AIEE ASSOCIAZIONE ITALIANA ECONOMISTI DELL'ENERGIA

the Italian Affiliate of the IAEE International Association for ENERGY ECONOMICS

in cooperation with

SDA Bocconi SCHOOL OF MANAGEMENT
SUSTAINABILITY LAB

Conference Proceedings

Current and Future Challenges to Energy Security

- energy perspectives beyond COVID19 -

AIEE ASSOCIAZIONE ITALIANA ECONOMISTI DELL'ENERGIA

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INTRODUCTION:

CURRENT AND FUTURE CHELLENGES TO ENERGY SECURITY

– energy perspectives beyond COVID19 –

The AIEE - Italian Association of Energy Economists (Italian affiliate of the IAEE - The International Association for Energy Economics) has organized this international conference in cooperation with the SDA Bocconi School of Management to bring together energy experts engaged in academic, business, government, international organizations for an exchange of ideas and experiences on the present and future landscape of energy security.

The previous editions of the AIEE Symposium on Energy Security, organized in Milan and Rome, were an opportunity to explore new energy trends, challenges and creative solutions for the energy security, the availability of new technologies, the emergence of new market conditions and of new market operators.

The AIEE Energy Symposium on Energy Security has become an important yearly appointment we did not want to miss! In the turmoil of the COVID19 pandemic outbreak the "ordinary" practices of our daily work routines had to change considerably and this year we had to rethink the structure of our conference and make it virtual.

In our uncertain world of possible pandemics return when health officials recommend against large gatherings of people, hosting a virtual event was an excellent alternative.

Following up on the success of the past editions this fifth AIEE Energy Symposium to provided a fresh look on the major forthcoming issues offering an excellent occasion to continue the dialogue and to share best practice and experience with delegates from all over the world.

The President of the Scientific Committee, *Agime Gerbeti*, in the Opening session has given a short overview of the main energy security issues in the present geopolitical context:

> "After a difficult period, it seems there are finally some good news the COVID vaccine is ready and Joe Biden, the President elect of the United States, has promised to sign the Paris Agreement. It looks like we are reaching the solutions for two important problems, the COVID19 pandemic and the medium-long term climate change.
>
> I believe that things are unfortunately different and that after a year in which almost everything has been suspended, the difficult part is now beginning.
>
> Let's start with the United States. Biden will certainly have more cordial relations with Europe than his predecessor, but if someone thinks that a common path between the US and the EU is about to begin again on energy, they might be wrong. Biden was Vice President when Obama chose to disengage from the Middle East, leaving Europe to deal directly with the oil producing countries and the Maghreb area for the first time since the end of World War II. Secondly, the former Democratic President has pledged to revitalize his internal crude oil production, transforming in a few years the US from an energy importer to a net exporter: so, without an immediate need for oil, the US confrontation with oil-producing countries was less "*frenetic*".

Thirdly, although the first term presidency was born under the sign of environmentalism, Obama has given great development to shale gas, which is not exactly a green measure.

Biden will not change this line and will continue to consider Europe both a commercial partner and a productive competitor.

Another chapter: at the end of this terrible year, the only country, among the big economies, which will see its GDP grow is China.

For almost fifty years, probably since Nixon's visit in 1972, the Western Countries have seen China as a large market ready to blossom, a growing market, recognizing it with the status of a developing country, with all the related advantages. A country that, once given up the clothes of communism, would have become a great market for the European goods.

But we were wrong; we welcomed China into the WTO even though it has never been really a market economy and we contributed to its growth even if its workers did not have the rights that we recognize to ours and we imported its goods even if they were manufactured with high emissive energy.

We were open because we were confident that its development would have been in our advantage, but we were wrong to think China as the outlet market for European products. For the Chinese products, Europe is the market to penetrate.

Let's move on to Russia. In recent days, despite a thousand controversies fuelled by some virologists who claim excessive haste, we have witnessed the first Russian vaccines in response to the Covid pandemic. They called their vaccine Sputnik. Ironically I suppose, as someone might remember that Sputnik was the first satellite launched to orbit and it gave birth to the competition with the United States that went down in history as the space race.

Despite the EU regulations which aim at the reduction of its energy dependence, Russia is still the fuel supplier of Europe. It is the same for all Europe but some countries suffer Russia's political influence with major sensitivity. Many countries of the former Soviet block, which economy is still fuelled by fossils, are suffering from the ambitious decarbonisation programs supported by the western and most liberal part of the European Union. And as we have seen during the last few days, the EU objectives have been revised upwards.

Will Russia, the world's largest gas producer and second largest oil producer, allow its European customer - without taking any action - to support its economy with wind turbines and photovoltaic panels? It is difficult to know the answer.

Finally, there is the British thorny issue. In my imagination Europe was a "bird's eye view" of the Colosseum, the Brandenburg Gate, the Eiffel Tower and the Big Ben. But it is no longer like this. The UK has become a competitor at heart of Europe. The Great Britain seeing itself downgraded economically will fight, as it has always done in its history and it will do it with pride. It will fight for fishing areas in the Channel as well as for wind farms in the North Sea; maybe with no more environmental constraints will procure gas from the USA and oil from Russia, or vice versa. In the course of history, first the Romans, then the French with Napoleon, finally the Germans in the Second World War understood that the British islanders are a very tough nut to crack.

The game for European energy security is starting now and we will have to fight on two fronts: one internal and one external.

> On the domestic front, it is absolutely, necessary that there should be a growing energy integration, both at the level of infrastructure and objectives. For this, an enormous communication effort will have to be made. We cannot leave national governments alone to inform the population of the decarbonisation advantages because the disadvantages of non-decarbonisation and climate change will be evident in the long term rather than the advantages of decarbonisation: it is very difficult to communicate the disadvantages of inaction. Without a shared vision of all the European countries, there are possible risks. If the first European defection occurred due to immigration policies, e.g. the Brexit, the next one could happen for the costs of the energy transition. Let's remember what happened in Paris with the yellow jackets.
>
> On the external front, Europe should expand its areas of influence, as it is already doing with the Energy Union, to manage cross-border trade safely and in reliable conditions.
>
> Secondly, Europe should behave more and more for energy purchases as a single negotiator, a single subject with a united vision. By allowing individual countries to negotiate their own supplies exposes them to less bargaining strength and competition with other European countries, crumbling the compactness of the European design.
>
> If EU member States continue to compete with each other for lucrative supplies from Libya, Egypt and elsewhere, there will be no European voice in the global energy market, and ambitious decarbonisation programs will remain just funds for industrial sectors without a real impact on global emissions."

