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Twenty years of white certificates in Italy: Lessons from crisis, reform and recovery

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ABSTRACT

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The Italian White Certificates (WhC) scheme was introduced in 2001 and became fully operational in 2005. It is characterised by broad sectoral coverage, measurement and verification of energy performance aligned with International Performance Measurement and Verification Protocol (IPMVP) option B,[1] technological neutrality, and a high degree of flexibility, including the participation of non-obliged (eligible) parties, a tradable certificate market, banking options, and adjustable targets for obliged parties.

By the end of 2024, the scheme had delivered more than 30 million tonnes of oil equivalent (toe) of cumulative energy savings, making a substantial contribution to national energy efficiency targets.

Major revisions were implemented in 2012 and 2017, affecting both targets and operational rules. These changes, together with evolving energy market conditions, progressively reduced the scheme's ability to generate the expected volume of certificates. The resulting structural shortage led to sustained price increases, ultimately threatening both target compliance and the overall stability of the scheme.

In response, a comprehensive reform was introduced in 2021 to prevent system collapse and to relaunch the scheme in line with the National Energy and Climate Plan. The revised framework, supported by a set of accompanying actions implemented by GSE, the scheme's managing authority, has led to a gradual but measurable recovery. To reinforce this trend, a new regulation adopted in July 2025 introduced further simplifications, particularly in measurement and verification procedures and project timelines, along with additional measures aimed at improving scheme effectiveness.

This paper reviews the evolution of the WhC scheme, focusing on the rationale behind the main regulatory changes and on the first evidence emerging one year after their introduction. Strengths and weaknesses observed over time are critically assessed, drawing on insights from the national snapshots published within the ENSMOV Plus project in 2025.

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INTRODUCTION

Energy Efficiency Obligation Schemes (EEOS) have progressively become one of the central instruments for delivering end-use energy savings under the European Energy Efficiency Directive (EED). Within this context, the Italian White Certificates (WhC) scheme represents one of the most long-standing experiences in Europe. Introduced in 2001 and fully operational since 2005, the scheme was designed with a set of ambitious and, at the time, innovative objectives. These included the creation of a market-based mechanism for energy efficiency, the promotion of Energy Service Companies (ESCOs), the extension of the scheme across all end-use sectors, and the adoption of a measurement-based approach to energy savings.

As shown in Figure 1, over the past two decades, the scheme has reported more than 30 million tonnes of oil equivalent (toe) of cumulative energy savings, making a substantial contribution to national targets and to the implementation of Article 7 of the EED (Broc et al. 2024).

At the same time, the Italian experience highlights the intrinsic complexity of EEOS based on tradable certificates and strict measurement and verification requirements. The combination of flexibility mechanisms—such as tradability, banking, and the participation of non-obliged parties—with rigorous rules on additionality and M&V has created a system that is both sophisticated and structurally sensitive to regulatory changes.

The evolution of the scheme has not been linear. After a phase of rapid growth in the first years of operation, the mechanism entered a period of increasing complexity and tightening of rules. The major revisions introduced in 2012 and, more significantly, in 2017 aimed at improving the quality and credibility of energy savings, but also had the effect of reducing the volume of certificates generated.

These changes, combined with external factors such as the interaction with other policy instruments and the emergence of fraud cases, progressively led to a structural imbalance between demand and supply. From the mid-2010s onwards, the scheme experienced a persistent shortage of certificates, resulting in sustained price increases and raising concerns about both the ability of obliged parties to comply with their targets and the overall stability of the mechanism.

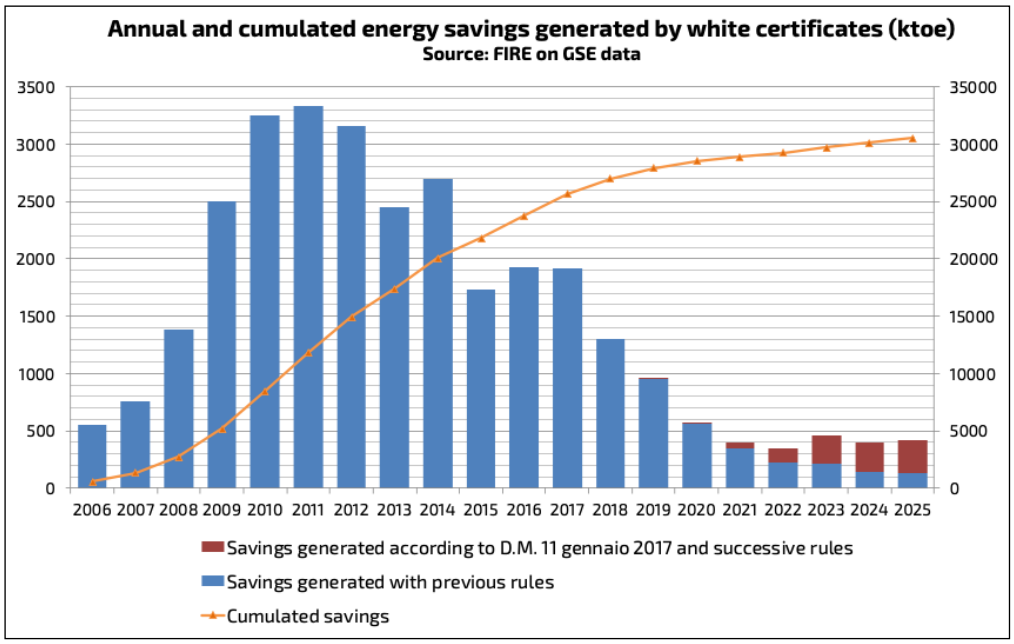

Figure 1 Annual and cumulated savings generated by white certificates in Italy since the launch of the scheme.

The response to this situation materialised in the comprehensive reform introduced in 2021, which explicitly aimed at restoring the functioning of the market and relaunching the scheme in line with the National Energy and Climate Plan (NECP). The reform addressed both the

1 In brief, the main points of IPMVP option B are: i) the involved system (e.g., chiller, motor, specific process, etc.) is isolated, ii) all relevant variables used to calculate savings are directly measured (not estimated), iii) energy savings are determined by comparing pre- and post-retrofit energy use, adjusted for operating conditions.

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demand side—through a significant revision of targets and the introduction of a market stability mechanism—and the supply side, through a set of measures aimed at reducing transaction costs, increasing the pool of eligible projects, and rebuilding trust among market participants.

A further regulatory update adopted in 2025 introduced additional simplifications, particularly in relation to measurement and verification procedures and project timelines, with the objective of consolidating the recovery observed after 2021 and improving the overall effectiveness of the scheme.

