White certificates in Italy: will it overcome the huge challenges it has been facing in the last three years?

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Abstract

The Italian White certificates scheme (WhC) was introduced in 2001 and has been effectively working since 2005. It has been characterised by rising targets, all sectors and energy efficiency solutions covered (at least in the first decade), and many flexibility options in place (e.g. non-obliged – a.k.a eligible – parties, tradable market for white certificates, bankability, flexibility on obliged parties targets, etc.). With more than 26 million tons of oil equivalent (toe) of energy savings cumulated by the end of 2017 it has contributed to the national energy efficiency targets.

The scheme underwent important changes first in 2012, then in 2017, both for the targets and the operating guidelines. These modifications, combined with energy market developments, resulted in a reduced capability of producing the expected certificates and in an increasingly shorter WhC market, thus putting at risk both the compliance with the targets and the operation of the scheme itself.

The paper will illustrate the main issues that affected the scheme over the years, in particular in the recent years, the effects produced by 2017 guidelines, and the need to adopt new rules in 2018 to avoid a collapse driven by skyrocketing market prices and an insufficient number of certificates to reach even the minimum targets (i.e. considering the flexibility given to the obliged distributors to postpone part of them for 1–2 years).

An historical excursus which can be useful to understand the challenges that an Energy Efficiency Obligation scheme (EEO) with tradable market can pose to policy makers and also the potential in terms of results. The paper will cover the main modifications and the issues arisen over the years and illustrate the effects of the new rules introduced in 2018, providing figures on the results in terms of issued certificates and market price.

Besides, the cost-effectiveness of the scheme will be evaluated, considering the different phases (with and without the tau coefficient, the multiplier introduced in 2011 and abandoned in 2017).

Introduction

The Italian White Certificates scheme is an Energy Efficiency Obligation scheme in which the electricity and gas distributors (DSOs) with more than 50,000 clients[1] are obliged to reach annual energy efficiency targets, proportional to the share of energy carriers distributed. The scheme was defined in 2001, after the liberalisation of electricity and gas markets, but due to its ambition and innovativeness[2] the operative design took more time than anticipated and the scheme effectively started in 2005. In the original scheme of 2001 at least four intents can be gathered:

1. The threshold was initially set to 100,000 clients. In 2017, 12 electricity distributors (227 TWh distributed and a total obligation of 2.39 million white certificates) and 46 gas distributors (1,056 PJ of distributed gas and a total obligation of 2.95 million white certificates) were involved in the obligation.

2. Since most of the existing schemes were limited in terms of eligible solutions and/or sectors it was not easy to adopt solutions already tested. One of the issues, for example, was how to calculate energy savings, considering that simplified approaches, such as deemed savings, would not have been indicated for large industrial projects, but at the same time metered savings approaches would have been too complex for small energy efficiency measures.

- the introduction of yearly growing targets in terms of energy savings, in accordance with the obligations imposed on distributors of electricity and natural gas;
- the design of a flexible market scheme, which could also act as a stimulus for the implementation of energy efficiency measures, due to the possibility of having eligible parties able to sell certificates to the obliged subjects;
- the possibility and opportunity to include all sectors and a large number of solutions in the mechanism;
- the idea of promoting the role of the energy service companies (ESCOs), the only eligible subject initially admitted.

White Certificates give proof of end-use energy saving achieved through projects aimed at increasing energy efficiency in the final uses of energy. Obliged parties can fulfil their targets by presenting a corresponding number of certificates by 31 May of the year following the year of obligation. Each WhC represents one tonne of oil equivalent (toe) saved due to the interventions carried out. Projects can receive certificates for a period of time initially set to 5 years (WhC lifetime) for most projects. Until 2018, only additional savings were considered, which are those savings over and above spontaneous market trends and/or legislative requirements.

Eligible projects can be implemented by the obliged parties themselves, or by eligible parties (small DSOs, ESCOs, companies with energy management expert or energy management system), which can obtain certificates and subsequently sell them. Therefore, WhC is not just an obligation scheme, but a market mechanism, made up of a demand side and a supply side, acting as a sort of incentive for eligible parties. The costs incurred by the obliged distributors, being regulated companies, are partially reimbursed through a tariff reimbursement component defined by ARERA (Italian Regulatory Authority for Energy, Networks and Environment) and linked to the weighted average price of the certificates in the spot market the previous year. This tariff reimbursement is based on the income of a specific component of end users' electricity and natural gas bills.

The Ministry of Economic Development is in charge of the policy and defines the guidelines in accordance with the Ministry of Environment. The main legislative act used to modify the scheme's guidelines is the ministerial decree, indicated as D.M. followed by the issuing date.

The scheme is managed by the public company GSE, which defines operative rules, evaluates the submitted proposals and releases WhC, performs verification and control activities by means of documental checks and on-site inspections, in order to ensure the correct technical and administrative execution of the projects for which access to incentives has been requested or granted, monitors the scheme outcomes and produces reports on the results.

The exchange of white certificates between obliged and eligible parties takes place on a dedicated platform managed by the GME (a public company owned by GSE), either as a spot market exchange, or as a bilateral agreement between parties.

Considering the long life of the Italian mechanism, it is interesting to illustrate how it evolved over time and the transformation it incurred in by considering the main phases related to the different policy re-designs. Before entering into such details, given the complexity of the subject and the space available in this paper, we suggest the reading of (Stede 2017, Di Santo, Biele, and De Chicchis 2018a and 2018b) to better understand the main aspects of the Italian scheme, such as additionality, the so-called tau coefficient[3], eligible parties role, WhC market framework, the tariff reimbursement mechanism though which distributors costs are covered, etc.

Phase I 2005–2007

Despite the complexity of the WhC scheme, if compared with the other available support schemes in Italy, the first phase was characterised by a very good performance in terms of supply, mainly based on compact fluorescent lamps, water aerators and low-flow taps and showerheads, both in residential and service buildings.

Figure 1 summarizes the outcomes of the first phase in terms of annual savings – which were identical in this phase to the issued certificates – and WhC spot prices. The updated targets represent the effective targets as resulting from the application of flexibility clauses[4] or, as it happened in the first phase of the scheme, from a definitional issue related to how each distributor's target was calculated. The "original targets" are the ones defined in the ministerial decree. White certificates prices were different due to the obligation for distributors to achieve the majority of their respective targets through savings related to their distributed carrier. Since electricity savings certificates were much more available than gas savings certificates, the result was the drop in the electricity savings certificates prices and the relative invariance of the other type.

