

Market reform options for a reliable, cost-efficient and decarbonised Italian power system

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Executive Summary

In its recent draft National Energy and Climate Plan (NECP), Italy set ambitious targets for the deployment of variable renewable energy in the country's electricity mix and committed to the closure of all coal plants by 2025. As a result of these developments, concerns about the economic viability of power plants in an energy-only market, and the ability of the power system to “keep the lights on,” the government has decided to introduce a capacity remuneration mechanism (CRM) to support security of supply. At the same time, European institutions have recently adopted the Clean Energy for All Europeans Package, including the rules that govern wholesale markets across Member States and Europe.

This paper¹ offers a review of the resource adequacy outlook for Italy and the proposed CRM design, and suggests ways in which the country can achieve the desired levels of reliability at least cost, while increasing the levels of renewables in its system.²

Our key conclusions are:

- With respect to Italy's resource adequacy outlook in the short term, it is clear the market is oversupplied and that the risks to security of supply are generally negligible. There hasn't been any need for new investment, so it is not surprising that none has come forward. Although risks to security of supply are expected to increase in the medium term, toward 2025 they are still projected to fall within established norms.
- What appears to drive concerns and the implementation of a CRM in Italy is the overweighting of highly pessimistic outcomes that are unrealistic. It is unthinkable that Italian consumers would knowingly spend hundreds of thousands of euros per megawatt-hour (MWh) on marginal generation to address these unlikely outcomes when far less costly alternatives are available to maintain the desired level of security of supply.

¹ The authors would like to acknowledge and express their appreciation to the following people who provided helpful information and insights into drafts of this paper: Luca Bergamaschi and Nicolò Sartori of the [Istituto Affari Internazionali](#), and Mariagrazia Midulla of [WWF Italia](#) and Matteo Leonardi (independent, associated with [ref.e](#)). Editorial assistance was provided by Deborah Stetler and Tim Simard.

² The present paper was drafted before the first auction of the newly introduced CRM took place on 6 November 2019 and hasn't considered the results of it. Preliminary results of this first auction are available on Terna's website: <https://www.terna.it/en>

- It is highly questionable that Italy is facing a reliability problem that makes the implementation of a capacity remuneration mechanism necessary.
- The design of the capacity market itself contains several elements that will likely lead to overprocurement of resources, excessive costs for consumers, and the lock-in of polluting resources. This also raises market barriers to the uptake of more cost-effective resources such as demand response and storage.
- We expect the capacity market to take significant value out of the energy market, thus rendering the latter inferior to the objectives it is meant to serve and contrary to the recently adopted European legislation. The CRM inherently discriminates against resources capable of safeguarding security of supply, such as demand response, because they are precluded from the available compensation.
- The CRM design prioritises generation over demand-side resources. Demand response is effectively considered an inferior resource, when it is, in fact, equally or, as is often the case, more valuable.

We recommend that the Italian authorities:

- Undertake a thorough and balanced resource adequacy exercise to more accurately assess the risks to security of supply and determine whether market intervention in the form of a CRM is necessary. The government can still consider whether a strategic reserve would be a more cost-effective way to achieve reliability while the system is transitioning and phasing out coal generation, and one that is better aligned with the country's decarbonisation goals.
- Adjust the design of the capacity market, if there is to be one, to ensure that it doesn't undermine the operation of the energy market and that the two are better aligned. A capacity market should be based on the same principles as a well-designed energy market: remuneration is paid not for annual availability performance but rather for availability during scarcity hours, with the risk of non-payment should the resource fail to be available for any reason during those hours. This is a best practice from international experience.
- Ensure that the capacity market creates a level playing field between generation and demand-side resources and treats the latter on a comparable basis with supply-side resources in order to minimise costs to consumers. The capacity market shouldn't undermine the energy transition by creating stronger incentives for fossil-fuel generators that are unnecessary and can be more expensive than other solutions.
- Develop safeguards to eliminate the risk of resource overprocurement stemming from the intrinsic bias of the system operator to procure more than is necessary or economically justified. There is a need to review how decisions from the transmission system operator are made both in terms of transparency (such as data availability) and accountability (for example, whether the system operator's objectives and solutions are in the public interest).
- Prioritise the implementation of market reforms and other measures: implement administrative scarcity pricing that will address the "missing money problem;" further advance the integration of the Italian market into the EU's single electricity market, particularly into its intraday and balancing markets; increase the amount of interconnection capacity that is made available to the market and further develop the internal transmission network; and enable access to all market segments for demand response and other resources that are currently prohibited.

