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economy

Energy efficiency obligations – the EU experience

eceee briefing for DG Energy on EU energy efficiency obligations on energy companies and their importance in meeting climate change and energy security challenges

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Commissioned by eceee under a contract from the European Commission's DG Energy

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2 March 2012

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Introductory remarks

This study has been carried out for the Directorate-General for Energy of the European Commission. The views expressed in the study have not been adopted or in any way approved by the European Commission and should not be relied upon as a statement of the European Commission's or the Energy DG's views.

The European Commission does not guarantee the accuracy of the information given in the study, nor does it accept responsibility for any use made thereof.

Finally, the views do not necessarily reflect those of eceee's individual members.

About the European Council for an Energy Efficient Economy (eceee)

eceee is a non-profit, membership-based European NGO. The goal of eceee is to stimulate energy efficiency through information exchange and co-operation. To facilitate this, eceee provides an information service through its website and e-mail newsletter, arranges workshops and conferences, and takes active part in the European Policy making process.

One of eceee's principal events is the Summer Study, held for five days every odd year in the early summer. The Summer Study attracts about 400 participants from a wide range of backgrounds. eceee and its summer study offer governments, industry, research institutes and citizen organisations a unique resource of evidence-based knowledge and access to reliable information.

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Executive Summary

This briefing on Energy Efficiency Obligations (EEOs) placed on energy companies (sometimes called energy company (or supplier) obligations) has been prepared for the Directorate-General Energy by eceee as a background paper for the Bucharest Forum working group on Energy Companies role in the Energy Efficiency Services Market.. It includes a history of and a snapshot of EEOs and their impacts within the EU as of September 2011. EEOs are in effect a direct intervention into the energy market. In this sense, the Member State (MS) governments are intervening into the energy market in similar fashion as other environmental interventions, e.g. the EU Emissions Trading Scheme or Green Certificates for renewable energy.

There is clear evidence that well designed EEOs, both in the EU and globally, can overcome many of the barriers to energy efficiency which prevent the uptake of such measures, particularly by households and small organisations. Barriers can be overcome through the inclusion of personalised advice, technical knowledge, finance on favourable terms or through subsidies, lowering transaction costs, providing quality assurance and confidence through a well-known brand. At the heart of any EEO is an obligation on some part of the energy company to prove that the activities they have promoted or funded have resulted in energy savings in eligible end use customers' premises or homes coupled with the threat that if they fail to deliver those energy savings, the company will incur financial penalties. The threat of financial penalties has meant that in over fifty years of operational experience in 5 EU countries, no energy company has missed their total energy saving target.

The detailed operations of existing and planned EEOs in the Member States are different and reflect the local status of the energy market (liberalised or otherwise), the energy efficiency history of the energy companies, climate, energy saving opportunities, culture, etc. Despite these variations, all have been judged successful by their governments and they have expanded their EEOs accordingly. There is now around €2 billion per year being spent by energy companies in the EU to deliver energy efficiency under EEOs. This figure still only represents between 1 and 5% of the energy bill to customers depending on the MS. The success of this policy tool prompted two more EU Member States – Poland and Ireland – to develop similar schemes.

One recent development is that in the UK some energy suppliers have been establishing heating companies, insulation subsidiaries and renewable micro generation companies (e.g. British Gas, E. ON). In principle, this can be viewed as these companies finally taking on board that the message that they should be seen in the future as energy service companies rather than commodity energy suppliers. Similar developments are starting in Italy. However, it is early days and more experience is required to decide whether this is indeed the case.

The end use sectors targeted by EEOs for energy saving activities vary within Europe, but all include the residential sector and most activity has been undertaken in the residential sector. This is because the use of deemed (or ex ante) energy savings simplifies the monitoring and verification process and allows mass marketing opportunities. Independent evaluations of the EU EEOs has shown that the cost to all parties (i.e. energy companies, customers and third parties) of saving a unit of electricity or gas are lower than the electricity and gas residential prices by between a factor of two to six.

Analysis of the National Energy Efficiency Action Plans (NEEPs) presented to the EU Commission by Member States in 2007 shows that for those with quantified plans in the residential and tertiary sector, the EEOs are a very important part of how they expect to meet their 9% energy saving target in 2016. Despite these EEO successes, due to the differences between the operational aspects of EEOs in different countries, it is unlikely that there could be a fully harmonised EU wide EEO scheme in the near term.

As market penetration of the more energy efficient version of the products increases with time, then the initial higher differential cost of the energy efficient product decreases as would be expected due to economies of scale. Additionally, energy companies become more skilled at marketing and delivering the energy efficiency measures and in the largest running EEO (GB) the actual cost of saving a unit of energy had roughly halved in real terms by 2008 since their introduction in 1994.

Using the data derived from the GB EEO for the period 2005-8 illustrates that investing a one off price rise on an on-going basis in energy efficiency by 2020 is nine times more effective in saving energy than the savings arising from the effect of the one off price rise itself. There is growing evidence that when EEOs are well established and with significant targets, then they can turn down energy demand. For the largest EEO, the residential sector consumption of natural gas has dropped by 15% between 2004 and 2009 despite a 7% increase in gas customers. Both top down and bottom up analysis indicate that EEOs have played a major role in helping this happen.

In conclusion, despite the wide variation in the way that EEOs have been implemented both in historic and liberalised energy markets, they have been successful policy tools:

- Member States with EEOs see them as a major policy initiative to meet their NEEAPs and climate change commitments and are continuing to expand their scope; there is growing interest from other Member States
- EEOs result in more energy savings than would be obtained from an equivalent rise in the price of energy alone
- Because of the reducing costs and the available potential still there are significant cost-effective possibilities in all EU countries and those Member States who started earlier are setting even more ambitious targets
- EEO schemes can deliver on low-hanging fruits but with a proper design also on long-term energy efficiency improvements
- By reducing the number of units required for household energy services, EEOs contribute to energy affordability for low income households in the transition to a low carbon world
- In the largest EEO, there is evidence over the last 5 years that they are contributing to a significant reduction in gas demand and have helped bring down the costs of EE measures over time
- At a time when Member States are facing difficult financial problems with public expenditure, the EEO approach avoids Member States having to spend public money to stimulate energy efficiency. The costs incurred by energy companies (typically a few % of the energy bill) are ultimately passed back to the end use customer and this is consistent with the polluter pays principle.

Introduction

This briefing has been prepared as a background paper for the Bucharest Forum working group on Energy Companies role in the Energy Efficiency Services Market by eceee drawing on the experience of a variety of EEOs or White Certificates [hereafter jointly referred to as Energy Efficiency Obligations (EEOs)] as they exist or are planned in Member States. It is a snapshot as of August 2011 and is intended to set out the evidence on the importance of such obligations in meeting climate change challenges in the Member States where they are currently in place and how this could be replicated to advantage across Europe. This briefing by eceee has been led by the Vice President, Eoin Lees, who has considerable experience of designing, implementing and evaluating such obligation schemes and who has drawn on his wide range of contacts throughout the eceee membership and the Bucharest Forum working group members to supplement information across Europe.

This report works through why EEOs are required and outlines the key principles which underline their successful operation. A snapshot of the situation within Europe in 2008 is presented with results as this is the last year for which there are considerable data available.. This is accompanied by recent developments with such obligations in the EU as of 2011.

The report deals with the importance of such obligations in those Member States where they exist as key components in meeting their commitments under the EU Energy Services Directive and why such obligations are more effective than simple energy price rises in delivering both energy and carbon dioxide reductions. Another section deals with the oft stated myth that energy efficiency only works in the short term for "low hanging fruit" by illustrating that as energy efficiency activity increases, the costs of the energy efficiency measures fall over time due to increased economies of scale and counteract the disappearance of the (then) cheaper energy efficiency measures. The final section highlights the growing evidence that such EEOs can actually turn down energy demand.

Why do we need Obligations to Encourage Energy Efficiency?