Both distributors (especially the large ones) and ESCOs offered lamps and water devices for free and the energy savings were evaluated as deemed savings. The result was the mentioned drop in electricity WhC price, which fell from around 80 Euros per certificate to around 30 Euros per certificate. This put ESCOs under pressure, since they risked not to be able to recover their investments. Distributors playing an active role (particularly the electricity ones), on the other hand, benefitted from a gain, since the reimbursement tariff was set to a fixed 100 Euros in those year and so they got more than they spent for the certificates.

White certificates were issued only for additional savings, defined as savings that wouldn't have occurred due to legislative, technological, and market developments. Energy savings were evaluated through three different procedures (see Eyre, Pavan, and Bodineau 2009, Di Santo et al. 2011, Di Santo, Forni, and Biele 2012):

- Standard projects (SPs, deemed savings), where savings were calculated based on the installed units (e.g. on installed lamps or square meters of solar thermal panels).

3. A coefficient that takes into account savings obtained beyond the WhC lifespan, discounting them. Thus it decouples annual savings and certificates (e.g. 3.36 certificates per saved toe issued for projects with 20 years of expected technical lifetime against 5 years of WhC lifetime).

4. Each distributor had the faculty to avoid fines provided it covered at least 50 % of its target. The missing part had to be recovered within the next two years. Being in a situation of oversupply this clause wasn't applied in the first phase of the WhC scheme, whereas it became the rule in the following ones.

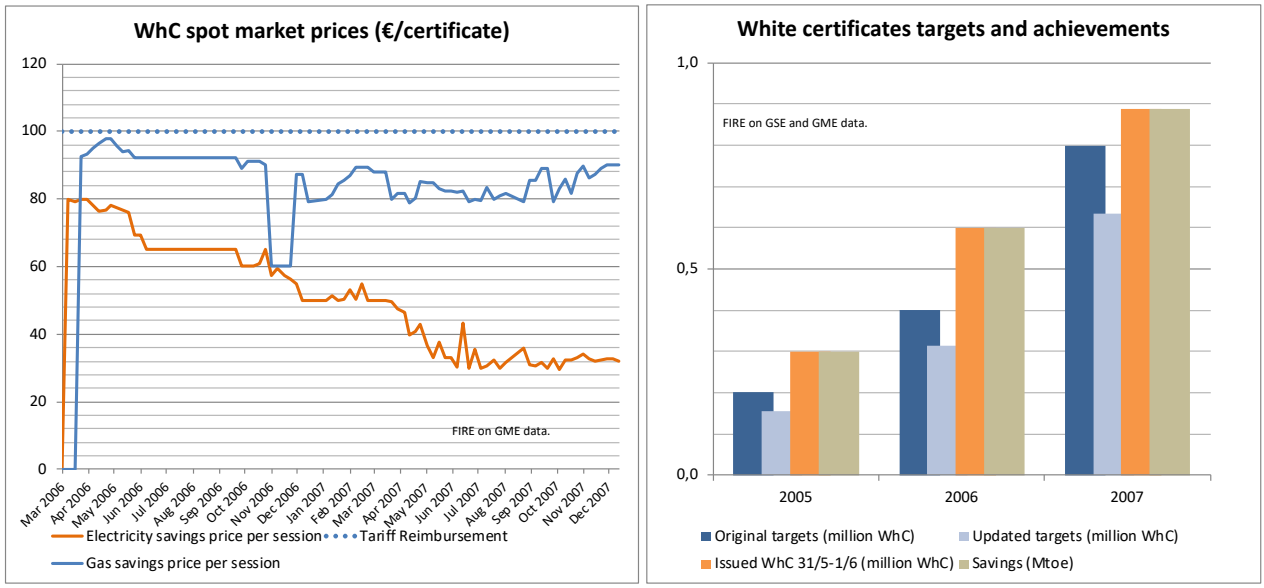


Figure 1. WhC prices and main achievements compared with the targets (2005–2007).

Additionality was defined in the files related to each type of energy efficiency measure covered by this procedure based on an ex-ante market survey, updated after a certain period of time.

- Simplified monitoring projects (SMPs, a type of metered savings), where savings were measured using meters, algorithm, standardised consumption baseline, and additionality defined in the corresponding files. This procedure was initially limited to technologies such as cogeneration, district heating, industrial pumping systems, mechanical steam recompression systems, etc.).
- Monitoring plans projects (MPPs, a type of metered savings), where savings were measured and the proponents had to define the required meters, algorithm, consumption baseline, and additionality for each particular project.

MPPs usage was limited, mainly due to the complexity of the approach if compared with previous incentive schemes. SPs were really successful, however they posed two challenges: the first with respect to the effective savings, since lamps and flow reduction devices given for free to people were not necessarily installed at once[5], the second to the rapid change of the market conditions for the successful solutions, with the relative impact on additionality. Having installed tens of millions of lamps obviously changed the reference solution on the market and this led to the change of additionality in the second phase. SMPs usage went mostly neglected, also because the files related to cogeneration and district heating (i.e. the most interesting in terms of potential proposals) have been blocked by an appeal to the administrative court and the consequent acts from 2006 to 2010.

5. But most probably they were at a certain time afterwards, so it was more a problem of time shift than of practical outcome.

Phase II 2008–2012

PART A: 2008–2011

The second phase is related to *D.M. 21 dicembre 2007*. The main changes introduced by the decree are:

- The increase of the existing targets and the extension of the scheme to 2009;
- The reduction of the obligation threshold for distributors to 50,000 clients;
- The introduction of a clause to automatically increase the targets at year *n+1* if at year *n* the available certificates overcome by more than 5 % year *n* updated targets;
- The flexibility clause was changed raising the minimum number of certificates from 50 % to 60 % of each distributor annual target, to be recovered in one year (instead of two);
- No more obligation for the distributors of producing at least 50 % of the targets by presenting savings related to distributed carrier (i.e. electricity, gas, and other fuel savings became equivalent in terms of value);
- The possibility also for companies with an appointed energy manager as provided by law 10/1991 to present proposals as eligible parties.

