Ad Hoc Group
on Environment, RES and energy efficiency

Effects of the introduction of successful mechanisms to promote Energy Efficiency in non-EU countries

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Contents

Objectives of the document

This document has been developed within the Ad Hoc Group on Environment, RES and energy efficiency of the Association of Mediterranean Regulators for Electricity and Gas (MEDREG).

In particular, a *Task Force on Demand Side Management* was established in November 2007, under the Italian chairmanship, with the objectives of analyzing energy efficiency policies adopted in Mediterranean countries and of studying the possibility to introduce successful mechanisms in countries that still have not adopted them.

In the previous document Doc Med 08 – 07 RES AG: *Pros and Cons of support mechanisms to promote energy efficiency we* focused on the status quo of energy efficiency policies in Mediterranean countries, carrying out an assessment of energy efficiency policies actually implemented and analyzing the pros an cons of different demand side management interventions.

The objective of this document consists in verifying the possibilities to extend successful policies in other countries adhering to MEDREG, analyzing potential obstacles in their implementation and main factors of success.

In paragraph 1 we recall briefly main conclusions of the work previously carried out, identifying successful policies for the promotion of energy efficiency.

The following section analyzes from a general perspective problems that could hamper the introduction of successful mechanism for the promotion of energy efficiency in MEDREG countries.

Paragraph 3 points out key factors of success for the introduction of energy efficiency policies in Mediterranean countries.

A more empirical approach is followed in paragraph 4, where we focus on three case studies, concerning policies that demonstrated to be successful.

The first case study concerns the introduction of energy saving obligations in Europe. On the basis of actual experiences in the adoption of such mechanism, we drafted synthetic guidelines that could be useful for countries that are planning to introduce it in the future. The section is completed by a description of main results of the introduction of a white certificates market in Italy.

The second case study focuses on tender mechanisms and it is mainly dedicated to the relevant experience of Portugal. The section analyses rational, objectives and main results of this measure, pointing out critical issues and factors of success in the specific context of this country.

A third case study regards the introduction of a time based pricing policy, in particular through the adoption of smart metering. Regarding this measure, we drafted synthetic guidelines for the introduction of smart meters in MEDREG countries on the basis of the experience of countries that have already adopted them. The section then focuses on the planned introduction of smart metering in Jordan, highlighting main objectives of the measure, potential obstacles and main factors of success in the specific context of this country.

1. Introduction: successful mechanisms to promote energy efficiency in Mediterranean countries

On the basis of previous analysis of support mechanisms to promote energy efficiency, the most efficient instruments result to be the following:

- white certificates markets;
- tender mechanisms;
- time based pricing;
- energy audits.

The introduction of a **white certificate market** in Italy and in France demonstrated to be effective in the promotion of energy savings. Besides, the system helps to achieve savings in the most cost-effective way.

The action could have a positive effect also on research for energy saving measures, as energy operators will invest in innovative energy saving solutions and development of more efficient service products will be promoted.

For end-users, in the end, this action can provide better access to finance, creating a framework that favors a policy of investments.

Referring to potentially negative impacts of the introduction of a certificates market, administrative costs related to the introduction of a white certificate market may be significant, mainly because the action forces operators to carry out new tasks and because it is necessary to build up an accurate monitoring and certification framework.

An alternative market based mechanism to achieve energy savings consists in designing a **tender mechanism** for the selection of demand side management measures. Such an approach was successfully implemented in Portugal; measures submitted by eligible promoters are analyzed and approved by means of a competitive process and ranked according to pre-established rules, based on a cost-benefit analysis.

Time based pricing allows consumers to alter their daily load consumptions, so as to achieve relevant monetary savings. Moreover, it allows an improvement of the level of efficiency for the whole electricity system. Hourly metering, in particular, already introduced in Italy, Spain, Portugal, Croatia and Egypt, demonstrated to be successful for the promotion of energy savings through the introduction of price signals to end users.

A further successful policy consists in carrying out **energy audits**, implemented in Algeria, Egypt, Israel, Tunisia and Turkey and in nearly all European countries. It demonstrated to be effective in pursuing comprehensive energy management programs, enabling the reduction of energy consumption, fuel switching and load management for targeted customers.

2. Barriers for the implementation of measures promoting energy efficiency in MEDREG countries

On the basis of the experience of MEDREG countries, it is possible to identify some obstacles that hampered the actual implementation of energy efficiency measures and their effectiveness. Such obstacles concern political and economical issues, as well as deficiencies in the endowment in terms of human capital and technologies.

Political issues

1) lack of political support and politics credibility at national level;
2) lack of enforcement capabilities at all policy making levels, hampering the implementation of supra-national, national or local energy efficiency measures;

Economic issues

3) deficiency of proper economic incentives, in terms of incentives level, benefiting subjects etc.;
4) excessive costs related to measures, in particular excessive administrative costs to implement and monitor mechanisms;
5) lack of internalisation of external costs in current energy tariffs, leading to a situation where a strong incentive to save energy is missing;
6) deficiency in the availability of financing instruments and evidence of other financial obstacles, such as an insufficient development of the energy services sector, a lack of knowledge of existing financing possibilities and lack of knowledge about the energy efficiency sector at financial institutions;
7) ineffectiveness of the fiscal system in promoting energy efficiency, through levies, subsidies etc.;

Issues related to skills/technologies endowment

8) unavailability of proper technologies at industrial level; the problem is particularly relevant in some South Mediterranean countries;
9) lack of competences among market operators;
10) lack of information at customers and end-users level; the problem resulted to be a crucial issue also in some European countries, such as Italy and France.

3. Necessary actions to introduce successful mechanisms for the promotion of energy efficiency

In order to achieve significant results in terms of energy savings it is necessary to overcome all the obstacles previously identified.

1) *Lack of political support and politics credibility*

   National Governments should fix ambitious but realistic targets in terms of energy efficiency at country level.

   At the same time, national plans for the achievement of targets should be prepared, defining a range of measures and their expected impact; moreover, when appropriate, general goals should be tailored to specific sectors.

   Sectoral targets could be effective but they should guarantee the necessary flexibility for the achievement of overall targets.

2) *Lack of enforcement capabilities*

   Once objectives have been fixed, political will and engagement at national, regional and local level are necessary for their proper achievement. For this purpose, a clear definition of the responsibilities of different actors involved is necessary.

   The task of monitoring the progress in the implementation of measures could be attributed to energy regulators, that at this purpose need to be appropriately resourced.

   In some national contexts it would be desirable to establish a body taking over the task of implementing the national energy efficiency action plan and of coordinating the different activities carried out at different levels.

3) *Deficiency of proper economic incentives*

   Diversified but coherent incentives should be elaborated to pursue the objectives defined in the efficiency plans.

   Incentives should be well focused, predictable and proper in their amount, to guarantee an effective evolution of the energy system.

   Incentives should promote and support targeted sectoral and horizontal measures, including the introduction of measures promoting energy efficiency actions by operators and favoring a more active participation of demand in energy markets. A proper mix of incentivized measures should be set up to reach successful results, avoiding negative consequences of different support mechanisms overlapping.

4) *Excessive costs related to measures*

   Mechanisms should be defined so as to minimize the administrative burden and reduce transaction costs.

The benefits of introducing complex measures in terms of actors involved, implementable measures, control levels etc, should be carefully compared with major costs for their implementation.

5) *Lack of internalization of external costs in current energy tariffs*

Energy tariffs should be defined so as to allow that appropriate and cost-reflective price signals lead to a major awareness of end-users in the use of energy. The use of price caps for all or for certain categories of consumers (be it on electricity or gas prices or on fuel prices) has an adverse effect on the effectiveness of the price signal and thus on the incentive to improve energy efficiency.

6) *Deficiency in the availability of financing instruments*

The existence of proper financing tools to support energy efficiency actions should be strongly promoted.

In particular, it should be considered as a priority the problem of access to financial support by smaller companies and customers, for example in the case of small scale energy efficiency projects.

At the same time, proper financial incentives and other instruments to incourage consumer investment are to be inclined towards technologies necessitating a relatively high initial capital outlay.

Moreover, it should be carefully evaluated the potential of development of Energy Services Companies (ESCOs), that can help to capture cost-effective energy efficiency potentials in different countries, with the involvement of the private sector.

7) *Ineffectiveness of the fiscal system*

The fiscal system should be designed so as to encourage changes in the behavior and the use of new products that allow energy saving, both for residential and industrial consumers.

The use of energy and CO_2 taxes could balance the effect of direct and indirect subsidies incorporated into national or regional energy prices, so that energy consumers are provided with a more realistic indication of the actual energy costs.

Measures such as grants and subsidies should be carefully limited to better target the proper audience.

Tax relief measures should be designed such that they avoid to provide support for technologies that are already profitable.

8) *Unavailability of proper technologies at industrial level*

The problem can have strong and durable effects on the development of energy efficiency programs.

A partnership mechanism among MEDREG countries could favor the promotion of new technologies and the industrial development of the production of equipments. The presence of such industries in the South Mediterranean countries is going to give a substantial contribute for the promotion of energy efficiency in the region.

9) *Lack of competences among market operators*

Public authorities could play an important role in terms of professional training and selection of energy services companies.

10) *Lack of information*

Public awareness should be considered as a key factor for the effectiveness of energy efficiency policies, favoring a behavioral change towards a more rational use of energy.

Efforts should be focused on both general and targeted advertising campaigns and on the adoption of proper product labelling.

4. Case studies: guidelines for the adoption of successful policies in MEDREG countries

4.1. Case study 1 - Introduction of energy saving obligations: the Italian experience

A consolidated intervention for the promotion of energy efficiency consists in the introduction of energy saving obligations placed on energy utilities.

The definition of saving obligations does not imply necessarily the introduction of certificates (US model), nor of certificate trading (as in the case of United Kingdom).

Energy savings certificates known as "white certificates", rely instead on the creation of a market for trading.

Whenever certificates are issued to demonstrate the achievement of energy savings, four systems are possible:

a. imposition of energy saving obligations and verification of compliance via certification of savings;
b. imposition of energy saving obligations and trade of obligation or certified savings;
c. introduction of savings certification to demonstrate eligibility for tax relieves, subsidies or carbon offset programmes;
d. a wider definition: scheme involving an obligation that can be met by improved energy efficiency and in which energy saving certificates can be created and traded within a larger allowance, certificates or project credit trading regime.

The focus in this document will be mainly on case b), i.e. the introduction of energy saving obligations and the release of white certificates demonstrating the implementation of interventions promoting energy efficiency. At the end of a compliance period obliged parties have to submit a number of certificates corresponding to their obligation; utilities can either implement actions to meet their energy saving target or buy certificates on the market.

This represents the most complex design for the achievement of energy savings; main considerations that will be drawn, however, can be easily extended to the case of more simplified systems, such as the introduction of energy saving obligations without the possibility of certificates' trading.

The white certificate systems currently in operation in Europe differ markedly in their basic design features; such systems are active only in Italy (since January 2005) and France (since 2006) among the Mediterranean countries[1].

4.1.1. Basic design features for the introduction of a white certificates market

Main design features relevant for the set up of a white certificates market are the following:

a) nature of the mechanism: compulsory or voluntary;

b) target;

c) period of compliance;

d) unit, denomination and value of certificates;

e) obliged party;

f) interventions deliverers and ownership of certificates;

g) promoted interventions;

h) certificates trading;

i) institutional design of the scheme;

j) measurement and verification (M&V) approaches;

k) cost recovery;

l) non compliance framework;

m) interactions with other mechanisms.

a) Nature of the mechanism: compulsory or voluntary

There are two main options to create demand for tradable certificates for energy savings, by obligation or by some kind of incentive (for instance, tax exemptions).

[1] At European level, other countries have or planned to have energy efficiency obligations on energy companies: United Kingdom, Belgium (Flanders Region), Ireland, Netherlands, Denmark and Poland.

In principle, white certificates can also be established for a voluntary market and/or for carbon markets. An entirely voluntary scheme, however, is unlikely to create a substantial market for white certificates.

On the other hand, imposing obligations provides for certain outcome, but at the same time opens a whole new array of associated design complexities.

European countries implementing up to now a compulsory white certificates market, entailing the trading of certificates, have been:

- **Italy** (2005-2009, updated until 2012)
- **France** (2006-2009)
- **United Kingdom** (2002-2005 (EEC-1); 2005-2008 (EEC-2); 2008-2011 (CERT))

In United Kingdom, in particular, the Carbon Emission Reduction Target (CERT), following on from the Energy Efficiency Commitment (EEC), requires gas and electricity suppliers to achieve targets for a reduction in carbon emissions generated by the domestic sector.

Poland has announced in its National Energy Efficiency Action Plan the implementation of a white certificate system in 2009.

Other countries, such as Belgium (region of Flanders), Ireland, Netherlands and Denmark, introduced energy savings obligations, without allowing tradability of certificates.

b) Target

Energy savings targets, generally set by national Governments, should be ambitious, gradual and reachable.

Energy efficiency targets should be **long term** targets (covering at least 3-5 years), in order to favor the adoption of more structural interventions by market operators. Moreover, only long term objectives, as well as a regulatory stability, can guarantee a better environment for investments.

For this reason, when introducing energy savings obligation relative to a period, there should be certainty about the follow up of the program in the next years, at least in its basic framework. For this purpose, targets should be properly fixed before the end of the previous compliance period.

The general target should be then split among obliged subjects on the basis of clear criteria, so as to favor its actual achievement.

Regarding the formulation of targets, they may refer to:

- primary or final energy;
- different units of measurement: MWh, toe or carbon.

The policy goal under which a white certificates scheme is introduced has direct implications for setting the unit of the target.

If the scheme builds on the policy goal of **improved security of supply**, the target will preferably be defined in primary energy savings, while if the aim is **reliability of energy supply** the target will be set in terms of final energy. In fact, a target expressed in terms of primary energy will involve supply side efficiency improvements.

A scheme based on a quantitative CO_2 reduction target involves a certain risk of non-carbon benefits of end-use energy efficiency being ignored; unless it is explicitly specified that the scheme refers to end-use energy efficiency, a target expressed in CO_2 and/or primary energy may focus action on supply side projects or other not energy efficiency related emission mitigation projects.

Italy introduced annual targets for 5 years, extended to other 3 years, while France and UK established cumulative targets for a period of 3 years.