This paper analyses the evolution of the scheme, focusing on the drivers of imbalance and the effects of recent reforms, drawing also on the EU-funded project ENSMOV Plus that makes available a wide range of reports, guides, and analyses through the platform energysavingpolicies.eu (Various Authors 2025). Rather than providing a comprehensive technical description of the scheme, which is available in previous literature (e.g. Di Santo and De Chicchis 2019, Di Santo et al. 2024), the paper adopts a policy-oriented perspective, aimed at extracting lessons relevant for the design and implementation of EEOS. In particular, the Italian case offers a valuable testbed for examining the trade-offs between accuracy and scalability in M&V, the interaction between regulatory stability and market confidence, and the challenges associated with aligning targets with the effective delivery capacity of the system.

DESIGN FEATURES OF THE ITALIAN WhC SCHEME

The Italian White Certificates (WhC) scheme is an energy efficiency obligation scheme (EEOS) based on a hybrid design combining regulatory obligations with a market-based mechanism. Its architecture reflects a deliberate attempt to reconcile flexibility—through trading and participation of multiple actors—with robustness in the measurement of energy savings.

The overall governance of the scheme involves multiple institutions. The Ministry of Environment and Energy Security defines the policy framework and sets the targets, while the Gestore dei Servizi Energetici (GSE) acts as the managing authority, responsible for project evaluation, issuance of certificates, monitoring, and control activities. The energy regulator (ARERA) defines the rules for the reimbursement of obliged distributors and defines and applies sanctions in case of failures by distributors in meeting their targets. The energy market operator (GME) manages the trading platform.

Obliged parties are electricity and gas distributors with more than 50,000 customers. Compliance is achieved through white certificates, each corresponding to one toe of verified energy savings. Eligible parties—including certified ESCOs and companies with certified energy management systems or certified energy management experts—can develop projects and trade certificates. This structure enables flexibility and market-based cost optimisation.

The Italian scheme places a strong emphasis on measurement and verification (M&V). Energy savings are generally assessed through project-specific monitoring plans, based on measured data collected both before and after the implementation of the intervention. The approach is broadly aligned with IPMVP option B, requiring the definition of an ex-ante baseline and the continuous measurement of relevant variables during the project lifetime.

This choice distinguishes the Italian scheme from many other EEOS in and outside Europe, where deemed savings or simplified engineering estimates play a more prominent role (Various Authors 2015, 2017, 2019). While the use of measured data increases the reliability and credibility of reported savings, it also entails higher transaction costs, longer project development times, and greater technical complexity.

The scheme allows for different types of projects, including retrofit interventions, new installations, and integrated projects combining multiple measures. Savings are recognised for a predefined period, typically ranging from three to ten years, depending on the type of intervention and its expected lifetime.

Several flexibility mechanisms are embedded in the design. For example, obliged distributors can postpone up to 40% of their annual target to the next two years without incurring any sanctions. Also, certificates can be banked and used in subsequent years, allowing obliged parties to manage compliance over time.

At the same time, the scheme includes mechanisms aimed at limiting excessive market volatility and ensuring compliance. These include the possibility, introduced in later phases, to access "virtual certificates" under specific conditions, as well as a cap on the tariff reimbursement mechanism set at €250/certificate. It should be noted that virtual certificates are certificates not linked to any savings that have a fixed cost of €10/certificate, exclude the tariff reimbursement, and can be later redeemed by presenting an equivalent amount of normal certificates (i.e. they act as a substitution fee).

The scheme is thus capable of generating effective and reliable savings. By issuing white certificates over the projects' lifetime, it also ensures that the organisations that benefit from the energy efficiency actions are stimulated to operate them at the highest possible performances. However, the same design features that underpin the strengths of the scheme also contribute to its vulnerabilities.

As will be discussed in the following sections, these elements have played a crucial role in shaping the evolution of the scheme, especially in the phases characterised by market imbalance.

EVOLUTION OF THE SCHEME: PHASES AND TURNING POINTS (2005–2021)

The evolution of the Italian White Certificates scheme can be interpreted as a sequence of distinct phases, each characterised by a different balance between flexibility, complexity, and robustness of the system. Rather than a linear progression, the scheme has followed a path marked by successive adjustments, often driven by the need to correct unintended effects of previous design choices.

EARLY PHASE AND RAPID GROWTH (2005–2012)

In its initial years, the scheme experienced rapid expansion, both in terms of participation and volume of certificates issued. This phase was characterised by a relatively simple operational framework and a high degree of supply elasticity.

A key enabling factor was the widespread use of standardised and deemed savings methodologies, which allowed projects—particularly in the residential and tertiary sectors—to be developed and replicated with limited transaction costs. Many large distributors played an active role in this period, while the role of ESCOs grew until they became the main actor in terms of proposals presented, initially acting as aggregators of small-scale interventions, pushing the participation of industrial enterprises, and facilitating market development.

The introduction of the tau coefficient in 2011 further reinforced this trend (see Di Santo, Biele, Forni 2012). By allowing future savings to be anticipated within the WhC scheme, the coefficient significantly increased the number of certificates issued per project, improving investment attractiveness and accelerating market growth.[2] However, this design choice also introduced a structural distortion. The link between certificates and actual annual energy savings became less direct, and part of the scheme's performance was effectively "front-loaded". While this did not immediately affect the functioning of the market, it contributed to building expectations on supply levels that would later prove difficult to sustain under different regulatory conditions.

INCREASING COMPLEXITY AND STRUCTURAL WEAKNESSES (2013–2016)

The period following 2012 marked a gradual transition towards a more stringent and complex regulatory framework. Several measures were introduced with the objective of improving the quality and materiality of savings, but with significant implications for the functioning of the scheme.

2 In practice, the tau coefficient generated a number of certificates around 3 times the annual savings, given the 5% discount ratio. For example, a project delivering 1 toe/year of energy savings with an expected life of 20 years received 3.36 certificates per year over the 5 years lifetime. With an expected life of 15 years 2.67 certificates, and so on.

First, the prohibition of cumulating white certificates with other national incentives reduced the attractiveness of the mechanism for certain types of interventions, particularly in the residential sector.[3] This, together with an increased capability from ESCOs to understand and propose energy efficiency projects also for manufacturing processes, contributed to a structural shift towards industrial projects (Di Santo et al. 2018a).

Second, the requirement to submit project applications before implementation introduced a stricter control on materiality but also increased planning constraints for project developers.

The combined effect of these changes was a gradual reduction in supply elasticity. Among projects based on metered savings[4] (also known as monitoring plan projects, MPPs) complexity increased, development times rose, and the pool of easily replicable interventions shrank. At the same time, targets continued to grow, based on expectations derived from the previous phase.

This divergence between expected and actual supply potential did not immediately result in a visible imbalance, partly due to the residual effects of earlier design choices, including the tau coefficient and the stock of projects developed under more favourable conditions. This is the reason why MPPs peaked in 2014, as shown in Figure 2.

