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White Certificates for the industrial sector

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ECEEE Industrial Summer Study 2012

Federazione Italiana per l'uso Razionale dell'Energia

FIRE

The Italian Federation for the Rational use of Energy is a no-profit association that promotes energy efficiency, supporting energy manager, ESCos and other companies dealing with energy.

Besides the activities directed to its nearly 500 members, FIRE operates under an implementing agreement with the Ministry of Economic Development to manage the Italian energy manager network since 1992.

In order to promote energy efficiency FIRE cooperates and deals with public authorities, energy technology and service companies, consultants, medium and large consumers, universities and associations to promote best practices and improve the legislation.

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FIRE activities and projects

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www.ener-supply.eu

www.esd-ca.eu

Among closed projects:

- www.e-quem.enea.it
- www.eu-greenlight.org
- www.enerbuilding.eu
- Eurocontract
- ST-Esco

Besides to dedicated meetings, FIRE organises the Enermanagement conference, workshops, and training courses. It implements dissemination campaigns, surveys, market analysis and studies.

Among the subjects with which FIRE has cooperated there are ENEA, GSE, RSE, large companies, universities, associations, agencies and trade fairs organizers.

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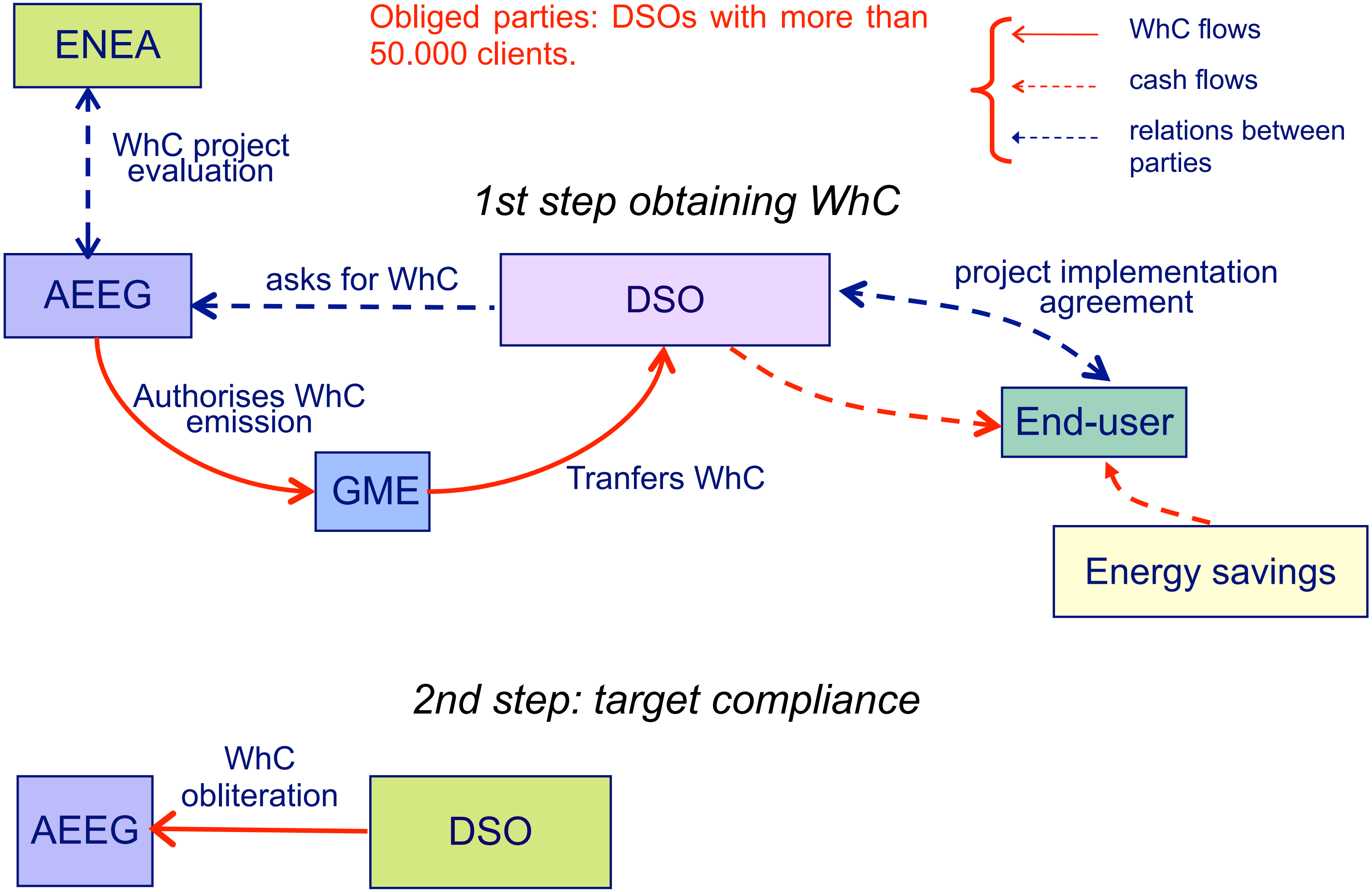
WhC: different approaches from different countries