It is a well-established fact that energy efficiency does not happen to the extent that "the rational economist" would predict due to well-known market barriers. These include:

- An emphasis on reducing capital expenditure rather than life cycle costs
- The landlord tenant or split incentives where the investment in energy efficiency by the owner materialises to the tenant of the building
- Energy efficiency is rarely a single measure or activity and as such, particularly for households, can represent hassle or inconvenience (transaction costs) in trying to arrange a variety of different skilled technicians, etc.; this is often linked to concerns about the quality of workmanship from small (unknown) companies
- Although the issue of fuel poverty has risen in recent years with the increase of energy costs, it still remains true that for many European households and businesses (outside of those covered by the EU Emissions trading Scheme), the cost of energy is not a significant element of their expenditure and so is not regarded as a high priority for action
- For small businesses and households, the lack of personalised advice and knowledge of what exactly needs to be done in their premises or property is significant; this is often linked to uncertainty about whether the claimed energy savings will be attained
- Perceived risk of energy efficiency investments by financial institutions

- Owner occupiers in the residential sector do not always have the cash available to meet the costs of those energy efficiency measures (particularly some of the more expensive wall insulation solutions) and are not convinced that at commercial interest rates, they will stay in the property long enough to benefit from the on-going savings; this is an issue because apart from double glazing, there is little evidence that most energy efficiency investments add a significant value to the property
- Policy inconsistency and lack of long term commitment to energy efficiency initiatives by governments

This is not an exclusive list of barriers, but many can be overcome through well designed obligations on energy companies to deliver energy savings in eligible end use customers' homes and premises (e.g. through the inclusion of personalised advice, technical knowledge, finance on favourable terms or through subsidies, lowering transaction costs, providing quality assurance and confidence through a well-known brand). A further complication of course is that energy efficiency is often unseen and rarely a talking point with neighbours or competitors – this is in contrast to the installation of visible renewable energy source measures such as photovoltaic or small scale wind generation which is furthermore supported by extensive government and/or energy customer funding.

As a result of these barriers and because of the well-known cost effective opportunities to reduce energy demand, seven Member States have or are introducing obligations on energy companies which require them to perform energy savings in eligible end use customers' premises and/or homes. It is in effect a direct intervention into the energy market. In this sense, the Member State governments are intervening into the energy market in similar fashion as with other environmental interventions, e.g. the EU Emissions Trading Scheme or Green Certificates for renewable energy.

Such obligations on energy companies are sometimes called EEOs or White Certificates but whatever the name, they operate to the same principle, i.e. the obligation requires the energy company to prove that the activities they have promoted or funded have resulted in energy efficiency improvements by eligible end use customers. For this, they are awarded a White Certificate or a certificate of energy saving accreditation which reflects the extent of the energy savings they have achieved; these certificates are used by the energy companies towards meeting their energy saving target. In some countries, White Certificates can be traded on a market place (usually the power exchange market) and energy companies can purchase these to meet their targets.

Summary of the Key Principles for Obligations on Energy Companies

The key principle is that some part of the energy company (usually the energy retailer or the distributor[1]) has an obligation to save energy in eligible end use customers' premises or homes and that if they fail to deliver those energy savings, the company will incur financial penalties. In most EU EEOs, energy companies are not restricted to saving energy from their own customers i.e. they can save energy from any eligible end use customer. The key steps are to set a target, to set out the rules for determining the energy savings and to have procedures for monitoring and verifying that those measures have in fact been installed. Governments may also highlight or ring fence any particular social or technological issue that the Member State considers important to give priority to.

The target for any particular energy company is related to its market share in the volume of energy supplied or distributed by it. In the residential sector, for simplicity, the share

[1] Retailer equals the part of the company that arranges for the supply of energy and send the bills; the distributor is responsible for making sure that the energy is conveyed to a local level; in some cases the retailer and the distributor can be the same body

of customer numbers is often used as a proxy. Historically in all the EU countries, the target has been the subject of much negotiation and discussion between the obligated energy companies and the Member State governments. As will be discussed later, such obligations do have an impact on the energy bills of the end use customers and so there is an inevitable trade-off between the cost to customers and the ambitions for the energy savings desired.

The process of actually accrediting energy savings is a trade-off between the relative value of those energy savings and the costs involved in measuring them. Projects with the larger energy users usually save a significant amount of energy and can often afford to have the energy saving measures monitored for actual savings achieved. At the other extreme in households and small businesses, the projects will have low energy saving values and measuring on an individual basis would be prohibitively expensive.

Consequently, for small energy users, a simple approach has been developed to keep the monitoring and verification costs down. This is known as deemed energy savings or ex ante savings and operates by using "approved" measures for which there are well established, independent energy saving values for that measure. For example, in households it is well known that insulating the same house will result in different energy saving measures due to the variations in behaviours of and required comfort levels in the different households. However as a result of many trials, the average energy saving from such energy efficiency measures is well established and as the obligations to be described later involve many thousands and even millions of households, then the average energy saving is a relevant and reliable measure. The monitoring and verification process then becomes a simple "measure count" of collecting the names and addresses of the homes that have been insulated and performing a random "dip check" of the submitted claims for energy savings by contacting the householder. This is accompanied by a random check on the quality of installation (important for insulation and heating measures) to ensure that the quality of the installation merits the deemed savings.

An alternative approach dealing with situations between the deemed energy savings and the actual measured savings is known as the scaled engineering estimates. For example, a compressor of a certain kW rating may have been shown to produce energy savings of a certain value. If a different sized compressor is installed, then it is possible to use the engineering estimates of scaling those energy savings to the new installed size. Monitoring and verification is again a measure count plus checking that the scaling estimate has been done correctly.

As an example of priority requirements to ensure social equity, Flanders, France and the UK have defined a priority group of customers (usually low income and/or the elderly) who receive priority in terms of energy efficiency measures or even have a fraction of the energy saving target which is restricted to them and that the energy companies have to meet. An example of a technological priority is the use in the GB system of awarding a bonus of 50% to innovative technology which makes a significant improvement on existing technology and which is being used for the first time in such obligations. To encourage deeper retrofit of households, the Irish Government is introducing an uplift of 10 to15% of the energy savings achieved if three or four approved measures are installed in the property.

What Costs are Involved and Who Pays?

There is an obvious cost involved with the installation of the energy efficiency measure or the purchase of energy efficient products. This cost is met by energy companies in the form of subsidies along with contributions from customers, landlords (especially social landlords), local authorities, charities, manufacturers, etc. The range of subsidy which is paid by the energy company varies tremendously from 0-100% of the cost of the energy efficiency measure. For the most vulnerable in society, often the entire cost is met by the energy company. Zero or low subsidies are linked to the desirability of the measure, the extent to which other financial incentives are available (e.g. tax breaks) and the use of

loans repaid out of the subsequent shared savings resulting from the energy efficiency measures.

There is an additional cost to the energy company of marketing, selling, reporting, planning, etc. of their activities under the obligations. These are often called the indirect costs and in GB they have been estimated as to be equivalent of about 18% of the energy companies' direct costs on energy efficiency measures.

The cost of auditing and verifying the energy saving projects and ensuring that the energy company has met their target is borne out by the administrator of the scheme. This is a very small cost, e.g. the Energy Regulator, Ofgem, estimated that its costs are less than 0.1% of the GB energy supplier costs in 2010.

Finally there is a government resource cost to set the target every few years and in the UK this cost is less than the Ofgem costs. There are also additional government costs in carrying out market updates to ensure that awarded energy savings reflect the reality of the improvement over the energy efficiency of the average product being sold and to measure the extent of increased amenity or comfort taking that can be associated, particularly with insulation measures. Again the costs of this are much less than the Ofgem costs on an annual basis.

For the costs falling on the energy company, there is a distinction in the way that these costs are passed on to the end use customers. If the obligation is on an energy retailer in a liberalised market, then in effect the costs of the obligations simply becomes a cost of business like other environmental requirements. As such it will be passed on to the end customer and competition should ensure that the energy companies deliver their obligations in the lowest cost possible. In contrast, if the obligation is on a regulated part of the energy company, be that a distributor or if there are still supply price regulations in place, then the costs are normally reflected in the regulated tariff that is charged to the end customers.

