

PROPOSAL FOR THE REFORM OF THE ITALIAN ELECTRICITY MARKET



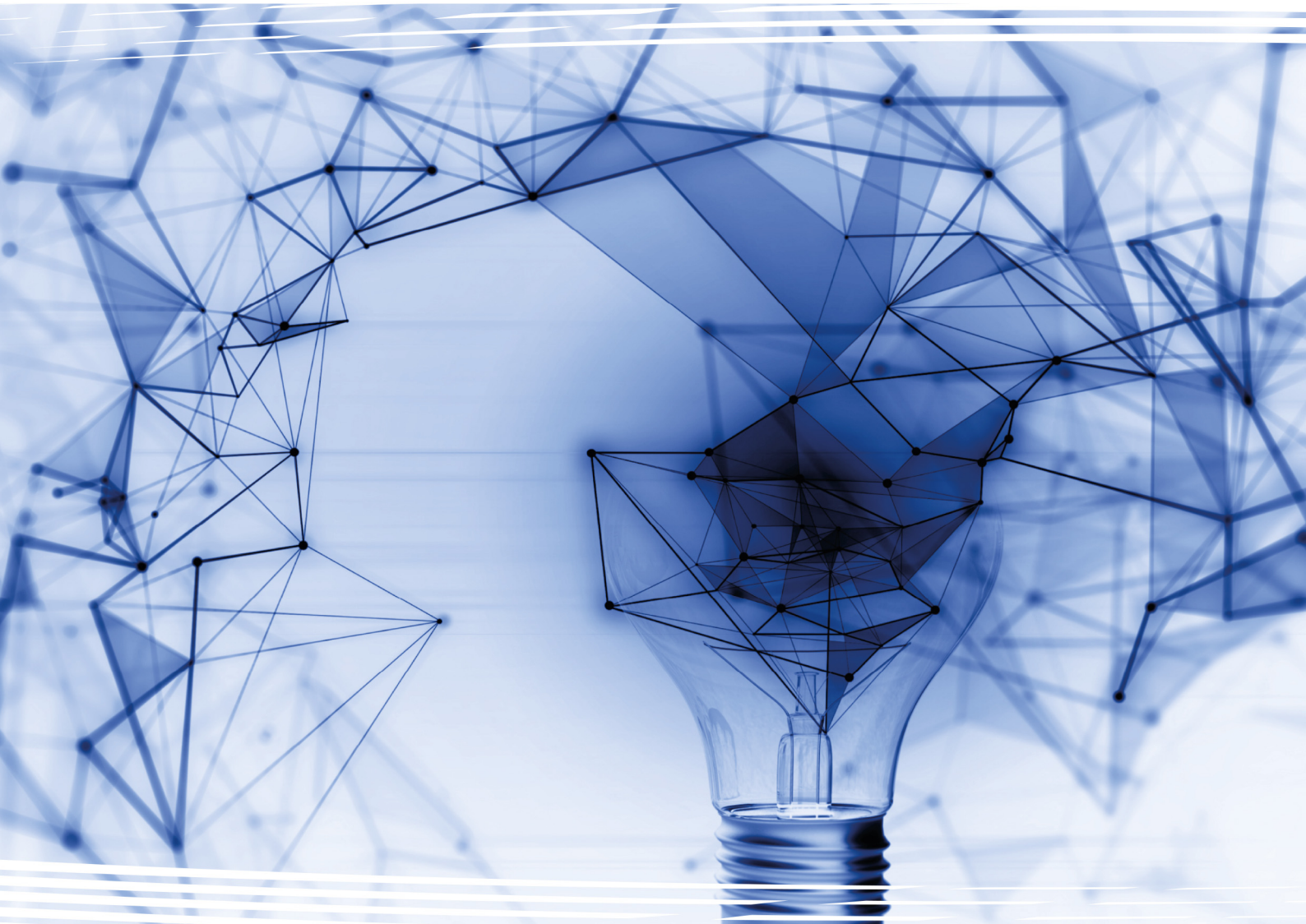
CONFINDUSTRIA

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PREFACE AND ACKNOWLEDGEMENTS



With the Green Deal and the “Fit for 55” package, Europe has placed the progressive electrification of the economic system at the centre of the EU decarbonisation process. For several years now, Europe and its Member States have been striving to transform the energy system towards sustainability and independence. The role of the electricity has been further strengthened by the consequences of the recent Russia-Ukraine conflict, with the arrangement of the “REPowerEU” plan, which further strengthen renewable electricity production targets.

Such new targets imply profound structural changes in the electricity generation technology mix and, therefore, a thorough review of the design of the markets. However, the enormous complexity of the markets and the international differences have made this process slow and not free from errors and inefficiencies. Recent years' events have significantly increased the urgency of this transformation, pushing the need of a pace change in the revision of market rules to allow a faster decarbonisation.

In this context, Confindustria considered necessary to anticipate and propose a reform of current outdated electricity market model (Legislative Decree Bersani 99/2009) in light of the strong need to define it more suitable for the green transition and, even more, to identify a fast and effective process for its full implementation.

This document develops a proposal organised in two parts:

- ♦ *the first part will identify the key principles of the future market design coherent with 2030 and 2050 decarbonisation targets*
- ♦ *the second part identifies a path to gradually transform current market design into a new platform consistent with the future electricity market.*

We believe it is important to emphasize the central role of the implementation path. Whereas the principles of the proposed market design have been already treated the literature, the most difficult challenge in the coming years will be to identify a transition path from the old to the new rules which will ensure the achievement of decarbonisation targets, technical and economic efficiency, while safeguarding competition.

The complexity of the analysis and the expertise required to identify these solutions were made possible with the financial support of the project member associations: Assocarta, Assofond, Assomet, Assovetro, Confindustria Ceramica, Consorzi Energia, Elettricità Futura, Federacciai, Federazione ANIE, Federbeton, Federchimica e Terna.

To the Associations and their experts (whom we name below) goes the merit of having contributed through passionate, sometime critical, but constructive discussions, without which the proposed solutions would not have benefited from a holistic view, indispensable in such a complex subject.

Special thanks also go to AFRY Management Consulting and the Team coordinated by Antonio Nodari, in particular to Riccardo Siliprandi, Roberta D'Alessandro, Emilio Ambrogi, and Davide Conti, for their great competence and patient support in developing the proposal.

Finally, our thanks go to Barbara Marchetti for the coordination activity.

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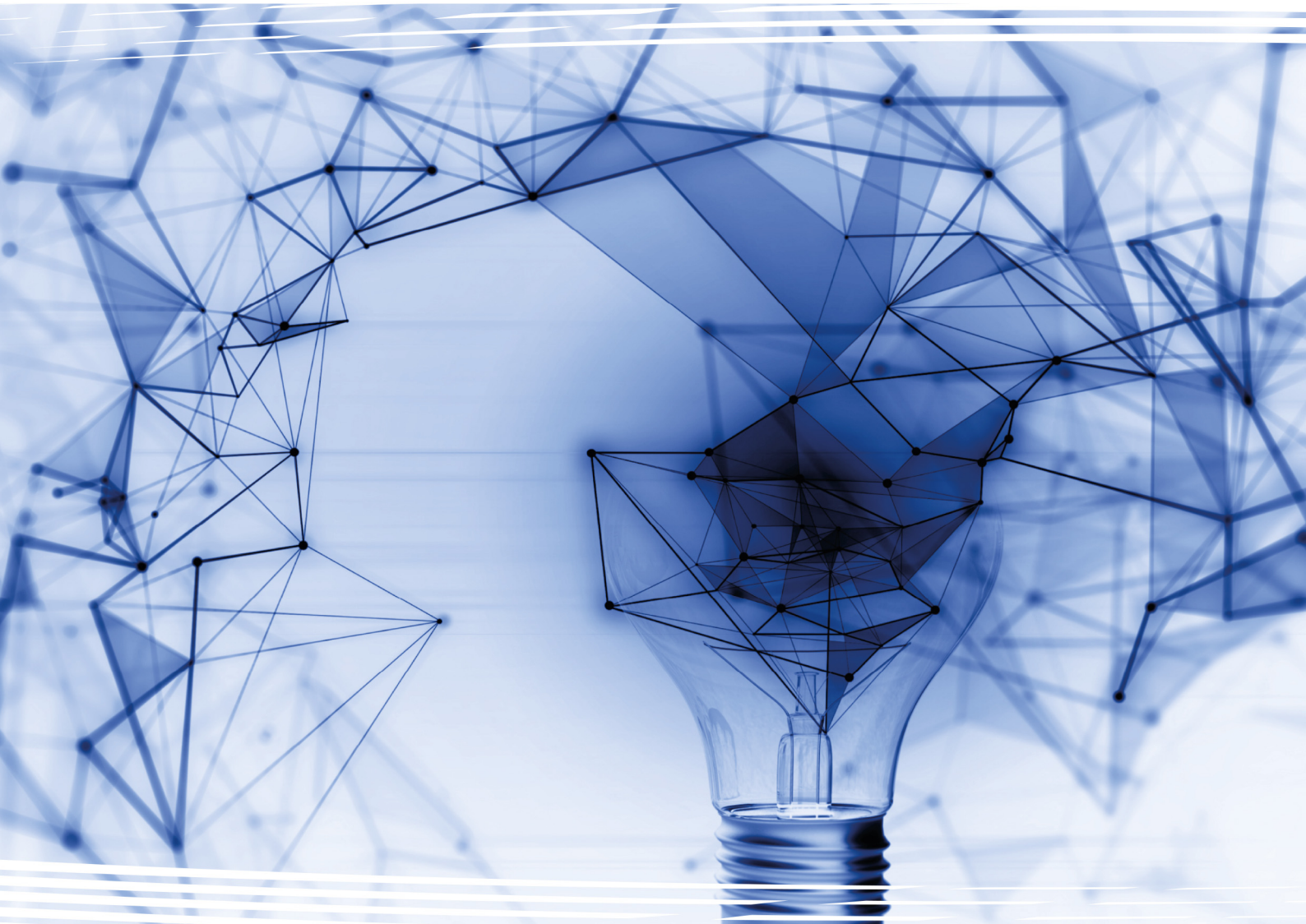
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EXECUTIVE SUMMARY



The market model must return to its core principles

Electricity is increasingly at the centre of the energy system and the events of recent years have accelerated the urgency of transforming our electricity system under the sign of sustainability and energy independence. Renewable sources, wind and sun foremost, are at the heart of such transition.

Considering the challenging targets ahead, Confindustria has acknowledged that the current electricity market model can no longer meet some of its key principles and in particular the ability to:

- ♦ support the transition towards a more sustainable market
- ♦ protect consumers and competition
- ♦ ensure market affordability

This is the result of several causes, but two of them are certainly most relevant and nowadays clearly understood also by public opinion.

First cause is the dependence of the Italian energy system on imported sources, which is due to:

- ♦ the need to source fossil fuels abroad - mainly gas but also coal for some uses - to meet the demand of the industrial processes, residential (heating, cooling) and the thermoelectric generation. For over a year now, geopolitical factors have been causing strong tensions in the markets, driving prices above sustainable levels
- ♦ the structural challenge to develop new renewable generation assets in an acceptable timeframe due to complex and uncoordinated authorisation processes, which resulted in a limited addition of more expensive green capacity

The main option to quickly overcome this dependency is to develop renewable generation - primarily wind and solar.

Second cause is the obsolescence of current electricity market design which requires a deep structural reform.

In fact, the current market design, introduced at the beginning of the liberalisation process, was aimed at short-term cost optimisation of (mostly) thermoelectric generation. Today, such a model proves ineffective in integrating renewable generation – Capex-based and with negligible variable costs – and, above all, it does not allow end users to benefit from the low costs of renewables. This is because gas-fired generation is typically 'marginal' (i.e. more costly) with respect to other sources and, despite it accounts for around 40% of the volumes, it defines the price of electricity in most hours.

Confindustria's proposal aims at overcoming these critical issues and fostering the development of renewables through a market model capable of separating the value of their energy from fossil fuels costs.

To achieve the aforementioned objectives, it is necessary to:

- ♦ build a new market platform to foster the development of renewable production and "decouple" renewable technology value from costs of fossil-fuelled electricity production
- ♦ create it as a direct market for renewable energy from producer to consumer, capable of considering all additional costs for the flexibility needed to make demand and production profiles compatible

This Proposal assumes that Government initiatives to simplify and facilitate authorisation procedures will be able to solve current exogenous problems which can profoundly distort the proper functioning of the market.

The transformation must be implemented efficiently and at minimum cost for the system. It is therefore compulsory to design an effective implementation path and to complement it with proper monitoring and control mechanisms.

The final goal is a direct producer-consumer green energy market decoupled from the gas price

In order to ensure its cost-effectiveness, the market needs to be redesigned based on the characteristics of the electricity system envisaged by the green transition. The new market design shall consider, on the one hand, non-programmable (or intermittent) renewable generation, which is unable to adapt to consumer needs, and, on the other hand, technologies able to provide the flexibility required to adapt generation to demand.

Intermittent renewables have been treated in the same way as conventional technologies till now. The renewable energy has been “purchased” with long-term mechanisms (incentives), yet “sold” on the markets in the short term. This mechanism has not favoured the complete transfer of the affordability and price stability advantages of renewables to consumers.

Therefore, to allow a proper integration of renewable sources, it is necessary to decouple RES from the short-term markets and from natural gas, by creating a “PPA¹ Platform” where consumers can directly purchase renewable energy with profiles suitable to their needs with medium-long term tenures.

The PPA Platform will provide medium-long term price signals accounting for the evolution of technologies cost. Its added value will be to provide consumers with green energy with standard profiles, making it available even when it is not produced.

This will be made possible only by the use of flexible resources such as, for example, hydroelectric storage and batteries. Therefore, it will be essential to immediately envisage the presence of a new flexibility market (*Time-Shift market*) to complement the PPA Platform and provide operators with the necessary medium-long-term tools to guarantee the sustainability of the products traded on the Platform.

In the long run, given the massive prevalence of intermittent renewables in the generation mix, most of the energy sold in Italy is expected to be more naturally valued on the PPA Platform. Short-term markets, both energy and services, will instead mainly value the energy needed to compensate demand volatility and generation fluctuations.

The envisaged implementation path must simultaneously ensure the development of new capacity and its inclusion in the direct producer-consumer market.

However, today a significant gap clearly exists between the needs of the renewables-based transition and the ability of the market model to efficiently integrate large volumes of green energy.

¹ PPA, *Power Purchase Agreement*

This situation requires the definition of an implementation path capable of leading the Italian electricity market to this new model, maximising the benefits of the transition and protecting consumers from possible distortions and increase in energy costs.

Therefore, Confindustria believes it is necessary to create a precursor to the PPA Platform that stimulates the creation of new renewables, ensures the sale of renewable energy according to consumer profiles, and exploits the benefits of renewables by decoupling the electricity price from gas.

The MAVER (*Mercato di Acquisto e Vendita di Energia Rinnovabile*, meaning market for the purchase and sale of renewable energy) is the proposed tool capable of achieving these objectives, as:

- ♦ it is a long-term (e.g. 10-15 years) semi-regulated market of energy profiles from new-built renewable sources
- ♦ it is organised on a zonal basis with contingencies set ex-ante by the Authority and Terna, allowing to rationalise new generation development in coordination with grid and storage development
- ♦ it provides clear locational price signals thanks to its zonal structure
- ♦ it guarantees the achievement of targets by envisaging the option to activate appropriate last-resort auctions (Aste di Ultima Istanza, AUI)
- ♦ it allows both supply and demand participation
- ♦ it will be complemented with appropriate mechanisms to facilitate the participation of public and private demand
- ♦ to foster MAVER development, large players could voluntarily act as market makers (only on the purchase side) and guarantee the market competitiveness, in a similar way to past experiences during the development of other energy markets
- ♦ it provides players with bankability conditions very similar to known tools ("FER" incentive schemes), also because of the presence of a central counterparty (GSE)²
- ♦ it allows the transfer of price stability and affordability advantages of renewable sources to consumers, through a price control mechanism (cap & floor),³ thus guaranteeing an effective decoupling of renewable energy from gas
- ♦ it stimulates the Time-Shift market (to be activated simultaneously with the MAVER) by creating the demand for flexibility and providing the necessary price signals. At the same time, it limits the influence of commodities on the value of traded products through the price control mechanism.

The characteristics of MAVER also reflect what emerged from the benchmark analysis of the tools which have supported the development of renewable generation in other relevant international markets. The success factors of such markets have been also considered in this proposal⁴.

² Please refer to Section 2.1.1 for full details on the counterparty risk management within the MAVER tool

³ Mechanism described in section 2.1.1 and illustrated in Figure 8

⁴ Detailed results of the analysis are presented in Annex B.1.

A Time-Shift market dedicated to flexibility with a medium-long term horizon will complement the trading of renewable energy

MAVER and the PPA platform are markets dedicated to direct energy trading between producers and consumers, which take account of consumption profiles rather than production ones.

For this reason, a trading platform for flexibility products (the *Time-Shift* platform) should be activated alongside the creation of MAVER. The flexibility products will allow producers to manage the risks associated with the production and consumption profiles mismatch.

The products exchanged on the *Time-Shift* platform will:

- ♦ have a medium-long-term tenure to ensure consistency with energy products traded on the MAVER/PPA platform provide the necessary tools to facilitate the bankability of renewable projects
- ♦ provide a broad range of products to meet the different operators' hedging needs
- ♦ provide the right price signals to stimulate the development of flexible green technologies such as hydro storage and batteries.

The MAVER, the *Time-Shift* and later the PPA Platform, should offer products which stimulate the interest of producers and consumers, optimise⁵ the exchange of renewable energy, and maximise the benefits for the system.

The management of balancing and system security services - in the short term and long term - must evolve accordingly

In parallel with these new instruments, existing markets will also need to be modified to accommodate the new market model, in particular:

- ♦ the ancillary services market (MSD) will have to evolve in line with European and national guidelines, promoting diversification, full integration, improved visibility of resources for the TSO and of their value for the operators
- ♦ the capacity market will complement the energy markets and large storage auctions. The capacity market will be the tool designated to ensure system adequacy should the other markets fail to ensure the economic sustainability of new and existing plants. The capacity market scope will be extended to also include flexibility objectives in order to facilitate and optimise the green transition.

Coordination between national network operators and distribution networks will be necessary to integrate generation and flexibility resources

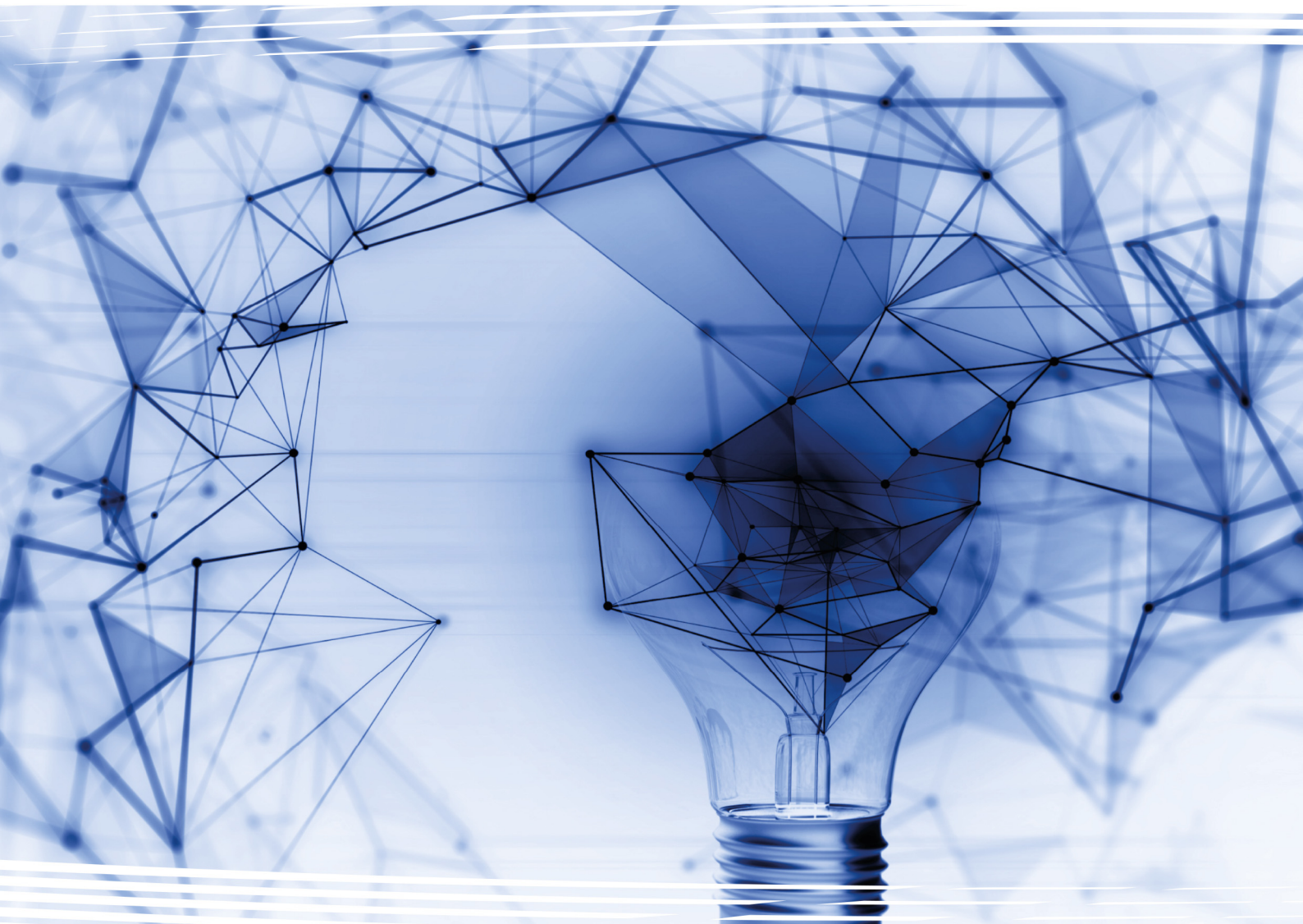
With the increasing penetration of distributed resources (both generation and flexibility), the market should ensure their development and better integration, as they play a key role in the transition of the electricity system.

⁵ In this regard, the liquidity of the Time-Shift market will also be sustained by the demand for profiled products in the MAVER, and by the storage procured through auctions as required by the current legislation (DLgs 8/11/2021, n.210, art. 18)

For this reason, operational management of transmission and distribution networks must evolve aiming at:

- ♦ preserving network security by ensuring that there are no security risks either in the national electricity system or in the local networks
- ♦ maximising the system economic efficiency, namely ensuring that the development and integration of distributed resources occur at the minimum cost
- ♦ ensuring competitiveness in the markets by limiting distortions and inefficiencies.

1. A NEW MARKET MODEL TO ENSURE THE GREEN TRANSITION



1.1 Current context and main challenges to the development of a green and sustainable market

The original sin of the European market model

The electricity market model defined by the European Union (the “*Target Model*”) aimed to establish a single market capable of levelling up price differences across Member States and improve security of the system thanks to high interconnection capacity between countries. However, the Target Model was designed in a context that is very different to the one we observe today. When it was conceived, the greatest benefit for the system derived from the ability to optimise the use of available sources and technologies (coal, fuel oil, gas, nuclear, hydroelectric) based on their production costs, taking into account both their economic and environmental impacts⁶.

The increased urgency to promote environmental goals and to guarantee independence of the European energy system led to the rapid development of renewable technologies, with the first renewable energy plan published in 2010 (*National Renewable Energy Action Plan*, NREAP). Among renewable technologies, solar photovoltaics (‘solar PV’) and wind power best responded to European sustainability and independence goals and as a result were placed at the heart of the decarbonisation process of the European electricity system.

In light of this, Member States started implementing a range of policies to reform existing markets which were designed to integrate large amounts of renewable generation into the system, in line with the timeframe set by European targets.

However, both solar PV and wind power present structural differences compared to the technologies for which the current market model was designed. This is mainly the result of two factors:

- ♦ solar PV and wind generators are intermittent and not programmable in the same way as traditional generators, meaning that they are not able to follow variations in demand;
- ♦ their variable generation costs are close to zero and they produce no CO₂ emissions.

As long as their penetration remained within certain ranges, such “intermittent” renewable sources could coexist with traditional generation technologies in the same electricity market, despite the distortions which are intrinsic to the various support mechanisms adopted in Europe. Indeed, what unifies the support solutions adopted in Europe so far is a long-term procurement through *pay-as-produced*⁷ incentives and the sale of renewable energy on existing short-term markets. This is the barrier which has been limiting the transfer of affordability, price stability and sustainability benefits associated with intermittent renewable technologies to consumers.

Thus, on the one hand, it has not been possible to fully exploit the benefits of the low and stable costs of renewable sources. On the other hand, it has become more difficult to sustain investment in traditional technologies. This resulted in the introduction of dedicated mechanisms designed to ensure adequacy of the electricity system (e.g. *Capacity Market*) in various European markets.

It is now clear that the change of pace in the green transition must come not only through greater investments in new renewable energy sources (‘RES’) plants, but also through a significant market design reform.

⁶ Through the cost of carbon dioxide (CO₂) emissions.

⁷ The remuneration is not based on a default production profile, but on the actual energy fed into the system.

The Italian market design must be profoundly reformed in order to accelerate the integration of renewables in line with national RES targets.

In Italy, the push towards the green energy transition, along with the progressive integration of the Italian market with other European ones, has led to the same contradictions that have substantially afflicted all the markets across the continent.

After a strong acceleration in renewable energy investment in the years 2009-2012, driven by availability of incentives, development of renewable energy projects entered a period of stagnation. This was also the result of an inefficient authorisation process applicable to new plants (Figure 1).

Increasingly higher renewable capacity targets have been set over the years, from approximately 1.5 GW/year established by the NREAP (*National Renewable Energy Action Plan*)⁸ in 2010 to about 3 GW / year defined by the PNIEC in 2019⁹ (it is expected that this target will increase further as a result of the “Fit For 55” and RePowerEU packages announced in 2021 and 2022, respectively). However, these ambitious targets have not been followed by interventions needed to create the market conditions necessary to guarantee an adequate response from the electricity system.

On the one hand, the authorisation processes are not yet able to guarantee the required acceleration, on the other hand, the market model is unable to effectively integrate larger quantities of intermittent renewable energy.

Importantly, the incentive schemes adopted so far do not enable the involvement of both generation and consumption, as only generation is allowed to participate. This creates distortions in the market since, while (renewable) generation is able to sell energy over a long-term horizon, the consumer has to resort to short or medium-term¹⁰ markets and remains exposed to the commodity price volatility (gas and CO₂). Gas has indeed a very high impact on the electricity price¹¹, despite accounting only for about 40% of the total generation.

⁸ The plan envisaged the achievement of 26% of renewable generation (GW) by 2020. This target has already been achieved in 2012, through an increase of 17 GW of RES from 2010 (see Figure 1).

