# THE ITALIAN APPROACH TO IMPROVING ENERGY EFFICIENCY: THE WHITE CERTIFICATES SCHEME

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**Abstract**

Recent International and EU energy policies are committed to new and more widespread renewable energy sources as well as to energy saving and energy efficiency. Initiatives have been launched in several countries and different tools implemented to improve technological, economic and environmental performance in the energy chain.

In Italy, legislation deregulating the electricity and gas sectors has introduced the White Certificates trading mechanism to promote, on the one hand, energy efficiency investments and, on the other hand, the growth of an energy services market.

The paper analyses, from a comparative perspective, Italy's commitment to EU energy policies focused on creating a competitive internal energy market offering quality service at low prices, developing renewable energy sources, reducing dependence on imported fuels and implementing energy efficiency tools, safeguarding the environment.

The strengths and limits of the Italian White Certificates mechanism will be examined, considering its importance as a market-based tool in national energy policy. The recent implementation of the system sets specific obligations and responsibilities on the part of operators in the energy distribution sector, but above all, launches new challenges endorsing more responsible consumption models promoting sustainability in the energy sector.

**Keywords**: energy policy, energy efficiency, White Certificates scheme.

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## Introduction

European Institutions are facing new challenges to promote EU competitiveness and employment, through a renewed energy policy. Over the last decades EU environmental and energy policies have been orientated towards an increasing interest in market based instruments for greater efficiency in the use of energy sources.

The tradable White Certificate Scheme is one of the new key instruments capable of supporting energy efficiency improvements.

Goals can be reached in a cost-effective way thanks to the tradability of White Certificates.

This paper critically analyzes the effects of recently adopted Italian initiatives, which promote energy efficiency by introducing the "Titoli di Efficienza Energetica (TEE)" or Energy Efficiency Certificates (EECs) also known as White Certificates Scheme (WCsS).

The study is divided into four sections.

The first examines the trends over recent decades for primary and final energy intensity in the world, EU and Italy.

The second describes recent Italian legal provisions promoting energy efficiency. The evaluations on savings achieved during the three years of the Scheme's application are reported.

The third highlights the characteristics of WCsS on the Italian market and shows the results obtained by negotiation of Certificates.

Finally, the conclusion provides ideas on possible adjustments of Italian WCsS, considering both the national experience carried out until now and those implemented in other countries.

## Background

Following the events linked to the oil crisis in the Seventies, a widespread revision process was implemented for improving energy efficiency, especially in energy-intensive sectors, such as those related to manufacturing, energy conversion and transport.

This process identified the technological and organizational solutions best suited to dealing with the increasing limits imposed by energy input prices.

Furthermore, the energy crisis of the Seventies did not merely represent a transitional phase between two periods.

The first period was characterized by the availability of low-cost energy sources, while the second by growing awareness concerning the scarcity of fossil fuels and their significant increase in price.

The transitional period, indeed, was also a phase of deep reflection on many other critical issues involved, such as those related to the need for geopolitical diversification and oil supply security, but above all to the more recent challenges arising from the environmental impact of the whole "energy lifecycle".

The initial policies adopted in industrialized countries for reducing energy vulnerability have favoured a shift towards alternative oil sources. Nevertheless low flexibility and long transitional processes have determined measures for improving energy efficiency and adopting energy saving instruments.

The outcome highlights a consistent reduction in energy intensity[1] although with different dynamics in OECD countries.

Energy intensity represents the most significant indicator in energy consumption and economic growth trends, however, it is influenced by many factors and energy efficiency is only one of the most important.

Changes in the economic structure of a country or in its energy technological innovation can have a strong impact on energy intensity performance.

Figure 1 illustrates declining trends over recent decades for primary and final energy intensity[2] in the world, the EU and Italy; the primary and final energy intensity is the lowest in Italy.

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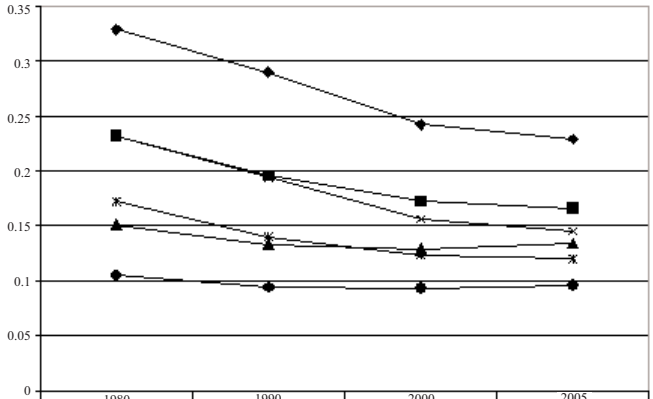
1 Energy intensity is given by the ratio between energy demand and the GDP of a country, or between energy consumption per unit of income, expressed respectively in tons of oil equivalent (toe) and € or $ of GDP.

2 Primary energy intensity measures the quantity of energy required by each country or region to generate one unit of GDP. It expresses "energy productivity", whose value reflects the features of the economic activities of a country (the "economic structure"), the implementation of technical energy efficiency measures and the energy mix utilized.
Final energy intensity corresponds to the energy used per unit of GDP by final consumers for energy purposes, excluding consumption and losses in energy conversion (power plants, refineries, etc.) and non-energy uses.




| | 1980 | 1990 | 2000 | 2005 |
|---|---|---|---|---|
| Primary energy intensity World | 0.329 | 0.290 | 0.242 | 0.229 |
| Primary energy intensity European Union | 0.232 | 0.196 | 0.172 | 0.166 |
| Primary energy intensity Italy | 0.151 | 0.133 | 0.129 | 0.134 |
| Final energy intensity World | 0.232 | 0.194 | 0.156 | 0.145 |
| Final energy intensity European Union | 0.172 | 0.140 | 0.123 | 0.120 |
| Final energy intensity Italy | 0.105 | 0.094 | 0.093 | 0.096 |

*Fig. 1* - Comparison between Primary and Final energy intensity (on a par with purchasing power) in the World, in the European Union and Italy (koe/$95p) (1).

At world and European level (Figure 1) primary energy intensity has decreased, respectively, by 12% and 16% in the period 1980-1990; 17% and 12% in 1990-2000 and 5% and 4% in 2000-2005. A reduction in final energy intensity, respectively, of 16% and 19% in the period 1980-1990, 20% and 12% in 1990-2000 and 7% and 2% in 2000-2005 has been identified.

The energy crisis has not only imposed a significant drive towards reducing energy consumption, but has also favoured technological development. These pathways have led to more efficient use of raw materials and energy sources as well as dematerialising economies and, therefore, reducing pollution.

The World Energy Council (WEC) estimates the same trend in 2050 and has outlined four different scenarios.

According to the less ambitious model, energy intensity should decrease at a world level by 20% in 2020, about 30% in 2035 and nearly 35% in 2050, compared to current data.

On the contrary, in the most ambitious model, a decrease of almost 25% by 2020, nearly 40% by 2035 and close to 50% by 2050.

In the Italian scenario (Figure 2 and 3) both primary and final energy intensity decreased, respectively, by 14% and 13% from 1970 to 1980 and by 3.6% and 10% from 1980 to 1990.