Considering also countries introducing savings targets without a trading mechanism for certificates, goals were mainly expressed in terms of final energy, using TWh as unit of measurement. Notably, Italy and Belgium chose to refer to primary energy. The program CERT in UK, introducing a goal in terms of carbon emissions reduction, refers to $MtCO_2$.

Table 1 – Energy savings goals in European countries introducing a white certificates market

	France	United Kingdom			Italy
		EEC-1	*EEC-2*	*CERT*	
Target (cumulated)	54 TWh	62 TWh	130 TWh	185 $MtCO_2$	6 Mtoe
Fuels	electricity, natural gas, LPG, heating/cooling, heating oil	electricity, natural gas, coal, oil, LPG	electricity, natural gas, coal, oil, LPG	electricity, natural gas, coal, oil, LPG	electricity, natural gas, other fossil fuels
Reference period	2006-2009	2002-2005	2005-2008	2008-2011	2005-2012

c) Period of compliance

A yearly compliance period presents the advantage of favoring a regular and progressive achievement of energy savings goals by obliged parties. Moreover, it may allow to monitor more effectively the functioning of the mechanism.

A short term period of compliance, on the other hand, requires the introduction of the necessary flexibility instruments, such as the possibility of using certificates in excess for the following year (banking) and, in case, of compensating a shortage of certificates (borrowing).

In Italy the compliance period is equal to one year, while in France and United Kingdom it corresponds to a three year period.

d) Unit, denomination and value of certificates

The unit of white certificates will correspond to that used in the establishment of the energy saving target, final or primary energy and defining the appropriate unit of measure (MWh, toe, carbon etc.).

A further step consists in the definition of the minimum size of certificates; the way it is fixed should satisfy a simplicity criterion and be not so high to discourage small scale projects.

Certificates may be differentiated according to the type of intervention carried out, e.g distinguishing among certificates from projects inherent to the electricity sector or to the natural gas sector. This becomes relevant when obliged parties have to pursue a share of their goals through interventions in one or more specific sectors.

Other relevant issues relate to:

- the coverage of certificates;
- the validity of certificates;
- banking / borrowing.

Concerning the **coverage** of certificates, different options are possible:

- annual savings: when an activity has been accepted to produce certificates, they will be issued once a year for a fixed period of time;
- lifetime savings: savings relative to each project are measured over the technical lifetime of the activity, with future savings discounted at an annual rate (discount rate);
- savings under the life of the white certificates scheme.

The choice of the conventional period during which certificates for an eligible project can be issued is crucial in determining the attractiveness of different projects; short periods can disincentive structural interventions, such as building improvements or projects in the industry sector.

On the other hand, long standard lifetime of projects increase the cost effectiveness of measures, by increasing the savings granted compared to those measures with similar annual savings but with shorter lifetimes; the use of a discount rate in the quantification of savings reduces such effect to some extent.

Banking allows participants over compliant with a target during a compliance period to carry over certificates in excess and use them to achieve saving goals in the following compliance period.

This option, as well as a long certificate validity, increases the elasticity and flexibility of demand in the long term. In any case, banking for obliged parties should be allowed only once they achieve their own targets, so as to reduce uncertainties about the achievement of the policy target. Moreover, proper limits to the use of banking should be introduced, e.g. in terms of the share of certificates allowed for this practice.

Borrowing consists in the possibility of using future certificates, expected to be generated in the next period, to meet current obligations.

This practice should be discouraged because it could significantly increase uncertainty in the attainment of targets.

In **Italy** certificates correspond to a value of 1 toe of saved energy. Three types of certificates exist:

- type I (relative to electricity);
- type II (relative to natural gas);
- type III (other energy sources).

In 2008 it was suppressed a rule stating that grid companies had to deliver at least 50% of their obligation within their own energy type. As a result of this, it was established the substantial equalization of type I and type II certificates.

Certificates for eligible projects are issued once a year in five (or eight, in particular cases) consecutive years.

Other countries adopted the logic of lifetime savings. In **UK** lifetime of measures varies between 8-12 years (mainly household appliances) and 40 years (cavity walls), while the discount rate was fixed at 6,0% in EEC-1 and at 3,5% in EEC-2.

Under EEC-1, suppliers could carry over to EEC-2 all their excess savings from measures implemented. Standard energy savings for each measure were not only lifetime discounted but also fuel-standardised; fuel standardized multipliers are applied to energy savings according to the carbon content of the displaced energy carrier. Savings were also adjusted for estimated free riders for each activity, based on market statistics for each measure and historical sales information, as well as for the heat replacement effect, which accounts for space heating provided by inefficient appliances, and light bulbs that has to be replaced by another heat source.

In CERT the unit of measure for savings was changed from lifetime discounted fuel standardized TWh to lifetime un-discounted carbon savings; this significantly broadened the scope of measures allowed for achieving the target. The reason for this change is that climate change is driven by the concentration of CO2 in the atmosphere, and that the total amount of CO2 savings is more important than the annual carbon savings.

In **France** the minimum size required to file a request for a certificate is 3 GWh "cumac" which is the energy saved over the duration of the technical lifetime corrected with a factor of 4% per year. To achieve the minimum size there is a possibility to pool savings from similar actions.

The standard operations take into account the expected savings over the full technical lifetime of the operation.

Banking of certificates is an allowed practice. Energy savings certificates, whose validity is at least 10 years, are attributed after the achievement of the action.

e) Obliged party

Obligation in terms of energy savings are placed on market actors, usually retail energy supplier or distributors; from a practical points of view final users tend to be excluded.

Main advantages of setting obligation on **distribution companies/grid owners** consist in their higher stability and in the fact of being relatively less interested in energy sales. On the other hand, **retail companies** are more dependent on sales but closer to the clients.

Obligation for individual utilities are generally allocated according to their market shares or domestic customers.

In **UK** EEC-1 obligations were placed on **electricity and gas retail suppliers** with customer bases over 15.000; in EEC-2 and CERT the threshold was increased to 50.000 domestic customers. As a consequence, CERT involves only six suppliers.

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

In France obliged subjects were **energy suppliers** whose sales exceed:

- electricity or natural gas: 400 GWh/year;

- liquefied petroleum gas: 100 GWh/year;
- heating/cooling: 400 GWh/year;
- heating oil: no threshold.

Overall, around 2.500 companies are concerned, a few dozen large companies operating in the electricity, gas, LPG and heating/cooling sectors and a large number of small and medium size heating oil suppliers.

The obligation is distributed among the obliged parties using a formula that takes into account sales in the residential and tertiary markets in 2004 (75%) and 2003-05 average energy prices (25%).

Italy implemented an energy saving obligation for **electricity and gas grid companies** with more than 100.000 final customers. Indicatively, for 2008, 14 electricity distributors and 61 natural gas distributors had savings obligation.

Starting from 2010 the obligation will be extended to distributors serving more than 50.000 final customers.

Each year national targets are allocated among eligible distributors on the basis of the quantity of electricity and gas distributed to final customers compared to the national total in year t-2.

Among countries that introduced savings obligations, Belgium (Flanders) placed them on electricity distributors, while in Denmark obliged subjects are energy grid companies operating in the district heating sector and, on the basis of a voluntary agreement, grid companies operating in the sectors of electricity, natural gas and oil.

f) Interventions deliverers and ownership of certificates

Energy utilities, suppliers o distribution companies, are most obvious subjects to deliver energy efficiency.

Other actors such as ESCOs, equipment suppliers and retailers, however, could be better placed to deliver energy efficiency to the final users, therefore a white certificates scheme open to these operators could be more cost-effective and effective. On the other hand, the larger the number of parties that can apply, the more stringent the procedure for accepting a certificate needs to be.

In general, the degree of involvement in the market of non obliged parties depends on the specific objective of the energy savings policy and, in particular, on the choice relative to subjects that should carry out energy efficiency improvements, being energy utilities or consumers.

If more players such as ESCOs are wanted, a market allowing certificate trading seems to be more efficient.

In any case, property rights of certificates must be clear and legally secured as it is unlikely that trades will occur if either party is unsure of ownership.

Certificates need to be a well-defined commodity that carries a property right over a certain amount of additional savings and guarantees that the benefit of these savings has not been accounted for elsewhere. For this reason, each certificate has to be unique and traceable, and must have at any time a single owner.

In principle the ownership of certificates should be with the initiator of the project, that may be an obliged party, a network operator or a supplier, or a third subject, such as ESCOs. Some cases, however, haven't been up to now clearly valued, such as for example the possibility of receiving certificates by association of end-users, representing end-users implementing EE projects, or by retailers/manufacturers offering rebates for EE products.

In **France** certificates can be issued to three types of actors:

- obliged energy suppliers;
- public collectives (state, region, department, commune or their "grouping");
- non-obliged parties, provided energy efficiency is not their main business activity; they are mainly industrial and commercial enterprises undertaking energy efficiency improvements of their own premises.

Companies that have energy efficiency as their main business (ESCOs) are excluded deliberately. The intention is to push energy suppliers to encourage the consumers to make energy efficiency improvements. Energy suppliers, however, may contract ESCOs to carry out energy efficiency activities on their behalf.

As regards **UK**, although obliged parties under the EEC are allowed to meet targets by claiming credits for measures carried out by third parties, ESCOs have not entered the energy efficiency market to any extent. This could be at least in part the consequence of the fact that there is no issuance of white certificates and no open access to credits and trading in credits for non-obligated parties and that energy savings measures related to industry are excluded from the program.

In **Italy**, both obliged parties as well as ESCOs, can apply for certificates. Independent companies resulted quite active in creating certificates; they are allowed to sell certificates in the open market or directly to an obliged party.

g) Promoted interventions

Certificates have to be created from projects that result in energy savings **additional** with respect to the ordinary activity of the implementer, i.e. achieved only as a consequence of the present obligation on the mandatory targets and beyond a "business as usual" logic.

Regulatory mechanisms should promote, in particular, interventions determining **permanent changes** in the demand and supply of energy services and technologies. The system should assure acceleration of innovative energy saving technologies.

A potential risk refers to the promotion of actions determining only efficiency increases, but that do not reduce overall energy consumptions, or mainly actions easy to implement and measure.

The use of **standard measures** can significantly simplify the administration procedures of mechanisms; however, other operations should be allowed, so that innovative technologies can be developed.

The identification of promoted interventions requires choices at different levels:

- sectors involved: residential, commercial, industry, transportation;

- energy sources: electricity, gas, heating oil, transport fuels, district heating and cooling, etc.;
- technologies: appliances, boilers, insulation, lighting, motors, vehicles, CHP, etc.

From a theoretical point of view, the wider the scope in terms of types of projects choices and the fewer limitations in terms of compliance routes, the more diverse marginal costs of compliance become and the greater the benefits of trading in terms of lowering the overall cost of compliance. Moreover, the extension of the scope in terms of eligible technologies can decrease the risk of price uncertainties and fluctuations.

On the other hand, limiting the scope of a scheme potentially reduce administrative and institutional costs. It is then worth pointing out that the positive effect of market forces deciding on measures taken is only valid where the benefits yielded by each unit of compliance/action - e.g. saved toe - are the same in whatever end-use sector or location it is achieved. Thirdly, since cost minimization is an inherent feature of markets, a completely open scheme is likely to focus compliance on large-scale projects; this could penalize, in particular, the residential and building sectors.

In the definition of eligible projects, moreover, it should be respected the basic principle that customer groups contributing to funding the scheme should be ensured to receive proper benefits.

In **France** eligible energy saving measures involve all sectors and all types of fuels, as long as they are not already covered by the emissions trading scheme.

The obliged parties are free to choose how to meet the obligations in terms of targeted energy type, consumer segment, technology and measure.

The savings can be achieved using predefined standardised measures or other operations; 170 standardized actions, in particular, were introduced, with predetermined saving targets. Standardized measures relates to these sectors: residential, tertiary, transport, industrial, heating, cooling and public lighting. Training and use of renewable energy sources are included among standard operations.

Eligible measures in the **United Kingdom** are restricted to the residential sector; a specific requirement was introduced to realize a share of the savings in the social housing sector.

The EEC, in particular, required that half of all energy efficiency measures implemented to achieve a supplier's target must be carried out amongst a priority group of customers consisting of those in receipt of means-tested or disability-related welfare benefits or credits. Under the CERT activity equivalent to at least 40 per cent of the target must be targeted at certain low-income domestic consumers or those who are over 70 years old; hence the programme also contributes to the Government's Fuel Poverty Strategy.

The Department for Environment, Food and Rural Affairs (DEFRA) requires suppliers to demonstrate clear additionality in each of the schemes they carry out - for instance, schemes must go beyond building regulations or involve the installation of appliances better than the market average.

The mechanisms are built around the use of standardised energy saving measures. The regulator produce a series of savings for these energy measures, reflecting the varying property type, construction and age, and these are used by the energy suppliers to claim their energy saving credits. Utilising standardised energy savings allows for an ex-ante approach to measuring savings carried out by obligated parties.

Despite the fact that an energy saving uplift is provided for obligated parties developing new standard measures, very few have been developed within the EEC program. The CERT program favored the development of new standard measures developed by obligated parties at households and community scale.

Italy includes all energy end-use sectors as well as intermediate uses in the gas sector. An illustrative list of eligible projects was drafted.

Up to 2007 the country had a special provision that at least half of the savings should be achieved via a reduction in electricity and gas end-use within the sector in which obliged subjects operate; this rule was eliminated since the following year.

Savings have to go over and above spontaneous market trends and/or legislative requirements The business-as-usual trend shall be adjusted with time, according to technical and market developments trends.

h) Certificates trading

A white certificate is both an accounting toll, which proves that a certain amount of energy has been saved, and a **tradable commodity**, which belongs initially to the subject that has induced the saving or owns the rights to these savings.

The tradability aspect enables to meet the objectives in a cost-effective way. However, in the compliance market what determines whether trading is of benefits and take place, determining a reduction of overall costs, are the size of the market, the number of actors involved, the role that utilities would like to play (in house energy efficiency or outsourcing the expertise) and the diversity of compliance options in terms of marginal costs.

In order to realize cost-efficiency, the market needs to be sufficiently transparent and liquid, involving a large number of trading parties that have sufficient information on products and prices and sufficient opportunities to trade.