	UK (CERT and CESP)	Italy	France	Denmark	Flanders region (Belgium)
Obligation period	2002-2005 (EEC-1) 2005-2008 (EEC-2) 2008-2012 (CERT) 2009-2012 (CESP)	2005-2012	2006-2009 (first period) 2011-2013 (second period)	2006-2009 (first period) 2010-2012 (second period)	2003 –
Target size (ongoing phase)	293 MtCO2 lifetime savings in 2012 (CERT) 19.25 MtCO2 lifetime savings in 2012 (CESP)	Cumulative savings of at least 22.4 Mtoe in 2012	345 TWh lifetime discounted (over the period January 2011-Dec. 2013)	2.95 PJ annual (first year savings) until 2009 As of 2010: 6.1 PJ/y (first year savings weighted with prioritisation factors reflecting action lifespan)	Approx. 580 GWh (2009 target) 3.5% of the amount of electricity supplied the year before to household and non-residential clients (2.5% in case of less than 2,500 clients).
Energy end-use sectors covered	Residential	All	All excl. ETS	All except transport	Residential and non energy intensive industry and service
Restrictions in achieving the target	40% priority group and 15% super priority group. 25% insulation measures (CERT) Low income areas; max 4% by loft insulations; max 4% by cavity wall insulations; max 1% by energy advice	Until 2008 50% on own energy source	25 TWh cumac max achievable by information, formation and innovation programmes	None specific	The actions must always consist of financial contribution and an awareness-raising element
Measurement and verification options	Standard values	Standard values (19 measures) Engineering approach (5 measures) Metered baseline method	Standard values (about 240 measures) Case-by-case approval for other measures	Standard values for approx. 200 measures Specific engineering calculation	Case-by-case approval by VEA
Dominant measurement and verification choice	Deemed savings only	Deemed savings	Deemed savings	Specific engineering calculations	NA
Accreditation of savings	Ex-ante	Ex-ante (majority)	Ex-ante	Ex-ante (adjusted first year savings only)	Ex-ante approval
Size of certificate	NA	1 toe	1 kWh cumac	NA	NA
Validity of certificate	NA (compliance in 2012)	The entire phase of the scheme (2005-2012)	3 compliance periods (compliance in 2009 and 2013)	NA (only adjusted first year savings count)	NA
Certification threshold size	NA	20 toe/year, 40 toe/year and 60 toe/year for savings evaluated respectively by deemed, engineering and metered baseline methods	1 GWh cumac (projects can be pooled to reach the threshold)	NA	NA
Trading* mechanisms	Trading among suppliers	Spot market OTC (dominant)	OTC only	No trading	No trading
Banking, borrowing	Banking of excess savings between phases (EEC-1 to EEC-2, EEC-2 to CERT)	Banking till 2012 Borrowing for 1 year if under compliance below 40%	Banking three compliance periods	Banking till 2012 As of 2010 borrowing if under compliance below 35% (45% in 2010)	Banking of excess savings

Figure 1. Summary of WhC schemes in Europe. Source: European Commission Directorate General JRC

Italian white certificates scheme (obliged parties)

Obliged parties: DSOs with more than 50.000 clients.



Source: FIRE.

Italian white certificates scheme (voluntary parties)

WhC and 20-20-20

WhC in Italy

WhC in industry

Comments

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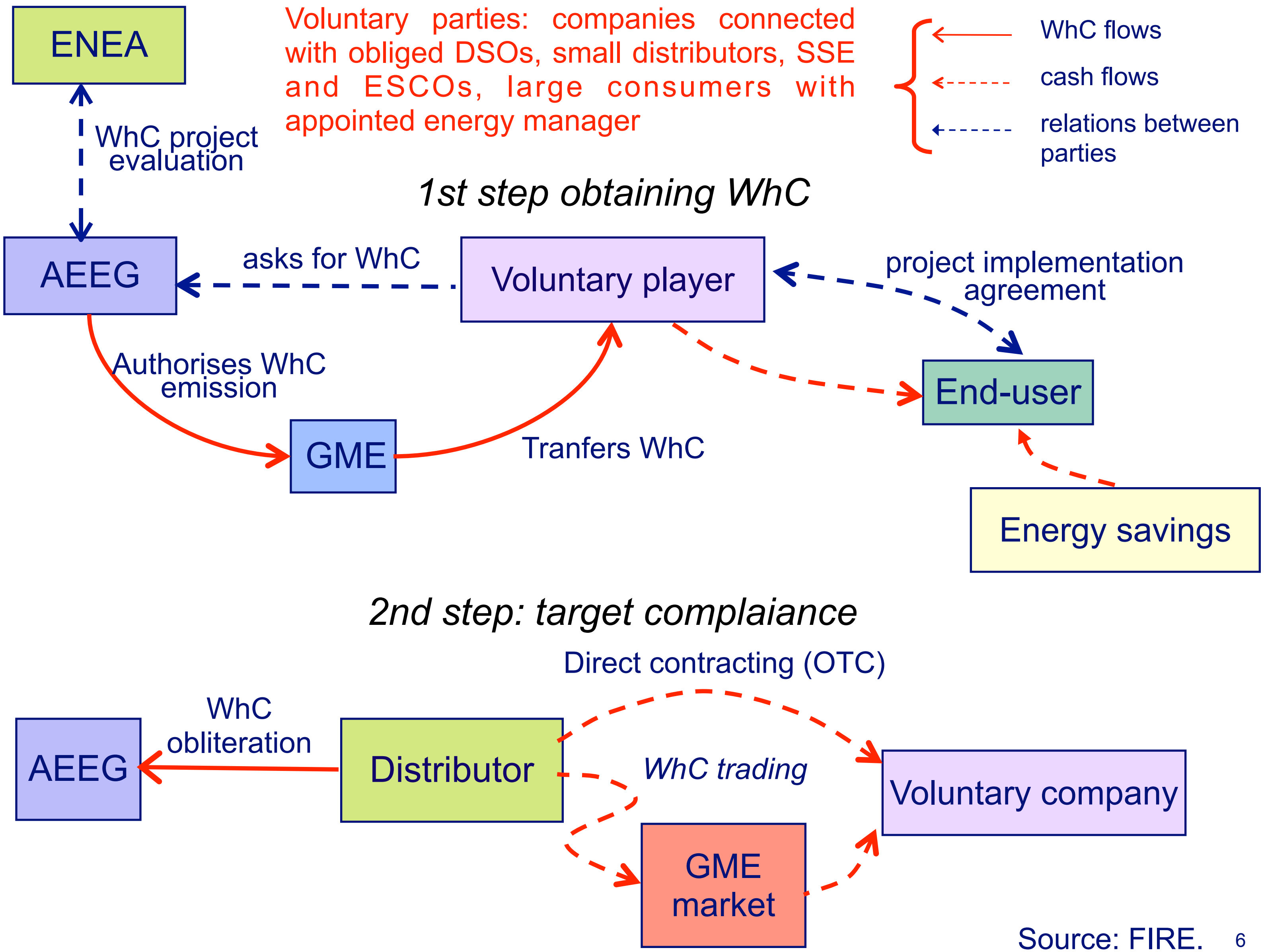
Voluntary parties: companies connected with obliged DSOs, small distributors, SSE and ESCOs, large consumers with appointed energy manager



