rebate given by obliged parties as part of their progress on targets or tax credits available for certain energy efficiency measures. In the UK in the case of insulation in social housing, obliged parties sign contract with social housing providers.

The **heavy reliance on deemed saving evaluation method** in most supplier obligation schemes reflects the reduced transaction costs associated with applying these. In the case of the massive give-aways of CFLs in Italy and the UK, installation remains unclear and hence the real amount of savings achieved.

The **impact of energy saving obligations on end-use prices** has been rather limited, e.g. approximately 1.5% in the UK[56]. Because the measures incentivized are cost effective, this price increase is more than outweighed by reduced energy use, so that the net effect of the policy is a reduction in overall energy costs [8].

The comparison of the results to date of the three most frequently cited schemes – UK, Italy and France – should be taken with care as these schemes differ profoundly in terms of setting the obligations, sectoral coverage, time span, evaluation methods and so on. The major results to date are summarised in Table 7.

[55] Nevertheless, one needs to keep in mind that in France residential tariffs are regulated and there is no cost recovery: hence obliged parties are not passing on the costs in any standard way.

[56] EEC-2, see [8]

Table 7 Results to date of the three largest schemes in the EU[57]

	UK (EEC-2)	Italy 2005-2007	France
Annual end-use energy savings (TWh)	3.5	4.5	1.3
Lifetime *primary* energy savings (Mtoe)*	5.87	6.99	2.02
Peak demand reduction in electricity (MW)**	299	612	86

Source: [8]

* Lifetime savings are cumulative and discounted for UK and France (with different discount rates). The lifetime savings for Italy are based on *estimated* lifetime of the same measures as in the UK [8].

** Estimate assuming load profile of savings is similar to the average load profile [8].

The level of ambition of the energy saving targets, the sectors covered, the size of the market, fair and transparent rules related to cost recovery (where relevant), provision of information to market agents, streamlined provisions for trading, effectiveness of measurement and verification, and rigid enforcement and non-compliance regime all affect performance of national schemes. These determine the effectiveness, transaction costs, dynamics of trading and levels of (over) compliance [15].

Based on the review and analysis of European schemes provided in the previous sections, the following lessons are formulated about the design and operation of supplier and utility obligations and tradable certificate schemes.

- Energy saving obligations engage energy market actors into energy efficiency without necessarily changing their business models – at least on the short term – from selling energy into selling energy services. Suppliers nevertheless report to have modified their institutional structure accordingly. Other mechanisms – such as decoupling of profits from amounts of energy sold and establishing performance contracts for managing proceeds from wire charges – may present effective alternatives.
- Energy saving obligations and white certificate schemes are well-suited to deliver low-cost and standard energy efficiency measures in any end-use sector. Nevertheless, they can be designed to channel efforts towards measures with higher upfront investment needs (e.g. longer lifetimes of certain project types, longer validity of certificates), especially whereby there is an increasingly ambitious target and after the initial rush to 'low-hanging fruits'. To date over-compliance has been observed in all the existing schemes in the EU, which also signals unimposing targets in comparison to economic saving potential.

[57] Difference between targets (annual or lifetime), the use of discount rates for lifetime savings and the different measure mix complicates a meaningful comparison of cost effectiveness of the schemes.