The modifications had many beneficial effects, including the rise in the price (needed to sustain energy efficiency measures different from CFLs and flow reductions taps). Besides, the savings generated doubled in 2008 and tripled in 2009 with respect to 2007. As shown by Figure 2, a slight undersupply occurred in these two years and, for the first time, the updated target became higher than the original targets. In addition, ARERA, which was in charge of defining the operative rules, introduced new SPs and SMPs files and linked the value of the tariff reimbursement to a mix of fuels. This proven not completely satisfactory, since distributors could receive reimbursement quite far from the sustained costs, depending

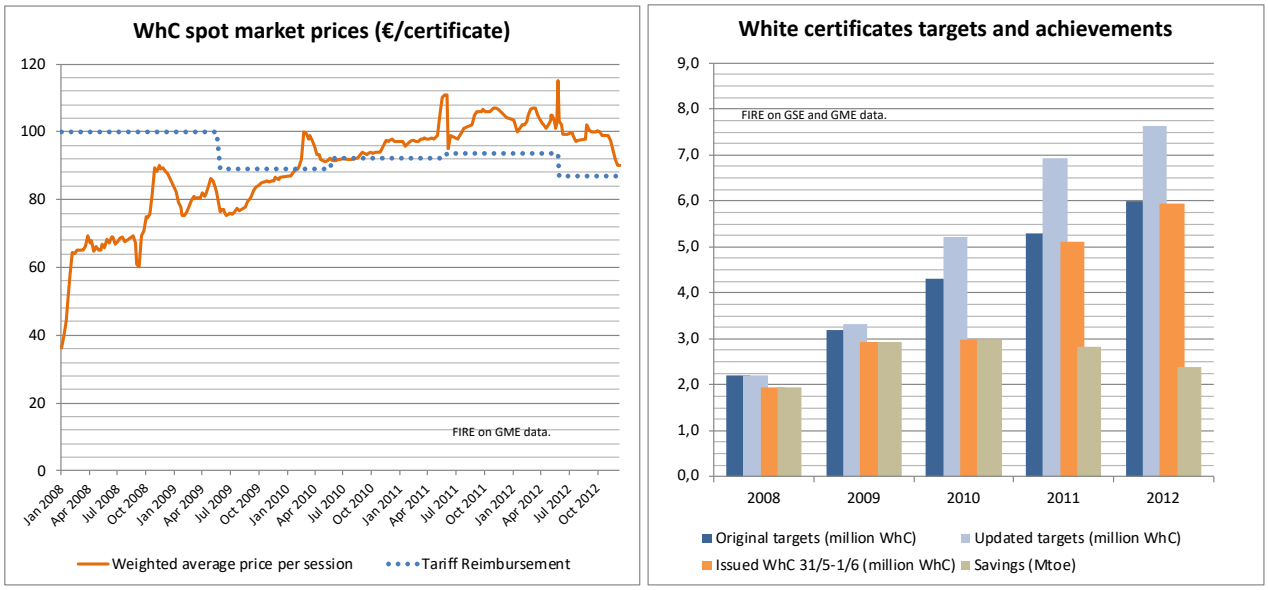


Figure 2. WhC prices and main achievements compared with the targets (2008–2012).

on the different trends of the WhC market and of the chosen fuel mix.

Despite these encouraging developments, an important change produced a block of the growth of energy savings in 2010. This was the result of two additional effects: the reduction of savings generated by new projects (i.e. projects presented in that year) and the end of the WhC lifetime for the projects presented in 2005/2006. The first effect, in particular, was due to the progressive reduction of additionality for CFLs and water flow reduction devices. The CFL file was updated in 2008 and 2009, increasing for example the number of 6W E27 lamps required to obtain one white certificate from 68 to, respectively, 620 and 3,559. Besides, the 2009 file excluded all lamps over 15W and by 31 January 2011 no new CFLs projects could be awarded white certificates. Considering that around 50 % of the certificates in those years came from CFLs, this resulted in the interruption of the growth trend and had an obvious effect on the market price, that as weighted average per session rose from around 50 to 111 Euros per certificate between 2008 and end of May 2011 (last sessions available for distributors to fulfil their targets).

This represented a turning point for the scheme, since the annual energy savings, the main goal of the scheme, chocked up in 2010 and since then the trend has been a slight decline. This also pushed ARERA to revolutionise the operating guidelines.

PART B: 2011–2012

In order to make the mechanism more attractive, ARERA introduced the *tau* coefficient in October 2011, which added to the annual savings recognized for each project the future savings related to the period between the end of the WhC lifetime (generally five years) and the end of the technical life (determined between ten and twenty-five years depending on the energy efficiency solution). The *tau* coefficient also applied retroactively to the projects already presented starting from the last months of 2011. This determined the decoupling between certificates issued and savings generated that appears in Figure 2. For more information about the *tau* coefficient and its effects refer to Di Santo et al. 2014a and Stede 2017.

The idea wasn't to just increase the certificates on the market, which would have been just a trick[6], but to increase the economic attractiveness of the scheme that was not so interesting for SPs after the end of CFLs et similia (see Di Santo et al. 2011). Most project got 2.65 or 3.36 times the white certificates they used to generate over the five years of lifetime. The result was the sought growth of interest in the mechanism, but with some negative effects. The decoupling between issued WhCs and savings generated, since the obligations for the distributors were not simultaneously reviewed, drugged the system, making it more difficult to understand the real performance of the efficiency certificates available over time. The definition of the tau coefficient was well structured, and actually allowed to better enhance the projects with a longer and therefore more complex technical life, but this created a potential problem with controls, because, in case of termination of the project before the end of the technical life, the proponent should return the WhC obtained in relation to the years of failure, and this is a difficult issue to manage[7]. Finally, whilst the tau coefficient made the interventions related to standard projects more interesting (Di Santo, Biele and Forni, 2012), it resulted in an excess of economic return for some monitoring plan projects (Di Santo et al. 2014b).

The introduction of the *tau* multiplier brought again the supply of certificates in line with the targets and blocked the relative increase of the updated targets, thus favouring a price reduction in 2012, but didn't have a positive effect on the energy savings. It appeared clear at the end of the second phase that the targets were set too optimistically in the last guidelines. It was also time to solve another negative effect: since the scheme started with a huge delay, it was decided in the 2004 guidelines