Market transparency and liquidity can be mainly enhanced by:

- exchange platforms which publish volume and price of transactions;
- broadening the geographic scope of the market (e.g. linking to other systems, allowing for imports and exports of certificates);
- allowing (limited) banking and, under particular circumstances, borrowing of certificates;
- providing certainty on demand (e.g. by formulating both long-term and intermediary targets);
- developing a forward market;
- introducing financial products.

Rules defining **trading parties** are also important for market liquidity. In principle, if administrative and monitoring costs are not disproportionate, the presence of many parties could enhance the prospects of diversity in marginal abatement costs and lower the risks of excessive market power. Parties that may be allowed to receive and sell certificates include obliged actors, exempt actors, ESCOs, consumers, market intermediaries, NGOs and manufacturers of appliances.

A key benefit of allowing many parties in the scheme is that new entrants may have the incentive to innovate and deliver energy efficiency solutions, which have a lower marginal cost.

UK combined its obligation system for energy saving with the possibility to trade obligations and savings only among the obliged parties and through bilateral contracts. Certificates trading is only possible once the seller's target has been met; for trades to be effective a written agreement of the regulator is needed; these were probably the main causes of the operators' little interest in certificates trading.

Tradable certificates have been introduced in Italy and in France. In Italy no authorization is needed for trading, which is possible both via bilateral contract and on a spot market. In France white certificates can only be traded via bilateral contracts.

i) Institutional design of the scheme

The institutional structure of the scheme involves administrative bodies to manage the system as well as processes such as verification, certification and market operation, transaction registry, monitoring, detection and penalization of non-compliance.

The level of complexity of the required institutional structure deeply depends on the nature of the mechanism planned for promoting energy savings.

A fundamental distinction, from this perspective, has to be made between mechanisms entailing trading of certificates and those only based on the introduction of savings obligation for some energy operators.

In any case, the institutional framework, operational and regulatory, should be clear but simple. The design should be planned so as to keep **low administrative burden** and **minimize transaction costs**. Such costs have been indicated as a possible drawback for white certificates market schemes compared to other policy instruments. Transaction costs could be very high both on the public institutions (e.g. set up the scheme, monitoring and verification, issuing of certificates, tracking of certificates, running the certificate market, etc.), and on other actors, in particular for obliged parties.

Authorities should develop a number of measures reducing transaction costs for market actors, such as:

- adopting streamlined procedures, e.g. a fast track or simplified modalities for small scale measures;
- adopting a common information channel;
- allowing bundling of energy efficiency measures: bundling of similar measures can reduce a project developer's financial burden of potentially fixed transaction costs, related to contract negotiation, baseline development and measurement and verification activities; this strategy can significantly reduce the administrative burden for eligible parties like ESCOs, favoring the adoption of measures in the residential sector.
- developing, whenever feasible, an ex-ante measurement and verification approach (see the following section);

- establishing an information clearinghouse, building trading platforms and designing standardized trading contracts; the implementation of a clearinghouse to provide information about traded prices, volumes and parties (both spot and bilateral) should be considered, in order to keep market actors updated and well informed about the dynamics of the white certificates market and its regulatory framework; in addition, the establishment of an electronic trading platform can reduce transaction costs by setting the place where potential buyers and sellers can meet regularly at any time, allowing bids and bilateral trading as well; the development of standardized contracts (or at least standardizing key contractual provisions) can reduce transaction costs related to legal services and perceived liability risks when trading;
- ensuring high effectiveness of informative policy instruments; information campaigns, educational and/or information centres, eco-labelling schemes, etc., need to be analysed and/or properly implemented and linked to possibilities and strategies provided by obliged parties; the energy rating, in particular, could provide links to obligated parties in a white certificates scheme who are searching for customers willing to implement eligible measures.

Concerning the model of governance, national Governments usually fix saving targets and define obliged parties. Moreover, they establish general rules concerning eligible measures and the enforcement mechanisms. The energy regulator has the task to set more technical rules concerning the development and evaluation of projects and, more in general, the functioning of the white certificates market.

For the issuing of certificate it should be appointed an independent body technically qualified. Once a project is in place, unless otherwise specified (e.g. in case of deemed savings approach) the implementing body should submit a measurement data and, on that basis, the regulatory body will verify the savings of a project and authorize the issue of corresponding certificates.

In **Italy** the Government fixed saving targets, determined obliged and eligible parties, eligible measures, some measurement and verification rules and some enforcement mechanisms (such as the criteria for setting the penalty) and decided on general principles concerning cost recovery. Moreover, it determined responsibilities regarding the definition of the implementing regulation, the administration of the system and the monitoring of results.

The energy regulator implements the scheme, defining technical rules for project design and evaluation, for certificates issuing and for the functioning of the market (jointly with the Electricity Market Operator, that manages the certificates' spot market), evaluating projects, certificating energy savings and checking annual compliance with the targets. Moreover it determines criteria and rules for cost recovery and has the responsibility of defining sanctions for non compliance.

Projects are not subject to approval before their implementation, although project developers may ask for an ex-ante "qualitative" eligibility check.

For the definition of criteria concerning the design, implementation and evaluation of projects the Italian regulator adopted a procedure of consultation of all interested parties.

The white certificates spot market is organized and managed by the Electricity Market Operator (Gestore del Mercato Elettrico - GME) according to rules and criteria approved by the regulator. GME issues and registers certificates upon specific request by the regulator, organizes market sessions, and register bilateral over-the-counter contracts according to rules set by the regulator.

In **UK** the energy regulator, OFGEM, is responsible for administrating the mechanism. OFGEM responsibilities, in particular, consist in determining the energy efficiency targets for each supplier, approving ex-ante proposed energy savings schemes carried out by obligated parties, monitoring implemented measures and enforcing compliance with obligations.

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

The regulator requires all obligated parties to submit quarterly reports describing progress made in achieving the saving targets. OFGEM delivers annual progress reports and a final report on the completion of a program phase and submit them to the Department for Environment, Food and Rural Affairs (DEFRA).

In **France** the ministry in charge of energy sets the rules and the obligation, allocates the energy savings certificates and controls the projects. ATEE (Association Technique Energie Environnement) manages a platform gathering economical actors involved in the energy savings market (energy suppliers, manufacturers, retailer, etc.) and makes proposals to ministry for new standardized actions.

ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie) acts as a kind of «back office» of the ministry, carrying out technical analyses and evaluations and warranting information to public bodies and companies.

Every three years the functioning of the white certificate system is to be analysed and the whole complex of transactions described and published in a report.

j) Measurement and verification (M&V) approaches

As savings cannot be measured they need to be calculated by comparing measurements of energy use and/or demand before (i.e. the baseline energy use) and after implementation of the saving measures.

The system should balance costs and accuracy of the calculation of energy savings as well as simplicity and cost-effectiveness of verification.

Three main approaches are possible, varying on the basis of the necessity of on-field measurement:

- deemed savings approach (Standard Savings Formula), using standard formulas from energy efficiency measures, not requiring on-field measurement - for example establishing that a given number of CFLs installed in the residential sector is equivalent to a given quantity of kWh saved);
- engineering approach, requiring some on-field measurement: savings are calculated on the basis of predefined algorithms and the measurement of some parameters;
- approach based on monitoring plans: comparison of measured consumptions before and after the project, taking into account changed

framework conditions (e.g. climatic conditions, occupancy levels, production levels).

There is no overall preferred method for all projects.

As a general principle, a **combination of an ex-ante and an ex-post M&V approach** could be more accurate than a pure ex-ante methodology, without the financial burden of a full ex-post approach.

In principle, the **ex-post** (or metering) approach is a more accurate guarantee of energy saved than the standard factors approach, that, for example, cannot verify details such as location and operating hours of installed appliances. In practice, however, the metering approach can hardly identify the actual saving, especially in households, where there is usually only one meter for all electricity usage.

For this reason the metering approach, as well as other extensive and complicated methods, may be reasonable for large installations or projects, but may result in high monitoring costs for projects of smaller size. To avoid a large increase in the M&V costs, only the uncertain part of energy savings obtained through saving measures implemented should be analyzed through an ex-post methodology.

On the contrary, the most predictable or certain part of savings obtained should be evaluated through an **ex-ante** approach. This kind of approach, that requires the pre-approval of the proposed methodology, proved to work effectively for energy saving measures for which technical performance are well understood.

Whenever possible, an ex-ante M&V approach appears to be a cost-effective way of accrediting energy efficiency measures. Main advantages of this approach derive from the fact that it entails simplified estimations, savings and thus baselines are agreed in advance, there is limited provision of documentation, and reduced monitoring and certification procedures are required.

For the method to be effective, reference scenarios and baselines must be kept constantly updated.

In **UK** the approval of energy saving schemes and computation of attained energy efficiency is based on an ex-ante approach, using the standards described in an illustrative mix. Savings of a project are calculated and set when a project is submitted based on a standardized estimate taking into consideration the technology used, weighted for fuel type and discounted over the lifetime of the measure. There is the option for energy suppliers to monitor and demonstrate the savings retrospectively instead of an ex-ante assessment, but this option has never been used.

The procedures for approving, notifying and calculating energy savings resulting from each measure are highly standardized. This reduces investment risks for obligated parties and minimizes administrative costs for the regulator and the obligated parties.

The requirements for monitoring and verification are based on technical assessments, consumer satisfaction and consumer utilization monitoring.

There is no monitoring requirement of the actual energy savings in relation to the ex-ante standardized savings for obligated parties. In some cases ex-post savings are monitored in order to improve the accuracy of standardized savings, but not at the expense of the obligated party. If standardized savings are amended for the next commitment period, the measures undertaken in previous commitment periods are not affected, although DEFRA revises their estimates of national energy and carbon saving retrospectively in the light of the new information.

The **Italian** scheme uses all three valuation approaches. Deemed savings approach, in particular, include default factors for free riding, delivery mechanism and persistence. All monitoring plans must be submitted for pre-approval to the regulatory authority AEEG and must conform with predetermined criteria (e.g. sample size, criteria to choose the measurement technology, etc.). Most of the projects submitted to date have been of the deemed saving variety.

In **France** standardized methodologies have been set up for calculating energy savings; these methodologies are based on straightforward user-friendly procedures. Standardized evaluation of energy savings are established for each action, expressed in kWh of final energy, cumulated over the life of the product. These procedures are the results of “technical” evaluations of savings.

In the Flemish region of **Belgium**, grid operators submit to the Department of Natural

Resources and Energy of the Ministry of Flanders, plans for actions to be implemented in the following year. These plans also include proposals for the calculation of energy savings. The Department then evaluates and approves (or, in case, reject) the method for the calculation of savings.

k) Cost recovery

Cost recovery provisions are required whenever obligations are placed on subjects benefiting of regulated tariffs, typically distribution companies. In these contexts a wire charge could be used to pay the costs these companies incur to implement projects for energy savings up to their saving target.

Suppliers are usually outside the regulated tariffs and so free to charge their customers for the energy efficiency projects.

In order to promote efficiency and to avoid distortions in competition, the cost recovery mechanism should not be a simple pass-through but a standard allowed cost.

The mechanism, moreover, should be technology neutral.

In **Italy** it was established a cost recovery mechanism in favor of obliged electricity and gas companies delivering the required certificates. Grid operators receive the contribute also when the interventions concern measures implemented by an obliged party at the premises of customers of another distributor.

In any case, cost recovery is allowed for savings projects only until an obliged party reaches its target; a distributor can’t receive it for measures if it sells or bank the associated certificates.

Until 2008 the amount, financed via electricity and gas tariffs, corresponded to 100 €/toe. In 2009 the value of the contribute decreased to 88,92 €/toe.

The revenues are collected in a fund and distributed by the energy regulator to distributors.

In the **United Kingdom** cost recovery is not applicable, since the obliged parties are energy suppliers who can pass the additional cost of compliance to the final user.

Certificates costs in France are ultimately carried by the end-users, through their energy tariffs.

l) Non compliance framework

For the mechanisms to be effective, a clear and enforcing non compliance framework has to be developed.

The system of sanctions has to be clear, simple and correct. Penalties, in particular, should be high enough to provide incentives to obliged parties to comply with their targets.

It is important to notice that the definition of a penalty may determine a potentially distortive reference price for certificates, introducing a kind of ceiling of the unit cost of certificates.

In any case it should be established that obliged parties compensate, at least in part, the deficit in the achievement of their obligations in the following compliance period.

In **France** penalty for obliged parties that do not meet their obligation by the end of the three year period was fixed at 20 €/MWh. The penalty is transferred into the general Government budget.

When the penalty is paid the deficit is cancelled.

In the next periods the penalty will double if the obliged parties cannot prove that they were unable to obtain certificates.

In **Italy** the energy regulator is in charge for the management of the penalty system, on the basis of general criteria fixed by the Government. Sanctions, in particular, have to be "proportional and in any case greater than investments needed to compensate the non-compliance". No penalty was actually introduced, thanks to a grace period.

According to general rules, in some circumstances distributors are allowed to compensate their deficit in a year during the subsequent two years without incurring penalties. Distributors' performance, in particular, is valued on the basis of the availability of certificates in the market during the year of reference. Availability of certificates is expressed as the ratio between issued certificates and the overall obligation on distributors in the year of reference. If the distributor achieved a share of its obligation at least equal to this ratio, it is allowed to compensate the deficit without penalties.

In **UK** the energy regulator has the power to consider whether it is appropriate to set a penalty for non-compliance. However, there is no specific guidance on how this penalty would be calculated.

m) Interactions with other schemes

A policy introducing energy savings obligations should ensure synergies and avoid overlaps within the portfolio of policy instruments targeting energy efficiency. A crucial aspect consists, in particular, in ensuring additionally of measures implemented under the mechanism, if a variety of policy instruments exists.

Overlaps in different policies are likely to temporary exists but should be eliminated through a constant review process. As a general rule, double counting with other policy instrument has to be avoided.

White certificates schemes may interact strongly with other important schemes and objectives within the EU energy policy framework.

First of all, a white certificates scheme may lower the costs of the **EU emissions trading scheme.** Additional energy savings result in reduced primary energy demand and hence in a reduction of greenhouse gas emissions.

White certificates market and the EU ETS, however, have to be kept as separate markets for the near future. At the moment, double counting may concern electricity savings, distorting the effectiveness of these two markets. This can be avoided if no coverage overlaps exist in terms of obliged/eligible actors, eligible sectors and eligible fuels.