Introduction

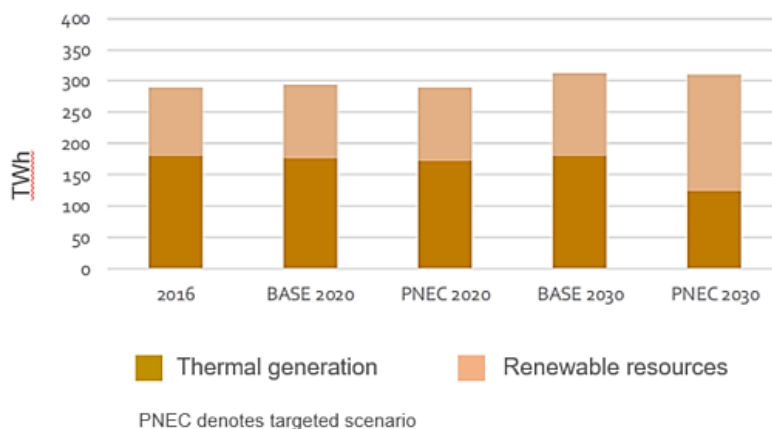
Context - Italy's draft electricity sector plan to 2030

Following the agreement on the Clean Energy for All package, and more specifically the Governance Regulation, Italy submitted its draft National Energy and Climate Plan to the Commission at the end of 2018.³ This sets out the country's objectives for the power sector amongst others, including the share of renewable energy and energy security, as well as measures for achieving those objectives.

According to the draft plan, the country aims to achieve a 55.4% generation share from renewable energy sources by 2030 (or 187 terawatt-hours (TWh) out of 337.3 TWh of gross domestic consumption), compared to a 34.1% renewable energy share as of 2017 (or 113.1 TWh out of 331.8 TWh). The main contributing technologies to this increase are projected to be primarily solar power and secondarily wind power. Other renewable energy technologies are expected to contribute to a lesser degree to the increase of the share. At the same time, Italy has committed to phasing out its coal capacity by 2025 and reducing the share of its thermal generation in the share of electricity generation. Figure 1⁴ presents the planned shares of renewable and thermal generation in the electricity mix based on the government's draft NECP.

Against this backdrop, the government has or is planning to introduce measures to enhance the levels of security of supply for the future. In brief, these include the reinforcement of the domestic network and further development of interconnection capacity, the implementation of a capacity market and the deployment of additional large-scale and small-scale storage.

Figure 1. Share of renewable and thermal generation in the Italian government's draft NECP



Source: Terna. 2019 Network Development Plan.

³ The draft Italian NECP is available in the original language and translated into English, alongside the European Commission's review of it, including recommendations for improvement in the following. European Commission. National Energy and Climate Plans (NECPs) [Webpage]. Retrieved from <https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/governance-energy-union/national-energy-climate-plans#content-heading-0>. Italy, and other Member States, have to deliver the final NECP by the end of 2019.

⁴ Terna. 2019 Piano di sviluppo della rete [2019 Network development plan]. Rome, Italy: Author. @courtesyTerna. Retrieved from <https://download.terna.it/terna/0000/1188/36.PDF>

Scope of the paper

This paper aims to address the question of how Italy can achieve its reliability goals cost effectively, while integrating increasing amounts of variable renewables. First, we provide a brief overview of the relevant European legislative framework. We then review the resource adequacy outlook in Italy, aiming to answer the question of whether there is any need to introduce a capacity remuneration mechanism (CRM) in the form of a market-wide capacity market (CM). Next, we provide recommendations about how to improve the design of the Italian CM. Finally, we provide recommendations about market reforms the Italian authorities can consider for integrating increasing amounts of renewable energy resources into the system and “keeping the lights on” at least cost.

