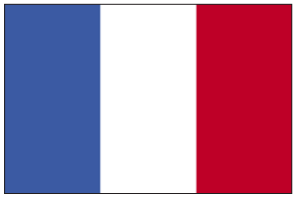
Ea Energy Analyses

Design of White Certificates
Comparing UK, Italy, France and Denmark



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Energy efficiency can be promoted by the use of tradable *White certificates*. In its basic form, an authority places an obligation of delivering an amount of energy savings on an actor, e.g. a grid company or a retailer. Realised energy efficiency is defined as certificates and can be traded.

“White certificates: *C*ertificates issued by independent certifying bodies confirming the claims of market actors for savings of energy, as a consequence of energy endues efficiency measures” (Energy service directive /36/).

White certificates have characteristics of market based instruments, e.g. that the concrete design of the activity is decided by market actors, and an incentive exists to find the most efficient way of fulfilling the obligations. This includes finding the cheapest way to achieve savings by selecting end-use sector and technology.

EU is considering white certificates as a possible market approach to energy efficiency, and may in a few years time then come forward with a proposal to encourage this /36/.

In practice, white certificates come in many variations – with a varied number of characteristics of the ideal tradable white certificates. The UK has had the obligation scheme EEC, Energy Efficient Commitment, which is based on similar activities that has taken place since 1994. In Italy, white certificates have been produced since January 2005, and in France an obligation system have been active since July 2006. In Denmark an obligation scheme has also existed for more than 10 years. As of 2006, the Danish system has several features of a white certificate system.

The Danish Energy Agency has asked Ea Energy Analyses to analyse the existing white certificates – mainly in UK, Italy and France – and to recommend how the Danish system can be further developed to make it more market oriented. The Danish Government has suggested a development in this direction.

1 Presentation of four national systems

The goals for the four schemes are presented in table 1. The largest national impact (measured as the first year impact of the activity in a single year) is expected from Denmark and Italy, with 0.52-0.56% reduction of the total primary energy supply. In this benchmark the lifetime of the savings and duration of the schemes are not included.

UK has a high impact, but only in households.

The lifetime of realised savings is treated quite differently in the four countries. Italy often use 5 years, while UK use up to 40 years.

Table 1: Goals for the four schemes.

	FR	**UK**	**IT**	**DK**
Total Primary Energy Supply, Mtoe (IEA 2004)	275	234	184	20
Stated goals	Activity in 2006/7 – 2008/9 = 54 TWh accumulated savings	EEC-2: 2005 - 2008 130 TWh accumulated savings	Activity in 2005-2009: 1.9 Mtoe savings in 2009	2,95 PJ/year. 2006-2013
First year savings as percentage of national consumption of final energy	0.09%	0.21%	0.5%	0.56%
Active savings measures as percentage of national consumption of final energy. This represents the reduction of total energy consumption in the stated year. *	0.28% (2008/9)	2.21% (2008)	1.8% (2009)	2.8% (2010)
Active savings measures in households as percentage of households consumption of final energy	-	6.75%	-	-
For France the activity has been assumed to be the same in the three years period. Also, it is assumed that 50% of the savings is electricity. A lifetime of 10 years is used in this calculation. For Italy the goal has been reduced with 22%, corresponding to the obligation for small utilities. A life time of 5 years is used in the calculation for Italy and Denmark. For UK the technical lifetime of 8 to 40 years is used. * If the activities are continuous the active savings will increase year for year. The active savings are highly dependent on the lifetime				

1.1 UK

The United Kingdom has had a program for energy efficiency that has targeted household consumption since 1994. The current system was introduced in 2002 when the first Energy Efficiency Commitment (EEC) period started with a target of 62 TWh of energy savings in the domestic sector. The EEC is intended to run in three phases of three years duration each. The second commitment period started in 2005, and runs to 2008 with a target of 130 TWh of energy savings in households.

The British system is described and assessed in a number of sources that have been used in this study. The most important are Capozza (2006), Lees (2006), Mundaca & Neij (2006), Bertoldi & Rezessy (2006), OFGEM (2007), DEFRA (2005) and (2007), Radov, Klevnas & Sorrel (2006). These can be referred to if the reader wants to achieve a deeper insight into the functioning of the EEC. This report intends to provide a basic overview of the most important features of the EEC and it's functioning, and highlight interesting issues that influence the impact the programme has on energy use in Great Britain.

The EEC is an obligation for electricity and gas retailers with customer bases over 50.000 to achieve energy saving targets by promoting energy efficiency improvements in households. There are currently 8 retailers that are covered by the EEC, although 6 account for more than 99.5% of the customers. The overall target is set by the Department for Environment, Food and Rural Affairs (DEFRA) through government legislation after a consultation process with stakeholders. It is enforced and administered by the regulator, the Office of Gas and Electricity Markets (OFGEM).

Even though the obligation for implementing energy savings is on electricity and gas suppliers, savings can be accredited for initiatives applied to the use of any energy carrier used for residential purposes. There is no requirement for obligated parties to make a certain amount of energy savings within their own energy type, or to spend a minimum amount on energy efficiency initiatives.

Obligation

DEFRA sets the overall target for each EEC period based on an illustrative mix of energy saving activities in British homes. The illustrative mix is developed using assumptions made by DEFRA on how the EEC target can be met at a cost to energy retailers that is acceptable for government.

The illustrative mix is based on standard, quantified energy savings derived from calculations using BREDEM, which is a modelling programme that estimates energy use in dwellings. Calculations for the EEC2 illustrative mix were based on energy saving measures implemented in a standard dwelling that was considered representative of the housing stock in the United Kingdom. The measures used in determining the target for EEC2 are shown in table 2.

The standard energy savings for each measure are lifetime discounted and fuel-standardised. Savings for each initiative are measured over the technical lifetime of the activity with future savings discounted at 3.5% annually[1]. The lifetime for each standard measure is shown in table 2.

Fuel standardised multipliers are applied to energy savings according to the carbon content of the displaced energy carrier. This is to encourage savings in carbon intensive fuels and link the EEC more closely to the government's policy on reducing carbon emissions. In the next EEC phase from April 2008, the unit of measuring savings will be changed from lifetime discounted fuel-standardised TWh to lifetime un-discounted carbon savings. This will broaden the scope of measures allowed for achieving the target in the next phase. The target for EEC3 (now to be called Carbon Emissions Reduction Target (CERT)) is lifetime savings of 42MtC, which is almost a doubling of activities under EEC2.

Savings are also adjusted for estimated free riders for each activity as well as for the heat replacement effect, which accounts for space heating provided by inefficient appliances, and light bulbs that has to be replaced by another heat source. The correction for free riders is based on market statistics for each measure based on information from the Department of Trade and Industry and historical sales information. The level of accuracy DEFRA achieves through this is questionable, but should be considered in the light that it is very difficult to determine deadweight. There is, however, cause to believe that deadweight should be controlled progressively in order to maintain integrity in an energy savings programme, especially for simple DIY (do-it-yourself) solutions such as CFL retail.

In order to determine the overall target for the EEC, the standard savings are multiplied by the estimated potential number of measures that can be implemented in the housing stock within an acceptable price range. This also provides an estimate of the overall cost of fulfilling the obligation. The estimated number of measures is shown in table 2.

The obligation for the individual energy suppliers are allocated by the regulator according to their market share of domestic customers. This target is adjusted annually.

The EEC requires that half of all energy efficiency measures implemented to achieve a supplier's target must be carried out amongst a priority group of customers consisting of those in receipt of means-tested or disability-related welfare benefits or credits.

[1] 40 years lifetime with 3.5% p.a. is equivalent to 21 years, 0% p.a.