Either way, in reality most of the costs are passed on in some form to the end user and, by doing so, it is consistent with the "polluter pays" principle.

How Are They Delivered?

In the EU, historically the way that the energy efficiency measures have been delivered by the energy companies is through bilateral contracts between an obligated company and an energy efficiency market actor such as an insulation company, the retailer of appliances, manufacturers, heating installers, etc. One recent development is that in the UK some energy suppliers have been establishing heating companies, insulation subsidiaries and renewable micro generation companies (e.g. British Gas, E. ON). In principle, this can be viewed as these companies finally taking on board that the message that they should be seen in the future as energy service companies rather than commodity energy suppliers. However it is early days and more experience is required to decide whether this is indeed the case.

The Italian and the French obligations differ in that accredited parties, and not just the obligated energy companies, can earn White Certificates in their own right and that these can be subsequently traded and ultimately bought by the obligated energy companies. In Italy there has been some development of energy service companies (as defined by the EU Energy Services Directive) but most Italian White Certificates earned by non-obligated parties are simply by companies involved in the installation of energy efficiency measures and would not meet the EU definition of an energy service company. However, recent amendments to the White Certificate have been enacted to encourage the development of real ESCOs and there is interest from both Italian distributors and retailers. In France there has been very little trading of White Certificates (<4% in the first phase).

In addition to the monitoring, verification and audit checks described earlier, there are often a requirement on energy companies to check on the quality of a sample of energy efficiency installations to ensure that "energy efficiency is a good experience". This has undoubtedly driven the quality performance of the insulation installer companies in the UK and has also improved their productivity from typically one insulation job per day in the mid-1990s to 3 per day in the summer months with the longer day lighting hours.

Energy Efficiency Obligations on EU Energy Companies

Snapshot in 2008

As will be seen below, comparing data between Member States is not always easy due to the very different nature of the obligations in these countries. 2008 is the last year for which there are considerable data available and for which comparisons have been made. For this reason, this year has been used as a snapshot to give some indication of relative activities in the Member States and some developments since then are reported in the next section.

Table 1 gives the main activities in the EU for 2008 for five Member States. It is immediately obvious that there is considerable variation in which companies are obligated and which customers are eligible. In terms of the obligated companies, only electricity at that time was the common feature and only the residential sector was an eligible sector in all obligations. Again there was considerable difference in whether the obligation was placed on the distributors (Flanders, Italy, Denmark) or on retailers. Although both France and Italy in principle could save energy amongst the transport sector, neither country has actually achieved any significant energy savings from transport (but see the next section for France and transport activities).

Table 1: Comparison of the Obligations on Energy Companies in the EU as of 2008.

Country	Obligated Company	Eligible Customers	Target set by	Administrator
Belgium–Flanders	electricity distributors	residential and non-energy intensive industry and service	Flemish Government	Flemish Government
France	retailers of non-transport energy	All (including transport) except EU ETS	Government	Government
Italy	electricity & gas distributors	All including transport	Government	Regulator (AEEG)
GB	electricity & gas retailers	Residential only	Government	Regulator (Ofgem)
Denmark	electricity, gas & heat distributors	All except transport or covered by EU ETS	Government	Danish Energy Authority

Table 2 is an attempt to look at the different nature of the energy saving target, the current size of the target and the estimated annual spend by the energy companies in meeting that target. As the Member States are of very different sizes, this has been

converted into euros per person to facilitate easier comparison in terms of the size of the activity. It is immediately obvious from Table 2 that there is no common agreement on the nature of the saving target, whether it be primary energy, as in Flanders and Italy, or delivered energy, as in France and Denmark, or the recent move from delivered energy to carbon dioxide in GB. Again comparing the targets is extremely difficult not just because of the differing nature of the energy saving target but also the use of different discount factors (or not) in different countries. The final column shows that, apart from GB, the annual spend by companies in 2008 were very similar when expressed in terms of expenditure per head of population. The greater magnitude of the GB expenditure reflects the fact that this has been running since 1994 for electricity and since 2000 for natural gas. Arguably, its magnitude is all the more surprising as it is restricted only to the GB residential sector.

Table 2: Comparison of the Target and Size of the Energy Efficiency Obligations in the EU as of 2008.

Country	**Nature of saving target**	**Current size of target**	**Estimated annual spend by companies, €M {€/person}**
Belgium–Flanders	1st year primary energy	0.6 TWh annual	26 {4}
France	lifetime delivered energy	54 TWh over 3 years	180 {3}
Italy	cumulative 5 year primary energy	2.2 Mtoe in 2008	190 {3}
GB	lifetime CO_2	154 $MtCO_2$ in 3 years to 2011	900 {15}
Denmark	1st year delivered energy	0.82 TWh annual	25 {5}

Although there are many different sectors which are open to the energy obligations, in practice most activity has happened in the residential sector. This is shown clearly in Table 3. At first sight, this might seem surprising that so much activity has been focussed on this sector (accepting of course the mandatory requirement in Flanders and GB), but this is due to the use of deemed energy savings which simplify the monitoring and verification costs and also provide opportunities for mass marketing and promotion. This combination is seen to be a cost effective way for the energy companies to deliver their objectives. Denmark is the only country which actually had less than half the energy savings coming from the residential sector.

Table 3: In 2008, most of the savings by European Energy Efficiency Obligation have occurred in the residential sector. *(Note the percentage figures relate to the savings required to meet the target not necessarily the percentage of the lifetime savings achieved.)*

Country	Period	% energy savings from residential sector
Belgium–Flanders	2008	58% (mandated)
Denmark	2008	42%
France	2006-9	87%
Italy	2005-8	83%
GB	2005-8	100% (mandated)

In part, this reflected the evolution of their programme which started initially as based in the industrial and commercial sectors. Currently, Denmark now has most of the energy savings coming from the residential sector.

Interestingly, even within the residential sector there are tremendous differences between end uses that the energy companies use to meet their targets. This is shown clearly in Figure 1 for the four countries which have published data on such savings.

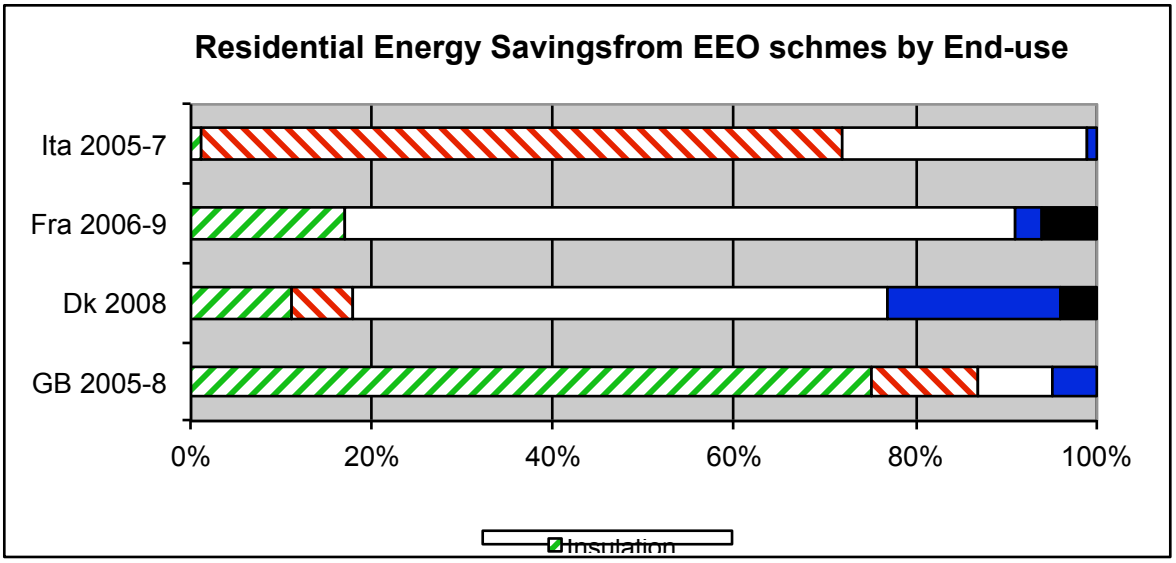

Figure 1: Where the Energy Savings in the Residential Sector have come from under the Energy Efficiency Obligations in the EU for Italy, France, Demark and GB. *(Note the percentage figures relate to the savings required to meet the target.)*

While at first sight this might seem surprising, it reflects the local Member State opportunities for saving energy and on occasion, the historical delays in starting programmes. For instance, the UK has a relatively old and poorly insulated housing stock whose construction (cavity walls) allows relatively cheap solutions to the problem

of wall insulation. The Italian scheme took a long time to complete the legal processes and so by the time it started, the prices of compact fluorescent light bulbs (CFLs) had fallen dramatically. This meant that the Italian companies were able to achieve energy savings from CFLs at around one third of the original cost estimate. This anomaly has since been corrected but it meant that CFLs did dominate the early saving measures in Italy[2]. Finally, Denmark has extensive district heating schemes in place.

