Energy company obligations to save energy in Italy, the UK and France: what have we learnt?

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Abstract
Market failures and other barriers to energy efficiency result in some cost-effective opportunities for energy efficiency improvement not occurring within a free market. This causes economic inefficiency and results in higher energy costs, increased carbon emissions and greater risks to energy security. Intervention to address these issues in competitive energy supply markets is therefore justified, but should be transparent and equitable between different actors in the market. Tradable obligations on energy companies can achieve these goals. This paper outlines the experience of such obligations in three major European countries. Market liberalization in European countries led to new formal regulatory structures at the same time as concerns about energy security and climate change were growing. The UK, Italy and France all chose to address these challenges, in part, through tradable obligations. However, different national priorities and different energy market structures led to a variety of policy designs. This paper outlines these different designs, including the 'governance approach' (responsibility for regulation and administration), obligated parties, scope, scale and tradable commodity. It identifies the expected, and currently observed, outcomes - both quantitative and qualitative changes to energy markets. It comments on some key issues, including the impact of different energy market structure on regulatory choices and their outcomes, the importance of monitoring and evaluation and the effectiveness of the markets for trading. The paper compares and discusses the process of learning at national level and draws conclusions about key design issues for this type of policy instrument.

Background
Energy policy in Europe faces a number of challenges in the coming decades. Energy is a key driver of the economy and human activity. The competitiveness of businesses and the welfare of citizens therefore both depend on energy costs that are at an acceptable level. Europe also has a high and growing dependence on imported energy, in particular on oil and natural gas. In addition, Europe seeks to be a world leader in addressing the threat of climate change and has adopted tough targets for reducing emissions of carbon dioxide (CEC, 2008).

The priority given to these different challenges differs from country to country within Europe. However, in principle improving energy efficiency can help to address all these goals – lowering energy costs for businesses and households, limiting dependence on imported energy and reducing emissions of carbon dioxide. Energy efficiency therefore plays an increasingly important role in energy policy both at the level of the EU and within individual Member States.

It is well-established that there is a very significant potential for improvements in energy efficiency through using technologies that are already cost effective. This has been summarised by the IPCC (Levine et al, 2007). The existence of this potential implies that the market, unaided, does not deliver the full potential of energy efficiency and the reasons for this are now fairly well-understood. There is a large literature on barriers to energy efficiency over many years (e.g. Grubb, 1990; Sanstad and Howarth, 1994; Eyre, 1997; Sorrell et al, 2004, Stern, 2006). The effect of these barriers is under-investment in energy effi-

ciency across different sectors of the economy and in different countries.

The implication for the energy system is that the potential for energy efficiency improvement, if tapped, can supply additional energy services at a lower cost than new energy supply. The concept of the "negawatt" (Lovins, 1989) has been used to popularise this idea. Provided that negawatt-hours from energy efficiency can be delivered more cheaply than new supply, investment in energy efficiency reduces the total cost of the energy system and therefore total consumer bills.

The barriers to energy efficiency are not directly related to energy market structure. On the contrary, they are deeply embedded within a consumer economy (Eyre, 1998), and therefore the causes of energy inefficiency are largely independent of the energy supply system. Regulating companies in the energy sector to improve the energy efficiency of their customers has been used in a number of different market structures. The first application was in Demand Side Management (DSM) in the investor-owned, monopoly utilities that dominated much of the electricity sector in the USA until the 1990s. Utilities were subject to price controls with an acceptable rate of return allowed on capital employed, including the costs of utility energy efficiency programmes "on the customer side of the meter".

Market reform and liberalization in US energy markets resulted in a reduction in regulation for energy efficiency. But in Europe market liberalization had the opposite effect. As a number of countries used the process of market reform to introduce independent regulation of the energy sector for the first time, the conjunction of this process with increased recognition of the potential for energy efficiency led to the introduction of energy efficiency obligation on actors in the reformed markets.

This paper discusses and compares the experience in three European countries that have adopted this approach to energy efficiency – France, Italy and the UK.

THE UK

Gas and electricity markets in Great Britain (i.e. more than 97% of the UK market) were privatised and reformed separately in the late 1980s. Both the initial regulators accepted the case for household energy efficiency programmes as regulatory requirements, although the programmes were limited in scale and abolished in the gas sector when the first Director General of Gas Supply retired. The Labour Government, elected in 1997, moved responsibility for determining the scale of the obligations from the regulators to Government ministers and they have been a feature of energy markets since then (Eyre and Staniaszek, 1995). The approach has the attraction of requiring the market to deliver energy efficiency improvement without public resources. Obligations on suppliers (retailers) to deliver energy efficiency for household customers were re-imposed in regulatory rounds in 1998, 2000, 2002, 2005 and 2008. Some continuity of approach has been maintained despite name changes – from the Energy Efficiency Standards of Performance (EESoP), via the Energy Efficiency Commitment (EEC) to the Carbon Emissions Reduction Target (CERT).

The initial scale of the obligations was £25 M[1] per year in 1994. This has risen very significantly to an estimated annual supplier investment was £305 M per year in the period 2005-2008 (Lees, 2008) and is expected to rise to £844 M annually from April 2008 (Defra, 2007), with a commitment to retain at least this magnitude until 2020. A number of reviews have confirmed that the approach is highly cost effective (e.g. IEA, 2006: NAO, 2008; Ofgem, 2008; Lees, 2008).