As **targets for renewable electricity** are generally formulated in relative terms (as a share of overall electricity demand), the energy saving effect of white certificates may also reduce the total cost of the achievement of these targets.

On the other hand, when falling electricity demand leads to falling average wholesale prices of electricity, the costs of meeting renewable energy targets may rise again.

In the presence of a **green certificates market**, moreover, by achieving high levels of effectiveness, a white certificates schemes can decrease the demand and thus prices on this market, thereby putting investments in renewable energy plants at risk.

The problem could be overcome setting absolute targets for the green certificates market.

In any case the two markets should kept separated, avoiding double counting that may arise when renewable energy technologies are considered in both schemes.

A white certificates scheme, in the end, reduces the need for energy saving subsidies, but at the same time it reduces the revenues from **energy taxes**, if rates remain unchanged.

4.1.2. The Italian white certificates market

Main features

The Italian mechanism has been in place since January 2005 and will last seven years. White certificates are issued to certify the reduction of consumption achieved through measures and projects of energy efficiency improvement. In particular, one certificate corresponds to one certified toe of saved primary energy.

Eligible projects are all end-use energy-saving projects, that can be implemented either by distributors or by energy services companies (ESCOs); only “additional savings” rising from efficient appliances/techniques/systems are eligible, while savings from ”business as usual measures” are excluded. Also interventions realized in the period 2001-2004, before the definition of the mechanism, are warranted the issuing of certificates.

Each year a cumulative energy saving target is fixed by Decrees, differentiated between the electricity and the natural gas sector; the global objective to be reached is a reduction in primary energy consumption of 2,2 Mtoe by 2008, of 3,2 Mtoe by 2009 and of 6,0 Mtoe by 2012. Then, an individual energy saving target is determined, related to market shares, for gas and electricity major distributors. Initially only distributors with more than 100.000 customers had to comply with energy savings obligations, but a recent Decree[2] lowered the threshold to 50.000 customers. Indicatively, for 2008, 14 electricity distributors and 61 natural gas distributors had savings obligations.

At the end of each year distributors have to prove the detention of requested white certificates either gained through projects directly managed or bought from ESCOs[3]. In principle non compliant operators are subject to economic penalties, but they have not been fixed in their amount thanks to a grace period.

On the other hand, the Italian Authority for electricity and gas (AEEG) makes an allowance in the distribution price formula to cover the costs of the white certificates system; in the first phase this cost has been assumed to be 100 €/toe of primary energy saved.

White certificates are tradable via bilateral contracts or in an organized market, managed by the Gestore del Mercato Elettrico (GME), a public operator managing also the Italian power pool.

In the Energy Efficiency Certificates Market:

- distributors may purchase certificates, if the savings achieved through their projects lie below their yearly target and they thus have to purchase the missing certificates in the market in order to fulfill their obligation;
- distributors may sell certificates, if the savings achieved through their projects exceed their yearly target and they may thus make a profit by selling their surplus certificates in the market;

[2] Decree of 21 December 2007 of the Ministry of Industry.

[3] The only requirement, valid until the end of 2007, was that at least 50% of the primary energy should have been saved in their customers’ premises from electricity and natural gas end-uses; the requirement was eliminated by the recent Decree of December 2007.

- ESCOs may sell the certificates that they have obtained through independent projects, as they are not required to fulfill any obligation and may thus make a profit by selling their certificates in the market.

Main results

Since the beginning of the scheme and until 31 May 2009 3,8 million toe of saved energy were certified. In the period 2005-2008 saved energy amounted to 2,8 million toe against a target of 2,2 million toe.

Most energy savings were related to electricity and were delivered via projects for which simplified M&V methodologies exist.

Fig.1 - Certified energy savings by source

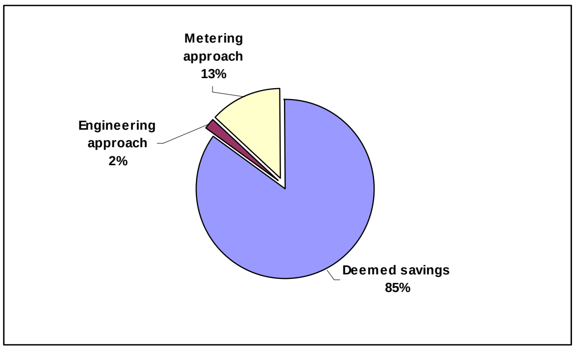
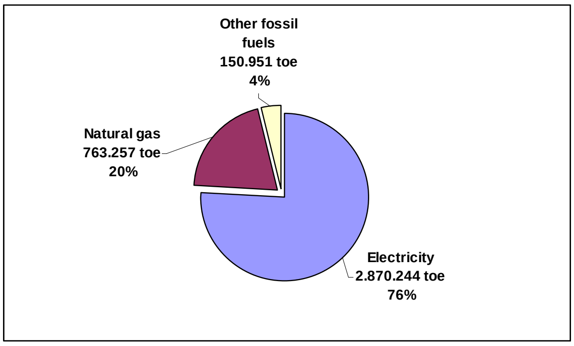


Fig.2 – Splitting certified savings by savings evaluation approaches



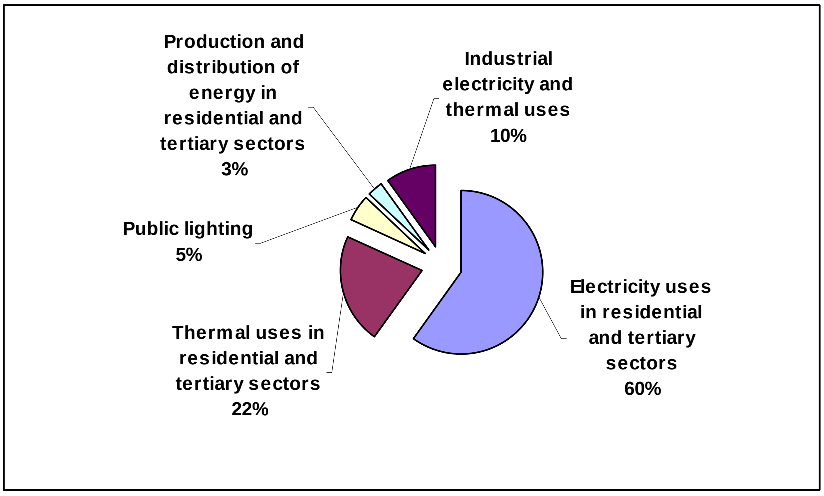
Energy Services Companies were by large the main deliverers of eligible energy saving measures.

Table 2 - Levels of activity of different subjects

	Nr. of subjects that obtained certificates	% certified certificates
Obliged electricity DSOs	10	9,8%
Obliged natural gas DSOs	19	8,4%
Non obliged distributors	15	1,0%
Energy Services Companies	196	80,8%
Companies with Energy Manager	2	0,1%
Total	242	100%

A relevant share of certified savings was related to interventions in electricity uses in residential and tertiary sectors.

Fig. 3 – Splitting of certified savings among sectors



The most popular individual measure has been the substitution of traditional lamps with high-efficiency fluorescent lamps in the residential sector (about 66% of certified savings).

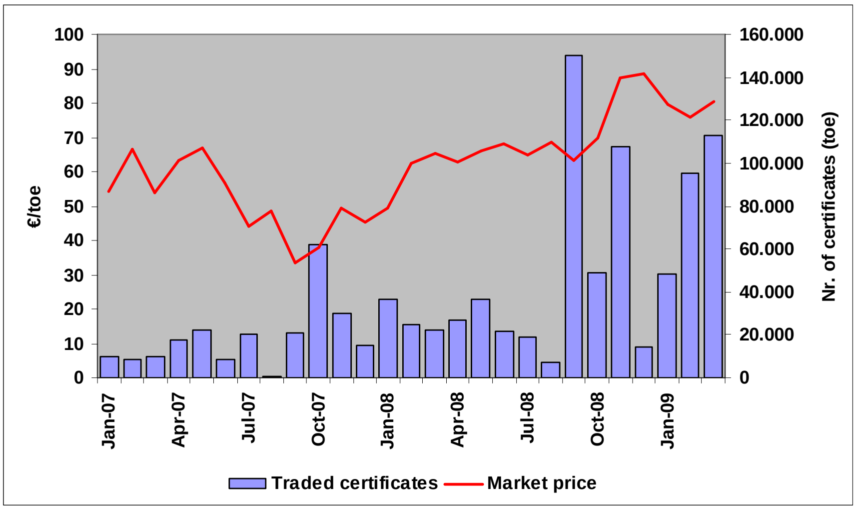
Table 3 - Main measures implemented

Interventions	Nr. Of approved interventions			Unit of reference for savings calculation		Certified savings (toe)	% of certified savings on total
	by DSOs	by ESCOs	total	unit	nr. of units		
Substitution of incandescent lamps with CFLs	95	614	709	Nr. of CFL	56.603.428	2.189.276	66,3%
Low flow showerheads in households	89	141	230	Nr. of showerheads	22.205.852	508.208	15,4%
Faucet aerators in households	68	157	225	Nr. of aerators	48.670.885	171.691	5,2%
Replacement of mercury vapour lamps wigh high pressure sodium lamps for public lighting	72	163	235	Nr. of lamps	536.811	140.947	4,3%
Use of solar water heaters	27	320	347	Mq of solar panels	352.847	81.369	2,5%
District heating	40	36	76	(analytical)	-	69.339	2,1%
High efficiency appliances (refrigerators, washing machines, etc.)	9	71	80	Nr. of appliances	1.086.286	41.381	1,3%
Low flow showerheads in recreational	4	68	72	Nr. of showerheads	267.460	20.057	0,6%
Power regulators in public lighting systems	11	98	109	W of lamps	41.499.743	171.691	0,5%
Dual pane windows	2	27	29	Mq of glass	238.841	15.861	0,5%

The following graph highlights the results of the white certificate market organized by the GME, in terms of prices and volumes.

In 2008 514.951 certificates were traded on the spot market, while bilateral exchanges amounted to 800.484 toe; market liquidity corresponded to 39,1%.

Fig. 4 – Results on the organized white certificate market (January 2007- March 2009)



Critical issues

There were not significant problems in the implementation of the white certificates system in Italy. However, the nature of interventions realized up to now, many of which could have only temporary effects, put in evidence the need to introduce some additional regulatory mechanisms in order to consolidate and strengthen the capacity of operators of promoting permanent changes in the demand and supply of energy services and technologies.

Moreover, the sanctions mechanism should be revised, in order to increase its effectiveness as a deterrent for operators with energy efficiency obligations.

Relevant changes have been introduced at the end of 2007 in order to increase competition in the market. In particular, the number of obligated parties was extended and it was eliminated a rule establishing that in order to satisfy the obligation distributors should have achieved at least the 50% of savings in the sector in which they mainly operated (electricity or natural gas). Certificates' market had a key role in highlighting, through price signals, market disequilibria and the need for corrections in legislative and regulatory measures.

In the end, it is worth point out that to increase the transparency in the market, it has been recently introduced an obligation for distributors to register also their bilateral trading of white certificates.

4.2. Case study 2 – Introduction of tender mechanisms: the Portuguese experience

Tender mechanisms are important instruments for the promotion of energy efficiency aiming at meeting international and national objectives for CO_2 emissions reduction.

Compared to the white certificates schemes, tender mechanisms have the advantage of being competitive mechanisms: only the best measures with the highest benefit-cost ratio are selected for implementation. Such mechanisms should be implemented and supervised by independent entities, such as the sectorial regulator.

Focusing on the Portuguese experience, ERSE (the Portuguese energy services regulatory authority) has developed such a mechanism under the name PPEC, the Portuguese acronym for electricity consumption efficiency promotion plan.

PPEC consists of a tender mechanism, by which eligible promoters submit measures to improve electricity efficiency in consumption. These measures are selected through technical and economical criteria publicly discussed and approved ex-ante. The budget is 23 million euro for years 2009-2010 and, as foreseen in the tariff code, that amount is supported through the Global Use of System Tariff, paid by all consumers.

4.2.1. Basic features for the introduction of a tender mechanism

The main design features relevant for the set up of a tender mechanism are the following:

a) Eligible promoters
b) Promoted interventions
c) Implementation period
d) Institutional design of the mechanism
e) Nature of the mechanism: compulsory or voluntary
f) Cost recovery
g) Technical and economic criteria for evaluating energy efficiency measures
h) Measurement and verification (M&V) approaches
i) Critical issues
j) Main results of the Portuguese tender mechanism

a) Eligible promoters

Promoters are the entities which may apply to the tender mechanism and which are responsible for the implementation of measures. So, the promoters should be all the agents which are closer to the consumers, thus having the ability to reach them and influence their behaviour.

In Portugal, the PPEC tender mechanism enables not only the energy utilities, but also other agents which have the ability to reach energy consumers, namely:

- electricity suppliers;
- transmission and distribution network operators;
- consumers' rights associations;
- energy efficiency agencies;
- municipal associations;
- investigation centres and educational institutions.

This has the advantage of maximizing the number of agents involved in the promotion of energy efficiency, reaching more consumers and increasing the spill over effect.

In PPEC for the years 2009 and 2010 more than 20 promoters are implementing measures of energy efficiency.

b) Promoted interventions

Tender mechanisms should finance measures which aim at overcoming market failures on energy efficiency. Thus, only measures that result in additional energy savings should be promoted. It is important to finance measures which produce almost instantaneously savings, but also measures which intend to change the behaviour of consumers.

PPEC finances two kinds of measures, named as tangible and intangible:

- Tangible – installation of equipment with a level of efficiency superior to standard equipment on the market, therefore producing measurable consumption reductions. Tangible measures are either destined to the industrial, services or household/residential sectors.

TECHNICAL CHARACTERISTICS OF TANGIBLE MEASURES (SOME EXAMPLES)

Measure	Assumptions
Residential lighting (Fluorescent Compact Lighting 18 W)	- Aimed for the household segment - Useful lifetime: 6 years - Annual consumption reduction: 62 kWh (relative to 75W incandescent light bulb)
Electronic ballasts	- Aimed for the services segment - Useful lifetime: 16 years - Annual consumption reduction: 63 kWh (relative to a ferromagnetic ballast and considering T8 bulbs of 36W)
Electronic speed variator (<=70KW)	- Aimed for the industrial segment - Useful lifetime: 15 years - Annual reduction in consumption: 25%

- Intangible – disseminating information on energy efficient practices in order to promote a change in behaviours. Examples of this kind of measures are energetic audits, information campaigns, seminars and conferences.

c) Implementation period

The period for implementing the measures should be neither too long nor too short. A onetime year to implement measures may be too short, because certain kinds of measures, namely those concerning the installation of efficient equipments in industry, may be implemented more successfully on longer periods, such as two or three years.