France has unusually treated replacement boilers as a building fabric scheme rather than a product replacement scheme. This means that they awarded the energy saving values to boilers based on the housing stock average boiler efficiency rather than the average efficiency of modern replacement boilers in the market place. Consequently this gives much greater savings than would normally be awarded say in Italy or the UK. This enhanced energy saving, coupled with the availability of tax breaks for new boilers from the French government meant that boilers were a relatively "easy and cheap" sale for energy companies and which they understandably exploited.

In reality, the different end uses saved in the residential sector across the EU reflect the different energy saving opportunities, the different rules or deemed energy saving values and the nature of the energy delivery systems.

Recent Trends

There is growing recognition that by setting a target which only counts the first year energy savings from that energy efficiency measures undervalues those measures with longer life times. For example, insulation has a thirty to forty year life time, depending on the measure, compared to say a ten to twelve year life time for appliances; if the target is first year energy savings only, then in terms of the total energy savings realised, the three to four times longer life time of insulation is not valued. Thus if the measures are similar or indeed slightly cheaper for the appliances, then there will be a perverse incentive for the energy company to invest in the shorter lived measures rather than the longer, more cost effective energy saving measures. To counteract this problem Denmark has introduced weighting factors dependent on the life time of the energy efficiency measure and Italy is looking at similar options to value longer lived measures such as insulation and industrial projects.

Another interesting development is that France is pioneering from January 2011 an obligation on companies involved with road transport fuels. Unlike the rest of the French obligations, this is being placed on the oil importers rather than the retailers of transport fuel because of the large number of such retailers. Although transport energy savings have been eligible to be counted against EEOs in various Member States, there has been virtually little activity to date. In France, in the first phase of the French White Certificates, 0.4% of the energy savings came from transport activities.

Globally, most of the EEOs have focussed on stationary end uses of energy and so it will be interesting to monitor the extent to which EEOs can be modified to deliver cost effective energy savings in transport.

New Activities

There are also some recent developments on EEOs in Poland and Ireland. In both cases the obligations have been placed on the energy retailers but there are interesting variations in the way that this has been accomplished.

In Poland, the legislation to introduce White Certificates on energy retailers was passed into law in early 2011. The obligation is on all energy retailers and they must meet 80% of their target through reducing energy consumption by end users with the balance being

[2] More recently, the GB EEO (CERT) had a dramatic upturn in the number of CFLs being sold or given away free in actions linked to the energy suppliers. CFLs were banned as eligible measures from April 2010 and it is estimated that by the end of the CERT programme, the CFLs will represent less than 20% of the energy suppliers' claimed energy savings.

from improved energy efficiency by the companies' own activities and/or reduction in energy transmission and distribution losses.

The obligation covers electricity, natural gas and heat providers and the system is administered by the new Polish Energy Regulation Office. There are penalties in place if the energy suppliers do not deliver the appropriate number of certificates. The White Certificate once validated can be traded at the Power Exchange and the expected cost of implementing the White Certificate schemes is likely to impact on energy prices in the region of 1.5-2%.

One of the novel aspects of the Polish White Certificate scheme is the use of a tender system which it is hoped will minimise the overall costs of the Certificates. This requires written offers of energy savings to be made to an independent board which, if accepted and successfully implemented, will earn White Certificates for the proposer. The proposer does not need to be an energy retailer.

In Ireland, the first phase of the Irish EEOs is being introduced on a voluntary basis from later in 2011 for a three year period. The obligation is on retailers of energy to stationary end users and covers the fuels such as electricity, gas, oil, solid fuel and peat. There is also an obligation on the importers of road transport fuel. The obligated parties are required to save energy in the residential, non-residential and road transport sectors. Due to the relative newness of such obligations in the road transport sector, the energy saving target for the importers of road transport fuel is smaller pro rata than that for stationary end uses when viewed in terms of the relative total annual energy consumption figures.

In the first phase of the Irish Government funded EEOs, the obligated parties will be able to take advantage of the Irish subsidy schemes which are in existence for many of the energy efficiency measures likely to be used. There are currently support levels available from the Irish Government covering roof and wall insulation, condensing boilers, heating controls and solar panel installations. The obligated parties will have to bear all the marketing, promotional, administrative, quality check and reporting costs associated with meeting their targets. Additionally, if they choose to use any of the energy efficiency measures which are currently not covered by government subsidies (e.g. windows and floor insulation, efficient stoves), then they will have to meet themselves any subsidy costs given for the installation of these measures.

To encourage deeper energy efficiency retrofits, there will be modest uplifts of their actual energy savings achieved by 10 or 15% depending on whether three or four energy efficiency measures are installed in the same property.

Evaluations of Energy Efficiency Obligations in the EU

All countries have undertaken evaluations of their own activities but comparison between the different between the different Member States is complicated because of the different targets, energy saving values, etc. as outlined above. An independent comparison was attempted by Bertoldi et al 2010[3] who tried a comparison for France, Italy and GB. In all cases, the total cost estimates of saving a unit of electricity or gas are lower than the electricity and gas residential prices by a factor varying between 2 and 6.

Denmark has evaluated the cost of saving a unit of energy for the phase that ran between 2006 and 2009 to be around 0.45 eurocents per kWh.

In GB, the phase which ran from 2005-8 resulted in a benefit (not a cost) to the nation of saving a ton of carbon dioxide or €60 after correcting for increased comfort taking (e.g. not all the energy savings are realised from insulation) and also for dead weight (i.e. those that would have done it anyway). The GB evaluation also showed that the target for 2005-8 was met 23% cheaper than the government estimate and that the cost to customers of the energy company activities was equivalent to 3.6% of annual fuel bills.

[3] Bertoldi, P, Rezessy, S, Lees, E, Baudry, P, Jeandel, A, and Labanca, N (2010): Energy Policy 38 (1): pp. 145-69

While more than two out of three low income households benefitted directly (mainly through free CFLs and retail appliances), over 1.1 million low income householders benefitted from more substantial energy saving measures (mainly insulation). For every euro raised from householders, either through their energy bills or their direct contributions to the energy efficiency measures, householders will benefit over the longer term by €9[4].

Table 4 attempts to track the national cost of saving a unit of electricity or gas in the GB EEOs since 1994.

Table 4: Tracking the Cost to All Parties (i.e. energy companies and others) of Saving a Unit of Electricity or Gas through the Various Phases of the GB Energy Efficiency Obligations. *(Note: all values have been expressed in p/kWh and converted to 2001 money & methodology – source as per previous footnote.)*

Fuel	**1994–8**	**1998–2000**	**2000–2**	**2002–5**	**2005–8**
Electricity	1.8	1.4	1.3	1.0	0.9
Gas			1.0	0.6	0.5

This task is complicated by the fact that the accounting rules (values of comfort factors & discount rates and life times of the energy efficiency measures) changed over the period. Nevertheless the Energy Saving Trust and latterly the DECC evaluations have attempted to gain an indication for what has been happening over time as the EEOs have expanded in scale. It is clear from Table 4 that in real terms the cost of saving a unit of electricity or gas has roughly halved. Figure 2 shows for the Italian EEOs the avoided energy costs for participating customers for the three main fuels of electricity, natural gas and gas oil for heating. Despite rising energy prices over the period 2002 to 2008, the distribution price allowance has awarded the distributors €100 per ton of oil equivalent whereas the value for the participating customers of the energy saved is between 8 and nearly 14 times that value. It implies that there are large "private" economic gains being achieved.