⁹ The plan envisaged the achievement of 55% of renewable generation by 2030, reaching a total RES capacity of 95 GW, up from the 59 GW reported in 2019.

¹⁰ Spot in the Day-Ahead Market (*Mercato del Giorno Prima, MGP*) and few years only in the Forward markets

¹¹ The main price indicator in the Italian market is the Day-Ahead Market (MGP) price, which is based on the *System Marginal Price*, calculated on the marginal price of the most expensive technology. This determines that Italian Day-Ahead Market (MGP) prices are dominated by the marginal price of gas, which is the technology that sets the final price in most of the hours.

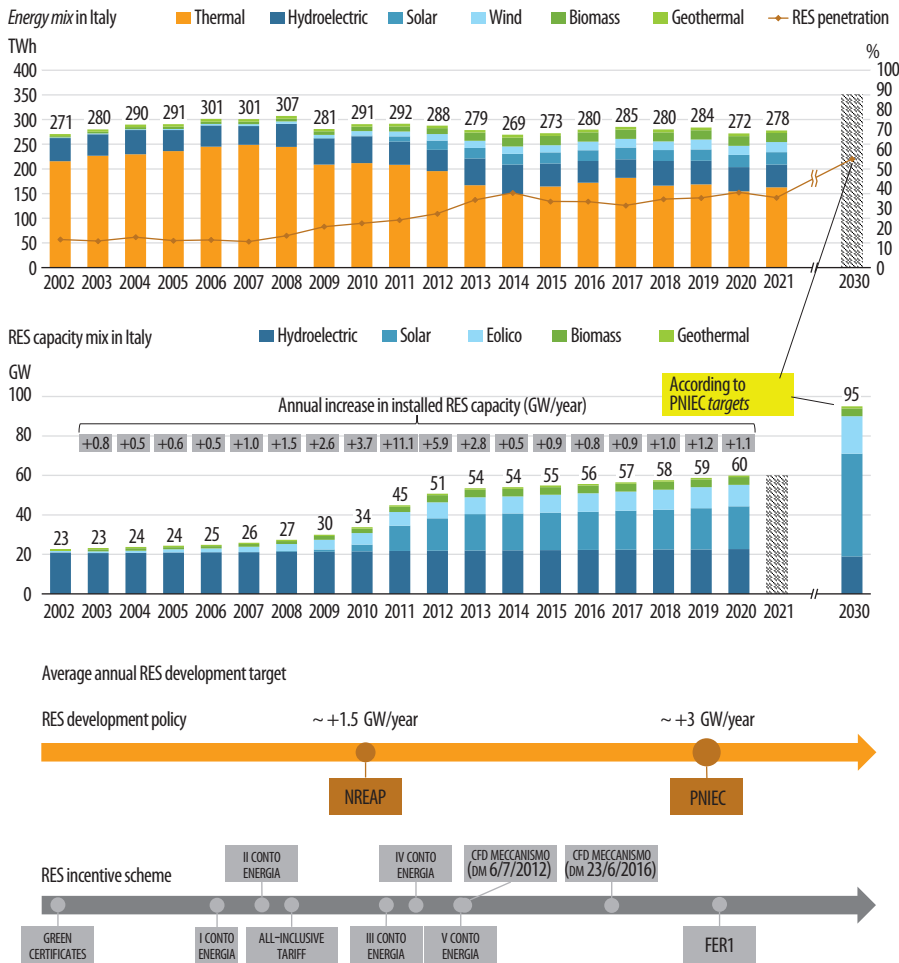


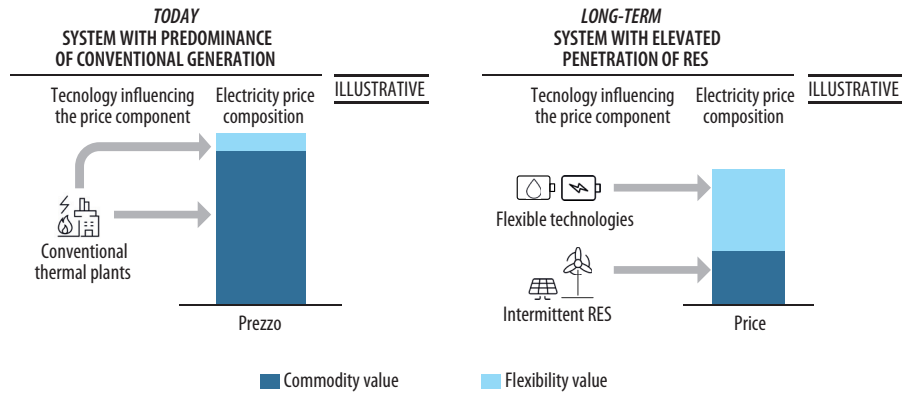
Figure 1
 Historical data and 2030 target for the energy mix, installed RES capacity, RES development policies and incentive schemes (Italy)

Source: energy mix and historical capacity – Terna; RES penetration and capacity by 2030 - PNIEC targets. | Note: the 2030 targets will be updated with the release of the new Terna-Snam scenarios

It should be noted that an effective market model needs to be designed with respect to the intrinsic characteristics of the underlying generation system. In a system dominated by conventional generation (Figure 2, on the left), plants are able to provide both the energy and the flexibility needed to match the demand profile at all times (conventional generators are programmable technologies). In this case, the value of electricity is primarily linked to the cost of energy production.

In a system dominated by intermittent (renewable) generation (Figure 2, on the right), where there is a mismatch between the time when energy is requested by the consumer and when it is produced, flexibility must be provided by other dedicated technologies (e.g. hydroelectric and battery storage). In such system, the value of electricity is more closely related to the cost of flexibility.

Figure 2
Expected evolution of the electricity price composition



Source: AFRY | Note: omitting network costs

In light of these considerations, the structure of the generation mix of the future Italian electricity system is characterised by a dichotomy: on one side the generation plants which are unable to adapt electricity generation to the consumers' needs, on the other side the storage technologies unable to produce energy, but fit for providing the necessary flexibility to the system. Since intermittent renewables and flexible resources have different operating models, the technological dichotomy needs to be translated into a dichotomy of the markets. This requires the implementation of a new market model where:

- ♦ generation and demand can exchange renewable energy with standard profiles (coherent with consumption profiles rather than generation ones), with long-term contracts and at prices reflecting the real cost of RES generation
- ♦ energy and flexibility are traded separately on markets that provide the correct price signals for both resources.

This will ensure the proper integration of renewables, by transferring the benefits of their affordability and stability to the consumer¹² and, at the same time, by providing the correct price signals to investors in both types of infrastructures.

The decoupling of the renewable energy market from gas is necessary to ensure its efficient integration

In order to ensure its cost-effectiveness, the market needs to be redesigned based on the characteristics of the electricity system envisaged by the green transition. The new market design shall consider, on the one hand, non-programmable (or intermittent) renewable generation, which is unable to adapt to consumer needs, and, on the other hand, technologies able to provide the flexibility required to adapt generation to demand.

Intermittent renewables have been treated in the same way as conventional technologies till now. The renewable energy has been "purchased" with long-term mechanisms (incentives), yet "sold" on the markets in the short term. This mechanism has not favoured the complete transfer of the affordability and price stability advantages of renewables to consumers.

Therefore, to allow a proper integration of renewable sources, it is necessary to decouple RES from the short-term markets and from natural gas.

¹² Since the generation cost of renewable plants is mainly linked to the investment cost, in the long run, the commodity cost is close to the long-term generation cost (*Levelized Cost of Energy, LCOE*) of renewables. The long-term generation cost of RES is lower than the one of conventional technologies and independent of any exogenous variable such as, for example, the price of fossil fuels.

Nevertheless, in a system based on RES, a new structural need emerges to ensure that the green transition efficiently takes place: the planning of the transmission and distribution grid must be closely related to the planning of renewable generation and storage.

In fact, beyond being unable to produce energy when needed, renewables (intermittent and unable to follow the demand profile), they are also mainly located in southern Italy, where sun and wind resources prevail, while consumption is concentrated in the North.

In the current market model and with RES penetration not yet at its full potential, the locational price signals are too weak and thus operators tend to focus investments in areas where natural resources are most abundant. It is therefore up to the TSO and the DSOs to “respond” to this situation through increased investments in the electricity network. Investments shall be aimed at enabling energy evacuation and the management of intermittent generation, in a context where the necessary flexibility resources are missing (proper price signals for investments in storage remain absent).

Therefore, in order to avoid serious inefficiencies in the transitional period, the market model will require adequate tools which allow coordinated control of development across three dimensions: RES, storage and network.

It must also be ensured that the transition to the new market will not distort existing markets nor disrupt their functioning¹³. For this reason, competent authorities (e.g., ARERA and AGCM) will need monitoring tools through which they can guarantee competition and correct any potential distortion in the market.

1.2 Confindustria's proposal for a new market model

Based on the rationale presented above, the structure of energy markets (Figure 3) needs to be modified in order to achieve the envisaged decarbonised system.

Two new structured markets should be defined and implemented:

- ♦ a medium / long-term negotiation platform – a PPA Platform dedicated to renewable energy where multi-year energy contracts are negotiated at *standard* profiles consistent with demand
- ♦ a new flexibility market (*Time-Shift*) – a market which allows intermittent generation to supply the energy profiles negotiated in the PPA Platform for the contracted period, through the use of flexible green resources such as batteries and hydroelectric resources.

In a generation mix dominated by renewables, the PPA Platform will be the main market for energy trading and will provide the correct price signals to investors.

The *Time-Shift* market will enable the PPA Platform's products to be sustainable by enhancing the price signals for energy generation as well as for flexible resources, together with the short-term markets and ancillary services markets.

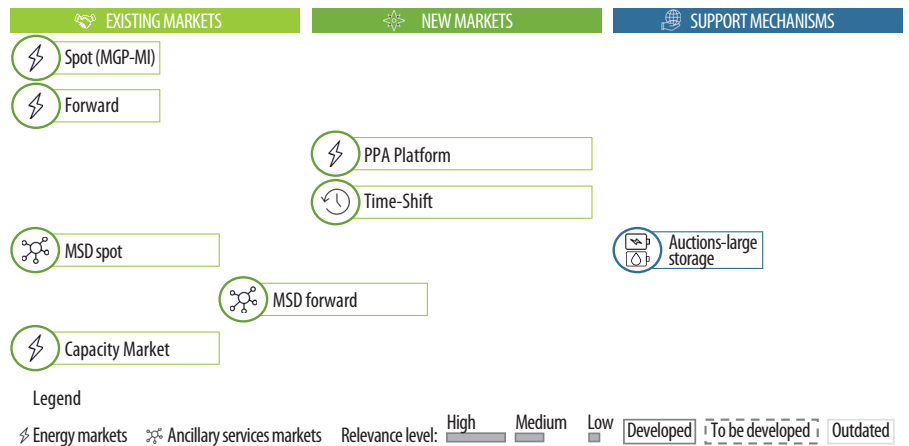
Short-term energy markets (day-ahead and intraday) will be less relevant as value drivers and more focused on the adjustment and balancing functions. It

¹³ To the extent of holding back investments in new renewable plants.

is envisaged that both the ancillary services market¹⁴ and the tools to ensure system adequacy¹⁵ will need to be adapted. More specifically:

- ♦ the current ancillary services market will have to be supported by a *Forward* product exchange platform, designed to ensure security of the system via long-term planning for the TSO and via greater visibility on expected margins for market operators;
- ♦ large storage auctions, already envisaged by Article 18 of Legislative Decree 8/11/2021, n.210, should continue to support development of flexible resources deemed necessary for the transition based on "low regret" volumes (i.e., supporting the additional capacity only if otherwise not stimulated by market conditions);
- ♦ the *Capacity Market* should remain the main instrument for ensuring system adequacy in case there is demonstrated capacity need and a simultaneous need of capacity remuneration.

Figure 3
The new market model



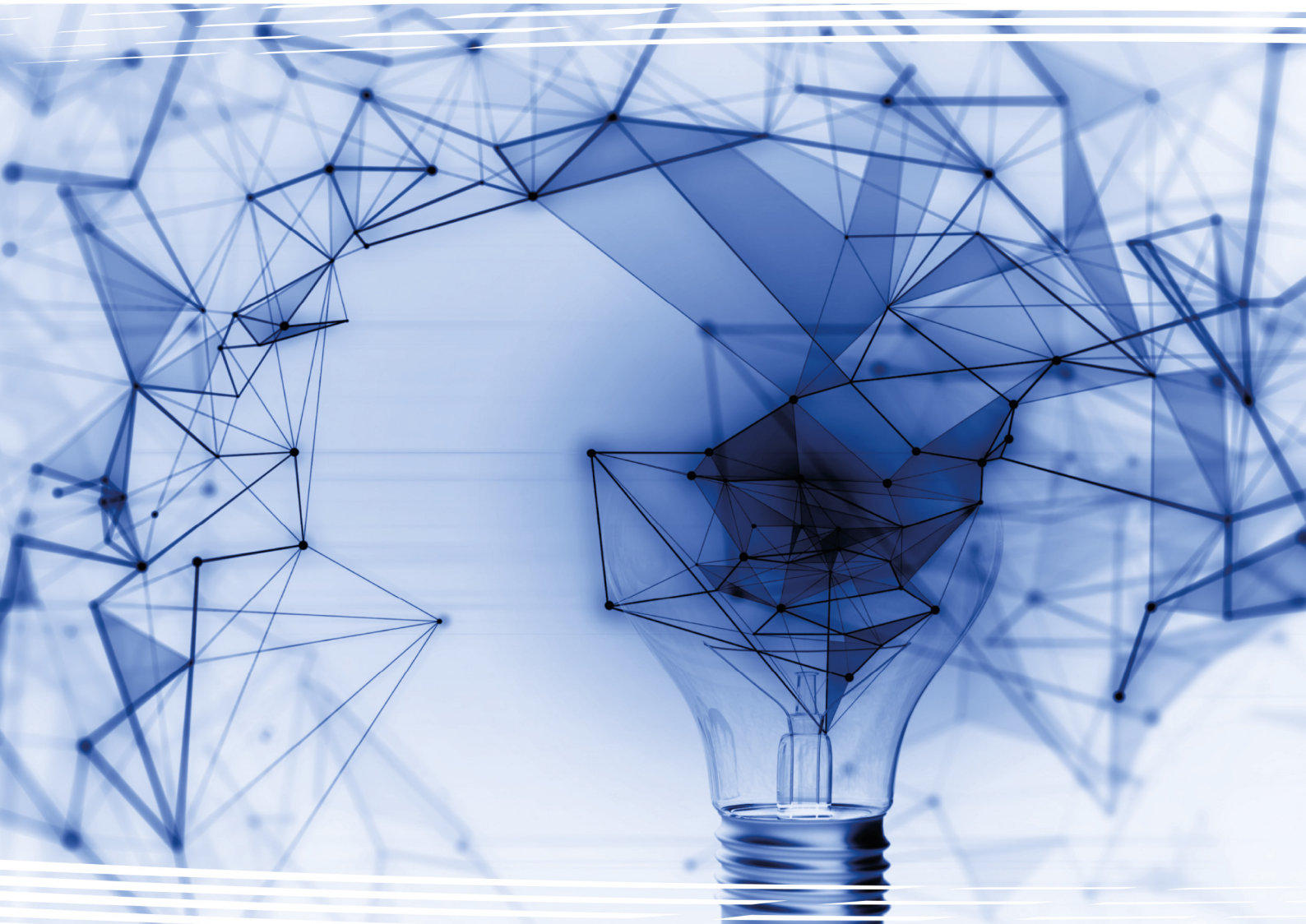
Conditio sine qua non for implementing the model is ensuring that the authorisation processes for new plants and repowering interventions - renewables and storage - are fast enough to keep up with the decarbonisation targets. With this in mind, beyond the tools already defined in the current legislative framework, Confindustria proposes additional efficiency levers to solve the issues related to the authorisation. The suggested levers are detailed in Annex A.1.

Given the current distance between the proposed model and the model in place, it is essential to define an effective implementation path, which is presented in the next section.

¹⁴ Refer to chapter 2.2.1

¹⁵ Refer to chapter 2.2.2

2. THE IMPLEMENTATION PLAN TO REALISE THE NEW MARKET MODEL



As of today, there is a significant gap between the structural needs of the transition based on renewables and the ability of the current model to ensure an efficient integration of large volumes of green energy.

This situation, exacerbated by the events of the last few years, requires the definition of an implementation path alongside a clear model design presented in Section 1.2. The implementation path shall be capable of leading the Italian electricity market towards its future, maximizing the benefits of the transition and protecting consumers from possible distortions and increases in energy costs.

The implementation proposal¹⁶, outlined hereinafter, will allow to reach the future market design in a virtuous way by intervening on three macro-areas:

- ♦ development of RES and flexible resources;
- ♦ reform of existing markets; and
- ♦ TSO-DSO coordination.

It is important to emphasise that a gradual evolution will be necessary to effectively define the future market design. Starting from the existing (or already foreseen) markets and support mechanisms, the transition phase will need to see the introduction of new tools that are able to harmonise the significant novelties of the new model with the need for an efficient and fast implementation path.

Figure 4 shows the structure of the markets and the support mechanisms that are present today and planned for the near future (until the end of 2023) by the regulations in force. In the current Italian landscape, the spot energy markets (day-ahead market MGP¹⁷ / intraday market MI¹⁸) represent the predominant vectors for the exchange of electricity between generation and demand. The exchange through long-term contracts, stipulated through bilateral PPAs, forward products and also through the new PPA Bulletin Board¹⁹, represents a minority share of the exchanged volumes instead.

Similarly, the spot ancillary services market (MSD) / balancing market (MB) play a predominant role in the offer of network services, while *forward procurement* of resources is carried out only within the pilot projects launched by Resolution 300/2017/R/eel and still under development (see Section 2.2.1 for more details).

For the years 2022-2024, the need of system adequacy is guaranteed through the *Capacity Market*, a mechanism capable of providing the right long-term price signals to support existing plants and new investments.

Finally, the support mechanisms present and planned in the near future are specified hereinafter:

- ♦ the RES auctions (current FER1 and new renewables auctions foreseen by Article 28 of Legislative Decree 199/2021) that will accompany the development of merchant renewable plants (the current GSE auction mechanisms will remain in force until exhaustion of the five-year plan being issued by MiTE pursuant to Legislative Decree 199/2021, however the possibility of acquiring products – even profiled – will be enforced. The auction price caps

¹⁶ The proposal accounts for the provisions of Legislative Decree 199/2021 - Implementation of (EU) Directive 2018/2001 of the European Parliament and of the Council, of 11th December 2018 - and Legislative Decree 210/2021 (Implementation of EU Directive 2019/944 of the European Parliament and of the Council, of 5th June 2019).

¹⁷ Mercato del Giorno Prima

¹⁸ Mercato Infragiornaliero

¹⁹ Prepared by the GME in compliance with the provisions of Article 28 of Legislative Decree 199/2021.

and tariffs will have to be periodically revised to take into account the evolution of Capex and Opex).

- ♦ the large storage auctions provided for in Article 18 of Legislative Decree 8/11/2021, n. 210, implementing EU Directive 944/2019, which are essential for the development of storages systems capable of supporting the need for flexibility, within the growing renewable generation and reducing thermal generation.

Figure 4
Market structure and support mechanisms - today and expected developments in the near future

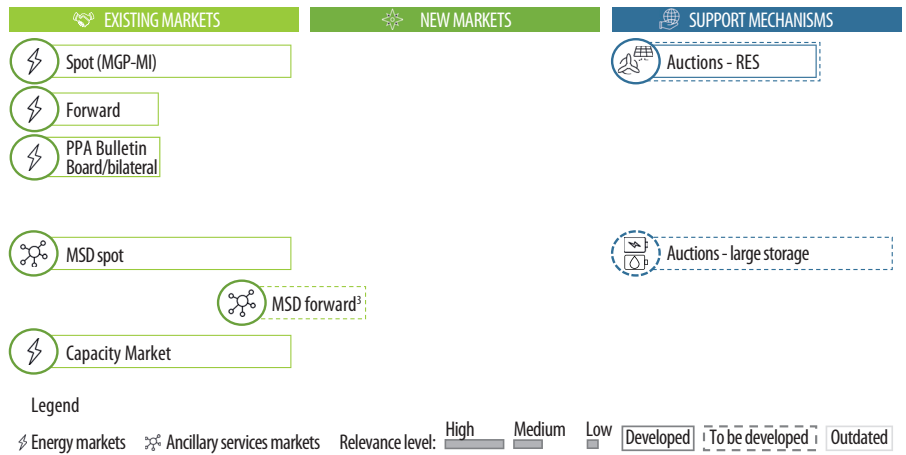
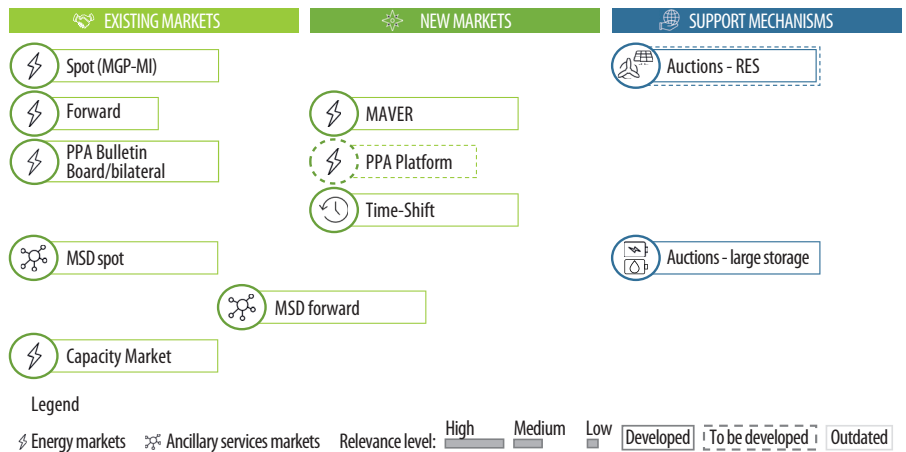


Figure 5 represents the market structure and support envisaged in the transition period (2024-2029).

Figure 5
Market structure and support mechanisms - transitional period



To accompany the transition from FER auctions mechanisms (participation restricted to generation, pay-as-produced remuneration and national quotas) to the proposed PPA Platform, we believe it is necessary to introduce a semi-regulated transitional market identified in the MAVER (Mercato di Acquisto e Vendita di Energia Rinnovabile, meaning market for the purchase and sale of renewable energy), which is described in detail in Section 2.1.1. The MAVER introduces the operating principles expressed by the PPA Platform and is characterised by:

- ♦ long-term contracts of standard generation profiles²⁰ for newly built renewables consistent with consumption profiles;
- ♦ zonal quotas for development optimisation and locational price signals;
- ♦ participation of demand to energy purchase; and
- ♦ prices linked to the real cost of RES (LCOE) and limited in variability (cap & floor).

²⁰ E.g., linear profiles like the *baseload* and *peak/off-peak* ones or shaped profiles like *PV* and *wind* ones

To provide the required standard profiles, the MAVER market will stimulate the development of flexible resources to shift energy from the time of production to the time of consumption. This requirement will be satisfied through another dedicated new market, the *Time-Shift* (as described in Section 2.1.2), which will allow intermittent RES generation to provide the negotiated energy profiles.

The MAVER will accelerate the transition and ensure a rapid decoupling of renewables from gas

The MAVER (*Mercato di Acquisto e Vendita di Energia Rinnovabile*, meaning market for the purchase and sale of renewable energy) is the proposed tool capable of achieving these objectives, as:

- ◆ it is a long-term (e.g. 10-15 years) semi-regulated market of energy profiles from new-built renewable sources
- ◆ it is organised on a zonal basis with contingencies set ex-ante by the Authority and Terna, allowing to rationalise new generation development in coordination with grid and storage development
- ◆ it provides clear locational price signals thanks to its zonal structure
- ◆ it guarantees the achievement of targets by envisaging the option to activate appropriate last-resort auctions (*Aste di Ultima Istanza*, AUI)
- ◆ it allows both supply and demand participation
- ◆ it will be complemented with appropriate mechanisms to facilitate the participation of public and private demand
- ◆ to foster MAVER development, large players could voluntarily act as market makers (only on the purchase side) and guarantee the market competitiveness, in a similar way to past experiences during the development of other energy markets
- ◆ it provides players with bankability conditions very similar to known tools ("FER" incentive schemes), also because of the presence of a central counterparty (GSE)
- ◆ it allows the transfer of price stability and affordability advantages of renewable sources to consumers, through a price control mechanism (cap & floor), thus guaranteeing an effective decoupling of renewable energy from gas
- ◆ it stimulates the *Time-Shift* market (to be activated simultaneously with the MAVER) by creating the demand for flexibility and providing the necessary price signals. At the same time it limits the influence of commodities on the value of traded products through the price control mechanism.

A market dedicated to flexibility with a medium-long term horizon (*Time-Shift*) will complement the trading of renewable energy

MAVER and the PPA platform are markets dedicated to direct energy trading between producers and consumers, which take account of consumption profiles rather than production ones.

For this reason, a trading platform for flexibility products (the *Time-Shift* platform) should be activated alongside the creation of MAVER. The flexibility products will allow producers to manage the risks associated with the production and consumption profiles mismatch.

The products exchanged on the *Time-Shift* platform will:

- ♦ have a medium-long-term tenure to ensure consistency with energy products traded on the MAVER/PPA platform and provide the necessary tools to facilitate the bankability of renewable projects
- ♦ provide a broad range of products to meet the different operators' hedging needs
- ♦ provide the right price signals to stimulate the development of flexible green technologies such as hydro storage and batteries.

The MAVER, the *Time-Shift* and later the PPA Platform, should offer products which stimulate the interest of producers and consumers, optimise the exchange of renewable energy, and maximise the benefits for the system.

In an initial phase of the transitional period, GSE auctions (*pay-as-produced*) are envisaged to remain in place as indicated by Legislative Decree 199/2021²¹. These auctions, however, will remain in the medium-to-long term only a residual tool to ensure the development of renewables coherently with national targets. Moreover, it will still be necessary to ensure the transfer to consumers of the affordability, stability and sustainability advantages of the renewable energy procured²² by the GSE in this way. Such energy will have to be made available to qualified consumers (as stipulated in the access requirements) through MAVER purchase-only sessions²³. MAVER contracts will have to be consistent with GSE auctions ones in terms of volume and duration, while the sale price will be awarded through upward auctions starting from the price defined in the GSE auctions.

Large-storage auctions will continue to support the development of flexible resources, with logic based on "low regret" volumes, namely financing additional capacity that would otherwise not be stimulated by actual free market conditions. The supported capacity will allow to reach the minimum level of flexibility required by the system, supporting the liquidity of the emerging *Time-Shift* market and simultaneously contributing to the security and adequacy of the system.

Regarding the ancillary services markets, the development of the *forward MSD* market will ensure the system security with long-term planning logic for the TSO, while providing market participants with greater visibility on the expected margins. The TSO and the Regulator will have to evaluate the best combination of *spot* and *forward* procurement, in the transitional period and on the long-term, in order to minimize dispatching procurement costs.