- Energy saving obligations give energy suppliers the possibility to offer value-added services to their customers, i.e. to go directly or via contractors to the customer with something else than the bill.
- Clear long-term policy and legislative mandates ensure investment stability under a supplier obligation, which is crucial for a sustained market transformation effect;
- Many design modalities – such as size and unit of the obligation, obliged parties, sectoral and energy coverage – reflect national policy priorities. The obligations can be expressed either in absolute terms or as a percentage of sales in a given year, depending on whether the system is intended to deliver a certain result (absolute target) or primarily focussed on influencing the business model and decisions of obliged parties (percentage of sales).
- At present white certificate schemes reward technology measures, but not behavioural ones. This is due to difficulties or disproportionate burden of measurement and verification. Developments in the UK and Denmark may bring valuable experience in this respect.
- There are many important trade-offs between e.g. market liquidity, accuracy of measurement and verification and administrative and transaction costs. Administrative costs of all policy instruments are a function of the simplicity of the system and the ease of obtaining reliable information necessary for its design and enforcement. The relatively low burden for the British authority include a single eligible sector, rather limited number of obliged parties, ex-ante measurement and verification approach, a limited set of measures, as well as lack of real certificates and trading provisions (either bilateral or spot).
- Defining standard measurement and verification reduce the transaction costs for obliged parties and project developers and thus may direct the market towards types of projects or sectors, where such standard methodologies ('deemed savings') are available. Thus, the co-existence of default values for unitary energy savings and of more detailed measurement and verification methodologies results in a bias towards measures that introduce energy efficiency technologies with default values for unitary energy savings.
- Providing administrative and monitoring costs are not disproportionate in opening up the generation of white certificates to any party (not just the obligated energy company), then this approach should theoretically ensure diverging marginal costs and lower risks of market power and speculative behaviour. On the other hand a wide scope may work against obliged parties positioning themselves as energy service providers as part of their use energy saving targets compliance strategy;
- Minimum buy-out prices[58] and penalties may act to establish a ceiling and a floor price. Banking of certificates or savings, long validity of certificates and long compliance periods mitigate price risks for obliged and eligible parties, but may discourage trading and thus reduce liquidity in the current compliance period.

[58] Not used in supplier obligation and white certificate schemes in the EU.

- Trading is expected to deliver cost efficiency gains when energy saving targets are set sufficiently high with respect to the existing economic saving potential in the sectors covered by obligations. The more challenging the obligation is, the greater the benefit of trading as it brings diversity in the marginal costs of compliance among trading parties;
- An efficiently working tradable certificate market requires that all players know the price of certificates in the market, the possibilities for the purchase and sale of certificates and possess information on the types and costs of energy saving technologies and processes in the market.
- Certificate trading is not an aim in itself. Trading is expected to deliver cost efficiency gains when energy saving targets are set sufficiently high with respect to the existing economic saving potential in the sectors covered by obligations. The more challenging the obligation is, the greater the benefit of trading as it brings diversity in the marginal costs of compliance among trading parties. Trading may be redundant in a supplier obligation with lenient saving targets or with limited scope and coverage.

5.2. Conclusions and recommendations on a Community-wide certification scheme

The present situation in the three major national schemes in Europe may offer little by way of arguments in support of establishing a fully-fledged harmonised Community-wide certificate scheme, presuming that the main aims of harmonisation and establishing an EU-wide scheme are increased market liquidity on the supply side of certificate markets, lower compliance costs for obliged parties and having targets across the EU in accordance with common rules.

Nevertheless, harmonising the rules for establishing national supplier obligations and allowing for a voluntary international trading may be recommended as a first step.

5.2.1. Equity aspects

A Community-wide trading scheme could raise a number of equity issues, related to the distribution of costs and benefits, notably end-users in one country financing (via higher end-use prices or tariffs) efficiency improvements in other countries. In addition loss of local co-benefits may not be offset by the possible financial gains from a Community-wide scheme. Establishing a transparent way of recovering or passing through costs without cross-subsidisation and unfair financial burden may be inherently difficult and distortive for a Community-wide market.

Experience in the UK and France shows that obliged parties take into consideration the commercial effects of marketing among local customers. Thus, obliged parties may ignore international trading for local measures that are not as cost-effective, but yield co-benefits that are important for their core business.

5.2.2. Technical harmonisation aspects

Assuming that MSs have similar broad visions of promoting energy efficiency via energy saving obligations, there are some partial harmonisation options that deserve attention.

The following are pre-conditions for establishing a harmonised certificate market:

- Harmonisation of basic rules for formulating the obligations,
- Harmonisation of basic rules related to the scope of eligible sectors, projects and eligible market actors,
- Harmonisation of principles and methods for measurement and verification of savings under energy saving obligations.