ITALY

In Italy, the national implementation of the EU Directive on the liberalisation of the electricity and gas market gave rise to growing concerns over the possible negative environmental impacts of the liberalisation process, both in terms of rising energy consumption, as a result of gradually declining energy prices, and of prevailing myopic behaviours in the utility sector, which might result in reduced investments in activities with relatively longer payback period, such as energy efficiency programmes. These concerns have been addressed in the legislation that implemented the EU Directives (1999 and 2000), which determine that concessions for distributors shall contain provisions to increase end-use energy efficiency according to quantitative targets to be set by the Minister of Industry jointly with the Minister of the Environment. The need to set these targets gave the Government a great opportunity to rethink the structure of the policy tools used until then to promote end-use energy efficiency.

In 2001 two legislative acts were issued which set end-use energy efficiency obligations for electricity and natural gas distributors and introduced a white certificate trading scheme as one of the options to meet these targets. The following three years were used by the national electricity and natural gas Regulator (AEEG) to define the technical and economic regulation governing the scheme, which in the meantime was also revised in order to take into account some institutional changes (i.e. shared responsibilities between the Government and Regional administrations in the energy policy field), as well as some improvements suggested by AEEG.

The system entered into force in January 2005 for a five year period. On the basis of the positive results achieved, in December 2007 the scheme was extended until the year 2012; in addition, some of its components have been updated in order to increase its effectiveness.

FRANCE

To apply the relevant European Directives, the French government has progressively liberalized the gas and electricity markets since 2000. The last step of this process was the opening of the households market to competition in July 2007. Since then, the French market has being totally open to competition, although prices remain regulated for all consumers.

In the context of market liberalization, an important law was adopted on 13th July 2005, defining a new energy political framework (Loi de programme 2005 – 781 du 13 juillet 2005). This law deals with four main items: security of supply, competitiveness, environmental protection and public service obligations throughout France. In the area of energy efficiency, it establishes a group of policy instruments to encourage energy saving, including a white certificates scheme. A global energy efficiency target has been set: national energy intensity must fall by 2% per year up to 2015, and then by 2.5% to 2030.

Through the white certificates scheme, the Government involves energy suppliers in national energy efficiency policy, formally for the first time, by giving them energy savings ob-

Table 1. Key design features of white certificate systems

Design Feature	UK	France	Italy
Energy efficiency metric	Carbon	Delivered energy	Primary energy
Obligation period	3 year	3 year	1 year
Policy scope	Households only	Non-EUETS	All end-uses
Obligation holder	Energy supplier	Energy supplier	Energy distributor
Main delivery agents	Energy suppliers	Energy suppliers	Energy service companies
Price regulation	None	To be defined	Distribution charge
Trading actors	Energy suppliers only	Energy suppliers, public sector and businesses	Any

ligations. In this sense, the French white certificates scheme, which started in July 2006 for a 3 year period, does not follow from former policies or plans and is totally new for all the actors involved.

Policy Objectives

As set out above, energy efficiency improvements can deliver a number of policy benefits – in energy security, economic efficiency and environment. However, national priorities amongst these objectives and other characteristics of energy markets have determined different approaches in the three countries we consider, for example in terms of which actors are given obligations, which sectors of the economy are covered and how the obligation is specified. These are summarized in Table 1.

OBJECTIVES AND ENERGY EFFICIENCY METRIC

In the UK there has been a very high policy priority given to carbon emissions reduction. Until recent years when production of gas and oil from UK indigenous reserves began to fall, the priority of energy security has been lower than in many other European countries. The obligations have been set by the Government department responsible for energy efficiency and climate change (Defra and its predecessors) rather than broader energy policy[2]. The benefits of the obligations have therefore been measured primarily in terms of carbon emissions reduction and the obligation specified in terms of carbon (or fuel savings weighted by a carbon factor).

In France and Italy, the objective of the instrument is to reduce energy demand for a wider variety of reasons, including energy security and economic competitiveness. The Italian scheme aims at a range of policy purposes (e.g. greenhouse gas emissions reductions, reduced dependence on energy imports, development of the market for energy efficiency products and services) and the quantitative target is set in terms of primary energy savings, i.e. tons of oil equivalent saved. This provides a strong incentive to save electricity, as this leads to larger primary energy savings. In France, the carbon content of electricity is very low and a carbon metric would provide a very limited incentive for electricity efficiency; the obligation is specified in terms of final energy, irrespective of fuel, which provides a relatively stronger incentive to save non-electric fuels than the metrics used in the UK and Italy.

The crediting lifetime (that is the period over which certificates can be generated by a project) varies between the countries. In the UK and France, the assumed physical lifetime is used with savings discounted at a (low) public sector discount rate. In Italy, the lifetime is fixed at five years, with the exception of projects that reduce consumption for heating and air conditioning, where the crediting lifetime is currently set at eight years. Moreover, energy savings are accredited on an ex-post basis, i.e. only after they have been delivered. This design feature significantly increase the number of measures required to deliver the obligation in Italy compared to numerically equal targets in the UK and France.

The UK and French schemes both currently use an obligation period of 3 years. The aim is to have a sufficiently long period to provide a stable investment environment, without preventing Government from changing the level of ambition and design details at regular intervals. Earlier UK obligations have used periods ranging from 2 to 4 years. In contrast, the Italian obligation operates annually, but with indicative targets set for a longer period to provide investment certainty.

COMPLIANCE

The compliance framework depends on the regulatory and legal traditions within each country, but in all cases is applied through a financial penalty imposed by the energy regulator overseeing the policy delivery. In France, the penalty is pre-set and will be 2 c Euro/kWh of saving not delivered. In Italy and the UK there is no pre-declared penalty level. In both countries, the legislative rules require a case-by-case assessment of non compliance. This approach avoids setting a 'buyout price', which particularly in Italy would act as a reference price for trading certificates, thus distorting market signals as to the real cost of saving energy. In the UK, the stated policy is that any financial penalty should exceed the cost of delivery. In Italy, a one-year grace period exists if at least 60% of the annual target is met; if not, the financial penalty does not cancel the obligation.