[4] Report to DECC "Evaluation of the Energy Efficiency Commitment 2005-08" http://www.eoinleesenergy.com/

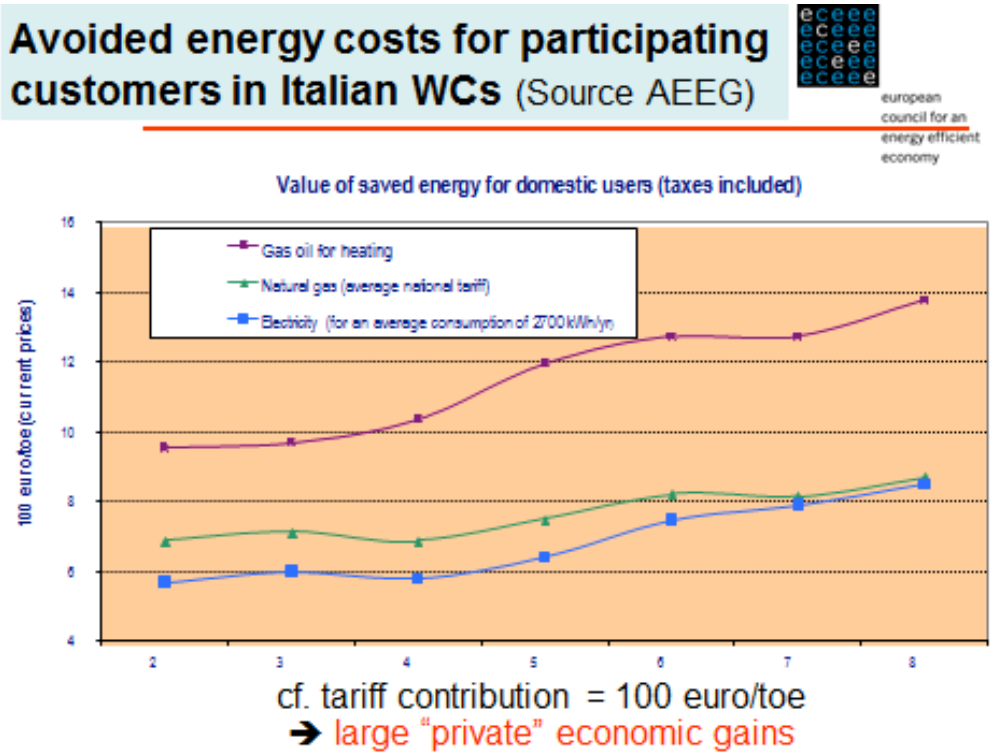

Figure 2: Avoided Energy Costs for Participating Customers in the Italian White Certificate Scheme for the Three Main Fuels in the period 2002 to 2008 (source AEEG).

It is also worth noting that in Italy, since the introduction of the Italian White Certificates, the allowance in the distribution price remained at €100 until 2008 at which point their price allowance was reduced to €85 per ton of oil equivalent (all prices in historic cash terms)[5]. In other words, despite the general increases in historic costs through this period, the costs of saving energy in the Italian White Certificate system has also reduced as the scale of activity and experience of the energy companies has increased.

Finally, the cost in the first phase of the French White Certificates for energy suppliers was 0.4 eurocents per kWh cumac. This is equivalent to 20% of the value of the fine that was set by the French Government for any energy company missing its target[6].

The result of all the Member States evaluations that have been undertaken is that activity has expanded in recent years in nearly all countries with existing obligations on energy companies. This is shown clearly in Table 5 which for the five longest running obligations lists the increases in 2011 activity over that in 2008. Clearly all have increased significantly, even the largest activity in GB. The Italian target has not increased in the savings to be acquired for the first time but due to the lowering of the primary energy conversion factor for electricity, it has effectively increased by 15%. Additionally, energy distributors will have to increase activity due to the lowering of the deemed energy saving values in 2008.

[5] Source AEEG

[6] http://www.eceee.org/eceee_events/energy-efficiency-obligations/2_ademe slide 18

Table 5: Increases in EU Energy Efficiency Obligations in 2011 Compared to the Situation in 2008.

Country	Activity for latest data (year) or new target	Increase over 2008 activity
Belgium–Flanders	2.6 TWh/y (2009)	>30%
Denmark	1.7 TWh/y	>100%
France	345 TWh cumac in 3 years by end 2013 including road transport	Approx. 300% (see next slide)
Italy	5.3 Mtoe cumulative	No change in ”new savings” but 15% real increase due to lowering of primary energy conversion factor for electricity
GB	185 $MtCO_2$ in 3 years by 2011	20% increase + extension to end 2012

The Italian regulator (AEEG) has also looked at the cost of the White Certificates compared to other sustainable energy initiatives that they administer e.g. tradable green certificates, electricity generation feed in tariffs from photovoltaic (PV), geothermal and biomass. AEEG has estimated that the cost of the Italian White Certificates in the period 2005 to 2009 averaged at 1.7 €cents/kWh.

As Figure 3 shows, the White Certificate figure is considerably cheaper than the other sustainable energy options.

Some Observations on Energy Efficiency Obligations in the EU

The core element in all the EEOs is the energy saving obligation backed by legally enforceable penalties if companies fail to meet their targets. This is in no small measure due to the fact that those governments with such obligations in place do not believe that voluntary markets will emerge in the near future. However, there are relatively few schemes in place (five Member States currently with two imminent) and although they vary quite a lot, they are all judged to deliver successfully by their governments.

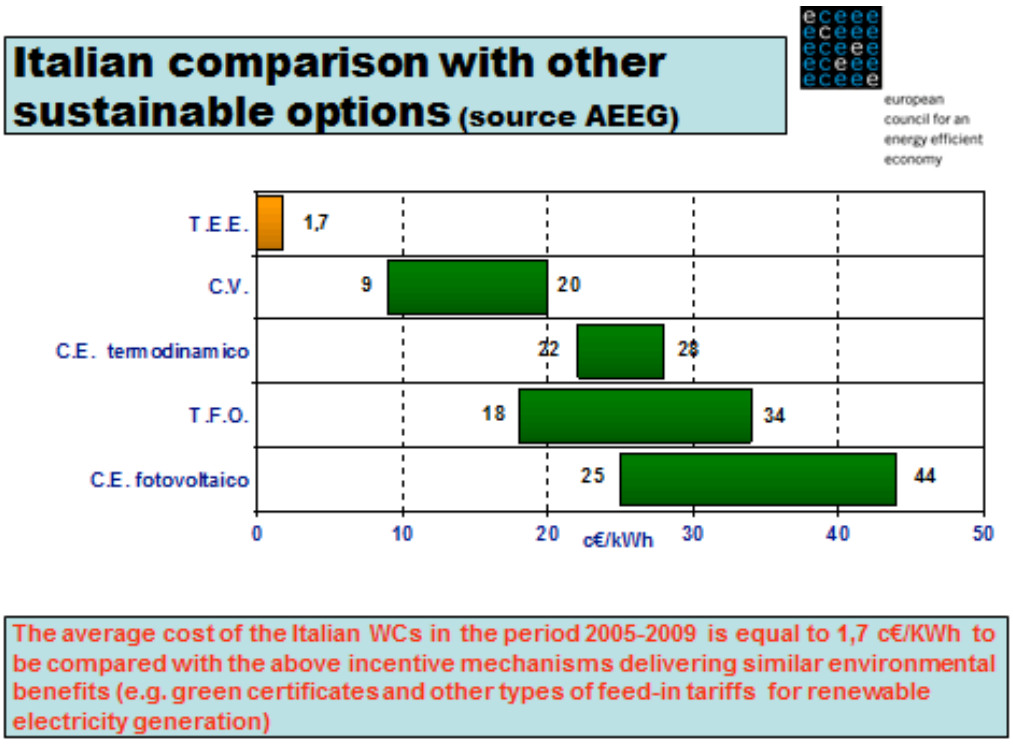

Figure 3: Comparison of the cost of the Italian White Certificate mechanism for saving electricity with other sustainable energy options.