Standardisation of certificates in terms of categories of energy efficiency measures allowed, primary or final energy, energy units (kWh, toe, kJ), content, validity and rules for issuing and redemption, etc. is a next step[59], along with establishing a registry and a trading platform is a next phase.

[59] The ongoing process on establishing a harmonised measurement model in the framework of the Energy Demand Management Committee "Energy Services" Formation - Directive 2006/32/EC – may inform this process.

5.2.3. A step-wise approach

Establishing a harmonised Community-wide scheme along the lines of Case 2 (common rules for obligation setting plus international trading, see section 3) and Case 3 (common European obligation plus international trading, see section 3) appears **premature** at this stage.

Harmonisation of the main principles of defining national energy saving obligations may bring important economies of learning and avoid energy market distortions. For this reason a step-wise approach along the lines of Case 1 (establishing national energy saving obligations following a harmonised set of modalities) is recommended, along with a voluntary Community-wide certificate market, keeping it open for MS to join. This would allow testing the functionality of a Community-wide scheme.

Yet, it is acknowledged that the interactions of white certificates with existing national policy instruments for the promotion of energy efficiency (for instance, subsidies) become very complicated in a Community-wide white certificate system with high probability for distortions at the certificate market or cumbersome national monitoring to ensure that projects receiving white certificates do not benefit from other support. Such policy additionality checks are currently not done in the existing scheme in the EU (apart from the UK). In addition, the impact of different energy prices, including energy taxation, on the cost of conserved energy and thus certificate market prices across countries needs to be studied.

5.3. Conclusions and recommendations on voluntary white certificates and emission markets

Allowing certified energy savings into the carbon emission market could be an early stimulus for a voluntary market in white certificates. Carbon traders and companies looking for "external" project-based carbon reductions on voluntary basis may be interested in voluntary white certificates, especially if they can use these under the EU ETS.

Allowing the conversion of non-electricity savings from sectors outside the EU ETS into emission credits can bring genuine and additional carbon reduction that are otherwise not covered by the EU ETS and that can be accounted for via a white certificate and converted into a carbon (project) credit. This is especially valid for sectors, where emission caps may be politically difficult (e.g. residential).

Linking white certificate and emission markets would allow a source of additional low-cost emission reductions from non-electricity savings from sectors outside the EU ETS, without compromising the emission cap and without capping the emissions of these sectors[60]. If the overall emission cap is to be preserved, this can be achieved via setting aside a certain share of the cap for certified energy savings. Alternatively, because energy savings have a precise carbon content, installations under the ETS can be allowed to exceed their individual caps without risking the integrity of the caps if they can demonstrate that the amount of excess emissions is covered by certified energy savings. The option of withdrawing emission permits from the ETS to allow electricity savings projects may be very complex to implement.

According to Article 24a of Directive 2009/29/EC amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community, **implementing measures for issuing allowances or credits in respect of projects administered by MSs that reduce greenhouse gas emissions not covered by the Community scheme may be adopted**. Any such measures shall not result in the double-counting of emission reductions nor impede the undertaking of other policy measures to reduce emissions not covered by the Community scheme. Measures shall only be adopted where inclusion of additional activities and gases is not possible in accordance with Article 24, and the next review of the Community scheme shall consider harmonising the coverage of those emissions across the Community. Such projects will be executed on the basis of the agreement of the Member State in which the project takes place.

These 'domestic offset credits' would need to be managed according to common EU provisions set up by the Commission in order to be tradable throughout the system. The provisions will seek to ensure that domestic credits do not result in double-counting of emission reductions or impede other policy measures to reduce emissions not covered by the ETS, and that they are based on simple, easily administered rules.

In the process of writing the present report we have been informed by DG Environment that although the potential of Article 24a is clearly acknowledged, its implementation for the time being and bearing in mind limited resources available, does not necessarily represent a priority, especially given that the fact that the

[60] Capping the emissions of the residential sector, for example, can be politically unfeasible.

potential of Article 24 should be fully exploited before use of Article 24a should be made. It is also acknowledged that there may be projects, which would not fit under Article 24, but the expectations are that no work will be done on the necessary legal procedures and framework for Article 24a before 2011/12 and only on condition that there would be projects effectively and efficiently reducing emissions.