The experience of non-compliance is too limited in all three countries for any comparative analysis based on outcomes.

POLICY SCOPE

White certificate schemes aim to incentivise investments that do not occur because of the barriers to energy efficiency. More conventional policies, e.g. based on tax, regulation or subsidy, have difficulty in delivering the full potential for final energy saving. This applies to a greater or lesser extent across all energy uses, and so, in principle, all sectors can be targeted.

The French obligation scheme targets energy saving by final energy consumers outside the scope of the EU Emissions Trading Scheme. It is expected that the majority of activity will be in buildings, but the scheme allows energy savings in other sectors, like transport and light industry.

The Italian scheme allows any technical energy efficiency measure in any sector. This tends to increase the potential for

cost-effectiveness compared to schemes with a smaller scope. In the first four years of implementation (2005-2008) at least half of each obligated party's target had to be met via measures involving electricity and natural gas use. Some restrictions apply to projects that have access to other incentives, e.g. CHP plants with access to green certificates and photovoltaic plants with feed-in tariffs).

Uniquely in the UK, the obligations have been restricted to households. The policy was initially implemented when the household energy market was not liberalized and justified in terms of this absence of a complete market. This was well before the EU Emissions Trading Scheme was considered, so the scheme has never been conceived of as a complement to the EUETS. Expansion to other sectors has not occurred, because of some business opposition to energy supplier involvement outside the household sector and because of fears that low income households might subsidize activity in other sectors. Social equity has been an important driver of UK policy design. It is assumed that costs of the measures are passed on to household consumers and therefore increase energy prices. Concerns about fuel poverty have led to an approach where a defined fraction (currently 40%) of activity is required to be undertaken in homes of a 'priority group' consisting of those on low incomes or otherwise vulnerable. This tends to reduce the cost effectiveness of the overall scheme.

OBLIGATION HOLDERS, DELIVERY AGENTS AND TRADING

In the UK and France, the obligation is placed on the energy suppliers (retailers) that sell to final consumers. The choice seeks to involve the actors in the energy supply chain that have a direct commercial relationship with final energy users. The idea is to use the commercial networks of these companies to incentivise energy saving. In the UK, this principally means 6 very large companies that dominate the household retail energy supply market. In France, the scheme includes about 50 electricity, gas, LPG, heating and cooling suppliers, whose sales to the buildings sector exceed a certain threshold (100 GWh/year for LPG, 400 GWh/year for others), as well as household fuel oil suppliers (for whom there is no specific threshold), so that a total of the 2400 suppliers is included.

In Italy, the obligations in the first four years of implementation (2005-2008) cover larger electricity and natural gas distribution companies - those serving at least 100,000 customers at 31 December 2001. From 2008 the obligation threshold has been lowered to 50,000 customers (served 2 years preceding the year of the obligation). Again, this was a deliberate choice, with the aim of developing a market for energy efficiency delivered by energy services providers, including Energy Service Companies (ESCOs), rather than necessarily by the obligation holders themselves.

The choice has important implications for the nature and extent of trading. In the UK, there is no transparent white certificate market. Only energy suppliers may have schemes accredited by the regulator and trading is legally limited to transfer of obligations (or delivery of those obligations) between energy suppliers. In practice each major supplier has developed a strong separate programme. The policy aim has been to change the business model of large energy suppliers to households away from commodity sales towards an 'energy services' model. The aim of the French scheme is broadly similar. It seeks to make the energy supply market evolve, so that energy suppliers integrate energy efficiency into their commercial approach: selling less energy, but selling differently, by developing energy services. In contrast with the UK scheme, the policy also allows for a market in white certificates, as there are some "eligible bodies", public bodies and enterprises (for actions on their own property), that can implement savings and obtain white certificates.

In Italy, trading of certificates is a central element of the scheme. Market deals require no authorization by the regulator or any other institution. Certificates are registered in an electronic registry and a dedicated electronic trading platform has been set up to allow the purchase and sale of certificates as an alternative to bilateral trading. Detailed rules and procedures have been designed to regulate access to the marketplace, to guarantee market transparency, security of market deals, as well as market liquidity. Trading operators include all eligible parties - all electricity and natural gas distributors, companies controlled by them and energy service providers, including, but not limited to ESCOs, as well as market intermediaries. From 2008, some larger consumers that have an energy manager can also be granted white certificates that can be sold to obligated parties.

PRICE REGULATION

In the UK, it is assumed that energy supply markets are sufficiently competitive, even at the household level, to limit excess profits, and therefore the obligated energy suppliers are not subject to price controls. In its analysis of the impacts of the policy, the Government assumes that costs of delivering the obligation are passed on in full to energy consumers.