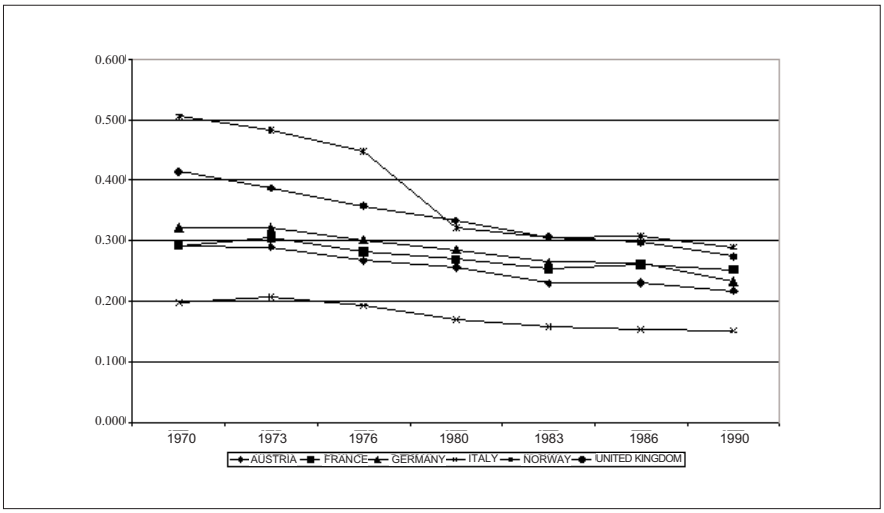



*Fig. 2* – Primary energy intensity in some European countries (koe/ECU90p) (2).

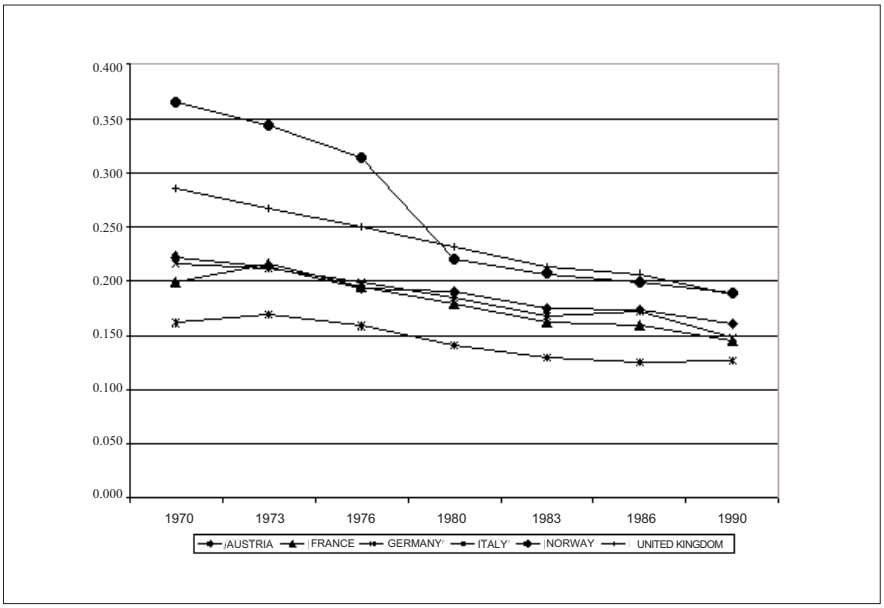



*Fig. 3* - Final energy intensity in some European countries (koe/ECU90p) (2).

The data are not directly comparable with more recent ones (from 1990 to 2005) as different statistical methodology have been adopted. The decline in primary and final energy intensity in the period 1990-2005, slowed down remarkably recording a stable trend.

After 1990, the declining energy intensity trend reduced considerably due to a number of factors including the delayed effect of the 1986 counter oil shock, the sharp decline in energy conservation efforts and the beginning of the world economic crisis.

In Italy, the trend has outlined an increase in energy consumption per unit of product, but the different economic sectors contributed in different ways: households registered efficient improvement every year; transport only recent significant improvements, while industry energy efficiency worsened.

In the years between 1970 and 1990, the Italian industrial sector had reduced its own energy intensity by about 45% due to outsourcing of some energy intensive productions in other geographical areas and process optimization where automation systems were applied (3).

On the contrary, between 1990-2005 the industrial sector globally presented a loss of 3.5% in energy efficiency[3]. This negative result is due to the differing performance of industrial branches.

Some branches, including chemical, steel and cement sectors had an increase in the energy efficiency. However this increase was not enough to counterbalance the reduction in machinery, metals, textile and food.

In the last years a reverse trend above all in food (with an improvement of 7.8% in 2000-2006) has been registered. The household sector improved its energy efficiency by 9.6% in the period 1990-2005. In the early Nineties energy efficiency increased the most, while the improvement gradually slowed down between 1996-2000. From the year 2000 the trend began to improve due to the highly efficient electrical appliances on the market and a wide use of fluorescent compact lamps. New measures were set to implement technologies for efficient end use such as thermal isolation in buildings and winter/summer air-conditioning based on renewable sources. From 2000 energy efficiency in electrical appliances increased by 6.3% and to 8.9% in the period 1990-2005.

Energy efficiency in transport improved by 5.5% in the period 1990-2005, 3.9% in 2000-2005 and 1.4% in 2006 compared with 2005.

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[3] This loss in efficiency was steady until 2000, but in the last years there has been an improvement (1.2% in 2005 and 0.6% in 2006 compared with the previous year).

A result due principally to an increase in car efficiency (10.3%).

Other transport modes showed greater improvement in efficiency but represented only a small part of the Italian transport sector.

This positive performance is counterbalanced by a decrease in the efficiency of trucks, although some improvements have been carried out recently.

Structural changes within the energy sectors in the last years have been characterized by widespread deregulation and stricter restrictions deriving from International and EU policies on environmental safeguarding issues. Both aspects have represented a new stronger drive for promoting energy efficiency. A number of instruments, including innovative market based and financing schemes for energy efficiency, voluntary agreements with large energy consumers, as well as labels and standard for more efficient household electrical appliances and economic incentives or fiscal measures have been applied (4).

The Italian energy policy has recently introduced an innovative system for promoting efficiency and energy saving: the White Certificates Scheme (WCsS).

The White Certificate certifies the reduction of consumption achieved thanks to energy efficiency improvement measures and projects. The certificates are issued by the Gestore del Mercato Elettrico (GME) – the Italian Electricity Market Operator - to electricity and natural gas distributors, companies controlled by the distributors themselves and companies operating in the energy services sector (Energy Service Companies - ESCOs).

The aim is to reconcile the gradual process of liberalization of electricity and gas markets safeguarding the environment, safety of supplies and technological innovation.

One White Certificate is equals to 1 ton of oil equivalent (toe) in energy saving and is issued according to three different procedures.

It certifies savings in primary energy obtained through actions aimed at reducing final consumption of electricity (Type I), consumption of natural gas (Type II) and consumption of other fossil fuels (Type III), respectively.