5.4. Recommendations for establishing a harmonised approach towards designing energy saving obligations in the EU

It is considered appropriate to first establish a set of principles to follow in the formulation of national supplier obligations and measurement and verification of projects. This would allow economies of learning and will set the conditions for introducing Community-wide trade at a later stage.

This report recommends to:

- Encourage the establishment of national energy saving obligations on energy suppliers or distributors expressed in **final energy** in order to target end-use energy efficiency measures rather than supply-side and networks;
- Ensure a **significantly large share of final energy consumption** covered by the subjects under national obligations, while retaining a manageable number of obligated parties by possibly excluding very small market actors for whom the saving obligation may pose a big burden or act as a barrier to market entry in the case of retailers.
- Establish common rules for **apportionment** of the national obligations (e.g. based on market share) in order to avoid energy market distortions[61];
- Establish **large scope** for national energy saving obligations – allowing savings in all end-use sectors outside the ETS, in all energy sources and by all market actors that can show savings of certain size – in order to capture the benefits of difference in differences in the costs of compliance;
- Keep compliance under national energy saving obligations confined to measures in **end-use sectors** to avoid an effect of large generation or network projects crowding out end-use projects;
- Establish common modalities for **allowing obliged parties to recover the costs of complying with energy saving obligations** in some way – either via cost recovery in regulated segments or passing costs through to the end-user in liberalized market situations;
- Establish a list of **standard energy efficiency measures** with pre-defined energy saving values (deemed savings based on experience in Italy, France and the UK), allowing also complex energy efficiency measures with more sophisticated measurement of savings;
- Allow for certification of project savings and certificate trading, **establish common trading rules** and modalities;
- Allow for the creation of a **voluntary Community-wide market in certificates**.

[61] Whether to target distribution or supply segments is dependent upon national energy sector conditions.

References

[1] Bertoldi, P. and S. Rezessy (2006). Tradable certificates for energy efficiency (white certificates): theory and practice. EUR 22196 EN. Ispra, Institute for Environment and Sustainability, DG Joint Research Centre, European Commission.

[2]. Friedman, B., L. Bird and G. Barbose (2008). Considerations for emerging markets for energy savings certificates. Washington, Report funded by the Department of Energy, Office of Energy Efficiency and Renewable Energy (EERE).

[3] Togeby, M., K. Dyhr-Mikkelsen and E. James-Smith (2007). Design of white certificates. Comparing UK, Italy, France and Denmark. Copenhagen, Ea Energy Analyses.

[4] Waide, P. and B. Buchner (2008). "Utility energy efficiency schemes: savings obligations and trading." Energy Efficiency 1(4): 297-311.

[5] CPUC. (2007). California's decoupling policy. California Public Utility Commission, www.cpuc.ca.gov

[6] Cowart, R. (2008). "Carbon caps and efficiency resources: how climate legislation can mobilize efficiency and lower the cost of greenhouse emission reduction". In: Vermont Law Review 33 (2).

[7] FERC (2009). Electric market overview: Energy Efficiency Resource Standards (EERS) and goals, Federal Energy Regulatory Commission, 3 April 2009.

[8] Eyre, N., M. Pavan and L. Bodineau (2009). Energy company obligations to save energy in Italy, the UK and France: what have we learned? European Council for Energy Efficiency summer study, La Colle sur Loup, ECEEE.

[9] Bodineau, L. (2009). The French Energy Savings Certificates Scheme. JRC workshop on white certificates, utility and supplier obligations, Brussels, 31 March -1 April 2009.

[10] Autorità per l'energia elettrica e il gas (2008). Terzo rapporto annuale sul meccanismo dei titoli di efficienza energetica. Situzione al 31 maggio 2008. Milan, Autorità per l'energia elettrica e il gas.