A comprehensive program, with six plenary sessions and keynote presentations, and 19 concurrent sessions gave the attendees from all over the world the occasion to participate in an interactive, collaborative networking and information sharing event, in the prestigious context of the *SDA Bocconi School of Management*, that was ranked 3rd in the 2019 Financial Times' European Business School Ranking and 8th in the world for business and management studies.

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Agime Gerbeti, President of the AIEE Scientific Committee, Italy
Carlo Andrea Bollino, Honorary President AIEE and Conference General Chair.

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Ivetta Gerasimchuk, Lead, Sustainable Energy Supplies, International Institute for Sustainable Development **- *The presentation of the Energy Policy Tracker Project***
Enrico Gibellieri, Consultative Commission on Industrial Change (CCMI) of the European Economic and social Committee (EESC) **- *Resources and Energy intensive Industries REIIs***
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EU towards 2030 and the energy security concerns

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Elena Donnari, High-level Administrator for CRM and MIT, CEER

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Giordano Colarullo, General Manager, Federation of the Italian Utilities - Utilitalia, Italy
Jean Michel Glachant, Director of the Florence School of Regulation and the Holder of the Loyola de Palacio Chair
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Íñigo del Guayo, Giuseppe Ferrari and Wojciech Drozdz

THE FUTURE OF CAPACITY REMUNERATION MECHANISMS IN THE EU, REVISITED

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Overview

This paper tries to present briefly which role are playing and will pay capacity remuneration mechanisms in the EU. Capacity mechanisms are measures taken by Member States to ensure that electricity supply can match demand in the medium and long term. Capacity mechanisms are designed to support investment to fill the expected capacity gap and ensure security of supply. Typically, capacity mechanisms offer additional rewards to capacity providers, on top of income obtained by selling electricity on the market, in return for maintaining existing capacity or investing in new capacity needed to guarantee security of electricity supplies. Capacity mechanisms have an impact on competition in the internal electricity market. Many of these mechanisms involve State aid, so they are subject to EU State aid rules. This paper will examine the provisions of the Regulation no 943/2019 and will compare the situation in Italy, Poland and Spain. The Guidelines on State aid for environmental protection and energy 2014-2020 (EEAG) contain rules to assess capacity mechanisms (Section 3.9 of the EEAG). This is a relatively new field in State aid policy.

Method

The method we shall use is to collect as much evidence as possible of the consensus around the need to design capacity remuneration mechanisms in such a way that competition is not distorted. We shall examine the decisions already taken by the European Commission, in relation to a number of countries. We shall review the situation of capacity remuneration mechanisms in Italy, Poland and Spain. After this "factual" approach, we shall evaluate them at the light of Regulation 943/2019. In the accompanying Memorandum of that 2019 regulation, the European Commission states its preference for the so-called 'energy-only market' option. However, the Commission remarks that this does not discard the possibility for Member States of using capacity mechanisms, provided these are based on a shared resource adequacy assessment methodology carried out in full transparency through ENTSO-E and ACER and comply with common design features for better compatibility between national capacity mechanisms and harmonised cross-border cooperation. Legislation is needed in this area to address the issues in a consistent way.

Results

The result of this regulatory approach of the European Commission lead to the approval of Regulation 943/2019, which contains new and very relevant provisions on capacity mechanisms. New Chapter IV (articles 20 to 27) of said norm contains specific rules, which we are going to analyse. In particular, we want to explain if and how the approval of said norm influences the existing mechanisms.

Conclusions

We want to examine the existing mechanisms, in particular the Italian and Polish ones, which were approved by the European Commission. In the case of Spain, the existing capacity payments were abolished in 2018, but the Government is considering the possibility of introducing new ones. We want to conclude by making an assessment on the three systems.

References

Hancher, L., De Houteclocque, A. y Sadowska, M. (editores), Capacity Mechanisms in the EU Energy Market. Law, Policy, and Economics, Oxford University Press, Oxford 2015.

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THE FUTURE OF CAPACITY REMUNERATION MECHANISMS IN THE EUROPEAN UNION, REVISITED, WITH A PARTICULAR ATTENTION TO ITALY, POLAND AND SPAIN

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1. Overview

The regulatory framework for electricity must be analyzed and designed in light of the principles governing the European Union's energy policy, that is, economic efficiency, security of supply and environmental sustainability (de-carbonization). This paper analyses how those three components influence the design of capacity remuneration mechanisms (CRMs) in both the European Union and in the different jurisdictions (Italy, Poland and Spain). Those mechanisms try to guarantee security, in a system dominated by renewables (which are intermittent and need back-up) and in the most efficient way (not distorting markets).

When the process of liberalization and privatization of the electricity sector began in the last two decades of the twentieth century, promoters of the new regulatory framework thought that the market would always provide signals about where and when to invest. The main investment decisions in this sector are those related to networks (transport and distribution) and those related to new or expanded production units.

The development of liberalization processes led to the conviction that generation and supply must be free activities, subject to free competition between operators. On the contrary, during this liberalization process, the transportation and distribution of electricity have been considered as natural monopolies and, for that reason, they must be subject to economic regulation. However, in a context of decentralization of generation and closed networks, this characterization of networks as natural monopolies is doubtful, especially for distribution. In any case, the regulation of the networks implies a more or less intense degree of public planning of the construction of the networks, particularly of the transport networks, in order to provide a satisfactory service.

The case of electricity generation is special. There is a concern about the 'missing money' problem and its implications for security of supply. This problem arises when the price of electricity in the energy markets does not provide sufficient remuneration to cover the fixed costs of capacity. In this case, investors lack incentives to build new capacity and may want to close capacity. The existence of maximum prices in the markets, fixed by the regulator, was the first justifying argument for the introduction of a regulatory incentive for the construction of new generation capacity or CRM. If the price is not allowed to reflect scarcity situations, then the incentive to build the necessary plants to avoid supply cuts in such scarcity situations disappears. This is the 'missing money' problem: the remuneration from the market price in the short term is insufficient to recover the investment in all the plants needed to satisfy the demand efficiently. The 'missing money' is due to the artificial limitation of the price in situations of shortage (which should be equal to the price that is willing to pay the demand for not being interrupted). There are other reasons why money may be missing, in particular bad market design that do not enable market prices to reflect the value of flexibility. If market prices did reflect the value of flexibility (not just scarcity), the case for capacity payments would disappear, except for special cases. The debate about the missing money has been going on for 30 years: do we need additional remuneration for conventional power plants, in

addition to income from the energy market? The debate is whether there is a need to give the generator of electricity additional compensation. There are arguments in favour of an additional payment (e.g. problems of the design of energy markets, such as price caps, which discourage investment) and others against (e.g., additional costs for related consumers, with planning, intervention and excess capacity)[1].