6. For a limited time it worked this way, before the targets were adjusted with the next decree.

7. Subsequently solved with *D.M. 28 dicembre 2012* by foreseen controls only over the WhC lifetime.

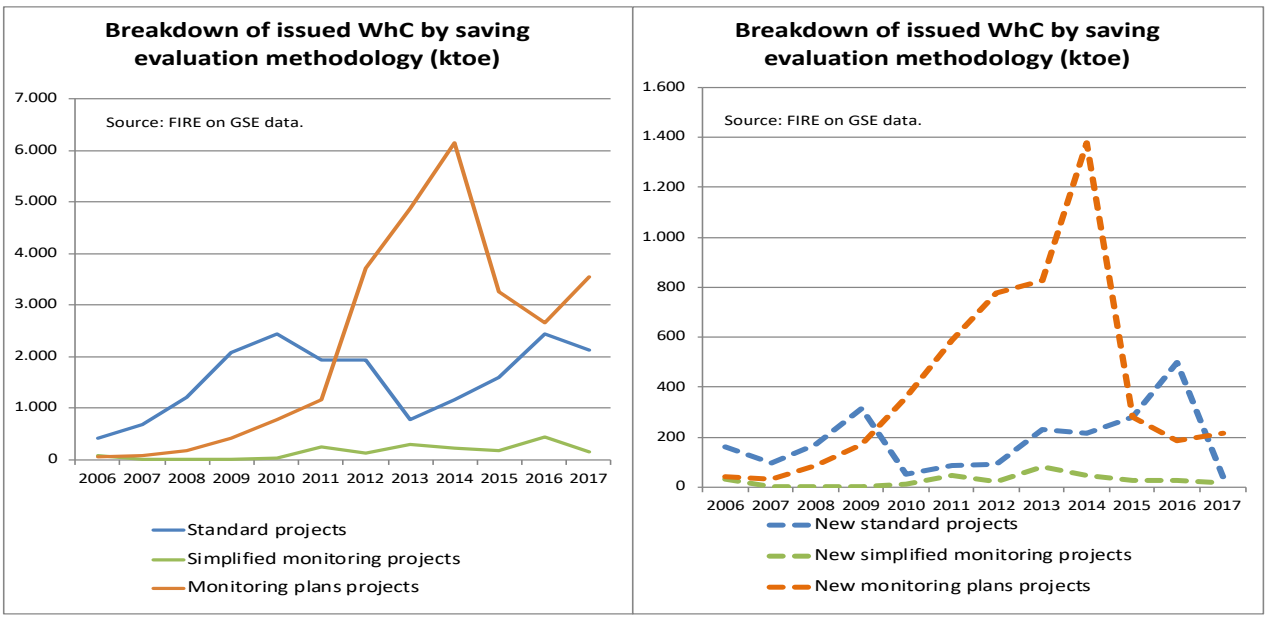


Figure 3. Breakdown of certificates among energy savings evaluation procedures (total and new projects).

to allow the presentation of proposals after the implementation of the energy efficiency projects. This was maintained afterwards to avoid introducing another barrier to the presentation of MPPs. However, the availability of the *tau* coefficient stimulated ESCOs to look for enterprises that already implemented projects to present them[8].

Phase III 2013–2016

D.M. 28 dicembre 2012 main changes were:

- New targets till 2016, expressed as white certificates to take into account the *tau* coefficient;
- Decision to stop by the end of 2012 the possibility to present projects after their implementation;
- GSE took over the role of managing agency in place of ARERA that maintained the role of determining the tariff reimbursement and applying fines if needed;
- Flexibility clause extended again to two years, but reduced to 50 % for 2013–2014;
- The introduction of new SPs and SMPs files, covering also the transport sector.

The reduction of the targets, with respect to the trajectory set by the previous guidelines, initially allowed to recover part of the accumulated gap, reducing the difference between law and updated targets in 2014. It was however a partial recovery. Two aspects contributed to show that the undersupply issue was going to grow again: the first one was the already mentioned decision to allow only the admissibility of projects yet to be implemented, the second one the decision from GSE to counter one of the drawbacks of the *tau* coefficient, that is the over-incentivisation of some industrial projects.

The first fact is the reason behind the race to the presentation of as many MPPs as possible in 2013, which translated the following year in the record of annual issued certificates both in global terms and considering only new projects, as shown in Figure 3. The second brought to the introduction of rules to exclude MPPs projects with very short pay-back time. Rules that were applied not only to new proposals, but also to projects already approved[9], a decision that had a negative effect on the scheme, introducing uncertainties and creating a perceived barrier between GSE and proponents.

The combined effects of these two points was a drop of issued certificates in 2014 and 2015, only partially recovered in 2016 thanks to a new rise of SPs (something that was not so positive, as we will illustrate in the Phase IV chapter).

Figure 4 shows the dramatic effect on the WhC price of the explosion of the updated targets in 2016. In less than a year the price jumped from 110 to 240 Euros per certificate. And it was just the beginning of the climb. Another issue was going to emerge: the risk of frauds with SPs (see Di Santo, Biele and De Chicchis 2018b). SPs have had the advantage of guaranteeing an easy application procedure, but since the start of the scheme the drawbacks of such method emerged. The first problem was the inconsistency of the documentation required for the application: in many cases a list of the clients involved in the project was sufficient. This made easy to produce false data for cheat and ill-intentioned people. The issue was aggravated by the possibility to easily sum up a lot of intervention implemented across different end users, spread among different proposals, collecting huge quantities of certificates. Of course, also MPPs among industrial enterprises allowed to request large number of certificates, but a lot of documentation was requested already in the evaluation phase, there was the need to provide measures

8. That is, proposals with no materiality, or full free riders' effect, to call it another way.

9. Such an approach is probably linked to a political decision to collect back the extra-money earned by companies thanks to too generous incentives, as happened in the same period with the so called "*spalma incentivi*", a law that retroactively reduced the photovoltaic plants feed-in tariffs.

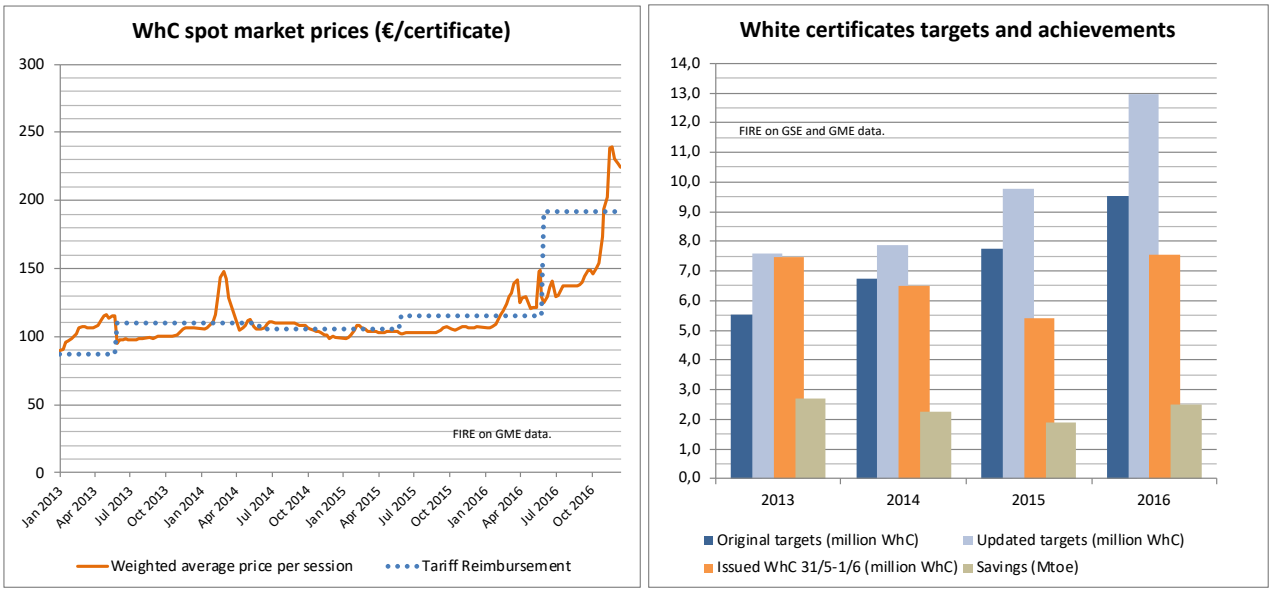


Figure 4. WhC prices and main achievements compared with the targets (2013–2016).

and very precise information, and projects referred to just one client, making documental and on-site control much easier.