[11] Lees, E. (2007). European experience of white certificates. WEC ADEME project on energy efficiency policies, World Energy Council.

[12] Lees, E. (2008). Evaluation of the Energy Efficiency Commitment 2005-08. Report to the Department of Energy and Climate Change. Wantage, Eoin Lees Energy.

[13] Togeby, M., K. Dyhr-Mikkelsen, A. Larsen, M.-J. Hansen and P. Bach. (2009). Danish energy efficiency policy: revisited and future improvements. European Council for Energy Efficiency summer study, La Colle sur Loup, ECEEE.

[14] NERA Economic Consulting (2006). Energy Efficiency and Trading. Part I: Options for Increased Trading in the Energy Efficiency Commitment. London, Report by NERA Economic Consulting on behalf of DEFRA.

[15] Mundaca, L. (2008). Markets for energy efficiency. Exploring the new horizons of tradable certificate schemes. International Institute for Industrial Environmental Economics. Lund, University of Lund.

[16] Schalburg, R., chief advisor of the Danish Energy Association. Personal communication.

[17] Adnot, J., B. Duplessis, A. Almeida, P. Fonseca, P. Moura, N. Labanca, M. Dupont and S. Rezessy (2006). Supply side: measurement and verification of energy efficiency projects. Work Package 4.1. report presented to Intelligent Energy Executive Agency by Armines and ISR-UC on behalf of the EuroWhiteCert team. Paris, Armines

[18] Pavan, M. (2008). White Certificates: the Italian experience gained in regulation, monitoring and verification and electricity market contexts. IEA-DSM and CESI Ricerca Workshop, Milan, 22 October 2008.

[19] Coase, R. (1960). The Problem of Social Cost. In: Journal of Law and Economics (3), 1-44.

[20] Munns, D. (2008). Trend analysis: administration of energy efficiency programs. Washington: Edison Electric Institute.

[21] Interlaboratory Working Group. 2000. Scenarios for a Clean Energy Future, Appendix E-1 (Oak Ridge, TN; Oak Ridge National Laboratory and Berkeley, CA; Lawrence Berkeley National Laboratory), ORNL/CON-476 and LBNL-44029, November.

[22] Grattieri, W. (2007). Market mechanisms for energy efficiency: white certificates in Italy, Ankara.

[23] European Regulators' Group on Electricity and Gas. (2008). Transposition of Consumer Rights Monitoring Report Ref: E08-CPR-20-03, 13 October 2008

[24] Perrels, A. (2008). Market imperfections and economic efficiency of white certificate systems. In: Energy Efficiency 1(4): 349-371

[25] Pagliano, L., Alari, P., Ruggieri, G. 2003. The Italian energy saving obligation to gas and electricity distribution companies. Scenario and case studies calculations show high environmental and economic benefits to actors (DISCOs, ESCOs, customers) and society. European Council for Energy Efficiency summer study, Mandeleu, ECEEE.

[26] Capozza, A., M. Devine, A. Enge, W. Grattieri, S. Monjon, L. Mundaca, L. Neji, V. Oikonomou and M. Tarbe (2006). Market mechanisms for white certificate trading. Task XIV final report. Milano, CESI.

[27] Dyevre, N. 2009. White Certificates in Europe: practical implementation in France. French Agency for Environment and Energy Management. Presentation made at the First international energy efficiency forum How to win on energy efficiency, Warsaw, 28 October 2009.

[28] Bertoldi, P, Rezessy, S., Lees, E., Jeandel, A., Baudry, P. and Labanca, N. *in press.* Energy supplier obligations and white certificate schemes: comparative analysis of experiences in the European Union. Article accepted for publication in the Energy Policy journal.

[29] Vlaams Energieagentschap. 2008. Flemish Energy Efficiency Action Plan 2008 – 2010.