Table 2: Measures, lifetimes and energy savings in EEC2 illustrative mix[2]

EEC2 measures	**No. of installations**			**Lifetime of measure**	**Net energy improvement**	
	Free riders	Additional	Total		Annually	Discounted over lifetime
	Million	Million	million	Years	MWh/unit/year	MWh/unit
Cavity wall ins. – private	0.12	0.88	1.00	40	5.15	110.1
Cavity wall ins. – social	0.12	0.58	0.70	40	5.00	106.7
Loft ins. – private	0.07	0.64	0.70	30	2.71	49.8
Loft ins. – social	0.02	0.40	0.42	30	1.87	34.5
Loft ins. DIY	0.23	0.23	0.46	30	3.34	61.4
Glazing E to C (in m^2)	0	4.50	4.50	20	0.03	0.4
B to A rated boilers	0.08	0.93	1.00	15	1.15	13.3
A/B rated boilers, exceptions	0	0.20	0.20	15	3.10	35.7
Fuel switching	0	0.05	0.05	15	7.91	91.1
Heating controls, upgrade	0	0.45	0.45	15	0.68	7.9
Heating controls, extra	0	0.09	0.09	15	1.88	21.7
CFLs – retail	5.92	3.83	9.7	16	0.01	0.1
CFLs – direct	12.0	20.6	32.6	16	0.01	0.1
Fridgesaver schemes	0.00	0.10	0.10	12	0.14	1.3
Appliances – cold	0	0.88	0.88	12	0.06	0.6
Appliances – wet	0	1.17	1.17	12	0.02	0.2
Appliances – set top box	0	0.50	0.50	8	0.01	0.1
Tank insulation	0.28	0.18	0.46	10	0.45	3.7
Draught proofing	0	0.31	0.31	20	0.74	10.5

Standard measures

The EEC is built around the use of standardised energy saving measures that are described in the illustrative mix produced by DEFRA. OFGEM builds on these to produce a series of savings for these energy measures, reflecting the varying property type, construction and age, and these are used by the energy suppliers to claim their energy saving credits. Utilising standardised energy savings in the EEC allows for an ex-ante approach to measuring savings carried out by obligated parties.

The use of standardised measures and the illustrative mix in the EEC provides an indication of the measures DEFRA considers important and an estimate of the average costs of implementing these measures. This influences the way in which the obligated parties fulfil their targets, and has played a role in a small amount of measures covering the vast majority of savings made. Despite the fact that an energy saving uplift is provided for obligated parties developing new standard measures, very few have been developed to date. When CERT comes into effect households and community scale projects will become eligi-

[2] Adapted from, "Energy Efficiency Commitment 2005-2008, Background information on the Illustrative Mix", DEFRA, 2005

ble for promotion by energy suppliers for the first time. This may increase the number of new standard measures developed by obligated parties.

An important factor that contributes to a few measures dominating the EEC is the long lifetime savings permitted for some standard measures. Recognising long lifetimes makes measures more economically attractive as it increases the cost effectiveness of the measure by increasing the savings granted compared to those measures with similar annual savings but with shorter lifetimes. The discount rate reduces the effect of long lifetimes to some extent. The discount rate for EEC1 was 6% whilst the discount rate for EEC2 and EEC3 is 3.5%. This was in line with the Treasury changing the discount rate in 2003. The effect that this has on the size of the target in EEC2 compared to EEC1 is significant when considering the long lifetimes of the dominant standard measures such as insulation. This results in cavity wall insulation providing approximately 32 MWh more per measure over the given lifetime. If one looks at the difference this makes in the overall target for EEC2, it is considerable. 424.790 cavity wall insulation measures were carried over from EEC1 to EEC2 as energy suppliers started work early on the doubled target of EEC2. This resulted in an increase of approximately 13.6 TWh in savings, due to the change in the discount rate alone, on measures implemented during EEC1 but carried over to EEC 2. This influences the way in which the EEC target is achieved and resulted in obligated parties preferring to carry insulation measures over from EEC1 to EEC2, and benefit from the reduction in the discount rate. This represents a distortion in the actual additional savings achieved in EEC2 compared to EEC1. Similar levels of measures will be carried forward to CERT where there will be no discounting of savings. The reason for this change is that climate change is driven by the concentration of CO_2 in the atmosphere, and that the total amount of CO_2 savings is more important than the annual carbon savings. The fact that measures are being carried forward, therefore, is a good thing as energy and CO_2 savings are being brought forward. It could, however, be argued that the ease, with which the obligated parties have achieved the targets to date at much lower costs than estimated, could suggest that the targets are too low, and that many carbon savings, that could have been implemented, have not been.

Long lifetimes can be used as an effective regulatory tool to promote particular energy saving measures considered more important than others; however, this does not appear to be the intention of DEFRA when considering the lifetime granted for CFLs.

Government has already made clear its intention to phase out inefficient light bulbs in 2011[3]. This makes all savings from CFLs after this date “business as usual” as the change would have taken place without the EEC intervention. Despite this, CERT, running from 2008 to 2011, will grant energy savings for 17.7 years for the replacement of light bulbs with CFLs. This could be seen as rewarding energy savings for “business as usual” activities, and shows that the

[3] Meeting the Energy Challenge, A White Paper on Energy, May 2007; Dept. of Trade and Industry

regulatory tool available to DEFRA is not being used efficiently to promote additional energy saving measures, but is rather being used to increase the apparent cost effectiveness of the EEC and overstating the real impact of the EEC.

The very concept that a CFL will be used for nearly 18 years is interesting considering technical improvements that will occur in lighting during this time, and the fact that lighting requirements and fashions change. (It can, however, be discussed that the length of time incandescent have been on the market contradicts the expectation that lighting fashions change.) The difficulties of trying to predict future technical improvements makes including them in a free rider calculation all but impossible, but the concept of using a lifetime that implies technical stagnation does not promote additional energy savings either.

A similar discussion could be had on whether no improvements will be made in the housing stock for nearly half a century as implied by the 40 year lifetime granted for insulation measures. Even though this is unlikely considering that social housing improvement programmes already exist, and that few domestic residences will not have a change of occupants over a 40 year period, the improvements in living standards, and the relatively large energy savings offered by cavity wall and loft insulation, could justify the use of long lifetimes to promote these measures[4].

Long lifetimes also raise the question of whether it is wise to regulate for periods as long as 40 years in this way. If buildings are demolished [5], redesigned, upgraded or change function, what happens to the energy savings already granted by the regulator? Should these become redundant and added to later obligations, or will energy savings continue to be calculated even though they are no longer active? These issues can raise doubts as to the integrity of the EEC due to the long lifetimes granted, as these implicate no or very little technical advancement due to the very low discount rate.

Trading

Three types of trading are allowed under the EEC;

- Horizontal trading – trading between two different obligated parties in the EEC scheme. This includes the trading of credits between obligated parties.
- Vertical trading – participants are allowed to meet targets by claiming credits for measures carried out by third parties
- Banking: Temporal trading – participants over compliance with a target during one EEC phase can be carried over and used for compliance during the subsequent target period

[4] The annual savings for cavity wall insulation for EEC3 will vary between 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.

[5] Currently ~25,000 out of Britain's 25 million housing stock are demolished annually so stock turnover is very low.

Temporal trading is the only trading measure that has been utilised to any significant extent by the obligated parties. ESCOs have not entered the energy efficiency market to any extent that they have an effect on the EEC. Some feel that this is a drawback of the EEC, and it is due to the fact that there is no issuance of white certificates and no open access to credits and trading in credits for non-obligated parties. Others believe that it is simply due to the costs of selling a concept which is still alien to consumers.

One can, however, question the need for an exchange dealing in white certificates, when the energy tariffs of the obligated parties are not regulated due to a liberalised market existing in the United Kingdom. The market in energy efficiency measures occurs in the costs being passed on to the consumer. If one supplier has higher costs their product will become more expensive or marginal profits will be reduced. There is also competition in the implementation of measures, which also provides incentives for cost effectiveness in achieving EEC targets. The lack of ESCOs in the market is more likely a reflection of the EEC, in reality, covering relatively cheap, low hanging fruits, rather than more expensive measures, and the fact that industry is not included in the EEC.

Administration and costs

The energy regulator, OFGEM, is responsible for administrating the EEC. The responsibilities of OFGEM under the EEC are to determine the energy efficiency targets for each supplier, ex-ante approval of proposed energy savings schemes carried out by obligated parties, monitoring implemented measures and enforcing compliance with the EEC.