In purity, the price of the wholesale electricity market, known as the "only energy" market, should be sufficient to provide all the investment signals that the generating company needs. However, for very different circumstances (among which the problem of 'missing money' stands out), sometimes that wholesale price is unable to provide the necessary signal. This means that in some circumstances there will be the need of a regulatory mechanism that either helps to invest in new generation capacity or rewards those other resources (eg storage, demand management) that provide security (reliability) when some other intermittent technologies (such as renewables) fail. It is not to forget that we are creating distortions with the capacity payments and the result is that the need for these payments is self-reinforcing. The right way forward is to get rid of distortions, not to add to them. Especially because the capacity payments always introduce the potential for political bias that makes European markets open to national restrictions or state aid (hidden).

In light of the above, capacity-building mechanisms have been established in some Member States. The European Union views these mechanisms with suspicion, insofar as it sees them as a real threat to free competition in the market. However, under certain exceptional conditions, provided that the rules on State aid are not violated, the European Commission is prepared to approve some aid schemes in some Member States. Apart from the competition argument (avoidance of state aids), there are two other conditions for allowing a capacity payment: (a) a clear need for the mechanism and (b) that the capacity remuneration is temporary. The evidence of need is the first step. To demonstrate that it is temporary requires identifying why the system has failed and that there is a plan to resolve the distortion that led to the need for extra remuneration.

The criteria to be used by the Commission are the Guidelines on State aid for environmental protection and energy 2014-2020 (EEAG)[2]. The reform of Regulation 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity*, has led to the approval of Regulation* (EU) no 2019/943 of the European Parliament and of the Council, of 5 June 2019 on the internal market for electricity (here-in-after referred as the 2019 Regulation)[3]. This Regulation incorporates provisions that will affect what is intended to be done in the Member States with regard to capacity mechanisms.

This paper tries to present briefly which role are playing and will pay capacity remuneration mechanisms in the EU. Capacity mechanisms are measures taken by Member States to ensure that electricity supply can match demand in the medium and long term. Capacity mechanisms are designed to support investment to fill the expected capacity gap and ensure security of supply. Typically, capacity mechanisms offer additional rewards to capacity providers, on top of income obtained by selling electricity on the market, in return for maintaining existing capacity or investing in new capacity needed to guarantee security of electricity supplies. Capacity mechanisms have an impact on competition in the internal electricity market. Many of these mechanisms involve State Aids, so they are subject to EU State aids rules. This paper

[1] L. Hancher, A. De Houteclocque y M. Sadowska (editors), *Capacity Mechanisms in the EU Energy Market. Law, Policy, and Economics*, Oxford University Press, Oxford 2015.
[2] Communication from the Commission, Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C 200/01), OJ C, 28th June, 2014.
[3] OJ 158, of 14th June, 2019.

will examine the 2019 Regulation and will compare the situation in Italy, Poland and Spain. The Guidelines on State aid for environmental protection and energy 2014-2020 (EEAG) contain rules to assess capacity mechanisms (Section 3.9 of the EEAG). This is a relatively new field in State aid policy[4].

2. Capacity mechanisms in Italy

In accordance with Article 108 of the Treaty on the Functioning of the European Union (TFEU), on August 24, 2017 the Italian Authorities notified to the European Commission as a State aid the measure adopted in order to support capacity providers in the electricity market.
After examining the Italian measures in detail, with Decision C (2018) 617 adopted on February 7, 2018, the Commission has defined the "*State Aid Case SA.42011 (2017/N)*" and has approved the Italian capacity mechanisms, declaring the compatibility under the EU State aid Rules of the benefits provided by the Italian government.
During the approval process, there has been a close cooperation between the national authorities and the European Commission. The plan has been reviewed and integrated several times in order to ensure its compatibility with EU State aid Rules and in particular with article 107 of The TFEU and with the 2014 Guidelines on State Aid for Environmental Protection and Energy[5].

In the European Commission press release of February 7, 2018, Commissioner Margrethe Vestager, in charge of competition policies, referred that "*capacity mechanisms can help to safeguard security of electricity supply, but they must be designed so as to avoid distortions of competition in energy markets. I am glad that our close cooperation with national authorities has enabled us today to approve well-designed capacity mechanisms in six EU countries. They will foster competition among all potential capacity providers to the benefit of consumers and our European energy market".*

The Italian mechanisms were approved seven years after the Decision of 2011 of the AEEGSI[6], the Italian Regulatory Authority for Electricity Gas and Water (as of January 1st, 2018, it became ARERA Regulatory Authority for Energy, Networks and Environment). That Decision defined the criteria and conditions in order to develop a remuneration mechanism for the electricity market, ensuring security of supply.

The focus on electricity supply security was in part determined by the severe blackout that struck the entire system in September 2003. After this unexpected event, and in order to minimize the risk of interruption to electricity, Statute No 290/2003 delegated the Ministry of the Environment to adopt specific decrees. They should be aim to speed up the reprogramming of the use of hydroelectric plants, to streamline the timetable of maintenance activities of production installations and the possible reuse of inactive power plants, and to increase uninterruptible electricity capacity in the country. Following the blackout, the legislature decided to reunify the property of network infrastructure with the management of the grid. A decree (DPCM) of May 11, 2004 later set the guidelines for the aforementioned process of reunification and imposed the adoption of the Grid Code on the manager of the

[4] Some of the ideas of these introduction are inspired by the work of S. Hesmondalg, J. Pfeifenberger and D. Robinson, "Resource Adequacy and Renewable Energy in Competitive Wholesale Markets", The Brattle Group, September 2010.
[5] Together with the Italian mechanisms, the Commission has also approved the electricity capacity system of other five important European States: the Market-wide capacity mechanism of Poland, the Strategic Reserve of Belgium, the Capacity Reserve of Germany, the Demand Response Scheme of France and the Interruptibility Scheme of Greece.
[6] Decision ARG/elt/98/11 of July 21, 2011.

grid. They provide objective and non- discriminatory technical rules for the access and use of the national transmission grid and related infrastructures, for the interoperability of networks, along with the provision of dispatching services, together with general criteria for the development of the security of the grid and for its maintenance.
In particular, Statute No 379/2003 established the main criteria for a capacity payment system, delegating the adoption of the mechanism to the Italian Energy and Gas Regulatory Authority (AEEGSI).