In Portugal, PPEC's approval process occurs every two years. Intangible measures have a one or two years' implementation period and tangible measures have a two years' implementation period.

d) Institutional design of the mechanism

The level of complexity of the required institutional structure deeply depends on the nature of the mechanism planned for promoting energy savings. The tender mechanism should be designed to keep low administrative burden and minimize transaction costs. A tender mechanism minimizes these costs compared to mechanisms entailing a trading of certifications.

ERSE has responsibilities in energy efficiency promotion, as clearly stated in the End-User Efficiency Directive (2006/32/CE) transposition to the national order. Additionally, in the Portuguese National Program for Climate Change the Government establishes for 2010, a goal of 1 020 GWh reduction in the consumption of electricity and also entitles ERSE of specific responsibilities in creating mechanisms to promote the energy efficiency in the demand side.

Accordingly, ERSE created PPEC, in 2006, establishing it in the Tariff Code. ERSE is the independent entity that manages the program, approving the measures to be implemented, according to public and pre-established rules approved after public consultations, and also supervises their implementation.

Once the measures are approved by ERSE, energy savings obligations are imposed to each promoter accordingly to the submitted measure. The promoters are obliged to submit half-yearly reports describing progress made in the implementation of the energy savings. Once a project is in place, the promoters have to submit to ERSE a measurement and verification plan, on the basis of which ERSE will verify the savings of the project. The rules also foresee audits to verify the compliance of the targets set. ERSE must produce a final report on the completion of targets set on the approval of the measures.

e) Nature of the mechanism: compulsory or voluntary

A tender mechanism is by nature a voluntary mechanism, i.e, it is not imposed upon energy companies. On the contrary, eligible promoters choose to join the program because of the benefits it brings, namely on their public image on environmental friendliness and concerns about lowering the electricity bills consumers pay.

The tender mechanism implemented in Portugal has been a success, with candidate measures outweighing the available budget in almost 5 times.

f) Cost recovery

In order to involve more the promoters, which implement the measures, and also the consumers, which are directing benefiting from the measures, a co-financing should be required.

In PPEC, promoters and/or beneficiaries have to support at least 20% of the total cost of the efficiency measure, being the remaining 80% supported by PPEC. The budget for two years is 23 million euro and, as foreseen in the Tariff Code, that amount is supported through a tariff paid by all consumers (Global Use of System Tariff), representing about 0,2% of the last resort tariff.

The payments are made to promoters only after the certification of the incurred expenses by an auditor.

g) Technical and economic criteria for evaluating energy efficiency measures

The measures should be analyzed and approved by means of a competitive process and ranked according to pre-established rules, based on a cost-benefit analysis. It is important that these rules be discussed with all the players involved. We describe shortly the evaluation criteria established in PPEC rules for the tangible measures.

In evaluating the tangible measures, first of all, the Social NPV (Net Present Value from a social perspective) is calculated. Measures with a negative NPV are excluded.

The tangible measures' ranking process is done individually for each segment: industry, services and households, thus allowing for the funds to be distributed by all segments, as the budget is also previously assigned to each segment.

Measures with a positive NPV are then ranked according to the following technical and economic criteria:

<u>(i) benefit-cost proportional analysis</u> (1) – 40 points

$$P_p = 40 \times \frac{RBC_p}{RBC_{\max}} \qquad (1)$$

where the weight of each measure (p) is proportional to its benefit-cost ratio (RBC), calculated in (3), up to 40 points, being 40 points given to the measure with the highest benefit-cost ratio;

<u>(ii) benefit-cost ordered analysis</u> (2) – 20 points

$$20 - (k-1) \times \frac{20}{n} \qquad (2)$$

where n is the number of measures and k is the position of the measure in terms of RBC. The RBC is calculated accordingly to the following expression (3):

$$RBC = \frac{\sum_{t=0}^{n} \frac{B_{S\,t}}{(1+i)^t}}{\sum_{t=0}^{n} \frac{C_{PPEC\,t}}{(1+i)^t}} \qquad (3)$$

where: RBC is the benefit-cost ratio; $B_{S\,t}$ is total benefits from the social point of view, in year t; $C_{PPEC\,t}$ is total costs, reimbursed by PPEC, in year t; i is discount rate; and n lifetime of energy savings;

<u>(iii) equity</u> (4 points) – evaluates the measure of equity considering the geographical scope and the way participants and suppliers are selected on the basis of a predefined set of questions;

<u>(iv) presentation quality</u> (7 points) – evaluates the measure in terms of how clearly and objective it is presented and how well its assumptions are justified. It also evaluates the quality of its measuring and verification plan both on the basis of a predefined set of questions;

(v) scale risk (10 points) – evaluates the variation in average costs in each measure as a function of its execution rate (4);

$$IS_C = \left(\frac{CF + \sum_{i=1}^{m} Cv_i}{CF + \sum_{i=1}^{n} Cv_i} \right) - 1 \qquad (4)$$

where: IS_C is scale index; CF is fixed PPEC cost, i.e, does not depend on the number of interventions; Cv_i is unit variable PPEC cost of intervention i; m is number of interventions; and n is half the interventions. The best ranked measure receives 10 points and the following are ranked proportionally to the maximum scale index.

(vi) ability to overcome market barriers and spillover effect (5 points) – evaluates measures in terms of its effectiveness in overcoming market barriers to its implementation and its capability in spreading out its effects on the basis of a predefined set of questions;

(vii) Innovation (2 points) – evaluates the degree of uncommonness of a measure and compensates innovative measures for its higher costs relatively to conventional measures on the basis of a predefined set of questions;

(viii) Weight of the investment in equipment in the total cost of the measure (10 points) – awards measures that maximize the direct investment in equipment rather the administrative or support costs (5);

$$ID = \frac{K}{CT} \qquad (5)$$

where: ID is weight of the investment in equipment in the total cost of the measure; K is PPEC amount spent on acquiring the equipment; and CT is total PPEC cost. The best ranked measure receives 10 points and the following are ranked proportionally to the maximum score.

ix) Experience in similar programs (2 points) – evaluates the relevance the promoter's or his partners' experience for the implementation of the measure.

The benefit-cost ratio, weight of the investment in equipment in the total cost of the measure and, savings sustainability are metric criteria, while the remaining are of a non-metric nature. In order for the non-metric criteria to be objective, a detailed classification matrix was created. The valuation of the non-metric criteria is done following the public referred to classification matrix. Considering that the consumption level also depends on the behaviour and predisposition of the beneficiary, the evaluation methodology also includes a model that incorporates into expected savings the behavioural factors influence. If there is great dependence between energy savings and consumer behaviour, then the behavioural factor is high, penalizing the efficiency measure. On the other hand, the behavioural factor is low for measures whose results do not depend too much from consumer actions.

h) Measurement and verification (M&V) approaches

PPEC approval process considers as much as possible standardized savings estimates.

While the approved measures are being implemented, promoters have to submit to ERSE periodic (each semester) reports on their physical and financial implementation. If the approved and expected savings in those reports are not met, the incentive payment, which is done ex-post, is compromised. The financial implementation is ensured by the accreditation of an official accounts officer.

The program's code also foresees the existence of technical and physical audits on the implementation, which may occur during or after the implementation period. Promoters have also to submit to ERSE the results of the measurement and verification plan, on the basis of which ERSE will verify the savings of the project.

i) Critical issues

Several scholars identify two major critical issues of DSM programs related to perverse effects not usually taken onto account when evaluating potential savings.

One is the rebound effect. This effect undermines potential savings because associated with a decrease in the price of a service is sometimes an increase in its demand.

The other is the free-riding effect, which states that part of the beneficiaries were already planning on implementing energy efficiency measures independently of the incentives given.

These two effects should not be neglected when analyzing and quantifying savings, because they tend to overestimate them.

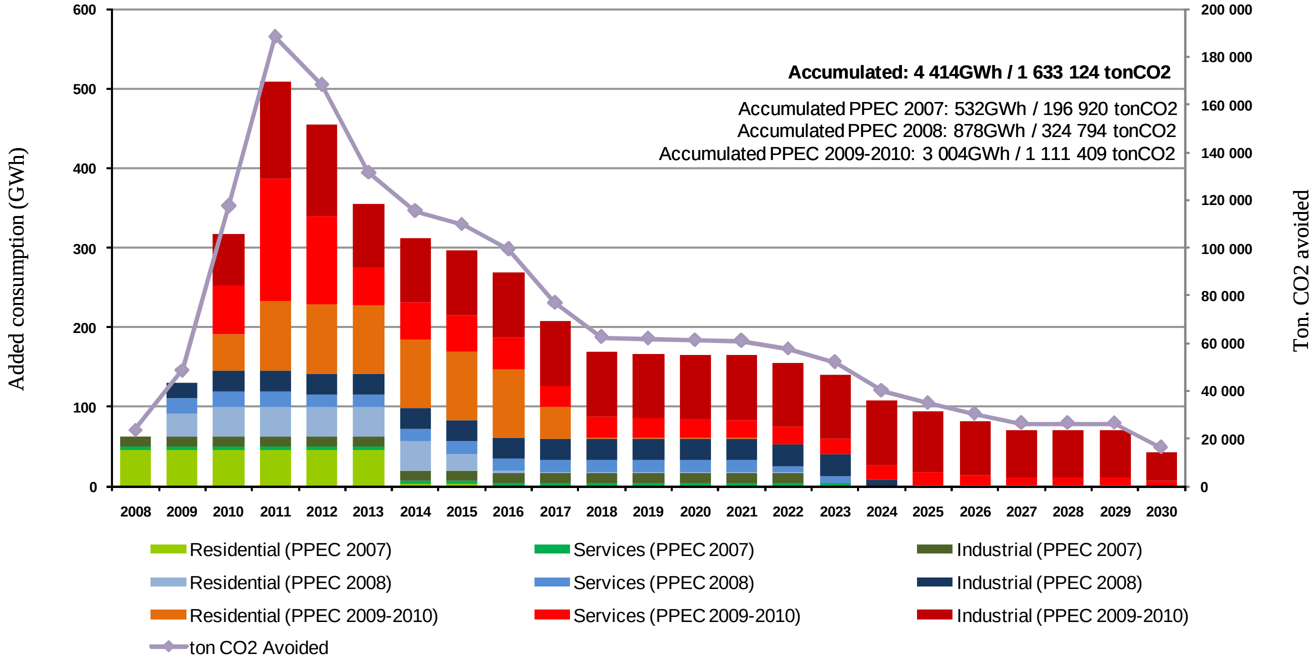
Another common issue when dealing with these programs is the potential risk of overlapping with other programs and consequent double counting of savings. It should be clearly defined the savings accountancy at a national level.

Additionally, the savings associated with DSM programs are often accused of being too difficult or costly to measure correctly and therefore, the management entity should consider the trade-off between M&V costs and its accuracy.

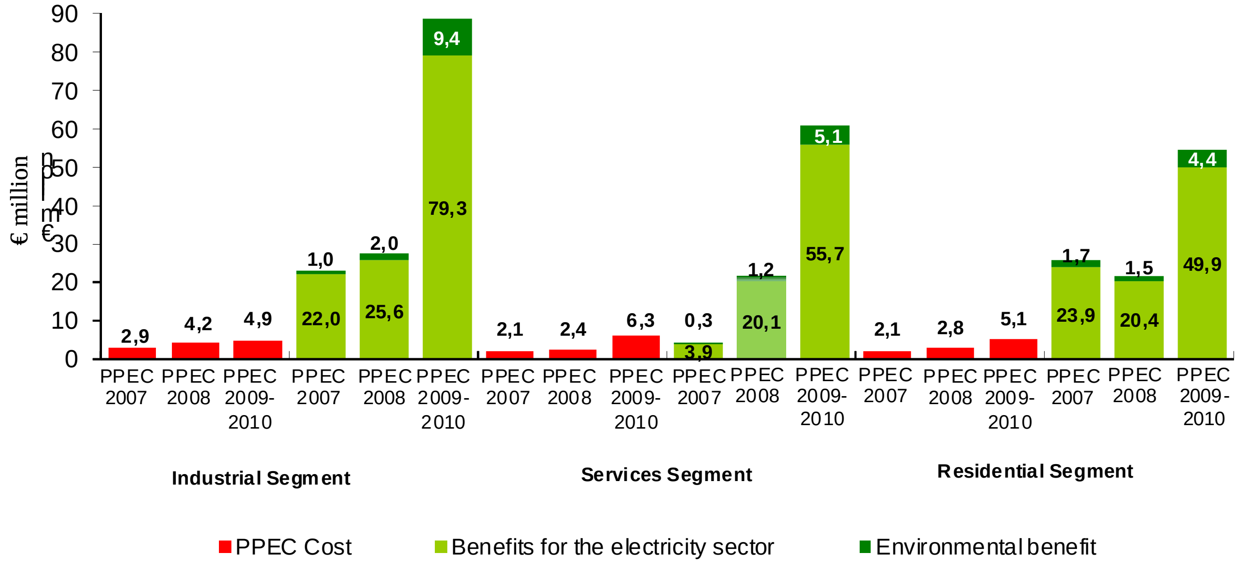
j) Main results of the Portuguese tender mechanism

The following figure depicts the expected measurable impacts for the implementation of the three editions of PPEC (2007, 2008 and 2009/2010).