The approval of energy saving schemes and determining improvements in energy efficiency attained is based on an ex-ante approach using the standards described in the illustrative mix. The procedures for approving, notifying and calculating energy savings resulting from each measure are highly standardised. This reduces investment risks for obligated parties and minimises administrative costs for the regulator and the obligated parties.

The requirements for monitoring and verification in the EEC are based on technical assessments, consumer satisfaction and consumer utilisation monitoring. There is no monitoring requirement of the actual energy savings in relation to the ex-ante standardised savings for obligated parties. In some cases post-ante savings are monitored in order to improve the accuracy of standardised savings, but not at the expense of the obligated party. If standardised savings are amended for the next commitment period the measures undertaken in previous commitment periods are not affected, although DEFRA revise their estimates of national energy and carbon saving retrospectively in the light of the new information.

Obligated parties have to verify the implementation of each measure by providing OFGEM with evidence of the exact type and number of measure that have been carried out. This is done by submitting documentation in the form of

agreements with contractors and partnerships with third parties. There has been some criticism of the way in which partnerships with local authorities and other organisations are administered as all savings are accredited to the obligated party, regardless of the proportion funded by the obligated party. However, the target is set assuming that energy suppliers will only make part contributions to the funding of the measures. This is done as the partner has to indicate that the project would not have taken place were it not for funding provided due to the EEC.

There are differing monitoring requirements for individual measures, but generally OFGEM requires that 5% of all measures must be monitored for quality of installation using a standardised questionnaire. 1% of measures funded by an obligated party must be monitored for customer satisfaction, and some DIY measures must be monitored for customer utilisation using a statistically significant sample of the beneficiaries of the programme. For certain measures, such as the purchase of appliances and CFLs, it is assumed that the customer intends to utilise the purchased goods and therefore no monitoring is required. The monitoring required for each standard measure is shown in the table below.

The regulator requires all obligated parties to submit quarterly reports describing progress made in achieving the EEC target. OFGEM must produce annual progress reports and a final report on the completion of an EEC phase, and submit them to DEFRA.

The administrative costs for OFGEM for running the EEC are approximately €592.000[6] annually. These costs are recovered through licensing fees for suppliers and account for approximately 1% of OFGEM's total budget.

The total cost of achieving the target for EEC1 was €413 million. Energy retailers' costs amounted to €533 million whilst households' own contribution and joint funding from other organisations accounted for €371 million[7]. Energy retailers pass on the costs of fulfilling energy saving obligations to customers through energy bills, which provides a competitive incentive for a cost effective approach to fulfilling the obligation. The nominal cost per energy bill of EEC1 was €4.74, which is about 15-20% lower than estimated in the illustrative mix[8]. A cost-benefit analysis of EEC1 was undertaken by DEFRA and returned the following results:

[6] All Euro amounts are derived using an exchange rate of €1.48 to £1.00 as on 2 August 2007.

[7] Assessment of EEC 2002-05 Carbon, Energy and Cost Savings, DEFRA, 2006

[8] Assessment of EEC 2002-05 Carbon, Energy and Cost Savings, DEFRA, 2006

Table 4: Cost-benefit analysis of EEC1[9]

	Net cost in millions of €	Net benefit €million/year	NPV lifetime, millions of €	Resource costs €/tC
EEC1 target measures	904	340	4,524	-499

Perspective

The British system is designed with the intention of keeping the administrative and transmission costs of fulfilling the energy saving obligation to a minimum. This appears to have been successful in the case of administration, but it is more difficult to assess the cost effectiveness of the obligated parties as they are not obliged to reveal costs incurred. It is, however, assumed that the costs incurred by private companies will be as low as possible.

In order to achieve the goal of low administrative costs the EEC does sacrifice a certain amount of precision and certainty with regards to the extent in which actual energy savings are achieved. Heavy reliance on standard measures and long lifetimes, along with very limited monitoring requirements, reduce the opportunity for accurately determining the real effect of the EEC on energy consumption in households.

The EEC provides obliged parties a large amount of freedom in fulfilling their obligation. The only restrictions are that they must occur in households and half must be achieved in low income households. There are no restrictions on whom the obligated parties may cooperate with and on the type of measures implemented. This, along with free competition amongst obligated parties on the same market, the opportunity to pass on costs to consumers and the freedom for consumers to change supplier at short notice, provides the framework for encouraging cost effective solutions to energy efficiency, and may be as effective, or better, than having an open market for white certificates.

[9] Adapted from “Assessment of EEC 2002-05 Carbon, Energy and Cost Savings”,DEFRA, 2006

Case study: West Lothian, Investing in Energy Scheme

The West Lothian "Investing in Energy Scheme" is a case study that demonstrates the integration of an energy efficiency scheme with other public programmes aimed at reducing energy consumption in households. The project involved the West Lothian Council, Warm Deal[10] and Scottish and Southern Energy[11].

The aim of the project was to maximize the level of grant income available for energy efficiency in West Lothian and increasing the number of households where energy efficiency measures were implemented. A single EEC provider was granted exclusivity for work undertaken in the area, which succeeded in securing a greater level of funding, whilst a single contractor was utilized for implementing energy saving measures in order to ensure quality and uniformity.

West Lothian Council sent out letters to all homes within the target area to inform them of the programme. The contractor surveyed all interested homes to assess the level of work required and the associated costs involved. After approval from the council the work was undertaken on eligible homes. 7,255 households received assistance in this way. Measures implemented included loft and cavity wall insulation, heating control upgrades, radiator panels, low energy lighting and an advice shop providing energy and fuel debt advice.

The council made a follow-up visit to every household that received assistance to provide advice on energy efficiency and carry out customer satisfaction surveys and quality control. It was determined that giving exclusive rights to one EEC provider increased the level of funding and the effectiveness of the programme in West Lothian, and highlighted the positive implications of allowing the integration of the EEC with other public programmes.

The West Lothian Council provided £200,000 annually; Warm Deal provided £125,000 whilst Scottish and Southern Energy provided £300,000 annually. The energy savings accredited to Scottish and Southern Energy were proportional to the funding provided.

[10] The Warm Deal Scheme provides funding for home insulation and is open to people who are either in receipt of certain benefits, are aged 60 or over or that are resident in Scotland. Warm Deal is government funded.

[11] Scottish and Southern Energy is an obligated party under the EEC.

1.2 Italy

Since 2005 Italy has used tradable white certificates to promote energy efficiency. Energy savings is seen as a way to fulfill the country's Kyoto commitment (a 6.5% CO_2 reduction). Also, challenges with the security of supply for both electricity and gas have motivated to promote energy efficiency.

Distributors of electricity and gas with more than 100,000 customers are obliged to deliver a certain number of white certificates per year. The obligation is increasing during the first five years. Certificates can be traded bilateral or at the market (GME, Gestore Mercatto Elettrico). The regulator (AEEG, Autorità per l'energia elettrica e il gas, Italian Regulatory Authority for Electricity and Gas) has a comprehensive role in developing the system, issuing certificates, and developing standard savings.

The Italian system is described in a number of sources, e.g.: Brogi and D'Adamo (2007), Bertoldi and Rezessy (2006), Bertoldi (2006), Bertoldi and Huld (2006) and Capozza (2006). The system is called Energy Efficiency Certificates (TEE: Titoli Efficienza Energetica). Based on our interview further details are given below.

Obligation

30 grid companies (20 gas and 10 electricity) are obliged to generate white certificates each year from 2005 to 2009. A continuation with increased obligation is expected for 2010 and onwards, but has not been decided yet (October 2007).

The obligations are increased during the period. The needed new activities are doubled in 2007, 2008 and 2009[12]. This is illustrated in the table 5. Here it is assumed a lifetime of five years (some building related activities have a lifetime of 8 years).

In 2009, the goal is a total of 2.9 Mtoe. However, 22% of the goal has not been distributed because 22% of the energy supply is done by small suppliers. So the practical obligation in 2009 (accumulated savings) is 2.6 Mtoe corresponding to 1.8% of the primary energy consumption.

When an activity has been accepted to produce certificates, certificates will be issued once a year in five (or eight) consecutive years.

[12] The obligation for gas in only increased by 50% in 2008

Table 5: Obligation for electricity and gas.