Article 1, paragraph 2, provides that the system: i) is based on competitive, transparent, non-discriminatory and non-distortive mechanisms, aimed at minimizing the economic impact on consumers; ii) is aimed both at remunerating new plants and infrastructures and at maintaining the efficiency of the existing ones; iii) is based on capacity targets defined by the Transmission System Operator (TSO); and iv) can remunerate consumers that can provide the reserve service.

Moreover, Article 1, paragraph 153 of Statute No 147/2013 provides that the Ministry of Economic Development shall provide the criteria for the definition of a capacity remuneration system. An important role in this process was played by TERNA, which is the Italian transmission system operator (TSO) based in Rome.
Following the AEEGSI Decision of 2011[7], the TSO's proposal of September 20, 2013 /TE/P20130004704 was approved by a ministerial decree of June 30, 2014.
The approval by the European Commission ended a ten-year long regulation process during which the Italian electric System has undergone significant changes, including the revolutionary development of renewable energy.

These changes required the market to fit the objective set by the 2017 National Energy Strategy (SEN), including the full decarbonisation (phase out coal-fire power plants) by the year 2025, and in order to ensure that electricity supply can match demand in the medium and long term with reserve systems for security supply.

With the Final Report of the Sector Inquiry on Capacity Mechanisms[8], the European Commission has assessed the compatibility under the EU State aid Rules of the capacity mechanisms of eleven European States in a comparative way and has considered the Italian proposal the most appropriate to market needs.
The Italian mechanism is therefore one of the best international practices and is intended to inspire the model of other countries.
The mechanism concerns the entire national market and was approved for a period of ten years until December 31, 2018, during which Italy implemented market reforms to address the structural supply risks in the electricity market. After the end of 2018, the capacity market is now regulated by ministerial decree of June 28, 2019, that updated the system without affecting the foundations of its discipline.

New provisions have been issued consistently with Regulation 2019/943/EU, published on June 5, 2019, that defined the conditions for the compatibility of capacity remuneration mechanisms with the European Treaty and set the carbon emission limits that remunerated capacity producers are required to comply with.

Furthermore, implementing the provisions of the European Commission Decision C(2018)617, the aforementioned decree identified the adequacy indicator of the electricity system in terms of LOLE (loss of load expectation), that represents the number of hours per

[7] Decision ARG/elt/98/11 of July 21, 2011.
[8] Commission's report. Final report on the sectoral inquiry on capacity mechanisms, C (2016) 752 final, Brussels, 30.11.2016, SWD (2016) 385 final.

year in which supply is statistically expected not to meet the demand and is used to determine the amount of capacity that needs to be installed in order to meet the desired reliability target. Article 2 of the decree states that the target value for the LOLE indicator amounts to three hours per year and, with regards to the capacity requirement, the threshold of the system adequacy to six hours per year. The new mechanism will be implemented in two phases. The transitory regime entails a more limited planning horizon compared to the ordinary regime and different demand participation schemes. The ordinary regime will begin as soon as the TSO will assess the technical conditions for a four year planning horizon, active participation of consumption and production, the setting of an elastic demand curve and risk mitigation mechanisms for newcomers.

Capacity providers can obtain a financial compensation for being available to generate electricity or, in case of demand response operators, to reduce their electricity consumption. The European Commission has authorized market-wide capacity mechanisms and stated that: *Italy has clearly identified and quantified the security of supply risks, also taking into account possible imports from neighboring countries*".

The Commission has also remarked that "*Italy has demonstrated that a significant amount of capacity risks exiting the market and new investments are unlikely to take place because investors cannot earn a sufficient return from their electricity sales*".
Brussels has recognized that the Italian mechanism is opened to all types of capacity providers, "*including demand response, existing and new capacities, domestic and foreign and the measures will keep costs for consumers in check thanks to the regular, competitive auctions to allocate capacity contracts*".
Under the measure approved by the Commission, TERNA is the central buyer of capacity that ensures transparency and provides medium and long term directives in order to lead investment and disinvestment decisions in an efficient way. It also guarantees the maintenance or the construction of new production plants, aiming at the achievement of the established security level. From the viewpoint of the appropriateness of the aid, the Commission concluded that a central-buyer mechanism has the potential to solve a general shortage of capacity, if properly designed.

The security level is identified through a target value of Loss of Load Expectation (LOLE). The LOLE represents the number of hours per year in which, over the long-term, it is statistically expected that supply will not meet demand. Contracts of one year duration can be awarded for existing capacity and fifteen years contracts can be awarded for new capacity. The Italian model provides that the TSO sets the objective of the so-called LOLE. On the basis of LOLE, it is possible to determine generating capacity demand curves for each market area and for each year of the capacity delivery period.

Another key element of the Italian mechanisms approved by the Commission are the auctions in the electricity market. As far as the single buyer of capacity is concerned, the TSO-TERNA organizes the auctions and sets the amount of capacity to be auditioned. The Italian capacity mechanism is a volume-based and market-wide mechanism that allows the participation, on a voluntary basis, of all the operators with the necessary requirements.

Existing and new capacity providers, including storage assets and demand response operators, who can provide evidence of existing or new capacity located on the national territory are admitted to the capacity market, as long as: i) they are not subject to dismantling the measures approved by the competent authorities; ii) they have the necessary building permits and have provided a detailed timetable indicating the main milestones of the plant construction and the expected date in which the new plants will be in operation (if new generators); iii) they have provided specific guarantees; iv) they meet specific minimum asset requirements; v) they

pledge to give up any other State aid for the amount of capacity that will be contracted in the mechanism during the delivery period; and vi) demand response must meet the qualification requirements for the so-called *Mercato per il servizio di dispacciamento* (MSD)[9].
The definition of new capacity includes not only capacity that has never participated to the so-called *Mercato del giorno prima* (MGP – day before market) but also installation under renovation of existing plants.