The initial energy saving goals were fairly low and have been achieved at costs below the expectation of the policy makers. Over the years, the schemes have expanded to currently requiring obligated energy companies spend around €2 billion per year. Perhaps the most striking aspect is that in around fifty years of operational experience of EU EEOs in 5 MSs[7], no energy company has failed to meet its overall energy saving target[8].

As was noted above, the nature of the targets, the end use sectors covered, the obligated part of the energy companies vary dramatically. In effect, this reflects the local status of the energy market, the energy efficiency history of the energy companies involved, the climate, the potential opportunities where energy might be saved and the culture of the Member State. Perhaps more importantly is that there are clearly different rules for measuring energy savings and for dealing with the issues of deadweight or free riders (those that would have done so anyway) in the existing schemes.

The evidence to date shows that the EEOs have been particularly successful in delivering low cost and standard energy efficiency measures and that the obligation has been overwhelming met through the deemed energy saving approach. As small end users face the greatest barriers to energy efficiency activity, such EEOs seem well suited to those end use sectors where some form of trading (e.g. personal carbon allowances) is unlikely to materialise in the near future.

The final point to notice is that such EEOs, both in the EU and the rest of the world, have functioned in liberalised as well as monopolistic markets – in other words they have proven to be a very flexible and effective tool in such diverse countries as the EU, the USA, Australia and several South American countries.

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[7] In what follows, the (year) after the country or region is the starting date: GB (1994), Flanders (2003), Denmark (2001), Italy (2005) and France (2006).

[8] One small Flemish distributor met its overall energy saving target but failed to meet its mandated share for the residential sector as it distributed electricity in an industrial area.

It is often postulated as to whether we can envisage EU wide EEOs. Given the above discussion on the variety of targets, end use sectors, obligated parties, etc., etc. and the fact that the local status of the energy market, energy history, opportunities and culture are so diverse, then it would be difficult to see this in the near future. However, we need greater harmonisation across Europe on how we determine and measure energy saving through such energy efficiency measures could prove beneficial especially if such schemes are established across EU. This would also entail dealing with the issues of dead weight/free riders, increased amenity/comfort and how they could usefully be better harmonised.

Indeed, the draft Article 6 goes further and proposes that EEOs are encouraged in all Member States or other options proven to be as effective and successful as these are used instead.

The Importance of Energy Efficiency Obligations in Helping Member States to Meet their 2016 Energy Saving Targets

Under the existing Energy Services Directive, Member States are required to submit National Energy Efficiency Action Plans showing how they would make their indicative energy saving targets of 9% by 2016. A study by ECF in 2009 looked at the National Energy Efficiency Action Plans to identify those policies which were expected to make the greatest contribution to energy and carbon dioxide savings in 2016. The study only examined the residential and tertiary sectors but as was discussed earlier, these are the sectors arguably of most relevance to EEOs in the EU. Unfortunately, only nine Member States actually quantified the policies from where they thought the energy savings would come and only three of these actually had EEOs in place.

Some policy measures were treated as packages and not separated into their individual components as the policy measures were designed as a package. For example, in Italy in the residential sector, as well as the promotional support from Italian distributors, for certain energy saving measures, there are tax incentives available for the government and for others there are subsidies.

Table 6 looks at the expected contribution from such EEOs by 2016 for Belgium (Flanders), Italy and the UK in terms of the percentage of energy saving that is expected in either the residential or tertiary sector to arise from those activities. The table also indicates where the Energy Efficiency obligation is linked to other incentives or building regulations.

Table 6: Indicative Savings from Energy Efficiency Obligations by 2016 for those Member States with Quantified NEEPs submitted to the EU by 2007.

Country	Residential Sector Policy mix	% of energy savings for residential sector by 2016	Tertiary Sector Policy mix	% of energy savings for tertiary sector by 2016
Belgium Flanders	EEO	>50%	EEO + Bdg Regs + Government subsidies	>80%
Italy	EEO + tax incentives + Government subsidies	>70%	EEO+ incentives	>70%
UK	EEO **	41%	No EEO	n/a
** UK NEEAP also states 44% of CO_2 savings by 2016 from EEO				

The Polish NEEAP expects that between 2 and 2.5 Mtoe energy saving will come from the EEOs that they will soon be introducing out of an anticipated 4.5 Mtoe.

As Table 6 shows, the EEOs are extremely important and a major contributor to the envisaged savings within those three countries that have such EEOs in place and quantified savings within their National Energy Efficiency Action Plan – indeed the Italian NEEP says that the most significant instrument in achieving its target will be the White Certificate mechanism.

The Falling Costs of Energy Efficiency Measures over Time

As market penetration of the more energy efficient versions of the products increases with time, then the initial higher differential cost of the energy efficient product decreases as would be expected from economies of scale. Again using data from the longest running Energy Efficiency obligation in the EU, it is clear that energy companies have driven down the costs and significantly improved the quality of installation of measures, particularly for the important insulation activities. Driving down the costs of energy efficiency measures is clearly of benefit even to those customers who do not participate in that particular phase of the EEO.

For example, data have been gathered on the prices and price differentials between energy efficient products and the less efficient products on the market by the Energy Saving Trust and the UK Government since 1994. These prices have been corrected for inflation and indexed to the real cost of energy efficiency measures in 2001[9]. Data prior to 1994 came from market research carried out by the Energy Saving Trust. Data from 1994 to 2002 were published by the Energy Regulator, Ofgem and since then data from the evaluations for DECC on EEOs have been used. Of particular importance is the use of GfK data[10] for products which track the progress of market transformation for energy efficient products as well as the price differential.

Figure 4 shows the falling cost of energy efficiency measures in real money over time in GB for typical energy efficiency measures. These are absolute prices for measures such as cavity wall insulation, CFLs, hot water tank insulation and fridge/freezer (A rated). The price for condensing boilers is the differential price compared to the market average for non-condensing boilers. This price differential started at £400 in 1994 and fell to £45 in historic cash terms by 2006.

Of course, fridge/freezer prices reduced over the period in line with the general trend in the costs of white goods due to the growth in production in the Far East but again using the GfK data, it is clear that the differential between an A rated and market average fridge/freezer dropped from £50 at the end of 2001 to only £6 (all historic prices) three years later. As the efficiency of the products continues to improve, a similar reduction in the differential cost between the energy efficient version and the non-energy efficiency version is evident. For example, for the A+ rated fridge/freezers (the most important product in the refrigeration market), the price differential dropped from £115 in 2004 to £30 by 2008 (historic price data). Finally, as evidence of real market transformation, by 2005 the B rated product actually cost £10 more than the A rated washing machine!

The cavity wall insulation prices have remained fairly flat in real terms during the period since 1996 despite significant increases in the cost of the raw materials due to their energy intensive nature. However dramatic drops between the pre Energy Efficiency obligation price for cavity wall and the current prices represents the transformation of the industry; this was driven by the energy companies in demanding both a higher

[9] The first energy company obligations with energy saving targets were introduced in GB in 1994.

[10] GfK is one of the world's largest research companies working in over 100 markets. It routinely tracks changing market sales for appliances etc. in many European countries.

quality service and to considerable productivity gains due to moving from one job per day to three jobs per day in the summer months with the longer day light hours.

Of course, some of these price drops cannot be repeated but equally innovation in new products and improved productivity in solid wall insulation will undoubtedly help keep the costs of energy efficiency measures, if not falling in real terms, at least constant.