Source: FIRE.

WhC and 20-20-20

WhC in Italy

WhC in industry

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Obliged parties (SO)	DSOs with more than 50.000 clients
Voluntary parties (SV)	DSOs with less than 50.000 clients Companies linked to or controlled from SO Energy service providers SSE Companies with *appointed* energy manager
WhC energy equivalent	1 WhC (also called TEE) = 1 *additional* toe
WhC economic equivalent	Depends on the market (95-115 €/toe recently)
Allowed actions	Energy efficiency improvements and savings
Duration of WhC issuing	5 years 8 years for building envelope related actions 10 years for high efficiency cogeneration
Saving evaluation	*Modalità standardizzata* - deemed savings *Modalità analitica* - engineering estimates *Modalità a consuntivo* - monitoring plans

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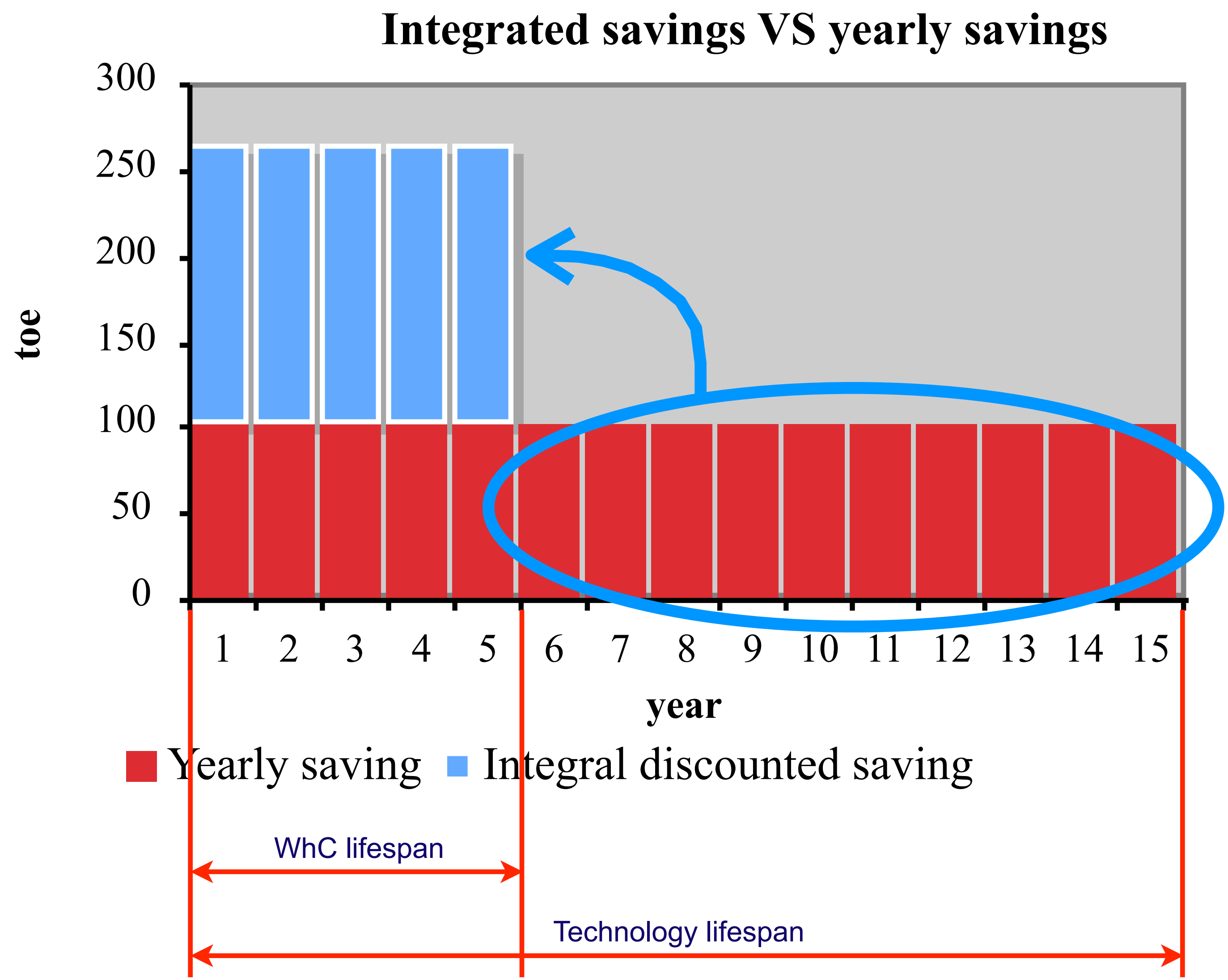
Types of certificates	Type I - electricity savings Type II - gas savings Type III - other fuels savings (no transport) Type IV - other fuels savings transport D.S. Type V - other fuels savings transport E.E. & M.P.
Duration and validity of WhC	Both till 2012, to be extended
DSO tariff reimbursment	It depends on a standard fuel mix price trend. Till now the range has been: 86.98-100 €/toe.
Targets	Primary energy efficiency improvements
Coefficient tau	It is the the ratio between the useful life of the measure and the standard WhC project life (5 or 8 years). It ranges between 1,00 and 4,58. It depends on the technology group as collected in the ministerial decrees tables.
WhC release timetable	WhC are released quarterly for deemed savings. After the measure are collected for the other projects (the timetable can be freely chosen, provided it is at least annually.