In the transitional period as well as on the long term, the *Capacity Market* will remain the tool ensuring the system adequacy in case there is a proven need for capacity for system adequacy and a simultaneous need to remunerate the required capacity. This mechanism will be less relevant than in the short-term, in particular compared with the *Capacity Market* auctions (celebrated in 2019 and 2022) that will remunerate new capacity on a multi-year basis and the existing capacity for the delivery in 2022, 2023 and 2024.

²¹ Legislative Decree 199/2021, in line with RED II, the planning of support mechanisms for RES until 2030. The effective implementation of the proposed market design should make the adoption of traditional incentive schemes marginal, while guaranteeing for the achievement of RES objectives through safeguard mechanisms, such as the AUI and MAVER sessions dedicated to innovative technologies (for the latter see Section 2.1.1).

²² To date, RES generation can sell energy through auction mechanisms with long-term time horizons, while the consumer has to rely on short- or medium-term markets and remains exposed to the volatility of commodity prices.

²³ Meaning MAVER market sessions in which bid offer is fixed in advance and operators can only participate on the buy-side.

Having achieved sufficient liquidity in the MAVER energy market and Time-Shift flexibility market, the new PPA Platform will be introduced. This Platforms will enable energy trading according to free market principles, over different time horizons and for any capacity, existing or new. Both contracts previously formalized on the MAVER and those now negotiated bilaterally or through the PPA Bulletin Board will be channelled into this platform. As shown in Figure 6, the PPA Platform will become the main energy trading market on the long-term (2030) and will always remain closely linked to the *Time-Shift* market to support the flexibility demanded by the contracted profiles.

In this context, the energy spot markets (day-ahead *MGP* and intraday *MI*) will become less relevant in energy valuation and more focused on an adjustment and balancing function.

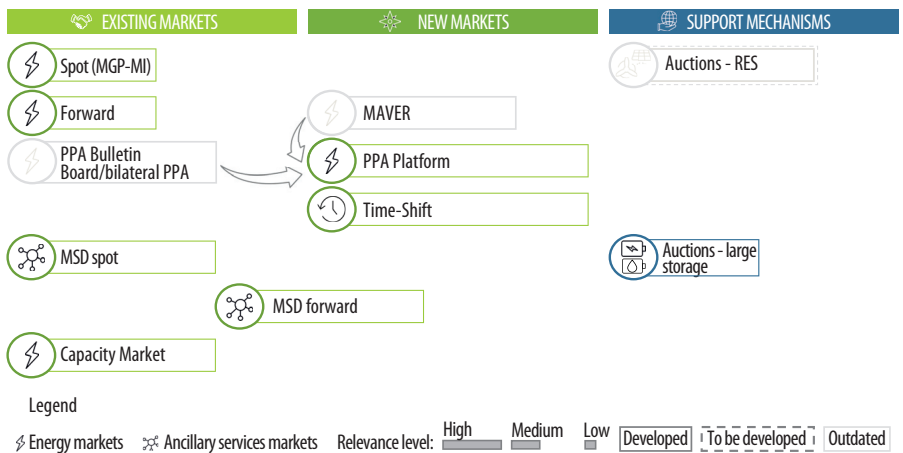


Figure 6
Market structure and support mechanisms - transitional period

The relevance of large storage auctions is foreseen to decrease in the long term compared to the transitional period, as a result of the development of flexible merchant capacity stimulated by the PPA Platform and the *Time-Shift* markets.

The potential quota will anyway always be determined on “low regret” volumes based on the actual development of storage, in order to ensure the residual flexibility requirement of the system.

The following sections detail the above-mentioned proposals.

2.1 The implementation path for the PPA Platform: MAVER, *Time-Shift*

2.1.1 The new MAVER platform: definition and operating principles

The objective of the MAVER is to introduce, in the transitional phase, the conditions for the creation of a free PPA market with sufficient liquidity to decouple the price of electricity from conventional fossil fuels, allowing consumers to benefit from the lower energy production cost. The design of the MAVER and its basic operating principles, presented hereinafter, has been realised also with the support of an in-depth benchmarking analysis of the most successful RES auction mechanisms worldwide. The results of this benchmark analysis and the relative lessons learned are available in Annex B.1.1.

The MAVER envisages periodic semi-regulated market sessions at zonal level for the exchange of financial products on a multi-year basis (e.g. 10-15 years) based on RES energy with standard volume profile (e.g. baseload, peak/off-peak,...). The MAVER sessions can be accessed by producers, necessarily of-

fering energy from new RES plants being stand-alone or co-located with storage systems, as well as consumers and demand, including traders and retailers. The MAVER will be equipped with appropriate mechanisms to facilitate the participation of public and private demand. To further foster MAVER's development, large operators could voluntarily play the *market makers* role on the purchase side, in line with what happened in the past development of other energy markets, always ensuring market competitiveness.

The MAVER sessions will be held throughout the year at a pre-defined frequency (e.g. quarterly) and according to a schedule that will be disclosed sufficiently in advance to stakeholders. MAVER participants will also have visibility on the volumes and profiles available in each session, which will be determined *ex-ante* on a five-year basis²⁴ by government bodies (e.g. MiTE) in cooperation with the national electricity transmission grid operator (Terna). Available volumes and profiles will be defined on a zonal basis considering the set decarbonisation targets and according to a cost minimization logic regarding new capacity integration into the national electricity system.

In order to protect the involved parties, the MAVER is proposed to be centrally managed by a public counterparty (e.g. GSE) that guarantees its operation and manages the counterparty risk²⁵, including both producers and consumers in a contract. This way the purchase/sale of the contracted energy will always be guaranteed, even in the event of default of the consumer/producer. Standard contractual frameworks must therefore be put in place to facilitate the administrative management of the new market and to introduce reference models for bilateral agreements concluded in a free market context. Such bilateral agreements, via the PPA Platform, will represent the main route to market access²⁶ in the future.

The MAVER envisages the stipulation of contracts for the exchange of financial products, so not to modify existing markets (Figure 7). Both producers and consumers will continue to sell and buy the actually produced and consumed electricity volumes on the market, receiving and paying the respective prices defined on the spot market. At the end of the year, the awarded producer will receive from (or pay to) the market operator (e.g. GSE) the differential between the awarded price (PS^P), and the average spot price on the standard profile ($Pavg_{MGP}$) for the awarded volumes V_{MAVER}^P . At the end of the year, the awarded consumer will pay to (or receive from) the market operator (e.g. GSE), the differential between the price awarded (PS^D) and the average spot price on the standard profile ($Pavg_{MGP}$) for the awarded volumes V_{MAVER}^D .

²⁴ In line with the provisions of Legislative Decree 199/2021 - Implementation of (EU) Directive 2018/2001 of the European Parliament and of the Council, of 11th December 2018.

²⁵ The centralised counterparty will be responsible for defining participation rules that minimise counterparty risk and management costs

²⁶ The PPA Platform will include current tools such as the PPA Bulletin Board and will enable the conclusion of bilateral contracts between operators.

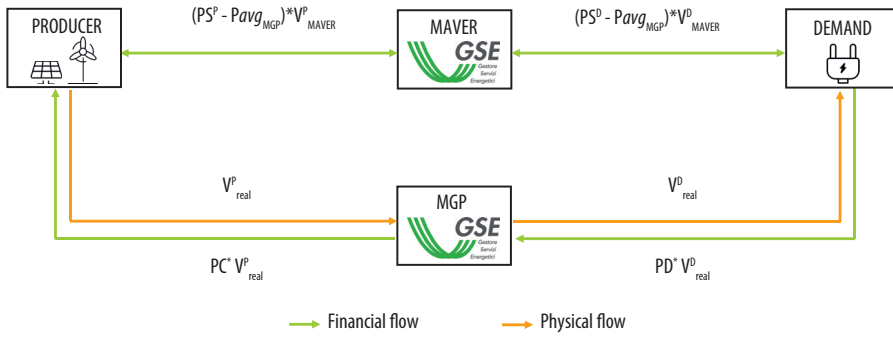


Figure 7
MAVER functioning scheme, viewpoint of market operator (GSE)

Source: AFRY | Notes: Assuming in this example, for the sake of simplicity, price settlement and settlement periods on an annual basis. Shorter periods could also be adopted, e.g., monthly in continuity with FER 1; PC - Captured Price; PD - Demand Purchase Price; PS - price awarded on MAVER; GSE - Gestore dei Servizi Energetici; $P_{avg, MGP}$ - average MGP spot price weighted on the (standard) reference profile

The MAVER envisages competitive logics, yet it aims at limiting price volatility by protecting both the producer, by ensuring an adequate return on investment, and the consumer, by introducing appropriate price limits.

It is envisaged that MiTE, with the consultative contribution of the sector associations, must establish a maximum and minimum reference price for each market area, valid for both producers' sales offers and demand's purchase requests (Figure 8), before each MAVER session. The maximum reference price, defined as *strike price* (or *cap price*), must consider the evolution in investment costs and the resulting LCOE for the technologies involved. The *strike price* must also consider the producer's opportunity cost, adequately valuing the temporal and zonal flexibility required to supply green energy with a standard profile produced by intermittent RES plants. The minimum reference price, named *floor price*, must be determined taking into account LCOE, flexibility cost and a minimum return on investment for the producer.

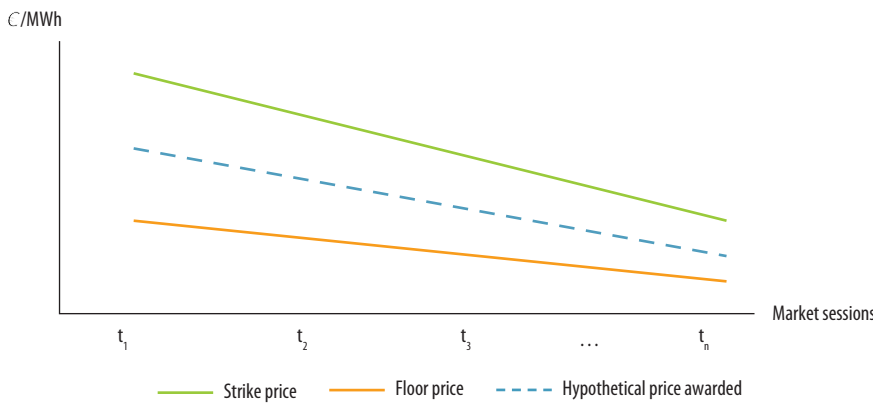


Figure 8
Indicative evolution of *strike price* and *floor price*

Source: AFRY

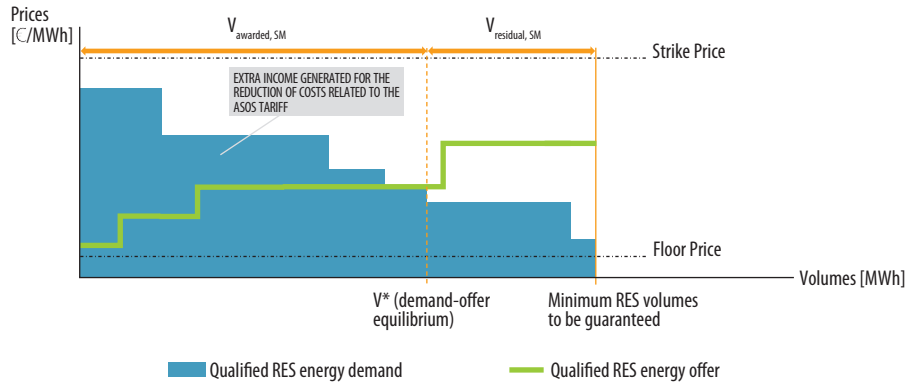
Participation in the MAVER is permitted to qualified entities²⁷ both on the demand side, including traders and retailers, and on the supply side, such as producers from RES plants in stand-alone configuration or co-located with storage systems. Qualified entities participate in the MAVER session for the market zones and the profiles of interest, by submitting sales/purchase offers defining their price and volumes (Figure 9). The MAVER session operator (e.g. GSE) collects the submitted offers and defines their merit order. The central counterparty (e.g. GSE) subscribes financial contracts in which demand and supply are awarded at the offered economic conditions, up to covering the

²⁷ The characteristics of the qualified operator are identified by the platform operator and/or Terna.

volume corresponding to the demand-supply equilibrium (V^*). Producers and demand will be remunerated / will pay according to the *pay-as-bid* principle.

Potential extra revenues, generated for volumes purchased by consumers at higher prices than the awarded sales offers, will be allocated to the reduction of the costs related to the ASOS tariff.

Figure 9
Functioning of MAVER market session



Source: AFRY

The implementation of non-competitive projects, such as innovative technologies and small plants, should also be envisaged within the MAVER. ARERA will have the responsibility to indicate potential further needs in case of deviation from the trajectory.

In order to compensate for potential remaining gaps with respect to the renewable penetration targets, the GSE will have the option of launching subsequent extraordinary sessions depending on the evolving liquidity of renewable energy supply, in line with the timeline set by the policymaker (e.g. MiTE). These sessions, called *Aste di Ultima Stanza* (AUI) i.e. last-resort auctions, will introduce different characteristics from the MAVER sessions, with the aim of incentivising participation in MAVER and minimising the volumes subject to AUI.

AUIs scheduling will have to remain uncertain in order to create a functional information asymmetry that introduces a risk factor for producers. Moreover, participation to AUIs will only be granted to producers having participated in previous MAVER sessions, in order to support, first and foremost, the liquidity of the MAVER itself. Furthermore, the maximum volume awardable through AUIs will not necessarily be equivalent to the residual share resulting from the MAVER sessions. A maximum share of purchase ($\%_{max\ purchase, AUI}$ e.g. 70%) will be defined by a designated governmental body (a.e. MiTE) in order to introduce an additional risk factor for producers, who will not have complete visibility over the available quotas. The part exceeding the quota defined by the maximum purchase share, together with potential unallocated volumes, will be offered in subsequent MAVER sessions.

The AUIs (Figure 10) will also include measures to reduce the impact on the consumer of potential additional costs compared to the prices awarded on the MAVER. Costs related to volumes purchased by the central counterparty and awarded at prices below the reference price ($P_{reference, AUI}$) defined by a Government body (e.g. MiTE) will be covered through the ASOS tariff. Otherwise, the cost share exceeding the reference price will be covered through general national and/or regional taxation, with the aim of identifying and possibly penalising the least virtuous Regions (e.g. in the case of clear authorisation delays).

As for the MAVER sessions, the maximum and minimum reference prices for AUIs will have to be defined by a government body (e.g. MiTE). However, contrarily to MAVER, the maximum awardable price ($P_{max\ awardable, AUI}$) and the minimum awardable price ($P_{min\ awardable, AUI}$) will not be disclosed to producers in order to introduce an additional risk factor in AUIs and incentivize the participation in the MAVER.

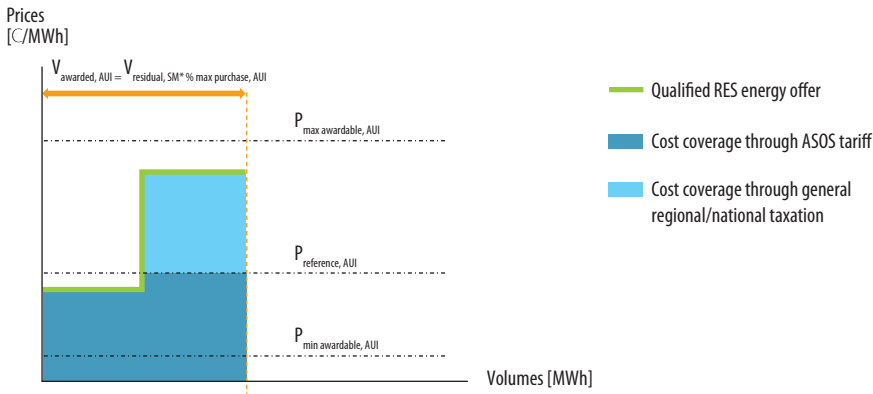


Figure 10
Functioning of last-resort auctions AUIs
(Aste di Ultima Istanza)

Source: AFRY

Bids submitted on the MAVER, both on the sale and the purchase side, will have to take into account the required cost to make the generation profile of a RES plant compatible with the contracted standard profile. Standard profiles are the tool most capable of stimulating the development of flexible and increasingly decarbonised resources, which allow RES integration at the lowest cost and impact for the system. Standard profiles also stimulate the shift in RES production both directly, through investments in storage, and indirectly, through flexibility supply on secondary markets (e.g. *Time-Shift*) at the highest value time for the system and grid. The definition of standard profile products will thus provide more correct price signals to RES technologies, which will be subject to different costs for the procurement of the flexibility required to make the intermittent generation profile of the RES plant compatible with the standard profile contracted on MAVER.

2.1.2 The *Time-Shift* market: definition and operating principles

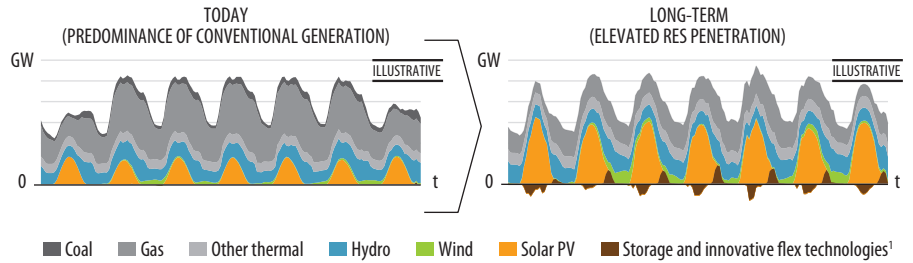
RES producers will be pushed to equip themselves with flexibility by the need to manage the profile risk, i.e. the need to make the generation profile of the RES plant compatible with the standard profile products sold on the MAVER (in the transitional period) and the PPA Platform (in the long term). The *Time-Shift* market will allow intermittent generation to hedge the profile risk and provide long-term price signals for temporal and geographic flexibility, supporting new investments in flexible resources aligned with producers and systems needs.

The *Time-Shift* is therefore a complementary market to the MAVER (before) and the PPA Platform (after). It will have to provide long-term products for each market zone, compatible with the standard profile products that are traded. On the one hand, the number of products should be sufficient to ensure consistency with the products available on the MAVER (before) and on the PPA Platform (after). On the other hand, the number of products should not be excessive, in order to ensure the liquidity of the *Time-Shift* market. The latter will be fostered also through the demand for profiled products created on the MAVER and the supply of flexible resources through large storage auctions. A sufficient liquidity in the *Time-Shift* market will in fact be crucial to maximise the effectiveness of the MAVER during the transitional period, in order to decouple the value of renewable energy from the short-term market and thus from conventional fossil fuels (e.g. natural gas).

Participation to the *Time-Shift* should however be allowed to all flexible technologies. As mentioned above, an efficient development of the MAVER market requires adequate liquidity of the *Time-Shift* market on the supply side. The progressive development of the flexibility assets contributing to the supply of *Time-Shift* services will occur through the participation to the other spot and forward markets present in the new market design (spot MSD, forward MSD, Capacity Market), beyond participation to the *Time-Shift* market itself.

Technological neutrality will allow an efficient market start-up, maximising the use of existing flexible resources in a first phase, and then gradually allowing the use of more competitive innovative technologies. Today, flexibility can be provided by the current operators' portfolios, which also include conventional thermal generation (e.g. gas). In the envisaged market, instead, the structural change in the generation mix and the evolution of investment costs of innovative technologies will naturally lead to changes in the operators' portfolios in alignment with the growing need for flexibility (Figure 11).

Figure 11
Expected evolution of demand and generation mix



Source: AFRY analysis| 1. Elettrolizzatori, Demand Response, V2G (Vehicle To Grid), TS: Time Shift

With the aim of virtuously starting the development of the necessary storage capacity to ensure sufficient *Time-Shift* market liquidity in the short term, it will be essential to effectively implement a dedicated auction mechanism for large storage supply, in line with existing legislative guidelines²⁸. The new storage capacity will be centrally and directly procured by Terna, while the operational management will be entrusted to the GME²⁹.

Awarded storage facilities will be paid a fixed investment remuneration fee, to be determined by government agencies with the advisory input of industry associations. Beyond contributing to ensuring the minimum flexibility required by the system, the new centrally procured storage capacity will have to be offered and made available on the markets, including the *Time-Shift*. The GME will manage the procured storage and make this capacity available on the different new and existing markets, in order to minimise the cost for the system. In light of this, any revenues obtained from these storage systems on the markets, including the *Time-Shift*, will be devoted to reducing system costs related to the supply auctions.

Thanks to a successful launch of the *Time-Shift* market, green energy producers from intermittent RES will be immediately able to source financial products with underlying time-shiftable energy (*time-swap* products). *Time-Shift* products will be essential for the management of the profile risk deriving from the purchase and sale products on the MAVER, in the transitional period, or the PPA platform, in the long term. Access to the *Time-Shift* market will also be granted to consumers hedging profile risk in the medium and long term.

²⁸ Article 18 of the Legislative Decree 8/11/2021, n.210.

²⁹ As envisaged by Article 18 of the Legislative Decree 8/11/2021, n.210.

Time-Shift products may be traded through market sessions managed by a central entity (e.g. GME) or bilaterally, with the possibility of using a dedicated notice board to facilitate the matching of *Time-Shift* supply and demand. The products available on *Time-Shift* will have to be compatible with the products traded on the MAVER and the PPA platform, both in terms of duration and profile.

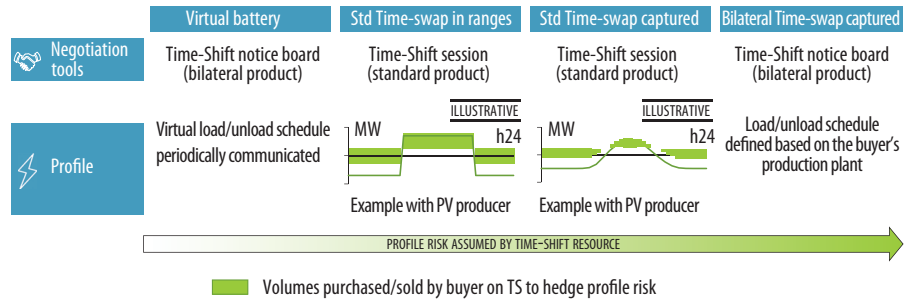
Time-Shift products will also need to provide buyers with different levels of profile risk hedging. Possible examples of *Time-Shift* products (Figure 12) include:

- ♦ virtual battery: a product traded on a dedicated *Time-Shift* notice board, with a duration defined bilaterally between the parties. The buyer communicates the virtual "charge/discharge" schedule to the *Time-Shift* resource on a regular basis (e.g. daily). The buyer assumes the whole price risk, but retains the opportunity to exploit arbitrage on the MGP
- ♦ standard Time-swap in ranges: standard product with predefined profile and duration (e.g. 1-15 years³⁰) traded on the *Time-Shift* market session. The *Time-Shift* resource sells a standard charge/discharge profile, constant over a dispatch interval (e.g. day, week, month), which is defined for a reference plant and different based on technology and market area. The profile risk is shared between buyer and *Time-Shift* resource with respect to predefined time slots. The buyer retains a profile risk, as the purchased *Time-Shift* product is not calibrated to a profile fully compatible with the typical generation profile of the plant
- ♦ standard Time-swap captured: standard product with a predefined profile and duration (e.g. 1-15 years³¹) traded the *Time-Shift* market session. The *Time-Shift* resource sells a standard load/unload profile, constant over a dispatch interval (e.g. day, week, month), which is defined for a reference plant, and different based on technology and market area. The profile risk is shared between the buyer and the *Time-Shift* resource with respect to a reference generation profile on an hourly basis. The buyer reduces the profile risk, as the purchase of the *Time-Shift* product is calibrated to a profile similar to the plant's typical generation profile
- ♦ bilateral Time-swap captured: product traded on a dedicated *Time-Shift* notice board, with duration defined bilaterally between the parties. The *Time-Shift* resource sells, for example, a load/unload schedule defined with respect to the production of the buyer's specific RES plant. In this case, the buyer fully hedges the profile risk, which is simultaneously assumed by the *Time-Shift* resource.

³⁰ In line with the duration of products traded on the MAVER and PPA platform.

³¹ In line with the duration of products traded on the MAVER and PPA platform.

Figure 12
Examples of Time-Shift products and their relative trading tools

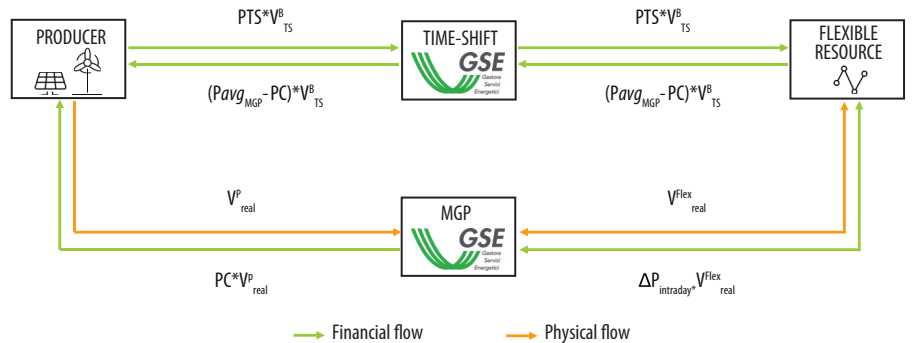


Source: AFRY

With the *Time-Shift*, RES producers will remunerate flexible resources for the flexibility offered, on the medium-long term. Considering, for the sake of simplicity, price settlement and balancing periods on an annual basis and captured *Time-swap* products allowing the RES producer to fully hedge the profile risk compared to a baseload product (Figure 13):

- the RES producer (*Time-Shift* buyer) will pay to the flexible resource a price for the *Time-Shift* service (PTS) to hedge the price risk related to the products contracted on the MAVER or the PPA Platform for the awarded volume (V_{TS}^B);
- at the same time, the RES producer will continue to sell actual physical volumes (V_{real}^P) on the day-ahead market, obtaining a remuneration equal to the average annual captured price from its plant (PC);
- the flexible resource will receive from the producer a price for the *Time-Shift* service (PTS) for the awarded volume (V_{TS}^B) and will trade a physical volume (V_{real}^{flex}) on the day-ahead market, securing a price differential ($\Delta P_{intraday}$).