In the other two countries, the obligated parties are subject to price controls, and therefore the treatment of costs of delivering the obligation is a regulatory decision. In France, suppliers remain subject to price controls, but to date, there has been no adjustment to price controls to reflect white certificate scheme costs. In Italy, the obligated parties are energy distributors, i.e. natural monopolies, and therefore operate in a regulated market. The policy package includes a cost recovery mechanism that allows them to benefit from a contribution from tariffs, which in the first four years of implementation was limited to the share of the target which is met via measures on electricity and natural gas use and from 2008 onward has been extended by the Government to include savings in other forms of energy excluding transport uses. The design of this component poses a number of specific regulatory challenges, characteristic of the Italian experience (Pavan, 2006). Standard allowed costs related to energy efficiency measures are the basis for determining the level of the contribution, as opposed to a pass-through of the actual costs borne and documented by obligated distributors. This choice is driven by the regulatory goal of providing incentives for distributors to look for the more cost-effective options to meet their obligation. Eligible costs include costs related to electricity and natural gas savings, up to the level of the target. This includes the costs of purchasing certificates, in order to avoid jeopardizing the development of the white certificate market and, therefore, an independent market in energy services. To avoid interference with the operation of the market, the tariff contribution is flat (i.e. technology-neutral); a differentiated tariff contribution

Table 2. Estimated outcomes for a recent single year of regulatory driven energy efficiency

	UK[1]	France[2]	Italy[3]
Annual end use energy savings (TWh)	3.5	1.3	4.5
Annual end use energy savings (%)	0.69%[4]	0.15%[4]	
Lifetime end use energy savings (TWh) [5]	53.5	18.0	52.0
Annual primary energy savings (Mtoe)	0.47	0.16	0.60
Lifetime primary energy savings (Mtoe)	5.87	2.02	6.99
Annual carbon savings ($MtCO_2$)	0.7	0.2	1.5
Lifetime carbon savings ($MtCO_2$)	19.6	6.1	17.8
Peak demand reduction in electricity (MW)[6]	299	86	612
total cost (M€)	311	180	
NPV (M€)	1043	428	
€c/kWh gas	0.58	1.00[7]	0.26[8]
€c/kWh elec	2.03	1.00[7]	0.27[8]
carbon cost effectiveness (€/tCO2)[9]	-53	-70	

[1] Based on evaluation of 2005-2008
[2] Estimates for annual average in July 2006 to July 2009 based on targets
[3] Based on 2005-2007 certified savings
[4] Compared to residential sector only for the UK, but for buildings sector (residential + tertiary) in France
[5] Lifetime savings are cumulative and discounted for UK and France (but at the different discount rates). The lifetime savings for Italy are based on estimated lifetime of the same as electricity measures in the UK.
[6] Estimate assuming load profile of savings is similar to the average load profile
[7] Ex ante estimate for gas and electricity average
[8] Based on market prices for white certificates
[9] Costs to the economy per unit of CO_2. Negative implies cost savings

would restrict the fungibility of certificates, reduce the scope for cost savings and increase administrative costs. Recently the criteria according to which the tariff contribution is fixed and amended have been updated.

Outcomes

Comparison of outcomes of current obligations across the three countries is not easy. The obligations are specified in different ways, cover different sections of the energy market and have subtly different objectives. In addition, the policy instruments vary from quite well-established (UK) to relatively new (France) and they cover different periods of time, with different rules for evaluation, so the extent of well-quantified information is very different. Effective quantitative comparison requires many additional assumptions and calculations. Despite this, some quantitative comparison is attempted below (see Table 2) for a single year of regulatory driven activity.

We have chosen to compare outcomes from periods of time that are reasonably recent and quite close in time. These are:

- For the UK: the annual average over the period of the Energy Efficiency Commitment 2 (EEC2), April 2005 to March 2008. This is now complete and has been evaluated by both the energy regulator (Ofgem, 2008) and for the Government (Lees, 2008).
- For Italy: the average of the first three years of the implementation period, 2005-2007.
- For France: the first period of obligations from July 2006 to July 2009.

The UK analysis is based on evaluated outcomes. For Italy, we use the certified savings for 2005-07. In France, as the first period is still running, we use the target data, informed by intermediate data available on 1st November 2008 (MEEDDAT / DGEC, 2008). In all cases, we judge the assessments to be the best available estimate of likely activity in a recent year. These outcomes are summarised in Table 2.

ENERGY SAVINGS

In the UK and France, the obligation is set in terms of the lifetime savings resulting from activity during the regulatory period. In the UK this was (in 2005-2008) specified in fuel standardised discounted lifetime energy savings (effectively lifetime carbon savings discounted at 3.5%). In the French scheme, energy savings are measured in final energy, summed over the lifetime, discounted at 4% and specified in "kWh cumac" ("cumac" meaning "cumulated and discounted"). In Italy annual savings are accounted for a standard 5 year lifetime (8 years for a limited number of measures):

Comparing the UK target for 2005-08 of 130 TWh, the French target for 2006-09 of 54 TWh cumac, and the Italian annual certified savings for the 3 years 2005-07 is therefore fraught with difficulty. To do this we have sought to estimate the annual savings in final energy, primary energy and carbon emissions resulting from one typical recent year as shown in Table 2.

The schemes are all of the same order of magnitude, aiming to save a significant fraction of 1% of energy used in the relevant sectors from a single year of activity. The UK scheme has been in existence for the longest period of time and grown in size over that period. The Italian scheme is now a little larger

in terms of annual savings and very similar for lifetime savings. The French scheme is more recent and smaller. Annual carbon savings in Italy are higher than in the UK, despite the latter explicitly targeting carbon, because of the strong focus on electricity savings in Italy.

Using some very simplified assumptions about the timing of electricity savings (that has nowhere been evaluated in detail), we calculate impacts on peak electricity load reduction ranging from 100 MW/year in France to 600 MW/year in Italy. This is a significant contribution to energy security, even in the UK where this is not an explicit objective.