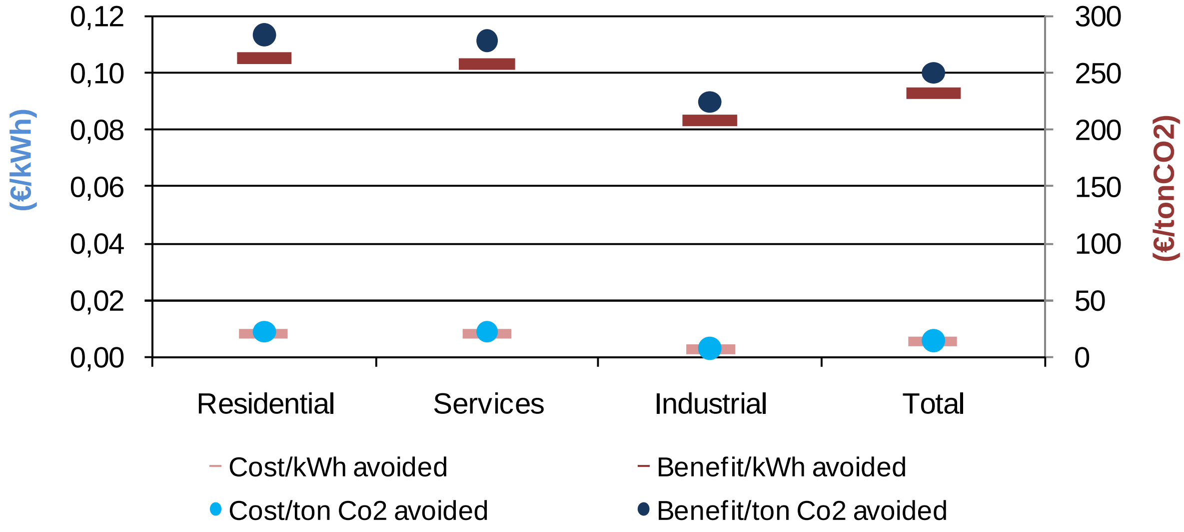
From 2007 to 2008, the expected cumulative avoided consumption from measures approved more than doubled (390 GWh / 144 455 ton CO2 to 878 GWh / 324 794 ton CO2) and in 2009-2010 this value was almost 8 times higher. This is the result of the higher benefit/cost ratio in 2009-2010 compared to the previous years.



The following figure illustrates the cost and the social benefit for each type of consumer estimated for PPEC 2007, PPEC 2008 and PPEC 2009-2010. The analysis clearly shows the gradual increase in the efficiency of the measures approved. In fact, in any given segment or year, expected benefits clearly outweight expected costs, up to a factor of 14 in PPEC 2009-2010.



As shown in the following figure, measures approved in PPEC 2009-2010 have a unit cost of 5,4 €/MWh avoided.



In the Portuguese case, the unit costs of consumption avoided are significantly lower than the cost resulting from the implementation of supply side equivalent measures, such as the premium given to special regime generation (28,1 €/MWh).

The premium paid to special regime generation is justified by the goal of reducing CO2 emissions and diversifying sources of supply. Demand side management tools, like PPEC, proves to be competitive and serve the same purposes as special regime generation. Although both solutions have other virtues, it is clear that their assessment should be made in parallel.

4.3. Case study 3 - Introduction of smart metering: planned interventions in Jordan

Electronic meters are more accurate than electromechanical meters, have lower energy consumption and can be easily combined with digital displays providing the consumer with more accurate information relative to energy consumption.

Smart metering, in particular, is a generic term for:

- Automatic Meter Reading (AMR): one-way system, collecting data from the meters, used for example to locate faults as well as providing interruption and voltage quality data;
- Automated Meter Management (AMM): two-way system, enabling data communication between customers, suppliers and distribution network operators.

The smart meter as interface between customer and other market participants plays a key role in all market processes and therefore impacts on the overall functioning of an energy market. The introduction of smart metering infrastructures cannot be considered as an objective in itself; expected benefits should be carefully weighted against potential costs. Many factors can influence the result of such an analysis, among which the metering regulatory framework, the metering organization model, the choice of a given technology, the conjectured roll out period and other ex-ante assumptions.

Many market participants can profit from the implementation of smart meters, customers, grid operators, suppliers, energy service companies.

Potential benefits are:

- an improvement of customer awareness: customers are allowed to observe on displays the volumes of energy used during different periods of the day (peak or off-peak hors), as well as the instantaneous electricity consumption, favoring consumption behavior changes[4];
- costs savings such as eliminating manual meter costs, customer transaction costs and bad dept; moreover, potential decrease of consumptions and of peak demand could reduce the need for additional investments in networks and generation;
- more accurate billing, since bills can be based on actual rather than estimated consumptions; moreover, the use of standardized load profiles for small customers in the clearing and settlement process could be replaced or improved on by individual customer load profiles;
- an improvement in the quality of the service: availability of service quality measurement allows regulators to design new incentives/penalties and improve the detection of network losses and theft by utilities;
- suppliers are able to offer customized contracts and added-value services;

[4] A necessary condition is, obviously, the presence of time-of-use pricing.

- network operators are able to manage networks and infrastructures more efficiently and plan future grid;
- easing of switching procedures: meters can be read at any time on request, shortening delays for switching to take effect;
- ability to integrate distributed power generation, as producers/consumers can monitor and control the fulfillment of technical and economic requirements.

Main costs can be divided in three categories:

- capital costs: costs related to meters, communication, associated systems for data handling and installation;
- operation and maintenance costs: costs related to reading, service and re-verification;
- stranded costs: cost of removing old equipment and systems.

Installation costs differ according to labour costs. Presenting smart metering data is another new cots potentially large, depending on the quality of the presentation.

Regulators should be conscious of who faces the costs and who gets the benefits in each phase of the implementation plan, taking into account the model for income regulation of DSOs and tariffs.

4.3.1. Basic design features for the introduction of a metering regulatory framework and the adoption of smart metering

Main issues connected to the introduction of a metering regulatory framework concern:

a) metering market model: regulated or liberalized;
b) mandate or promotion of smart metering;
c) targeted customers;
d) ownership of electricity meters;
e) party responsible for smart meter operation;
f) meter design and operation;
g) financial issues.

a) Metering market model: regulated or liberalized

While in the regulated market metering can be a monopoly business carried out by grid operators (or, in case, by meter service providers) and paid by final customers, either through regulated metering tariffs or as a part of grid tariffs, in a competitive meter market, it’s up to the consumer or the supplier to decide on the meter type to be installed; this could result in having an heterogeneous meter infrastructure with different levels of functionalities within grid areas.

Independently from market organization, a **regulatory framework** fixing minimum functional requirements is certainly needed, to ensure a certain standard of data quality and functionality.

A more complex regulatory approach could be advisable at least at a preliminary stage, since smart metering more certainly improve processes and reduces costs and system wide benefits as improved network monitoring, operation and planning, don't need to be strictly targeted. in any case, regulators should preliminarily be interested in valuing the possibility that smart meters are developed on a business case.

In Europe only Germany, Netherlands and UK chose to liberalize metering.

In **UK**, in particular, full electricity metering competition entered into force in 2003. A key principle of this policy was to make retailers, not network operators, primarily responsible for purchasing metering services – the so called 'retailer hub' principle. Decisions about whether or not to invest in smarter meters for customers' homes were therefore commercial decisions for electricity (and gas) retailers.

In the country, as well as in Netherlands, uncertainty about the future organization of the meter market seems to have delayed the implementation of smart metering infrastructures.

b) Mandate or promotion of smart metering

Legislators and regulatory authorities may take different approaches, such as:

- removing any legal or regulatory barriers to smart metering, enabling but not mandating smart metering;
- putting an obligation on the meter responsible to ensure frequent data retrieval and access without making any reference to smart metering, e.g. establishing that electricity bills shall be based on measured hourly data;
- mandating the introduction of smart metering, establishing or not some financial incentives or compensations.

Mandating the introduction of smart meters presents advantages with reference to the establishment of an obligation to ensure frequent meter reads, as it guarantees benefits from additional functionalities of smart meters, such as remote tariff change and transferring price signals to the customer.

Obligatory roll out of smart meters requires the party responsible for the regulated meter service to install and operate smart meters within their monopoly area. The energy authority, in particular, generally defines one or more of the following aspects:

- scope of meters affected (customer group, demand threshold etc.);
- timeframe within which meters have to be replaced by new smart meters;
- basic functionality of smart meters.

For the policy to be effective, **proper deadlines** should be established for the installation of smart meters to certain customers group; gradual replacement should be planned so as to limit discriminations.

Mandating distribution network operators to rollout smart meters is certainly the easiest way to introduce smart metering in a quick and coherent way. On the other hand, network operators may tend to adopt less creative and flexible solutions than energy suppliers and energy service providers.

In any case, a proper regulatory framework is necessary to avoid the adoption of incompatible systems. If clear and suitable regulatory principles and technical specifications are established, competition in smart metering is feasible, delivering at least the same results than a centralised approach based on the monopoly of distribution network operators.

It is worth pointing out that regulatory authorities should review regulations that hinder the development of smart metering, such as lack of cost reflective time-of-use tariffs.

In Europe actual implementation of smart meter policies differ quite widely, as a consequence of differences concerning the legal framework and the power of regulators. However, a growing number of Member States are in the process of drafting policies or are at least planning to do so. In particular, compulsory introduction of smart meters was adopted in eleven countries.

In Italy, following a voluntary meter replacement program launched by the incumbent utility in the 1990s, the regulatory authority has mandated the introduction of smart meters in 2006; replacement should be completed by December 2011. In Spain legislation mandated full meter replacement in households by December 2018.

c) Targeted customers

In order to define the scope of the intervention of meters' replacement, an accurate costs and benefits analysis should be carried out.

Estimates of costs and benefits should refer to different scenarios, calculated in terms of one or more selected metering technologies, and making different assumptions on smart meters deployment rates.

Estimated costs are generally incremental or differential costs incurred with the current metering technology and the full deployment of the smart meter technology.

The impact of smart meters on consumers' costs, in particular, should be carefully estimated.

Estimated benefits should refer to the overall or social impact of smart metering, as well as to the impact for the different stakeholders.

Differences in the costs are driven by the assumed lifetime of the meters, the discount rate, the speed of technology deployment and, of course, the selection of the meter. Differences in computed benefits depend fundamentally on the demand response model employed and/or the assumptions made on the peak shaving potential.

Cost-benefit analyses that take a social view of the issue generally result in net positive benefits; analyses that take a narrower point of view (the retailer business case, for instance) do not lead to similar outcomes. The positive results of broader scope analyses have been taken as motivations for a regulatory intervention in the majority of cases.

A crucial issue in these analyses consists in assumptions made about how customers will respond to the information that smart meters will provide and whether they will change the way they use energy. Up to now, there is little evidence that customers will reduce their energy use or shift their use away from peak periods in response to better information and energy prices that vary across the day.

d) Ownership of electricity meters

Different potential owners of meters may curb investments in smart meters. If the meter belongs to the customer, in particular, it may be unwilling to upgrade an existing meter.

When suppliers own smart meters, they face a potential stranded asset risk if they invest in a smart meter and customers subsequently change supplier. This points out the need for a scheme whereby customers are able to retain meters when they change supplier and the need for installations to comply with interoperability standards.

In most countries the customer meter lies with the distribution network operator. In Spain, however, it could be owned also by the supplier or the consumer, in UK by the supplier, the consumer and the metering company.

e) Party responsible for smart meter operation

Meter operation includes four different activities:

- installation;
- maintenance;
- reading;
- data management.

Distribution companies are generally responsible for operating smart meters. In Spain consumers may be responsible for the maintenance, while in France they may be responsible for the installation; in this country, moreover, suppliers can be responsible for data management and maintenance of meters.

In **UK**, where competition was introduced in metering services, suppliers are responsible for all the activities, though consumers may be responsible for installation and maintenance. Ofgem, the energy regulator, believes that retailers are best placed to understand how different groups of customers are likely to respond to the information that smarter meters will provide, as well as the costs and benefits to different groups of customers of the different technologies available. On the other hand, Ofgem is aware that some barriers could prevent retailers from rising to this challenge.

f) Meter design and operation

Concerning meters' design and operation, it appears crucial that all smart metering systems in the future are **interoperable**. This means that if one energy supplier installs one type of smart system into a property, the basic functions of the meter must be able to be used by a different supplier, if the customer chooses to switch.

In general, interoperability should ensure that:

- customers with smart meters can switch supplier without necessarily having to change their meter;
- suppliers or metering companies will not face technical barriers to interacting with smart meters installed by their competitors;
- full competition in the market of meters leads to a decrease of their prices, for the benefit of customers.

This is possible through the definition of **minimum functional requirements** or technical standards, warranting the offer of the same minimum options to all customers, whether under a customer protection scheme or customers that decided to switch, independently from the utility providing the service.

Functional requirements not only guarantee minimum services for customers, but also reduce investment risk for meter operators and stimulate competition between meter vendors, avoiding the establishment of local monopolies.

Energy suppliers can install systems with more functionality but basic functions of the systems would be interoperable. Requirements should secure non-discrimination of suppliers, customers or third parties, such as ESCOs.

Concerning these issues:

- minimum requirements should apply at system level rather than equipment level, to render them independent from architectures used by operators or recommended by AMM system vendors;
- smart metering systems should be qualified by performance levels rather than intervention in their architecture or in the size of the system or any of its parts; more in general, in order to allow for economic optimal solution and technical innovation, it should be left to individual meter service providers to decide on the technical solution to fulfill the required functionality.

This would prevent the rejection of solutions whose architectures or philosophies may be different for those currently used but which may be just as efficient. Moreover, it would be guaranteed that regulators don’t interfere with the decisions made by operators or recommended by system vendors and would prevent holding back or limiting technological progress.

Minimum functional requirements should concern both meter design and meter operation.

Meter design mainly relates to:

- which variables should be measured: active power, reactive power, number and duration of network outages, maximum demand, etc.;
- which information should be locally displayed: meter storage capacity, processing capacity etc.

Information that smart meters can display should include:

- actual demand (or generation);
- actual price;
- actual tariff;

- total consumption per time band.

Other information could be:

- electricity and gas consumption and costs;
- historical consumption data for comparison;
- greenhouse gas emissions.

Additional information could be provided either through the display of the meter or through alternative ways, such as on line data access.

Meter operation relates to data transmission and communication protocols. Minimum functional requirements should concern:

- the interface between meter and customer (technology, data transmission technology, ability to remotely control consumer appliances, on demand data access for customers);
- the interface between meter and supplier/distribution operator/meter company (data transmission technology, ability to remotely connect/disconnect consumer appliances, on demand meter data access for third parties).