Figure 13
Example of the Time-Shift operation scheme - viewpoint of market operator



Source: AFRY; Note: Assuming in this example, for the sake of simplicity, price settlement and settlement periods on an annual basis and captured time-swap products with which the RES producer fully hedges the profile risk compared to a baseload product

With the introduced mechanisms, RES producers will be able to appropriately manage the price risk. Assuming, for the sake of simplicity, price settlement and balancing periods on an annual basis and captured *Time-swap* products allowing the RES producer to fully hedge the profile risk concerning one product, the RES producer's final revenue on the final traded volume by will be given by the sum of:

Revenue from the MAVER/PPA Platform:	$+ (PS^P - P_{avg_MGP}) * V_{MAVER}^P$
Revenue from the MGP:	$+ PC * V_{real}^P$
<i>Time-Shift</i> cost:	$- ((PTS * V_{TS}^B) - (P_{avg_MGP} - PC) * V_{TS}^B)$

PC is to be intended as the average price captured by the plant on an annual basis, and P_{avg_MGP} as the arithmetic average of the MGP spot price referred to the standard profile contracted on the MAVER / PPA Platform.

The hypothesis of full profile risk hedging for the producer (Figure 14) implies that the underlying volume of physical energy generated by the RES plant (V_{real}^P) is equivalent to the volumes of the financial products sold on the MAVER or the PPA Platform (V_{MAVER}^P) and traded on the *Time-Shift* (V_{TS}^B). In such hypothesis, the final energy price obtained by the producer (P^P) will be equal to the price awarded on the MAVER / PPA Platform (PS^P), discounted by the cost of the *Time-Shift* products for the purchase of the necessary flexibility (PTS).

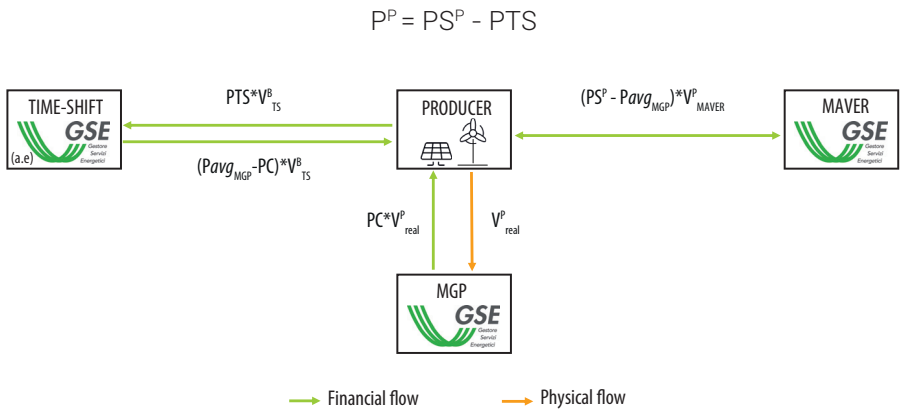


Figure 14
Example of the Time-Shift operation scheme - producer's point of view

Source: AFRY; Note: Assuming in this example, for the sake of simplicity, price settlement and settlement periods on an annual basis and captured time-swap products with which the RES producer fully hedges the profile risk compared to a baseload product

2.1.3 Evolution of the PPA Platform

The PPA Platform will maintain the conditions to ensure the continuity of the RES development initiated with the MAVER, becoming the main marketplace for the purchase and sale of renewable energy for new and existing capacity. In the long term, both bilaterally negotiated PPAs and agreements previously concluded via the PPA Billing Board³² will be brought onto the PPA Platform.

The launch of the PPA Platform will take place when sufficient liquidity in the markets will be achieved to ensure its proper functioning in the years to come. At the launch of the PPA Platform, the MAVER will be discontinued.

With the introduction of the PPA Platform, MAVER will have definitively fulfilled its intended objective: to initiate a virtuous mechanism to enable the transition to a free market based on bilateral trading for the purchase and sale of RES energy.

The products introduced by the MAVER during the transitional period, as well as any products defined *ad-hoc* through bilateral negotiations between supply and demand, will be brought onto the PPA platform. The experience gained on the MAVER with regard to the trading of long-term profile products (at the basis of PPA agreements) will enable operators to efficiently transition to a free market situation, also thanks to the introduction of standardised contract formats and appropriate management of counterparties' guarantees.

The PPA platform will be managed by a central counterparty (e.g. GME) and foresees the exchange of physical or financial products of RES energy with

³² Organised and managed by the GME as of 30 March 2022 pursuant to Article 28(1) of Legislative Decree No. 199 of 8 November 2021, with the aim of promoting the meeting between parties potentially interested in entering into long-term contracts for the purchase and sale of electricity from renewable sources, as well as enabling the fulfilment of the obligation to register the same contracts concluded between operators.

multi-year delivery (e.g. 10-15 years for new RES plants, 5 years for existing RES plants), on standard profiles agreed between demand (retailers and final consumers, including CERs³³ and “qualified”³⁴ aggregators) and supply (“qualified”³⁵ RES and RES + storage producers).

In addition to facilitating the matching of supply and demand, the PPA Platform will foresee the standardisation of contracts, including a system of penalties to be paid in the event of non-compliance with withdrawal or injection obligations by one of the counterparties. The PPA Platform will introduce appropriate tools for the counterparty risk management, by providing for:

- ♦ a *clearing house* with a guarantee system with a *multilayer* approach, that is with allocation of the credit risk on different categories of subjects such as: the operator itself (through *margining* with guarantee deposits/funds), other *clearing* operators within the limits of the contribution paid to a special guarantee fund managed by the *clearing house*, *clearing house* responsible for the residual risk towards consumers with its own capital and/or socialisation
- ♦ an *off-taker* of last resort (e.g. GME or the PPA Platform operator itself) in the event of the counterparty default.

The design of the PPA Platform and its basic principles was also supported by a benchmark analysis carried out on the Spanish and US PPA markets, markets where PPAs have been most successful in terms of new RES capacity installed (see Annex B.1.2 for more details on the benchmark results and related lessons learned).

In order to promote the continuous development of renewables, progressive obligation shares will be introduced on retailers, at the same time as the PPA Platform. These are to be defined taking into account the actual liquidity on the PPA platform in relation to the RES growth targets. Obligation shares on retailers, if adequately dimensioned and progressively updated, are able to allow for a rapid growth of RES development, as proven by experiences in some international markets (see Annex B.1.3).

2.2 Evolution of the existing markets and the network management to adapt to the new market design

Within the described evolution environment, the decarbonisation targets and the associated increase in intermittent RES penetration must not preclude the achievement of the fundamental needs of security and adequacy of the electricity system. Today such needs are guaranteed by the Dispatching Services Market (*Mercato dei Servizi di Dispacciamento*, MSD) and the *Capacity Market* mechanism, respectively. The existing markets mentioned above must be reviewed so that they continue to ensure the relevant needs while guaranteeing operators' competitiveness and the system economic sustainability.

In particular, with the increase in intermittent renewable generation, the demand for ancillary services to ensure system security is expected to grow steadily. The new MSD market will have to allow a better visibility on available resources for the TSO to ensure system security, so that grid issues can be timely and efficiently resolved. At the same time, the ancillary services market

³³ See Section 2.4 for Confindustria's proposals on the energy communities (*Comunità energetiche*) and Annex B.3 for further details concerning the United States market, where Renewable Energy Communities have obtained a significant success.

³⁴ By the PPA Platform operator (e.g., GME).

³⁵ By the PPA Platform operator (e.g., GME).

will have to ensure clear price signals for individual services, providing operators with transparent information. The new MSD market will also have to adapt to the evolution of resources, promoting the full integration of available technologies, including innovative and distributed resources, in order to ensure competition and system cost optimisation.

As far as system adequacy requirements are concerned, it is essential that the *Capacity Market* is only activated when there is a real need to remunerate capacity (existing and/or new), in case existing markets fail to provide sufficient price signals for operators.

2.2.1 Evolution of the ancillary services market MSD

In Italy, the current ancillary services market is characterised by near real-time procurement (through the *ex-ante* MSD and the Balancing Market MB) with the main participation of traditional resources (e.g. thermal and hydroelectric plants). In a market design tending towards the predominance of intermittent RES and profiled green energy trading based on long-term contracts (MAVER and PPA), the TSO will have to procure resources not only on the short-term but also in the medium/long-term.

The TSO will have a better visibility of the resources available for system security thanks to technology-neutral forward auctions (to involve as many resources as possible), which are in addition to the spot market, and the contextual segmentation of services (e.g. primary, secondary, tertiary, inertia). Forward auctions, together with clear segmentation of services, will also allow greater transparency on network requirements and price signals for operators. In order to better integrate the different technologies within the MSD/MB, it will also be necessary to structure asymmetrical services that entail only the increase/decrease of the feed-in profile, also enabling to MSD/MB participation those resources that can provide upwards-only or downwards-only services. The new scheme will also have to provide explicit remuneration for those services that are currently mandatory or in any case not remunerated (e.g. primary reserve, voltage regulation). These will have to be defined in coordination with forward procurement mechanisms in order to avoid over remuneration. The introduction of this hybrid procurement system and the simultaneous segmentation of services will have to be evaluated by the TSO and the Regulator, with the aim of minimising procurement costs for dispatching.

The gradual shift towards hybrid procurement (*forward* services flanked by *spot*) is already occurring in Europe. In line with EU Directives³⁶, the ancillary services of the main European markets historically characterised by long-term procurement (unlike the Italian ones) are moving towards procurement closer to real time to cope with the growing instability of the system. In particular, the shift is taking place with the introduction of common European platforms for sharing *standard* short-term products³⁷ and, at local level, with the integration of new short-term products within national schemes³⁸.

In Italy, an MSD market with a hybrid procurement of spot and forward products would allow the TSO to have greater visibility on the available resources not only close to the delivery time, but also over longer time horizons (e.g. months, years). In this way, starting from a base of long-term resources (forward procurement), the TSO would be able to complete its requirements within short-term intervals by procuring resources in the short term (spot procurement).

³⁶ EU Directive 2017/2195.

³⁷ e.g., PICASSO, TERRE, MARI and FCR common market.

³⁸ e.g., in the UK, with the conversion of the STOR service from forward to spot and the introduction of the *Dynamic Containment* (spot) service to replace the FFR (forward) service.

The price signals provided by forward products would also allow market participants to have greater visibility on expected margins, with consequent benefits for the financial stability of projects.

Table 1 proposes examples of new forward products that can be introduced within the new MSD, to complement the existing spot products. The proposal is based on a benchmark analysis of the main ancillary services markets in Europe, such as Germany, France, the UK and Ireland (see Annex B.2 for further details on benchmark results and main lessons learned). The shown product selection has been defined based on the existing products observed in these countries and their possible application to the Italian MSD market.

The selection and definition of the best forward products must be evaluated by the TSO and the Regulator, so to preserve the network security and achieve the best cost/benefit ratio for the system. On the latter, the additional costs resulting from forward procurement will have to be justified by a simultaneous reduction in the spot MSD costs and/or greater efficiency in resolving network issues, in order to minimise the total procurement costs for dispatching.

In the new MSD, it will be crucial to make the most of the flexibility offered by the system, allowing the integration of all the existing resources and promoting the diversification of these resources for the services offered.

Table 1
Possible example of forward products for the ancillary services, derived from European experiences

	FREQUENCY REGULATION				VOLTAGE REGULATION
	Primary reserve	Secondary reserve	Tertiary reserve	Inertia regulation	Reactive power absorption / supply
Remuneration	Capacity	Capacity+ Energy	Capacity+ Energy	Capacity ³⁹	Capacity+Energy
Service duration	Months	Months	1 year	1-10 years	1-10 years
Procurement start	One month before	One month before	Several months before	One year before	One year before
Capacity auctions frequency	Monthly	Monthly	Yearly	Yearly	Yearly
Enabled technologies	Thermal, RES, storage, DSR, distributed generation in aggregated form that meets the technical requirements				

Source: AFRY, based on the European experiences analysed (see Annex B.2 for further details)

The current regulatory framework envisaged by the TIDE⁴⁰ provides guidance on the steps to be taken for the evolution of ancillary services, with the aim of guaranteeing the security of the electricity network despite the continuous expansion of non-programmable and distributed units. Technological neutrality is one of the cornerstones of the electricity dispatching reform envisaged by the TIDE, according to which the dispatching regulation should follow the principles of impartiality, technological neutrality and efficiency, as indicated by the European Directives (EU Balancing Regulation 2017/2195). According to these principles, storage systems, consumption units, renewable generation units and aggregated units should be enabled to provide ancillary services. In this context, a revision of the minimum requirements for the provision of ancillary services is envisaged, considering that current ones are stringent and enable mainly relevant thermal units. Such revision aims at maximising the types of enabled units (e.g. minimum requirements not differentiated by technology;

³⁹ Inertia is a power service for which a remuneration on the supplied energy is not necessary.

⁴⁰ Consultation document 322/2019/R/eel.

gradient requirements not formulated in absolute terms (MW/min) but in relative terms (%Power/min) where required), while preserving the service effectiveness. In addition to the relaxation of minimum requirements, the TIDE envisages no distinction between relevant and non-relevant units and between programmable and non-programmable units, for the purpose of resource allocation.

The completion of the new regulatory framework for the MSD is also supported by the pilot projects launched by Resolution 300/2017/R/eel, such as:

- ♦ UPR project (Resolution 383/2018/R/eel): for the provision of tertiary reserve (both rotating and replacement) through relevant generation units, including stand-alone storage systems and renewable sources coupled with storage systems;
- ♦ UVAM project (Resolution 422/2018/R/eel and subsequent amendment 79/2021/R/eel): for the provision of tertiary reserve (both rotating and replacement) through aggregated units including production, demand and battery units;
- ♦ FRU project (Resolution 200/2020/R/eel): for the provision of ultra-fast frequency/power reserve to support primary regulation mainly through stand-alone batteries and aggregated units;
- ♦ AFRR project (Resolution 215/2021/R/eel): for the provision of secondary frequency/power reserve through relevant programmable and non-programmable generation units, including stand-alone storage systems and aggregated units not previously enabled for the participation in the ancillary services market.

The above pilot projects are aimed at integrating those resources not previously enabled within the MSD by easing the minimum technical requirements and removing the participation limits for certain technologies. The experience gained during the pilot projects will provide the necessary guidance to the TSO for the proper integration of all technologies within the new MSD market design.

2.2.2 Evolution of the adequacy tool *Capacity Market*

Where the capacity for adequacy need is not met through existing market mechanisms, the *Capacity Market* will be the mechanism ensuring the adequacy conditions of the electricity system, supporting existing plants (including plants subject to life extension) and new investments, in alignment with decarbonisation objectives.

The *Capacity Market* will remain the mechanism for ensuring adequacy, with auctions at regular intervals (e.g. annually from 2024), only in the case of a proven need for capacity for adequacy, as a result of regular evaluation by the TSO⁴¹, and a simultaneous need to remunerate the requested capacity, after the decision maker's evaluation on the basis of current and expected market conditions.

The periodic assessment of the need for adequacy and the need for *Capacity Market* as a solution tool will be necessary in view of the expected RES penetration targets.

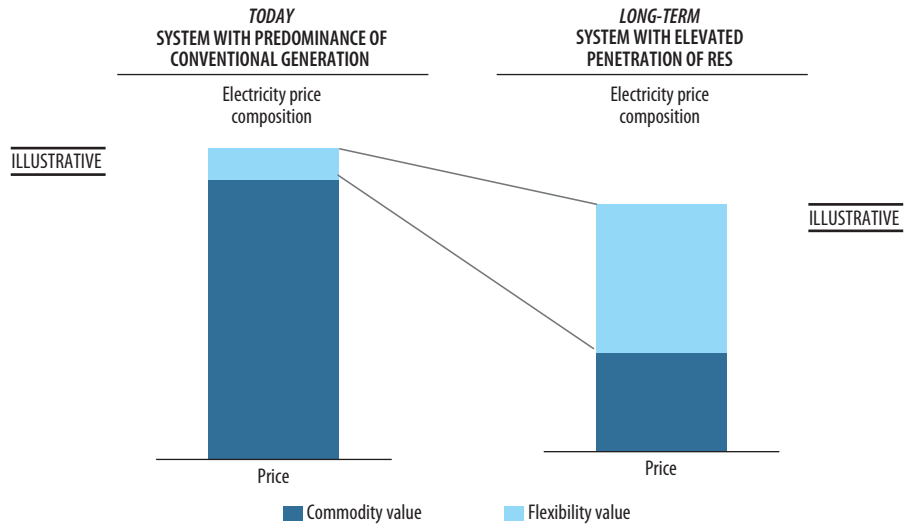
The *Capacity Market* will have to be updated to exploit technologies that will also respond to the growing demand for flexibility, adapting to major system changes in order to facilitate and optimise the energy transition process. The current *Capacity Market* was introduced in a context where conventional thermal generation played a dominant role in the energy system and was therefore

⁴¹ Annually, as already envisaged by the Article 3 of the MiSE Ministerial Decree of 28/06/2019.

designed solely to enhance adequacy. However, flexibility will be key in the electricity system in the long term and increasingly necessary to enable the efficient integration of a large amount of intermittent RES.

Whereas today, due to an electricity system strongly based on conventional generation (e.g. gas, coal), electricity prices mainly reflect the cost of producing energy and therefore the fuels cost, in a market with high RES penetration electricity prices will mainly reflect the cost of flexibility (Figure 15). In the long run, the flexibility value will therefore prevail over the energy production cost and markets will mainly remunerate technologies that can provide such flexibility.

Figure 15
Expected evolution of the electricity price composition



Source: AFRY | Note: omitting network costs

Therefore, in the new market design, the *Capacity Market* will have to be progressively updated to guarantee the minimisation of system costs with respect to the objectives of adequacy and flexibility, accounting for the system evolution and consequently for the contribution of the various technologies in this dual perspective. If the need for new capacity (in addition to the capacity budgeted in 2024) is actually identified, priority will then be given to resources that guarantee greater flexibility, the offered price being equal. The mechanism will have to be progressively updated to ensure that system costs are minimised with respect to the objectives of adequacy and flexibility. In addition, in order to increase the operators' opportunities to participate to the *Capacity Market*, an increase in the frequency of secondary market sessions can be envisaged (to be assessed after the results of the auctions held in 2022) together with a revision of the rules for calculating the derating factor to allow for a more active participation of non-thermal technologies (e.g. storage). As shown in Figure 16, to meet the 2025 adequacy requirements aligned with the PNIEC scenario, the TSO calculated the introduction of additional capacity of 6.5 GW, mainly to balance the exit of coal-fired plants planned for 2025. Out of this 6.5 GW, 4.3 GW have already been contracted by Terna through the *Capacity Market* auctions, with delivery scheduled for 2022-23, and have already obtained all the permits required for commissioning.

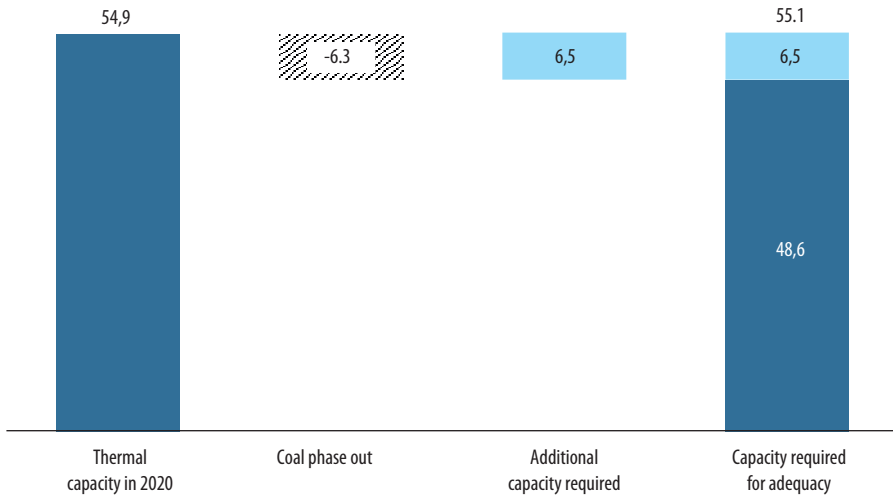


Figure 16
Capacity needed for adequacy by 2025 (PNIEC scenario) - GW

Source: Terna – Rapporto di adeguatezza 2021

After 2025, the adequacy requirements foreseen for 2030 would already be met, taking into account the capacity foreseen by the PNIEC⁴² scenario and the *Capacity Market* auctions already announced. However, due to the release of new RES targets under the *European Green Deal*, which are more ambitious than the PNIEC, a revision of the capacity for adequacy is necessary to consider a penetration of intermittent renewables higher than previously predicted.

A market scenario with high penetration of RES and storage may put at risk the sustainability of existing plants, which are not supported by adequate market conditions. Furthermore, the energy spot market alone would not provide sufficient long-term price signals to stimulate the entry of new capacity under purely *merchant* market conditions.

In line with the EU Regulation 943/2019, Member States may introduce capacity remuneration mechanisms, if existing market mechanisms fail to guarantee the correct requirements. These mechanisms are removed if they are evaluated as unnecessary by the adequacy assessments, for three consecutive years.

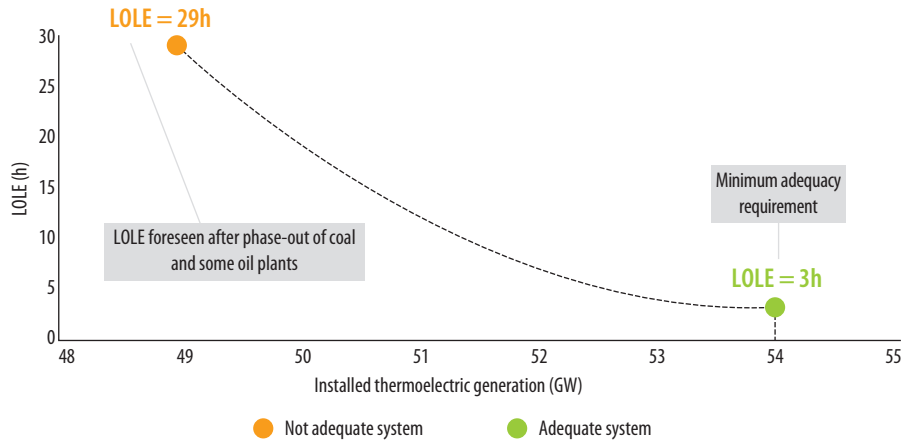
It is essential to ensure the adequacy of the electricity system, so that the demand for electricity is always met, in compliance with the service security and quality requirements, limiting the electricity price volatility and system interruptions. The minimum adequacy requirement established through the *Loss Of Load Expectation* (LOLE) represents the total number of hours per year in which a portion of electricity demand is not met due to constraints of the generation and/or transmission system. The MiTE Ministerial Decree of 28/10/2021 defines the maximum LOLE achievable by the Italian electricity system in order to guarantee the minimum adequacy requirements, which is set at 3 hours per year. Based on the adequacy assessment carried out by Terna in 2019 and presented in the *“Rapporto Adeguatezza Italia”*, the LOLE expected in 2025 would be 29 hours (Figure 17), according to the PNIEC scenario and following the planned phase-out of coal-fired plants. The maximum electricity price that the consumer is willing to pay in the event of an inadequate system, indicated as the overall VOLL (Value of Lost Load) and calculated by Terna at the national level⁴³, is 28 k€/MWh. This value can represent a high cost for the system, multiplied by the volumes for which demand is not met, if the number of hours associated with

⁴² 71 GW of solar photovoltaic and wind power plants, 18 GW of storage and network development interventions (e.g. *Tyrrhenian Link*).

⁴³ In compliance with ARERA Resolution 507/2020/R/ee.

the VOLL is not contained. As anticipated, the minimum adequacy requirement of 54 GW (relative to a maximum LOLE of 3 hours) is achievable thanks to the capacity contracted through *Capacity Market* auctions with delivery expected in 2022-23. New adequacy assessments will be necessary for the longer term (2030), linked to the increase of the RES targets of the *European Green Deal*, as anticipated.

Figure 17
LOLE vs thermoelectric capacity - PNIEC scenario, year 2025



Source: Terna – Rapporto di adeguatezza 2021, with reference to the adequacy assessment of 2019

Adequacy has to be ensured in an interconnected and integrated electricity system such as the European one, where adequacy issues even in a single market can cause major price fluctuations also in neighbouring markets. These events have already occurred in the past, such as the outage of several French nuclear plants in November 2016, which caused electricity prices to rise considerably, not only within the French market, but also in neighbouring markets. Affected neighbouring countries included Italy, which imports considerable amounts of nuclear energy from France during the year. Figure 18 shows the hourly prices formed in the main European markets neighbouring France on 14th November 2016, at 6:00 p.m.. In conditions of low adequacy levels in France, the Italian PUN price reached 110 €/MWh, about 1.6 times higher than the average price for the year 2016, resulting from a French price of about 830 €/MWh, more than 20 times higher than the average price for the year 2016.

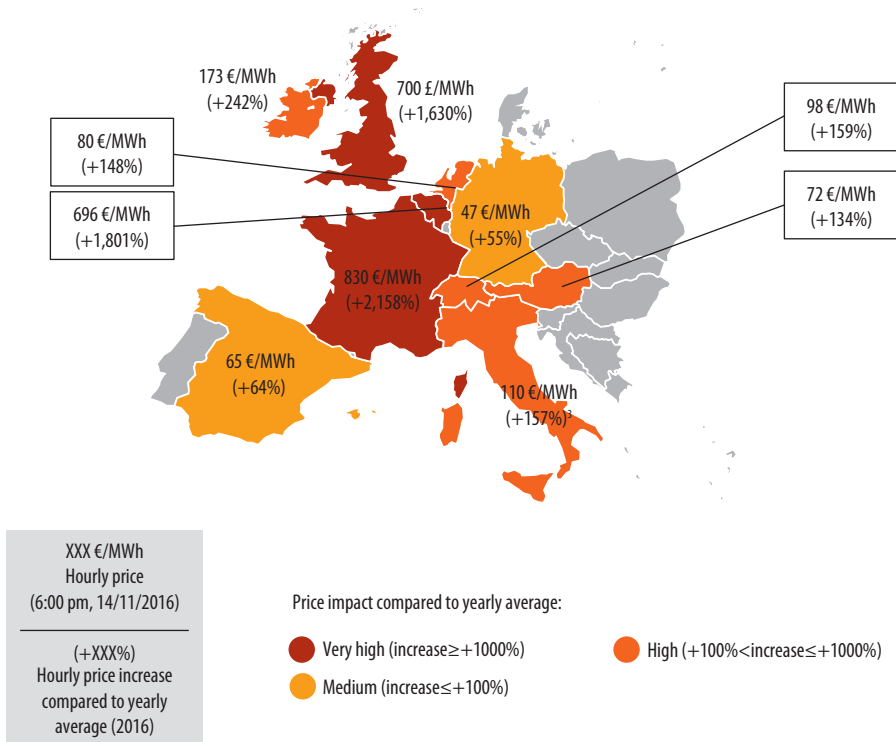


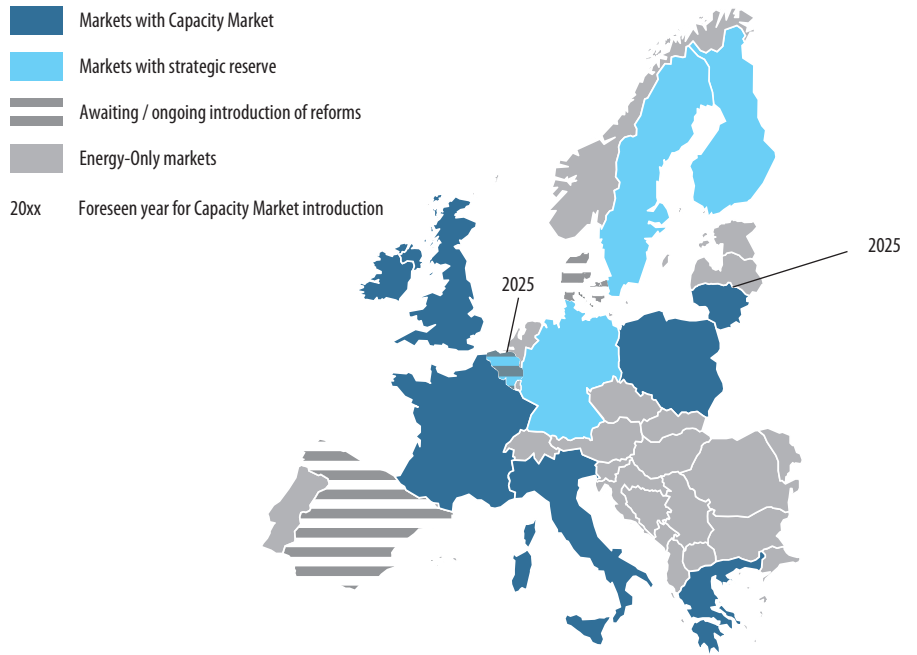
Figure 18
Electricity prices following the French nuclear outage on 14/11/2016, 6:00 p.m.