It should be noted that all three schemes are scaling up, and therefore size comparisons depend crucially on the time period considered. In the UK, the target for all suppliers of 130 TWh in 2005-08 was surpassed by 44%. The excess is allowed to be carried over into the following obligation period of 2009-2011 (Ofgem, 2008), in which period the targets are approximately doubled. The assessment of the Italian scheme at the end of the third year of implementation (2007) shows that annual targets have been over-achieved, with trading an important option that has contributed to this over-achievement. The overall target allocated to obliged distributors for 2005, 2006 and 2007 was approximately equal to 1.1 million toe. The amount of energy savings certified by AEEG in the same time period equal about 1.8 million toe. This has allowed very substantially increased targets for 2008 and 2009. In France, the scheme is more recent and on 1st November 2008, 28.6 TWh cumac had been achieved, representing about 53% of the total obligation of 54 TWh cumac that energy suppliers have to reach on July 2009. This relatively low result is due to inertia and the time needed to implement the mechanism in 2006 and 2007. Nevertheless, it is expected that a majority of energy suppliers will deliver their obligation in July 2009 and that the target of 54 TWh cumac will be reached.

COST EFFECTIVENESS

Cost effectiveness is generally measured against the main objective of the scheme, although other metrics can be calculated.

In the UK, the costs were estimated in advance by Government (Defra, 2005) and have been recently assessed ex-post (Lees, 2008), with the finding that costs were 23% lower than originally expected, largely due to economies of scale and market transformation effects of the programme. The total economic benefit exceeded 3 billion Euro for a supplier investment of 0.9 billion Euro. The scheme has been accepted as highly cost effective by the relevant auditing body (NAO, 2008). In Italy, a comprehensive cost-benefit analysis will be carried out at the end of the regulatory period. Similarly, in France, because the first round of obligations is not yet complete, there is no monitored data on cost effectiveness. However, in both cases, from the scale of the energy savings and some knowledge of costs of implementation, we can conclude that the schemes are cost effective.

In all cases, the cost of energy saved was low compared to consumer prices. In the UK, the costs are estimated to be 0.6 c Euro/kWh for gas and 2.0 c Euro/kWh for electricity. In France, the Government estimates that the obligations could cost energy suppliers 1 c Euro/kWh cumac, which would be broadly consistent with costs in the UK. In Italy, some preliminary considerations can be made comparing the avoided energy cost for consumers benefitting from measures, with the tariff contribution allowed to obligated distributors and with the average market prices of certificates. This shows that in the first three years of implementation of the scheme, the energy cost avoided by consumers has consistently and widely exceeded both the amount of the tariff contribution and the average market prices of certificates (Pavan, 2008). The avoided energy cost is equal to six to twelve times the tariff contribution, depending on the fuel.

These results are broadly along the lines expected. The schemes seek to deliver cost effective measures, and therefore, provided energy company activities can overcome the barriers to investment with transaction costs that are small compared to the investment costs, the cost of energy saving will be less than the cost of avoided supply. This strong emphasis on cost effective measures allows carbon emissions to be reduced at a negative cost to the economy, which is -54 Euro/tCO_2 in the UK (Lees, 2008) and we estimate to be somewhat better (more negative) in France.

QUALITATIVE ISSUES

Technical measures

In the UK, the regulations require that all measures are implemented in households. The key measures undertaken, in order of energy savings delivered, were cavity wall insulation, loft insulation, efficient boilers, compact fluorescent lamps and efficient appliances. The very heavy reliance on insulation is driven by the evaluation metric (lifetime savings) which incentivises the use of long lifetime measures. In addition the availability of many millions of unfilled cavity walls to be insulated at low cost (~300 Euro) and high savings (~4 MWh/year) makes this the most attractive measure for suppliers. Heating measures are relatively minor, because high efficiency boilers are normally a requirement of building regulations, and therefore only attract a small credit.

In France, despite the broader scheme scope, more than 91% of the white certificates delivered by November 2008 originated in the residential sector, whereas tertiary sector represents only 3% and light industry 4%. The scheme uses 170 "standard actions". The majority concern buildings, representing a wide range of energy savings opportunities: heating, building fabric, lighting, ventilation, domestic appliances etc. In spite of this, initial results show a focus on only a few: individual efficient boilers (30%), collective efficient boiler (13.6%), heat pumps (12.4%), insulation (9.3%) and windows (6.6%). All of these are also eligible for the tax credit for household energy efficiency, another measure established in 2005. Energy suppliers have clearly directed their programmes to take advantage of this support.

In Italy, the largest contribution to energy savings certified by AEEG has so far been delivered by the market penetration of compact fluorescent lamps in domestic uses, replacement of mercury vapour light bulbs with sodium vapour bulbs with incorporated feeder for public lighting, industrial cogeneration, district heating, the diffusion of low-flow shower heads and aerating nozzles for domestic uses and solar thermal energy. The energy savings can be broken down into five broad categories of measures: reduction of electricity consumption in the household sector (59%), reduction of heating needs in

the household sector (21%), public lighting (8%), measures involving energy production and distribution system in the residential sector (mainly cogeneration with district heating) and industrial uses (6% each). The overwhelming majority of the energy savings certified to date (roughly 90%) relate to projects for which deemed savings, engineering M&V methods and streamlined procedures have been developed by AEEG (Pavan, 2007, 2008a), confirming the importance of having reliable but simplified calculation approaches and verification rules.

There are obvious differences in measures used, driven largely by national circumstances and the detailed rules concerning energy savings and lifetimes for which the measures are credited. However, in all of the countries, the technical measures that have been adopted to deliver energy savings have been predominantly basic energy efficiency measures in residential buildings, for which the scheme authorities credit 'deemed savings'.