White Certificates are one of the most relevant tools for promoting energy efficiency, as is evident from the recent Action Plan for Energy Efficiency 2007-2016 presented by Italy in Brussels. The policies outlined in the Plan, which the Italian Government has already implemented and will continue to do so, aim at the estimated target established by the

Directive 2006/32/EU: a saving in energy set at 9.6% by 2016 (about 11 Mtoe). In October 2006, the European Commission launched a controversial Plan of Action to cut primary energy by 20% by 2020 compared to estimated future energy consumption for the same period.

The WCsS contributes to achieving positive and far-sighted results in energy end use efficiency and creating a synergy between the need to decrease energy dependency, increasing the safety of supplies and reducing greenhouse gas emissions.

All the previous factors can improve both competitiveness and technological innovation of the productive system as well as creating new employment in Italy.

## The Italian White Certificates Scheme: legislative aspects and operative effects

*Legislative aspects*

The legislative iter of Italian White Certificates Scheme (WCsS) derives from the Ministerial Decrees of 24 April 2001[4], deregulating electricity (Legislative Decree no. 79 of 16 March 1999) and gas (Legislative Decree no. 164 of 23 May 2000) markets.

The system established by the two decrees, however, has never been operative. After three years two new decrees, modifying the previous framework, were approved and enforced in July 2004[5]. These, in their turn, were amended by the Ministerial Decree of 21 December 2007[6], introducing an obligation scheme, typical of *command and control* regulations to increase energy efficiency for distributors of electricity and natural gas, and at the same time a market-based mechanism: the WCsS.

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4 The Ministerial Decrees of 24 April 2001, besides identifying the quantitative objectives set by the Italian Laws (Legislative Decrees no. 79 of 1999 and no. 164 of 2000), defined, on the one hand, how distributors subject to energy saving obligations could carry them out – by introducing a market of energy efficiency Certificates – and, on the other, commissioned the Regulatory Authority for Electricity and Gas (AEEG) to define the regulations and management of the scheme.

5 The innovative and complex nature of the WCsS required some amendments of Ministerial Decrees of 2001, which led to postponing the starting date to 1 January 2005.

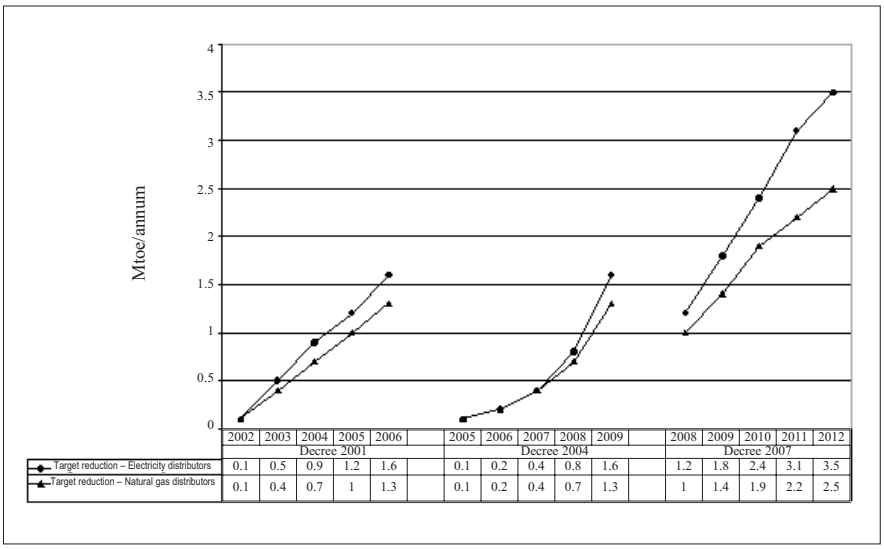
6 With the Ministerial Decree of 21 December 2007 Legislation reinforced the previous scheme promoting energy saving rewards, defining a clearer legislative framework in terms of investments and extending the period of reference. The principal amendments introduced concern the extension of the obligation to electricity and gas distributors with at least 50,000 final clients connected to their distribution network at the date of 31 December two years previous to that in which the obligation was introduced (in place of the previous threshold of 100,000 users); the revised apportioning criterion of the national quantitative objectives among obliged distributors the corrected and simplified sanction scheme in the event of non-fulfilment of energy saving obligations, and the extension of access to the WCsS to operators having appointed an energy manager.

This innovative tool is coherent with a deregulated market context, where the services supplying electricity and gas can be offered by a number of operators in a more "cost-efficient" way (5).

The quantitative objectives, established at a National level by mechanisms delineated by the Ministerial Decrees of 2004, set a total saving of electricity and gas equal, respectively, to 3.1 and 2.7 Mtoe (period 2005-2009).

A goal considerably lower if compared to previous objectives of the Ministerial Decrees of 24 April 2001, equal to 4.3 Mtoe for the electricity sector and to 3.5 Mtoe for gas, over the five years of application. This is the result, of the requests made by operators asking for a more gradual process of enforcement of the Ministerial Decrees (6).

However the initial target and the reformulating of objectives at the end of the period considered reach the same values for the fifth year of application (Figure 4).




| | 2002 | 2003 | 2004 | 2005 | 2006 | | 2005 | 2006 | 2007 | 2008 | 2009 | | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Decree 2001 | | | | | | Decree 2004 | | | | | | Decree 2007 | | | | |
| Target reduction – Electricity distributors | 0.1 | 0.5 | 0.9 | 1.2 | 1.6 | | 0.1 | 0.2 | 0.4 | 0.8 | 1.6 | | 1.2 | 1.8 | 2.4 | 3.1 | 3.5 |
| Target reduction – Natural gas distributors | 0.1 | 0.4 | 0.7 | 1 | 1.3 | | 0.1 | 0.2 | 0.4 | 0.7 | 1.3 | | 1 | 1.4 | 1.9 | 2.2 | 2.5 |

*Fig. 4* – Comparison between national goals defined by current legislation (6).

The energy saving is equal to 2.9 Mtoe/annum, an amount superior to the average annual increase of National energy consumption during the previous five-year period (equal to 2.6 Mtoe).

Recently, the Decree of 21 December 2007 has redefined the goals for 2008-2009 and newer and more ambitious goals for 2010-2012 (Figure 4).

The aim is to keep the growth rate of energy demand equal to energy services delivered, reducing Italy's dependency on imported sources of energy and promoting greenhouse gas emission reductions as established by the Kyoto Protocol (7, 8).

The national target is sub-divided annually with Autorità per l'Energia Elettrica e il gas (AEEG)[7] – Regulatory Authority for Electricity and Gas - Resolutions between electricity and gas distributors, supplying at least 50,000 users at the date of 31st December two years previous to the start of the mandatory year, proportionally to the electricity and natural gas supplied[8].

The distributors, therefore, are committed to pursue specific energy saving goals by implementing projects and measures aimed at increasing energy efficiency. They can intervene directly or through other operators, such as companies in the energy service sector (ESCOs)[9], or alternatively through companies entitled to appoint energy managers.

Mandatory objectives for energy saving involve 61 distributors of natural gas and 14 of electricity, for 2005-2008 (Table 1).

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[7] The Italian Regulatory for Electricity and Gas is responsible for defining and maintaining of technical rules, as well as monitoring and promoting the entire scheme.

[8] The effective extension of the obligation to the distributors of electricity and gas with at least 50,000 final clients connected to their own distribution network has been fundamental for greater involvement of distributors who operate in the natural gas sector.