Source: AFRY analysis on Entso-e data

The major European markets have already implemented capacity remuneration mechanisms to ensure the adequacy of their electricity systems. As shown in Figure 19, to date within Europe the *Capacity Market* mechanism is implemented in Italy, France, the UK, Ireland, Greece and Poland. The *Capacity Market* mechanism is planned from 2025 in Belgium (replacing the strategic reserve) and Lithuania, while in countries such as Germany, Sweden and Finland a strategic reserve system has been implemented.

The introduction of a *Capacity Market* is currently being discussed in Spain, where the government issued a proposal in April 2021. The previous capacity remuneration system, which remunerated 24 GW of CCGT plants, was discontinued in 2018, with the exception of 10 GW of CCGT plants that will continue to receive capacity remuneration (€10,000/MW/year), gradually decreasing until 2028. In addition, at the end of 2021, the new German government included in its coalition agreement the possibility of considering the implementation of a *Capacity Market* and other tools ensuring the security of supply of the network, in the face of the phase-out of coal- and nuclear-fired plants planned for 2030.

Figure 19
Current state of the European market design



Source: AFRY analysis

Current Italian *Capacity Market* provides for the capacity assignee to receive from the TSO the monthly premium (*Capacity Payment* in €/MW) awarded during *Capacity Market* auctions, in addition to the possibility of generating revenues on the MGP, MI, MSD ex-ante and MB markets. In exchange for the *Capacity Payment* received, assignees must return to the TSO a portion of the revenues earned on the MGP and MSD (or the penalties, in case the energy is not sold on the MGP and not offered on the MSD). Such portion of revenues is proportional to the difference between a reference market price and a strike price.

The revenues returned are expressed as a monthly variable charge ($CVAR_m$), calculated as the sum of the nominated capacity for each hour of the month Q_h multiplied by the difference between a reference hourly price $P_{ref, h}$ and a daily strike price $P_{strike, d}$:

$$CVAR_m = \max (0; \sum_h Q_h * (P_{ref, h} - P_{strike, d}))$$

The reference price $P_{ref, i}$ (€/MWh) can be represented by the zonal MGP price, the price awarded by the operator on the MSD or the maximum price recorded on the MSD for each hour, according to the cases described below.

Following the application of ARERA Resolution 83/2022/R/eel, the strike price $P_{strike, d}$ (€/MWh), is instead calculated on a daily basis as the sum of three components:

$$P_{strike, d} = P_{gas, d} - P_{CO_2, d} + P_{charges, d}$$

$P_{gas, d}$ represents the marginal gas production cost for an OCGT plant, proportional to the average of the accepted offers for *title* and *locational* products on day d, weighted on the relative gas quantities. $P_{CO_2, d}$ arithmetic average of ETS prices. $P_{charges, d}$ represents the costs for dispatch, disposal and other charges and risks. Figure 20 shows the reference price calculation methodology based on the offered price and in the cases of accepted/not accepted/missed offers on the MGP and MSD for the *Capacity Market* assignee.

Capacity share Q_h		Reference price $P_{ref,h}$	
		Prezzo offerto $\leq P_{strike,d}$	Prezzo offerto $\geq P_{strike,d}$
Accepted as a result of the Energy Markets	MGP/MI MSD	$P_{ref,h} = \text{prezzo MGPz}$	
Offered but not accepted or not offered on the Energy Markets and Offered and accepted on the MSD	MGP/MI MSD	$P_{ref,h} = \max(\text{MGPz price; Strike price})$	$P_{ref,h} = \max(\text{MGPz price; Offered price on MSD})$
Offered but not accepted or not offered on the Energy Markets and Offered and not accepted on the MSD	MGP/MI MSD		$P_{ref,h} = \max(\text{MGPz price; min(Offered price on MSD, Max price on MSD)})$
Offered but not accepted on the Energy Markets and not offered on the MSD or not presented on the Energy Markets nor the MSD	MGP/MI MSD	Adequate system: $P_{ref,h} = \max(\text{MGPz price; Max price on MSD})$	
		Not adequate system (scarcity event): $P_{ref,h} = \text{VOLL}$	

ACCEPTED OFFER
NOT ACCEPTED OFFER
MISSED OFFER

Figure 20
Determination of the reference price for the calculation of refunds within the Capacity Market

Source: AFRY analysis

The strike price, and thus the amount returned by the capacity assignee, is highly dependent on the price of the gas commodity and the efficiency of the peak technology chosen. The strike price has the function of limiting energy overpricing for the system (resulting from short systems / opportunistic operators' behaviour), aligning the energy price with the generation cost of the chosen peak technology.

To date, the strike price is based on the generation cost of an OCGT. In the future, in order to ensure the Capacity Market efficiency, the calculation of the strike price will have to account for the evolution of peak technologies in the Italian electricity system, in order to align the strike price, and therefore the refunds, with the actual marginal costs of the peak technology (Figure 21).

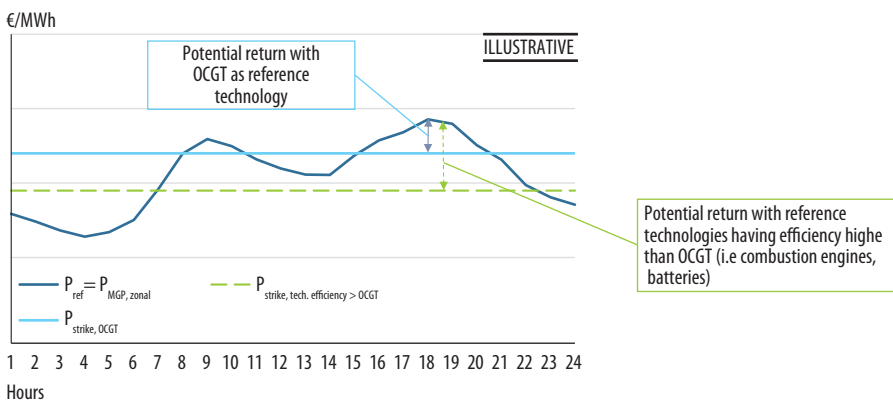


Figure 21
Strike price comparison for different marginal technologies

Fonte: analisi AFRY

2.3 The network management role of the TSO and the DSOs in the new market

In light of the increasing penetration of distributed resources (renewable and/or flexible), it is necessary for the new market to ensure their development and integration, as they are fundamental for the electricity system transition. For this to happen, an evolution must occur in today's operational management of services in the transmission and distribution grids. The evolution must preserve the networks security, i.e. ensuring no security risks in the national electricity system or in the electricity network grid to which distributed resources are or will be connected, the system cost-effectiveness, i.e. ensuring the minimum cost of this development and integration, and the market competitiveness, i.e. limiting distortions and inefficiencies.

Renewable and flexible distributed resources now represent an additional tool to effectively achieve the energy transition. Renewable plants, storage, and electricity demand can play an active role not only in the production/consumption of electricity, but also in the provision of services that guarantee the security of the electricity distribution system.

The new local resources management model must be designed on the basis of the above mentioned principles of security, cost-effectiveness, and competition, priority features for determining the best possible system.

The new local resource management model must guarantee the security of the distribution networks by adhering to the following cornerstones:

- ♦ to offer services that can be activated locally and that, if there is a benefit to the system, can be managed in coordination with the transmission network services. Congestion resolution services on local networks can potentially involve TSO and DSOs in order to optimise the resolution of local issues also taking into account the needs of the transmission grid
- ♦ to apply an implementation timeframe compatible with decarbonisation and renewable development objectives, in order to effectively address network security issues that may arise from a rise in the distributed intermittent generation and from the increasingly active role of electricity demand
- ♦ to reconcile the model with the system operators' investment plans on the networks, especially with regard to investments in network digitisation
- ♦ to ensure that the skills and tools of the system operator and the supply are adequate for the management model requirements
- ♦ to ensure the feasibility of data sharing and management on the local services.

The introduction of a new model must also ensure the system cost-effectiveness by searching for the best trade-off between local supply of resources and other possible alternatives (e.g. expansion of electricity infrastructure). While ensuring cost-effectiveness, the model must also favour the efficient and safe operation of the distribution system⁴⁴. The greater cost-effectiveness of the model must also be assessed by considering the possible interactions and synergies between the local and global service markets (which include MGP/MI and MSD/MB).

Additionally, it is crucial to preserve the competition among resources within the model to avoid distorting effects and inefficiencies. In this landscape and in line with the EU Directives⁴⁵, a necessary condition for the DSO's active role in the network services management in coordination with the TSO is that adequate guarantees are provided concerning decision-making autonomy, operational independence and transparency on the performed activities. In particular, it is necessary to ensure:

- ♦ *system operator's*⁴⁶ neutrality in the selection and activation of the distributed resources, according to principles of system security and cost-effectiveness (based on economic merit)
- ♦ *system operator's*⁴⁷ transparency on the activated services (e.g. disclosing information on the resources activated, the reasons underlying the activation,

⁴⁴ As envisaged by EU Directive 2019/944, and its transposition through the Legislative Decree 8/11/2021 n. 210.

⁴⁵ As envisaged by the EU Directive 2019/944 and its transposition through the Article 23 of the Legislative Decree 8/11/2021 n. 210, and the AGCM report number AS1824.

⁴⁶ As envisaged by EU Directive 2019/944, and its transposition through Legislative Decree 8/11/2021 n. 210.

⁴⁷ As envisaged by EU Directive 2019/944, and its transposition through Legislative Decree 8/11/2021 n. 210.

the prices awarded by the resources), aimed at providing the correct signals to the operators and allowing the monitoring of the correct market functioning

In order to guarantee neutrality and transparency, monitoring mechanisms must be envisaged by the Regulator and/or institutions for ex-ante and ex-post verification of the correct activity of the system operator.

Furthermore, the new model will have to be defined in such a way that:

- ♦ sufficient liquidity is achieved within the individual services. This could be obtained, for example, through local markets being also open to small resources (in the order of kW) and with medium-term procurement, so as to increase the number of resources available in typically small markets such as distribution networks ones
- ♦ technical/operational, regulatory and financial barriers are removed in order to make the activation of local resources massive.

In the future, a massive development of renewable generation alongside flexible resources such as batteries and demand response is foreseen also for the distribution network. As shown in Figure 22, intermittent RES capacity connected to the distribution network represents more than 70% of the total intermittent capacity (30 GW), amounting to 22 GW in 2019. Considering that total intermittent renewable capacity will have to grow from around 30 GW today to 87 GW in 2030 according to the targets set by *Fit For 55*, it can be assumed that distributed capacity will continue to play an important role in the future generation mix. Furthermore, distributed storage and demand-side resources can provide the system with flexibility services for a secure network management. In this context, based on the 2030 energy scenarios developed by Confindustria and RSE in 2022, small-scale battery capacity is expected to increase by about +20 GWh, while the consumption of electric vehicles and electric heat pumps is expected to rise respectively by about +23 TWh and +9 TWh, as compared to 2018 values.

It is therefore safe to assume that in the target market model for 2030, the efficient, safe and reliable management of the electricity system will increasingly involve the distribution networks, with RES generation and distributed flexible resources playing an increasingly active role.

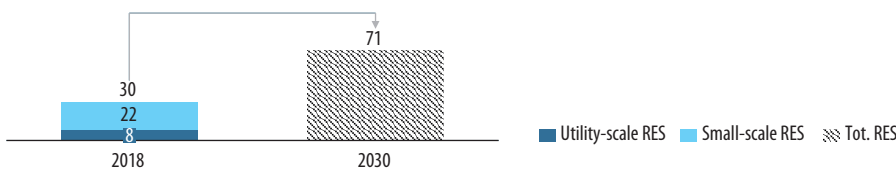


Figure 22
Expected evolution of the intermittent⁴⁵ installata (GW)

Source: total intermittent RES capacity as of 2019: Terna; share of small-scale intermittent RES capacity as of 2019: ARERA; total intermittent RES capacity as of 2030: PNIEC target⁴⁹

⁴⁸ Solar PV and On-Shore wind.

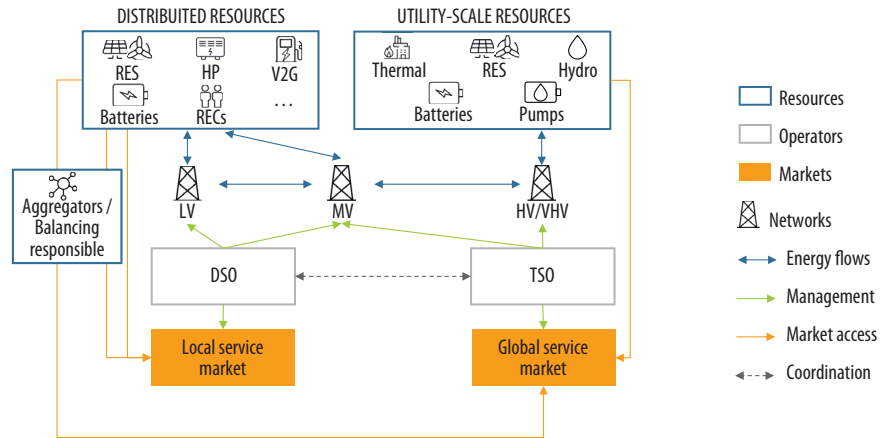
⁴⁹ 2030 targets will be updated with the release of the new Terna-Snam scenarios

The best TSO-DSO coordination model for the future market cannot be identified without a thorough analysis accounting for the security, reliability and cost-effectiveness of the system and the competition between operators.

Figure 23 illustrates a possible operating diagram for the electricity system applicable to the future market design. The proposed diagram envisages the creation of a local services market for the distribution network managed by the DSOs, supported by the existing global services market managed by the TSO, which includes MGP/MI and MSD/MB. The local services market comprises services such as congestion resolution and voltage regulation on the low- and medium-voltage networks operated by the DSOs. Distributed resources able to offer these services will include, also in aggregated form, RES distributed generation, batteries, electric vehicles, heat pumps and other flexible consumption units, and Renewable Energy Communities⁵⁰.

The evaluation of the TSO-DSO coordination model and the local services procurement model is beyond the scope of this project and requires a dedicated and detailed study in the light of the key principles identified above.

Figure 23
Illustrative diagram - possible evolution of the operating diagram of the electricity system



Source: AFRY

Several projects for the provision of local flexibility services have already been initiated at European level, to evaluate the most appropriate and efficient solutions with the involvement of both TSOs and DSOs as service buyers (see examples presented in Figure 24).

⁵⁰ See Annex B.3 for further details on the US market, where Renewable Energy Communities have achieved significant success.

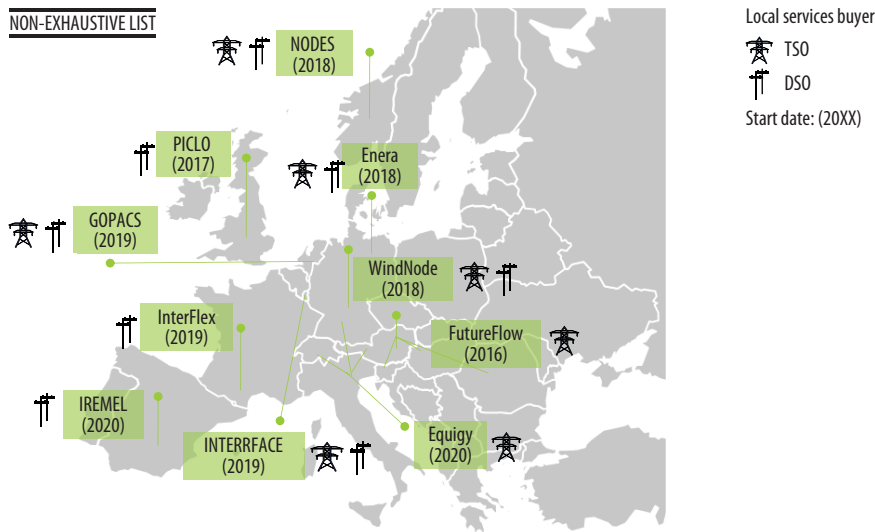


Figure 24
Examples of European initiatives and platforms for local flexibility services

Source: AFRY analysis

The main purpose of the analysed European experiences was to test the effectiveness and efficiency of services on distribution networks, particularly the congestion resolution services and the voltage regulation on distribution networks.

Further details on some of the relevant initiatives, among those presented in Figure 24, are provided below:

- ♦ **Nodes:** platform for exchanging short- and long-term flexibility services, which are experimentally used in several countries, including the UK, Norway and Sweden, with the aim of evaluating the potential benefits of local flexibility services. Flexibility services for the distribution network offered on Nodes include congestion resolution, voltage regulation and grid balancing (intended as energy supply). Several projects have been developed through the platform, including:
 - *NORFLEX (Norway):* large-scale demonstration project (3 years), involving TSO, DSOs and flexibility service providers, aimed at demonstrating how local flexibility can be used by the TSO
 - *IntraFlex (United Kingdom):* demonstration project joined by Western Power Distribution and flexibility service providers, focused on flexibility services from a few days up to 90 minutes before delivery
 - *Sthlmflex (Sweden):* project involving distributors in the Stockholm area, aimed at launching a regional flexibility market, on a day-ahead and intra-day basis and through auctions for long-term seasonal services.
- ♦ **Piclo:** platform for the exchange of local flexibility services, where 667 MW have been procured to date and 13.9 GW of flexible capacity have been registered. The platform is active in the UK market and has initiated procurement sessions through which DNOs have contracted flexible resources, including:
 - *2018-2019:* a project for more than 450 MW of flexible resources was initiated involving 6 DNOs. System operators organised auctions to contract resources for congestion resolution, voltage regulation or outages
 - *May 2021:* UK Power Network procured, via auction, flexible resources, such as EVs, DSRs and small-scale batteries, and signed service contracts for a total of € 30 million
 - *June 2021:* SP Energy Networks contracted, via auction, 555 MW of flexible distributed capacity.

- ♦ GOPACS: initiative initiated by the Dutch TSO (TenneT) and the regional grid operators to solve mainly local congestion problems. GOPACS is not a market platform but uses orders on existing electricity market platforms. Based on buy and sell orders submitted on the ETPA intraday platform, GOPACS quickly calculates whether the order fulfils the following conditions:
 - it resolves the local congestion
 - it aggravates the congestion in other parts of the electricity network.

The service is remunerated by the operator of the congested local network.

- ♦ Enera: initiative part of the SINTEG programme, launched by the German government to evaluate a large-scale local flexibility market within the German electricity market, with the main focus on congestion resolution on the local network. The project is in cooperation with EPEX spot and a consortium of 33 partners. The initiative requires transmission and/or distribution operators to submit their offers for flexibility contracts, having identified possible congestion in a given period. This project aimed to identify actions and investments in the digital infrastructure, which are necessary for the country's energy transition.

Despite the numerous initiatives for the development of services on local networks across Europe, divergent positions remain on the topic, which lead to further investigation on a national and local basis.

In December 2021, the association of TSOs (ENTSO-E), DSOs (EDSO) and the industry (Eurelectric) published a document⁵¹ defining a roadmap for the evolution of the regulatory framework for the development of flexibility on the local distribution networks. To this end, the document provides an assessment of the regulatory gaps that need to be filled in order to facilitate the participation of distributed resources to flexibility services. Some conflicting positions emerge among the recommendations identified by TSOs and DSOs, such as:

- ♦ concerning the need to develop a harmonised model for the use of flexible resources, TSOs believe that DSOs cannot manage or be responsible for redispatching markets, while DSOs believe they are to be responsible for congestion resolution, capacity management and redispatching on their own grids;
- ♦ regarding the need to develop a list of common attributes for new flexibility services (e.g. grid capacity management, congestion management, voltage control) DSOs believe that voltage and reactive power control may become increasingly complicated as the increase in the penetration of distributed resources. Therefore, DSOs consider it a priority to define common high-level principles among EU states for the identified local services. TSOs, on the other hand, believe that the problem of voltage control should be solved locally, without the need to involve other European markets. Therefore, according to the TSOs, the high-level principles mentioned must be established at national level.

Among the issues discussed at the Working Group, points of convergence between the parties also emerged, such as:

- ♦ the need to define requirements for data exchange (metering, congestion, balancing) necessary to facilitate market-based mechanisms for congestion resolution, which is considered a priority for both TSOs and DSOs

⁵¹ [DSO-TSO Roadmap on the Evolution of the Regulatory Framework for Distributed Flexibility](#).

- ♦ the need to define guiding principles acceptable at European level, following best practices derived from methodologies used in existing markets. TSOs and DSOs assign a medium priority to this issue, compared to other actions to be taken.

Within the Italian landscape, through the lessons learnt during the implementation of pilot projects for the provisioning of local ancillary services (e.g., pilot projects envisaged by ARERA Resolution 352/2021), preliminary indications can be obtained regarding the best operating model to apply to the local services market and the coordination between system operators.

2.4 The role of Renewable Energy Communities in the new market

With the new targets foreseen by the proposed revision of the renewable energy directive and the further additions of the *REPowerEU Plan*, the energy production from renewable sources will be increased to 45% by 2030. The new target for renewable generation implies a substantial production increase for the electricity sector, which is likely to far exceed the current PNIEC targets.

Electricity as energy carrier, which is the central axis of the European decarbonisation process, has undergone a profound paradigm shift since the *Clean Energy Package* in 2018. This process has led, *inter alia*, to the promotion and recognition of the new role of the *prosumer* and of the market demand, which is taking on an increasingly important pro-active function, also with the aim of safeguarding the competitiveness of the industrial system. In this perspective, in fact, the new consumer is asked to strengthen its capacity of renewable self-production, playing a strategic role for the medium and large industrial companies subject to the ETS regime, which see an increase in their decarbonisation objectives with the *Fit for 55* package. The magnitude of the new renewable production capacity requires, however, a framework capable of facilitating the creation of enabling organisational structures, such as Energy Communities. In the Italian context, similarly to many other European countries, the industrial geography presents relevant industrial districts located on a territory characterised by strong supply chain synergies. However, the Article 2, Letter 16 of Directive 2018/2001 provides a limiting definition with reference to Renewable Energy Communities, which excludes medium and large enterprises from the governance group.

In the case of industrial districts, the extension of participation of medium and large companies in the development of renewables, would increase the local potential investment in renewable generation capacity. Such extension could occur through the creation of consortium structures that are able to more adequately manage the price and counterparty risk related to investments in new power plants. Moreover, considering the incremental need for renewable generation related to hydrogen development targets, this would also allow to strengthen the green H2 production projects that should find priority application in industrial processes for natural gas consumption reduction. Finally, the enlargement of the voluntary participation group by modifying b) of the definition would in any case be respectful of the governance principles set forth in a) of the definition and the goals set forth in c).

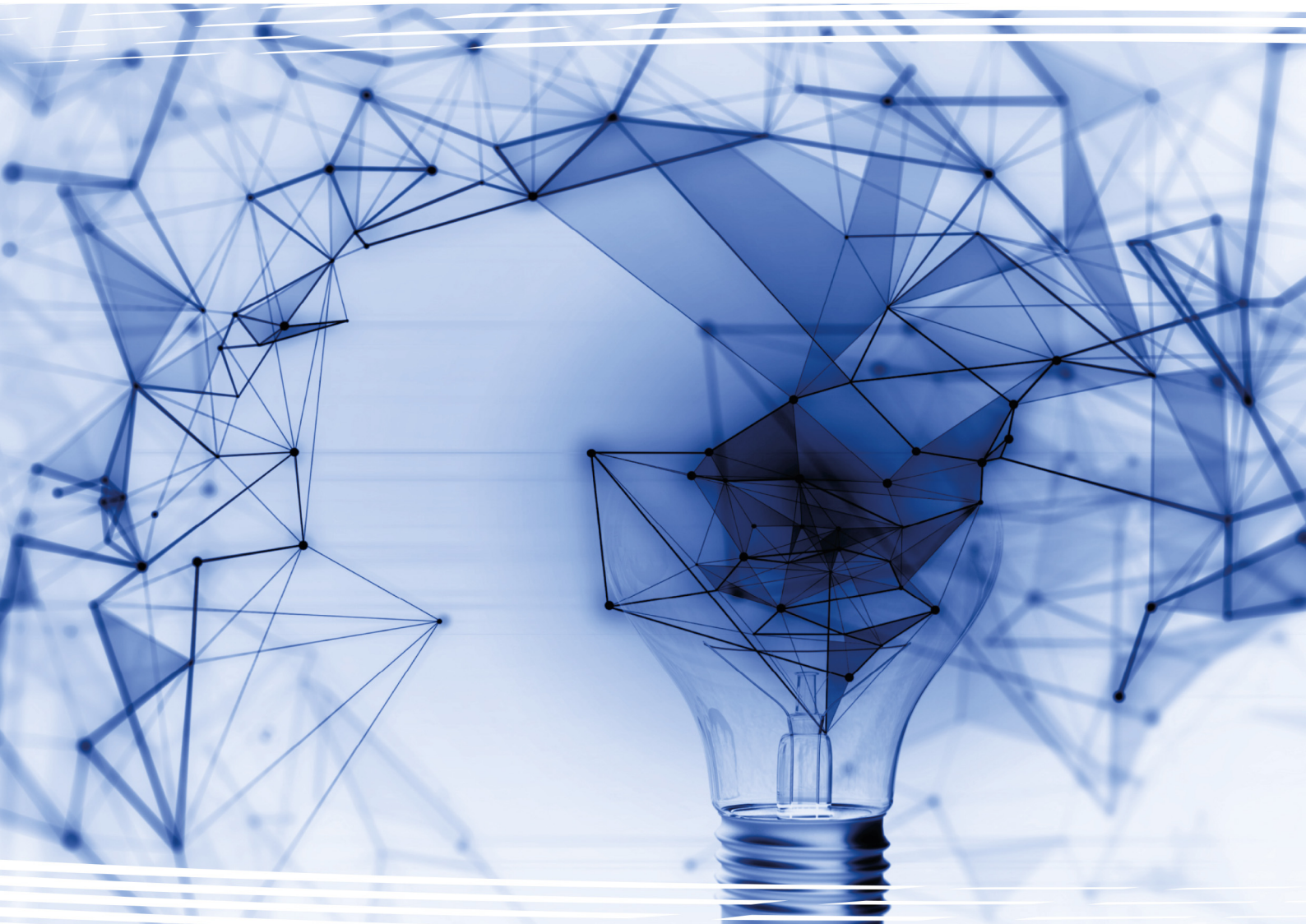
In general terms, the RES development will also have to be fostered by simplifying the access to energy communities at the industrial, service and residential levels, ensuring that such communities are managed by a qualified operator.