The European framework for securing supplies

The European institutions have recently adopted the Clean Energy for All Europeans (CE4All) package of legislation that, among other things, sets out the rules governing the wholesale electricity markets in Europe.⁵ More specifically, the Electricity Regulation sets out common rules that apply directly across all Member States of the European Union⁶ with the goal of creating a single electricity market across Europe. The regulation will apply beginning January 2020.

The general principle of the regulation is to establish well-functioning, competitive and fast wholesale markets that reflect the true value of energy and balancing services.⁷ The legislative file aims at removing regulatory and other distortions that are common in several European markets, such as the imposition of price caps that prohibit power prices from rising above a certain level. Ultimately, the regulation intends on establishing common rules across all Member States that would enable resources to compete against each other on equal terms and allow power to flow freely between EU countries based on market economics.

In this spirit, the regulation stipulates that Member States with identified risks to security of electricity supply should ensure that their wholesale energy markets are free of distortion and obstacles. Nations in this category must first identify the regulatory obstacles and market failures, such as the imposition of price caps, that are causing the risks. National policymakers must develop a market reform plan, detailing how they plan to remove the identified obstacles, and submit it to the European Commission for review. Member States with capacity

⁵ The last step to finalise the CE4All package was completed in May 2019, with the adoption of the package. European Council and Council of the European Union (2019, 22 May). *Clean energy for all: Council adopts remaining files on electricity market and Agency for the Cooperation of Energy Regulators*. [Press Release]. Retrieved from <https://www.consilium.europa.eu/en/press/press-releases/2019/05/22/clean-energy-for-all-council-adopts-remaining-files-on-electricity-market-and-agency-for-the-cooperation-of-energy-regulators/>

⁶ European regulations do not require transposition into national law, like European directives. They apply directly across the EU Member States upon entering into force.

⁷ For example, the CE4All package stipulates the use of market-based procurement in the balancing market and ancillary services — where all types of resources, including demand-side resources, can participate — and promotes the introduction of shorter imbalance settlement periods of 15 minutes.

remuneration mechanisms in place and those contemplating their implementation are also subject to this obligation.⁸

The regulation also lists a series of measures that a Member State should consider when addressing the root causes of the risks to reliability. These include but are not limited to: i) implementation of scarcity pricing in the balancing market, ii) further development of the transmission network, including interconnectors, iii) removal of any obstacles that disable the demand side from participating in the energy market and iv) establishment of market-based procurement for balancing and ancillary services.

EU countries may only apply capacity remuneration mechanisms if there are residual risks despite the energy reform plan they are implementing or are planning to implement (an energy reform plan and a CRM can be executed simultaneously). The CE4All package also stipulates that a Member State should investigate whether the outstanding reliability concerns can initially be addressed through a strategic reserve, as this is more consistent with the spirit of the regulation.⁹ A Member State is only permitted to apply a market-wide CRM as a last resort.¹⁰

To monitor the risks to security of electricity supply, the European Network of Transmission System Operators for Electricity (ENTSO-E) is responsible for undertaking a Pan-European resource adequacy assessment. In addition, Member States can perform more detailed national assessments that are based on the EU-wide assessment (e.g., using the same reference scenarios), but they can also conduct sensitivity analyses on additional situations that might arise. The Electricity Regulation asserts that national assessments should apply a methodology and dataset consistent with the EU-wide assessment. They must have a regional scope and use a common methodology (to be established) for assessing the contribution of interconnectors to security of supply. If the resource adequacy assessments project acceptable levels of supply security as set by a Member State's reliability standard, the country will not be permitted to put a capacity market in place.