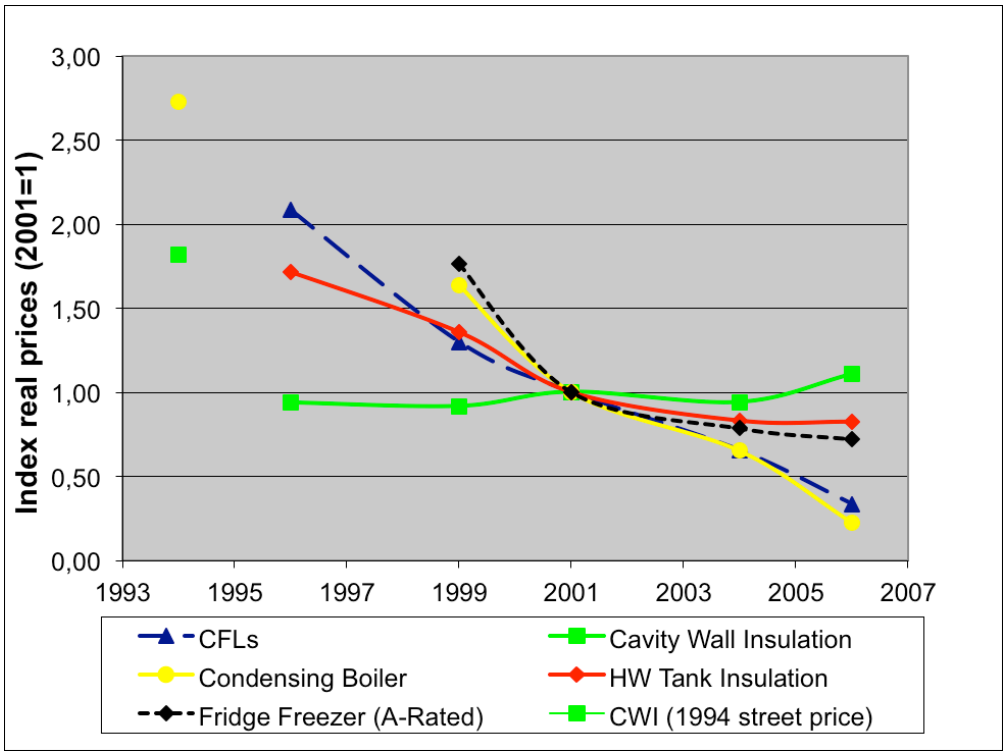

Figure 4: Falling costs of Energy Efficiency Measures under the GB Energy Efficiency Obligations from 1993 to 2008. *(Note: all prices are corrected for inflation and indexed to costs in 2001).*

Importance of Energy Efficiency Obligations to Energy Affordability

Various roadmaps have been published showing how the EU and its individual Member States might reach a situation by 2050 where the energy demand of the EU or country can be met while at the same time reducing carbon dioxide emissions by 60% or more. There will be a small penalty to GDP resulting from the increase in energy costs as the energy supply is decarbonised. In turn, this has given rise to concerns that, as the energy supply costs rise, energy affordability in a low carbon world will increasingly be a challenge. Indeed this is already an issue which is being picked up politically, e.g. the French White Certificates from January 2011 have introduced ring fenced savings for low income households similar to the Flemish and GB models.

The EU Emission Trading Scheme increases the cost of energy depending on its carbon dioxide content and so sends strong price signals to the supply side. However, the signals that are ultimately passed on through this to the demand side are much weaker. For example, in the UK for a 10% increase in electricity prices, demand reduction is 2.3%[11].

[11] It is also worth noting that the income elasticity increases demand by 3.4% for a 10% increase in income and throughout the last two decades, this income elasticity has been a major contributor to the steadily rising demand for electricity observed in most of the original EU15. Income and price elasticities quoted vary widely but a conservative value (i.e. higher in magnitude than central evaluations) has been used here – see for example www.uregni.gov.uk/uploads/.../NIAUR_Report_UU_revised.doc

However, recent studies both in GB and Ohio in the USA have shown that using EEOs are more effective in stimulating energy savings than a one off price rise. The GB study for this report looked at the effect of raising electricity prices by 3% (roughly equivalent to the magnitude of the price rise for consumers due to the EEOs that ran from 2005-8) compared to investing that price rise in on-going EEOs. The lower curve in Figure 5 shows the cumulative energy savings arising from such a 3% price rise with the assumption that the real price of electricity is constant in the period from 2005-2020 apart from the initial 3% increase[12].

The 2008 evaluation of the GB obligations[13] which ran during this period provided data that showed the levelised cost to electricity suppliers of saving a unit of electricity was 2 eurocents/kWh[14]. The actual electricity energy savings in the period 2005-8 were used to give an indication of how much electricity energy savings would be achieved each year and for how long they might last. The electricity energy savings are primarily insulation (36%), lighting (34%), and appliances and information technology and communications (ITC) (29%). Thus the calculation allows for the fall off over time of electricity savings from the shorter lived measures such as lighting, appliances and ITC. The calculation also corrects for comfort (increased amenity) which is important in lowering the insulation savings.

The calculation also assumes that the levelised cost of saving a unit of electricity remains the same in real terms after 2008 through to 2020. As was shown earlier, this is not such an unreasonable assumption as might be first assumed. Finally, it was assumed that there was an underlying growth in electricity demand for households of 1.4% which was the historic average over the twenty year period prior to 2005[15]. Figure 5 shows clearly that the cumulative energy savings by 2020 from investing that one off 3% rate rise in EEOs is nine times more effective than the cumulative energy savings arising from arising from the effect of the one off 3% price rise in 2005. The gap by 2020 is so large that any modifications to the assumptions are unlikely to affect the general principle that for households the energy price mechanism is not nearly as effective at saving energy as EEOs using that one off price rise to invest in energy efficiency.

[12] Thus a 3% price rise in electricity will reduce the residential sector demand on average by 0.69%.

[13] Report to DECC "Evaluation of the Energy Efficiency Commitment 2005-08" http://www.eoinleesenergy.com/

[14] Actually 1.7 pence/kWh converted at €1.18/£.

[15] Deduced from UK Government Digest of UK Energy Statistics 2011.

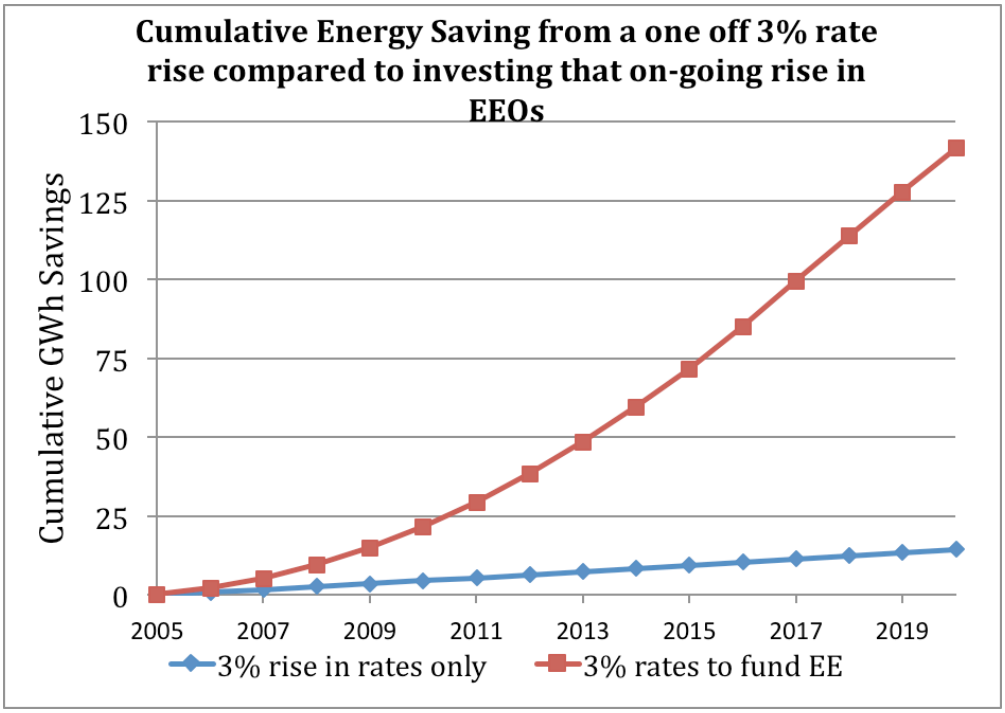

Figure 5: Comparison of the Cumulative Energy Savings from a one off 3% Price Rise Compared to Investing that On-going Rise in Energy Efficiency Obligations.