Impacts on energy industry structure

In the UK, there has been very little impact on energy industry structure. Each of the six major household energy suppliers (British Gas, EdF Energy, Eon, RWE Npower, Scottish and Southern Energy, and Scottish Power) has developed its own programme, which is used to some extent as a marketing tool. However, despite some trials, energy services models have been unsuccessful, so that energy efficiency programmes are operated separately from the core activity of selling energy units. Insulation is undertaken largely through specialist installer companies, as suppliers have chosen not to diversify into this industry. Where insulation is in social housing, there are significant economies of scale through contracts with social housing providers. Energy efficient appliance programmes generally operate through major retail companies with energy suppliers providing an incentive for efficient models. In the EEC2 period this has extended from earlier cold and white appliances to integrated digital televisions. Compact fluorescent lamp schemes operate through similar retailer subsidy schemes as well as direct sales.

In Italy the largest share of EECs (76.6%) has been issued to energy service providers (including ESCOs), followed by obligated distributors (21.5%) and non-obligated distributors (1.9%). While the picture looks quite different for different obligated distributors, these figures reveal that the dominant strategy of obligated parties so far has been to rely on trading in order to cover a substantial part of their respective target and that the mechanism is promoting the development of the market for energy efficiency services. New operators are gradually entering the energy service market and new forms of partnership between various market actors are emerging. The number of energy service providers with at least one energy saving project certified by AEEG within the system was 140 at the end of the third year of implementation of the scheme (2007).

In France, energy suppliers have clearly integrated the scheme into their commercial approach to the household energy market. The majority have developed new services to encourage or support investment by households, through advice, individual audits, and financial instruments like low interest loans and up-front subsidies. To do that, suppliers had to form partnerships with retailers, installers, manufacturers and banks. In the installation sectors this has help to structure and organise the offer to households. This impact is due to a combination of the white certificates scheme and opening of the household market to the competition, leading to energy suppliers developing new services and commercial approaches.

In the UK and France, the obligations have been delivered by energy suppliers, working in partnership with energy efficiency industries (e.g. heating, insulation, glazing). This has been a new activity for energy suppliers undertaken as part of the new opportunities open to them in liberalised energy markets. But the obligations have not changed the core business of the energy suppliers. In Italy the situation is different, as the obligations are on energy distributors that do not have direct commercial relationships with final energy users. The obligations have therefore been delivered mainly through the development of energy service companies.

White certificate trading markets

In the UK, the legislation allows for trading of either energy efficiency obligations or the delivery of that obligation between suppliers. There is no transparent market in savings, although it is believed that there have been bilateral trades between suppliers, as well as sales of insulation measures to suppliers from the managing agent for Government funded programmes. However, the responsibility for registering schemes rests with the energy regulator, who will only consider applications by licensed suppliers, which effectively precludes the development of speculative activity by third parties.

In France, there is no organised trading market, but white certificates trading is possible via the register, as obligated bodies and eligible actors can exchange certificates through bilateral trades. However, up to 1st November 2008, only 0.44 TWh cumac have been exchanged, that represents 1.5% of the white certificates delivered (28.6 TWh cumac), with a value of 1.4 M Euro. To deliver their obligations, on the whole energy suppliers decided to implement programmes themselves with their household customers, in preference to using a white certificates market option. This strategy explains the fact that trading is in this initial period.

In contrast, in Italy trading is a central element of the scheme, both in regulatory terms and with respect to the quantitative outcomes. A platform for spot market trading has been organised and specific rules and procedures defined by AEEG in order to guarantee market liquidity, transparency and security of market deals (Pavan, 2007). Trading does not have to be authorised in advance. From mid-2008 both quantities and prices of bilateral deals (i.e. of over the counter-OTC trades) have to be registered. The obligation to register OTC prices has been introduced by AEEG in order to increase the transparency of trading, to the advantage both of market operators and of the Regulator: as market signals, if not distorted, are important to monitor the costs incurred by the system to meet its energy efficiency goals, and they are one of the possible reference parameters for updating the tariff contribution and defining the penalty for non- compliant parties.

Something more that 1.3 million white certificates have been traded in the three year period, a volume roughly equal to 120% of the assigned target of the same period, and that corresponds to 74% the total certificates issued during the same period of time. The volume of certificates traded OTC has been markedly

higher than the volume traded on the spot market (70% on the overall period), although the proportion traded on the spot market is gradually increasing (17% in 2005, 24% in 2006 and 35% in 2007). The prevalence of OTC trading is linked to an array of factors, including, but not limited to, the opportunity to conclude (bilateral) forward contracts to hedge against the risk of price volatility and, for the major obliged distributors, the opportunity to limit transaction costs by purchasing large quantities of certificates "in one shot" as compared to the small quantities being offered so far during market sessions. The nature and characteristics of some of the actors on the supply-side of the market has certainly had a role in driving them into the OTC market.

In the first year of implementation of the mechanism, certificates traded on the spot market at an average price of 77 Euro/toe in the case of measure involving electricity use (type I certificates), 94 Euro/toe in the case of measures involving natural gas use and 33.8 Euro/toe for other types of measures (type III certificates). In 2006 and 2007 market prices gradually but significantly declined as a result of the over-supply of certificates with respect to the demand driven by the energy efficiency obligation: in the third year of operation (2007) prices reached an average of 45 Euro/toe for type I certificates, 77 Euro/toe for type II certificates and 22 Euro/toe for type III certificates.