Tau coefficient



Saving evaluation methods

Saving evaluation method → Deemed savings / Engineering estimates / Monitoring plan

• *Deemed savings*: the saving is evaluated with respect to the number of installed reference units (e.g. square meter, kW, number of installed units). No measures are required. Only standardized solutions can be included in a deemed saving file.

• *Engineering estimates*: the saving is evaluated with respect to some measured quantities through a dedicated algorithm defined in the considered file. Required meters are also indicated in the considered file.

• *Monitoring plan*: the method is similar to the previous one, but the algorithm, the baseline, the additional saving coefficient, and the needed meters should be preliminarily proposed by the applicant and approved from ENEA.

D.S. files for industry, tau coefficients and M.P. results

WhC and 20-20-20

WhC in Italy

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Industrial deemed savings files

File number	Technology	Unit	Unit per toe		Saving (10^{-3} toe/unit/year)		Units needed to reach 20 toe		Tau
			min	max	min	max	max	min	
9	VSD electric engines for industrial pumping systems								
	1 turn industry	1 kW	12	42	24	83	314	91	2,65
	2 turns industry	1 kW	6	20	49	166	153	45	2,65
	3 turns industry	1 kW	3	11	95	319	80	24	2,65
	seasonal industry	1 kW	11	38	27	90	284	84	2,65
11	high efficiency electric engines								
	1 turn industry	1 kW	37	294	3	27	2.220	283	2,65
	2 turns industry	1 kW	19	149	7	53	1.126	142	2,65
	3 turns industry	1 kW	10	77	13	102	581	74	2,65
	seasonal industry	1 kW	35	270	4	29	2.040	262	2,65

EE Measure	tau
IND-T Industrial processes: generation or heat recovery for cooling, drying, burning, melting	3.36
IND-GEN Industrial processes: electricity generation from renewable sources, heat recovery, or cogeneration	3.36
IND-E Industrial processes: efficient drive systems (motors, etc.), automation and power factor measures	2.65
IND-FF Industrial processes: interventions other than the above, for the energy optimization of production processes and plant layout designed to achieve a lasting energy consumption reduction normalized by quantity and quality of production	3.36

	Approved					Rejected			Other			Total
-2011	at 1st attempt	at 2nd attempt	at 3rd attempt	at 4th attempt	at 5th attempt	at 1st attempt	at 2nd attempt	at 3rd attempt	Suspended	Retired	Under approval	
Ms No.	399	270	41	3	1	86	12	4	9	31	117	973
Ms %	41%	28%	4%	0%	0%	9%	1%	0%	1%	3%	12%	100%
	74%					10%			16%			