[9] ESCOs (acronym for *Energy Services Companies*) are financial firms originating in the USA and set up between the end of the Seventies and the beginning of the Eighties to respond efficiently to the increasing demand for energy and resource savings, both in the public and private sector.
Recently, the ESCOs have acquired greater weight, even in Italy promoting energy saving.
ESCOs accredited to date by the AEEG are over 1100. However, only 185 have applied for verification and savings certification and only 140 have been issued with White Certificates.

TABLE 1

**ENERGY SAVING OBLIGATIONS BY SECTOR (6)**

| **Year** | **Electricity sector** | | | **Natural gas sector** | | | **Total** |
|---|---|---|---|---|---|---|---|
| | Distributors subject to obligation | toe | % | Distributors subject to obligation | toe | % | |
| **2005** | 10 | 97,854 | 62.8 | 24 | 58,057 | 37.2 | 155,911 |
| **2006** | 10 | 191,949 | 61.6 | 21 | 119,809 | 38.4 | 311,758 |
| **2007** | 10 | 385,558 | 60.9 | 20 | 247,824 | 39.1 | 633,382 |
| **2008** | 14 | 1,200,000 | 54.5 | 61 | 1,000,000 | 45.5 | 2,200,000 |
| **2009** | 14 | 1,800,000 | 56.3 | 61 | 1,400,003 | 43.7 | 3,200,003 |

However Enel and Italgas are still incumbent operators because they maintain about 90% of the electricity target and over 30% of the gas target, respectively (Table 2).

TABLE 2

**ENERGY SAVING OBLIGATIONS DIVIDED BETWEEN DISTRIBUTORS (6)**

| **Years** | | **2005** | **2006** | **2007** | **2008** | **2009** |
|---|---|---|---|---|---|---|
| **Distributors of electricity** | | **tons of oil equivalent (toe)** | | | | |
| Enel Distribuzione S.p.a., Roma | | 87,849 | 169,610 | 341,933 | 1,041,237 | 1,564,025 |
| ACEA Distribuzione S.p.a, Roma | | 3,897 | 7,850 | 15,596 | 49,131 | 73,335 |
| AEM Distribuzione Energia Elettrica S.p.a, Milano | | 2,827 | 5,660 | 11,083 | 34,383 | 50,229 |
| ASM Brescia S.p.a., Brescia | | 461 | 3,242 | 6,046 | 19,842 | 29,120 |
| AEM Torino Distribuzione S.p.a., Torino | | 1,263 | 2,472 | 4,793 | 15,094 | 21,403 |
| AMPS S.p.a., Parma (Enìa S.p.a. from 2006) | | 336 | 670 | 1,308 | 4,062 | 6,099 |
| Other Distributors | | 1,221 | 2,445 | 4,799 | 36,253 | 55,789 |
| ***Total*** | | ***97,854*** | ***191,949*** | ***385,558*** | ***1,200,002*** | ***1,800,000*** |
| **Distributors of natural gas** | | | | | | |
| Società Italiana per il Gas S.p.a., Torino | | 20,215 | 40,643 | 79,821 | 239,506 | 330,499 |
| Enel Distribuzione Gas S.p.a., Milano | | 3,201 | 17,318 | 42,424 | 127,312 | 169,513 |
| HERA S.p.a. Bologna | | 4,915 | 10,974 | 26,047 | 81,866 | 107,834 |
| AEM Distribuzione Gas e Calore S.p.a, Milano | | 3,391 | 7,031 | 14,176 | 41,921 | 56,058 |
| A.M.Gas S.p.a., Bari | | 273 | 574 | 1,208 | 3,728 | 50,213 |
| Toscana Energia S.p.a., created in 2007 from the merger with Fiorentina Gas and Toscana Gas | FiorentinaGas S.p.a., Firenze | 1,717 | 3,223 | 6,652 | 36,638 | 49,068 |
| | Toscana Gas S.p.a., Pisa | 847 | 2,747 | 5,933 | | |
| Enìa S.p.a., created in 2006 from the merger with AGAC S.p.a. and AMPS S.p.a. | AGAC SPA, Reggio Emilia | 1,639 | 5,675 | 11,505 | 35,154 | 46,506 |
| | AMPS S.p.a., Parma | 1,098 | | | | |

| Years | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| Italcogim Reti S.p.a., Milano | 1,960 | 3,982 | 8,314 | 25,556 | 34,938 |
| ASM Brescia S.p.a., Brescia | 1,022 | 2,055 | 4,916 | 16,359 | 32,106 |
| Azienda Energia e Servizi S.p.a, Torino | 2,018 | 4,106 | 7,804 | 24,597 | 31,284 |
| Compagnia Napoletana di Illuminazione e Scaldamento col Gas S.p.a., Napoli | 1,445 | 2,922 | 6,189 | 19,649 | 26,492 |
| Ascopiave S.p.a., Pieve di Soligo (Treviso) | 2,266 | 4,729 | 9,054 | 28,038 | 24,751 |
| AC.E.GA.S. S.p.a., Trieste | 483 | 2,936 | 5,787 | 17,326 | 22,539 |
| AMGA Azienda Mediterranea Gas e Acqua S.p.a., Genova (incorporated in the IRIDE group dal 2006) | 1,181 | 2,325 | 4,592 | 12,991 | 17,433 |
| Other Distributors | 10,386 | 8,569 | 13,402 | 291,118 | 400,769 |
| ***Total*** | ***58,057*** | ***119,809*** | ***247,824*** | ***1,000,002*** | ***1,400,003*** |

The analysis of data reveals greater involvement on the part of the distributors operating in the electricity sector (over 60% up to 2007 and nearly 55% in 2008) for the presence of a number of large size firms.

Distributors can create many initiatives to encourage innovation as established in Appendix to the Decrees, ranging from improving the distribution network to the use of high efficiency electric and electronic equipment raising company awareness and information programmes for final users on the rational use of energy[10].

The most important interventions regard residential building and service sectors and, on a smaller scale, transport.

A base period of five years is established for interventions, which can reach eight years if the project is structural and more expensive (i.e. thermally insulating buildings, bio-architecture techniques).

*Measurement and Verification*

Savings achieved through energy efficiency projects are verified

10 These recent measures are designed to gradually influence production models and user consumption habits (i.e.: information campaigns focused on growth awareness and training). They are authorized "only as support measures for other types of intervention initiatives", and no longer for actions authorized as autonomous projects.

and certified by the AEEG, prior to GME issuing Certificates of energy efficiency in favour of distributors, companies controlled by the same distributors and companies operating in the sector of energy services (ESCOs).

The Authority annuls the Certificates presented by the distributors to attest the extent of respected obligations. The distributors holding certificates in excess can retain them for subsequent use (Figure 5).