Besides, the tau coefficient—by increasing the economic value of all projects—started to produce the appetite from malevolent organisations to participate in the scheme through purposely created companies, which began to present non-existent standardised projects falsifying the requested documentation (the growth of standardised projects in 2015–2016 was unfortunately in part related to frauds and laid the foundations for the structural issues that would have soon emerged and produced the 2017 reform).

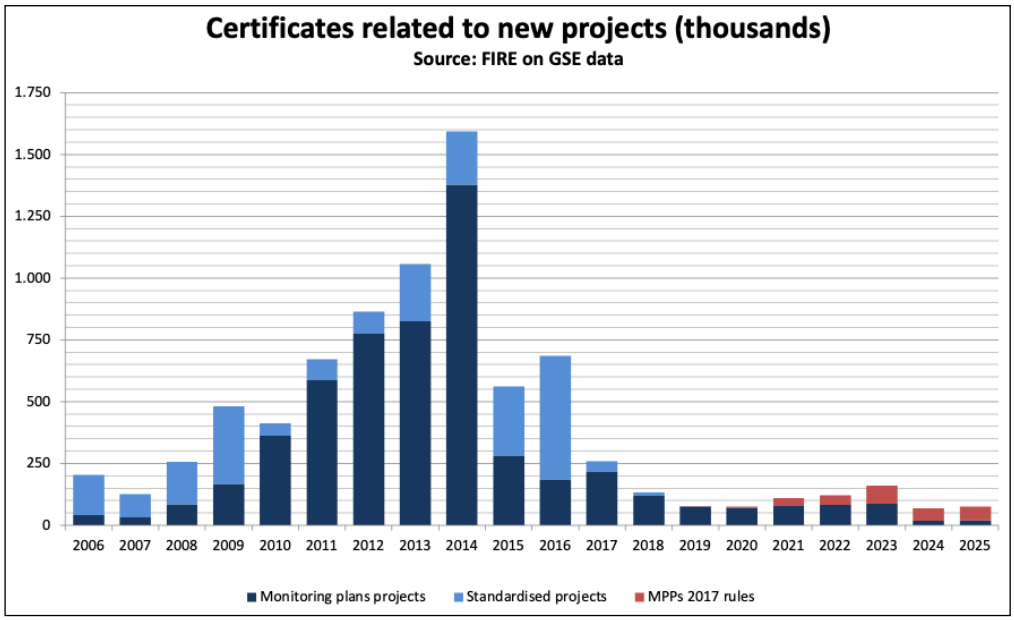

Figure 2 Certificates related to new projects for each year.

THE 2017 REFORM AND THE CRISIS OF THE SCHEME (2017–2021)

The 2017 revision of the scheme represents the most critical turning point in its evolution. The reform introduced a fundamental shift in the approach to M&V and project eligibility. Simplified and deemed savings methodologies were effectively phased out, and a stronger reliance on metered savings was enforced. Baseline definitions became more stringent, with additional requirements for meters and M&V procedures, and additionality requirements were reinforced.

At the same time, the scheme was affected by the emergence of significant fraud cases linked to previous project types. The response to these events involved tighter controls and the exclusion or revision of entire categories of projects, leading to the withdrawal or non-issuance of a substantial volume of certificates.

3 Alternative measures, such as tax reliefs (“Ecobonus”) were much more economically attractive—and much easier to exploit—than white certificates.

4 Metered savings in the Italian scheme refers to measures implemented at project level, as in IPMVP option B, not to smart meters linked to the networks’ point of delivery.

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While these measures were partially justified in terms of improving the credibility and integrity of the scheme, their combined impact on the supply side was substantial. The transition to a fully metered approach significantly increased the complexity of project development and evaluation. Lead times lengthened, and the number of new projects capable of generating certificates decreased sharply. As Figure 2 shows for the first four years after the reform, the certificates issued for new projects remained negligible.

This structural contraction of supply occurred in a context where targets had not yet been adequately adjusted. As a result, a persistent gap between demand and supply emerged. The market progressively shifted into a "short" position, with the number of available certificates insufficient to meet the obligations.

The price signal reacted accordingly. Certificate prices increased rapidly, reaching levels that were significantly higher than in previous years. However, due to the intrinsic characteristics of the scheme, higher prices did not translate into a proportional increase in supply. The development of new projects under the revised rules required time, technical capacity, and a level of regulatory certainty that was not immediately available.

This phase highlights a critical structural feature of the Italian scheme: the limited short-term responsiveness of supply in a system based on project-based, metered savings. Unlike mechanisms relying on deemed savings, where supply can adjust relatively quickly, the Italian WhC scheme exhibits significant inertia, making it particularly sensitive to abrupt regulatory changes. Moreover, since white certificates are issued over the project lifetime—rather than as a one-off allocation, as in the French scheme—any increase in market prices had a significant impact on the overall cost of the scheme (until the introduction of the cap on the tariff reimbursement). This is because higher prices also apply to certificates generated by existing projects that are still within their lifetime.

By the end of the 2010s, the scheme was therefore characterised by a persistent shortage of certificates, which was worsened by the 2017 reform, increasing compliance risks for obliged parties, and growing concerns about the overall stability of the mechanism (Figure 3). The introduction of temporary measures, such as price caps and flexibility instruments, helped mitigate the most immediate effects but did not resolve the underlying imbalance.

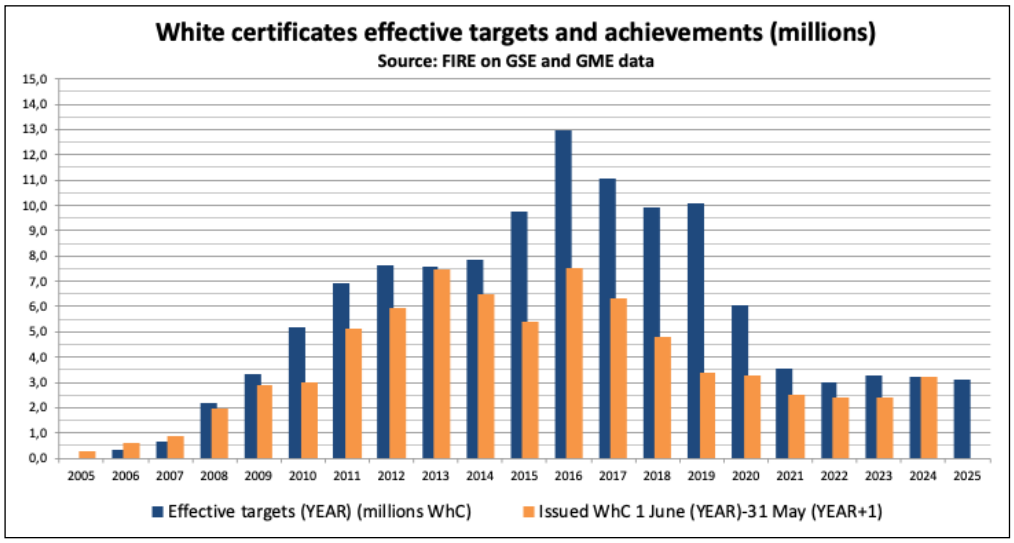

Figure 3 Effective targets (60% annual target plus residual targets) and issued certificates.