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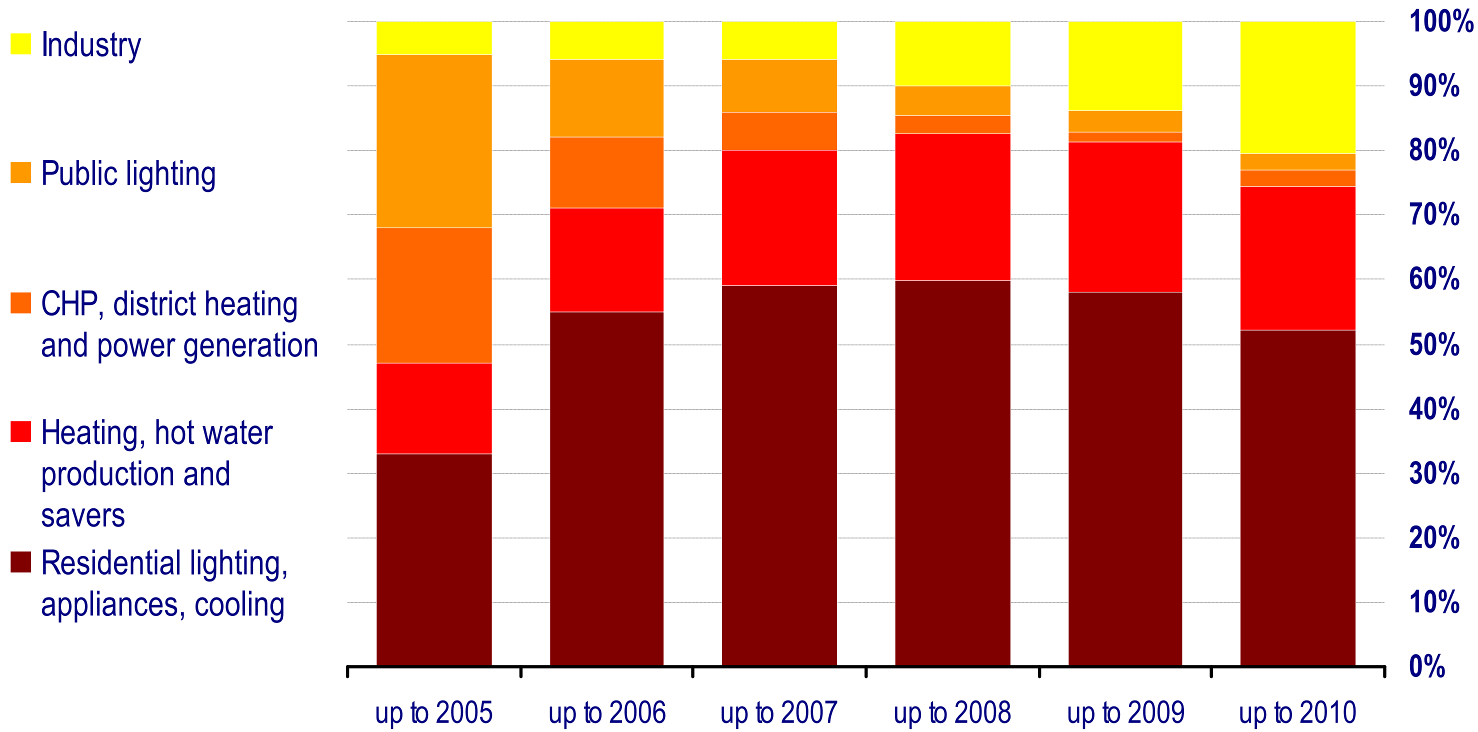
Monitoring plan: more interesting (potential savings and tau value), but more difficult to obtain (more complex and longer procedure) than deemed savings and engineering estimates.

Issued certificates VS targets

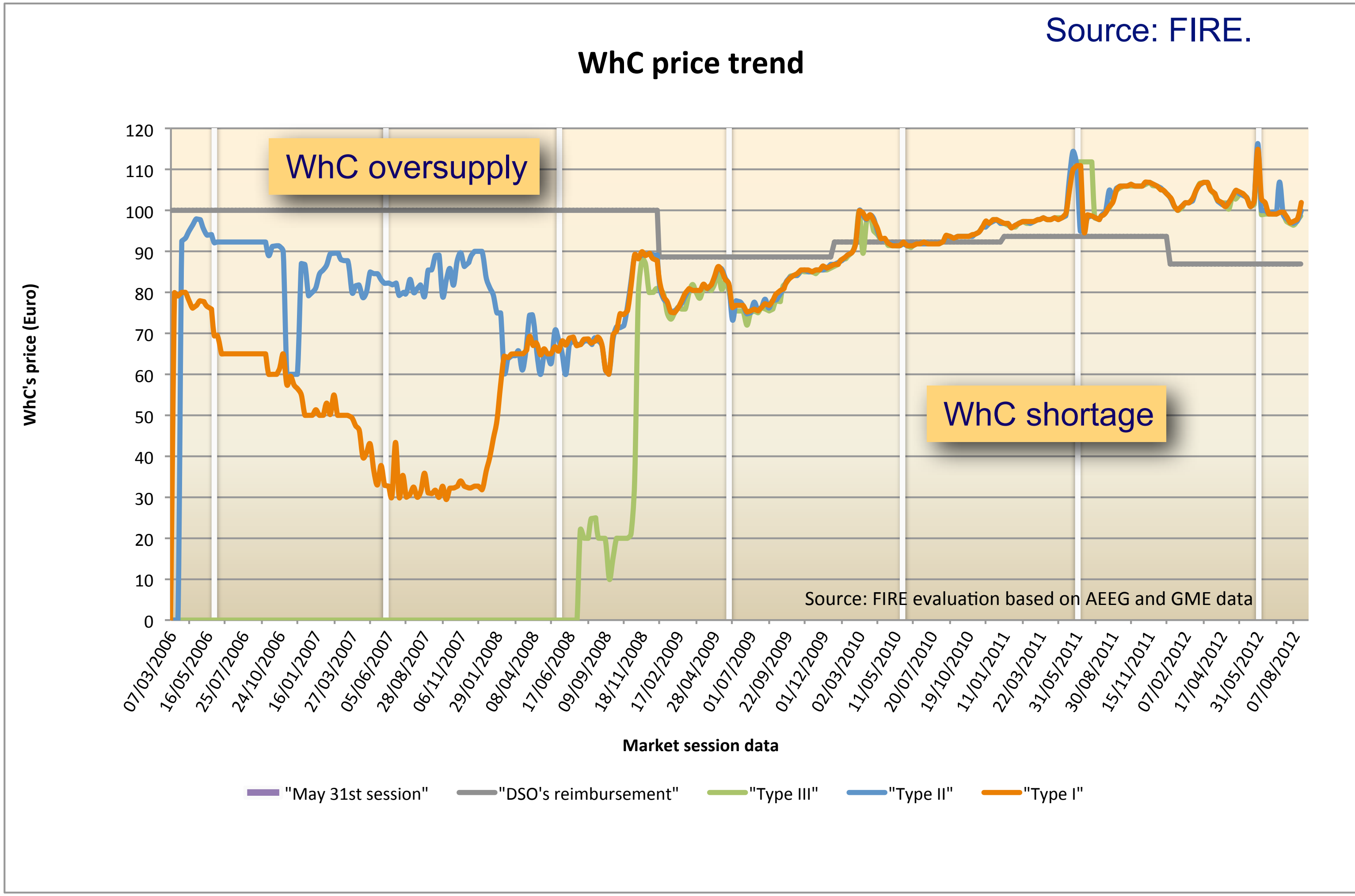
Source: AEEG.