Foreign capacity may participate to the internal market. Italy has submitted that the participation of foreign resources in the mechanism at the same conditions as the Italian ones would require cross-border balancing markets. Only in that case, foreign capacity could react to real-time cross-border price signals. For this reason, Italy commits to negotiate agreements with other relevant TSOs to enable the participation of foreign capacity at the same conditions applied to domestic capacity.

The openness of the mechanism ensures competition between different technologies. This method guarantees that capacity is provided at the lowest cost for consumers and, at the same time, it avoids distortions in the electricity market.

The Italian mechanism also has a special feature to ensure its effectiveness: the so-called "strike price". As stated by the European Commission, when electricity prices reach a certain level, they trigger an obligation for power plants selected in the auctions to pay back some of the State aid. The power plants can finance this payback obligation from revenues they generate from the sale of electricity. The Italian capacity mechanism therefore not only ensures availability of capacity, but also gives power plants an incentive to use the capacity to offer their electricity on the market when it is needed. The strike price is one of the most important parameters in order to ensure that the participation to the market takes place under sustainable economic conditions, although the operators think that it may limit their profits, discouraging investments.

The Italian capacity mechanism provides that if the production plant is not able to offer energy on the market when needed, it may incur into the payment of penalties. The TSO will take different measures against the capacity provider in case of temporary or permanent breach of the obligations.

Temporary non-fulfilment occurs when the capacity provider is not able to reach 80% of the contracted capacity in a given month over a number of hours at least equal to 25% of the total number of hours in that month. In such a case, TERNA shall suspend the payment of the capacity incentives for the months in which non-fulfilment takes place.

Definitive non-fulfilment occurs when the temporary one lasts for three months. In this case, the capacity provider must reimburse the capacity premiums already received for each month included between the first and the third month of non-fulfilment. TERNA will also reallocate the correspondent contracted capacity in the adjustment auctions or in the secondary market.

The Italian authorities confirmed that the capacity incentives may not be cumulated with other aid measures. In particular, if the generators are subject to any type of investment incentive scheme for the produced energy, they must give up the incentive in order take part in the capacity market, otherwise they will not be admitted to the auction.

Italy is in a stand-by attitude, waiting for the approval from the Ministry of Economic Development and several market reforms.

Italy is planning to upgrade the domestic transmission network, invest in cross-border transmission capacity, and carry out a number of market reforms that will enable electricity markets to send clearer investment signals. However the European Commission declared that

[9] European Commission Decision SA.42011 Italian capacity mechanism *C(2018) 617 final, 57.*

these reforms do not ensure the desired level of supply security in the short term, the capacity mechanism is therefore necessary for the time being.

3. Capacity mechanisms in Spain

Spain introduced capacity payments in 1997, at the same time the electricity sector was liberalised. The system was replaced by a new one in 2007, which was reduced or abolished by Royal Decree-Law no. 9/2013 and by the 2013 Electricity Sector Act. Finally, at the end of 2018 (to enter into force on January 1, 2019) the payments for capacity were extinguished, by decision of the Spanish Government (however, there might be some old pending capacity payments to be made, to comply with previous the 20 year commitment for newer CCGT plants). Coal plants are subject to other legislation not mentioned here, for instance to support coal power station environmental upgrading to meet EU legislation.

Capacity payments included two types of services: the incentive to invest in capacity and medium-term availability service. The incentive to invest in capacity was considered necessary to ensure the coverage of demand in the long term and was paid as in €/kW installed, for 20 years. This mechanism still applies to the capacity which was built under that legislation, until the end of the 20 year period. In 2012, this mechanism was revised, and in 2013 it was withdrawn. Art. 13 of the 2013 Electricity Sector Act is entitled "economic and financial sustainability of the electrical system". Regulatory powers on the electricity sector are subject to the principle of economic and financial sustainability of the electrical system. The economic and financial sustainability of the electrical system means the capacity to meet all costs of electricity supply. The costs of the electricity system are determined in accordance with the provisions of the 2013 Electricity Act as follows: (...) «d) Remuneration associated with the application of capacity mechanisms, where applicable». In other words, the 2013 Electricity Sector Act states that capacity remuneration mechanisms may exist, but not necessarily.

Regarding the availability service, Ministerial Order TEC/1366/2018, of 20th December 2018, establishing the electricity access tariffs for 2019, withdrew payments for the availability service. The European Commission had analysed different capacity payment mechanism and criticized the Spanish availability payments for not being allocated on a competitive basis.

The Preamble to the Ministerial Order explained their decision in this way. The availability service was regulated in the 2011 Order. The Ministry for Ecological Transition recalled that the legislative package presented by the European Commission on November 30, 2016, entitled "Clean Energy for All Europeans" (including in relation to the electricity sector a complete modification of the law), was pending approval. The new laws would lay down the regulatory framework to advance the achievement of the internal electricity market and to comply with the climate commitments of the Paris Agreement within the framework of the XXI United Nations Conference on Climate Change 2015. This legislative package contemplates a reform of the current capacity mechanisms, to adapt them to EU regulations, whose allocation should be produced through competitive mechanisms, as indicated in the report on the sectoral research on capacity mechanisms, published by the European Commission in November 2016[10]. The Ministry also recalls that the energy system has initiated a process of transition to a new scenario characterized by de-carbonization, the decentralization of generation, the electrification of the economy, the more active participation of consumers and a more sustainable use of resources. In this scenario, with increasing renewable penetration and the approval of the European legislative package 2018-29, an in-depth analysis of the availability service is prudent, in accordance with the

[10] Commission's report. Final report on the sectoral inquiry on capacity mechanisms, C (2016) 752 final, Brussels, 30.11.2016, SWD (2016) 385 final.

guidelines resulting from the aforementioned European legislative package as well as with the other objectives. These were the reasons given by the Ministry to suppress the availability service.

Electricity generating companies have criticized, understandably, the Order of 2018 that eliminates availability service payments. They argued that it is a necessary service, because it enables them to keep available the facilities required to ensure the coverage of electricity demand peaks and periods of low renewable production, so that the coverage of the demand is guaranteed at all times. In effect, they argued, it is contradictory that the Order appeals to the greater penetration of renewables and de-carbonization, since both are circumstances that suggest the need for the availability service, rather than measures that could lead to closure of mothballing of stations. It is also contradictory, they argued, that the Order appeals to the European modifications, since in those modifications a payment system by capacity is allowed, insofar it is compatible with competition. The Spanish system has experienced some excess of capacity in the past, and since coal plants are being shut, and so are nuclear plants, the rising renewable output will show the need for capacity mechanisms. The European Commission recognizes that the price of the energy market, in many cases, is an insufficient signal to guarantee the coverage of the electricity supply, but capacity mechanisms are exceptional, temporary, and it is for Member States to demonstrate they need them.