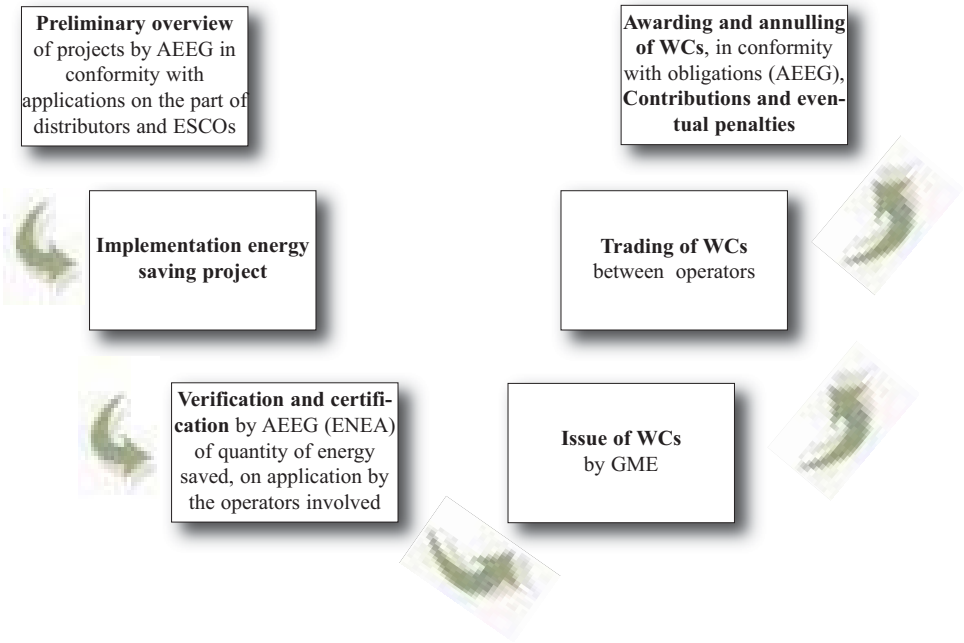


*Fig. 5* – The certified energy saving process (9).

The "bankability" of the Certificates[11] enables distributors to accumulate surplus Certificates which maintain intact their value over time and can be used during the five-year application period of the Ministerial Decrees (2005-2009), recently extended also to the second application period of the scheme (2010-2012).

[11] The Authority has established that only 40% of the specific annual goal can be covered by Certificates whose validity extends to over a year. The limit has been determined to avoid speculation on the part of obliged operators.

These certificates can also be sold, independently of the reference period of the savings to which they are associated. The purpose of this regulation is to provide a tool which guarantees greater decisional flexibility, in programming and implementing committed investments.

A critical and complex aspect of the WCsS, that has contributed to delaying operations, is to identify suitable measuring methodologies for evaluating energy saved on each single project.

Measurement and verification are crucial in determining the amount of energy saved.

These savings cannot be quantified directly but can be calculated comparing the consumptions (measured or estimated) before the action (baseline) and the consumptions after action[12].

The Authority has defined three different evaluation methods based on standard, analytical and final assessment acknowledging energy saved thanks to the intervention plans. The three methods are (10):

a. deemed saving;
b. engineering methods (partially ex post);
c. complete monitoring plans approved by the regulator (AEEG) (ex ante).

The first is suitable to some types of large scale actions, for which it is possible to establish *a priori*, on the basis of standard parameters, net savings obtained for each unit installed (i.e. high efficiency appliances), ranging from low consumption bulbs and high efficiency boilers to double glazing and household appliances.

The standard assessment facilitates preliminary procedures and documents required for checking and subsequently certifying project results. The analytical assessment addresses the measurement of the functional parameters of the system, in the post-project phase (i.e. number of functioning hours, average load factor, end product quantity). The measurement parameters are input for the algorithms to calculate savings obtained. The algorithms and the measurement parameters are indicated in specific technical evaluation schedules devised by AEEG, in close cooperation with the Centro Elettrotecnico Sperimentale Italiano (CESI) and the Ente per le Nuove Tecnologie, l'Energia e l'Ambiente (ENEA).

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12 The "Certificates" markets related to energy efficiency or also emission trading provide two different approaches: Cap and Trade (C&T) and Baseline and Credit (B&C). In the first, an absolute amount of Certificates (cap) is fixed in advance by Authority and they are distributed and traded. Under a B&C approach a "baseline" of compulsory performance is established and the relevant credits are assigned. These credits may be sold or purchased, if the "baseline" is not achieved or if it is exceeded. The Italian WCsS is B&C and therefore presents two main limits: the set of performance (baseline) and the guarantee of additionality.

Methods for final assessment, are based on consumption determination prior and subsequent to intervention applied to projects for which no pre-defined evaluation schedules are available. This method can be applied for the verification and certification of results obtained, only if during the course of the first twelve months, the project has generated savings of 200 toe and 100 toe (and over), respectively, in projects implemented by distributors, or by other parties.

To avoid excessive fragmentation of initiatives and at the same time optimize the use of economic resources as well as favour smaller projects by private operators, each project must have a minimum dimension. For instance, evaluation standardized projects need to save at least 100 toe/annum for obliged distributors and 50 toe/annum for other operators (i.e. ESCOs). These settings become 200 toe/annum and 100 toe/annum for final assessment projects.

The first two methods of evaluation are less complex in quantifying savings, because they are based on "technical schedules" which describe regulations, modalities and procedures for calculating the extent of energy saving achieved through the project (11).

Thanks to the technical schedules about 90% of the certified energy savings during the first three years of WCsS, were relative to the first two methods (12).

The final assessment, where the technical schedules are absent, was less frequently adopted as management and monitoring costs are higher.

Technical schedules are suitable only for energy equipment that are sufficiently recognized and can be 'grouped' in terms of structural characteristics and performance. They are difficult to apply to innovative technology and some specializing industrial sectors.

Furthermore, the technical schedules have to be updated regularly considering market trends and the technological and legislative innovation dynamics. This is necessary to guarantee that the WCsS can promote only the most efficient and innovative technologies in energy end use.

*Incentives and sanctions*

The AEEG devised specific benefits for Type I and II Certificates to compensate the higher costs needed for distributing firms to improve energy efficiency.

The AEEG defined same allocation criteria regarding benefits.

Distributors are granted an allowance of 100€/toe saved, up to the period 2008 and 88.92 €/toe in 2009.

Criteria for receiving the subsidy guarantee that the costs added to consumer bills are always inferior to the total economic benefit deriving from the Ministerial Decrees in force.

Allocate funds derive from electricity transmission and natural gas transport tariffs, in conformity with criteria fixed by the Authority.

If the Certificates presented do not reach prescribed standards, defaulting distributors are subject to pecuniary sanctions imposed by the AEEG. However, these have not yet been quantified by the Ministerial Decree, in order to limit the risk of strategic behaviour that might affect or alter market trends. If the unitary value of the sanction set for distributors who do not respect deadlines were established, automatically, the limit over and above the price of the Certificates would be determined, beyond which, buying the Certificates would not be economical[13].

Consequently, to offer incentives for energy saving, sanctions should be "proportional and, in any event, superior to the cost required for compensating action and, in any event, superior to the entity of the investments" (6).

For this purpose, reference criteria for defining the sanction level have been devised. Sanctions, which have never been enforced up to the present, however, are to be proportioned to the unsaved toe and the toe amount to be determined by WCs market value (6).

## The WCs market: characteristics and results

*WCsS energy saving: some evaluations*

During the third year of the scheme outlined above, the AEEG certified 903,627 toe of total energy saving in Italy and authorized the issue of 698,592 Type I Certificates, asserting the reduction of electricity consumption; 179,260 Type II Certificates, for the reduction of natural gas consumption and 25,775 Type III Certificates, for the reduction of consumption of solid, liquid and gas fuels. They are equal, respectively, to 79%, 16% and 5% of the total of Certificates issued.