Is there any Evidence that Energy Efficiency Obligations Work?

As it is only in recent years that the EU EEOs have become significant in terms of their annual expenditure, then the natural place to look for an impact is in GB which has the largest EEOs. Furthermore, the obligation only applies to the residential sector and so it is easier to identify any potential impact. The top down evidence is considered first followed by reporting a study which has attempted a bottom up analysis from real customer data.

In GB, natural gas is the main (non- transport) fuel used in the residential sector accounting for over 70% of final energy demand in households. Prior to 2005, residential gas demand was increasing between 1 and 2% per year.

However in 2005, there were three important developments which all impacted to reduce demand. First, the Energy Efficiency obligation doubled in that year and 72% of the delivered energy savings between 2005 and 2008 came from insulation measures in gas households. Second, the Government introduced building regulations on boiler replacement which meant that condensing boilers had to be installed unless there were excessive costs or technical problems[16]. Despite initial fears that the exceptions to the building regulations might prove to be significant, the market penetration of condensing boilers quickly moved from 36% of the replacement market to more than 97%[17]. Finally, there were significant gas price rises for residential customers during this period which obviously contributed to a reduced demand for gas.

On the other hand, between 2004 and 2009 gas customers increased by around 1.6 million (7%) and this obviously would increase demand. Furthermore, there were more degree days in 2008 and 2009 than in the earlier period; no attempt has been made to

[16] As they were a legal requirement, then normal condensing boiler replacements were no longer elible for the GB EEOs.

[17] As there are ~1.3 million gas boiler replacements per year, this is a significant saving as the efficiency of the condensing boiler is typically 15 percentage points better.

allow for this but it is clear that the correction for 2008 and 2009 would increase any apparent energy savings as "warmer winters" are not an issue at the end of the period[18].

To do a full analysis is complicated but such a study is underway by the GB Government at present.

Figure 6 shows the residential gas demand as reported by the British Government for the years 2004-2009. No correction has been made for the colder winters of 2008 and 2009.

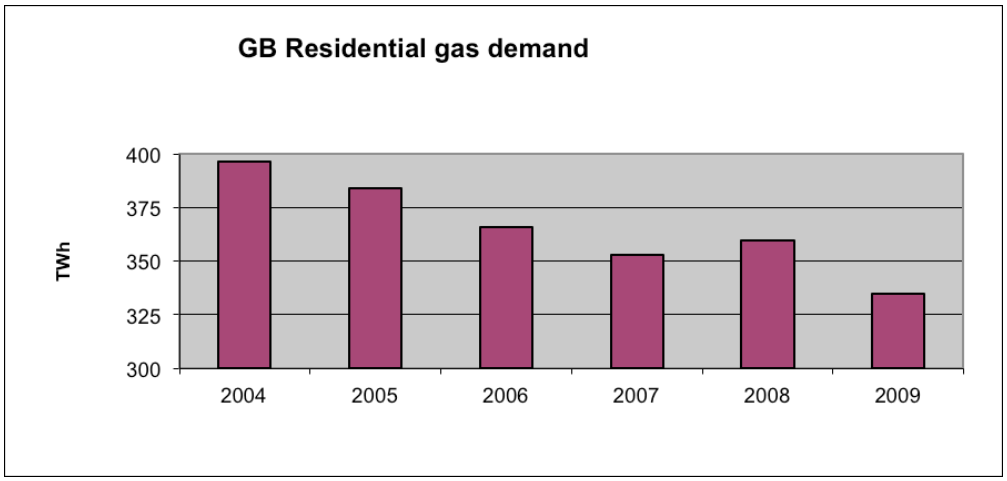

Figure 6: Reduction in GB Residential Gas Demand in the Period 2004-2009 (Source: Digest of UK Energy Statistics 2010).

From Figure 6 it is clear that there has been around a 15% reduction in total residential gas demand in GB over the five years despite a 7% increase in the number of households using gas.

In a separate study, British Gas has undertaken an analysis of the energy bills of ~4 million customers on their database over a similar time period and has observed that there has been a 22% reduction in the gas consumption per household during the period 2006 to 2009[19]. This is equivalent to gas demand falling by around 4.9%per annum compound over this period.

The study looked at factors affecting demand:

- Households, population, income and tenure of property
- External and internal temperatures
- Energy efficiency measures
- Changes in behaviour, lifestyles, increased climate change awareness etc.

They concluded that:

- Retail gas prices changes are not significantly correlated with household natural gas consumption changes (possibly due to customers switching to lower tariffs or switching to cheaper retailers)
- The economic factors did decrease annual consumption in some years but over period slightly increased consumption
- Behaviour and lifestyle changes (including greater awareness of climate change issues) reduced gas demand by ~ 2.7% per annum
- Annual reduction in gas customer demand was 3.3% as a direct result of energy efficiency measures (mainly insulation and heating)

[18] The years 2004 to 2007 were remarkably consistent in terms of degree days and 2008 & 2009 had around 10% more degree days than the others in this period.

[19] British Gas Home Energy Report 2011 – An Assessment of the drivers of Domestic Natural Gas Consumption, February 2011, Centre for Economics and Business Research Ltd

Their conclusion is that the major contribution to this reduction in gas consumption per household is due to energy efficiency.

Clearly both the top down and bottom up estimate are showing significant reduction in gas consumption per household over the period due to more insulation, better boilers and increased energy prices. None of these on their own can account for the observed reduction, but British Gas claims from analysis of their customer database that most of their observed 22% reduction per household (equivalent to falling 4.9% compound over the period 2006-2010) is due to energy efficiency. It is likely that government analysis will also show that energy efficiency is the major contributor to the observed reduction.

What are the Advantages of such Energy Efficiency Obligations

In short, they work! In the ~50 years of operational experience in the EU, all energy companies have met their overall energy saving targets.

This should be compared with other approaches where the energy companies do not have such explicit energy saving obligations. For example, in Spain since 2005, there has been a levy on electricity and gas distributors to raise about 70% of the funds required for an energy efficiency initiative. The funds are supplemented with money from the central and regional governments and the European Union. The energy efficiency funds are open to tenders for energy efficiency projects on a regional basis and the only companies who are not eligible for participation are those energy distributors who collected the money for the Spanish and regional governments. However, by the end of the 2006, some €368 million should have been spent on the energy efficiency projects but only €264 million was actually spent.

As the failure to meet the EEO results in a financial penalty for that obligated company, the contrast shows that such penalties clearly focus the mind! Arguably, the EEOs have an advantage that the target is expressed in the desired outcome i.e. energy or carbon dioxide savings rather than the intermediary of money.

Finally it is worth noting that such EEOs avoid the Member State governments having to use public expenditure to stimulate energy efficiency – this is very relevant with the current financial problems facing Member States.

Concluding Remarks on Energy Efficiency Obligations

Globally, and certainly within the EU, EEOs have been successful policy tools. This is despite the wide variation in the way that they have been implemented and also the energy market liberalisation status in these countries.

Within the EU, seven Member States see them as major policy initiatives which will help them meet their National Energy Efficiency Action Plan commitments and also those on climate change. Those Member States that have had them in place for a few years are continuing to expand their scope and there is growing interest from other Member States. They have resulted in more energy savings than would have been obtained from an equivalent rise in the price of energy alone. Furthermore, by reducing the number of units required for household energy services, EEOs contribute to energy affordability for low income households in the transition to a low carbon world.

Finally, in the largest EU EEO, there is evidence over the last five years that they are contributing to a significant reduction in gas demand. Furthermore they have helped bring down the costs of energy efficiency measures over time due to the fact that they successfully tackle many of the barriers to implementation of energy efficiency, particularly for small energy users such as households and small organisations.

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