The gas sector is also understandably critical of the Spanish Government's decision to eliminate remuneration for capacity. The energy sector seems to be aware that the capacity reserve margin is currently quite high and ENTSO-E does not see any problems of meeting peak demand before 2025, so it may appear that there is no need for additional remuneration. The gas industry recognizes that from a competitive point of view, renewables are unbeatable. Sun and wind are the cheapest in terms of their levelized cost of energy (LCOE). However, they do not provide the firm and flexible electricity need to ensure supply security. For the gas industry, there are several arguments in favour of capacity payments. First, combined cycle (natural gas) does guarantee the regularity and quality of the supply. Coal plants are shutting, nuclear plants will begin to shut, renewable penetration is rising, prices are expected to be falling; so the availability of CCGT will become more important as revenues fall. There will be the need for CCGT to be operating for some time to come (maybe not very long) in order to maintain security of supply and to help back up renewables. Second, in a marginalist system of pool price formation, combined cycles do not currently earn any margin above their annual operating and maintenance costs (approximately 6 million euros) . On the contrary, some of them generate large losses. Third, they have the obligation to be available all the time and there are many regulated costs. In these circumstances, shareholders may well wish to shut their plants. The right to close the plant should be defended, if they are not profitable. Forth, they argue that if the Government was trying to design new capacity mechanisms, it should have had them ready before abolishing the existing ones. Previously, capacity payments and long-term investment incentives were received. If Spanish society wants security and quality, it must pay for it. In 2010 combined cycles received about 24,000 or 30,000 euros per plant; today they receive nothing.

In view of the criticism, it seems clear that the wholesale market must be reformed. When the coal plants close, the Spanish electricity market will lose a marginal price signal. The Spanish Market walks towards a situation in which the energy will be extra-marginal. The future park should be similar to the current one. There are 56 combined cycle power plants. According to the gas sector, all are necessary. There are studies that say that 30 more are needed. The CCGT owners are making the case for ensuring that they are still in business when the situation gets critical and they argue that they are already facing financial difficulties justifying staying open. Whether they are natural gas power stations or other sources of

capacity, it seems very likely that additional incomes (in the form of capacity payments) will be necessary to the energy market, given how this market is organized today11.

On September 2020, the Spanish Ministry for Ecological Transition opened a public consultation procedure to learn from companies and all interested agents about the opportunity of introducing CRM and of which type. The government is seeking arguments for a mechanism, but they should be credible, which means not obviously biased. The document identifies all of the EU legislation conditions, as we explain in Section 5.

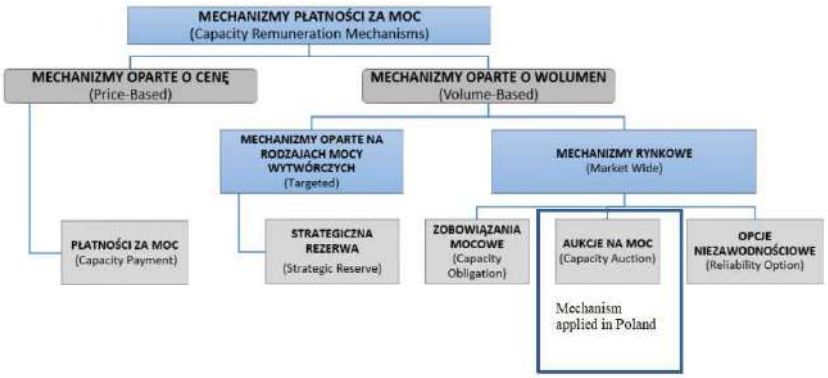
4. Capacity mechanisms in Poland

One of the main challenges of the proper functioning of the electricity market in Poland is ensuring continuity of electricity supply to customers in the long-term. To meet this challenge, there is the need of guaranteeing the availability of transmission and distribution networks (the so-called network resources) as well as of production capacity units (so-called generation resources adequacy). These infrastructures must be available several years in advance to the needs of recipients. The goal of the capacity market is to provide customers with long-term stable and secure electricity supply by power plants. The capacity market is to address the so-called missing money problem, which leads to missing capacity problem. The problem is originated by the decreasing time of operation of controllable conventional units against the priority dispatch of subsidized energy from specific technologies (in particular RES). What is more, economic competitiveness of conventional units against subsidized RES decreases, what threatens country's energy security. This happens firstly due to increasing fixed costs of power plants based on conventional fuels caused by rising needs for their modernization due to their aging (average age of coal-based power plant in Poland is over 45 y.o.). Secondly, prices of electricity, emissions and fuel lead to margin erosion. On top of that electricity market within next couple years will have to face the withdrawal of old inefficient power units, which account for over a third of the total power capacity. In order to provide base capacity that ensures stability of electricity supply and energy security, there is the need to transfer fixed costs in shorter periods of their work, and, consequently, in the absence of coverage of these costs, there is the risk of those units being cancelled. Additional subsidy given to power producers is the main mechanism of capacity market that aims to ensure sufficient electricity supply in the system. A situation in which the electricity market would not be able to meet the peak demand already occurred in Poland in the summer of 2015. This resulted in the reduction of energy supply to many industrial recipients and significant financial consequences. In this context, the Polish authorities committed to reform the Polish electricity market by implementing capacity market, which introduces duality of remuneration of power producers – one for energy production, the new one for readiness of electricity delivery.

Capacity mechanisms related to the Polish power market (as in the case of Italy or Spain) are mainly regulated at the European level by a Decision of the European Commission: Decision on State aid No. SA.46100 (2017/N), of 7 February 2018. The entire process for all regulations for Poland began on 16th November 2016, when the Polish Government drafted its plans of new capacity mechanism. The final Capacity Market Act was published on 8th December 2017 and came into force on 18th January 2018. Later in April 2019 the Polish program to support high-efficiency cogeneration and reduce subsidies to finance the program for energy-intensive users was approved by the European Commission (Decisions of 15 April, 2019: SA 51192 and SA 52530). Originally Polish capacity market was to start its operation on 1st October 2020, however its launch was postponed for 1st January 2021.