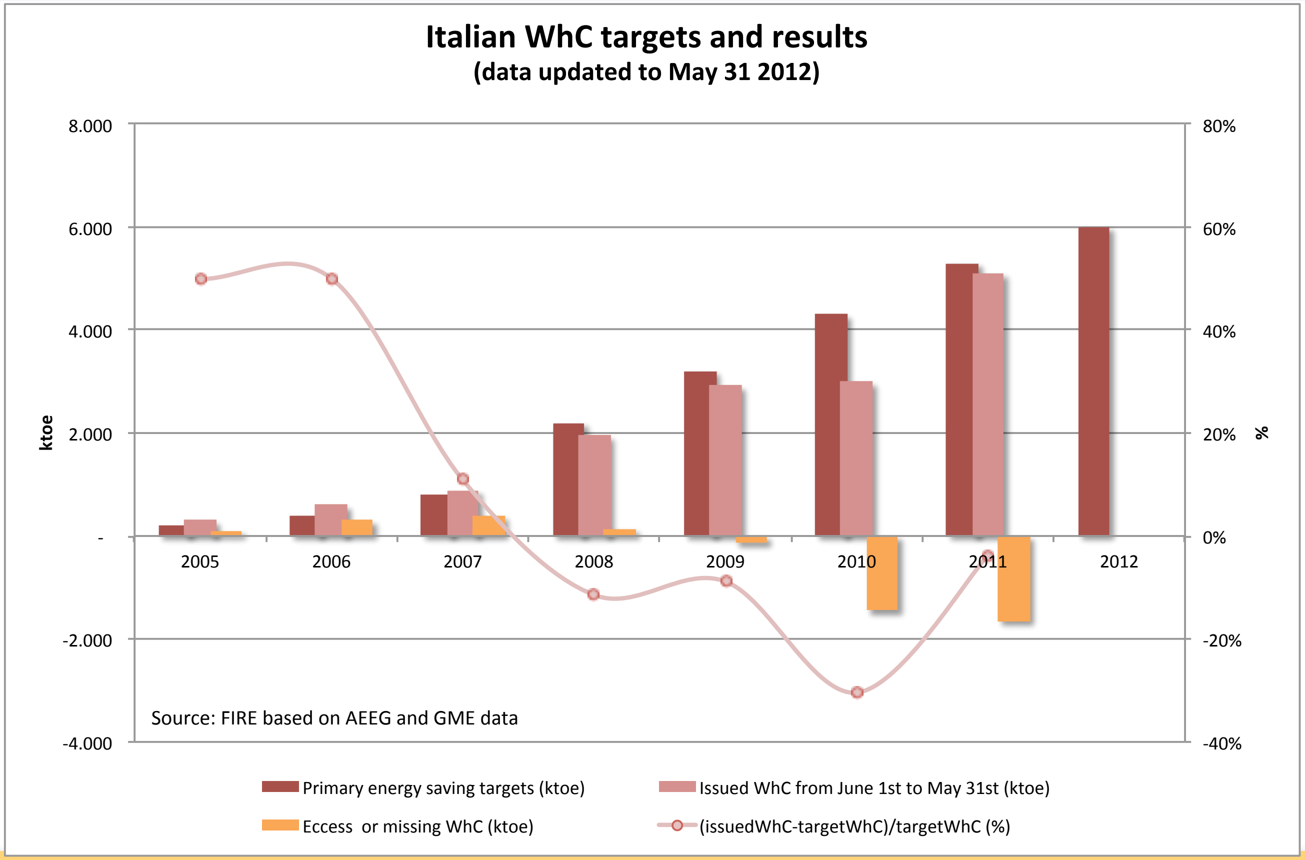
Monitoring plans and industrial projects are steadily growing, both for a better understanding of the rules and the interesting economic performance due to the potential savings and the tau coefficient.

Price trends

Source: FIRE.



Issued certificates VS targets



In the first phase there has been an excess of WhC on the market. Then it came a change that has taken the market on the opposite situation. The main drivers of this change are: CFL and similar files no more available, the completion of their 5 years cycle for some projects, the insufficient growth of monitoring plans.

The 2011 results has shown an improvement, in part due to the tau coefficient (i.e. WhC on the markets and targets are no more directly linked).