GSE tried to improve the situation both by introducing additional documental request at proposal time and by starting extended documental controls[10] on a sample of proponents. Most of them showed indeed issues (lack of requested documents, incorrect documentation, request of other incentives such as tax deductions, etc.). This pushed towards the need of a stricter evaluation procedure, but also showed the intrinsic deficiencies of the SPs method.

In the meantime, in 2014 ARERA changed the calculation of the tariff reimbursement, linking it to the weighted average WhC price of the year n-1 starting from year 2013. This solved the afore mentioned issues related to the excessive differences between the cost incurred by obliged distributors and the WhC price paid to the eligible parties.

Phase IV 2017–mid 2018

D.M. 11 gennaio 2017 introduced a deep redesign of the Italian scheme, affecting many aspects such as targets, baseline and additionality, saving assessment and measurement, verification and control procedures.

Concerning the methods for the calculation of energy savings, the decree modified SPs and eliminated SMPs, aiming at overcoming the mentioned issues with SPs, improving even more the quality of the collected data and giving measure a role in all procedures. Therefore, two methods are presently considered:

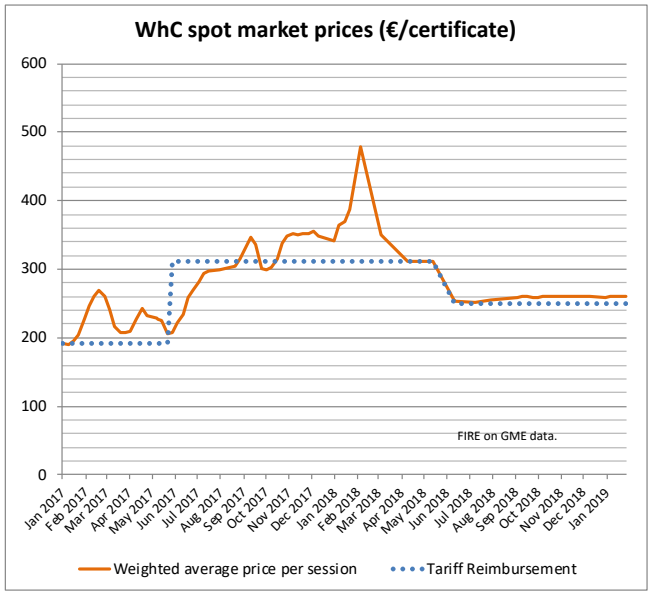
- Standard projects with sample measure (SPSMs, a mix of deemed savings and metered savings), used when the project is made by homogeneous interventions in similar contexts and operating conditions, and the installation of meters on all the facilities is not economically feasible. Savings are calculated based both on the installed units and the measurements done on a statistically representative sample. This should ensure a more reliable evaluation of energy savings for standardized solutions.
- Monitoring plans projects (MPPs, a type o metered savings), which remain similar to the past, but with additional requirements for the identification of consumption baseline. This has to be based on meters capable of at least daily measures of the savings, and measurements are required for a twelve-months period prior to implementation of the project.

The new guidelines eliminated the *tau* coefficient, to solve the issue mentioned earlier, and increased the WhC lifetime for most projects. To summarise, projects with a *tau* of 2.65 got a lifetime of 7 years and projects with a *tau* of 3.36 got 10 years, resulting in a reduction of the issued certificates (see Di Santo, Biele and De Chicchis 2018a and 2018b).

In addition, the new decree defined the average market offer, representing the application of the new technologies available on the market to deliver the service provided by the evaluated project, as baseline for additionality. Before the introduction of 2017 guidelines, the additionality evaluation process was basically the same, with one important exception: the market-adjusted baseline was calculated with respect to the average efficiency of the given solution, considering both the installed application and the average market offer. This change has probably been introduced to overcome the issue of state aids regulations for white certificates[11], that was under discussion in the same period, by cutting out any possibility of discussion, being the new definition of additionality clearly beyond the requirements of the 2012/27/EU directive (EED). Unfortunately, the result was in most cases a large drop in the eligible energy savings (see Di Santo, Biele and De Chicchis 2018a and 2018b),

10. Bills, performance sheets about the installed technologies, declaration from the occupants, certifications about the installed solutions, documentation about the respect of building codes (e.g. EPCs, proofs of heating, etc.).

11. Given the predominance of the industrial sector in the Italian scheme this was a potential issue.



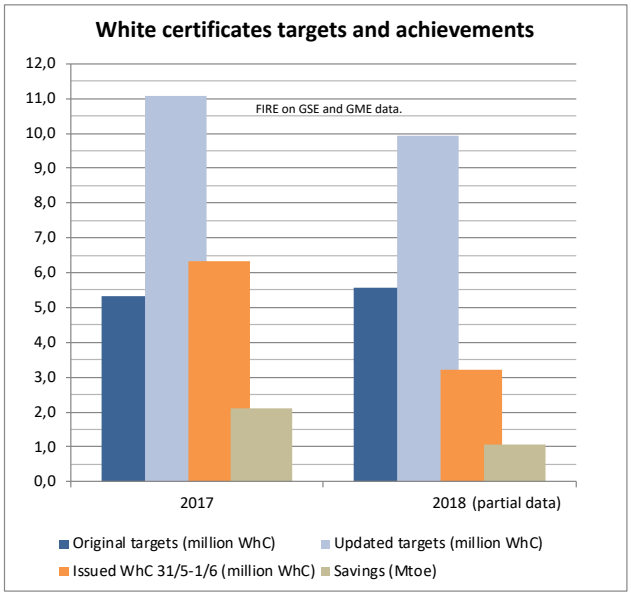


Figure 5. WhC prices and main achievements compared with the targets (2017–2018).

a negative news, to be coupled with the elimination of the tau coefficient and of SPs, for a supply side of WhC already under pressure.