Mtoe – Type I: Electricity	New certificates produced this year	Certificates produced in earlier years (5 years lifetime assumed)	Total obligation
2005	0,1	0	0,1
2006	0,1	0,1	0,2
2007	0,2	0,2	0,4
2008	0,4	0,4	0,8
2009	0,8	0,8	1,6
Mtoe – Type II: gas	**New certificates produced this year**	**Certificates produced in earlier years (5 years lifetime assumed)**	**Total obligation**
2005	0,1	0	0,1
2006	0,1	0,1	0,2
2007	0,2	0,2	0,4
2008	0,3	0,4	0,7
2009	0,6	0,7	1,3

Three types of certificates exist: Type I: Electricity, Type II: Gas, and Type III: Other. However only type I and II have any practical use. Grid companies must deliver at least 50% of the obligation within its own energy type. The conversion from electricity to primary energy (toe) is similar to 39% efficiency in the generation of electricity (2.56 units fuel for 1 unit electricity).

ENEL has 50% of the total obligation (45% electricity and 5% gas). This makes ENEL an important and potential dominating player in the market. In the electricity market ENEL has 90% of the obligations, however more than 10% trade from non-ENEL obligated can take place because gas companies can buy the cheaper electricity certificates. If gas utilities bought all the electricity certificates they could, i.e. 50% of their obligations, ENEL would still represent 64% of the traded electricity certificates.

Standard measures

The current standard measures are shown in table 6.

ENEL has produced many of its certificates by distributing free CFLs, e.g. in 2007, 7 million CFLs will be given away for free. Together with public lighting CFLs takes a high share of the total savings – probably much higher than these technologies share of the economic potential for energy efficiency in Italy. The described standard savings for CFLs and street lighting, combined with the fact that an ENEL subsidiary (ENEL Sole) owns many street lights, have made these two types of saving very attractive for ENEL.

Building improvements, like double glazing or insulation (for heat or cold) seems to be under represented among the realised savings. The maximum 8

years lifetime seems to make such projects less attractive. In the same way, projects in the service sector and in the industry seem to be under represented.

Table 6: Standard measures

Standard measures
Mainly households Substitution of incandescent lamps with CFLs Substitution of pilot-flame gas water heaters with electronic ignition gas heaters Substitution of single-pane with dual-pane windows Wall and roofing insulation (heating savings) Wall and roofing insulation (cooling savings) High efficiency refrigerators, freezers, washing machines, dish washers facilities Low flow showerheads in homes, hotels and recreational Faucet aerators in homes **Substitution** Substitution of electric water heaters with electronic ignition gas heaters **Mainly large end-users** Variable speed drives for pumping systems below 22 kW High efficiency electric motors Power regulators in public lighting systems Replacement of mercury vapour lamps with high pressure sodium lamps **Supply options** Gas fired boilers rated 4 star efficiency Air conditioners with cooling capacity below 12 kW Air source heat pumps in new or renovated residential buildings Use of photovoltaic generators below 20 kW Use of solar water heaters
Analytical measures
Energy recovery from natural gas decompression Installation of variable speed drives for pumping systems above 22 kW CHP District heating (e.g. use of industrial surplus heating)

Trade

In the first half of 2007, 274.000 toe have been traded. 29% have been traded on the market, the rest bilaterally. Both bilateral and market traded certificates pay 0.2 €/toe to the GME market. This is covering the cost of the market system and the bookkeeping of who owns which certificates.

90 ESCO's have sold certificates to the market. More than 400 other ESCOs have been accredited, but have not yet produced certificates.

Figure 1: Volume traded.

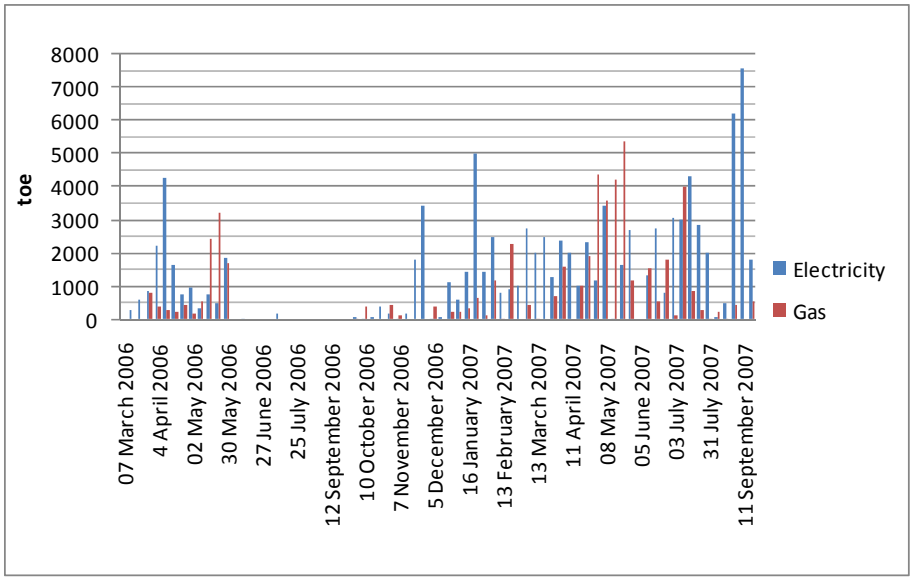
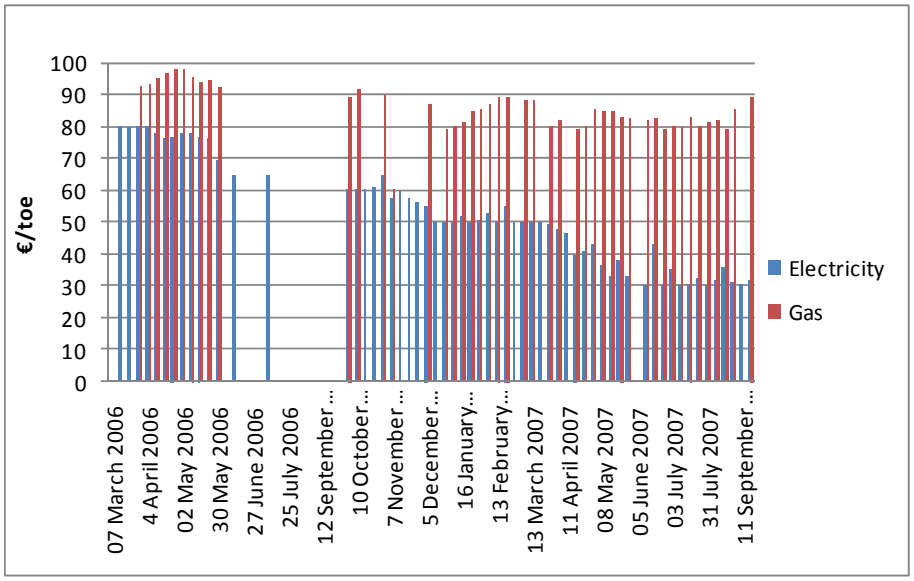


Figure 2: Prices for electricity and gas certificates



ENEL has stopped using the market since April 2007. The current price of 30-40 €/toe is considered too low, and ENEL now enter multi-years bilateral contracts for 60 €/toe. Part of the background for the evaluation can be the 100 €/toe which the obliged parties receive for certificates. Although there is no direct relation between actual cost and the (fixed) cost compensation, the 100 € seem to set a standard.

Obligations are increased in 2007 and the following two years, and more trade can be expected. This tendency can be seen in the traded volumes: From June

to October 2006 (the start of the 2006 obligation) very little trade took place. However, from June to September 2007 considerable trade took place.

Administration and costs

The costs of producing the certificates are well described in the form of the public price information. Type I certificates (electricity) was traded at 80 €/toe in the start of 2006, but the price has decreased gradually to 30-40 €/toe in mid 2007. Type II (gas) started at 90 €/toe and ended at 80 €/toe. This should in theory be the marginal (most expensive) costs of producing one certificate. However, the market is not sufficient liquid and the price information may not reflect the general costs of producing the certificates.