[11] An issue of Papeles e Energía, no 6 (2019) contains several useful discussions about the future of capacity mechanisms in Spain.

Figure 1. Classification of power market mechanisms



Source: Capacity remuneration mechanisms and the internal market for electricity. Report on 30 July 2013, ACER.

The scheme is notified for 10 years, however it is planned that it will operate until 2046. A mechanism applied in Poland is classified as a volume-based, market-wide capacity auction system. Well-functioning capacity market must provide day-ahead capacity reserves at minimum level of 5 percent (and 9 percent in times of shortage risk). The product of the capacity market is the net disposable power in the supply period, along with the obligation to deliver it in the 'threat periods' (the so-called power obligation) and is subject to the power agreement. Participation in the system are granted after conduction of so-called general certification procedure and open to existing generators on the market, new generators, demand response operators (DSR), warehouse operators located in Poland as well as foreign entities that had signed agreement with the Polish TSO. Participants take part in main and supplementary auctions held by the regulator annually. The power market auction operates on the basis of a competitive mechanism for selecting offers through the so-called Dutch auction, which puts pressure on bidders. The auction starts from high levels and is gradually lowered until the volume offered at a given price becomes smaller than the ordering party needs. The performance obligation requiring the supplier to deliver electricity to the system during periods of danger is met on the basis of an agreement between the operator and the power supplier. The agreements are generally signed for period of 1 year. Longer obligations are signed for new-built units (15 years) and modernized units (5 years for units exceeding 550g of CO_2 emissions per kWh and 7 years for units not exceeding it). Obliged suppliers regularly receive remuneration in exchange for a commitment to provide capacity during periods of 'systemic stress', under penalty of fines. In order to ensure effectiveness and flexibility of the scheme supply commitments are subject to exchange on a secondary market. The Act allows trading with them both on OTC basis and exchange. Currently set of rules are being developed in order to allow exchange regulated on Polish Power Exchange (TGE). Total annual remuneration costs for suppliers are covered by the end-users by paying the 'power fee rates' as part of the standard energy tariff. It was first announced by the President of the Energy Regulatory Office on 30th November 2020. For the following year it varies between 1,87-10,46 PLN for individual end-users. Other entities will pay 0,0762 PLN for each kWh used during workdays between 7-22 hours.

On the eve of commencement of functioning of Polish capacity market it is possible to analyze its size, structure and try to predict its strengths and weaknesses. Until today five

general certification procedures were conducted. Each of them entitled over 1000 entities to participate in auctions. Between November 2018 and December 2019 four main and three supplementary auctions were held. This allowed to ensure electricity supply for a period of 2021-2024 on a minimum level of 22,1 GW of capacity each year.

Table 1. Results of main auctions within Polish capacity mechanism

	Auction 1	Auction 2	Auction 3	Auction 4
Delivery year	2021	2022	2023	2024
Capacity bid	26 000 MW	13 000 MW	13 000 MW	12 000 MW
Capacity contracted	22 427 MW	10 580 MW	10 631 MW	8 671 MW
Capacity contracted annually	22 427 MW	23 039 MW	23 215 MW	22 108 MW
Remuneration (kW/year)	240,32 PLN	198,00 PLN	202,99 PLN	259,87 PLN
Coal share	79,0 %	69,4 %	78,4 %	59 %
Natural gas share	7,6 %	7,5 %	4,8 %	23 %
DSR share	2,7 %	7,2 %	7,4 %	12 %

Source: Forum Energii based on URE and PSE data

The results of hitherto auctions confirm that the majority of participants entitled under the scheme are large coal-based power units owned by state-controlled utilities. It is estimated that three Polish largest power producers (PGE, ENEA and Tauron) provide over 80 percent of contracted supply capacity. However, one can observe that the share of coal capacities decreases in each auction. At the same time role of natural gas capacities and DSRs increases. Clearing prices for capacity obligations varied between 198,00-259,87 PLN/kW/year and were much higher than previously expected. In result of this previously estimated annual cost of capacity mechanism doubled from 2.6 bln PLN to 5.5 bln PLN in 2021. Within a period of 2021-2025 total costs of capacity market will exceed 25 bln PLN, which is nearly the cost previously expected to be reached until 2030. The majority of it will be covered by business customers and the non-energy intensive industry (over 55 percent) and individual households (over 26 percent). The energy-intensive industry will incur in costs of around 7 percent.

As indicated above, first four years of functioning of capacity market in Poland will be focused on aiding of emission-intense coal-fired power plants. Therefore the scheme will temporary solve the problem of missing money and missing capacity. This will change on 1st July 2025. With this date restrictions passed by the European Commission in the Winter Package will come into force. These regulations claim that power generators that emit more than 550 g of CO_2 of fossil fuel origin per kWh of electricity shall not be committed or to receive payments under a capacity mechanism. Technically it will exclude from the scheme all coal-fueled power plants in Poland, that today account for more than 70 percent of total installed capacity. This may again threat country's energy security and lead to return of missing capacity problem. Though, this shall not occur in 2025. Results of hitherto auctions guaranteed contracts for this year at level of cca. 19 000 MW of capacity. A 14-percent gap compared to average of 2021-2024 period shall be filled during first main auction for 2025 which is set to be held on 14th December 2020. However, the gap of coal-based obligations expiring in 2026 may increase to 10 000 MW of capacity. This may be replaced by new energy generation sources, foreign sources or increasing role of DSR. Capacity of DSR contracted within Auction 1 equaled 617 MW, while on Auction 4 it increased to 1031 MW. The European Commission estimates the DSR potential in Polish energy system for 1200-2500 MW annually. Both growing role of DSR and foreign capacities shall lead to increasing role of trading with obligations on secondary market.

Days before official launch of functioning of capacity mechanisms in Poland, chances and risks related to its implementation can be drawn. These differ while analyzing 2021-2025 period and post-2025 period. The most importantly, it must be admitted that by contracting

supply obligations for period 2021-2025 the regulator made a solid step in order to provide stability of electricity supply and energy security for Polish economy. High auction clearing prices gave power generators substantial financial ease within next years. On the other hand, these funds will be financed from additional fees on utility bills of Polish citizens and enterprises, which will turn out much higher than previously expected.