This situation set the stage for the comprehensive reform introduced in 2021, aimed at restoring a functional equilibrium between demand and supply and rebuilding confidence in the system.

MARKET IMBALANCE AND STRUCTURAL SHORTAGE

The phase that unfolded after the 2017 reform can be interpreted as a textbook case of structural imbalance in a tradable certificate scheme, where regulatory changes alter the underlying supply function without a corresponding adjustment in demand (Di Santo 2018). At the core of the issue lies a fundamental asymmetry between how demand and supply react to changes in the system.

On the demand side, the mechanism is inherently rigid. Targets are set exogenously by the regulator, typically over multi-year periods, and are only partially adjustable in the short term. Even when flexibility mechanisms are introduced—such as the possibility to postpone part of the obligation or to use alternative compliance options—the overall level of demand remains largely insensitive to short-term market conditions.

On the supply side, by contrast, the responsiveness of the system depends on the characteristics of project development and on the regulatory framework governing eligibility and M&V. In the Italian case, the progressive shift towards metered savings and project-specific evaluation has resulted in a supply function that is highly inelastic in the short to medium term. This inelasticity stems from several structural factors.

First, project development cycles are long and uncertain. From the identification of an opportunity to the submission of a proposal, approval by the managing authority, implementation, and subsequent monitoring of savings, the process can easily span more than one year.

Second, the technical complexity of M&V requirements increases both transaction costs and the risk perceived by project developers. The need to define a robust baseline, identify relevant variables, install appropriate metering systems, and ensure compliance with evolving guidelines introduces a level of uncertainty that cannot be easily offset by price signals alone.

Third, the pool of eligible projects is not infinitely expandable. Once the most cost-effective and standardisable interventions have been exploited, further savings require more complex, site-specific measures, particularly in the industrial sector. These projects are typically capital-intensive, heterogeneous, and less replicable, further reducing supply elasticity.

When the 2017 reform tightened M&V requirements and excluded simplified methodologies, these structural characteristics became dominant. The supply curve effectively shifted inward, both in terms of volume and responsiveness. However, targets continued to reflect expectations based on previous conditions, when supply was more elastic and supported by mechanisms such as the tau coefficient.

The price dynamics observed in this period reflect these structural conditions (Figure 4). Certificate prices increased sharply, reaching levels significantly above historical averages. A decree in 2018 introduced a cap on the reimbursement for distributors at €250/certificate and this explains the stabilisation of the spot market price.

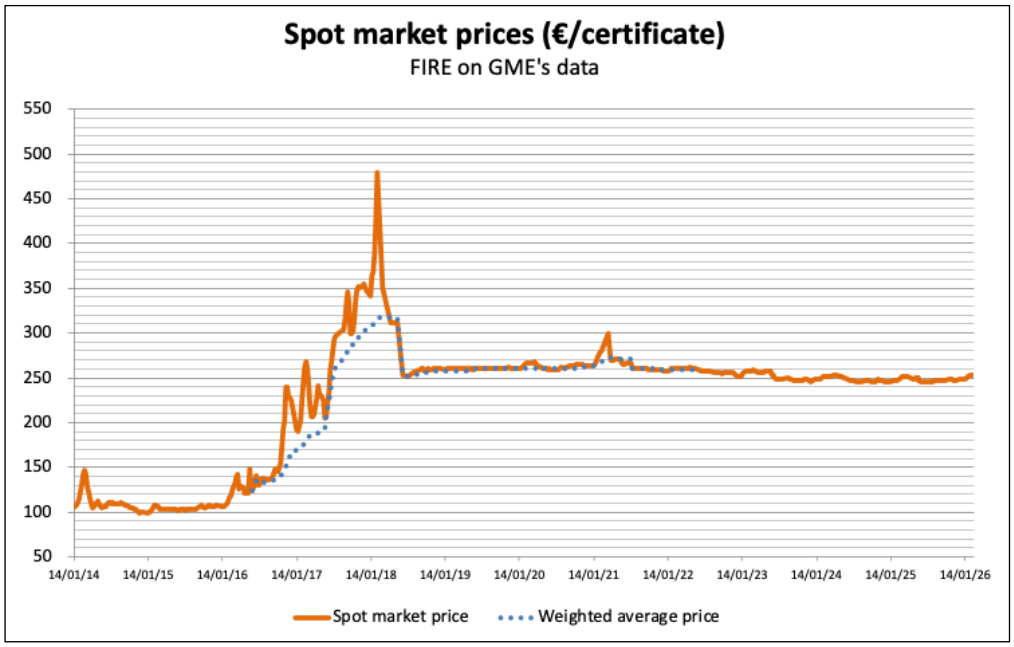

Figure 4 WhC spot market price (January 2014–February 2026).

Given the supply inelasticity cited above, price signals lose part of their effectiveness as a coordination mechanism. Instead of triggering a rapid expansion of supply, they primarily redistribute costs among market participants, increasing the financial burden on end-users—who pay the reimbursement through dedicated social charges in the electricity and natural gas bills—without immediately resolving the shortage.

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Taken together, these elements highlight a critical design challenge for EEOS based on tradable certificates: the need to align target setting with the effective dynamics of supply, considering not only technical potential but also regulatory constraints, transaction costs, and time lags.

The Italian experience shows that when this alignment is lost, the system can enter a state of persistent imbalance that cannot be corrected by market forces alone and requires a comprehensive regulatory intervention. The 2021 reform can be seen precisely as such an intervention, aimed at re-establishing a feasible equilibrium between demand and supply.

THE 2021 REFORM: RATIONALE AND KEY MEASURES

Unlike previous adjustments, which often focused on specific aspects of the mechanism, the 2021 reform can be interpreted as a systemic redesign aimed at restoring the basic functioning of the market. Its underlying rationale can be summarised along three main objectives: (i) re-aligning demand with the actual supply potential, (ii) reducing structural barriers affecting project development, and (iii) rebuilding confidence among market participants.

ADDRESSING DEMAND RIGIDITY: TARGET REVISION AND MARKET STABILITY

The most immediate and impactful measure introduced by the reform concerns the revision of targets. Targets for the years preceding the reform were significantly reduced and aligned with NECP, and new targets for the subsequent period were set at levels more consistent with the observed and expected supply of certificates. This decision reflects a clear recognition that the previous target trajectory was no longer achievable under the revised regulatory conditions.