When the obliged electricity and gas companies deliver the required certificates, they receive cost compensation for type I and II certificates. The cost compensation has until now been 100 €/toe. To put it simple an obliged electricity company can buy certificates for 30-40 €/toe and receives 100 €/toe as cost compensation. The regulator is preparing to reduce the compensation.

We have not received detailed cost estimates for the administration of the Italian system, but the impression is that the establishment of the electronic market for trading has been moderate, while the cost of certificating the savings as well as developing the standard savings are dominating the administrative costs.

Case: ESCO Italia

ESCO Italia is a company focused on energy, including renewable energy and energy efficiency. The company has 6 regional subsidiaries.

The last year they produced white certificates corresponding to 100.000 toe. 90% of these were for gas and 10% for electricity. 80% was standard solutions and 20% customized solutions. Certificates are sold bilaterally as well as on the market.

The company has participated in a hearing from the regulator (AEEG) about white certificates. They argue:

- For a significant increase in the obligation, e.g. from 2.9 Mtoe in 2009 to 5 Mtoe per year from 2010 and after
- That a solution must be found for small utilities (with less than 100.000 customers).
- That the national obligations should be supplemented with regional goals for energy efficiency
- That the price for bilateral trade with certificates should be published to enhance transparency
- That ESCO's and obligated parties should be equal in receiving cost compensation
- That coordination and an exchange mechanism should be established between the white certificates and the EU emission trading system (EU ETS). They suggest 1 toe white certificate should be equal to 1 ton CO_2.

Perspective

The fact that an activity can generate certificates in five (or eight) successive years is creating challenges. In 2007, an activity can generate certificates in 2007 to 2011 (2014). However, no obligation has been published for 2010 and the following years. This creates uncertainty about the value of certificates for

2010 and later. In the worst case (for an ESCO), no obligation exist after 2009, and the certificates will have no value after this year.

In the other countries (UK, FR and DK) the activity is rewarded in the year the activity take place – all savings are calculated and contributed to the first year. This is the same time as the investment for the activity takes place. The Italian system rewards the activity at the same pace as the savings are realised. Risk is put on the obliged party (or the Esco).

In UK and France the technical lifetime is used to calculate the total amount of energy saved. This results in longer lifetime for most measures.

ENEL suggests that the system should be changed so ESCOs could also get cost compensation, and that the obligation should be put on retailers as they have more end-user contact.

It is currently being discussed whether to make white certificates the main instrument for promoting combined heat and power (CHP). Researchers and the regulator have expressed concerns for this development: Will CHP-projects dominate and will end-user energy efficiency be marginal?

1.3 France

The overall target of the French white certificate system is a 2% average annual decrease in end-use energy intensity (end-use energy consumption divided by GDP) in the period until 2015, and from 2015 to 2030 a 2.5% average annual decrease /23/.

The introduction of a white certificate scheme occurred at the same time as (it was not introduced as a consequence of the market liberalisation) an overall change from a monopoly market to a market with full competition. As of July 1st, 2007 the last of the consumers, namely all residential consumers, were given free choice of supplier. As part of the market change, the state monopolies, such as EdF and GdF, were allowed to switch from only supplying one type of energy to selling all types of energy and services.

Before the introduction of white certificates, EdF and GdF negotiated 3-year commitments with the government every three years regarding the tariffs and savings activities. Each year they had to send in a report on their activities. With the introduction of the liberalised market the task of realising savings was divided among energy suppliers of a certain size.

The following description is primarily based on interviews with representatives of all obliged parties, the system regulator, and the organisations involved in the development and continued maintenance and updating of the system. The main source of written background material has been law texts (e.g. documents 30 and 31) and other documents available at the white certificates national registry home page: www.emmy.fr.

Obligation

The total obligation is 54 TWh cumac (which means cumulated and actualised over the equipment lifetime) in the first period. The obligation is distributed among the obliged parties (energy suppliers with minimum 400 GWh/year sales and all suppliers of residential heating oil) using a formula that takes into account 2004 kWh sales in the residential & tertiary markets (75%) and 2003-05 average energy prices (25%) /Arrêté 26 sept. 06/.

The largest energy suppliers are by far EdF and GdF.

An average supplier of heating oil has typically 500 customers with a sale of about 2,000 litres per year per customer. Approximately 75% of these suppliers are organised in a branch organisation. They put pressure on the system developers and managed to push down the threshold value so that they would be included in the obligation /BR/. The suppliers of heating oil have been given special permission to act as a group instead of individual companies.

Table 7: French obligation per type of energy supplier.

Energy type	Number of obliged parties*	End-use sales in tertiary and residential sectors 2004 (TWh)**	Three year obligation (TWh)**	Reference price average of 2003-2005 (EUR/MWh) **
Electricity	15	266	31	110.1
Natural gas	10	239	14	42.8
Heating oil	2,363	109	6.8	47.8
LPG	6	16	1.5	82.7
Heating / cooling	7	10	0.7	52.6
Total	2,401	641	54	-

** - Article by Bertrand Rabany "Les certificats …" except the number of obliged LPG companies which is from JP.*
*** - Arrêté 26sep06.*

The obliged parties are free to choose how to meet the obligations in terms of targeted energy type, consumer segment, technology and measure. The savings can be achieved using predefined standardised measures or other operations (also called customized operations).

The lifetime of the French certificates is 3 periods (= 9 years) and banking (i.e. saving extra certificates for the next period) is possible /Decree 603, article 6/.

Certificates can be issued to three types of actors:

- Obliged energy suppliers;
- Public collectives (state, region, department, commune or their "grouping"); and
- Non-obliged parties provided energy efficiency is not their main business activity. In reality this means industrial and commercial enterprises undertaking energy efficiency improvements of their own premises /Article by BR/.

This is called the "clause d'additionalité". Companies that have energy efficiency as their main business (ESCOs) are excluded deliberately. The intention is to push new market development – in particular to push energy suppliers to encourage the consumers to make energy efficiency improvements /DG/. At present only few ESCOs exist in France /DG/. Assumedly energy suppliers may contract ESCOs to carry out energy efficiency activities on their behalf should they wish to do so.

Standard measures

Savings can be achieved by standardised operations or other operations. An overview of the existing standardised operations is given in the table below. One-page descriptions of each can be found on the white certificates national registry home page: www.emmy.fr. France is the only country which has developed standardised transport measures. Unfortunately, nobody has applied these yet (Energy efficient transport ranges high on the French energy policy

agenda.) Training and use of renewable energy sources can also be found among the standard operations.

Table 8: Standardised savings per June 2007.

Segment	End-use	No.	Operation
Residential	Building envelope	6	Insulation of walls, roofs, windows, floors
	Thermal	29	Heating system, mechanical ventilation (3), biomass (2), solar water heating (3)
	Equipment	3	Lighting (1), washing machine (1), refrigerator/freezer (1)
	Services	1	Training
Tertiary	Building envelope	7	Insulation of walls, roofs, windows, floors
	Thermal	16	Heating system, airconditioning (1), biomass (1), solar water heating (1)
	Equipment	9	Lighting (8), ”Night curtains” on refrigerators
	Services	1	Training
Transport	Equipment	2	Tyres
	Services	2	Training
Industrial	Buildings	5	Lighting
	Production system	4	Motors, heat recovery,
Heating, cooling and public lighting	Heating and cooling	4	Heat recovery or renewable, insulating mousse, rehabilitation of heating system?
	Lighting	4	
Total	All main segments	93	Building envelope = 13 Thermal = 49 (bio =3, solar = 4) Lighting = 18 Training = 4 Other = 9

The minimum size required to file a request for a certificate is 1 GWh ”cumac” which is the kWh saved over the duration of the technical lifetime corrected with a factor of 4% per year[13] /Arrêté 30may06, article 4/. The standard operations take into account the expected savings over the full technical lifetime of the operation.

An overview of eligible operations (=measures) by type of actor is presented in the table below.

[13] A refrigerator marked A++ which can save 50 kWh/year and has a lifetime of 10 years equals a saving of 420 kWh cumac.

Table 9: Eligible operations by type of actor. Most activity takes place by the obliged actor directed at third party (shaded cell).