Consequently, the number of Certificates issued by the GME, in the period considered, was equal to nearly twice that of the objective set for 2007.

13 Distributors have to show that their specific annual goal has been reached by handing in a quantity of Certificates equivalent to goal set by the AEEG, by 31st May each year, starting from 2006. Penalties are applied in the event that distributors do not succeed in reaching 60% of the assigned energy saving target; distributors in default are, in any event, obliged to recover eventual shortfalls by the end of the following year.

Taking into account the WCs issued in the previous period and not annulled after auditing the 2005 objective, the global number of Energy Efficiency Certificates available at 31 May 2008 amounted to 1,337,707, equal to 210% of the total objective to be achieved in 2007 (1,025,260 Type I Certificates, 247,618 Type II Certificates and 64,829 Type III Certificates) (13, 14).

The high number of Type I Certificates suggest, at least initially, electricity saving has low costs and is easier to achieve over natural gas saving. The very low number of Type III Certificates, however, is due to their consignment not favouring the right to receive contributions.

The data analyzed show that the number of Certificates issued increases year by year at a greater rate compared to set objectives. If, on the one hand, the enormous success of the scheme represents a testimony for the urgent need to guide consumer models towards "sustainability" paradigm, on the other hand this success must not be misinterpreted.

In effect, the set objectives in the first three years were not particularly ambitious. Moreover, the distribution companies could have also received Certificates for interventions in the previous period (2001-2004).

Therefore, the real challenge will be in the following years when the yearly objectives will become stricter.

From the analysis of the data the supply of Certificates is wider for electricity distributors, strongly conditioned by the kind of measures adopted for reducing energy consumption (Table 3) as well as by the nature of the operators involved.

TABLE 3

**PERCENTAGE OF SAVINGS PER TYPE OF ACTION (6)**

| **Sectors** | **Percentages** | | |
|---|---|---|---|
| | **May 2006** | **May 2007** | **May 2008** |
| Household electricity savings | 33% | 55% | 59% |
| Household heating | 14% | 16% | 21% |
| Public lighting | 27% | 12% | 8% |
| Cogen+ fuel switch+district heat | 21% | 11% | 6% |
| Industry | 5% | 6% | 6% |

To date, energy saving mechanisms in the household electricity sector have been preferred, increasing from 33% to 59%, compared to those in the industrial sector. As far as public lighting, a reduction from 27% to 8% was recorded (6).

The most savings (about 85%) were possible through widely available, easy to install and economically produced technologies such as small-scale electrical and electronic equipment.

About 10% of energy savings were due mainly to co-generation and district heating plants and 5% of energy savings were achieved by the use of solar panels (6). However, the low diffusion is related to the lack of information available rather than to the differences in cost compared to traditional technology.

From January 2005 to May 2008, over 800,000 low-consumption household appliances and 230,000 solar panels for producing hot water were installed, 21 million high efficiency electric bulbs were used. Energy efficiency has improved in industrial processes thanks to the installation of hundreds of new electric engines and various co-generation systems; in the public sector lighting efficiency systems have improved with the substitution of 420,000 electric bulbs and other energy saving devices.

Consequently, the scheme has been unable to generate significant structural long-term changes in energy end use, as the operators have preferred to implement low cost projects. In this context, they have received both short term energy saving acknowledgements, and incentives covering direct and indirect costs of the scheme (financial burdens, "transition costs" to manage the Certificates) (15).

An adequate period is necessary not only so that the system can produce its full rewarding effects on all the potential users, but also to evaluate the energy consumption saving related to the different phases envisaged of the scheme. Above all in relation to industrial interventions which, usually, require lengthy monitoring periods for a correct evaluation.

Undoubtedly, the WCs have contributed in the acceleration of the market diffusion of high efficiency equipment and components. In the medium/long term, WCs will probably play a significant role in the gradual phasing out of the high consumption energy market (16).

In this scenario, the companies providing energy services (ESCOs) have contributed to reaching the objectives set for 2008 with over 70% of the total WCs issued. This is proved by the interest shown by both obliged and non obliged operators. However, this might appear slightly misleading as legally independent distributing Companies (such as Enel Sole or Enel

SI) are controlled by operators obliged to delivering WCs, and considered ESCOs. Consequently, there is risk of over-estimating independent ESCOs contributions in the energy efficiency market in Italy.

Besides, the territorial distributions of certified energy saving in Italy is not equally represented: almost fifty per cent in the North (46%), about 29% in Central Italy and about 25% in the South.

The uneven territorial distribution of energy saving is linked, obviously, to the type of operator involved. While the ESCOs operate more or less homogenously throughout the Country, distributors on the contrary concentrate their activities mainly in the North.

*Features of WCs market*

The tradability of WCs allows transactions between operators either on the basis of bilateral contracts, or inside a market deliberately set up and regulated by the Gestore del Mercato Elettrico (GME), in compliance with the AEEG regulations.

The flexibility of the Scheme permits distributors to choose, on a cost-efficient manner, whether to implement the scheme themselves or purchase the Certificates from other distributors, companies controlled by the distributors themselves and companies operating in the sector of ESCOs.

The creation of an Energy Efficiency Certificates market represents an innovation in energy scenario; a key tool for enhancing and rewarding action which stimulates greater efficiency not only from an energetic point of view, but also, and above all, from an economic perspective. In effect, both distributors and ESCOs are encouraged to develop projects on an improved costs/benefits ratio.

The GME plays a fundamental role, as it is responsible for organizing and managing the entire IT platform for the encounter between WCs demand and supply as well as supervising the correct running procedures of the transactions between operators.

Demand for WCs, as shown in Figure 6, is expressed by distributors on the market subject to obligations, who have obtained savings inferior to their annual objective and consequently, are obliged to purchase the Certificates necessary to respect their stipulated commitments.

Market supply of Certificates, on the contrary, is determined by the amount of primary energy corresponding to projects achieved by different operators. Supply, consequently, is fed both by distributors subject to obligations who, thanks to the different initiatives undertaken, succeed in

selling their surplus Certificates deriving from savings superior to their objectives and by distributors and ESCOs that glimpse new and important business opportunities in the WCs market, exploited exclusively for commercial reasons.

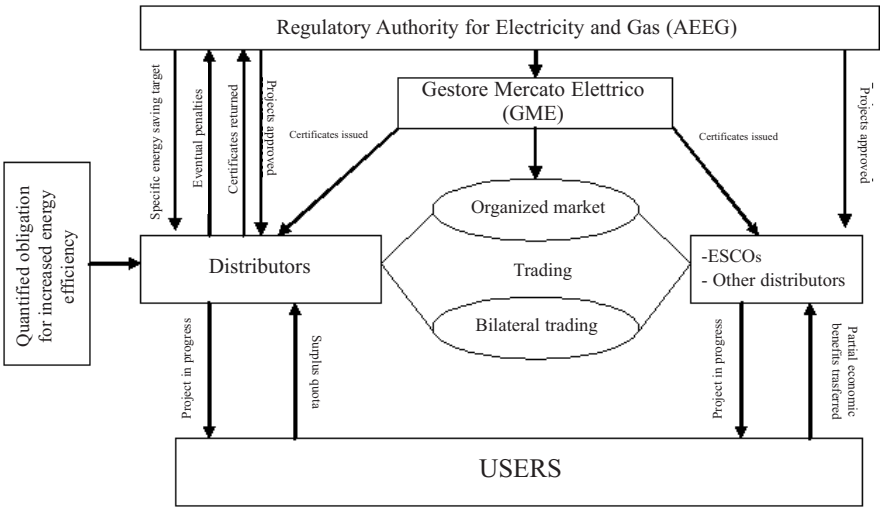


*Fig. 6* – Framework of the Italian White Certificates Scheme (9).