A summary of the proposed constitutive and technical criteria for the industrial sector, aimed at promoting the new *prosumer* role of the industrial user, is presented below:

- ♦ to extend the participation also to entities such as medium and large enterprises and consortia of medium and large enterprises
- ♦ to enlarge the perimeter of interest of the "primary substation" to the "contiguous primary substation" to promote the development of production capacity nearby
- ♦ to overcome the 1 MWp maximum size restriction for single plant
- ♦ to extend the participation to technologies such as high-efficiency cogeneration and trigeneration plants
- ♦ to envisage pre-emption on suitable areas for RES development
- ♦ to provide for an efficient economic incentive structure, which includes bonuses for avoided costs for the system, properly considering the technological development degree. These bonuses may include, for example:
 - exemption from transport charges (AT): due to avoided costs for the zonal transfer of energy
 - reduction of distribution charges: due to the avoided costs for transmission over distribution networks
 - reduction of *Capacity Market* charges: due to the fact that RECs contribute to system adequacy reducing the *Capacity Market* costs
 - reduction/exemption of uplift: due to avoided balancing costs as RECs are able to self-balance
 - premium based on locational signals: to develop plants close to industrial districts/consumption centres, thus promoting investments in areas with a scarce presence of RES projects
 - possible fiscal support mechanisms: to favour investments aimed at the green transition, consistent with the objectives of accelerating decarbonisation and related to the relocation risks.

An example of a virtuous market is the US one, where RECs have developed mainly through mechanisms such as net metering schemes, access to long-term contracts (PPAs) and dedicated government programmes (see Annex B.3 for further details).

ANNEX A FURTHER DETAILS ON THE REFORM PROPOSAL



A.1 Review of the authorisation process

The effective implementation of the proposed market design assumes that authorisation processes are sufficiently rapid for RES development to keep up with decarbonisation targets.

This study does not aim to find a solution to the authorisation problems that have hindered the development of renewables in Italy in recent years, thus considering the solution of authorisation problems as a *conditio sine qua non* for the implementation of the new market design.

Confindustria and the Working Table have identified and submitted several actions to the decision maker. However, the implementation of these actions is not under the scope of this study since they are entirely exogenous to the definition of the future market design.

In addition to the potential solutions already identified, further interventions are suggested applying reward mechanisms (Table 2).

PROPOSAL	PROS	CONS
Compensatory interventions (environmental and social)	Scheme already used in some regions for PV (e.g. land transfer/electricity supply to local communities and/or PA)	Generally bilateral negotiation between developer and local authorities/communities
Incentivisation of "local content" (e.g. tax reliefs for investors)	Indirect effects on employment and industrial development on the territory	Need to build local expertise and technology centres
Introduction of final zonal electricity prices	No need for regional legislation intervention	Indirect and not immediate incentive (probably long reaction times)

Table 2
Further possible efficiency levers for solving the authorisation issues

Source: AFRY experience on the market

A.2 Rationale behind the proposal of adopting a mixed supply model for RES development

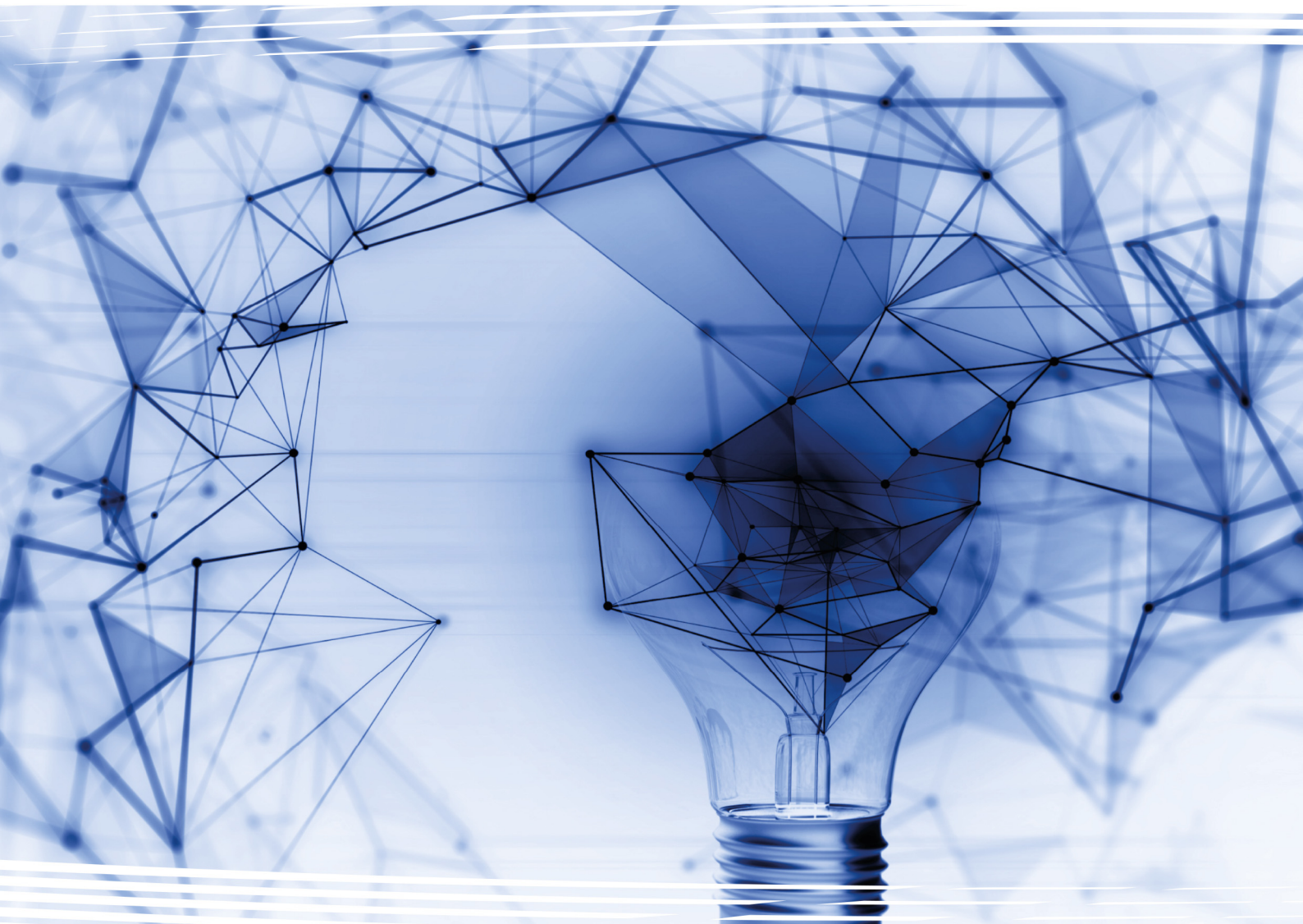
During the transitional period, described in Chapter 2, a mixed supply model can preserve competitiveness and RES development while minimising system and grid costs. Table 3 presents the contributions that auctions/'regulated' market sessions and PPAs can individually provide to the electricity market.

Table 3 - Impact of auctions/regulated market sessions and PPAs on the electricity market

TOOL	MARKET COMPETITIVENESS	CONTRIBUTION TO RES DEVELOPMENT	COST REFLECTIVE PRICING	CONTROL OF GEOGRAPHICAL DISTRIBUTION	MINIMISATION OF END-USERS COSTS
Auctions / Regulated market sessions	! Dependent on auction design and renewable energy access rules (e.g. demand access)	✓	! Auction price generally defined also taking into account the technologies costs	✓ By defining zonal quotas and/or zonal price adjustments	! Depends on the auction design - some schemes consider consumer surplus and/or savings on consumption
Power Purchase Agreements - PPAs (corporate /utilities)	✓	! Significant contribution only in markets with high RES liquidity (e.g. USA, Spain)	! Dependent on PPA and RES market liquidity, generation mix and market structure	x Plants typically not developed where most efficient for the grid (e.g. consumption in the North/production in the South)	✓

Source: AFRY experience on the market | Legend: ✓ high; x low; ! it depends

ANNEX B ANALYSES SUPPORTING THE DEVELOPMENT OF THE PROPOSAL



B.1 RES development mechanism

B.1.1 Auction mechanisms

The design of the MAVER (described in Section 2.1.1) was supported by a detailed benchmark analysis of the main RES auction mechanisms within the global landscape. The analysis is focused on those auction mechanisms that have effectively enabled the development of RES in their respective countries.

The collected lessons learnt (see Figure 25 for a summary and Annex B.1.1.2 for more details) have supported the design of some of the fundamental principles of the MAVER operation, such as:

- ♦ procurement through long-term contracts, as observed in all the mechanisms analysed, with durations from 8 to 30 years
- ♦ the presence of zonal RES quotas consistent with the development of the electricity system, as introduced by the mechanisms LTPA in Mexico and LTC Energia in Brazil, where zonal quotas are defined
- ♦ the presence of clear locational price signals, as introduced by the same LTPA mechanism in Mexico and LTC Energia mechanism in Brazil, through price differentiation on a zonal basis
- ♦ the access to both supply (generation) and demand (consumption), as provided by the LTPA mechanism in Mexico, which allows RES energy to be contracted directly between producers and consumers
- ♦ the presence of a central counterparty for counterparty risk management, as observed in all the analysed mechanisms, with the exception of the LTC Energia mechanism in Brazil
- ♦ the stimulus of flexibility demand, as done within the LTC Energia mechanism in Brazil where the criteria for selecting awarded plants are also based on the compatibility between generation profiles offered by plants and those required by buyers (DSOs in this case)

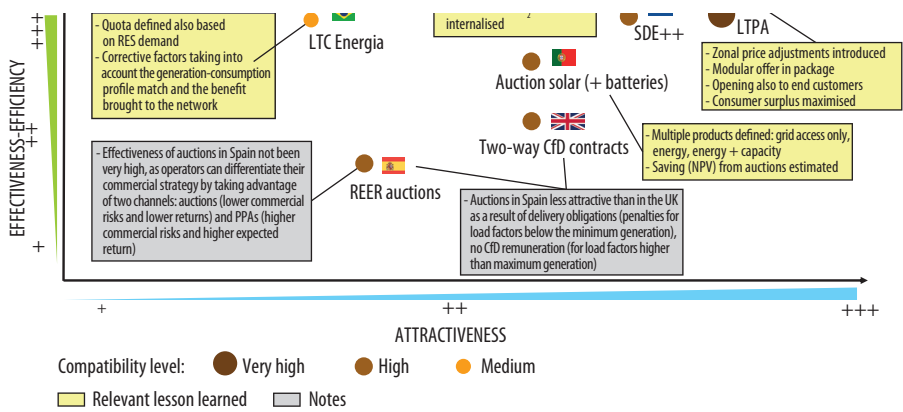


Figure 25
Main lesson learned from benchmarking RES auction mechanisms

Source: AFRY analysis | 1. Excluding residential utilities

The adopted methodology and the details resulting from the benchmark analysis are reported in Annex B.1.1.1 and Annex B.1.1.2 respectively.

B.1.1.1 Adopted methodology

To identify the best auction mechanisms, those set up by the most virtuous countries and most in line with the model objectives were analysed. Evaluation criteria were adopted such as attractiveness for the investor, effectiveness/efficiency for the system and compatibility with the Italian electricity system (see Figure 26 for details on the parameters and evaluation criteria adopted).

Figure 26 - Details on the methodology adopted for benchmarking RES auction mechanisms

PARAMETERS		EVALUATION CRITERIA								
Attractiveness	Type of product and volumes	+	- Based on energy as-produced (MWh) and/or capacity (MW) with production constraints (max/min) imposed on the operator							
		++	- Based on energy as-produced (MWh) and/or capacity (MW) with production constraints (max/min) chosen by the operator							
		+++	- Based on as-produced energy (MWh) and/or capacity (MW) without constraints							
Attractiveness	Remuneration	+	- Price risk and volume/imbalance risk for the producer (e.g. market sale without withdrawal guarantee)							
		++	- Price risk or volume/imbalance risk for the producer (e.g. sale at a fixed price, without withdrawal constraints)							
		+++	- No price risk or volume/imbalance risk for the producer							
Attractiveness	Counterparty risk	+	- Sale of energy to the market							
		++	- Sale of energy to a single counterparty (e.g. single supplier)							
		+++	- Sale of energy to multiple counterparties (e.g. multiple suppliers, end customers)							
Effectiveness-Efficiency	Contribution to RES/batteries development	+	- Below RES development expected by targets							
		++	- In line with RES development expected by targets							
		+++	- Above RES growth expected by targets							
Effectiveness-Efficiency	Degree of competition	+	- Offers below the quota. Prices higher than LCOE for the technology							
		++	- Offers in line with/slightly below the quota. Prices in line with LCOE of the technology							
		+++	- Offers above the quota. Prices below LCOE of technology							
Effectiveness-Efficiency	Impact on the system	+	- No zonal price signals (e.g. application of national quotas) and limited reduction in procurement costs (e.g. auctions for technology)							
		++	- Only zonal price signals (e.g. application of zonal quotas) or minimisation of procurement costs (e.g. technology neutral auctions)							
		+++	- Zonal price signals (e.g. application of zonal quotas) and minimisation of procurement costs (e.g. technology neutral auctions)							
Compatibility	Ease of implementation	+	- Mechanism never/ little used in Italy (e.g. auctions on suppliers)							
		++	- Mechanism partially implemented in Italy (e.g. two-way CfD but without cost control)							
Compatibility	Compatibility with the new model	+++	- Mechanism implemented in Italy (e.g. two-way CfD)							
			<table border="0"> <tr> <td>+</td> <td>- Meets 1 or no criteria</td> <td rowspan="3">} Criteria</td> <td rowspan="3">1. Flexibility (geographical and/or temporal) valorisation</td> <td rowspan="3">3. End customers /suppliers as buyers</td> </tr> <tr> <td>++</td> <td>- Meets 2 criteria</td> </tr> <tr> <td>+++</td> <td>- Meets at least 3 criteria</td> </tr> </table>	+	- Meets 1 or no criteria	} Criteria	1. Flexibility (geographical and/or temporal) valorisation	3. End customers /suppliers as buyers	++	- Meets 2 criteria
+	- Meets 1 or no criteria	} Criteria	1. Flexibility (geographical and/or temporal) valorisation	3. End customers /suppliers as buyers						
++	- Meets 2 criteria									
+++	- Meets at least 3 criteria									

Degree of advantageousness: +++ Very high ++ High + Medium

Source: AFRY

The following countries and relative auction mechanisms were analysed:

- ◆ Portugal: centralised RES auctions coupled with batteries
- ◆ Spain: two-way CfD scheme (REER auctions)
- ◆ United Kingdom: two-way CfD scheme
- ◆ Netherlands: one-way CfD scheme (SDE++ auctions)
- ◆ Mexico: long-term clean energy scheme (LTPA)
- ◆ Brazil: long-term clean energy scheme (LTC Energia)

B.1.1.2 Benchmark results

Portugal (centralised RES+batteries auctions)

The Portuguese auctions have effectively enabled the participation of RES plants coupled with batteries, thanks to mixed remuneration systems (Figure 27).

Figure 27 - Detailed results for the auction mechanism in Portugal

SOLAR AUCTIONS (+BATTERIES)		PARAMETERS	
General description - Type: centralised pay-as-bid auction - Participants: solar PV, solar PV + batteries (minimum battery capacity equal to 20% of solar capacity, minimum duration 1h) - Definition of quotas: national - Contract duration: 15 years - Three mechanisms: - i) Fixed compensation to the system (with merchant access) - ii) CfD model - iii) Flexibility option - Plants compete in the same auction, regardless of the chosen mechanism. Offers are classified according to the greatest saving for the electrical system (on an NPV basis) - Auctions guarantee the authorization for the connection to the grid for the awarded plants - Obtaining the permitting does not represent a constraint for the participation to auctions	Attractiveness	Type of product and volumes	+ - Product: i) N.d. (only access to grid connection); ii) Energy asproduced (MWh); + iii) Forward capacity (MW) and energy asproduced (MWh) - only with batteries + - Quota: 700 MW
		Remuneration	+ - i) Merchant, net of grid connection cost (€/MW); ii) Two-way CfD (€/MWh); iii) Remuneration of capacity (€/MW) + compensation paid to the system (€/MWh equal to $(P_{market} - P_{reference}) * 90% * Capacità\ quando\ P_{market} > P_{reference}$
		Counterparty risk	+ - i) Energy sale on the market by producers + - ii) and iii) Energy sale on the market by producers and management of remuneration/compensation through a centralised counterparty (REN)
	Effectiveness-Efficiency	Contribution to RES/batteries development	+ - Capacity awarded: 670 MW, 12% of the solar growth envisaged by target (+5.5 GW by 2030) + - COD by auction award: 4 years
		Degree of competition	+ - Operators' offers equal to about ten times the available quota + - Prices awarded: i) 74k€/MW (system compensation); ii) 11.14€/MWh iii) -37k€/MW (<0, system compensation). Solar LCOE expected in Portugal by 2022: ~35 €/MWh
		Impact on the system	+ - No price differentiation at the zonal level + - Minimisation of system costs (competition between different technologies) + - Prospective system savings estimated at 559m€ by the Portuguese government
	Compatibility	Ease of implementation	+ - As-produced energy-based products and forward capacities already used in Italy + - CfD mechanism and fixed remuneration already used in Italy + - Classification to be implemented based on "greater savings for the electrical system"
		Compatibility with the new model	+ - Expected valorisation of flexibility (solar + batteries) + - Classification of offers based on higher saving for the electrical system (control of the impact on the system)

Degree of advantageousness: +++ Very high ++ High + Medium

Source: AFRY analysis | 1. Reference price updated every 3 months by the Portuguese government and equal to the projected marginal cost of a CCGT; 2. Average value weighted on capacity

Spain (auctions for two-way CfD)

In Spain, mechanisms based on CfD and as-produced energy did not stimulate battery participation, as they could not allow effective arbitrage in the markets (Figure 28).

Figure 28 - Detailed results for the auction mechanism in Spain

REER AUCTIONS		PARAMETERS	
General description - Type: centralised pay-as-bid auction - Participants: onshore wind, offshore wind, solar PV, solar CSP, biomass, othertechnologies ¹ . Planned participation of plants coupled with batteries providing that only energy produced by the incentivised RES plant is stored - Contract duration: on national basis - Quotas: 15 years (biomass and biogas); 12 years (remaining technologies) - One auction round performed from 2020 to date - Separate auctions for different technologies with additional contingent on a technology-neutral basis - Obtaining the permitting does not represent a constraint for the participation to auctions	Attractiveness	Type of product and volumes	+ - Product: energy as-produced (MWh) + - Quota (1st round): 3 GW + - Profile: annual max/min load factor set per technology ²
		Remuneration	+ - Two-way CfD (€/MWh) with volatility adjustment: $P_{received} = P_{awarded} + Coeff_{adjustment} * (P_{market} - P_{awarded})$ + - Adjustment coefficient: 0.05 for solar PV and wind, 0.25 for other technologies
		Counterparty risk	+ - Energy sale to the market by producers and management of remuneration/compensation through a centralised counterparty (OMIE)
	Effectiveness-Efficiency	Contribution to RES/batteries development	+ - Capacity awarded: 1st round - 3GW (no batteries), 6% of the expected RES growth according to target (+51 GW by 2030) + - COD by auction award: 3 years - solar PV, 4 years - onshore wind
		Degree of competition	+ - Operators' offers equal to approximately three times the available quota + - Awarded prices: 25.6 €/MWh - onshore wind, 24.6 €/MWh - solar PV. Expected LCOE in Spain by 2022: ~35 €/MWh (solar), ~60 €/MWh (onshore wind)
		Impact on the system	+ - No price differentiation at zonal level + - Limited reduction in system costs (technologies compete in separate auctions; existence of additional auction with mixed quota)
	Compatibility	Ease of implementation	+ - As-produced energy-based products already used in Italy + - CfD mechanism already used in Italy
		Compatibility with the new model	+ - Obligation on minimum amount of energy to be injected and limit on maximum energy that can be incentivised

Degree of advantageousness: +++ Very high ++ High + Medium

Source: AFRY analysis | 1. Including biogas, hydropower, wave; 2. Penalty if energy produced < min, no remuneration for energy produced > max; 3. Weighted average value on capacity; 4. Access to batteries, but product type and remuneration not stimulating

United Kingdom (auctions for two-way CfD)

The mechanism used in the UK is hardly compatible with the model proposed by the study, failing to provide flexibility and zonal price signals (Figure 29).

Figure 29 - Detailed results for the auction mechanism in the UK

CFD CONTRACTS		PARAMETERS	
General description	<ul style="list-style-type: none"> - Type: centralised pay-as-bid auction - Participants: onshore wind, offshore wind, solar PV, other technologies¹ - Separate auctions for groups of technologies with similar costs (pot) - Quotas: on a national basis - Contract duration: 15 years - Limits on capacity and budget for each po defined by the UK government - Three auction rounds have been carried out from 2014 to date. Fourth round scheduled between December 2021 and May 2022 	Attractiveness	Type of product and volumes <ul style="list-style-type: none"> + - Product: energy as-produced (MWh) + - Quota and budget: quotas and/or budgets defined for each auction round
			Remuneration <ul style="list-style-type: none"> + - Two-way CfD (€/MWh) + - For future auctions, different remuneration systems are under discussion (e.g. reference price linked to forward seasonal prices; cap/floor prices)
			Counterparty risk <ul style="list-style-type: none"> + - Energy sale on the market by producers and management of remuneration/compensation through a centralised counterparty (LCCC)
		Effectiveness-Efficiency	Contribution to RES/batteries development <ul style="list-style-type: none"> + - Awarded capacity (per round): i) 2.1 GW; ii) 3.3 GW; iii) 5.8 GW (95% offshore wind); 38% of the offshore wind growth envisaged by target (+30 GW by 2030) + - COD by auction award: i) 2-5; ii) 4-5; iii) 4-6 years
			Degree of competition <ul style="list-style-type: none"> + - Offered discount² (offshore wind): i) 16%; (ii) 39%; (iii) 25% + - Awarded prices²: (i) £117.77/MWh; (ii); £62.14/MWh (iii) £40.81/MWh. Expected LCOE for offshore wind in the UK by 2022: ~£55/MWh
			Impact on the system <ul style="list-style-type: none"> + - No price differentiation at zonal level - Limited reduction in system costs (technologies compete in separate auctions)
		Compatibility	Ease of implementation <ul style="list-style-type: none"> + - As-produced energy-based products already used in Italy + - CfD mechanism already used in Italy
			Compatibility with the new model <ul style="list-style-type: none"> + - Control of the incentive level (defined budget at each auction round)

Degree of advantageousness: +++ Very high

++ High + Medium

Source: AFRY analysis | 1. Including biomass and wind farms on remote islands; 2. Average value weighted on capacity

Netherlands (SDE++)

In the Netherlands, the use of emission abatement cost as a selection parameter has increased the level of competition between different technologies (Figure 30).

Figure 30 - Detailed results for the auction mechanism in the Netherlands

SDE++		PARAMETERS	
General description	<ul style="list-style-type: none"> - Type: centralised downward auction of pay-as-bid type repeated annually - Contract duration: 8-15 years depending on the type of plant - Participants: intermittent RES, hydroelectric, geothermal, biomass, CCS, electrolysis, demand - Quotas: on a national basis - Improvement of the previous SDE+ auction system, open only to RES - Merit curve built on the basis of unit cost for avoided CO2 emissions. - Defined maximum offer limit for each admitted technology - Allocation of the incentive until the budget exhaustion for each auction session - Possible application of a capacity cap for a specific technology at the Government discretion to ensure that all sectors achieve the set goals 	Attractiveness	Type of product and volumes <ul style="list-style-type: none"> + - Product: energy as-produced (MWh) or CO₂ emissions avoided (tCO₂) + - Budget: 5 billion euros planned for the first auction (November 2020) - Profile: imposed maximum annual load factor per technology
			Remuneration <ul style="list-style-type: none"> + - One-way CfDs (€/MWh) in addition to the expected revenue from the market sale + - Maximum incentive amount determined annually on the basis of standard generation profiles
			Counterparty risk <ul style="list-style-type: none"> + - Energy sale on the market and management of remuneration/compensation through a centralised counterparty (RVO)
		Effectiveness-Efficiency	Contribution to RES/batteries development <ul style="list-style-type: none"> + - Awarded capacity: 1st round-3.6 GW (solar and onshore wind), +20% RES growth from 2020. + - Growth above the average annual contribution expected in order to reach the 2030 generation target
			Degree of competition <ul style="list-style-type: none"> + - Operators' offers equal to about 1.3 times the budget for the first auction
			Impact on the system <ul style="list-style-type: none"> + - No price differentiation at zonal level + - Minimisation of system costs (competition between different technologies)
		Compatibility	Ease of implementation <ul style="list-style-type: none"> + - CO₂ emissions avoided product to be implemented + - Annual emission reduction targets to be defined at zonal level - Conversion coeff. to be established for technology and for standard plant performance
			Compatibility with the new model <ul style="list-style-type: none"> + - Expected enhancement of flexibility + - Limit to maximum energy that can be incentivised + - Control of the incentive level (defined budget at each auction round)

Degree of advantageousness: +++ Very high

++ High + Medium

Source: AFRY analysis

Mexico (long-term auctions for clean energy)

The definition of quotas and supply correction coefficients on a zonal basis adopted in Mexico (Figure 31) favour RES growth coordinated with grid development.