A disruptive element for the performance of WhCs scheme, also influencing control and verification procedures, are the huge frauds committed on standardized projects that emerged in 2017. According to MiSE, such frauds amounted to an annual amount of 600 thousand certificates, and subsequently another 700 thousand titles were blocked due to more detailed checks carried out by GSE. This is about 1.3 million certificates less per year, which caused a collapse in the supply not forecasted when D.M. 11 gennaio 2017 was issued[12]. These frauds, as indicated in Di Santo, Biele and De Chicchis 2018a and 2018b, were based on ill purpose companies, with parent companies located outside Italy, created to present false projects by providing false documentation. Besides the elimination of SPs, the decree reduced the possibility to present interventions implemented across different end-users only to proponent investing in the implementation of the energy efficiency measures (e.g. ESCOs acting through EPC and directly financing the investments).

The growing uncertainty about the possibility to cover the targets in the years to come further pushed the price of the certificates up, passing from 200 Euros per certificate in January 2017 to around 480 Euros per certificates in February 2018. To avoid further growth, MiSE temporarily reduced the spot market sessions to one per month and introduced the news to come with the new decree, among which a cap to the tariff reimbursement that had the desired effect to calm down the WhC price.

An important lesson learnt between 2016 and 2018 was that the design of the WhC market proved to be unstable. Supply became highly inelastic, since from the time the project is developed to the issue of certificates at least one and a half years could be taken with the new rules, whereas previously SPs could act as fast followers. Furthermore, the criterion for determining the tariff contribution translates to distributors buying certificates in every market session to have a weighted purchase costs in line with the weighted average prices and therefore with the tariff contribution itself, a demand strategy which encourages the price increase in an under-supply scenario. Besides, due to the WhC lifetime, the rise in price benefits new, but also existing projects, which would not need it, as they were previously presented with lower prices. In a fluid and elastic market system this should not cause particular inconvenience, but in the actual situation it would result in a high cost for the system, to be paid through the electricity and gas tariffs by all end users (see De Paoli 2017, Di Santo et al. 2018b and Giannetti 2018).

Last modifications (from mid 2018 on)

Given the afore mentioned issues, MiSE issued new guidelines in 2018 to avoid a collapse driven by skyrocketing market prices and an insufficient number of certificates to reach even the minimum targets (i.e. 60% of the legislative target plus the part of the flexibility clause to be recovered). *D.M. 10 maggio 2018* introduced another revolution, dealing both with supply and demand side. For the first aspect, the purpose was to increase the number of available certificates through the following actions:

- abolition of additionality for projects linked to improvements of existing facilities (in parallel, WhC lifetime for these projects has been reduced from 10 to 7 years and from 7 to 5);
- introduction of new eligible projects;
- introduction of a first group of eight SPSMs files (led for internal and public lighting, electric motors, compressed air generation, smart bill, naval propulsion systems, hybrid and electric vehicles fleets).

The elimination of additionality for the improvement of existing facilities is an attempt to overcome one of the main issues

12. To confirm this, MiSE reduced the flexibility clause to one year in the decree, a choice that makes sense only in the hypothesis of being able to recover the lack of certificates on the market.

related to MPPs, especially in the industrial sector. This should facilitate both the participation to the scheme and the evaluation and verification of proposals by GSE. It is worth noticing that additionality will continue to be taken into account, both to establish eligible projects and to determine the quota of savings compliant with the EED directive art. 7, but its calculation won't be requested to the proponent.

On the other hand, there was the need to support the demand side. This has been done by introducing measures to moderate the market prices and to overcome the lack of certificates to cover the minimum targets. A cap equal to 250 Euro/WhC has been put on the distributors' reimbursement, and GSE has been given the possibility to issue temporary non-energy saving related certificates to obliged parties in case of lack of certificates to cover the minimum targets. The flexibility clause for distributors has been already increased to two years, maintaining the 60 % minimum threshold. These measures have a temporary function and have been preferred to the reduction of the targets, in the belief that supply will recover and an equilibrium between demand and supply will be met again in the next years.

It will take time to verify the effects on the supply side and understand if they will be enough, but the new rules should ensure some stability in the meantime. White certificates operators will benefit from good WhC price and less rejection issues. The new rules, on the other hand, won't be sufficient to overcome all the issues: the differences between supply and demand on the WhC market is too large and even if the new rules will be successful in promoting new projects, they will generate certificates from 2019–2020 on, leaving a treacherous period to deal with. So new developments have to be expected in the next months, depending on the developments.

Cost-benefit analysis

Figure 6 summarises the results and the targets over the scheme life. Apart from the issues highlighted over the paper, it clearly appears that the energy savings, the main goal of scheme, from 2010 on didn't grow anymore[13]. This isn't necessarily an issue, since over time many changes have been made all in the direction to improve the reliability of the energy savings assessed and the additionality of the implemented projects. As the EUMERCI project (www.eumerci.eu) demonstrated, the quantity and quality of information collected with the WhC projects is an excellence at EU level, balancing the complexity related to MPPs, the main source of certificates.

An important question is: such complexity paid in terms of cost-effectiveness? A question to which it is very difficult to answer, since cost-effectiveness is a complex theme that should consider many aspects. Here is an attempt to understand how the main economic indicators changed over time.

To start with, let's see if 250 Euros per certificate (i.e. the value of the cap) is a rational price, after years passed at 100–110 Euros per certificate. It can be observed that the elimination of the *tau* coefficient reduced the certificates issued for a generic project by a factor of 1.7, considering that the average *tau* is around of 2.9, the current WhC life corresponding to this value is generally equal to ten years, and discounting at 5 % rate. So, a price in the order of 180–200 Euros would not have been abnormal. Taking it to 250 Euros can be justified considering the major difficulties related to the presentation of projects, the stricter rules on measurement and verification, the modification of additionality, and the loss of confidence and trust on the part of operators.

In terms of global costs, with 250 Euros the annual cost of the scheme can be expected in the order of 1.8 billion Euros, considering also the residual target to be recovered. This goes together with savings around 7.2 million of WhC annually, all additional because linked to the projects presented with guidelines previous to D.M. 10 maggio 2018, and around 2.6 Mtoe of annual energy savings. It means 650–700 Euros/toe, a value lower than the cost of energy[14]. So the scheme started with 30–80 Euros/toe, rose at 100 Euro/toe before the introduction of the tau coefficient, jumped to around 300 Euro/toe, a value that remained almost constant for five years, and more than doubled in the last tricky years. Turning to an analysis of the bill expenditure, for a home user, the cost of the scheme translates in about 3 Euros/MWh for electricity, compared to an average cost of 196 Euros/MWh, and to 0.01 Euros/m^3 for natural gas, compared to an average cost of 0.73 Euros/m^3, for an annual cost of 21 Euro against an annual expenditure of about 1,550 Euro in 2017[15]. In relative terms, the cost appears acceptable.