Table 2. Chances and risks of Polish energy sector due to capacity mechanisms

chances	**risks**
+ providing supply security for 2021-2025	- no incentive for energy diversification until 2025
+ financial aid for power generators	- higher cost for end-users than expected
+ increasing role of DSRs	- low incentive for new investments
	- missing capacity risk after 2025

Source: Own study.

What is more, by contracting majority of obligations with capacity based on coal-fired power plants, there is – at least until 2025 – a little incentive for new energy investments leading to energy mix diversification. After that period this will lead – due to exclusion of emission-intense units from the scheme – to risk of reappearance of missing capacity problem. The capacity gap may be filled by development of DSR or entry of foreign capacities. This may lead to a conclusion that in the mid-term (until the end of 2025) Polish capacity mechanisms, although at a high-price for end-users, shall fulfil its fundamental function to help ensuring continuity of electricity supply to customers. Answer for a question how it will deliver its goals in the long-term highly depends on a pace and effectiveness of transformation of Polish energy-mix in a following decade.

5. New provisions on capacity mechanisms in the European Union

The 2019 Regulation includes provisions on capacity remuneration mechanisms in Chapter IV (articles 20 to 27, both inclusive). If the coordinated (European) assessment of adequacy reveals that in certain countries or regions capacity mechanisms are required, then it would be necessary to design them in such a way as to cause the least possible disruption in the internal market. Clear and transparent criteria should be determined to minimize the distortion in cross-border trade of said mechanisms. There is the need to avoid isolated national mechanisms in terms of capacity that would create new barriers in the market and undermine competition. The 2019 Regulation does not rule out the possibility for Member States to use capacity mechanisms, if they are based on a methodology of evaluation of adequacy through shared resources, prepared by ENTSO-E or ACER with full transparency, and conform to common guidelines for compatibility between national capacity mechanisms and harmonized cross-border cooperation.

Chapter IV of the amended regulation establishes new general principles for Member States to deal with the aspect of adequacy of resources in a coordinated manner. It establishes principles and a procedure for the development of a European assessment of the adequacy of resources to better determine the need for capacity mechanisms and, where appropriate, a reliability standard by the Member States. It specifies how and under what conditions capacity mechanisms can be introduced in a manner compatible with the market, including the rules for participation of capacities located in another Member State and for the use of interconnection. It establishes how regional operational centres, national TSOs, ENTSO-E and national regulators through ACER will participate in the development of technical parameters for the participation of capacities located in another Member State, as well as in the operational rules for such participation.

Chapter IV is entitled "Adequacy of resources". Art. 20 deals with the resource adequacy problem. It imposes the obligation to carry out a robust medium to long-term European resource adequacy assessment to provide an objective basis for the assessment of adequacy concerns. That assessment is complemented by national assessments. In accordance with Article 21, to eliminate residual resource adequacy concerns, Member States may, as a last resort, in accordance with Article 107, 108 and 109 of the TFEU, introduce capacity mechanisms. Article 22 contains the principles under which capacity mechanisms can be introduced: (a) be temporary; (b) not create undue market distortions and not limit cross-zonal trade; (c) not go beyond what is necessary to address the adequacy concerns; (d) select capacity providers by means of a transparent, non-discriminatory and competitive process; (e) provide incentives for capacity providers to be available in times of expected system stress; (f) ensure that the remuneration is determined through the competitive process; (g) set out the technical conditions for the participation of capacity providers in advance of the selection process; (h) be open to participation of all resources that are capable of providing the required technical performance, including energy storage and demand side management; apply appropriate penalties to capacity providers that are not available in times of system stress. Article 213 does also contain specific requirements when the capacity mechanism has been designed as a strategic reserve, as well as limits for the participation in the mechanisms in polluting generation units (coal).

6. Comparisons and conclusions

There is an ongoing debate as to whether some kind of capacity remuneration mechanisms must be in place in the electricity market, to avoid the 'missing money' problem. Within those ones in favour of having some mechanisms, the debate is about the form, which those mechanisms should adopt. It is important to stress from the outset in this conclusion, that the European Commission rejects that capacity mechanisms can be a permanent element of the system. The analysis of both the Guidelines on State aid for environmental protection and the content of the 2009 Regulation regarding capacity remuneration can be misleading. To avoid any confusion it is of relevance to underline that CRM are an exception to free market, which should be avoided and only used in extraordinary circumstances and on a temporary basis. Italy and Poland have been negotiating during several years with the European Commission, until a Decision was adopted by the European Commission on the 7th February, 2018. The European Commission authorized Italy and Poland to adopt market-wide capacity mechanisms, since they had clearly identified and quantified the security of supply risks, also taking into account possible imports from neighboring countries. A significant amount of capacity risked exiting the Italian market and new investments were unlikely to take place without the capacity mechanism because investors could not earn a sufficient return from their electricity sales. Poland demonstrated that it was faced with market failures in the electricity market that prevented prices from incentivising power generators to keep existing capacity in the market or to invest in new capacity. The Italian and Polish mechanisms are open to all types of capacity providers, including demand response, existing and new capacities, domestic and foreign. On the contrary, Spain has been progressively diminishing the existing capacity payments, until they were abolished at the end of 2018. There, it will be necessary to debate whether mechanisms will be introduced or not, and to comply with the new EU regulations that require the Member State to demonstrate not only that the impact on competition is minimal, but also that the mechanism is needed, that it is temporary and that reform is underway to eliminate the problems that gave rise to the need for extra payment. In that debate, many options will be on the table, including whether to include new capacity and existing capacity, the duration of capacity payments, the participation of demand, storage and aggregators, and the design of auctions to be considered (with regard to auctions, capacity mechanisms should not be base only in central auctions, but also in contracts of a bilateral

nature). When designing future capacity mechanisms for Spain, both the reform of the 2009 Regulation and the Guidelines must be taken into account, in the light of the experience accumulated by the capacity mechanisms approved by the European Commission. The best alternative for Spain would be the "reliability options", which have been adopted by Italy. Energy companies complain about the elimination of capacity mechanisms, since that decision led to an extremely difficult financial situation. The Spanish draft Act on Climate Change and Energy Transition foresees the existence of a capacity remuneration mechanism. When passed, it seems clear that the Spanish Government will be aiming to introduce capacity mechanisms, and could inspired by some of the elements of the Italian example. In September 2020, the Spanish Ministry for Ecological Transition opened a public consultation to learn the views of companies and all interested agents concerning the case for and against introducing capacity mechanisms and, in case they are adopted, what would be the best design.

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