Assessment and Experience of White Certificate Schemes in the European Union

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Introduction

- **Market-based instruments** (MBIs) are public policies which make use of market mechanisms with transferable property rights to distribute the burden of a public policy.

- In the **energy sector MBIs** have been used to promote RES-E and to cut harmful emissions (e.g. CO_2, SO_2, No_x quotas coupled with permit/allowance trading).

- Theoretically MBIs **minimize cost for society** for reaching a certain target (static efficiency) and create incentives to innovate and improve performance (dynamic efficiency).

Policy drivers in Europe

- Bringing **sustainability** to the energy sector:
  - **EU Energy Efficiency Target**: by **2020** the EU should save at least **20 % of its primary energy** in a cost-effective manner;
  - The **Directive on Energy End-Use Efficiency and Energy Services (2006)**: a target of **9%** over **9 years**; the Directive mentions White Certificates and leaves the option of the Commission to later on recommend introduction.
  - New proposal for a **Energy Efficiency Directive** (June 2011)
  - In 2005 the **EU ETS** has started – now is in the second phase.

- Energy market restructuring and **liberalisation**:
  - Directive 2003/54/EC: all customers are able to choose their gas and electricity supplier by 1 July 2007 at the latest;
  - Effects of liberalization on energy efficiency.

Energy Efficiency Policies in the EU

- **Traditional Energy Efficiency Policies:**
  - Energy taxation (at EU and national level);
  - Incentives for investments in energy efficiency (national);
  - Information campaigns (mainly national);
  - Promotion of energy services (ESCOs) (weak EU measures);
  - Minimum Efficiency Requirements (MEPS) for end-use equipment (at EU level) and equipment Labelling (at EU level);
  - Buildings Codes (standards) (at national level);
  - Energy Audits (at national level);
  - Voluntary programmes (mainly in industry at national level, but also for equipment and cars, these are at EU level);
  - DSM programmes (not many, at national level or regional level)
- **Innovative policy mechanisms**
  - Suppliers obligations & white certificates;
  - Feed-in tariff for energy savings;
  - 'Cap-and-invest' schemes.

De-regulation and EE: creating compliance markets

A possible market-based policy portfolio (compliance market) oriented towards end-use energy efficiency could comprise

- **Energy-savings quota** (obligation) for some category of operators (distributors, suppliers, consumers, etc.). The **quota** is achieved by energy **savings** associated to energy efficiency **projects**.
- Projects savings verified **by the regulator** and **certified by means of the so-called "white" certificates** (certificates for energy savings);
- The savings or the certificates or the quota could be **traded**;

Nature of tradable certificates

- A white certificate is both ***an accounting tool***, which proves that a certain amount of energy has been saved in a specific place and time, and a ***tradable commodity***, which belongs initially to the subject that has induced the savings (implemented a project) or owns the rights to these savings, and then can be traded according to the market rules, always keeping ***one owner*** *at the time*.

- As for renewable electricity certificates (a.k.a. green certificates), the value of the white certificate is different from the economic value of the saved energy (Euro/kWh).

- In principle white certificates can also be established for a **voluntary market** (this is happening in the US).

Key features

Five key elements of white certificates schemes:

1. the ***creation and framing*** of the demand (government set the **overall target** and its **apportioning to obliged actors**).
2. Institutional ***infrastructure*** and processes (such as measurement and verification) to support the scheme.
3. the ***cost recovery*** mechanism, in some cases.
4. A system of ***sanctions*** in the case of non compliance
5. the ***tradable instrument*** (certificate) and the rules for issuing and trading,

Major energy saving obligations and white certificate schemes in the EU

- **UK** (GB only) has a variation of this policy mix scheme since 2002 (successor of EESoP), limited trading;
- Tradable certificates have been introduced in **Italy s**ince 2005, and in **France** since mid-2006.
- **Flanders** (region of Belgium)*:* savings obligations imposed on electricity distributors without certificate trading option;
- **Denmark**: saving obligations on electricity, gas and heat distributors;
- In the pipeline: **Poland and Ireland**. The Netherlands, Portugal, Romania and Bulgaria are interested in this policy instrument.

Major design choices

- The results delivered (dominant projects and sectors) are determined the nature of the projects
  - Size of the obligation
  - Choice of primary or final energy,
  - Obliged and eligible actors,
  - Eligible measures and lifetimes of measures,
  - Measurement &Verification of savings (M&V) – e.g. penalise CFLs,
  - Cost-recovery,
  - Interactions with other policy tools.

- Administrative costs are a function of the simplicity of the system.

Different Actors in the UK

UK Government
(Set the target)

ofgem

The administrator
(Oversee the scheme &check savings)

Scottish and Southern Energy plc

ScottishPower

EDF

npower

e·on

British Gas

The suppliers **(Obliged parties)**

The installers

Get paid for installing at the customer premises

Scope of the obligation

- **Energy versus carbon targets:**
  - **Primary energy** (IT and Flanders) – bias on electricity, supply side projects (CHP, small-scale RES) – as part of general energy security and reliability of supply strategy;
  - **Final energy** (DK and FR);
  - **Carbon dioxide** (UK) – complements other CO2 policies.

- **Cumulative versus annual targets:**
  - Cumulative (UK and FR) – e.g. in the final year of the period
  - Annual (IT) –
  - Example of working with cumulative savings and long (technical) lifetimes of measures: the annual savings for cavity wall insulation under the CERT is roughly 3.01 MWh in year 1 to 0.75 MWh in year 40. This results in lifetime savings of approximately 65 MWh, which is 21 times the first year savings.