This system presents specific characteristics that should encourage the various operators to invest in energy efficiency and to participate more actively on the market in a cost-efficient way (17).

It should be noted that an organized market offers significant advantages due to total transparency in the formulation of prices and the security and efficiency of the system. Particularly, it carries out an important function of price disclosure, which allows all the operators to identify prices at which they are exchanging WCs and, consequently, enables better investment planning.

The total number of Certificates exchanged, in the third year of the scheme, was equal to 861,674: 65% through bilateral contracts and only 35% on the organized market. These data can be compared to 321,846 Certificates exchanged during the second year of the Scheme and to 145,567 of the first year, respectively for 76% and 80% by bilateral contracts (13, 14). The preference of the operators for bilateral exchanges is probably due to the delay in launching the WCs market (only three

months before the deadline of 31 May) and, subsequently, to excessive fluctuations in their prices.

Furthermore, structural differences between the two types of exchange exist. The bilateral contracts are more flexible and they are a suitable tool for large scale operators; they allow long-term exchange agreements at set prices facilitating financial risk management, compared to the organized market which, at present, contemplates only spot transactions.

Mainly Type I Certificates (about 87%, in the first year, 83%, in the second and 80% in the third) were exchanged, while Type II Certificates accounted for about 13%, 17% and 19%. Consequently, Type III Certificates were marginal not guaranteeing distributors under obligation the benefit of the fixed fee contribution[14].

The relation between the quantities of different types of Certificates negotiated reflects the different allocation of obligations pertaining to the distributors of electricity and gas and the structure of supply influencing the relative prices of exchanges.

Transactions, furthermore, have shown a marked trend towards price reduction of the Certificates exchanged, for the surplus of their availability compared to estimated demand for 2007 (Table 4).

[14] Recently, the AEEG, with Resolution EEN no. 36 of 2008, has extended - starting from the mandatory year 2008 - the unitary tariff to Type III WCs, with the exclusion of primary energy saving achieved by interventions on energy use for auto-traction.

TABLE 4

**PRICE AND QUANTITY OF CERTIFICATES EXCHANGED ON THE MARKET CLASSIFIED BY CATEGORY (14)**

| Certificates | 2006 | | | 2007 | | | 2008 | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Type I** | **Type II** | **Type III** | **Type I** | **Type II** | **Type III** | **Type I** | **Type II** | **Type III** |
| **Certificates exchanged** | 15,024 | 10,086 | 76 | 46,444 | 30,422 | 0 | 243,646 | 58,986 | 2,300 |
| **Total countervalue** | € 1,157,412.29 | € 948,060.73 | € 2,572.00 | € 2,225,168.65 | € 2,557,802.70 | € 0 | € 11,000,757.00 | € 4,506,039.00 | € 50,385.00 |
| **Minimum price** | € 69.00 | € 90.00 | € 32.00 | € 32.89 | € 60.00 | € 0 | € 29.44 | € 60.00 | € 5.00 |
| **Maximum price** | € 84.00 | € 98.00 | € 36.00 | € 65.00 | € 91.28 | € 0 | € 69.31 | € 90.00 | € 37.99 |
| **Average price** | € 77.04 | € 94.00 | € 33.84 | € 47.71 | € 84.08 | € 0 | € 45.15 | € 76.91 | € 21.91 |

Only recently, a significant reverse trend was reported in WCs price terms, due to the "corrective" action established by the Ministerial Decree of 21 December 2007 which aims at reducing the demand and supply gap, extending the obligation until 2012, gradually increasing objectives.

The dynamic in the price of WCs, inferior to the contribution price-list, have encouraged distributors, to date, to pursue a passive strategy.

In other words, the operators limited merely to trade Certificates on the market, rather than developing initiatives towards innovative and energy efficient solutions (18).

*Costs and Benefits of WCsS*

The WCsS short term functioning period makes it difficult to assess the effectiveness and efficiency of the System. However, during January 2005 and December 2008, the Scheme produced a global saving of over 2 Mtoe.

A saving on a par with the electricity produced in a plant of about 1,100 MW and translated in terms of the domestic consumption of over 2.5 million residents.

The result is extremely advantageous in environmental and economic terms, energy system safety and increased competitiveness in the energy service sector and improvement in advanced energy technology (19).

In environmental terms, the WCsS has contributed to a reduction of over 5 million tons in terms of CO2 emissions, consolidating energy efficiency culture.

In economic terms, the incentives granted by the Authority are about 110 million Euros, while energy costs saved by consumers benefiting from energy saving policies (measured in terms of energy per unit saved) are estimated equal to 9-14 times more, compared to the cost of the incentives themselves.

WCsS also create transaction costs as a result of the need for monitoring, validating, marketing and overall administrating the system among the obliged parties.

However, evaluation of these transaction costs is not an easy task. In Italy, access to information is limited as the obliged parties could organize their actions and do not have to report their costs (20).

## Conclusion

To date, the WCsS scheme in Italy, unique in its kind and at the centre of ongoing debate, is the object of in-depth studies and analyses on the part of a growing number of Countries, both on a European and International scale, in terms of its relevance as a market tool for promoting final use energy efficiency. For instance, in July 2006, France introduced an extremely similar system to the Italian WCsS, overall from the point of view of applied regulations. Subsequent to France, Poland approved the introduction of the White Certificates Energy Efficiency tool, while in other European Countries (the United Kingdom, Denmark, Ireland, Belgium - the Flanders Region in Belgium), various forms of energy saving obligations were the responsibility of operators on electricity and natural gas markets.

The European Commission is evaluating the benefits of introducing a community-wide scheme for White Certificates.

Furthermore, other Countries outside Europe (the United States, Australia, Japan, and Korea) are also considering the opportunity of using a similar system.

In any event, whatever the outcome in this respect, debate on the potential and critical factors characterising the current Italian WCs mechanism is certainly necessary. An attempt to compare the Italian WCsS with the French and English systems will be carried out, in order to analyze the limits and strengths of Italian experience.

*The Italian WCsS: comparison with other experiences*

The Italian, French and English schemes adopted for implementing energy efficiency, in spite of being conceptually similar, they show in their basic design features some marked differences.

Above all the French and English energy saving targets[15] are less ambitious than those established in Italy, even though their yearly energy consumptions are higher by about 30% compared with the yearly Italian energy consumption.

Besides, the English initiatives concern only the residential sector, on the contrary, residential, industrial and tertiary sectors are included in the Italian Scheme, while in France besides all those considered in Italy the transport sector is also considered.