To prevent future misalignments, a market stability mechanism was introduced, allowing the Ministry to periodically revise targets based on a set of monitored indicators, including the volume of issued certificates and the pipeline of projects under evaluation. This represents an attempt to introduce a feedback loop into a system that had previously operated with relatively rigid target-setting procedures.

Another relevant aspect concerns the management of compliance flexibility. By reducing targets and redefining the conditions for accessing alternative compliance options—such as virtual certificates—the reform aimed to gradually reduce the reliance on exceptional measures that had been introduced to cope with the shortage phase (i.e. virtual certificates and reimbursement cap). In doing so, it sought to bring the system back to a situation where compliance is primarily achieved through "real" energy savings.

ENHANCING SUPPLY: ENLARGEMENT OF ELIGIBLE PROJECTS

On the supply side, a first set of measures focuses on expanding the pool of eligible projects. The reform introduced an updated and more articulated classification of interventions, with the objective of facilitating the identification and development of projects across different sectors. In addition to traditional categories such as retrofit and new installations, a new class of "integrated projects" was defined, allowing for combinations of interventions affecting entire systems or production lines.

This change addresses one of the structural limitations that had emerged in previous phases: the difficulty of fitting complex, real-world interventions into rigid project categories. By providing a more flexible framework, the reform aims to better capture the diversity of energy efficiency opportunities, particularly in the industrial sector.

REDUCING TRANSACTION COSTS: SIMPLIFICATIONS IN PROJECT DEVELOPMENT

A second group of measures targets the reduction of transaction costs associated with project development and submission.

One of the most relevant changes concerns the definition of the ex-ante baseline. Under specific conditions, proponents are allowed to avoid the requirement of a full twelve-month monitoring period prior to the intervention, particularly when repeating patterns can be identified or when reference values derived from market data can be used. This addresses one of the most critical bottlenecks in the previous framework, where baseline definition often represented a significant barrier in terms of time and cost.

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Additional simplifications include the reduction of minimum thresholds for certificate issuance and the possibility to anticipate a higher share of savings in the first years of project lifetime for certain sectors, such as buildings and transport. These measures improve the financial attractiveness of projects and facilitate participation, especially for medium-sized interventions.

The reform also introduced procedural simplifications in the evaluation process. The possibility for the managing authority to request additional information only once, combined with defined timelines for the conclusion of evaluations, contributes to increasing transparency and reducing uncertainty for applicants.

REDUCING RISK AND UNCERTAINTY: PRELIMINARY PROCEDURES

A distinctive and effective feature of the 2021 reform is the introduction of preliminary communication and preliminary verification procedures, two types of preliminary assessment. These instruments allow project proponents to interact with the managing authority before the formal submission of a project. In the case of preliminary communications, proponents can signal their intention to develop a project and receive initial feedback on eligibility. Preliminary verifications go further, providing a more detailed evaluation of key aspects such as M&V methodology, baseline definition, and expected savings.

From a market perspective, these tools play a crucial role in reducing perceived risk. In a system characterised by high complexity and historically high rejection rates, the possibility to obtain ex-ante validation significantly lowers the uncertainty associated with project development.

This is particularly relevant for industrial projects, where investments are often substantial and the cost of a rejected application can be significant. By reducing this risk, the reform aims to unlock a portion of the supply that was previously constrained not by lack of technical potential, but by regulatory uncertainty.

STRENGTHENING INSTITUTIONAL SUPPORT AND MARKET CONFIDENCE

Beyond regulatory adjustments, the reform places strong emphasis on the role of institutional support. The managing authority (GSE) is tasked with developing a comprehensive set of tools and services aimed at supporting project developers. These include detailed guidelines, databases of reference projects, tools for estimating potential savings, and dedicated assistance services.

This shift reflects a broader change in approach. While previous phases of the scheme were characterised by a more control-oriented framework, the 2021 reform recognises that, in a complex system based on project-specific M&V, effective functioning requires continuous interaction between regulators and market participants.

Improving the quality and clarity of guidance is also instrumental in reducing the rate of rejected projects, which had been a major issue in the years preceding the reform. A higher success rate, in turn, contributes to rebuilding trust in the mechanism, which is a critical condition for long-term participation.

FIRST EVIDENCE OF RECOVERY (2022–2024)

The period following the 2021 reform provides the first opportunity to assess whether the measures introduced have effectively addressed the structural issues that characterised the previous phase (Di Santo and De Chicchis 2022). While it is still too early for a comprehensive evaluation, several indicators point to a gradual but tangible recovery of the scheme.

This recovery does not manifest as a sudden increase in certificate volumes, but rather as a progressive improvement across different dimensions of the system: project pipeline, approval rates, market balance, and stakeholder confidence. These elements need to be analysed jointly, as they reflect both short-term adjustments and longer-term structural dynamics.

PROJECT PIPELINE AND PARTICIPATION DYNAMICS

One of the first observable effects of the reform concerns the renewed activity on the supply side, particularly in terms of project submissions. After a prolonged period characterised by declining participation and high uncertainty, the number of new project proposals has started

to increase (Figure 5). This trend is especially visible in the use of preliminary procedures, which have been widely adopted by proponents (Figure 6). The uptake of preliminary assessments, in particular, suggests that market actors perceive these tools as effective in reducing the risk associated with project development.

This is a relevant signal from a behavioural perspective. In the years preceding the reform, high rejection rates and evolving interpretation of rules had significantly eroded trust in the mechanism. The availability of ex-ante validation mechanisms appears to have reversed this trend, encouraging proponents to re-engage with the scheme.

APPROVAL RATES AND ADMINISTRATIVE PERFORMANCE

Another key indicator of recovery is the improvement in project approval rates. During the crisis phase, rejection rates for monitoring plan proposals had reached very high levels, in some cases exceeding 50%, mainly due to the increasing complexity of M&V requirements and the lack of clarity in their application. This represented a major barrier to participation, as the risk of rejection translated directly into financial risk for project developers.

Following the reform, and in parallel with the strengthening of support measures by GSE, approval rates have increased significantly. Although data must be interpreted with caution—given that not all submitted projects complete the evaluation process within the same time frame—the trend is clear: a higher share of projects reaches a positive outcome. According to GSE data in 2026 (Various Authors 2026), only 1% of the applications has had a negative evaluation, and all applications following a preliminary request have had a positive evaluation so far.