Resource adequacy in Italy

The Italian market has suffered from an acute overcapacity problem over the past decade or so. Following an expected increase in demand and the implementation of a direct capacity payment for generators, the country saw a significant surge in the installed capacity of gas generation,

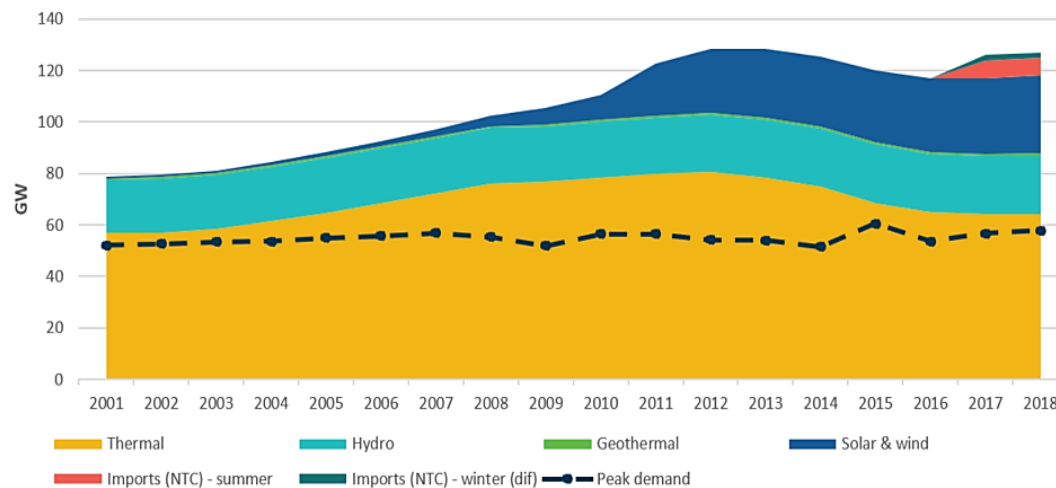
⁸ Following the Member State's submission, the European Commission is tasked with issuing an opinion about whether the plan is complete within four months of receipt. It can then suggest amendments to Member States. EU countries already implementing a CRM are not permitted to sign any contracts until they have received the Commission's opinion on their energy reform implementation plan. For Member States contemplating the introduction of a CRM, the energy reform implementation plan is part of the State Aid submission to the European Commission. The Electricity Regulation also stipulates the prerequisites for annual monitoring and reporting on implementation of the plan.

⁹ A strategic reserve is an instrument that sits outside the market and does not intervene in the energy market. It is, therefore, a more consistent solution to the vision of well-functioning wholesale markets. It is also much easier to abolish a strategic reserve, while the opposite is true for market-wide CRMs, as market players tend to rely heavily on them for their economic viability. Finally, strategic reserves are generally limited in size and, because of this, tend to cost only a fraction of market-wide CRMs. For example, the procurement cost for the strategic reserve in Great Britain for winter 2016/2017 was about one-third of the equivalent cost of the CM that replaced it the following year. Baker, P. (2018, 30 October). Britain's capacity market for electricity: Lessons for Europe [Blog post]. *Euractiv*. Regulatory Assistance Project. Retrieved from <https://www.euractiv.com/section/electricity/opinion/britains-capacity-market-for-electricity-lessons-for-europe/>

¹⁰ A CRM is meant to be a temporary measure, can only be approved for a maximum of 10 years, and might need to be phased out even before the expiration of the approval period under certain conditions (e.g., if no new contracts are signed for three consecutive years).

mainly combined cycle gas turbines (CCGT). In addition, starting from the end of the last decade, the installed capacity of variable renewable energy increased dramatically, especially for wind and solar generation, owing to support schemes for renewables. At the same time, peak demand remained broadly flat from the beginning of the early 2000s until recent years due to lower-than-expected economic growth, the effects of the global financial crisis, and the trend toward less energy-intensive economic productivity in developed economies globally, including in Italy. The evolution of the generation mix and realised peak demand from 2001 to 2018 are depicted in Figure 2.^{11, 12}

Figure 2. Evolution of installed capacity and peak demand in Italy



Source: Adapted with data from Mastropietro, P., et al. (2018). *The Italian capacity remuneration mechanism: Critical review and open questions*, as well as with data from Terna.