Figure 31 - Detailed results for the auction mechanism in Mexico

LT CLEAN ENERGY AUCTION		PARAMETERS		
General description	<ul style="list-style-type: none"> - Type: centralised competitive pay-as-bid auction with nodal price - Participants: <ul style="list-style-type: none"> - Capacity: all technologies - Energy: RES and lowemission technologies - Green Certificates (CELS): RES and lowemission technologies - Single or multi-product offer - Quotas: on a zonal basis - Price defined for the entire package offered, with offer that can be conditioned on the assignment of all or some of the products offered - The awarded product can be delivered with different plants in the portfolio - Contract duration: 15 years - capacity and energy; 20 years - green certificates - Auctions launched by CFE following RES penetration obligations introduced by the Energy Transition Law - Three auctions (2015, 2016, 2017) 	Attractiveness	Type of product and volumes	+ - Product: flexible, one or more products between: capacity, energy, green certificates + - Quota: zonal quotas per product as per suppliers/DSO's request - Profile: max/min energy limits and resulting certificates as per operator offer
			Remuneration	+ - PPA at a fixed price (€/MWh) per year + - Zonal correction coefficients considered only in the selection mechanism - Stringent penalties in case of under delivery
			Counterparty risk	+ - Energy sale to a centralised counterparty (CFE) and/or interested private buyers (admitted from the third auction) with the participation of a centralised mediation entity as a <i>Clearing House</i>
		Effectiveness-Efficiency	Contribution to RES/batteries development	+ - Awarded capacity: 7 GW, +200% compared to total installed RES in 2015 (year of the first auction) + - COD by auction award: entry into service within 3 years, first auctions in 2015
			Degree of competition	+ - Operators' offers above the quota available in all auctions + - awarded prices ² : 20 USD/MWh for solar systems in the last auction. Expected LCOE for solar in Mexico by 2022: >40 USD/MWh
			Impact on the system	+ - Zonal price differentiation + - Minimisation of system costs (competition between different technologies)
		Compatibility	Ease of implementation	+ - Product with multi-product package to be implemented - Zonal quotas to be defined on the basis of the expected growth of RES penetration
			Compatibility with the new model	+ - Access also allowed to private buyers of renewable energy + - Limits on minimum input obligations and maximum energy that can be incentivised + - Withdrawal of contracted energy by supplier and end customers

Degree of advantageusness: +++ Very high ++ High + Medium

Source: AFRY analysis | 1. In the case of under-delivery, the producer must pay the offtaker the baseload market price; 2. Average value weighted on capacity

Brazil (long-term auctions for clean energy)

The control of the demand requirements and transmission grid constraints used in the Brazilian model are potential success factors for short-term RES growth (Figure 32).

Figure 32 - Detailed results for the auction mechanism in Brazil

LTC ENERGIA		PARAMETERS		
General description	<ul style="list-style-type: none"> - Type: centralised competitive pay-as-bid auction - Contract duration: 20-30 years - Participants: RES and thermal capacity - Quotas: on a zonal basis - Two types of auctions: A-3 and A-5, with 3 and 5 year delivery respectively - Auctions launched to stimulate new generation capacity in response to growing demand - Participation: decided by MME and ANEEL, single, mixed or neutral technology auctions - Awarded entities selected on the basis of a cost-benefit index that incorporates: <ul style="list-style-type: none"> - expected value of renewable electricity based on its geographical location, time profile and seasonal profile - compatibility between the production profile of the plant and the contracted demand profile 	Attractiveness	Type of product and volumes	+ - Product: energy as-produced (MWh) + - Quota: demand forecasts from suppliers, considered network transmission limits - Profile: annual max/min load factor imposed
			Remuneration	+ - PPA (€/MWh) + - Adjustment of the offer to consider benefit for the system during the selection phase
			Counterparty risk	+ - Energy sale to the supplier/ distributor and management of remuneration by producers (contract signed directly with the distributor / supplier)
		Effectiveness-Efficiency	Contribution to RES/batteries development	+ - Awarded capacity : +40% solar from 2014 to 2019, + 10.4 GW onshore wind. + - COD by auction award: delivery at 3 or 5 years depending on the type of auction
			Degree of competition	+ - Awarded prices: decreasing trend shown; last auctions concluded at an average offered price of 28 USD/MWh lower than LCOE level
			Impact on the system	+ - Zonal price differentiation + - Minimisation of system costs (competition between different technologies)
		Compatibility	Ease of implementation	+ - Supplier auction mechanism never used in Italy - Zonal quotas and cost-benefit indexation mechanism to be defined
			Compatibility with the new model	+ - Limits on minimum input obligations and maximum energy that can be incentivised + - Withdrawal of contracted energy by supplier + - Control of assigned capacity in line with growing demand and network limits

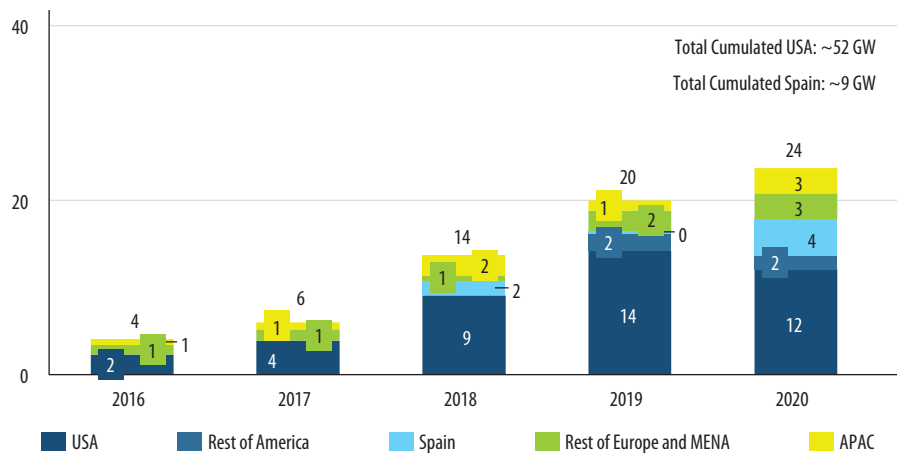
Degree of advantageusness: +++ Very high ++ High + Medium

Source: AFRY analysis

B.1.2 PPA mechanisms

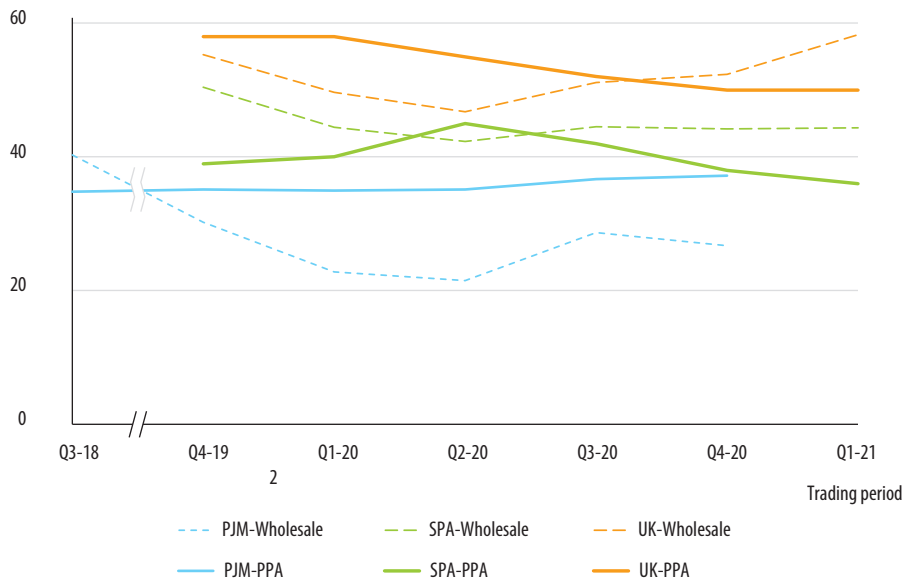
The following benchmarking of PPA markets, and related lessons learned (see Annex B.1.2.1 and Annex B.1.2.2), supported the design of the PPA Platform described in Section 2.1.3. The analysis is focused on those markets where PPAs effectively enabled the development of RES, such as Spain and the United States, markets characterised by low wholesale prices and high liquidity of renewables (see Figure 33 and Figure 34).

Figure 33
Evolution of corporate PPA¹ - GW



Source: AFRY elaboration on BloombergNEF data | 1. Data do not include onsite PPA and Australian sleeved PPA

Figure 34
Comparison of PPA and forward¹ prices in the PJM, Spain and UK markets - (EUR/\$)/MWh



Source: AFRY elaboration on Refinitiv data | 1. Average Cal+1,+2,+3

The lessons learnt have supported the design of some of the fundamental principles of the PPA platform such as:

- ♦ procurement through long-term contracts, as observed in both the Spanish and US markets, with average durations between 5 and 15 years
- ♦ the presence of clear locational price signals, as in the US market, where contracted energy prices reflect the relevant nodal prices
- ♦ the presence of a central counterparty for the management of counterparty risk, as observed in the Spanish market, where corporate contracts can benefit from financial guarantees through a centralised entity

- ♦ the transfer of the economic advantages of RES, as occurred in both the Spanish and US markets, where the high liquidity of the supply allowed the contractualisation of PPAs at prices in line with the LCOE of RES technologies

B.1.2.1 Adopted methodology

In order to identify the best solutions for the new market model, the characteristics of the PPA markets were analysed, taking into account the most virtuous countries and those most in line with the model’s objectives. The PPA markets found to be the most virtuous in these terms, and considered within the benchmark, were those of Spain and the United States. As with the auction mechanisms, the PPA mechanisms were evaluated according to criteria of attractiveness, effectiveness/efficiency and compatibility with the model proposed by the study (see Figure 35 for details on the parameters and evaluation criteria used).

Figure 35 - Detail of the methodology adopted for benchmarking the PPA markets

PARAMETERS		EVALUATION CRITERIA			
Attractiveness	Type of product and volumes	+ - Delivery volume and profile obligations ++ - Delivery volume obligations (on an annual/quarterly basis) but no profile obligations +++ - As-produced (MWh) – without delivery volume and profile obligations			
	Remuneration	+ - Price risk and volume/imbalance risk for the producer (e.g. indexed price sale, no withdrawal guarantee) ++ - Price risk or volume/imbalance risk for the producer (e.g. fixed price sale, without withdrawal constraints) +++ - No price risk or volume/imbalance risk for the producer (e.g. fixed price sale, with withdrawal guarantee)			
	Counterparty risk	+ - Energy contracted mainly with Corporate customers ++ - Energy contracted mainly with Utility customers without financial guarantees for Corporate +++ - Energy contracted mainly with Utility customers and with financial guarantees for Corporate			
Effectiveness-Efficiency	Contribution to RES/batteries development	+ - Below RES development expected by targets ++ - In line with RES development expected by targets +++ - Above RES growth expected by targets			
	Degree of competition	+ - Prices higher than LCOE for the technology ++ - Prices in line with LCOE for the technology +++ - Prices below LCOE for the technology			
	Impact on the system	+ - No zonal/nodal price signals (as network needs), no direct access local community/community aggregator ++ - Zonal/nodal price signals (as network needs) or direct local community/community aggregator access +++ - Zonal/nodal price signals (as network needs) and direct local community/community aggregator access			
Compatibility	Ease of implementation	+ - Mechanism never used in Italy ++ - Mechanism partially implemented in Italy +++ - Mechanism implemented in Italy			
	Compatibility with the new model	+ - Meets 1 criterion ++ - Meets 2 criteria +++ - Meets at least 3 criteria	<table border="0"> <tr> <td style="vertical-align: middle;">} Criteria</td> <td style="vertical-align: middle;">1. Possibility of centralised PPA procurement 2. Centralised entity for financial guarantees 3. Possibility of standard profiles</td> <td style="vertical-align: middle;">4. Possibility of access to local community/community aggregator</td> </tr> </table>	} Criteria	1. Possibility of centralised PPA procurement 2. Centralised entity for financial guarantees 3. Possibility of standard profiles
} Criteria	1. Possibility of centralised PPA procurement 2. Centralised entity for financial guarantees 3. Possibility of standard profiles	4. Possibility of access to local community/community aggregator			

Degree of advantageousness: +++ Very high ++ High + Medium ! Variable

Source: AFRY analysis

B.1.2.2 Benchmarking results

Spain

In Spain, PPAs are mainly signed with utilities. Corporate contracts can benefit from financial guarantees provided by centralised entities (Figure 36).

Figure 36 - Detailed results for the PPA market in Spain

PPA		PARAMETERS	
General description	- Type: i) Physical: energy physically exchanged through the network ii) On-site: energy exchanged directly between producer and offtaker through private network iii) Virtual: energy not physically exchanged - Contract duration: 10+ years	Attractiveness	Type of product and volumes ! - Product: according to the contract. Typically energy as-produced or delivery volume obligations (MWh) (usually as % of the total volume, the rest sold as merchant) - Profile: according to the contract
			Remuneration ! - Price: i) and ii) usually fixed price (€/MWh); iii) usually CfD (€/MWh) - Withdrawal constraints: according to the contract
			Counterparty risk + - Bilateral contracts, mainly between producer and Utility + - Possibility for Corporate contracts to have financial guarantees through a centralised body +
		Effectiveness-Efficiency	Contribution to RES/batteries development + - Installed capacity: 11 GW (from 2017, 85% solar, 9% onshore wind), 18% of the RES growth foreseen by target (+62 GW from 2017 to 2030) + +
			Degree of competition + - Awarded prices ¹ : 36 €/MWh (solar)-2020. Estimated LCOE in Spain by 2022: 35 €/MWh (solar) + - Competition: 22% capacity covered by first two players, 85% by first twenty players +
			Impact on the system + - No zonal/nodal price signals (in line with network needs), no direct access local community/community aggregator
		Compatibility	Ease of implementation + - Similar PPA mechanisms already implemented in Italy + +
			Compatibility with the new model + - Centralised institution for financial guarantees + - Possibility of standard profiles, defined bilaterally

Degree of advantageousness: +++ Very high ++ High + Medium ! Variable

Source: AFRY analysis | 1. Average value weighted on capacity

Spanish PPAs show significant growth since 2018, supported by high RES availability, low prices and reduced counterparty risks.

PPA projects identified by AFRY in Spain amount to around 11GW to date (Figure 37) 84% of the signed contracts are Utility type, 16% Corporate type.

The high liquidity of RES and new projects, the availability of low-cost green power (LCOE among the lowest in the EU) for consumers, limited grid constraints, and availability of credit guarantees are the main drivers of the growth of this contracting methodology:

- ♦ PPA prices today are around 28-35€/MWh
- ♦ the prices awarded in RES auctions in January 2021 in Spain reached values of €24-25, below the average prices observed so far in PPAs

In June 2020, the Spanish government set a guarantee credit fund for PPAs of €600m for the next 3 years. The European Commission approved the scheme in January 2021.

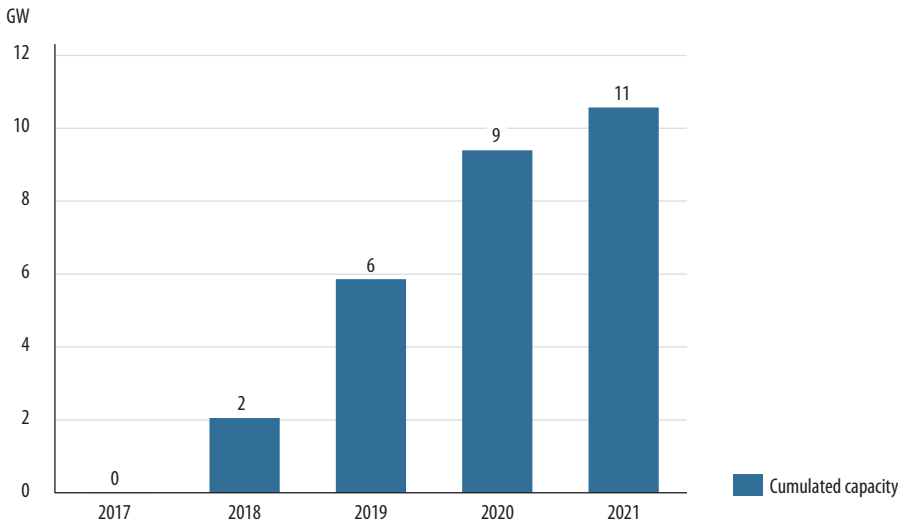


Figure 37
Evolution of PPA contracts in Spain - GW

Source: AFRY analysis

United States of America

In the USA, the sale of RES energy through PPAs is also made accessible to energy communities through CCAs (Figure 38).

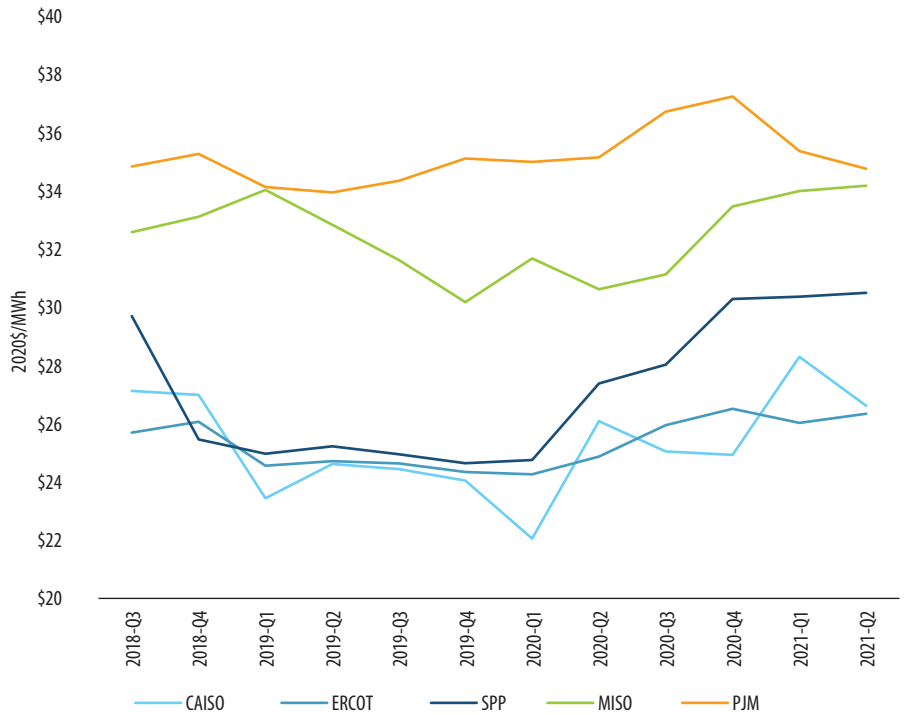
Figure 38 - Detailed results for the PPA markets in the United States

PPA		PARAMETERS	
General description	- Type: i) Physical: energy physically exchanged through the network ii) Virtual: energy not physically exchanged - Contract duration: 5-15 years	Attractiveness	Type of product and volumes ! - Product: according to the contract. Typically energy as-produced or delivery volume obligations (MWh) and RECC exchange possibilities - Profile: according to the contract
			Remuneration ! - i) usually through fixed price (€/MWh); ii) usually through a mixed mechanism: % energy at fixed price, % energy at indexed price (€/MWh) - Withdrawal constraints: according to the contract
			Counterparty risk + - Bilateral contracts, mainly between producer and Corporate - Contracts with Utility are more common in vertically integrated markets (e.g. non-ISO) to meet RES supply obligations (limited % of total energy)
		Effectiveness-Efficiency	Contribution to RES/batteries development + + + - Installed capacity: 60 GW (solar and onshore wind, since 2008), 31% of installed onshore solar and wind capacity by 2020
			Degree of competition + + + - Registered prices: 32 USD/MWh (solar), 31 USD/MWh (onshore wind)-2020. LCOE estimated in US by 2020: 34 USD/MWh (solar), 29 USD/MWh (onshore wind)
			Impact on the system + + + - Nodal price signals (in line with network needs) - Access to PPA for community aggregators (CCA)
		Compatibility	Ease of implementation + + - Similar PPA mechanisms already implemented in Italy
			Compatibility with the new model + + + - Possibility of centralised PPA procurement - through obligations on utilities - Possibility of access to community aggregators - Possibility of standard profiles, defined bilaterally
Degree of advantageousness: +++ Very high ++ High + Medium ! Variable			

Source: AFRY analysis, Lawrence Berkeley National Laboratory, LevelTen Energy | 1. Average of the 25th percentiles of PPA prices offered in the CAISO, ERCOT, SPP, MISO, PJM markets via LevelTen Energy's PPA platform

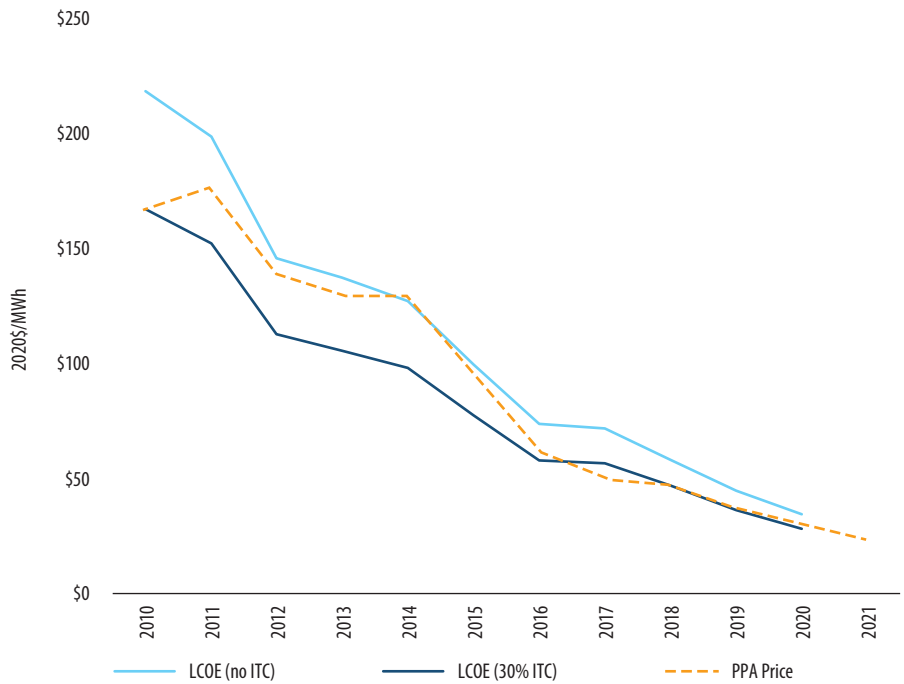
On average in the US, solar PPA prices are strongly correlated to LCOE values for solar projects (Figure 39 and Figure 40).

Figure 39
Evolution on PPA price for the USA market¹



Source: LevelTen Energy | 1. 25th percentile of PPA prices offered through LevelTen Energy's PPA platform

Figure 40
Evolution of solar LCOE in the USA market



Source: Lawrence Berkeley National Laboratory

B.1.3 Retailer obligation mechanisms

Mechanisms for introducing retailers' mandatory shares (provided for in the identified market model, in order to promote RES development together with the PPA Platform, as described in Section 2.1.3) have already been introduced in the past in advanced markets such as California and the UK. In these markets, properly designed and progressively upgraded retailers mandatory shares have enabled a rapid growth of renewable development.

Details on the lessons learned from the experiences in the Californian and UK markets are presented below.

Renewable Portfolio Standard (RPS) in California

Since 2013, the *Renewable Portfolio Standard (RPS)* programme has introduced mandatory shares for retailers, which are imposed a minimum supply of electricity from renewable generators identified as eligible.

The mandatory shares were gradually defined by the Californian government and progressively updated, in order to avoid risks of overpricing and distortionary effects. The initial target was to achieve 33% RES energy of energy volumes sold by 2020, and it was easily achieved two years ahead of schedule (Figure 41).

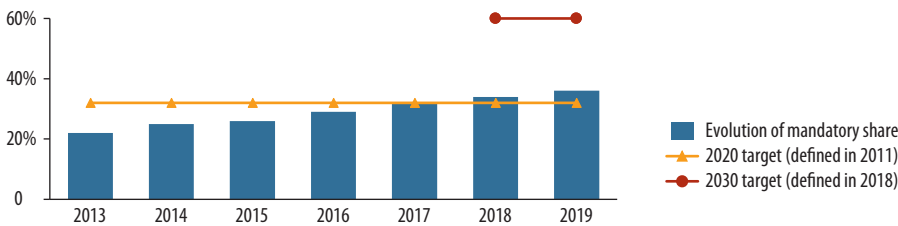


Figure 41
Evolution of mandatory shares and targets in the *Renewable Portfolio Standard* programme in California

Source: AFRY analysis on California Energy Department data

The Californian experience shows that these mandatory shares have helped to effectively kick-start the development of RES in the market, thanks also to the introduction of financial credit mechanisms for investors.

Renewable Obligations (ROC) in the United Kingdom

Similarly in the UK, the *Renewables Obligation (RO)* – mandatory share of renewable energy for suppliers similar to the Green Certificates – was the main government policy driving the rapid increase in renewable capacity deployment, between April 2002 and April 2017 (Figure 42).

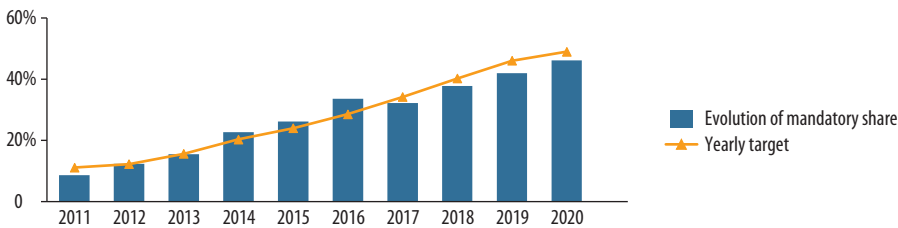


Figure 42
Evolution of mandatory shares and targets in the *Renewable Obligations* programme in the UK

Source: AFRY analysis on BEIS data

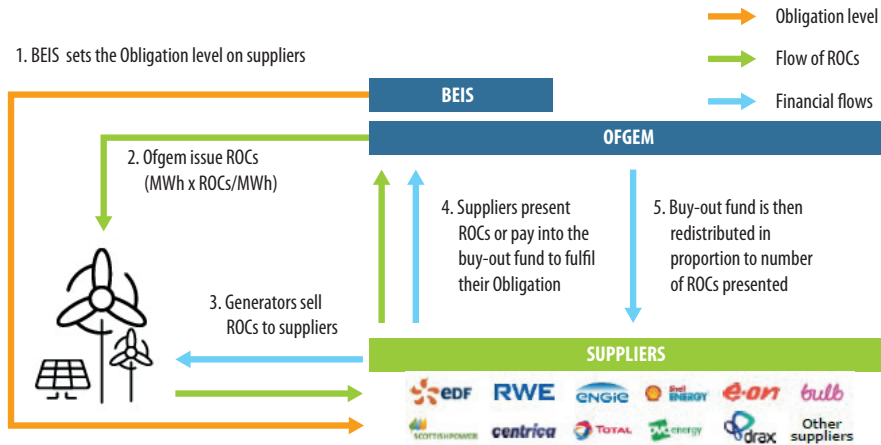
The mandatory share quota is updated by the Department of Business, Energy and Industrial Strategy (BEIS), excluding 85% of the expected demand of energy-intensive customers from the calculation of eligible demand subject to obligation, in order to preserve the competitiveness of the industrial sector.