Actor	Own property		Directed at third party
	Standardised operations	**Other operations**	**All operations**
Obliged	Yes	Yes if PBT > 3 years	Yes
Public collective	Yes	Yes if PBT > 3 years	Yes
Other legal entity	Yes if not within principal field of own business activity and does not create direct income	Yes if PBT > 3years and not within principal field of own business activity and does not create direct income	Yes if not within principal field of own business activity and does not create direct income

In the calculation of the pay-back-time (PBT) the applied energy price should be the average energy price over a period of 36 months prior to the decision to invest in the action. Prices published by "Observatoire de l'énergie" may be used /www.emmy.fr/.

Trade

No organised certificate trade system is planned, on the contrary. The intention is "only" to create fluidity in the market through flexibility of trade i.e. the holder of the national certificate registry can facilitate contact between interested parties through the registry website. The French ministry (Ministère de l'Économie, des Finance et d'Emploi) does not want "to create a market for financial speculations".

Administration and costs

Certificate costs are ultimately carried by the end-users (through their energy tariffs).

Obliged parties, who do not meet their obligation by the end of the period, must pay the government 0.02 EUR/kWh cumac missing /Decree 2006-600, article 8/. When the penalty is paid the deficit is cancelled (not carried on to the next 3-year period). In the next periods the penalty will double if the obliged party cannot prove that they were not able to obtain certificates /Loi 2005-781, article 14-IV/.

The 0.02 EUR/kWh penalty is channelled back into the general government budget. The possibilities for using this money for a special purpose were discussed, but the idea was rejected.

In addition to paying a small fee for opening an account, obliged parties must pay a registration fee of 27.50 EUR/GWh and non-obliged a registration fee of 13.75 EUR/GWh to be paid up front for registration of certificates. The registration fee will increase with 10% in 2008 and 10% again in 2009 /Service contract template, article 4/.

If one assumes that the total obligation of 54 TWh cumac is realised in the first year – ¾ by obliged parties and ¼ by non-obliged parties, then the registration alone will generate 1,299,375 EUR. Assuming a salary level of 30,000 EUR/year then this equals 14 full time staff members.

The certification fee is used for administration the registration system incurred by Locasystem.

For comparison there are approximately 10 persons in government administration (DRIRE) working full time administrating the certificate system – all regional offices included – and their costs are not covered by the registration fee.

Every 3 years the functioning of the white certificate system is to be analysed and the whole complex of transactions described and published in a report /Loi no. 2005-781, Article 16/. The first review will thus take place no later than the end of the first period.

Updating, monitoring and evaluation work have been ongoing since the system started. Two types of updating are necessary:

- Regulatory changes – France, for example, recently introduced a new building regulation which is stricter than the EU building regulation (EPBD). France does not only place restrictions on the total building but also on individual components such as boilers (a standard boiler is for example no longer allowed). This means that some of the baselines and savings listed in the standard operation descriptions are too low and must be adjusted already within the existing period. Exactly which date the new figures will step into effect is not yet decided.
- Market changes – The market evolution of for example refrigerators is being observed during this summer (2007) and then the values will be updated.

Three entities work together on the updating, monitoring and evaluation of the system, namely Directions Régionales de l'Industrie, de la Recherche et de l'Environnement (DRIRE), Ademe and ATEE[14]. Together they try to reach consensus on the relevant topics. On the technical level Ademe maybe uses 2 people full time for this. DRIRE maybe uses 1-3 for updating (plus the 10 for handling the certificate applications).

[14] ATEE is the Technical Association for Energy and Environment which has existed for many years. The association has created a club in relation to the introduction of white certificates, namely Club C2E = Club de certificats d´économies d'énergie. The club contains representatives from the energy supply business and the equipment manufacturers

Case example – Training

With this case it is illustrated how a non-technical operation is dealt with. The French white certificate system has at present (2007) four types of standardised training measures:

- Training of companies, employees and building workers (BAR-SE-01, residential sector)
- Training of companies, employees and building workers (BAT-SE-01, tertiary sector)
- Training of public transport drivers (TRA-SE-01)
- Training of light vehicle commercial drivers such as cab drivers (TRA-SE-02)

The standardised operations BAR-SE-01 and BAT-SE-01 consists of training of companies, employees and building workers who carry out construction as well as building maintenance in residential and tertiary sector buildings, respectively.

The requirements are:

- Prior approval of the content of the training by the pilot committee especially created for this operation.
- A statement from an approved professional organisation attesting that the obliged party has refunded the training expenses, based on an actual invoice.
- However, the savings claimed through this type of operation may maximum constitute 7% of an obliged party's total obligation within the obligation period.

The lifetime of the obligation is 3 years.

Lifetime savings (kWh cumac) = Training costs (EUR) / saved energy expense (EUR/kWh cumac), where the saved energy expense is set to 0.020 EUR/kWh cumac. In other words, 50 kWh cumac per EUR training expenses.

The two other training operations are similar is construction. Here the resulting kWh cumac saved depends only on the type of vehicle and the lifetime of the operation is set to 1 year. The training activity has to consist of both theoretical and practical training. A sort of examination/review must focus on the practical elements.

Perspective

The system has only been in operation for about a year (from June 2006). Therefore only limited statistics exist and it is not public. Our impression of the activity level and type is therefore based on interviews with the obliged parties and other experts.

Interestingly enough, the focus of the certificates submitted so far is not on lighting improvements as is the case in Italy. The focus appears to be on the building envelope.

It appears that most, if not all, measures implemented so far are standard operations, and that most of the consumers are persuaded by subscription fee rebates, loans and grants. There are also some customized operations on the way, but mainly in the industrial segment, and the projects take longer to develop.

So far the obliged parties keep within their own market, and as a result no real competition takes place.

And so far mainly only obliged parties have applied for certificates.

There is no innovation bonus. However, the value of the certificates are doubled for operations implemented in zones not connected to the continental mainland (“metropolitain”) electricity grid /Decree 603, article 3/. A bonus for Energy Performance Contracting is currently under discussion since it is expected to have a greater guarantee for actual savings than a normal installation of energy efficient equipment.

Case 2 – Boiler replacement

France deliberately uses several mechanisms. VAT reductions and income tax reductions are for example used in conjunction with the white certificate system.

We have carried out calculations of the effect of using several mechanism together for a specific case, namely replacement of an LPG boiler system in a standard 150 m^2 single family household in the climatic zone H2 with a low temperature boiler with regulation. The household can save 72,800 kWh cumac over the assumed lifetime of the boiler system. The household tariff is 0.09 EUR/kWh. The total investment cost (labour and equipment) costs 7,000 EUR (including normal VAT) of which work costs make up 1/3. The consumer is paid 800 EUR by the obliged LPG supplier for passing on the associated certificates to the LPG supplier. In addition the household may claim a 15% income tax reduction on the equipment investment.

The assumed lifetime of the boiler system is 16 years in accordance with the standardised operation BAR-TH-08. Inflation and prices changes through the lifetime of the boiler are ignored. The annual savings are reduced by 4% each year (resulting in a factor 11.99 instead of 16). Reduced government income from VAT on energy consumption is also ignored. Administrative staff at DRIRE, Ademe and ATEE constitutes a salary expense of 30,000 EUR/year/staff. An overview of the cost and benefit items from various perspectives is presented in the table below.

Agent	Costs	Benefits
Obliged energy supplier	Registration fee for dossier Advertisement (ignored) Customer contact (ignored) Bonus payment to customer Lost energy sales (ignored)	Avoided penalty Customer retention (ignored)
Installer	Advertisement (ignored)	More work due to lower VAT
Household customer	Labour investment at reduced VAT Equipment investment	Lifetime energy bill savings Bonus payment from energy supplier Income tax savings due to equipment investment
Government	Lost VAT revenue Lost income tax revenue Lost energy VAT revenue (ignored) Administration costs System maintenance costs	Lifetime energy savings
Society	Labour investment costs minus normal VAT Equipment investment costs minus normal VAT	Lifetime energy savings

The societal cost of the measure is 0.08 EUR/kWh without supporting mechanisms and remains unchanged for the case with the three mechanism combined. If the penalty for not meeting an obligation is assumed to be indicative of the acceptable costs for any measure, then the measure is not attractive from a societal point of view.