Typical cement production cycle

20-20-20

WhC in Italy

WhC in industry

Comments

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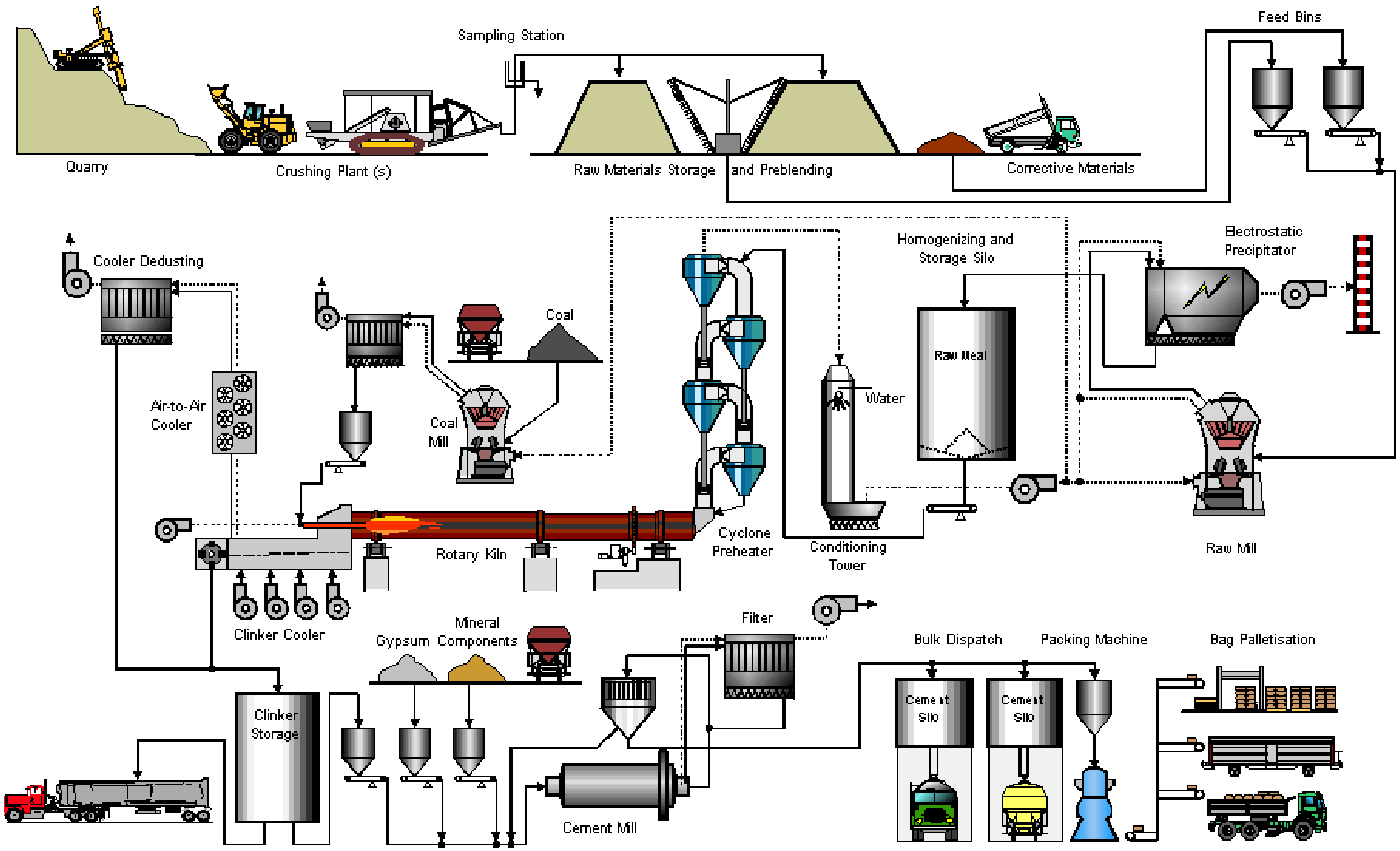
Source: Reference Document on Best Available Techniques in the Cement, Lime and Magnesium Oxide Manufacturing Industries, EC, 2010.



The cement industry in Italy

- 20-20-20
- WhC in Italy
- **WhC in industry**
- Comments

Italy is among the largest cement producers in Europe.

With a total production of 36.3 million tons of cement it was in 2009 the main producer, despite the significant decline in recent years (-15.6% in 2008).

The production facilities are located throughout the country and currently total 88 manufacturing units, of which 58 are full-cycle and 30 are grinding factories.

There are 80 active rotary kilns, all based on the dry or semi-dry technology that enables the achievement of greater energy efficiency.

The cement industry is clearly one of the most interesting for the WhC scheme in terms of potential certificates and it serves well as an example of WhC implementation in the industrial sector.

The data and the assumptions on this presentation are taken from the guideline for the cement industry created by ENEA and FIRE that will be published on the website www.efficienzaenergetica.enea.it.

Potential savings

Despite remarkable advances in technology, in terms of energy efficiency, there are still margins for improvement.

The BAT considered in the cement industry BRef indicate a value of 3,000 MJ/t of clinker for thermal energy and 90 kWh/t of cement for electricity.

The savings that would result from the transformation of the entire cement factories park is about 300 MJ/t of clinker. Given the annual national production of 36.3 million tons of cement, a clinker/cement ratio of 0.75, and assuming an approximate percentage of plants renovation of 50%, the global saving will be around 100 ktoe/year.

For the consumption of electrical energy, considered over the entire production line, the possible reduction from the baseline is about 25 kWh/t of cement. Considering again a penetration rate of 50% the global saving will be around 85 ktoe/year.

Typical algorithms for the cement industry

The variables to be measured are:

- Amount of fuel used in the oven;
- Lower calorific value of fuel (LHV);
- Amount of clinker produced (tonnes);
- Annual consumption of electricity.