UK CERT Scheme

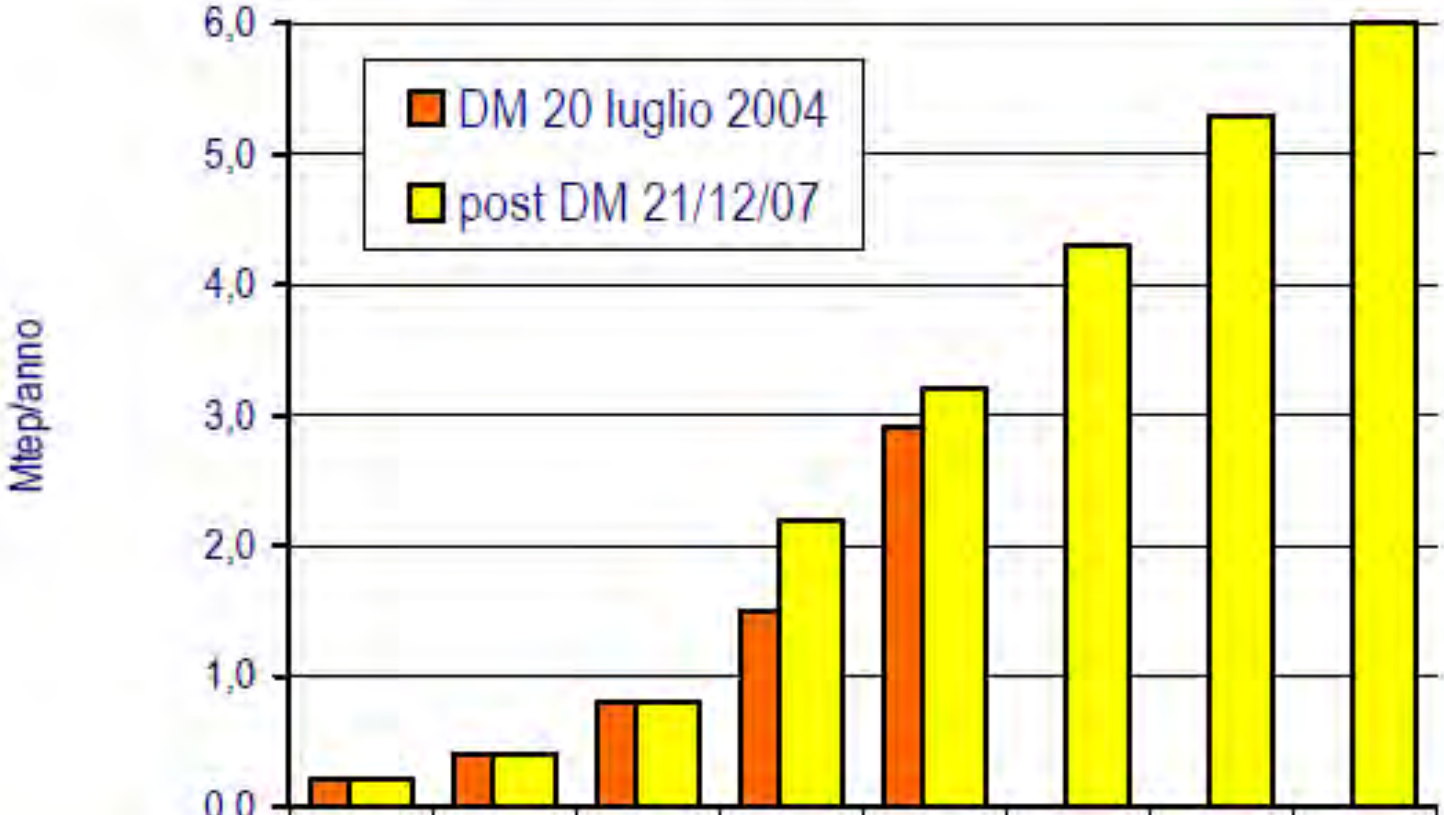
- The EEC and CERT are one of the principal policy mechanisms to deliver energy efficiency improvement measures into existing homes in Great Britain. EEC1 and EEC2 continue to deliver energy and carbon savings until 2020 (next slide),

Energy efficiency improvement programmes, energy services, and other measures to improve energy efficiency planned for achieving the target	Annual energy savings expected by end of **2010**		Annual energy savings expected by end of **2016**		Annual energy savings expected by end of **2020**	
Measures in the Household Sector:	**TWh**	**MtC**	**TWh**	**MtC**	**TWh**	**MtC**
Energy Efficiency Commitment Phase 1 (EEC1)	3.1	0.3	3.1	0.3	3.1	0.3
Energy Efficiency Commitment Phase 2 (EEC2)	7.8	0.5	7.8	0.5	7.8	0.5
Carbon Emission Reduction Commitment (CERT)	14.2	1.0	15.5	1.1	15.5	1.1
Supplier Obligation	0.0	0.0	31.2	2.2	50.2	3.5

Supplier obligation targets in the UK

- EEC-1: 62 TWh fuel standardised lifetime discounted.
- EEC-2: 173 TWh fuel standardised lifetime discounted.
- CERT target: 293 $MtCO_2$ lifetime savings in 2012 (approx. double increase from EEC-2).
  - Increased by 108 $MtCO_2$ and extended by 21 months, min. 68% of the increase (min. 73.4 $MtCO_2$ via professional insulation).
- The EEC and CERT are principal policy mechanisms to deliver EE into existing homes. EEC1 and EEC2 continue to deliver until 2020.

Italian targets



	2005	2006	2007	2008	2009	2010	2011	2012
DM 20 luglio 2004	0,2	0,4	0,8	1,5	2,9			
post DM 21/12/07	0,2	0,4	0,8	2,2	3,2	4,3	5,3	6

French targets

First Period (07/2006 to 06/2009)

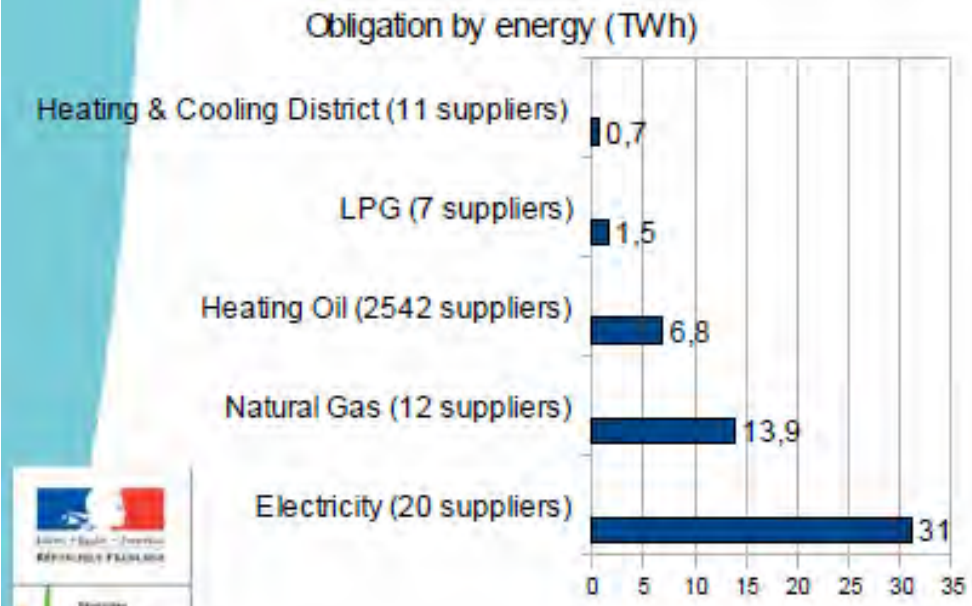
-Target : **54 Twh**

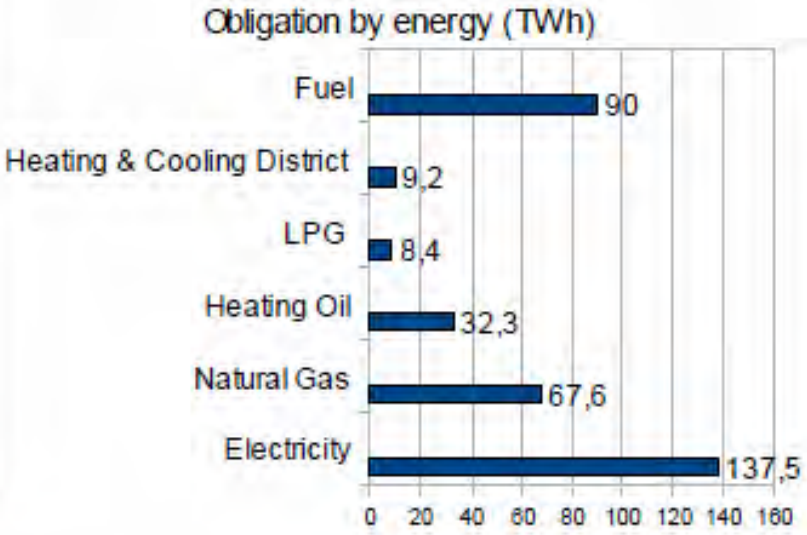
Second period (01/2011 to 12/2013)