However, the issue of cost effectiveness remains to be addressed. To do this, a possibility is to compare the incentive granted to one saved toe to the avoided cost of imported gas[16]. The following table shows how some fundamental variables changed over time, by applying the different guidelines to the price variation of the WhC, assuming different additionality values due to the evolution of the rules and taking into account a tau equal to 3.36 (applied only for the 2012 guidelines), a technical life of 20 years (reference used to define the useful life in the various regulatory phases), a cost of saved toe of 900 Euros, a cost of imported gas of 319 Euros/toe[17] and a discount rate of 5 %. The toe indicated in the table refer to total energy savings generated by an energy efficiency project. The cumulative value of incentive and the avoided natural gas import are calculated on a technical life reduced to ten years, against the theoretical twenty (cautionary hypothesis).

To better understand the table, let's follow the second case. This is a project presented with the rules defined by *D.M. 28 dicembre 2012*, for which a 50 % additionality is assumed. For each toe saved, the project generates $1 \times 3.36 \times 0.50 = 1.68$ certificates (i.e. the toe is multiplied by the *tau* and by the additionality coefficient). Therefore, during the WhC life, $1.68 \times 5 = 8.4$ certificates are generated, corresponding to 840 Euros with the price of 100 euros per certificate and to 2,100 euros with certificates at 250 euros (the values shown in the table – 727 and 1,818 respectively – are lower because discounted at 5 % per year). These two values, which repre-

13. It is important to underline that such savings cannot be directly compared with the ones reported to the EC for the EED art. 7 purposes.

14. Electricity costs around 1,050 Euro/toe and natural gas costs around 900 Euros/toe.

15. GSE estimates with an average price of 286 Euros per certificates.

16. This makes sense also given that natural gas is also the main fuel for electricity generation in Italy.

17. Value obtained from ISTAT (Italian statistical body) average price data for 2009–2018.

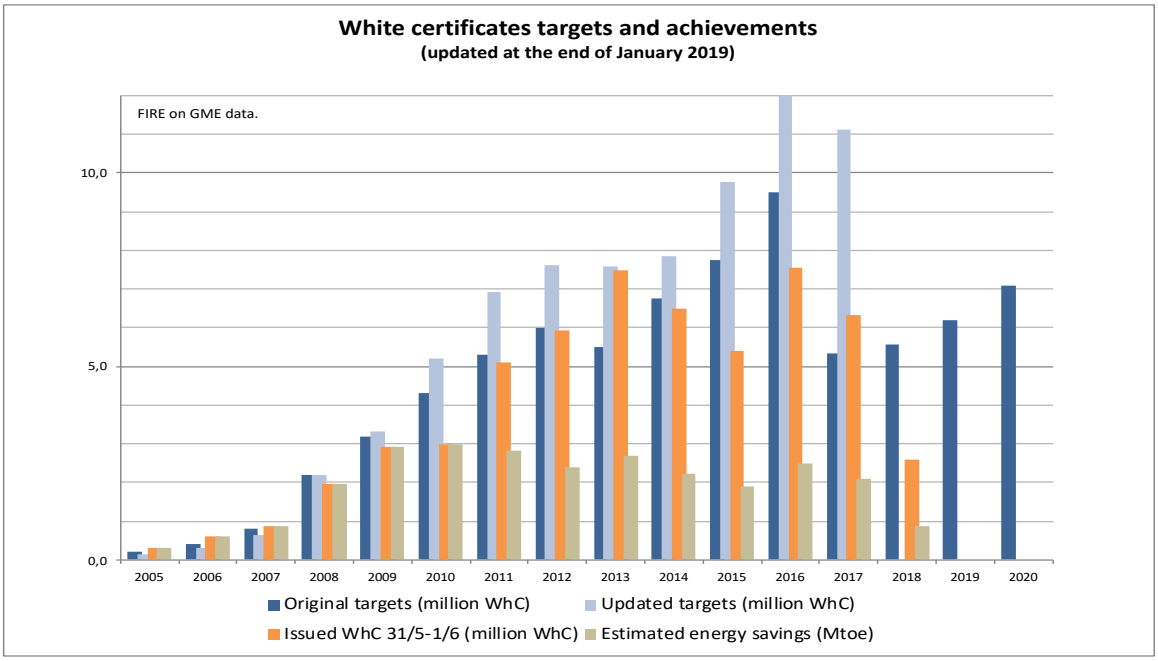


Figure 6. WhC scheme achievements and targets: the whole picture.

Table 1. How WhC incentive compared with import reduction.

Reference decree (WhC guidelines)	Additionality coefficient (i.e. quota of savings eligible for WhC)	WhC lifetime (years)	WhC/year on toe saved per year	Cumulative value of incentive at 100 euros/WhC (euros)	Cumulative value of incentive at 250 euros/WhC (euros)	Value of avoided gas import (euros)
D.M. 28/12/2012	100 %	5	3.36	1,455	3,637	2,463
D.M. 28/12/2012	50 %	5	1.68	727	1,818	1,232
D.M. 28/12/2012	10 %	5	0.34	145	364	246
D.M. 11/01/2017	10 %	10	0.10	77	193	246
D.M. 10/05/2018	100 %	7	1.00	579	1,447	2,463

sent the total amount of the incentive issued in the two WhC price hypotheses, are then compared with the economic value of natural gas import avoided thanks to energy savings, equal to the cost of imported gas multiplied by the additionality coefficient and the discount factor over 10 years: 319 × 0,50 × 7,72 = 1,232 Euro. The cumulative value of the incentive should be lower than that of the avoided gas import in order for the scheme to be effective.

Taking into account the various options in the table, it shows that the comparison with the avoided value of imports with the price of WhC at 250 Euros is always unfavorable in the case of the *D.M. 28 dicembre 2012*, due to the multiplicative effect of the *tau* coefficient. Considering that almost all the certificates on the market fall under this condition, one can understand how the cost-effectiveness of the scheme is at risk with current prices. Fortunately, most of such projects have been in place from some years and thus the average WhC price they benefitted from is lower than the present WhC price, making their weighted average cost acceptable. Generally speaking, such values allow to confirm that the scheme performed very well in economic terms until 2016 and that the new price makes perfectly sense with projects presented from 2017 on.