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[15] It is useful to highlight that these objectives are measured in TWh in the UK and France but in Mtoe in Italy.

One of the most peculiar aspects of Italian WCsS is the presence of an organized market close to the bilateral contracts, that nevertheless maintain a principal role. These is not enough data about Italian energy efficiency trend market nor information about the operators, particularly about ESCOs and obliged operators.

Another important characteristic of the Italian Scheme is the grant of a monetary subsidy for each Type I and Type II Certificates delivered by obliged operators (the distributors) as they cannot transport costs upon their customers. In fact the gains of Italian distributors are set by AEEG.

As regards sanctions for possible non-fulfilment of established goals Italy and UK have not fixed, any penalties, but the Authority will do so. On the contrary, the French system has set a penalty 2 c€7kWh not saved, compared to a cost equal to 1c€/kWh. The introduction of a "safety valve" can determine the risk of non-achievement of the set objectives.

Nevertheless it involves two advantages: the easy application of the sanction and an implicit arrangement of the WCs highest value.

In the end, it is important to consider the "hybrid" methods of energy saving evaluation chosen in Italy: standard, analytical and final assessments. The standard method is the most diffused in Italy and it is adopted both in French and UK. In these countries many training activities are introduced to improve energy efficiency and obtain "uplift". Italy should also follow this initiative to achieve the reduction of transaction costs.

*Limits and strengths of the Italian WCsS*

The lack of updated official statistics data and sector studies on the characteristics and nature of the plant and equipment in energy use and energy consumption are among the critical elements, which have to date hindered the full potential of the Italian WCs.

This basic factor could contribute in evaluating the feasibility of the new technical schedules and, as a result, in the simplification of the evaluation process of the projects.

Another weakness in the Italian system lies in the type of action implemented, which generally, exploits innovations characterized by a short technical life, consequently, unable to offer all the advantages related to radical technological eco-innovation in the different energy sectors.

Despite this, the WCsS has fundamental role in the articulated array of national policies and measures for the promotion and improvement of energy efficiency. The recent Italian legislation introduced by the Legislative Decree no. 115 of 2008 and in force from 4 July 2008 is a

driver in the widespread experimenting of energy efficiency in every sector, achieved especially through a number of actions. However, an adequate harmonising process of the system as a whole is needed.

The success and the wide diffusion of Energy Efficiency Certificates market at a national level requires a gradual process in which all the operators involved - distributors, users/consumers, public sector institutions, ESCOs, etc. – will need to acquire experience in order to fully exploit opportunities and succeed in achieving real improvement in all kinds of performance: economic, technological and environmental.

Distributors are facing a global new scenario, from which complex and articulated aspects are emerging, that have an extremely significant impact on managerial approaches.

Specific competence in energy, environment and economic-financial evaluation methodologies are necessary to make strategic decisions (*make or buy*) that is, whether to buy Certificates or, alternatively, to implement energy efficiency projects.

Local Authorities play a central role in dealing with improved energy resource management, in a local context. They are self-sufficient in formulating the general indications of regional and local energy-environmental planning; they are free to determine energy saving goals, the development of energy renewable sources and the means of accomplishing all of these.

It is clear, at this point that Institutions need to play a determining role in relation to energy and environmental issues and to specific rewarding actions in terms of training and information.

*Energy efficiency improvement: further Italian initiatives*

The WCs are only one of the most important national instruments foreseen to reach energy saving objectives set in the National Action Plan for energy efficiency (35.7 TWh/y in 2010 and 126.3 TWh/y in 2016).

The main measures are financial and fiscal (structural funds for energy, promotion of industrial initiatives, research projects financing, tax deductions). Other measures such as compulsory standard (building certification, product ecodesign) and market based tools (Green Certificates besides WCs, for instance for high efficiency co-generation) are adopted.

The 2007 and 2008 Financial Laws implemented measures to improve the energy efficiency in the residential sector and set the minimum required standards for new buildings and restructured buildings, such as

minimum energy performance indicator and compulsory photovoltaic plants to produce electricity.

The Laws no. 296 of 2006 and no. 244 of 2007 set the principles and the methods to improve energy efficiency in households.

New buildings must have an energy performance index lower than a threshold both for winter and summer air-conditioning, external shielding systems. At least 50% of primary energy consumption for water heating must come from renewables sources and photovoltaic plants are compulsory in order to produce electricity. Restructured buildings of more than 1,000 square meters must comply with these rules.

In the field of electrical appliances the target is the replacement with high efficiency appliances; from 2010 the sale of electrical appliances of energy class lower than A is forbidden.

For lighting, the target is the replacement of incandescent lamps with compact fluorescent lamps through white certificates, information programmes, and incentives for fluorescent lamps.

For existing buildings a tax deduction is given of up to 55% of the amount remaining payable by the taxpayer for interventions such as thermal insulation of the opaque building surfaces and the use of efficient boilers and air conditioners. Tax reductions and respective subsidies are allowed for solar panels.

The law sets a tax deduction equal to 20% for the purchase of electrical appliances at least of A+ class and a tax deduction equal to 36% for the substitution with high efficiency lighting appliances in commercial buildings. In 2007 there were 106,000 interventions with an estimate of primary energy savings of 880 GWh/y and avoiding 193,000 t/y $CO_2$ emissions, the data for 2008 are not updated.

The 2007 and 2008 Financial Laws established the incentives for the substitution of vehicles with low consumption and LPG/natural gas vehicles.

The targets of consumption of biofuel and other renewable fuels in the transport sector increased to 2.5% within 31st December 2008 and 5.75% within 31st December 2010. The obligatory quota that has to be introduced in the consumption was 2.0% in 2008 and 3.0% in 2009.

Until the Nineties the main measures were infrastructural types; in the last 15 years there has been a mix of measures. The most important measures are financial (incentives for the shift to LPG or natural gas vehicles and replacement of low efficiency ones), but also fiscal (implementation of EU Directive on use of biofuels), cooperative measures (Voluntary

Agreement Ministry of Environment/FIAT/Unione Petrolifera for the promotion of Methane Vehicles and Distributors) and infrastructural measures.

In recent years the main energy efficiency tools for the industry sector are only financial and fiscal: incentives for high efficiency motors and inverters, for mechanical vapour compression and for high efficiency co-generation have been adopted.

In the "Industry 2015" Programme, promoted by Minister of Economic Development, to increase the competitiveness of the industry 30 energy efficiency and energy savings projects were selected and will be finance, by the public funds: 200,000,000€ on 500,000,000€ of total investments.

The projects concern:

- energy efficiency: high efficiency materials for buildings and bioclimatic architecture, high efficiency machinery and motors, technologies to improve energy efficiency in the industrial process and high efficiency electrical appliances;
- energy production: photovoltaic solar, thermo-dynamic solar, wind and energy from wastes.

The Legislative Decree no. 20 of 2007 sets the support to high efficiency co-generation, through many measures such as Green Certificates and WCs for energy produced by co-generation plants combined with district heating.

The coexistence of different policy tools to promote end-use energy efficiency and other environmental, social, technological and economic benefits, require strong coordination, above all at the institutional level avoiding over-incentives and alterations market forces.

Received 1 October, 2010
Accepted 28 September, 2010

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