-Target : **345 Twh**

-Added energy supplier : **fuel distributors**

Objective shared between energies then among suppliers
in each category according to their sales in the residential and tertiary sector





System scope 1/2

- End-use **sectors covered** (e.g. residential, tertiary, industry and transport);

- Types of projects and/or technologies eligible and modalities under which projects are allowed (e.g. lifetimes)
  - IT – all end-use sectors;
  - UK - residential sector only plus 40% priority group;
  - DK - all end-use sectors apart from transport;
  - Flanders - residential, non-energy intensive industry and service sectors;
  - FR - only excludes projects in industry sectors under the ETS.

- Energy saving obligations and white certificates are considered best suited for **measures in end-use sectors**, excluding generation projects
  - Some supply-side options: micro cogen, PV and SWH, in Italy grid-connected cogeneration and new district heating (boilers and network)

Type of projects in the UK

System scope 2/2

- A trade-off between harnessing the **full potential of a market-based instrument** and **managing the complexity and cost** of administering the system;

- In theory the wider the scope in terms of types of projects (compliance choices) and the fewer limitations in terms of compliance routes, the greater the benefits of the scheme, especially in terms of **trading and compliance costs**;

- Wide coverage implies more **diverse marginal costs** of compliance among trading parties and greater benefits of trading;

- On the other hand, extensive scope may result in difficult and expensive administration of the scheme.

Obligated parties 1/2

- **Suppliers** (retail companies) – UK and FR
  - Strong links to the final consumer and may have the motivation to offer value-added services;
  - Uniquely placed to provide information about consumption through billing and metering processes and to inform consumers about measures on offer.

- **Distributors** (DNOs) – IT, DK and Flanders
  - More stable regulated organisations, which are natural regional monopolies and will not go out of business (as may happen with suppliers);
  - With proper tariff regulation, they do not have the strong push to sell 'more kWh', as is in the case of suppliers;
  - However they are disconnected from the end-user and thus may lack motivation to do end-use energy efficiency.

Obligated parties 2/2

- Small market actors may be excluded (at least initially);
- Target apportionment
  - Based on market share (IT and DK; market share + turnover: FR) or number of consumers (domestic only: UK);
  - Target can increase linearly (all EU schemes) or not linearly with the obliged party size.
- Grid-bound energies only versus wider scope
  - Grid-bound energies (UK, IT and Flanders) or also other regulated energy providers (FR and DK), France also non-regulated (heating oil)
  - Regulated versus non-regulated energy segments
  - Start smaller scale (e.g. grid-bound only) and expand scope
- Large end-users
  - Are utilities best positioned to deliver savings in an efficient manner?

Role of ESCOs in Italy

Example of Eligible Actor

Tipologia di soggetto	Percentuale di TEE certificati rispetto al totale				
	fino a 31/5/06	fino a 31/5/07	fino a 31/5/08	fino a 31/5/09	fino a 31/5/10
Distributori elettrici obbligati	9,1%	6,1%	11,4%	9,8%	7,8%
Distributori gas obbligati	23,8%	9,4%	10,1%	8,4%	7,7%
Distributori non obbligati	2,5%	12,2%	1,9%	1,0%	0,4%
Società di Servizi Energetici (SSE)	64,6%	72,3%	76,6%	80,8%	83,5%
Soggetti con Energy Manager (SEM)	-	-	-	0,1%	0,6%
Totale complessivo	100%	100%	100%	100%	100%

Certificate trading

- Questionable whether **trading** is a key element in national systems;
- EU-wide certificate market would be very complex (e.g. need to harmonise measurement methods);
- Buoyant certificate trading is taking place only in **Italy**, where projects are implemented by **ESCOs;**

- France - **limited trading**
  - Suppliers prefer to implement the projects themselves through agreement with equipment suppliers and installers, positioning themselves as suppliers of energy services (utilities do not offer incentives, act as *"project organizers"*).

- UK - certificate **trading is not a feature of the scheme** and no formal certification of attained savings takes place.
  - Most suppliers use the same contractors to undertake the work;
  - Suppliers can only trade once they meet their own energy saving targets;
  - **Agreements with equipment suppliers** and installer to offer "standards" solutions to residential clients (not necessarily their customer base).
  - Banking of savings

Measurement & Verification: Baseline Definition

- Baseline: a counterfactual reference scenario without additional savings efforts;
- Must go beyond present regulation or market averages (additionality);
  - For appliances – beyond Ecodesign requirements (dynamic).
- Appliances and equipment: sales average and performance of the most commonly used appliance on the market “average-on-the-market”;
- Buildings: average consumption of installed stock of buildings;
- Building stock (e.g. in insulation measures in France);

Measurement & Verification: Lifetimes

- Technical lifetimes vs. fixed lifetimes of measures (e.g. 5 years in Italy applied until Nov. 2011, 1 year in Denmark and Flanders) - implications on additionality of savings.

- Saving estimates from measures with long lifetimes may be overestimates: in the course of the lifetime of the measure the baseline (e.g. market or stock average) remains at the same level as it was at the time when the savings were attributed.

BUT

- Fixed lifetimes for all measures may markedly penalise measures with longer lifetimes.

Monitoring

- Ex-post monitoring for utilization, satisfaction, etc. Using statistically significant samples.
- Spot checks at customers' premises.
- Expert visits, standardized questionnaires.