While the problem of overcapacity has declined in recent years, the country still has a significant surplus of capacity relative to peak demand. The installed capacity of thermal generation has decreased as a result of unfavourable economics, especially for gas generators,¹³ as well as the implementation of environmental legislation at the European level that has forced the closure of some older plants. Notwithstanding these changes, in 2018 the installed capacity of traditional thermal generation alone was 64 GW compared to around 58 GW of realised peak demand for the year. On top of that, hydro capacity accounted for around 23 GW, while just over 30 GW of variable

The lack of investment in new thermal capacity in recent years comes as no surprise because none was needed.

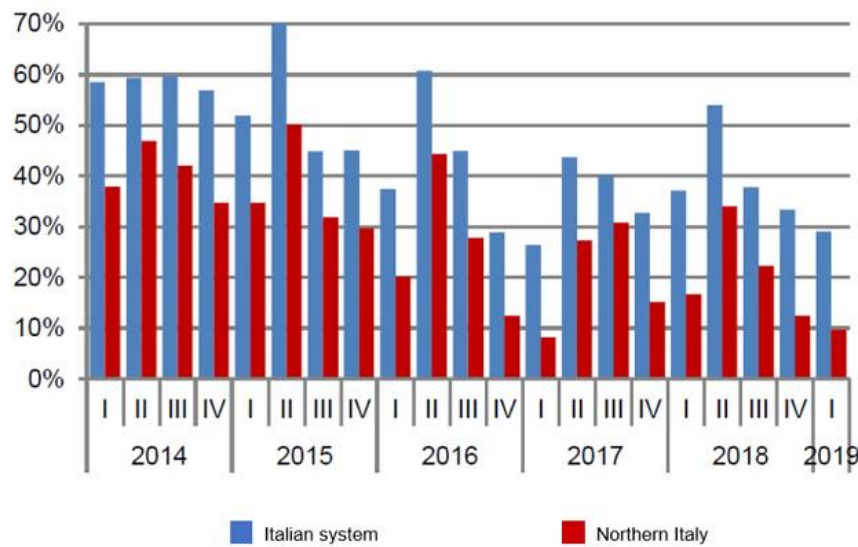
¹¹ Graphic is our own interpretation based on data (up to 2017) from Mastropietro, P., Fontini, F., Rodilla, P., and Battle, C. (2018). *The Italian capacity remuneration mechanism: Critical review and open questions*. *Energy Policy*. Retrieved from <https://www.sciencedirect.com/science/article/pii/S0301421518306256>; 2017. The graphic also uses data provided by Terna. [TERNA SpA, Statistiche \[Statistics\] \[Webpage\]](https://www.terna.it/it/sistema-elettrico/statistiche). Retrieved from <https://www.terna.it/it/sistema-elettrico/statistiche>. NTC data from European Commission only shown for 2017-2018 based on realised figures for 2016. European Commission, 2018 February.

¹² It is not clear whether the Italian transmission system operator (TSO) is also publishing weather-corrected peak demand information. We believe that the TSO should also estimate and report this, as weather-corrected peak demand gives more information about the evolution of underlying demand.

¹³ According to Mastropietro, P., et al. (2018), the load factor for gas generators almost halved between 2010 and 2014 from around 44% to 26%. The load factor of gas generators increased from 2014 to 2016, as a result of plant closures and mothballs.

renewable capacity was installed in the country.¹⁴ Italy is well interconnected with its neighbours, especially in the north. The capacity made available to the market for imports varied between around 7 and 9 GW in the summer off-peak and winter peak periods of 2016, respectively.¹⁵ The lack of investment in new thermal capacity in recent years comes as no surprise because none was needed. The significant surplus of capacity over peak demand is depicted in Figure 3.¹⁶ Despite the reduction of surpluses, they were still around 30% for the entire country and 10% for northern Italy in the first quarter of 2019, which is significantly higher than the target de-rated margin used in other markets.¹⁷

Figure 3. Excess power generation capacity relative to peak demand



Source: ENEA (2019). *Quarterly analysis of the Italian energy system*.