Thermal energy savings:

Rt = (CSTB - Cstpost) x B [toe/year]

where:

CSTB = specific heat consumption baseline [toe/t clinker]

Cstpost = Et/B = specific heat consumption *ex-post* [toe/t clinker]

Et = annual consumption of thermal energy = amount of fuel used x LHV [toe]

B = tons of clinker produced [t clinker/year]

Electricity savings:

Re = (CSEB - Csepost) x B x c [toe/year]

where:

CSEB = specific electricity consumption baseline [kWh/t clinker]

Ee = annual consumption of electricity [kWh]

Csepost Ee/B = specific consumption of electricity [kWh/t clinker]

B = tons of clinker produced [t clinker/year]

c = 0.187 x 10^{-3} [toe/kWh]

In order to prepare a monitoring plan the following points must be addressed:

- process description;
- description of the EE solution;
- identification of the baseline, and thus of additional savings;
- definition of the algorithm to calculate the energy savings;
- description of the M&V system.

Usually the third and fourth points are the most difficult to address, for different reasons.

Typical baseline values

Reference values	Thermal energy	Electricity
BRef	3,000 – 4,000 MJ/t clinker	90 - 150 kWh/t cement
Italian current practice	3,860 MJ/t clinker	114 kWh/t cement
Breakdown by production steps		
Grinding of raw materials	84 MJ/t clinker	38 kWh/t cement 35 kWh/t raw material (raw material/clinker = 1.52; humidity 5%)
Clinker burning	3,768 MJ /t clinker	25 kWh/t cement 33 kWh/t clinker (clinker/cement = 0,77)
Cement grinding		43 kWh/t cement
Other consumption (fans, fuel preheating, etc.)	8 MJ /t clinker	8 kWh/t cement

For new plants (or a complete renovation of an existing plant) the reference is the market average, i.e. the typical solution proposed in that period of time for the same intervention. As mentioned above, currently it is the dry process with multiple stage preheater and precalciner.

For the renovation of an existing plants, provided an hardware intervention is implemented and not only an improvement of the plant management or of the regulation of the energy devices, the baseline reference is the higher between the specific consumption of the ex-ante plant and the specific consumption of the current practice in the same industrial sector.

Savings collected in the cement industry within the WhC scheme

EE measure	No.	Savings	
Furnace renovation	5	$(2 \div 13) \times 10^{-3}$	toe/t clinker
Furnace substitution	4	$(4 \div 13) \times 10^{-3}$	toe/t clinker
Heat recovery	3	$(0.11 \div 1) \times 10^{-3}$	toe/t clinker
RDF recovery	7	$(2 \div 4) \times 10^{-3}$	toe/t clinker
Cement mill modify	2	$(0.5 \div 3) \times 10^{-3}$	toe/t cement
Cement mill substitution	3	$(2 \div 4) \times 10^{-3}$	toe/t cement
Fan advanced regulation	3	$(0.05 \div 0.4) \times 10^{-3}$	toe/t clinker
Advanced management systems	3	$(0.2 \div 0.4) \times 10^{-3}$	toe/t clinker
Raw materials mill substitution	2	$(0.7 \div 2) \times 10^{-3}$	toe/t clinker

The good number of applications demonstrates that even if monitoring plans are complex, they can successfully be used, especially when the available savings are good enough to justify the effort.

In Italy, there is a minimum threshold to present a single EE measure of 60 toe, that at present WhC prices corresponds to 6,000 €/year for five years. The table shows typical savings between 15 and 3,500 toe.

Conclusions

The algorithm is not an issue technically, but it is important that it is chosen taking into account the necessity to normalise the savings with the industrial production – the clinker in this case – and to ensure that the effect of the EE intervention is correctly isolated from other energy consumption.

Most problems that arise in this connection are due to an insufficient number of meters or to their incorrect positioning. But there are may also be errors in the definition of the savings formula.

Since in the cement industry fuel and clinker consumption present high values – on the order of hundreds of thousands of tons per year – an accurate measurement may be difficult. To address this issue, one possibility is to refer to the measurement uncertainties listed in Annex VII of the Decision 2007/589/EC related to the emission trading scheme (directive 2003/87/EC).

The use of alternative fuels is still limited, so its effects on the final result is still not very significant, but considering the Italian interest in refuse derived fuel (RDF) from industrial and municipal waste, the implications of its use should be analysed, both with respect to WhC and ETS. and should lead to a different baseline for RDF fired plants.

Conclusions

With large EE interventions, like the ones considered in the cement industry, monitoring plans are working well. Industrial companies have come to understand the opportunity that WhC represent and are trying to join in.

More importantly, EE is finally going to be promoted by the mechanism. Monitoring plans have in fact already overtaken deemed savings and engineering estimates in Italy in the last months in terms of issued certificates.

Due to the complexity of the plans the proponents are improving their knowledge of the industrial sectors in which they operate, with positive effects on their potential to promote and replicate similar actions. Some of the proponents have indeed become full ESCOs this way, fulfilling one of the original aims of the WhC scheme in Italy.

A final important aspect: the real trigger to success of the scheme and of the involvement of industry is information and training. It is fundamental to devote sufficient economic and personnel resources to these activities. The advantages for the system in general are enormous compared with the cost of implementing these actions.

Operative references

1. Recognition SSE e EM	www.autorita.energia.it/it/ee/ee_home2.htm
2. RVC and PPPM presentation	https://www.autorita.energia.it/raccolte-dati/effenerg-ia
3. WhC GME's register	http://www.mercatoelettrico.org/It/Mercati/TEE/RegistroTEE.aspx
4.a GME's market	http://www.mercatoelettrico.org/It/Mercati/AccessoTEE.aspx
4.b GME's OTC platform	They are carried out within the GME's register
5. Market statistics	www.mercatoelettrico.org/It/Esiti/MGP/EsitiMGP.aspx
6. WhC statistical reports	www.autorita.energia.it/it/pubblicazioni_ee.htm

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