Measurement and verification: Italy

3 M&V approaches:

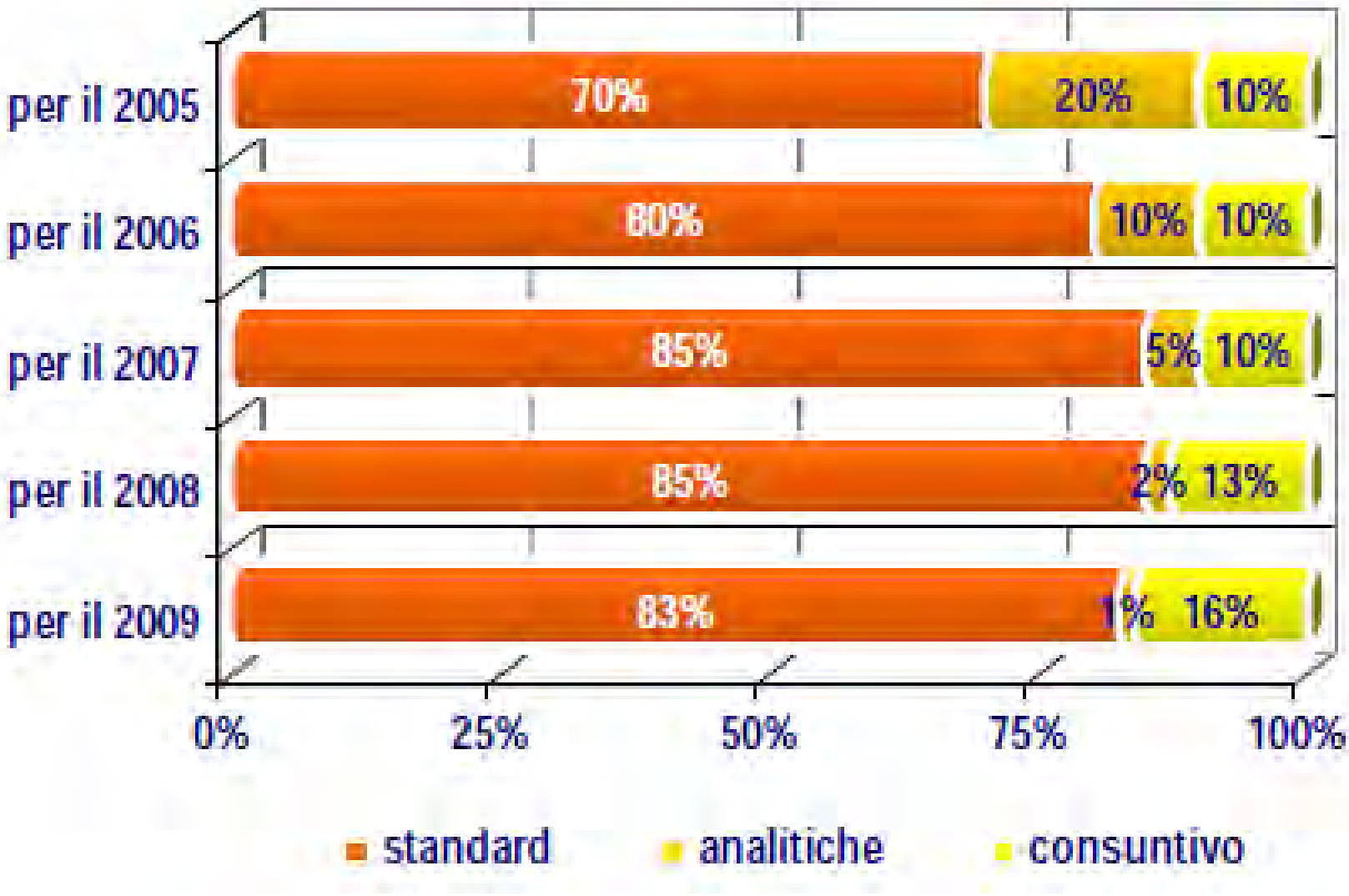
- deemed savings approach (saving per unitary actions fixed ex-ante) with default factors for free riding, delivery mechanism and persistence: no on-field measurements required;
- engineering approach, model with some on-field measurement,
- a third approach based on monitoring plans: comparison of measured or calculated consumptions before and after the project, taking into account changed framework conditions (e.g. climatic conditions, occupancy levels, production levels); all monitoring plans must be submitted for pre-approval to the AEEG and must conform with pre-determined criteria (e.g. sample size, criteria to choose the measurement technology, etc.)
- 90% of the savings delivered via projects submitted to date are of the deemed saving and engineering method variety. There is ex-post verification and certification of actual energy savings achieved (yearly)

Measurement & Verification: Italy 2/2

- 90% of the savings delivered via projects submitted to date are based on the deemed saving and engineering methods.

- Ex-post accreditation of annual savings (certification of actual energy savings achieved).

- Ex-post spot checks + link of the electronic registry with the information system of the regulator.


per il 2005
70%
20%
10%
per il 2006
80%
10%
10%
per il 2007
85%
5%
10%
per il 2008
85%
2%
13%
per il 2009
83%
1%
16%
0%
25%
50%
75%
100%
standard
analitiche
consuntivo

Measurement & Verification: France

- 214 standard values (incl. Measures in transport).
- Energy savings cumulated over the life time and discounted with a discount rate of 4% (kWh cumac).

Measurement and verification: UK

- Savings calculated and set when a project is submitted;
- A standardized estimate: technology used, weighted for fuel type and discounted over the lifetime of the measure of 3.5 %;
- ‘Comfort factors’ adjustment of carbon benefits, dead-weight factors accounted for.

Measurement & Verification: the UK

- Savings calculated and set when a project is submitted.
- A standardized estimate: technology used, weighted for fuel type.
- Ex-post verification (e.g. monitor quality of 5% of professionally installed insulation and heating measures via standardized questionnaire, 1-5% monitoring for utilization).
- Financial savings and benefits discounted by 3.5 %.

Measurement & Verification: Denmark & the Flemish Region

DENMARK

- Specific engineering calculation developed by obliged actors (dominant).
- Standard values approved by the Danish Energy Agency.
- Obliged actors are responsible for verification, documentation and reporting.
- Independent audit and quality controls are required.
- The Danish Energy Agency performs special controls of the documentation on an annual basis.

FLEMISH REGION: annual action plans by DSOs

- Description of actions.
- Target groups.
- Budget.
- Expected primary energy savings and methods for calculation.
- Data filed for reporting results.

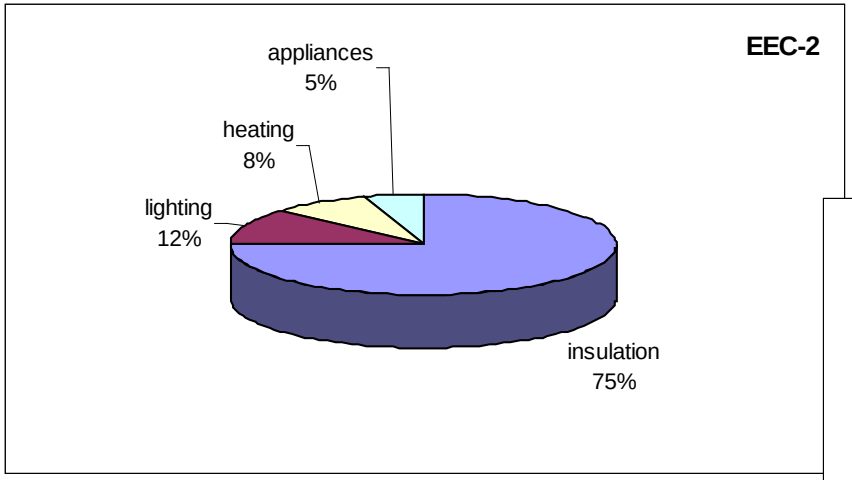
Examples of Eligibility and Reporting: France

- **In the first phase White Certificates may be claimed for any action taken by a legal entity, additional to this legal entity's usual activity, leading to energy saving (ETS installations excluded).**
- **In the second phase: Energy suppliers, local and regional authorities, social landlords and the national agency for residential housing ANAH.**
- **Additional to this legal entity's usual activity (out of its principal activity, no financial revenues provided).**
- **Supporting documents:**
  - Proving the active and incentive contribution (e.G. Certificate from the consumer).
  - Proving the reality of the action (bills, statements from the consumer).
  - Proving the absence of double counting (statements by consumer or contractor).