Of course, this decline in market prices was not only the result of the supply surplus; other important factors had an impact on this trend, among which: the lack of targets for the post-2009 period (that were set in December 2007, up to 2012); prevailing short-term strategies on the supply-side which, in turn, were at least in part the outcome of the characteristics of this market; possible market power on the demand-side which, again, was the result of the structure of the two reference markets; possibly, a lack of confidence in the penalty mechanism, which at that time was quite complex and possibly ineffective. At the end of 2007 a number of regulatory measures and legislative changes were introduced in the system with the aim of rebalancing the certificates market, promoting an upsurge of certificates market value and, thus, an upsurge of the incentives to develop of new investments in energy efficiency measures (Pavan, 2008b).

Comparing across the countries, the situation in France and UK clearly differs from that in Italy. Only in Italy is here a strong market in white certificates. In France and UK, there is some bilateral trading, but most of the obligations are delivered by the obligated companies themselves without using white certificate trading.

Consumer issues

In the UK, the effective delivery of measures is ensured through checks undertaken on behalf of the regulator. Compliance levels are high (Ofgem, 2008). However it is clear that customer awareness of the obligation as a mechanism, and of the role of energy suppliers in providing a subsidy remains very low. Research for the UK Government showed that only for lighting measures (where suppliers market directly to consumers) does awareness of the role of energy suppliers exceed 10% of households (Lees, 2008). For other measures, energy suppliers are not seen as important by consumers, even though the incentives deriving from their obligations actually play a key role.

In Italy the white certificates scheme is undoubtedly contributing to raising consumer awareness of the private and social benefits related to end-use energy efficiency. Although information campaigns and training programmes are not eligible within the scheme (due to the difficulties in measuring the energy savings directly attributable to these "soft" measures), the system is designed in such a way as to promote the diffusion of correct and complete information to final customers, which is a condition, sine qua non, for effectively promoting investments in energy efficient technologies. In addition specific tariff funds are devoted to this purpose.

In France, customers are generally unaware of the white certificates scheme and of the fact that energy suppliers have energy saving obligations. In contrast the household tax credit for energy efficiency is a very well known policy instrument. This accounts for the widespread use of tax eligible measures by energy suppliers.

Governance

The history of governance arrangements chosen differs to some extent between the three countries, although the basic approaches are now similar. In Italy, the Government sets the national target, the obligated parties, the eligible parties and measures; the Regulator (AEEG) is responsible for designing and updating the technical and economic regulation governing the scheme (e.g. measurement and verification approaches for energy savings, cost recovery mechanism, enforcement system, trading rules), of administering it (with the exception of trading on the spot market, which is administered by the Electricity Market Operator), of monitoring its outcome also to propose the Government legislative changes aiming at improving its effectiveness and economic efficiency. Indeed most of the changes introduced at the end of the third year of implementation of the system (2007) have been suggested by AEEG on the basis of the quantitative and qualitative outcomes monitored via its administration (e.g. increase of the annual target for the year 2008 and 2009, new targets for the period 2009-2012, revision of the apportionment rules, simplification and strengthening of the enforcement system, measures to reduce the level of concentration on the demand-side of the market and to increase the number of actors eligible on the supply side. The existence of annual targets as opposed to multiyear-target in the other two countries, has facilitated the introduction of these legislative and regulatory improvements.

In UK, the schemes were initially the sole responsibility of the electricity and gas regulators, initially separately. This introduced some problems, with different regulators taking a very different approach to interpretation of their legal duties with respect to how far this implied a responsibility to promote energy efficiency. All regulators were unwilling to impose targets that would significantly raise prices, even where there was good evidence that this would be a cost effective way to deliver consumer benefits and a lower cost energy system. This was resolved in a change in the legal framework (The Utilities Act, 2000) which gave the duty to set the target to Government (in practice to the Department for the Environment) with the regulator retaining responsibility for the detailed rules under which the energy suppliers work and for monitoring the scheme. There is no white certificate market to regulate, but

some bilateral trades to approve. And price controls do not apply to the obligated companies.

In France, a similar approach has been adopted to that in the UK and Italy with the Government (in this case the Ministries of Environment and Industry jointly) setting the target and the regulator implementing the detailed provisions, including the register through which limited trading occurs. The impact of the obligations on price controls in France remains open.

Lessons

In general, in all three countries there is a strong emphasis on using 'deemed savings' especially for measures where the savings from individual investments are too small to justify detailed monitoring. Whilst this approach can be criticized for leading to some inevitable inaccuracies, the alternative (of not allowing small projects or requiring over-burdensome monitoring) has much larger disadvantages.

In all three countries, there has been a growth in energy efficiency activity. The target of the regulation has resulted in this being undertaken by energy suppliers in UK and France, whereas in Italy an independent energy services market has developed. The existence of the regulation provides opportunities for new offers for customers, new services and new incomes streams.

The design of the regulation incentivizes delivery of energy savings at minimum cost. The main activity has therefore been in energy efficiency technologies that are already in the market and cost effective. There has been some limited attempt in the UK to incentivize newer technologies, but it seems unlikely that a market based solution of this type will ever alone be sufficient to bring through the next generation of energy efficiency technologies – it is a deliver policy mechanism not a substitute for RTD.

The policy mechanism is designed to influence investment in energy efficiency technology, rather than the effective use of that technology once installed. Where deemed savings are used, the savings relate to 'average behaviour' and therefore, by definition, there is no incentive to use the technology as efficiently as possible. This seems likely to remain a constraint of this type of policy mechanism (Eyre, 2008). Policy mechanisms that impact directly on energy users' behaviour should be seen as complementary. In the Italian white certificates scheme, information campaigns on the effective use of the installed technology are granted a premium of 5% if minimum information requirements defined by AEEG are met. In addition, tariff funds are used to finance information campaigns from electricity and natural gas distributors as well as audit schemes at the local level.