Seen from a government perspective, the cost of the three mechanisms combined is acceptable, namely 0.01 EUR/kWh.

Our calculations show that without any energy efficiency mechanisms the customer's simple payback of the measure is about 13 years, while with white certificates, as well as income tax exemption and VAT reduction, the simple payback time is reduced to 3.3 years. A white certificate system alone will result in 5.2 years, and the other two mechanisms combined 5.4 years.

1.4 Denmark

The Danish obligations for energy savings has existed for many years – and have had a considerable extent, especially within the electricity grid companies. In 2006, the obligations were increased (see table 10) and the obliged parties were allowed to search for energy savings in all energy types and all over Denmark. Earlier, the utilities only worked with their own end-users. For natural gas, electricity and oil the obligation is negotiated with the sector organization while for district heating the obligation is put on the individual company.

Table 10: Obligations

	First year's savings	Number of obliged companies
Electricity	1.4 PJ/year (0.39 TWh/year)	70
Natural gas	0.5 PJ/year (0.14 TWh/year)	4
District heating	0.9 PJ/year (0.25 TWh/year)	160
Oil	0.15 PJ/year (0.04 TWh/year)	6
Total	2.95 PJ/year (0.82 TWh/year)	240

The Danish system is described in IEA (2006), and realized savings in 2006 is described in appendix 1.

Only first year's savings are considered. It can be noted that a (theoretical) one year life time is equal to using a standard life time of five years (as in Italy). In any case, no differentiation is made between building measures (cavity wall isolation with +20 years technical life time) and behavioral measures (maybe with one year life time).

Also, no difference is made between energy types. 1 kWh of district heating is considered equal to 1 kWh oil, natural gas or electricity. Only in cases with substitution, e.g. from electric heating to district heating, a factor 2.5 is multiplied to electricity to correct for the efficiency of electricity generation.

Not correcting for lifetime of savings and energy type is a simple approach. In many cases savings with natural gas, oil and district heating is related to energy use in buildings, e.g. insulation. It can be argued that electricity savings have a shorter lifetime than isolation, and that the two factors (efficiency of electricity generation and long lifetime of isolation) outweigh each other. Low transaction costs have been the argument for this simplified approach.

In many cases energy savings are obtained in the industry sector. Here the transaction costs are considered to be the lowest. Utilities have a tradition for energy audits in trade and industry.

In 2005, the Danish electricity utilities used 6.7€/MWh_{sold} for DSM activities (in total 22 M€). The majority of these costs were used for individual consultancy, e.g. as energy audits in trade and industry. In average, each time the utilities spend 1€ on DSM the end-users spend 1.7€ for investments in the recommended projects. The average pay-back time for the end-users is estimated to

be 3 years. The Danish Energy Association (organisation for all utilities) estimates that the accumulated impact on the electricity consumption is a reduction of 3.7%. In 2005, the energy audits covered end-users corresponding to 5% of the total electricity consumption. In addition to the energy audits the utilities carried out phone advising, exhibitions, school arrangements and informative bills. Also, campaigns, e.g. for reduced stand-by losses, are part of the activities. In total, 70 different electricity grid companies are active with DSM (Dansk Energi – Net, 2006).

Similar activities take place in relation to district heating and natural gas, but not to the same extent. In 2005, the gas companies used 0.4€/MWh_{sold} for DSM activities (in total 2.1 M€). The gas utilities used 30% of the costs in relation to households. The DSM activities take place at three gas distribution companies.

In 2006, half of all savings were realised in trade and industry (see appendix 1). For the electricity utilities the tendency is even clearer: 2/3 of the savings are from trade and industry. Oil companies have only reported oil savings, while electricity and natural gas utilities have reported 1/3 of the savings in other energy types than their own.

In 2006, a tender was held to attract new ESCO-types of actors. However, no qualified bids were received. Many of the potential actors to give a bid seem to find it more attractive to enter contracts directly with the obliged parties.

Comparative analyses

In this section, we highlight aspects that could be important from a Danish viewpoint, e.g. aspects that potentially could be implemented in Denmark.

The schemes in France and Italy are still fairly new. In Italy, the official report about 2006 is expected in October 2007. In France, the first evaluation will be published in 2009.

In theory, white certificates are supposed to promote energy efficiency where it is cheapest. However, it is clear from our review of the three frontrunner countries that energy efficiency activities in households are dominating. In the UK system only the residential sector is included, but in France and Italy the realised activities seem to be concentrated on the residential sector. The economic potential for energy savings is expected to be equally spread on all sectors[15]. The focus on the residential sector is encouraged by the fact that a majority of the standardised savings is related to energy savings in this sector. The design of the standardised savings (and the rules for using non-standardised savings) can distort the overall impact of the white certificates. In Italy, the standardised savings for CFLs appear so attractive that it is "stealing" all the savings. A large share of the Italian certificates is related to ENEL giving CFL's away for free.

The procedures of securing that the savings are real, and in line with the rules, are different in the three systems. In UK, a considerable degree of self control is delegated to the 8 obliged parties. Potentially, large sanctions seem to be effective in maintaining discipline. In France, no rigid regulatory system of control is in place apart from verification of whether the necessary documents are correct. However, the obliged suppliers have a self interest in ensuring consumer satisfaction with the energy efficiency services promised. Furthermore, the responsible ministry may carry out on-site controls on customer sites /DG/. In Italy, both the 30 obliged parties, as well as 100 ESCOs, can apply for certificates. The larger the number of parties that can apply, the more stringent the procedure for accepting a certificate needs to be.

We have only received few concrete cost figures about the certificating, but our findings indicate that it is lowest in UK and highest in Italy.

The savings associated with the standardised procedures vary across the countries. As seen in table 11 and 12 France have comparatively low values, while the other countries have higher values – depending on the type of measure.

[15] E.g. in the EU Commission (2006): Action Plan for Energy Efficiency: Realising the Potential, it is indicated that savings in all sectors can be expected in the order of 25 to 30% ("Full energy saving potential 2020").

Table 11: Standardised savings for freezer and fridge/freezer combination.

	First years savings (kWh/year)	Life time savings (kWh)
A+Freezer		
France	(50)	420
Italy	180	900
UK	60	596
Denmark	125	(1,250)
A+ Combi		
France	(60)	560
Italy	180	900
UK	140	1,392
Denmark	195	(1,950)
Assumptions		
France	4% discount, 10 years life time	
Italy	5 years life time	
UK	3.5% discount, 12 years life time	
Denmark	10 years life time	

Numbers in parentheses is calculated by us.

Table 12: Standardised savings for CFLs.

	First years savings (kWh/year)	Life time savings (kWh)
CFL		
France	(33)	230
Italy	66	330
UK	10	208
Denmark	18-77	(144-616)
Assumptions		
France	4% discount, 7.5 years life time	
Italy	5 years life time	
UK	3.5% discount, 16 years life time. Heat replacement corrected	
Denmark	5 sizes, 1,000 hours per year, 8 years life time	

For the end-user the white certificate systems may look like subsidy schemes. In Italy CFLs are given away for free, in France many offers include some kind of financial compensation, such as rebate on the subscription fee or cash payment, and in the UK subsidy is given to investments – and a special high subsidy is given to low income households. This tendency might be important when evaluating the cost-benefit of the systems, since subsidy schemes are vulnerable to free riders. Everybody wants a subsidy, and can the certification systems sort out the free rider problem? With standardised savings a free rider factor is often included in the calculation, e.g. by comparing the average sold product with the product in focus. In UK it is expected in CERT that 12% of cavity wall isolations supported by ECC activities are free riders based on the historical trends before the measure was promoted by energy suppliers. However, this does not ensure that savings will all be additional. It is theoretically possible that all savings from a standardised method will come from free riders. Energy taxes and minimum efficiency standards do not have the problems with free riders (but probably others).