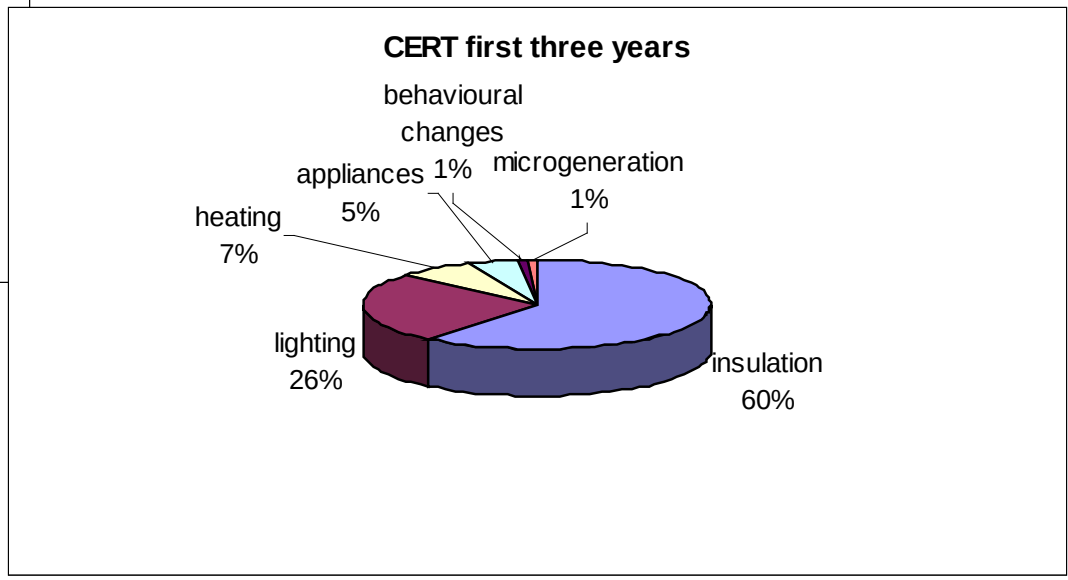
Results delivered in the UK 1/3

- EEC-1 over-compliance – 140% of the target and carry over to EEC-2 equal to approx. 28% of EEC-2 target;
- EEC-2 over-compliance - 144% of the target and carry over to CERT equal to 13% of the original CERT target;
- CERT - by the end of its third year (March 2011) suppliers delivered 67% of the overall target equal to 197 Mt CO_2 in carbon saving measures (including carry over).

Results delivered in the UK 2/3



Source: G. Purchas, DECC, UK



The heavy emphasis on insulation: lifetime savings and using technical lifetimes of measures, which provides an incentive for the use of measures with long lifetimes.

Greatest number of measures: professional loft insulation, DIY loft insulation and cavity wall insulation

Results delivered in the UK 3/3

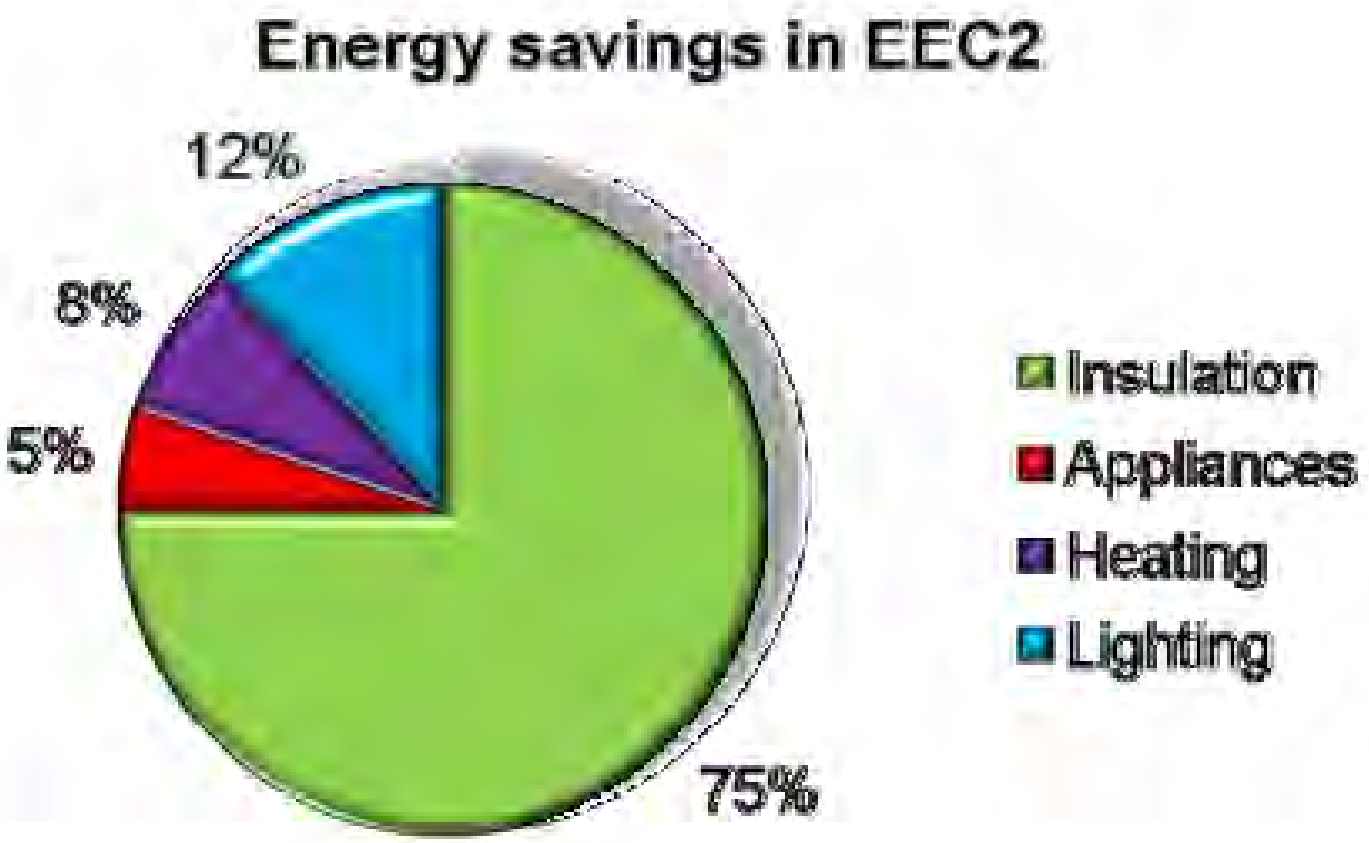
EEC 2002-2008

- **5 million households received insulation.**

CERT **(ongoing)**

- **More than 3 million households received insulation.**
- **300 million CFLs distributed (CFLs and halogen no longer eligible).**
- **Estimated 5 billion GBP to be invested by suppliers.**
- **2 billion GBP in societal benefits.**