It is generally assumed that the costs of energy efficiency measures undertaken as a result of regulation will be passed through in energy prices, whether explicitly in regulated distribution charges or in supplier costs. However, the impact on prices is rather limited, approximately 1.5% even in the largest scheme in the UK in the periods assessed above. Because the measures incentivized are cost effective, this price increase is more than outweighed by reduced energy use, so that the net effect of the policy is a reduction in overall energy costs. However, it should be noted that the costs will tend to fall evenly across consumers, whereas the private benefits accrue to those taking advantage of energy efficiency offers. This uneven distribution of benefits may be politically important, although the public benefits of emissions reductions and improved security of supply, of course, apply to all.

Discussion

There are some important similarities between the three national systems we have considered. In all cases, the countries have moved from very centralized monopoly energy systems to liberalized markets. Although the emerging systems are very different in terms of ownership and market concentration, it was the establishment of formal regulation in each country that allowed inclusion of energy efficiency obligations within the energy market. In each of the three countries, the primary objective of the obligation has been increase the level of investment in cost effective energy efficiency measures. Although the extent of experience is different in each country, in all cases the policy is seen as successful.

Different national priorities have led to some important differences. The obligation in denominated in carbon in the UK, primary energy in Italy and end-use energy in France. This reflects different policy priorities, such as a high priority for energy security in Italy, and different national circumstances, e.g. a low carbon content of electricity in France. This undoubtedly will influence the technologies used to deliver the objectives, although in all cases cost effective energy efficiency remains central.

We can draw some conclusions across the three countries about the implications of energy company obligations for energy efficiency market organization and transformation. Schemes have been successful in transforming large product markets, for example, in all three schemes, partnerships between energy suppliers, manufacturers and retailers have strongly boosted the sales of efficient heating systems. But it is more difficult, and so far energy company obligations have been less successful, in engaging and restructuring the work of the key trades in the energy efficiency business, in particular those involved in building work that is critical to performances improvement of building fabric (builders, joiners etc). This is likely to require going beyond measures that install standard products with deemed savings. It would be interesting to analyse what might incentivise these broader changes, for example greater use of 'eligible actors' outside the energy sector and greater use of trading that is possible in the Italian and French scheme designs.

Italy's choice of the distribution companies as the obligated actors has produced a different energy efficiency market, with a much stronger emphasis on independent energy service companies. It is probably too early to tell whether this approach will be more cost-effective than the greater reliance on energy suppliers in the UK and France. However, there are increasing concerns in the UK that the very heavy reliance on energy suppliers will not be effective for the next generation of more expensive energy efficiency measures.

Cost recovery practice is also different in the three schemes: in Italy, a charge on electricity and natural gas distribution rates finances a flat tariff contribution per toe saved by obligated distributors, thus granting transparency on the costs of the system to final consumers; in the UK, energy suppliers can pass on their costs through prices in the liberalized market; in France,

the law allows an increase in energy regulated tariffs corresponding to costs approved by the public authority, although that possibility has not yet been implemented. In any case, in such a scheme, the economics has to work for obligated companies, whether it is through a formal cost recovery mechanism or profits from new markets and activities.

Some of the important differences seem to relate to the longevity of the policy instrument. The UK has the most experience of this policy approach. This has the advantage of allowing the size of the obligations to have been expanded over time, as regulatory and supplier experience accumulates and delivery capacity develops. On the other hand it clearly gives other countries the 'second mover advantage' of designing their policies based on the observed strengths and weaknesses of UK policy. In particular, two observed weaknesses of the UK system – the lack of a transparent market in energy savings and the restriction to the household sector – have both been improved upon in the French and Italian systems. However, at the most detailed level of scheme implementation the ability to learn across countries is restricted by the differences in the three schemes, with respect to objectives, scope and design. For example, in Italy, the extensive use of trading (with a specific marketplace, specific trading rules both for the spot market and for bilateral trading) has required regulatory choices that are specific to the Italian system.

Conclusions

Based on this analysis of three different European countries we draw some general conclusions for other countries that are looking at similar policy options:

1. Energy supplier and distributor obligations are a proven approach to delivering energy efficiency measures.
2. They contribute to delivery of a number of energy policy goals: economic, security and environmental, and at a scale that is sufficient for the policy to be make a significant contribution to these objectives.
3. The approach is cost effective, saving energy at lower cost than the cost of supply.
4. The policy benefits recipients of energy efficiency measures, with costs falling on all consumers.
5. The trading metric and other scheme details have a big impact on the mix of technical measures delivered.
6. To date the approach has been most successful in delivering mass market, cost effective measures in the buildings sector, using a 'deemed savings' methodology.
7. These is less experience of using the approach to deliver larger projects and in other sectors.
8. The approach is less likely to be successful for measures that are innovative or not cost-effective, or to deliver change in customer attitudes or behaviour. Complementary policies will be required to deliver these objectives.
9. Obligations placed on suppliers tend to lead to supplier-led activity with little trading; whereas obligations placed on distributors lead to more trading and independent energy service company activity.
10. Where the obligated companies are subject to price controls, the regulatory authority need to take into account the costs in price controls.

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Endnotes

1 The current (January 2009) value of the £ is close to 1 € and is treated as such throughout this paper, although higher rates (typically 1.3 to 1.4) have prevailed through much of the period analysed.

2 UK Government department responsibilities were revised in October 2008 to bring responsibility for energy and climate change into the same department.