The RO is a green certificate scheme that provides an eligible generator with renewable energy obligation certificates (ROCs) that it can sell to "under-performing" suppliers (Figure 43). The RO is now closed to new capacity but will continue to operate until 2037, providing support to the 35 GW of renewable capacity currently enrolled in the scheme. These generators will receive support until 2027 or 20 years after accreditation.

There is a legal obligation for accredited suppliers to meet a specified proportion of their electricity supply with RDCs or to pay the buy-out fund based on their deficit. This specified proportion is called the “obligation level” (ROC/MWh).

The obligation level is set by the Department of Business, Energy and Industrial Strategy (BEIS) through the “headroom” mechanism, six months before each annual obligation period (each financial year, April to March). The government forecasts ROC supply and eligible demand taking into account a 10% buffer.

Figure 43
Operating diagram of the Renewable
Obligation Certificate in the UK



Source: AFRY analysis

B.2 Forward products in relevant European markets

The following benchmark of European forward products for ancillary services supported the preliminary proposal of products for the Italian market, presented in Table 1. In particular, the analysis supported some of the identified products, such as:

- ♦ The primary reserve product, which turns out to be in line with what is already in use in the UK with the FFR product, except for the remuneration of energy, which is not envisaged for the Italian case, since the remuneration of capacity alone is more in line for a product such as primary regulation, characterised by a short-term service
- ♦ The secondary reserve product, which is in line with what is already in use in the UK with the Fast Reserve product
- ♦ The tertiary reserve product, which conforms to the mFRR and RR products used in France
- ♦ The inertia regulation product, which conforms to the experimental NOA Stability Pathfinder programme adopted in the UK, except for the remuneration of energy, as remuneration of capacity alone is more in line for a power product such as the inertia regulation product

The methodology used (Annex B.2.1) and the details of the benchmark results (Annex B.2.2) are shown below.

B.2.1 Adopted methodology

The forward product proposal was defined based on the existing products observed within the benchmark and their possible application to the Italian MSD market. The analysis focused on forward products used for frequency regulation (such as primary, secondary, tertiary reserve and inertia regulation) and voltage regulation (such as services for absorption/supply of reactive power), which are considered to be of greater relevance within the Italian ancillary services context.

B.2.2 Benchmarking results

Germany

In Germany, services are not supplied for longer than a week (Figure 44).

Figure 44 - Characteristics of the main ancillary services in Germany

	SERVICES			
	Primary frequency reserve	Secondary frequency reserve	Tertiary frequency reserve	Outage
Products	- FCR	- aFRR	- mFRR	- Interruptibility service: immediate/fast
Remuneration	- Capacity	- Capacity - Energy	- Capacity - Energy	- Capacity
Start of procurement	- One day before	- One day before	- One day before	- One week before
Auction interval Contract duration	- Daily auctions - 4 hours	- Daily auctions - 4 hours	- Daily auctions - 4 hours	- Weekly auctions - 1 - 2 weeks
Minimum capacity	- 1 MW	- 1 MW	- 1 MW	- 5 MW (max of 200 MW)
Activation times	- < 30 sec	- < 5 min	- < 15 min	- Immediate: < 350 msec - Fast: < 15 min
Delivery times	- > 15 min	- > 45 min	- > 60 min ¹	- 3 different options ²
Enabled technologies	- Thermal, RES, storage, DSR, distributed generation	- Thermal, RES, storage, DSR, distributed generation	- Thermal, RES, storage, DSR, distributed generation	- DSR

Source: Regelleistung, ENTSO-e | 1. Several hours in case of demand - emergency 2. a) min 15min, max 60min per day for at least 4 days/week; b) continuously for 4 hours, once a week; c) continuously for 8 hours, once every fortnight

France

In France, spot services are complemented by medium-term (annual) services such as tertiary reserve and load interruptibility services (Figure 45)

Figure 45 - Characteristics of the main ancillary services in France

	SERVICES			
	Primary frequency reserve	Secondary frequency reserve	Tertiary frequency reserve	Outage
Products	- FCR	- aFRR	- mFRR - RR	- Interruptible Load Programme
Remuneration	- Capacity	- Capacity - Energy	- Capacity - Energy	- Capacity
Start of procurement	- One day before	- One day before	- Several months before	- One month before
Auction interval Contract duration	- Daily auctions - 4 hours	- Daily auctions - 1 day	- Annual auctions - 1 year	- Annual auctions - 1 year
Minimum capacity	- 1 MW	- 1 MW	- 10 MW	- 25 MW
Activation times	- < 30 sec	- < 15 min	- mFRR: < 15 min - RR: < 30 min	- 5 sec
Delivery times	- > 15 min	- No limit	- mFRR: > 2 hours - RR: > 1.5 hours	- Up to 7500 hours/year
Enabled technologies	- Thermal, RES, storage, DSR, distributed generation	- Thermal, RES, storage, DSR, distributed generation	- Thermal, RES, storage, DSR, distributed generation	- DSR

Source: RTE, ENTSO-e

United kingdom

The UK market represents the most advanced model of hybridisation of short- and long-term procurement (Figure 46).

Figure 46 - Characteristics of the main ancillary services in the UK (1/2)

	SERVICES		
	Primary frequency reserve	Secondary frequency reserve	Load increase
Products	- FCR <i>It will be gradually replaced by Dynamic Containment (procurement day-ahead)</i>	- Fast Reserve	- Demand Turn Up (increase in demand or reduction in generation)
Remuneration	- Capacity - Energy	- Capacity - Energy	- 2 options: Capacity (<i>Fixed route</i>) or Energy (<i>Optional route</i>)
Start of procurement	- One month before	- One month before	- <i>Fixed route</i> : 3 months before - <i>Optional route</i> : variabile
Auction interval Contract duration	- Monthly auctions - from 1 to 24 months	- Monthly auctions - months	- <i>Fixed route</i> : annual auctions - months - <i>Optional route</i> : based on availability-hour windows - 1 MW
Minimum capacity	- 1 MW	- 25 MW	
Activation times	- < 10-30 sec depending on the service ¹	- < 2 min	- Based on the technical capabilities of the plant
Delivery times	- > 20 sec, 30 min, indefinite time depending on the service ¹	- > 15 min	- Based on the technical capabilities of the plant
Enabled technologies	- Thermal, RES, storage, DSR, distributed generation	- Thermal, RES, storage, DSR, distributed generation	- Thermal, RES, storage, DSR, distributed generation ²

Source: National Grid | Note: Non-exhaustive list of balancing services on the market | 1. Non-Dynamic Response, Dynamic Response (within it, different for Primary/Secondary/High Voltage Response); 2. Units providing Demand Turn Up cannot provide other balancing services

It also introduces innovative services aimed at maximising the use of available resources (Figure 47).

Figure 47 - Characteristics of the main ancillary services in the UK (2/2)

	SERVICES		
	Voltage regulation	Inertia regulation	Congestion management
Products	- NOA High Voltage Pathfinder (reactive power absorption)	- NOA Stability Pathfinder (inertial response)	- NOA Constraint Management Pathfinder (risoluzione delle congestioni)
Remuneration	- 2 options: Capacity or Capacity+Energy	- Capacity - Energy	- 2 options: Capacity or Capacity+Energy
Start of procurement	- One year before	- One year before	- One year before
Auction interval Contract duration	- Annual auctions - from 1 to 10 years	- Annual auctions - from 1 to 10 years	- Annual auctions - from 1 to 10 years
Minimum capacity	- 15 MVar (reactive power absorption), connected to the network $\geq 33kV$	- ≥ 1.5 p.u. of the available power (MVA), connected to HV network	- > 200 MW
Activation times	- < 2 min	- N.d.	- < 150 msec
Delivery times	- Availability for the duration of the contract, 24/7	- > 0.5 sec	- > 2 h
Enabled technologies	- Technologies that meet technical requirements	- Technologies that meet technical requirements	- Technologies that meet technical requirements

Source: National Grid | Note: non-exhaustive list of balancing services on the market

Ireland

Ireland turned to innovative long-term products to supplement the most available resources (Figure 48).

Figure 48 - Characteristics of the main ancillary services in Ireland

	SERVICES		
	Inertia regulation		Voltage regulation
Products	- FRR	- SIR	- SSRP
Remuneration	- Energy	- Energy	- Energy
Start of procurement	- Several months before	- Several months before	- Several months before
Auction interval Contract duration	- Annual auctions - 5-6 years	- Annual auctions - 5-6 years	- Annual auctions - 5-6 years
Minimum capacity	- N.d.	- N.d.	- N.d.
Activation times	- < 10 sec	- Seconds	- Seconds
Delivery times	- Seconds	- Seconds	- Minutes
Enabled technologies	- Thermal, wind, storage, DSR, synchronous compensators, interconnectors (VSC and LCC), aggregators	- Thermal, hydroelectric, storage ¹ , synchronous compensators	- Thermal, hydroelectric, wind, storage ² , synchronous compensators, interconnectors (VSC)

Source: EirGrid | Note: non-exhaustive list of balancing services on the market | 1. Pumping only and Compressed Air Energy Storage; 2. Pumping only, solid-state batteries (e.g. Lithium) and Compressed Air Energy Storage

B.3 Renewable Energy Communities (RECs): the success in the United States

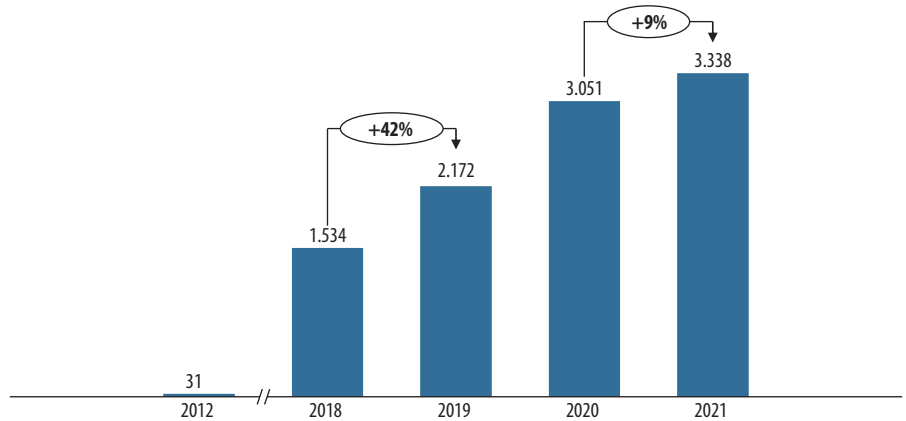
As explained in Section 2.4, the new design must ensure the active participation of the demand in the markets, through dedicated programmes for the development of RECs that enable demand to procure/sell RES energy at competitive prices through long-term contracts.

RECs can contribute to RES and PPA development if supported with programmes and incentives. The US markets are an example of how proper planning at the regulatory level can enable the effective development of distributed RES through:

- ♦ net metering schemes, the main driver of growth, and obligations to switch to RECs for individual entities that can no longer use virtual net metering
- ♦ possibility of long-term contracts (PPAs) by local communities through investor-owned utilities (IOUs), with exchange of renewable energy certificates (RECs)
- ♦ launch of dedicated government programmes, such as:
 - *Green Tariff Shared Renewable Program* (California), through which eligible consumers can purchase 50% to 100% of their consumption through renewable energy, directly from the developer, against receipt of RECs (exchangeable with utilities)
 - *Opt-out pilot programme* (New York), through which municipalities can directly procure renewable energy for their citizens, through dedicated tenders, without intercession from utilities

RECs are included in the US regulatory framework under the *Community Solar* (CS) scheme, which identifies any solar project, or purchase programme, in which the benefits from the installation are shared by multiple customers who purchase or lease a portion of the CS project, receiving credit for their share of generation. The *Community Solar* programme has enabled the installation of more than 3 GW of new solar capacity by 2021 (Figure 49), with a further 4 GW expected within the next 5 years.

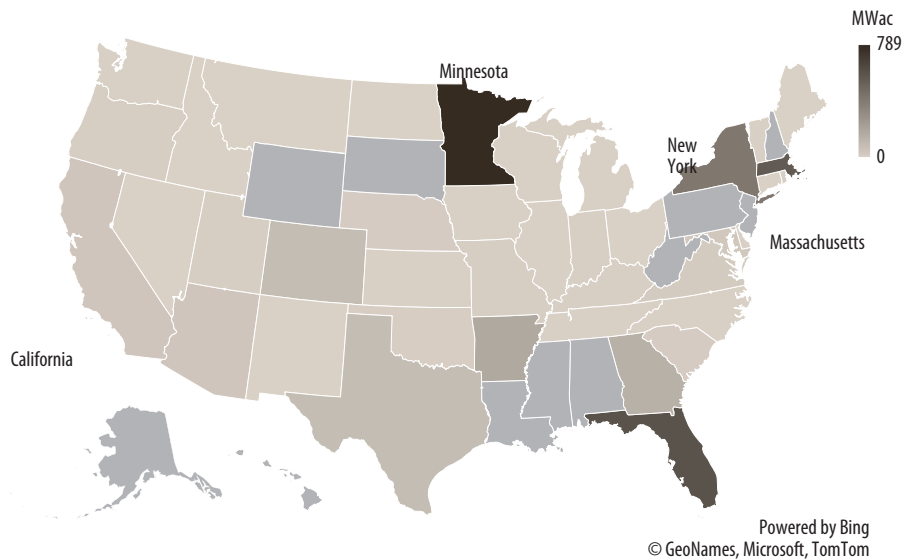
Figure 49
Total new solar capacity installed in the United States through the Community Solar programme (MW)



Source: AFRY elaborations on SEIA (Solar Energy Industries Association)

Minnesota, Massachusetts, California and New York are the leading states in terms of capacity developed through CS (Figure 50). The extent of capacity development by CS does not always correspond to the availability of solar irradiation (e.g. Minnesota), demonstrating that the deployment of distributed plants in the REC context is enabled by targeted policies.

Figure 50
Community Solar's installed capacity in 2020



Source: National Renewable Energy Laboratory

Community Solar in Minnesota

Minnesota and Massachusetts are among the leaders in the *Community Solar* mechanism due to the adoption of strong support policies.

Minnesota has the largest CS installed capacity (Figure 51) due to the easy and inclusive subscription service enabled by virtual net metering that is supported by *Xcel Energy* (investor-owned utility - IOU). There is also no limit to the installed capacity.

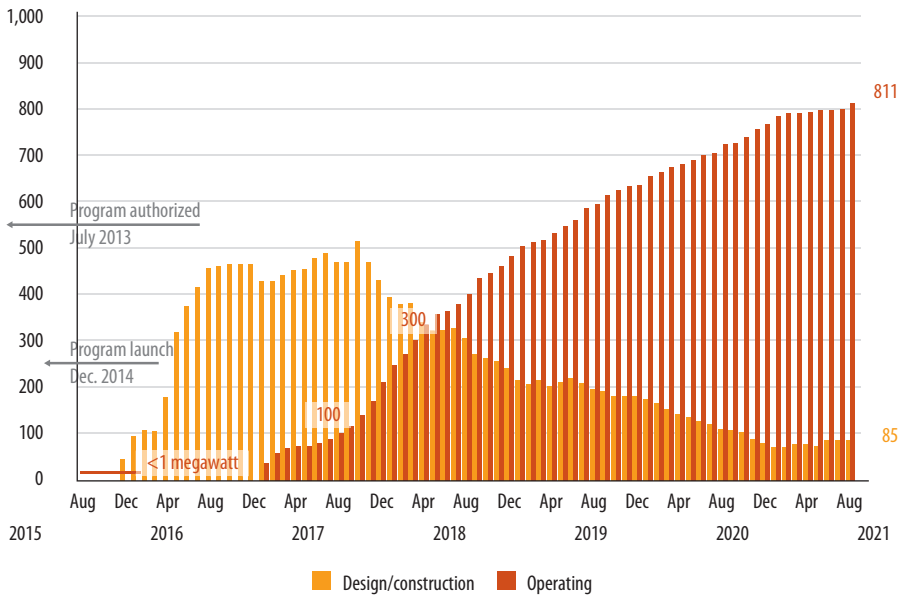


Figure 51
Evolution of *Community Solar* capacity in Minnesota (MW)

Source: Institute for Local Self-Reliance

Community Solar in Massachusetts

Massachusetts has implemented enabling policies that include net metering and private development of CS on public land. Public entities typically find it too complex to develop CS on their own. Additional key reasons for the success of CS include:

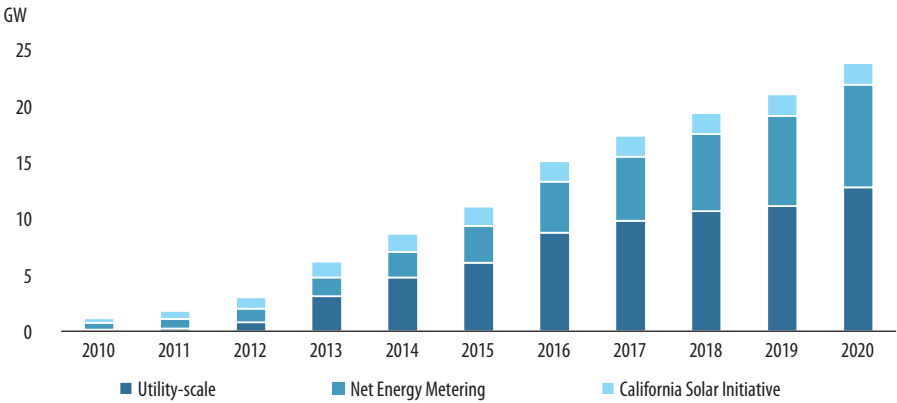
- ♦ realistic assumptions regarding the available solar resource, inflation and fair market values
- ♦ long-term contracts establishing predictable prices for net metering credits and SRECs
- ♦ a contractually binding process to address participants who move or can no longer benefit from virtual net metering
- ♦ a credible legal opinion letter concerning the structure of a project in relation to securities regulations and tax law
- ♦ O&M escrow reserves for insurance, taxes, inverter replacement and system decommissioning.

Community Solar in California

In California, Community Solar has contributed marginally to solar capacity growth (155 MW as of 2018). The *Green Tariff Shared Renewables* support programme has driven the development of CS capacity so far, however, the limitation to 600 MW of installable capacity statewide has hindered its development.

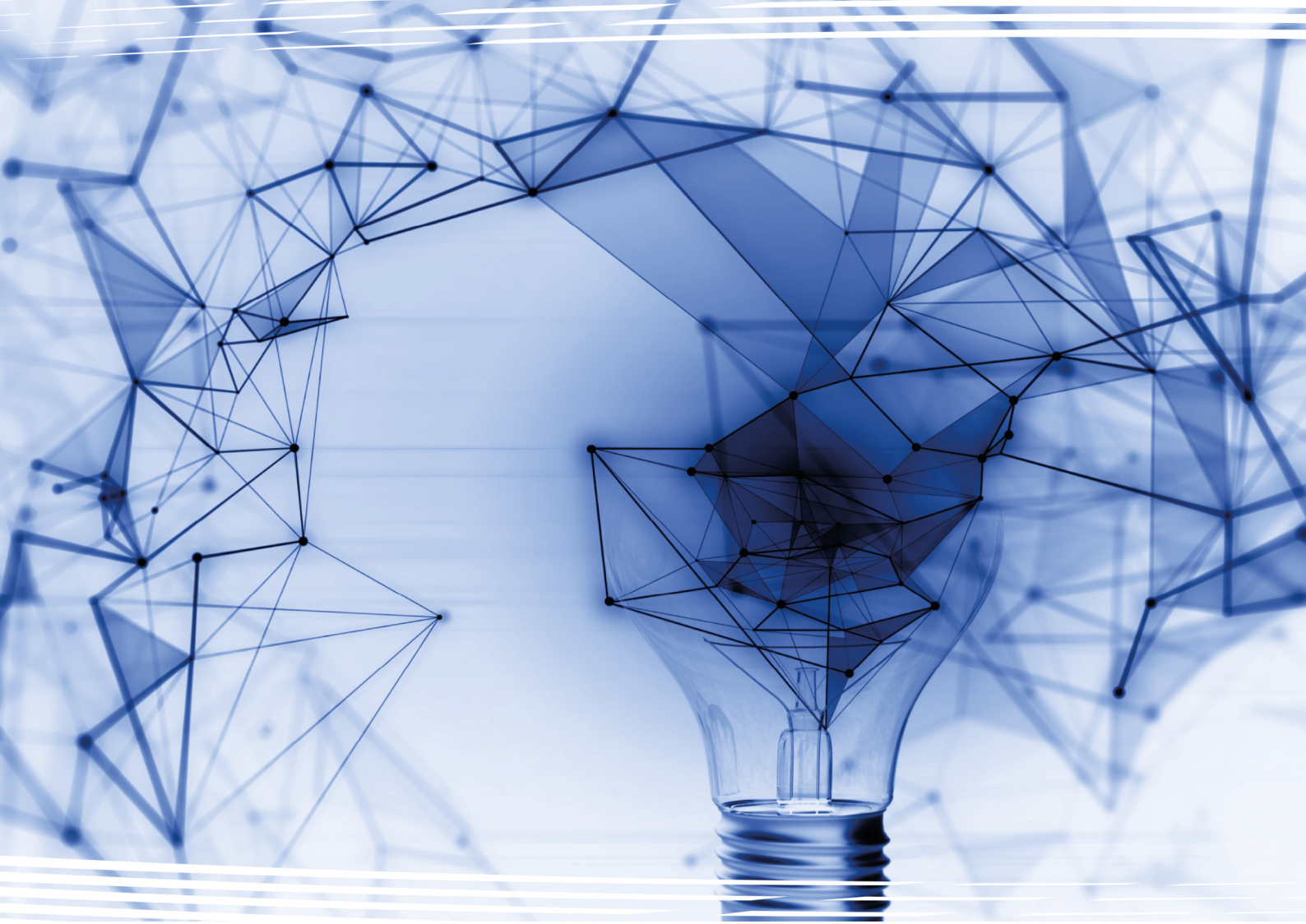
The *Community Choice Aggregation* programme is the preferred access to market for consumers in California. *Community Choice Aggregation* (CCA) allows cities, counties, and united electricity authorities (municipalities) to offer supply service to consumers located within their boundaries. The mechanism is similar to Community Solar but requires legislative approval. There are currently 23 CCAs operating in the CAISO market and they are located in IOU service territories to provide an alternative for electricity service with cleaner energy at competitive rates. As of 2020, CCAs have secured more than 6,000 MW in long-term PPA, including around 3,800 MW of solar capacity.

Figure 52
Evolution of solar capacity
in California (GW)



Source: Joule Power, Institute for Local Self-Reliance

GLOSSARY



ACRONYM	FULL WORDING
aFRR	automatic Frequency Restoration Reserve
AGCM	Autorità Garante della Concorrenza e del Mercato
ANEEL	Agência Nacional de Energia Elétrica
APAC	Asia-Pacific
ARERA	Autorità di Regolazione per Energia Reti e Ambiente
AUI	Asta di Ultima Istanza
BEIS	Business, Energy and Industrial Strategy
CAISO	California Independent System Operator
CCA	Community Choice Aggregation
CCGT	Combined-Cycle Gas Turbine
CCS	Carbon dioxide Capture and Storage
CEL	Certificados de Energías Limpias
CfD	Contract for Difference
CFE	Comisión Federal de Electricidad
CM	Capacity Market
COD	Commercial Operation Date
CS	Community Solar
CSP	Concentrated Solar Power
CVAR	Corrispettivo Variabile, Variable Remuneration
DNO	Distribution Network Operator
DSO	Distribution System Operator
DSR	Demand Side Response
EPTA	Energy Trading Platform Amsterdam
ERAA	European Resource Adequacy Assessment
ETS	Emission Trading System
EU	European Union
EV	Electric Vehicle
FCR	Frequency Containment Reserve
FER	Fonti Energetiche Rinnovabili
FFR	Fast Frequency Response / Firm Frequency Response
FIT	Feed in Tariff
FRU	Fast Reserve Unit
GME	Gestore dei Mercati Energetici
GSE	Gestore dei Servizi Energetici
GO	Guarantees of Origin
HP	Heat Pump
HV	High Voltage
IOU	Investor-Owned Utility
IS	Interruptibility Scheme
ITC	Investment Tax Credit
LCC	Line Commutated Converter
LCCC	Low Carbon Contracts Company
LCOE	Levelised Cost of Energy/Electricity

LOLE	Loss Of Load Expectation
LS	Load Shedding
LT	Long Term
LTC	Long-Term Contracts
LTPA	Long Term Power Auction
LV	Low Voltage
MAVER	Mercato dell'Acquisto e della Vendita di Energia Rinnovabile
MB	Mercato del Bilanciamento, Balancing Market
mFRR	minute Frequency Restoration Reserve
MGP	Mercato del Giorno Prima, Day-Ahead Market
MI	Mercato Infragiornaliero, Intraday Market
MiSE	Ministero dello Sviluppo Economico
MiTE	Ministero della Transizione Energetica
MME	Ministry of Mines and Energy
MSD	Mercato dei Servizi di Dispacciamento, Ancillary Services
MENA	Middle East and North Africa
MV	Medium Voltage
NCSP	National Community Solar Partnership
NOA	Network Option Assessment
NPV	Net Present Value
O&M	Operation & Maintenance
OMIE	Operador del Mercado Ibérico de Energía
OCGT	Open Cycle Gas Turbine
PA	Public administration
$P_{avg_{MGP}}$	Arithmetic average of the MGP spot price calculated on the standard profile
PNIEC	Piano Nazionale Integrato per l'Energia e il Clima
PPA	Power Purchase Agreement
PSV	Punto di Scambio Virtuale
PUN	Prezzo Unico Nazionale
PV	Photovoltaics
REC	Renewable Energy Certificate/Credit/Community
REER	New Renewable Energy Economic Regime
REN	Redes Energéticas Nacionais
RES	Renewable Energy Sources
RO	Renewable Obligation
ROC	Renewable Obligation Certificate
RR	Replacement Reserve
RVO	Netherlands Enterprise Agency
SDE	Sustainable Energy Transition Scheme
SIR	Synchronous Inertial Response
SM	Sessione di Mercato, Market Session
SPEN	Scottish Power Energy Networks
SREC	Solar Renewable Energy Credit
SSRP	Steady-State Reactive Power

STOR	Short Term Operating Reserve
TIDE	Testo Integrato del Dispacciamento Elettrico
TSO	Transmission System Operator
TTF	Title Transfer Facility
UK	United Kingdom
UKPN	UK Power Networks
UPR	Unità Produttive Rilevanti, Relevant Production units
UVAM	Unità Virtuale Abilitata Mista, Mixed virtual unit enabled for ancillary service participation
VHV	Very High Voltage
VOLL	Value Of Lost Load
VSC	Voltage Source Converters
V2G	Vehicle to Grid



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