Meter communications can be either from the meter to devices inside the building, from the meter to the energy company or both. There is a number of communication technologies for both cases, including GSM, power line carrier and radio. Each communication system has advantages and is appropriate for different geographical situations and customer types.

In any case, the party responsible for collecting and administrating meter data (indipendent meter service provider or grid operators) should warrant access to meter data and other smart meter functionalities (remote demand reduction or disconnection, power quality measurement, remote tariff change, etc.) to all authorized market players - namely customers, suppliers and network operators - on a **non-discriminatory** basis and ensuring appropriate levels of transparency and confidentiality. Proper market rules should ensure which market players can trigger different functionalities.

The identification of an independent meter service provider and the setting of accessible data platforms could favor the availability of market data to authorized third parties; alternatively, complete IT system related undundling of grid and supply business should be required. This option, however, has resulted up to now difficult to implement.

It is important to highlight that the use of technical standards should be promoted both within and between countries.

In Europe minimum functional requirements are determined by the objectives of national smart metering policy and differ from country to country.

In **Italy**, minimum functional requirements include:

- weekly profile: four price bands; at least five intervals throughout the day; weekly programming including holidays; at least two changes of the weekly profile a year per meter must be allowed;

- interval metering capability: depth of 36 days;
- security of data withdrawal: required protection through checksums or CRCs (Cyclic Redundancy Checks), even during their transmission to the AMM control centre. If a protected memory area is corrupted and cannot be recovered from the backup (if present), an alarm should be sent to the AMM control centre. Meters must also be equipped with a programme status word, read continuously, that signals with timeliness any errors to the control centre;
- remote transactions:
  - ✓ periodic readings for billing purposes;
  - ✓ reading of interval metered data;
  - ✓ contractual changes: meter activation and deactivation; name change; change in contractual power; change in weekly profile; reduction, suspension and reactivation of contractual power;
  - ✓ meter re-parameterisation;
  - ✓ synchronisation of meter clocks;
  - ✓ transmission of messages on the meter display;
  - ✓ continuous reading of the status word;
  - ✓ reading information related to slow voltage variations;
- freezing of withdrawal data (billing, contractual changes, switching, etc.)
- meter display;
- upgrade of the programme software;
- slow voltage variations.

g) Financial issues

Legislators or regulators can warrant grants for roll out, discourage installation of electromechanical meters or cofund operational expenses. Roll out obligations are usually combined with specific regulatory tools covering technical, procedural and financial aspects.

Where metering tariffs are set by the regulatory authority, the regulator may provide incentives the installation of smart meters by allowing a higher meter tariff for smart meters. The tariff should obviously reflect the level of functionality of installed meters.

Investments in meter technologies should in principle be treated like any other investment made by the network operator (or the regulated meter operator). The issue of split incentives among different market operators and the existence of social-economic benefits of smart metering, however, could be an argument for some additional financial measures to the ordinary regulation.

In the Italian electricity sector, the metering tariff is separate from the distribution tariff and both are uniform at national level. As from 2007, investments in electronic meters and AMM systems for low voltage customers will be recognized, through equalization mechanisms, only to DSOs that really invest in these technologies.

Starting from 2008 financial penalties shall be applied to DSOs that do not reach the minimum yearly percentage of electronic meters installation determined by the regulator.

4.3.2. The reform of the electricity tariff and the planned introduction of smart metering in Jordan

In Jordan a National Efficiency Strategy is in force since 2007; it defines a 20% target for the reduction of total energy consumption by 2020.

The strategy will focus on the achievement of many different goals, the most important of which are:

- to reduce energy consumption without negatively affecting production or the standard of living;
- to achieve balance between imports and exports, in particular through the lowering of the imported oil bill on the national level;
- to reduce production cost and improve competitiveness of the local industries and other sectors;
- to lower investments in the equipment used for the production, conversion, transport and distribution of energy;
- to decrease the emission of gases harmful to the environment.

Policies that will be implemented to achieve these goals are the following:

- restructuring of the electricity tariff and introduction of smart metering;
- gradual elimination of subsidies to oil products and electricity prices;
- elimination or reduction of custom duties and indirect taxes on materials and equipments;
- provision of grants and soft loans for large energy conservation projects;
- measures to improve electric load management in generation, bulk supply and distribution networks;
- introduction of energy efficiency labels;
- activation of building codes;
- introduction of energy audits for large industrial and commercial operators;
- implementation of energy efficiency demonstration projects (lamps, street lighting and solar water heaters);
- training programs for operators involved in energy efficiency;
- public awareness programs.

Focusing on the reform of the electricity tariff, in Jordan the proper energy pricing is considered as one of the best tools to improve energy efficiency in the different sectors, providing incentives to end-users to search and adopt more virtuous consumption behaviors.

On this basis, the Electricity Regulatory Commission (ERC) has taken serious steps to reform the electricity tariff and remove existing subsidies.

ERC, in particular, changed the electricity tariffs in 2008, through the introduction of a time-of-use tariff (three part tariff) for many consumers' categories like new medium agricultural and commercial consumers, as well as for the consumers whose load is greater than 200 kW.

In the near future ERC plans to apply a two part tariff on residential consumers and other consumers, as soon as electronic meters will be installed.

Since 2008 all the new procurements for meters concern electronic devices. At the same time, ERC has started a campaign to increase public awareness regarding the time-of-use tariff and main tools to achieve the saving goals.

The Commission believes that the introduction of smart metering will:

1) reduce the contribution to peak demand of the residential and commercial sectors and of the segment of other small customers;
2) encourage small customers to consider conservation and energy efficiency options to reduce their bills.

Two other goals strengthen the decision of installing electronic meters instead of electromechanical meters:

- reduction of non-technical losses, as electronic meters are more accurate than electromechanical meters and consume less energy;
- decrease of energy theft.

In the following part we briefly point out main decisions taken for the introduction of smart metering in Jordan.

Metering market model

The installation of new electronic meters will occur within a regulated framework. ERC, in particular, will set the minimum technical specifications required for the new electronic meters and will also inspect meters before the installation.

Mandate or promotion of smart metering

In a first phase time-of-use pricing will be implemented on a voluntary basis. Each consumer will get two bills, one of which based on a flat tariff and a second based on a time-of-use tariff for its energy consumption. This provision should encourage consumers to gradually change their behavior so as to reduce electricity bills.

In order to effectively achieve the objectives of energy conservation, time-of-use tariffs will be mandatory within the phase two.

The timing for the conclusion of the first phase depends on the ability of companies in replacing meters. Moreover, the intervention could be favored by certain consumers bearing the cost for the substitution. In any case, it is likely that the operation will take not less than 2 years.

Ownership of electricity meters

The distribution companies will be the owners of electronic meters.

Party responsible for smart meter operation

Distribution companies will be responsible for the installation, maintenance and operation of smart meters.

Meter design and operation

Information available to consumers will be historical consumption data as well as the relative price, for some types of consumers. New meters can be easily updated to display new kind of data and to perform new operations.

Financial issues

As the process of meters' substitution will be carried out within a regulated framework, ERC will fix tariffs so as to fully cover the costs of electronic meters during their life cycle.

In the first phase the cost of new meters is likely to not significantly differ from that relative to electromechanical meters, which is relatively high.

In the future ERC will review such a decision if companies present evidence of capital or operative costs higher than those estimated.

5. Conclusions

White certificates market, tender mechanisms and the adoption of smart metering resulted to be all successful policies for the promotion of energy efficiency.

Before any implementation of energy efficiency measure, a careful evaluation of expected benefits and costs of such measures in the context of the eligible country should be carried out: the introduction of these policies has not to be considered an objective in itself.

In developing countries it is advisable, at a first stage, to introduce energy efficiency obligations placed on energy utilities and move later and progressively to more complex systems like, for example, a white certificates mechanism.

The experience to date in Europe with white certificates and tender mechanisms is still quite limited. Implementation of these policies is generally successful where mature financial infrastructures and experienced market players are in operation. Moreover, liberalized electricity markets and development of energy services companies enables to promote energy efficiency more effectively.

With respect to the white certificate scheme, the experience of countries such as Flanders and UK demonstrated that even without the benefit of full trading mechanisms, there are still significant financial benefits related with the introduction of saving obligations.

Regarding smart metering, it is recommended to introduce interoperable meters from the beginning, complying with minimum functional requirements. This will allow the switching of consumers from one supplier to another when markets will become mature for the development of competition.

6. Next steps

In the future it could be of interest to carry out other case studies concerning the introduction of specific policies in MEDREG countries.

Moreover, we could evaluate the effects of extending the functioning of national mechanisms to a supranational level.

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AD HOC Group
on Environment, RES and energy efficiency

Effects of the introduction of successful mechanisms to promote RES and CHP in non-EU countries

6 May 2010

1. Introduction. Successful promotion mechanisms in E.U. countries

There can be no doubt that renewable energies have extensive **advantages** for society concerning industry, employment, local and regional development, checking the deterioration of trade balances, security of supply and improvements in environmental quality. As a result of all these advantages, we could point out that renewable energies constitute a guarantee for sustainable development. Nonetheless, renewable energies also suffer from **disadvantages** when compared to fossil fuels. These disadvantages arise from greater investment costs, the dispersion of energy sources and the intermittency of some of them, which lead to higher costs when taking advantage of energy. The role played by economic regulation is fundamental to guide the energy model towards the path of sustainability, especially in liberalised energy frameworks like the current one, so that market failures are reduced or minimised when regulatory mechanisms are introduced.

It is precisely at this point where economic regulation should intervene within energy frameworks that have liberalised generating activities in order to introduce regulatory mechanisms that guide investors to more efficient generation technologies from an energy-related and environmental standpoint.

There are a great range of market-based instruments governments use to subsidise renewable electricity. These can be divided into **investment support** (capital grants, tax exemptions or reductions on the purchase of goods) and **operating support** (price subsidies, green certificates, tender schemes and tax exemptions or reductions on the production of electricity).

The European Commission presented its assessment of the support schemes in the Commission Staff Working Document: “The support of electricity from renewable energy sources”, that accompanies the Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources. Brussels, 23.1.2008 SEC(2008) 57 {COM(2008) 19 final} using two main criteria: one criterion measuring **effectiveness** (i.e. ability to deliver an increase of the share of renewable electricity consumed) and the other criterion measuring **efficiency** (i.e. comparison of the total amount of support received and the generation cost). In addition, the effectiveness of a policy was correlated with the average expected profit from investments in renewable electricity using the same policy.

According to the EU Commission assessment, **feed-in tariffs achieve greater renewable energy penetration, and do so at lower costs for consumers**.

The effectiveness of policies promoting wind energy, biogas and photovoltaics technologies has been highest in countries using **feed-in tariffs** as their main support scheme. However, not all feed-in schemes implemented in EU Member States have been equally successful. For onshore wind energy, Denmark, Germany and Spain have shown the highest effectiveness indictors for the period 1998-2006. High investment security coupled with low administrative and regulatory barriers in these countries has stimulated a strong and continuous growth of wind energy over the last decade. For biogas, the highest growth can be seen in Austria, Denmark, Germany, Greece and Luxembourg, all using feed-in tariff systems. For PV energy, the strongest growth in recent years can be seen in Germany, followed by Spain, Italy and Greece, that also use feed-in tariff systems.

The level of support is adapted to the generation costs wich varies between EU Member States and also between technologies. Two thirds of the EU Member States are considered to have a level of support which is sufficient to cover generation costs for onshore wind, small hydro and solid biomass.

Other support mechanisms, such as **investment grants** and **tax rebates** are difficult to measure as these mechanisms are usually used as additional policy tools. The combination of investment grants and tax rebates have proved to be very successful for the development of solid biomass in some countries, but less effective for the development of wind energy.

The E.U. experience could be a good example in order to select the right mechanisms for each country, acording to the particular economic and social situation of the different members.

2. Particular Barriers in other countries for RES and CHP

2.1. Insufficient information and “Know-How” in RES and CHP technologies.

RES and CHP development demand an specifical and complex technology. For some MEDREG members these tech industries are not enough developed.

In many countries possibly there are not enough skilled personnel who can install, operate, and maintain renewable energy technologies. Sometimes developers often lack sufficient technical, financial, and business skills.

To sum up, in some countries there is poor information and there is an important shortage of renewable and CHP energy technology.

Also, the lack of links between technology, industry and commercial network could be an extra barrier to set an efficient energy policy.

2.2. Low investment levels for RES and CHP projects

The development and commissioning of electricity generation projects based on clean energies is highly conditional upon each country's economic evolution and political situation. The economic crises suffered by some countries over the past few years have not allowed an appropriate energy policy to be drawn up as regard to renewable energies or even the improvement of already established conventional energies.

This social and political situation, as well as the lack of economic security, creates a feeling of uncertainty among possible investors, who are uncertain about the return on the high costs involved in implementing these facilities.

Renewable and CHP energy systems have a much more investment cost by KW than conventional energy sources. The energy investments require higher amounts of financing for the same capacity installation. This makes the cost of renewable energy investments more dependent on the cost of capital than conventional energy systems.

Capital markets may also demand a premium in lending rates for financing renewable energy projects as more capital is being risked in comparation than conventional energy projects.

In some countries poorly developed financial markets, products, and institutions, as well as high credit and economic risks are strong barriers for RES and CHP projects.

2.3. Insufficient network capacity

It is true that some renewable technologies like wind energy are intermittent and need backup energy; others like biomass are not. In any case, developing countries generally have a certain degree of generation flexibility like fuel oil or hydraulic power that can play this role. Wind energy cannot cover demand peaks or cover an increase in demand and widen electricity supply without being accompanied by other energies. It is, however, evident that all renewable generation, and specifically wind energy, will reduce the need to generate electricity with fossil fuels. It will therefore reduce the need to buy fuel, energy dependence and the associated economic and social risks it entails.

RES and CHP technologies are most difficult to manage for the network Systems Operators than conventional technologies. The main reasons are:

-Predictability (Some of the technologies are not predictable with accuracy).

-Operation (Some of RES technologies as wind or solar, are not easy-to manage)

-Long time response.

In some countries, network capacity is not stronger enough to manage this new RES and CHP energy, wich involves an extra barrier to new projects.

Also, the generator location in remote places could be an additional problem for the network

2.4. Legislative and regulatory framework undeveloped or without stability.

Developing countries have implemented **some legislation** that attempts to incentivize and support the exploitation of natural resources as sources of primary energy. Nevertheless, in most cases this legislation **does not tend to be stable,** which in practice means that the progress of projects is slow and difficult.