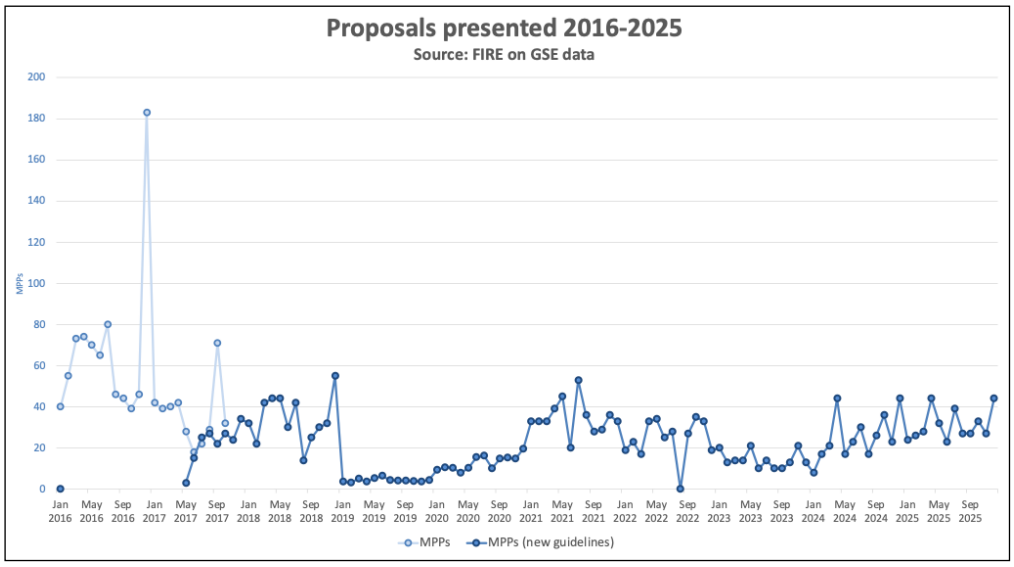

Figure 5 Monitoring plan applications 2016–2025 under old (2012) and new (2017) guidelines.

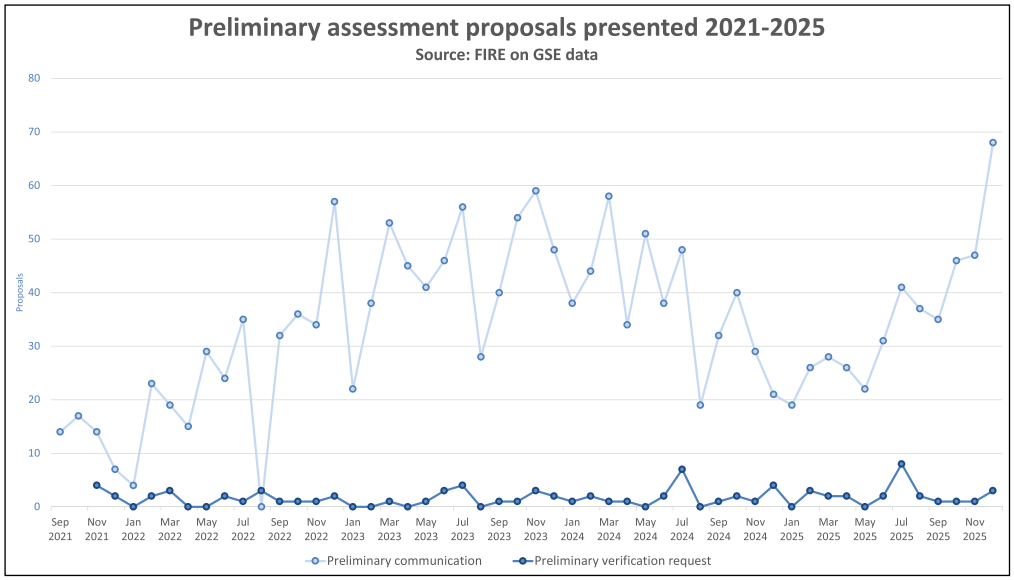

Figure 6 Preliminary assessment proposals presented 2021–2025.

This improvement can be attributed to several factors. First, the introduction of preliminary assessments allows potential issues to be identified and addressed before formal submission. Second, clearer guidelines and increased interaction with the managing authority reduce the likelihood of misunderstandings. Third, the procedural simplifications introduced by the reform streamline the evaluation process.

From a systemic perspective, a higher approval rate is not only a matter of administrative efficiency, but also a key driver of market confidence. The expectation of a reasonable probability of success is essential to justify the upfront costs associated with project development.

CERTIFICATE SUPPLY: SLOW RECOVERY AND STRUCTURAL INERTIA

In terms of issued certificates, the recovery appears more gradual and less pronounced. This is consistent with the structural characteristics of the scheme. As discussed in previous sections, there is an inherent time lag between the submission of a project and the generation of certificates, due to the need for implementation and subsequent monitoring of savings. As a result, improvements in the project pipeline translate into increased supply only after a delay.

Moreover, part of the observed dynamics is influenced by exogenous factors. In particular, the effects of the COVID-19 pandemic on industrial activity have had a temporary impact on energy consumption patterns and on the ability of projects to generate measurable savings.

Despite these constraints, there are indications that the downward trend observed after 2017 has stabilised. In some segments, particularly for projects developed under the post-2017 rules, the number of certificates issued has started to increase, albeit from relatively low levels.

An important aspect to consider is the progressive exhaustion of certificates generated under previous regulatory regimes (Figure 1). As these certificates reach the end of their lifetime, the system increasingly relies on new projects developed under the new rules. This transition is critical, as it will determine the long-term sustainability of the scheme.

MARKET BALANCE AND PRICE DYNAMICS

The effects of the reform are more immediately visible in market dynamics. The reduction of targets has contributed to alleviating the pressure on the demand side, leading to a gradual rebalancing of the market. Price levels, which had reached very high values during the shortage phase, have dropped below €250/certificate since the second half of 2023.

However, this adjustment should not be interpreted as a simple return to equilibrium. Rather, it reflects a new balance point, characterised by lower targets and a supply that is still constrained but more consistent with demand.

The role of regulatory mechanisms, such as the tariff reimbursement cap and the conditions for accessing virtual certificates, remains significant in shaping price dynamics. These instruments act as stabilisers, preventing extreme price fluctuations but also limiting the extent to which price signals can incentivise additional supply.

From an analytical perspective, the current phase can be described as a transition from a structurally short market to a more balanced equilibrium.

REBUILDING CONFIDENCE AND SYSTEM CREDIBILITY

Beyond quantitative indicators, one of the most relevant outcomes of the reform is the gradual rebuilding of confidence among stakeholders. The combination of more realistic targets, reduced uncertainty in project development, and improved interaction with the managing authority has contributed to restoring the perception of the scheme as a viable and predictable policy instrument, as collected by FIRE through surveys and interviews.

This aspect is particularly important in a system where investment decisions are made by a heterogeneous set of actors, often based on expectations about future regulatory and market conditions. Confidence, in this sense, acts as an enabling factor that influences both the quantity and the quality of projects entering the pipeline.

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At the same time, this recovery remains conditional. The experience of previous years has shown that the scheme is highly sensitive to regulatory changes and to the consistency of their implementation. Maintaining a stable and transparent framework, together with the right support to operators from GSE, is therefore essential to consolidate the positive trends observed so far.