Besides, all this does not take into account the other benefits produced by the scheme (data acquisition, market development, employment, etc.) and the trend in future energy and import prices, assumed on average in line with those of the last decade. To be noticed that an option to keep low the cost of the scheme and to avoid some other negative effects could have been to freeze the WhC price for projects presented before 2017 to, for example, 150 Euro per certificate. Such a choice would have granted a good economic performance to old projects, while maintaining a market without caps for new proposals. Finally, it is worth noticing that, according to evaluations made by ENEA ("Rapporto Annuale Efficienza Energetica", 2018, ENEA), WhC still perform better than other Italian incentive schemes in terms of euros spent for toe saved, but this is also due to the different mix of eligible projects.

Conclusions

The WhC scheme has been capable to work for more that 12 years, producing more than 26 Mtoe of additional savings and over 56 million white certificates. It worked in all sectors, generating 62 % of the savings in industry. Over the years, the

modification to the guidelines allowed to overcome many of the above mentioned issues, even if some of the adopted solutions also produced negative effects.

In the last years many critical issues have arisen, due to more complex rules, frauds, WhC market rules, and cost recovery mechanism. Stricter rules on additionality and the large amount of data required for the projects, not comparable with other schemes in Italy, have restricted the eligible projects and the generable savings, with a timeline not always linked to the set targets. The high number of rejected proposals (more than 50 % of the presented MPPs, as reported in Di Santo et al. 2018b) is also indicative of unclear rules, which would require more preliminary discussion and greater information and training support to operators. Among the consequences of the issues arisen in the last years there is also a high administrative dispute.

In any case, apart from some improvable design choices, one of the main problems has been to fix the targets. Many issues are linked to targets set too optimistically, probably due to the difficulty to forecast the effects of the mix of changes that each decree produced and also to unexpected events (e.g. the magnitude of the frauds discovered in 2017). The main lessons learnt, in our opinion, are:

- the importance to have in place a robust monitoring, reporting and verification (MRV), together with effective controls to avoid frauds, a priority with simplified projects;
- the need to modify the rules at least every 2–3 years, to avoid problems from growing too much (i.e. good MRV and evaluation are not enough, policy makers should be able to react in time);
- the idea to set the targets and forget, leaving the supply to adapt, most probably won't work, considering additionality requirements and market developments;
- EEOs with tradable markets are very complex to manage, and only worthy if large enough to justify the required efforts.

References

Bertoldi, P., and S. Rezessy. 2006. "Tradable certificates for energy savings (white certificates) – theory and practice." European Commission Joint Research Centre, Institute for Environment and Sustainability. EC.

Bertoldi, P, L. Castellazzi, N. Artemis Spyridaki, V. Oikonomou, N. Renders, I. Moorkens, and T. Fawcett. 2015. "How is article 7 of the Energy Efficiency Directive being implemented? An analysis of national energy efficiency obligation schemes", eceee Summer Study – First Fuel Now. eceee.

Bini, V., S. D'Ambrosio, and D. Di Santo. 2017. "Report on the interviews to the key stakeholders and the first EPATEE survey". Synthesis Report. EPATEE.

De Paoli, L. 2017. "La promozione del risparmio energetico in Italia: i certificati bianchi". Energia 4/2017. RIE – Automobile Club d'Italia.

Di Santo, D., D. Forni, V. Venturini, and E. Biele. 2011. "The White Certificate scheme: the Italian experience and proposals for improvement". eceee Summer Study – Energy efficiency first: The foundation of a low-carbon society. eceee.

Di Santo, D., D. Forni, and E. Biele. 2012. "White certificate for the industrial sector". eceee Summer Study - Industry: A third of Europe's energy use. eceee.

Di Santo, D., G. Tomassetti, E. Biele, and S. D'Ambrosio. 2014a. "Italian white certificates scheme: the shift toward industry". eceee Summer Study – Retool for a competitive and sustainable industry. eceee.

Di Santo, D., G. Tomassetti, E. Biele, and S. D'Ambrosio. 2014b. "White certificates in industry: the Italian experience". IEPPEC conference in Berlin. IEPPEC.

Di Santo, D., E. Biele, and D. Forni. 2016. "White certificates as a tool to promote energy efficiency in industry", eceee 2016 summer study. eceee.

Di Santo, D., and E. Biele. 2017. "EPATEE case study – ITALY: white certificates". EPATEE case studies. EPATEE.

Di Santo, D., E. Biele, and L. De Chicchis. 2018. "White certificates as a tool to promote energy efficiency in industry". eceee summer study – Leading the low-carbon transition. eceee.

Di Santo, D. 2018. "Certificati bianchi: una situazione complicata". Analisi trimestrale del sistema energetico italiano. ENEA. ISSN 2531-4750.

Di Santo, D., E. Biele, and L. De Chicchis. 2018. "White certificates in Italy: lessons learnt over 12 years of evaluation". IEPPEC conference in Vienna. IEPPEC.

Eyre, N., M. Pavan, and L. Bodineau. 2009. "Energy company obligations to save energy in Italy, the UK and France: what have we learnt?". eceee Summer Study – Act! Innovate! Deliver! Reducing energy demand sustainably. eceee.

Giannetti, D. 2018. "Evaluation of Energy Efficiency policies in Italy". 3st EPATEE peer-learning workshop in Roma. EPATEE.

Labanca, N, and P. Bertoldi. 2016. "Energy Savings Calculation Methods under Article 7 of the Energy Efficiency Directive". EUR 27663 EN. doi 10.2790/855880.

Rosenow, J., D. Forster, B. Kampman, C. Leguij

t, Z. Pato, A. Kaar, and N. Eyre. 2015. "Study evaluating the national policy measures and methodologies to implement Article 7 of the Energy Efficiency Directive". ED59360 – Issue Number 2. Ricardo-AEA.

Stede, J. 2017. "Bridging the industrial energy efficiency gap – Assessing the evidence from the Italian white certificate scheme". Energy Policy 104. 112–123.

Various authors. 2012. "Best Practices in Designing and Implementing Energy Efficiency Obligation Schemes". Research Report Task XXII of the International Energy Agency Demand Side Management Programme. IEA DSM.

Various authors. 2013. "White certificates". CEN/CLC/TR 16567. CEN.

Various authors. 2015. "Energy saving policies and energy efficiency obligation scheme". D2.1.1: Report on existing and planned EEOs in the EU – Part I: Evaluation of existing schemes. ENSPOL project.

Various authors. 2017. "Snapshot of Energy Efficiency Obligations schemes in Europe: 2017 update". Fourth European Workshop Meeting of the White Certificates Club. ATEE.

Various authors. 2018. "Rapporto Annuale sul meccanismo dei Certificati Bianchi". Annual report on white certificates. GSE.