[30] Moorkens, I., Aernouts, K., Renders, N. 2007. Good practices of DSM in Flanders/Belgium. Workshop on Demand Side Management INFRA 25625. Ankara, 22-23 November 2007

Annex I: Examples from the US

Table 8 summarizes the main features of energy savings obligations in the United States. As of 2009 15 of the states in the USA have some energy efficiency or energy savings obligations, either as a stand-alone target (referred to as energy efficiency resource standards, EERSs) or combined with renewable energy obligations (referred to as renewable portfolio standards, RPSs). In the US obligations have been expressed as a percentage of demand, peak demand, load growth or retail sales. Half of the stand-alone obligations are expressed as percentage of retail sales. As of 2009, two bills have been introduced for a national energy efficiency resource standard that would require that would require savings raising to 15% of electricity and 10% of natural gas by 2020.

The first US state to introduce such a scheme was Texas, where a requirement was legislated for distributors to offset certain percentage of their load growth through end-use energy efficiency (20% of load growth in 2009). A handful of the schemes were introduced before 2005, while the majority came into force in 2007-2008.

Five states have incorporated tradable certificates, but only Connecticut is actively trading. A few other states, including North Carolina and Illinois, are gathering input on certificate trading.

Unlike in Europe, in some US states energy efficiency has been introduced as a target delivery option within renewable energy obligations [2; 4]. Combined efficiency and renewable portfolio targets are a relatively new concept, with most targets adopted since 2006. States that allow energy efficiency to qualify as an eligible resource within a broader portfolio standard typically place a cap on the total target that can be met with energy efficiency measures.

An important structural feature of combined renewable and efficiency portfolios in the US are the resource tiers, which specify the type of resources (renewable, other energy resources, energy efficiency) that are expected to contribute to a certain share of the overall target. For example, North Carolina's RPS policy places efficiency within a tier of resources including some forms of renewable energy that are expected to be more expensive than the efficiency measures, which tends to stimulate the efficiency measures [2]. In contrast in Pennsylvania efficiency is included within a tier of resources that also includes lower-cost energy resources such as waste coal, large hydro, and certain biomass technologies. This allows obligated parties to take advantage of these lower-cost alternatives and forego or reduce the need to implement efficiency for compliance [2]. The tier requirement in Pennsylvania is 10% by 2020.

Separate tiers for efficiency and renewables allow capturing energy savings opportunities without sacrificing renewable energy development. Separate tiers are likely to provide more certainty to the market, because the quantities needed of each resource could be more clearly delineated. Such a combination may encourage the adoption of efficiency in the short term and push the development of renewable resources in latter years, delaying the market's ability to develop manufacturing capabilities and infrastructure [2].

For instance in Nevada 20% of electricity must be provided from eligible renewable and energy efficiency sources by 2015 with a maximum of 25% to be derived from

energy efficiency measures [4]. With combined portfolios and certificate trading allowed, white and green certificates could be used interchangeably.

Experience in the USA shows that there exist other ways to implement energy savings obligations. Apart from supplier or distributor obligations, these include obligations borne by a state agency, "Energy Efficiency Utility", standard performance contracting for energy efficiency, or bidding into regional capacity markets [6].

As an example of distributor obligations, California has the so-called “loading order”, whereby in all utility policy choices, energy efficiency comes first, then renewables, then fossil fuels. Regulators also adopt “decoupling” and performance incentives for energy efficiency[62]. Decoupling removes the disincentive for utilities to encourage energy conservation, since their revenues are not tied to the amount of energy sold, as well as provides an incentive for utilities to focus on effective energy efficiency programs and invest in activities that reduce load thus aligning shareholder and customer interests to provide for more economically and environmentally efficient resource decisions [5].

As an example of an "Energy Efficiency Utility" Vermont awards the proceeds of its uniform wires charge to a non-profit organisation (Efficiency Vermont) based on a performance contract (amount of savings to be delivered). Through a public tender and competitive bidding and under the supervision of the regulator Efficiency Vermont is to deliver a predefined amount of energy savings (at present 7% of Vermont’s energy requirements).

As an example of standard performance contracting for energy efficiency, Texas has a target (% of load growth) to be met via incentive payments to project sponsors for installing eligible energy efficiency measures in residences, businesses or industrial facilities. The level of incentive is set by the regulator.