THE 2025 UPDATE: SIMPLIFICATIONS AND EXPECTED IMPACTS

The regulatory update introduced in July 2025 builds on the trajectory initiated by the 2021 reform, but with a more targeted focus on one of the core structural bottlenecks of the scheme: the complexity and rigidity of measurement and verification (M&V) procedures and their impact on project development timelines.

While the 2021 reform primarily addressed the imbalance between demand and supply through a combination of target revision and support measures, the 2025 intervention can be interpreted as a second-stage optimisation, aimed at improving the operational efficiency of the system and enhancing its capacity to generate new projects under the existing framework. Table 1 summarises the main updates.

Table 1 Main news introduced by 2025 rules' update.

TARGETS	MAIN CHANGES INTRODUCED IN 2025
Proponents	The possibility to present proposals referring to projects implemented among different end-users has been reintroduced, but only for interventions of the same typology and with a maximum threshold for savings of 50 toe. It is possible to present a proposal in the form of temporary association or grouping of companies or entities.
M&V	For single intervention with savings below 250 toe/year it is possible to get a constant number of certificates—equal to the average of savings measured over the first three years—starting from the 4th year, without the need to communicate the measurements. Baseline measurement can start after the start-up project date, provided the operative variables that affect energy consumption remain unaltered. The baseline for substitutions (i.e. an energy efficiency solution or process that replaces an existing one, even if of different type, like a heat pump substituting a boiler) can alternatively be defined based on the lower value between the market reference baseline and the consumption calculated based on technical documentation.
Timelines	Various flexibility options have been introduced for delays (e.g. project start-up, ex-post consumption measurement, application to request white certificates, etc.), usually in exchange with a reduction in the number of certificates issued.
Eligible projects	New options, for example for electrification actions—including the contribution from coupled electricity RES—and for savings associated with the use of new materials. The lifetime for substitutions is now equal to the one for new installations.
Financial flexibility	Virtual certificates maximum quantities will decrease from 60% in 2025 to 20% in 2030. The possibility to obtain more certificates in the first half of the project lifetime, reducing proportionally the quantity for the second half, has been extended to all type of projects.

The simplifications introduced aim to reduce the barriers linked to the existing M&V, without fundamentally altering the measurement-based nature of the mechanism. Although details vary across project types, the overall direction is clear: increasing flexibility in baseline definition, reducing minimum monitoring requirements where justified, and streamlining the documentation needed for project approval.

In parallel, the update addresses project timelines, which have historically represented a critical issue. By shortening administrative phases and improving alignment between project development cycles and certificate issuance, the reform aims to facilitate investment decisions and make revenue streams more reliable.

It is worth highlighting that these updates do not sacrifice the robustness of M&V. The new simplifications can be interpreted as a recalibration rather than a paradigm shift. The objective is to introduce a degree of pragmatism in the application of M&V rules, particularly in cases where strict requirements do not generate proportional benefits in terms of accuracy, while preserving a very high level of accuracy in the assessment of energy savings.

EXPECTED EFFECTS ON SUPPLY DYNAMICS AND EARLY EVIDENCE

From an analytical perspective, the 2025 measures are expected to act primarily on three dimensions of the supply function:

- they should reduce transaction costs, lowering the threshold for project participation
- they are likely to shorten development cycles, reducing the time lag between project conception and certificate generation
- by reducing uncertainty associated with baseline definition and procedural requirements, the reform may further strengthen the positive trends in participation and project pipeline observed after 2021.

However, it is important to note that these effects will materialise only progressively, given the intrinsic characteristics of the scheme.

Given the recent introduction of the 2025 update, quantitative evidence is still limited. However, initial qualitative signals suggest a positive reception among stakeholders, particularly regarding the simplification of procedures and the reduction of administrative burdens. Figure 5 and Figure 6 seem to confirm the feedback collected from a large sample market operators and the information shared by GSE at the beginning of 2026, including a positive expectation on the capability of the scheme to reach the targets in the coming years.

If effectively implemented, these measures have the potential to consolidate the recovery initiated by the 2021 reform, moving the scheme towards a more stable and functional equilibrium.

LESSONS LEARNT AND POLICY IMPLICATIONS

The evolution of the Italian White Certificates scheme provides a rich set of insights for the design and implementation of EEOS, particularly in contexts where both the reliability of savings and the scalability of the system are key policy objectives (Di Santo et al. 2018b).

Rather than offering generic recommendations, the Italian case highlights a number of structural lessons that emerge from the interaction between regulatory design, market dynamics, and institutional capacity.

TARGET SETTING MUST REFLECT EFFECTIVE, NOT THEORETICAL, SUPPLY POTENTIAL

One of the most critical lessons concerns the setting of targets. In the Italian experience, the imbalance that emerged in the second half of the 2010s was not primarily due to a lack of technical potential for energy savings, but to a mismatch between targets and the system's ability to deliver projects under the prevailing regulatory conditions. This distinction is crucial. Technical potential assumes ideal conditions, while effective supply depends on transaction costs, regulatory constraints, project development cycles, and market confidence.

Setting targets without fully accounting for these factors can lead to persistent shortages that cannot be corrected by market forces alone. In such situations, price signals lose their effectiveness, and the system risks entering a self-reinforcing cycle of imbalance, whose effects on system costs also depends on the scheme rules.

The introduction of a market stability mechanism in 2021 reflects the recognition that target setting must be adaptive and based on continuous monitoring of actual system performance.

HIGH-QUALITY M&V REQUIRES COMPENSATORY DESIGN MEASURES

A second key lesson concerns the role of measurement and verification. The Italian scheme demonstrates that it is possible to implement an EEOS largely based on metered savings, ensuring a high level of robustness and credibility. However, this comes at a cost in terms of complexity, time, and—without proper support and sufficient time to initially qualify market operators and end-users—reduced participation.

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This implies that strong M&V requirements cannot be considered in isolation. They must be complemented by design features that mitigate their impact on supply dynamics. These include simplifications in baseline definition, procedural streamlining, and tools to support project development. For new schemes, options based on deemed savings are recommended to facilitate the start-up of the project and increase supply elasticity.

The experience of the 2017 reform shows that tightening M&V without introducing compensatory measures can lead to a sharp contraction of supply. Conversely, the reforms of 2021 and 2025 suggest that it is possible to maintain a measurement-based approach while improving accessibility and reducing transaction costs.

MARKET-BASED MECHANISMS REQUIRE ACTIVE GOVERNANCE

The Italian case challenges the idea that tradable certificate schemes can function as self-regulating markets. While the price of certificates plays an important role, it is not sufficient to ensure equilibrium in the presence of structural constraints on supply. In particular, when project development cycles are long and complex, the responsiveness of supply to price signals is limited. Important issues will arise also in case of strong oversupply, since this can undermine the capability of the scheme to act as incentive for end-users and market operators.