Result in the UK

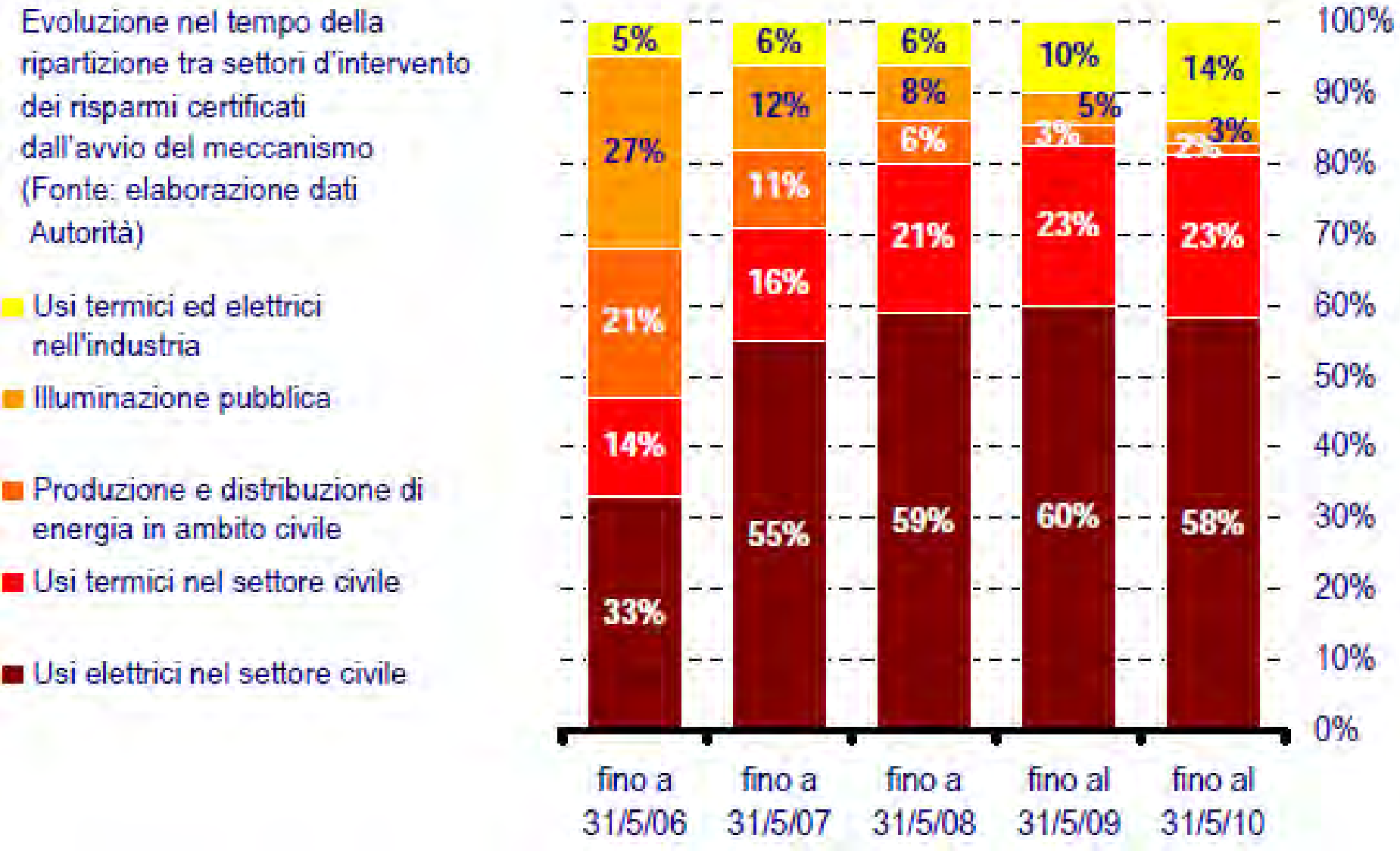


Source: G. Purchas, DECC, UK

Results in Italy

FIGURA 2.6

Evoluzione nel tempo della ripartizione tra settori d'intervento dei risparmi certificati dall'avvio del meccanismo (Fonte: elaborazione dati Autorità)



Results in Italy

FIGURA 2.8

Ripartizione percentuale tra borsa e bilaterali dei titoli scambiati annualmente dal 2005 al 2009 *(Fonte: elaborazioni su dati GME).*