Finally, energy efficiency is credited in New England ISO’s Forward Capacity Market by allowing supply and demand reduction bids to meet growth needs. Since the first auction in 2007 demand resources including energy efficiency won two thirds of the bids for new capacity and lowered the clearing price [6].

The last three models work on the basis of tendering of savings or bidding into capacity markets are expected to function in a liberalised market setting. Decoupling can function with respect to distribution tariff regulation.

[62] In the case of investor-owned utilities in California decoupling work as follows: 1. Utilities submit their revenue requirements and estimated sales to regulators, 2. The regulators set the rates by regularly applying adjustments to ensure that utilities collect no more and no less than is necessary to run the business and provide a fair return to investors, and 3. Any excess revenue gets credited back to customers. Any shortfall gets recovered later from customers. Decoupling 'Plus', adopted in September 2007, establishes a new system of incentives and penalties to drive investor-owned utilities above and beyond California’s ten-year energy savings targets. It rewards utilities that succeed in helping customers become more energy efficient, by designing and delivering programs that encourage consumers to save energy and offers a way for investor-owned utilities to generate earnings for shareholders when they invest in cost-effective energy efficiency [5].

Table 8. Energy saving obligations in the United States

State and date of introduction	Obliged parties	Target size and year	Trading provision
Stand-alone energy saving obligations			
California (2004)	Utilities (investor-owned)	1% annual energy savings Electricity: 2631 GWh (2013) Natural gas: 444 Mmtherms (2013)	
Connecticut (2005)	Retail electricity suppliers	4% of retail sales (2010 and thereafter) (up from 1% in 2007, 2% in 2008 and 3% in 2009)	X
Colorado (2007)	Utilities (investor-owned)	5% of both retail sales and peak demand (2019)	
Illinois (2007)	Utilities (investor-owned) with more than 100 000 customers	2% of energy delivered (2015) and 1.1 % of peak demand (2018)	
Maryland (2008)	distributors	15% reduction in per capita electricity use by 2015 as compared to 2007	
Michigan (2008)		1% annual new savings in electricity and 0.75% annual new savings in gas from previous year sales (2012)	X
Minnesota (2007)	All electricity utilities	1.5% of retail sales based on prior 3-year average(2015)	
New Mexico (2008)	Utilities (investor-owned and municipal utilities)	10% of 2005 retail sales (2020)	
New Jersey (2007)		2020	X
New York (2008)	Utilities (investor-owned)	15% of forecast retail sales (2015)	
Texas (1997)	distributors	20% of load growth over the previous 5 years (2020) (before 2007 it was 10%)	
Vermont (?)		2009-2011 goals of 2% annual savings. Competitive bidding (Efficiency Vermont is the contracted implementer). Program delivery decoupled from financing source	
Energy saving obligations integrated in renewable portfolio standards (RPS)			
Hawaii (2004)	All electricity utilities	20% RPS target for 2020, up to 50% can be satisfied with energy savings	
Maine (2005)		10% by 2017. Demand reduction and energy efficiency as SOS priority resources.	
Nevada (2005)	Utilities (investor-owned) and retail suppliers	20% RPS target for 2015, up to 25% can be satisfied with energy savings. Targets for 2022	X
North Carolina (2007)	All electricity utilities	Investor-owned utilities: 12.5% RPS target for 2012, up to 40% can be satisfied with energy savings. Public-owned utilities: 10% RPS target for 2018, unlimited use of energy savings. Targets for 2021	
Ohio (2008)	distributors	2% of retail sales (2019) 25% RPS target for 2025, up to 50% can be satisfied with energy savings. 22% energy savings by 2025 starting 2009.	
Oregon	EE as part of RPS law	IOU 2008 goal 34 MW, administered by Energy Trust Oregon	
Pennsylvania (2004)	Retail electricity suppliers	10% RPS target for 2020. EE is in a resource tier – tier requirement is 10% by 2020.	X

Sources: [2; 7]