This implies that active governance is essential. Regulatory authorities must continuously monitor market conditions, adjust targets when necessary, and provide guidance to market participants. The role of the managing authority (GSE) in the Italian scheme illustrates this point. The shift towards a more supportive and interactive approach—through guidelines, preliminary assessments, and technical assistance—has been a key factor in restoring the functioning of the system.

In this sense, EEOS should be seen not as purely market-based instruments, but as hybrid systems requiring both market signals and strong institutional coordination (see also Bertoldi et al. 2010).

REGULATORY STABILITY IS AS IMPORTANT AS REGULATORY QUALITY

Another important lesson concerns the role of regulatory stability. The Italian experience shows that even well-designed measures can produce negative effects if introduced abruptly or without sufficient transition periods. The 2017 reform improved the theoretical robustness of the scheme but did so in a way that significantly disrupted market dynamics. Frequent or unpredictable changes undermine confidence and increase the perceived risk associated with project development. This, in turn, reduces participation and further constrains supply.

The reforms introduced after 2021 suggest a more balanced approach, combining necessary adjustments with mechanisms that enhance predictability and allow for gradual adaptation. For EEOS, this implies that the timing, sequencing, and communication of regulatory changes are as important as their technical content.

SUPPORT MEASURES ARE NOT ANCILLARY, BUT STRUCTURAL COMPONENTS

A final lesson concerns the role of support measures. At least in the Italian case, in many policy designs, support activities—such as guidelines, technical assistance, and information tools—are considered secondary elements. The WhC case suggests the opposite.

In a complex system based on project-specific M&V, the ability of participants to understand and correctly apply the rules is a key determinant of performance. High rejection rates in the years preceding the 2021 reform were not only the result of strict requirements, but also of insufficient clarity and support.

The strengthening of support functions by the managing authority has been instrumental in improving approval rates and rebuilding confidence. This indicates that support measures should be considered an integral part of the policy design, rather than an add-on.

SYNTHESIS AND BROADER IMPLICATIONS

Taken together, these lessons point to a broader conclusion: the effectiveness of EEOS depends less on individual design features than on the coherence of the overall system.

The Italian WhC scheme illustrates the challenges of combining a market-based approach with high standards of measurement and verification. It also shows that achieving this balance requires continuous adjustment, informed by monitoring and feedback from the market.

For policymakers, the key implication is that EEOS should be designed as adaptive systems, capable of evolving over time while maintaining a stable and credible framework for investment (see also Rosenow and Bayer 2017, Fawcett, Rosenow, and Bertoldi 2018).

CONCLUSIONS

After more than two decades of operation, the Italian White Certificates scheme remains one of the most advanced and, at the same time, most complex examples of an EEOS based on tradable certificates.

Its evolution highlights both the potential and the structural limitations of such mechanisms:

- The scheme has demonstrated the capacity to deliver substantial and verifiable energy savings, supported by a robust measurement and verification framework and by the mobilisation of specialised market actors.
- It has shown a high sensitivity to regulatory design choices, particularly in relation to the balance between demand and supply and to the complexity of project development.

The crisis phase that emerged after 2017 can be interpreted as the result of a misalignment between targets and the effective capability of the system to generate certificates under increasingly stringent rules. The reforms introduced since 2021 have addressed this misalignment, combining a revision of targets with measures aimed at reducing transaction costs and rebuilding market confidence. The subsequent update in 2025 further refines this approach, targeting the operational bottlenecks that limit the responsiveness of supply.

The first evidence suggests that the scheme has entered a phase of gradual recovery. However, this recovery remains conditional on the stability and coherence of the regulatory framework, as well as on the continued effectiveness of support measures and simplifications.

More broadly, the Italian experience confirms that EEOS based on tradable certificates and strong M&V requirements should be designed as adaptive systems. Their performance depends not only on the theoretical soundness of individual components, but on the dynamic interaction between regulatory rules, market behaviour, and institutional capacity.

From this perspective, the main challenge for the coming years is to consolidate the current equilibrium, ensuring that the scheme can deliver a stable flow of new projects while maintaining the level of robustness required by European policy frameworks.

COMPETING INTERESTS

The author has no competing interests to declare.

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REFERENCES

Bertoldi, P, Rezessy, S, Lees, E, Baudry, P, Jeandel, A and **Labanca, N.** 2010. 'Energy supplier obligations and white certificate schemes: comparative analysis of experiences in the EU'. *Energy Policy*, 38(3): 1455–1469. DOI: https://doi.org/10.1016/j.enpol.2009.11.027

Broc, J-S, Oikonomou, V, Thomas, S, Exintaveloni, D-S, Schlomann, B, Rohde, C and **Di Santo, D.** 2024. 'Climbing a new hill: a review of Member States' strategies to meet their energy savings obligation for 2021–2030'. *eceee Summer Study proceedings*.

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

Di Santo, D, Biele, E and **De Chicchis, L.** 2018a. 'White certificates as a tool to promote energy efficiency in industry'. *eceee Industrial Summer Study proceedings*. ISBN: 978-91-983878-3-4.

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

Di Santo, D and **De Chicchis, L.** 2019. 'White certificates in Italy: will it overcome the huge challenges it has been facing in the last three years?'. *eceee Summer Study proceedings*. ISBN: 978-91-983878-5-8.

Di Santo, D and **De Chicchis, L.** 2022. 'Italian white certificates: a first glimpse on the effects of the new guidelines introduced in 2021'. *eceee Summer Study proceedings*. ISBN: 978-91-988270-1-9.

Di Santo, D, Biele, E and **Forni, D.** 2012. 'White certificates for the industrial sector'. *eceee Industrial Summer Study proceedings*. ISBN: 978-91-980482-1-6.

Di Santo, D, Negro, C, Romiti, J, Forni, D and **De Chicchis, L.** 2024. 'White certificates and tax relief schemes in Italy'. *eceee Summer Study proceedings*. ISBN: 978-91-988270-3-3.

Fawcett, T, Rosenow, J and **Bertoldi, P.** 2018. 'Energy efficiency obligation schemes: their future in the EU'. *Energy Efficiency*, 12(1): 57–71. DOI: https://doi.org/10.1007/s12053-018-9657-1

Rosenow, J and **Bayer, E.** 2017. 'Costs and benefits of Energy Efficiency Obligations: A review of European programmes'. *Energy Policy*, 107: 53–62. DOI: https://doi.org/10.1016/j.enpol.2017.04.014

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. 2019. 'Snapshot of energy efficiency obligation schemes in Europe'. *ENSMOV*.

Various authors. 2025. 'Snapshot of energy efficiency obligation schemes in Europe'. *ENSMOV plus*.

Various authors. 2026. 'Rapporto Annuale sul meccanismo dei Certificati Bianchi'. *Annual report on white certificates*. GSE.

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