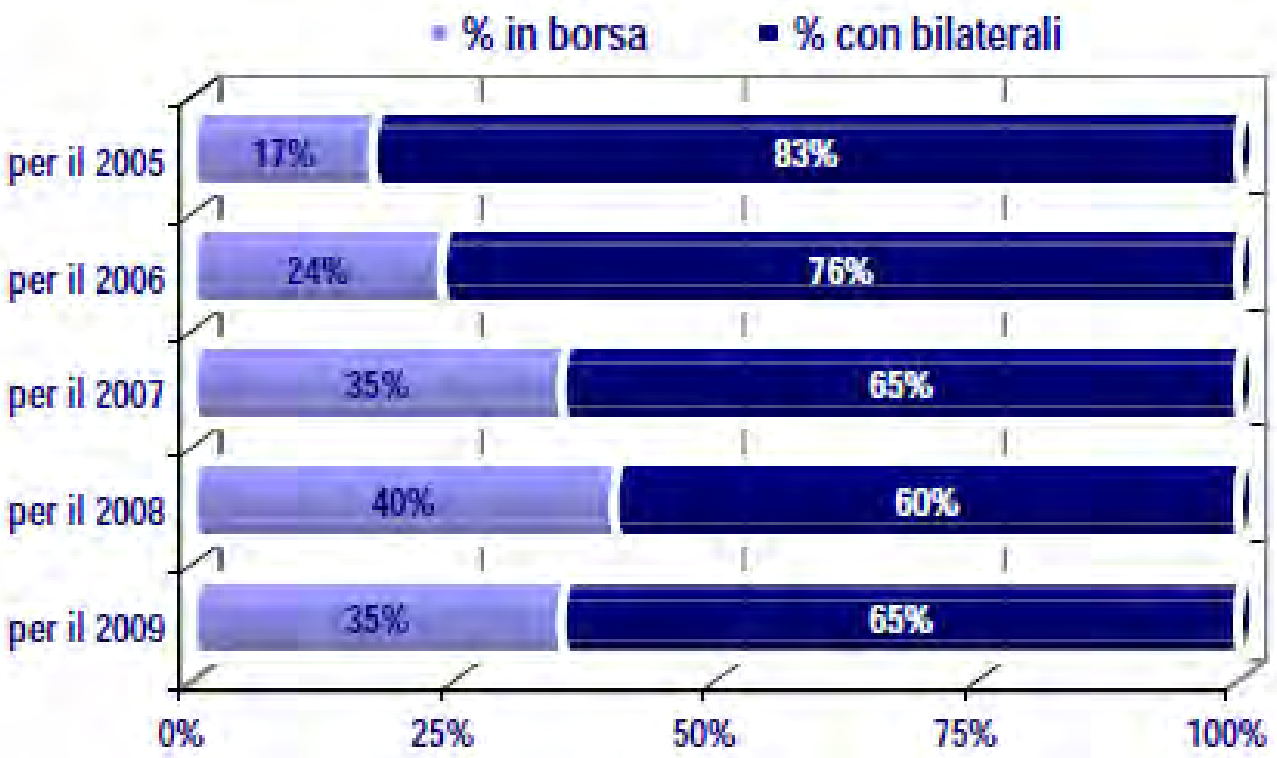
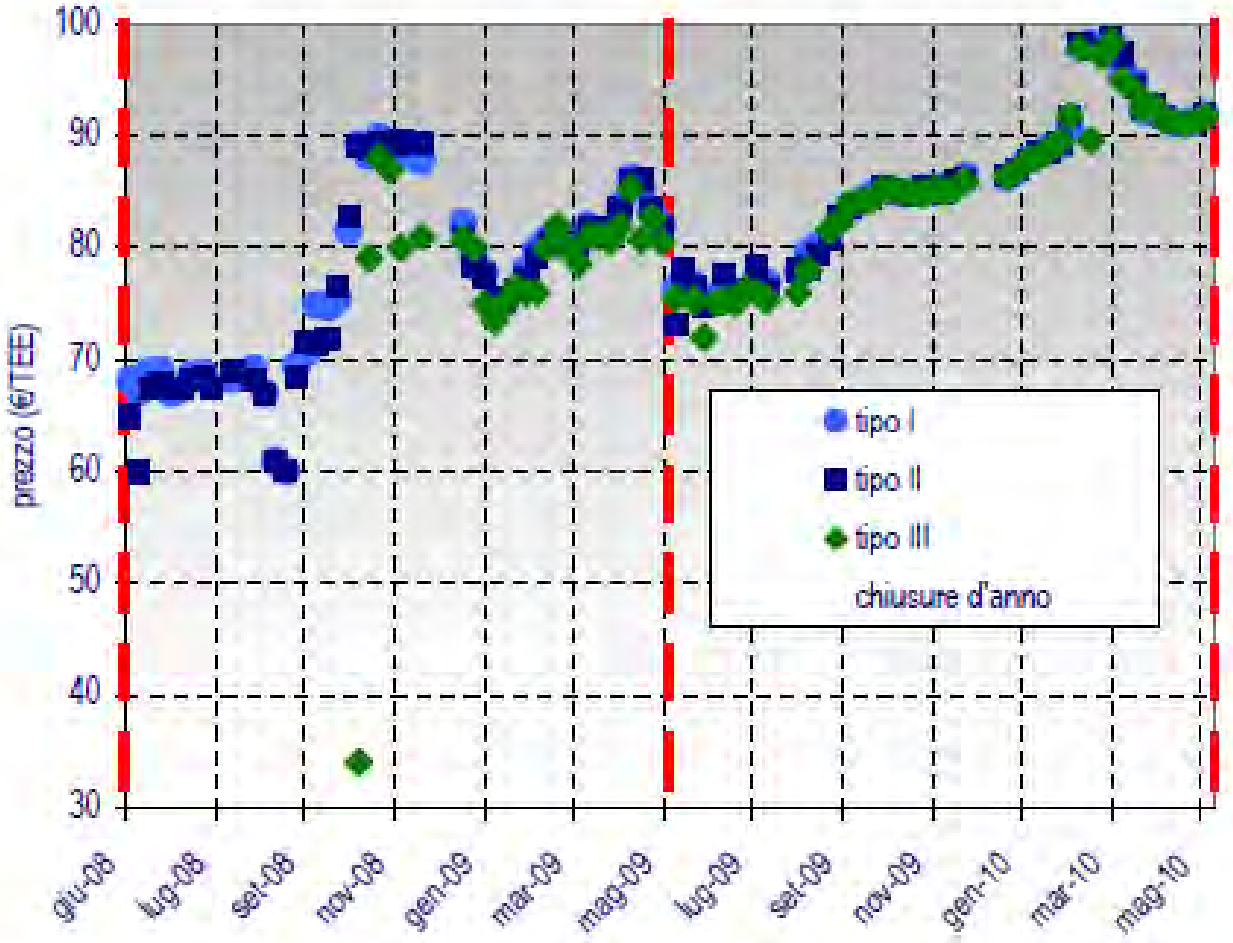


FIGURA 2.10a

Andamento dei prezzi dei TEE in borsa da giugno 2008 a maggio 2010 *(Fonte: elaborazioni su dati GME).*



Results in France

- **Results of the first obligation period**
  - More than 65 TWh delivered at the end of the first obligation period

Référence	Intitulé de l'opération	Part des économies d'énergie certifiées
BAR-TH-06	Chaudière individuelle de type Condensation	14,6%
BAR-TH-08	Chaudière individuelle de type Basse température	11,1%
BAR-TH-07	Chaudière collective de type Condensation	10,4%
BAR-TH-29	Pompe à chaleur de type air / air	9,3%
BAR-EN-01	Isolation de combles ou de toitures	6,8%
BAR-EN-04	Fenêtre ou porte fenêtre complète avec vitrage isolant	6,4%
BAR-TH-09	Chaudière collective de type Basse température	4,0%
IND-UT-02	Système de variation électronique de vitesse sur un moteur	3,6%
BAR-TH-04	Pompe à chaleur de type air/eau	3,5%
BAR-TH-24	Chauffe-eau solaire individuel (DOM)	3,5%

Secteur	Part du résultat total
Bâtiment résidentiel	88,1%
Bâtiment tertiaire	4,4%
Industrie	6,0%
Réseaux	0,9%
Transports	0,6%

Results in France

- End of march 2011, some figures :
  - 196,2 TWh delivered from the early beginning

Secteur	% kWh cumac
Bâtiment résidentiel (BAR)	83,25 %
Bâtiment tertiaire (BAT)	7,05 %
Industrie (IND)	5,96 %
Réseaux (RES)	3,52 %
Transports (TRA)	0,22 %

Sous-secteur	% kWh cumac
Enveloppe (EN)	17,03 %
Thermique (TH)	69,15 %
Equipement (EQ)	3,87 %
Services (SE)	0,48 %
Bâtiment (BA)	0,41 %
Utilités (UT)	5,54 %
Chaleur et Froid (CH)	2,56 %
Eclairage (EC)	0,97 %