Non clear guidelines for authorization procedures, non-objective and non-transparent procedures for grid connection, and long times to obtain authorisation for grid connections are examples of some barriers to develop RES and CHP.

In the absence of a clear and stable legal framework, independent power producers delay or stop future investment projects for renewable or CHP energy facilities. A clear legal framework is necessary for project developers to plan and finance projects on the basis of known and consistent rules.

2.5. Lack of experience in promotion mechanisms.

For many countries there is no previous experience to test the success of the promotions policies. It could involve an extra difficulty at the beginnings.

Evaluating costs and fixing tariffs properly, with no past experience, could be a very difficult task.

These countries fix some kind of investment support (capital grants, tax exemptions, or reductions in the purchasing goods) or operations support (price subsidies, tax exemptions or reductions on the production of electricity)

Futhermore, burocratic and administrative proccess could be an extra barrier if there is no previous experience in this issues.

The pricing system and the setting of electricity tariffs also hinder the energy sector's "clean development". Extreme poverty in some countries obliges a relatively low tariff ("social tariff") to be set in order to be in a position to supply electricity to most of the population as an "essential service". This approach makes it difficult to cover costs that go beyond those of conventional generation.

2.6. Lack of electricity supply for all consumers

In some non-EU countries, some consumers have not access to the distribution and transmission lines. This could be a priority for this countries, before RES and CHP development. On the other hand, this issue can be an opportunity for RES and CHP technologies to supply electric energy to isolated areas.

3. Possibility to introduce successful mechanisms and eliminate barriers for RES and CHP in other countries.

3.1 Guaranty of regulatory stability

The stability of regulation is a basic starting point to promote RES and CHP. National and foreign private investors will be interested on invest in new facilities if there is low regulatory risk.

The experience in many industrialized countries shows that stability in regulation of electricity generation is a very important aspect for new investments.

Furthermore, reducing the risk is a key point to reduce the premium demanded for capital markets.

Without prejudice to the foregoing, regulation has to offer sufficient guarantees to ensure that economic incentives are stable and predictable during the entire life of a facility.

Nonetheless, it is also useful to establish transparency mechanisms for:

a) Annual incentive updates, by associating updates to the evolution of robust indexes (like the CPI, ten-year bonds, etc.).

b) Periodic reviews every four years in order to progressively adapt incentive levels to each technology's learning curve. For reasons of legal security, such reviews should only affect new facilities.

3.2.Definition of specific national targets/objetives

The definition of National targets in National legislation it is a key point for each member. It is important to define at least, these parameters:

-Current level of RES and CHP technology.

-National future targets for specific RES and CHP technology types. (In % or MW installed)

-Deadline to reach targets.

-Economic impact assessment of the effort necessary to reach targets.

Targets have to be ambitious, but realistic, and according with the economic, social and physical features of the country, and the possible evolution of the energy prices. The volatility and growing price of a barrel of oil should lead governments to reconsider other ways of generating electricity that reduce foreign dependence, perhaps at a higher cost.

It is also important to define the targets, taking into account other national priorities as tourism, industry development, employment etc.

In order to define the targets, is very important to study carefully the country potential and national possibilities for each technology. In general, key points to consider are:

- The existence of a lot of as yet unexploited energy potential.
- Regulations those are favourable to attaining greater energy penetration, which have allowed developers' expectations and confidence to be strengthened.
- A mature industrial sector having a firm interest in the renewable sector.
- The existence of technology and the capacity to develop manufacturing at a national level.
- The planning conducted by regional authorities supports the targets laid down by the Plan.
- The incorporation of technological enhancements, allowing for a high level of renewable energy penetration without affecting the security of electricity supplies.

3.3. Definition of network development plans

To achieve a good level of RES and CHP development, and to combine these targets with the guaranty of the supply, it is necessary to get a strong network. So, a minimum network development has to be defined in mandatory planning.

The development of electricity produced from renewable energy sources will increase the need for stronger grids and interconnectors.

In the development plans is necessary to take into account that network has to connect customers and places where renewables resources are.

The advance in international grid interconnections and the promotion of international electricity markets will help to achieve the targets.

3.4 RES and CHP access regulation and grid integration.

It is important to develop connection procedures for RES and CHP facilities. Non-discriminatory access rules and priority in dispatch have to be established.

Members shall ensure that network operators in their territory guarantee the transmission and distribution of electricity produced from RES and CHP. They shall also provide for non-discriminatory connection to the grid system of electricity produced from RES and CHP. Transmission system operators shall give dispatch priority with market based balance responsibility to generating installations using renewable energy sources, always complying the security of supply guarantee.

The Government shall clearly define any technical specifications which must be met by RES and CHP equipment and systems in order to be connected to the grid and to benefit from support schemes.

In order for Transmission System Operators to guarantee the security and the adequacy of the power systems installations, the new generators which are close to be connected to the grid have to comply with the grid codes and technical specifications.

As an example, an obligation for RES and CHP generators could be to connect the facilities to a Control Center, in order to improve operation network.

3.5 Collaboration programs between members

Developing mechanisms to collaborate in promotion of RES and CHP could be a way to remove certain barriers.

To promote efficient industries, and to develop Research and Development issues, collaboration between different countries is a key point.

This collaboration could involve different aspects:

- Technology (i.e. with High-tech transfer technology programs)
- Regulatory collaboration: Regional associations as MEDREG, ARIAE, ICER, etc.
- Technical collaboration between Technical System Operators (TSOs)
- Training programs (i.e. CEDDET, Florence School of Regulators, Universities, etc.)

3.6.Definition of promotion mechanisms

The Government must define promotion mechanisms with transparency and stability in national legislation.

The mechanisms have to be open and flexible to adapt to the economy evolution, but with the enough stability guaranty to support investments.

It is also necessary to introduce some support schemes, wich could be divided into investment support and operating support (feed –in tariffs achieve greater energy penetration and do so at lower cost for consumers).

As has been pointed out, it is important to set a methodology wich involves an effort to provide certainty and objectivity in the special scheme's remuneration. The definition of technology groups and subgroups (types of technology) is important in this regard, so that their investment and annual operating costs are known. The *remuneration* for each type of technology is firstly determined through the methodology and, on the basis of this, the *regulated tariffs and premiums* are calculated in a subsequent stage.

It is necessary to get basic information for each kind of technology concerns investment costs and average operating costs and income taken from real facilities started up during the preceding period. This information is completed with average technical characteristics. The basic information includes the following points:

- Hours of use
- Energy performance.
- Project's economic life and investment depreciation period.
- Unitary investment and, if appropriate, investment grants.

- Company tax and, if appropriate, prevailing write-offs.

- Operating costs: fuel, if appropriate, operations and maintenance, insurance, fees (for use of land or flow rate) and others.

- Operating income other than from the sale of electric energy to the grid: sale of electric or thermal energy to associated industries, sale of by-products in the case of cogeneration (pulp, dry waste, fertilizers, etc.), energy recovery or waste reduction fees, and, if appropriate, income from emission rights or from the sale of green certificates.

Economic incentives granted to companies or individuals embarking on projects with renewable energy resources, establishing **tax exemptions** for the importation of machinery destined to these ends and setting **premiums** to encourage savings on energy consumption are to be found among the measures taken in some developing countries

However, **capacity tenders and the subsequent signing of long-term agreements** between the public administration and the awardees of the tenders have not been used to date.

4. External Financing

Developing countries must have external financing to increase their renewable capacity. There are some sources of external financing:

4.1. Flexibility Mechanisms

The agreements reached at the Kyoto Protocol have allowed investments to be made through the Clean Development Mechanisms (CDM) or the Joint Implementation Mechanism (JIM) by the agreement's signatory countries (Annex I countries, or developed countries) in less developed countries in order to reduce the former's CO_2 emissions. These mechanisms were established to promote the transfer of technology to third countries and to help developed countries meet their commitments.

This is because these projects can obtain CO_2 emission rights if they can show they avoid emissions in their countries thanks to CDM. Additionally, such countries can sell these emission rights to companies subject to the European emissions market or to countries with emission reduction commitments according to the Kyoto Protocol. The income generated by the sale of rights therefore comes from developed countries and reduces the need for support for renewables in developing countries, as well as the costs this would involve for their economies.

This system is benefiting countries with renewable energy potential lacking the economic resources to carry out costly projects.

Many of the projects put forward to encourage renewable energies are aimed at providing electricity to disadvantaged places located in rural areas lacking electricity coverage, which is one of the major problems affecting developing countries.

4.2. Official Aid Development (ODA)

Access to electricity and other advanced forms of energy is an essential component in the fight against poverty and underdevelopment. Almost a third of the world's population completely lacks such access. In the face of this reality, the international community, the governments of different countries and a range of institutions have studied, planned and started up several mechanisms to deal with this situation.

4.3. Private initiative

The essential role played by electricity supplies demands that the regulatory framework ensures profitability and the continuity of efficiently made private investments.

Systems based on electricity service concessions in rural areas are an appropriate model for efficient and continuous electricity supplies. The concession scheme1 is attractive for large private companies, local companies, cooperatives and other forms of organization of the community benefits from it.

The concession model facilitates the creation of sufficiently large markets as a guarantee for business sustainability and in order to extend and ensure electricity supplies to as many consumers as possible.

One example is the Desertec Industrial Initiative. The aim of this initiative will be to start supplying electricity to the European Union and to generate sufficient power to meet the needs of the producer countries as soon as possible. The target is to supply around 15% of Europe's electricity by 2050. The focus of the Desertec initiative in the field of power generation will be on the sun and wind as renewable sources of energy. This initiative shall be financed from contributions made by the participating companies, even additional funds may be raised from public sources.

4.4. Post Kyoto mechanisms and flexibility mechanisms in the Directive 2009/28/CE

The new Post Kyoto mechanisms that will be implemented in Mexico 2010, can be a good opportunity for new projects.

Also, in the Directive 2009/28/CE , new flexibility mechanisms will be implemented in order to achieve the 20/20/20 targets for the EU countries. One example is the Mediterranean Solar Plan Project:

4.4.1. Mediterranean Solar Plan

The Mediterranean Solar Plan (MSP) aims to attain an installed power of 20 GW with renewable energies in southern Mediterranean countries by 2020.

The common approach for financing these projects is based on both public and private funding, community funding and loans from the European Investment Bank as well as from other international financial organizations. The sovereign funds of countries from the Gulf Cooperation Council interested in taking part in a project like the Mediterranean Solar Plan can also contribute to the investment.

[1] "Electricity Regulation in Isolated Rural Areas of Guatemala" Project, Activity B1.3: "Key Issues for Regulation". Energy sans Frontières.

Although it is certainly true that the current economic and financial crisis will not facilitate the tasks of mobilising the necessary funding, the development of a renewable energy project in North African countries is a priority to ensure the region's sustainable development. In this regard, the participation of private initiatives should be promoted, especially direct foreign investment (DFI). The advantages provided by this option concerning, for instance, the financing of renewable generation facilities should be taken into consideration. DFI does not affect public budgets and it promotes job creation and technology transfers. It also trains human capital and enables the development of new industrial sectors.

Some estimates suggest that 70% of PSM projects will be financed through private funds, which fits in with the free access model with regulation through premiums. Now then, this will only come about as long as the regulatory conditions in the different countries are profitable. Foreign investment, and more specifically European foreign investment, has shown an interest in the potential of renewable energies on the southern shores of the Mediterranean. However, there are constraints to their development due to the fact that the public finances of countries in the south of the Mediterranean are not capable of providing sufficient economic incentives to renewables.

This problem should be overcome through external funding mechanisms, both for the facilities themselves and through a tariff remuneration framework for any green electricity exported to the EU (which is compatible with the new Directive to promote renewables). Other measures consisting of tax measures through tax write-offs, agreeing upon loan bonuses and setting up guarantee funds to reduce the projects' risk levels could be adopted. The private sector could become involved in these projects through public-private partnerships for important investments. Additionally, other ways to reduce the projects' risk levels should be taken into account, such as strengthening the role played by energy services companies, giving them a capital stake and ensuring the facilities' maintenance.

Furthermore, as part of international funding, the role played by the European Investment Bank should be highlighted. However, other international and regional banks could also be used, like the World Bank, the African Development Bank or regional Arab institutions. These instruments could include donations and concession loans.

Another possibility lies in mobilising the recourse to the clean development mechanisms (CDM) laid down by the Kyoto Protocol. CDMs constitute a financial tool that is scarcely used in the region.

Lastly, Development Cooperation could also make a contribution through the funding of facilities that contribute to the fight against energy poverty, along with technical and training programmes.

Technical cooperation is another of the aspects highlighted by the main studies, which stands out most in two areas of action: (i) in the use and development of the technologies associated to renewable energies; and (ii) in the electricity sector's management and regulation.

Training programmes could comprise three levels and should be considered as a key element for cooperation between the EU and developing countries:

- Vocational training to have local human resources available that would allow new energy sources of be disseminated and consumers to be satisfied.

- Training in research and development (R&D) and innovation in renewable energies given to research organisations considered as a point of reference in the countries in question to encourage the transfer of technology.

- Training given to the regulatory bodies and civil servants of developing countries, thereby extending the transfer of knowledge to the field of managing and regulating renewable energies and the electricity sector.

5. Conclusions

The definition of National targets in the National legislation it is a key point for each member. Targets have to be ambitious, but realistic, and according with the economic, social and physical features of the country, and the possible evolution of the energy prices. The volatility and growing price of a barrel of oil should lead governments to reconsider other ways of generating electricity that reduce foreign dependence, perhaps at a higher cost.

The setting forth of economic incentives and tax exemptions in sectoral regulations on the basis of technologies, along with installed capacity targets, constitutes an important energy and environmental policy instrument, which guides the decision-making of investors within a liberalised regulatory framework like the electricity generating activity framework. However, capacity tenders and the subsequent signing of long-term agreements between the public administration and the awardees of the tenders have not been used to date.

It is important to develop connection procedures for RES and CHP facilities. Non-discriminatory access rules and priority in dispatch have to be established.

Developing countries must have external financing to increase their renewable capacity. There are some sources of external financing. The Mediterranean Solar Plan shall be the main mechanism to increase this capacity.