In France, the white certificate system is deliberately used in combination with other policy measures, such as consumer income tax reduction and installer VAT reduction on energy efficiency work. In the UK, obligated parties can work together with schemes such as Warm Front and social housing projects and claim all the energy savings achieved if the partner organisation attests to the additionality of the project due to the contribution made by the obligated party. However, for working with other central government initiatives, the savings claimed by energy suppliers are in direct proportion to their funding support.

Another issue is the updating of standardised measures as the markets change and development of new measures. The UK is the only country of the three that rewards innovation, namely through an uplift in the credits given to an obligated party for developing a new methodology. This allows for a 50% premium in energy savings for that measure; however, there is a maximum of 10% of the total target savings that can be accredited using the uplift factor. In France, the intention is that existing standards are continuously updated based on market surveys and regulatory developments. How to handle the change in existing standards has, however, not yet been decided.

The open market in Italy seems to have created a business case for ESCOs: Independent companies are active in creating certificates. They sell certificates on the open market or directly to an obliged party. In UK and France (with no white certificate stock exchange market) many installers and building constructors are working as subcontractors for the obliged parties.

What can Denmark learn?

The Danish system for promoting energy efficiency was revised in 2006. Obligations are put on electricity, gas, district heating and oil companies (grid companies for the three first energy vectors). The goals have been increased compared to before 2006. Trade in energy savings is allowed in the Danish system, but very limited trading has taken place to date.

The Danish Government has stated that it wants to develop the system further in the direction of a more market oriented system. One way of doing this is by means of white certificates.

Inspired by the review of the white certificate systems in UK, Italy and France we would highlight:

- If more players in the energy efficiency market are wanted (e.g. ESCO's), an open market seems to be efficient. Without an open market little trade seems to take place. Market competition can, however, occur at other levels than on an exchange. This could be between electricity retailers or between suppliers of energy saving measures such as boiler fitters or insulating companies.
- A central feature of designing a white certificate system is the question of who should pay. In all 3 countries it is ultimately the energy con-

sumers who pay. In France and UK the obligation is placed on the retailers – and the costs are not regulated.

- An interesting idea could be to put an adder on the energy bill (as in Italy) and oblige an independent unit to buy certificates from an open market. This would be a kind of energy savings trust where the design of the activities was entrusted to market players. With this construction energy companies (grid companies as well as retailers) could deliver certificates if they found that this would fit into their business.
- The Danish administration should be careful in the design of standard solutions. Attractive standard solutions for the residential sector could change the focus from where savings can be obtained most efficiently to where "the easy standard solutions exist". Industrial and service sector type savings should have a prominent place in the system (in 2006 2/3 of the savings in the Danish system was realised in trade and industry). The fact that the French (until further) and Italian systems are heavily dominated by measures in households, whilst the Danish system is dominated by measures in industry, should be looked at.
- Transport could be included in the system. France has taken steps in this direction, but few results have been obtained so far. We have not found any technical or practical reasons for not including transport.
- In Denmark the tradition has been (as in Italy) to put the obligation on the grid companies. These monopolies are regulated and it has been considered a natural place to put the obligation. However, the UK and French system with the retailer as the obliged party has some interesting features: Mainly that no cost control (grid tariff regulation) is needed.
- The effects of varying lifetimes on the measures that are implemented should be carefully considered in a certificate system. The effect that the long technical lifetimes employed in Britain and France can make investment-heavy measures more attractive, but it can also distort the actual energy savings achieved. The Italian and Danish systems use annual savings over a restricted period (in Denmark: "first year", in Italy typically 5 years). This is a simple approach, but it may favor projects with short life time rather than those energy efficiency projects with the best net present value. Lifetimes of measures can be used as an effective regulatory tool, and this should be considered when applying them rather than simply following technical lifetimes. Using very long lifetimes can imply technical stagnation and cause regulatory problems in the future.
- The use of discount rates in energy saving certificate systems is an issue that should be looked at carefully. Discounting is used to used to compare costs and benefits that occur in different time periods based on the principle that, generally, people prefer to receive goods and services now rather than later. Energy savings do not fit well into this concept. The goal of reducing CO_2 emissions is related to the total CO_2 content in the atmosphere. This is again related to the total accumulative energy consumption. From this perspective a discount rate of zero

should be used – the UK has decided to adopt this approach when counting the CO_2 savings from CERT (from 2008).

- The use of discounting can also distort targets in energy saving programmes, and be used to increase or decrease the number of credits given for measures. This may be problematic, especially when increasing the discount rate to follow increasing prime lending rates, which should be done in order to maintain integrity if discounting is used.
- Critical for achieving real additional savings are suitable sized evaluation at regular intervals of the market development, and the degree of consistency between expected and real savings and timely adjustment of the standard solutions.
- Danish energy policy in relation to energy efficiency is a portfolio of taxes, minimum efficiency standard and obligations to energy companies. When developing this portfolio, politicians should carefully evaluate the best next step. Since white certificates have transaction costs and free riders, higher taxes for sectors that today pay reduced energy- and CO_2 taxes may be more efficient from a long term societal point of view.

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- Mr. Patrice Henning, Gaz de France
- Mr. Christian Charlot, Technical manager, Ecofioul
- Mr. Joel Pedessac, Comité Français du Butane et du Propane
- Mr. Patrick de Beaurepaire, Syndicat National du Chauffage Urbain et de la Climatisation Urbaine
- Mr. Robert Angioletti, Ademe
- Mr. Luc Bodineau, Ademe
- Ms. Stephanie Monjon, Ademe

Italy:

- Ms. Marcella Pavan, AEEG, Autoritá per l'energia elekttrica e il gas. Italian regulator
- Mr. Nicola Lablanca and Mr. Lorenzo Pagliano, Department of Energy, Polytechnical University
- Mr. Stefano Alaimo, GME, Gestore Mercato Elettrico, Market for certificates
- Mr. Walter Grattieri and Antonio Capozza, CESI Ricerca
- Ms. Anna Brogi, ENEL distribution

Poland:

- Ms. Aneta Ciszewska Energy Department, Ministry of Economy
- Mr. Dariusz Koc, KAPE

The Netherlands:

- Mr. Roel Kaljee, EnergiNed
- Mr. Vlasis Oikonomou, SOM Research Institute, Department of Economics, University of Groningen

UK:

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France

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UK

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OFGEM is the energy regulator in the United Kingdom. Its overriding goal is to protect energy consumers by promoting competition, wherever appropriate, and regulating the monopoly companies which run the gas and electricity networks: www.ofgem.gov.uk

DEFRA sets the target for the EEC and is, amongst other roles, responsible for Britain's efforts against climate change: www.defra.gov.uk/environment/climatechange/uk/energy

Italy

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EU

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Appendix 1: Danish obligation scheme

Energy savings reported in 2006/7

Electricity and natural gas utilities and oil companies have reported their realised savings for 2006. See table 1 and 2. Data from district heating are reported later and are not included here.

Table 1. Realised first year energy savings 2006 by obligated party and end-use sector.

	Realised in 2006				Average annual goals for 2006-2008
TJ	Residential	Public sector	Trade and industry	Total	
Electricity utilities	138	157	690	985	1,400
Natural gas utilities	447	23	198	668	500
Oil companies	159	1	21	181	150
All	**744**	**181**	**909**	**1,834**	**2,050**

The realised savings has been lower that the average goal for 2006-2008. This was expected since the system was initiated during 2006. In the first half year of 2007 the electricity utilities have realised savings corresponding to the average goal.

Half of the savings take place in trade and industry. For electricity 2/3 of the savings are from trade and industry.

Table 2. Realised energy savings by obligated party and energy type

TJ	**District heating**	**Natural gas**	**Oil**	**Electricity**	**I alt**
Electricity utilities	85	179	62	657	985 *
Natural gas utilities	1	383	227	57	668
Oil companies	0	0	181	0	181
All	**86**	**562**	**470**	**714**	**1,834**

* Including 2 TJ with energy type other

The energy companies realise most savings within their own energy type. However, for the electricity and natural gas utilities 1/3 of the savings are outside their own type. In the first half of 2007 the electric utilities have realised 37% of the savings within electricity, 38% within natural gas, 18% within oil and the rest within district heating and other energy types.