Référence	Intitulé de l'opération standardisée	% kWh cumac
BAR-TH-06	Chaudière individuelle de type condensation	17,79 %
BAR-TH-08	Chaudière individuelle de type basse température	8,15 %
BAR-TH-07	Chaudière collective de type condensation	7,33 %
BAR-EN-01	Isolation de combles ou de toitures	6,13 %
BAR-TH-12	Appareil indépendant de chauffage au bois	5,70 %
BAR-TH-04	Pompe à chaleur de type air/eau	5,43 %
BAR-EN-04	Fenêtre ou porte-fenêtre complète avec vitrage isolant	5,30 %
BAR-TH-07-SE	Chaudière collective de type condensation avec contrat assurant le maintien du rendement énergétique de la chaudière	4,38 %
BAR-TH-29	Pompe à chaleur de type air/air	3,94 %
IND-UT-02	Système de variation électronique de vitesse sur un moteur asynchrone	3,51 %

Targets and Results - Denmark and the Flemish Region

DENMARK

- 2006-2009: 2.95 PJ (increased to 6.1 PJ for 2010-2012).
- 2006-2009: 114% of the target.
- 29.3% of the total savings were natural gas savings, 27.2% savings of electricity, 24.1% of district heating, 17.4% oil and 2.1% of other energy sources.
- Horizontal technologies in industry.

FLEMISH REGION

- 2009 target: 0.58 TWh.
- Exceeded by a factor of 4 with more than 2.5 TWh of primary savings achieved.
- Glazing, boilers, insulation.

System Costs 1/2

Cost to households:

- Italy: 3.7 Euro/household in 2009 (AEEG estimates go up to 6.4 Euro/hh in 2012).
- UK EEC-2: 6.9 GBP/year per customer per fuel bill (23% below ex-ante estimates).
- UK CERT: 45 Euro/year/household on bills.

- UK EEC-2 cost of conserved energy: 0.6 pence/kWh gas and 2 pence/kWh electricity.
- Italy: 1.7 Eurocents/kWh annual.
- Flemish region: 2.3 Eurocent/kWh primary (first year savings only).
- Denmark 2010-2012: approx. 6 Eurocents/kWh (4.5 Eurocents/kWh in 2006-2009, first year savings only or 0.45 Eurocents/kWh for average lifetime of 10 years).

System Costs 2/2

Administrative cost estimates (implementing authority):

- UK EEC-1: 1 million GBP over 3 years.
- France: 700,000 euro/year.
- Italy: 1 million euro/year.

General observations (1)

- **Over-compliance**, in some cases at costs below policy makers' expectations;
- Core element: the energy saving **obligation** (absolute or proportional to sales)
  - Voluntary markets not expected to emerge;
- Focus on **end-use sectors**, coverage of electricity and natural gas, at minimum;
- Best suited to deliver **low-cost** and **standard** energy efficiency measures, often targeting **small energy users**, lowering the transaction costs and contributing to market transformation;
- Function in both **liberalised energy markets** and whereby they target **monopolistic segments**;

General observations (2)

- Crucial importance of **measurement and verification**, strong focus on **standardised** saving values;
- **Trading** can bring added value where the targets are set sufficiently high with respect to the saving potential in the sectors covered;
- Trading may be better suited for broader systems, but even in smaller ones it reduces transaction costs;

Conclusions - 1

- The white certificate systems currently in operation in Europe **differ** markedly in their basic design features. The three schemes have shown good results, **meeting or exceeding the targets**.

- UK and France have chosen to impose the obligation on **suppliers** and Italy on **distributors** (grid owners).
  - Suppliers have **strong links to the final consumer** and motivation to market value-added services and the obligations seek to transform their business model away from pure commodity sales and towards energy service sale.
  - Distributors are more **stable regulated organisations**, which are regional monopolies. With proper tariff regulation, these do **not** have the strong push to sell 'more kWh', as is in the case of suppliers.

- **Certificate trading** is taking place only in **Italy**, where projects are implemented by **ESCOs.**

Conclusions - 2

- Questionable whether **trading** is a key element, it could make the scheme more cost-effective but also adds additional costs.
- There is **limited trading in France** as suppliers prefer to implement the projects themselves through agreement with equipment suppliers and installers to position themselves vis-à-vis their clients as suppliers of energy services (utilities do not offer incentives, act as *"project organizers"*).
- Certificate **trading is not a feature of the scheme in the UK** and no formal certification of attained savings takes place, due to lack of formal certification, most suppliers using the same contractors and suppliers can only trade once they meet their own energy saving targets.
- Obligated **suppliers in the UK enter in agreement with equipment suppliers** and installer to offer "standards" solutions to residential clients (not necessarily their customer base).
- Trading is a key feature of the **Italian scheme**, where distribution companies rely on other market actor to implement projects, and these are allowed to sell the certificate on the market.

Conclusions - 3

- Choice of primary or final energy, measure lifetime, obliged parties, eligible measures, and M&V, and cost-recovery determine the nature of the projects (e.g. many CFLs in IT and UK, none in France; building insulation in the UK, boilers in France).
- The dominant measures in France – efficient boilers, heat pumps, insulation and window – are eligible for tax credits.
  - This 'piggy-backing' is also due to the **lack of cost-recovery** (in France residential tariffs are regulated).
  - In contrast, in the UK and Italy (two different models of implicit pass through or explicit cost recovery), obligated parties tend to **subsidise** the energy efficiency intervention (more in the UK).
  - in Italy there are also very large tax credits, so most of the measures for the residential sector are implemented because of the tax credit and not the white certificates, in Italy subsidies are only for CFLs and white goods. Different the case for industrial and street lighting sector.
- Administrative costs are a function of the simplicity of the system.

Conclusions - 4

- The three schemes are dominated by **subsidy measures**, i.e. obliged parties subsidize savings measures partially or entirely (more in the UK and less in Italy – almost none in France).

- The three schemes are dominated by measures with **standardized saving factors**, especially in the residential sector (UK scheme only in the residential sector). Transaction costs for real measurement could be very high.

- It is difficult to give 'prescriptions' about the optimal setup concerning the **subjects under obligation**, the **sector covered**, the **eligible parties**, or **trading** rules (no trading, bilateral transactions or exchange).

- A **liquid** market – both in terms of demand and supply – would ensure realization of the economic benefits attributed to market-based instruments. Explicit **property right** and **ownership recognition** is needed with registry and transaction databases

- The **size** of the target, **lifetime** of measures, the redemption period, banking and borrowing of certificates, and the design of non-compliance penalties all have an impact on market liquidity and stability.

Conclusions - 5

- Supplier obligations and white certificates are one possible policy tool
  - Combine a project implementation mandate with financing channel;
- Performance depends on design choices and status of energy markets.

Thank you!

We welcome comments

For more information!

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