The surplus in capacity is expected to persist in the short term as indicated by the Europe-wide resource adequacy assessment, the Mid-Term Adequacy Forecast (MAF) assessment,¹⁸ undertaken by ENTSO-E. More specifically, the latest MAF shows that Italy is projected to have only negligible risks to security of supply in 2020 in its base case scenario, except for Sicily, which presents a loss of load expectation (LOLE) slightly higher than the reliability standard assumed by the Italian government. According to the ENTSO-E report, the risk is due to the

¹⁴ The installed capacity of hydro generation includes around 7.5 GW of pumped-storage hydro capacity and 5.5 GW of run-of-river hydro. The installed capacity of variable renewable energy resources is split into 20 GW of solar and 10 GW of wind capacity.

¹⁵ European Commission. (2018, February). *State Aid SA.42011 (2017/N) – Italy – Italian Capacity Mechanism*. Brussels, Belgium: Author. Retrieved from https://ec.europa.eu/competition/state_aid/cases/270875/270875_1979508_218_2.pdf

¹⁶ Note: Peak demand equals 1% of the most critical hours. Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile [Italian National Agency for New Technologies, Energy and Sustainable Economic Development] (ENEA). 2018. *Analisi trimestrale del sistema energetico italiano - I trimestre 2019* [Quarterly analysis of the Italian energy system – 1st quarter 2019]. Rome, Italy: Author.

¹⁷ For example, Great Britain's set reliability standard equates to a target de-rated margin of around 3.5%. Great Britain and Italy have the same target for the level of risks to security of supply, as this is defined by the reliability standard. A de-rated margin takes into account a realistic view of the availability of different resources at peak time.

¹⁸ European Network of Transmission System Operators for Electricity. (2018). *Mid-term adequacy forecast 2018*. Retrieved from <https://www.entsoe.eu/outlooks/midterm/>

relatively high unavailability of the aging installed thermal generation in Sicily.

The MAF base case scenario for 2025 finds a projected level of supply security consistent with objectives. The LOLE is below the assumed reliability standard for each of the six zones in Italy, including for Sicily; the latter result indicates that the risks for that region are mainly short term in nature.¹⁹ Terna, the Italian transmission system operator (TSO), conducted a resource adequacy assessment as the basis for the CM, but unfortunately this information is not publicly available.

Lack of transparency: The case of public resource adequacy assessments

Our review of the resource adequacy outlook in Italy is based on ENTSO-E's MAF. At the time of the government's decision to introduce a CRM, the Italian transmission system operator, Terna, had never published a resource adequacy assessment for the country. Despite the lack of public documentation, it is clear that Terna had indeed undertaken a national analysis, as indicated by the European Commission's decision on the scheme in February 2018.²⁰ While the European Commission refers explicitly to this analysis, it has kept this information confidential for reasons unknown.

It is concerning that the national transmission system operator has never published a resource adequacy assessment for Italy to inform the market and other stakeholders about the risks to security of supply as well as to solicit feedback to inform and improve its assessment. Unfortunately, this is a common practice in organised markets.²¹ It is all the more concerning that the Commission has approved the application for a CM from a Member State that did not undertake a public consultation for the resource adequacy assessment used to underpin the need for its CM. The Commission tasked an independent auditor with reviewing and assessing the integrity of the national resource adequacy assessment. This cannot, however, be considered a substitute for a public consultation. The Commission has not published the independent auditor's assessment. This decision is at cross-purposes with the general objective of, and slows the momentum toward, greater transparency in energy markets, a need considered imperative across all stakeholders in the sector.²²

¹⁹ ENTSO-E also presents the risks for a 1-in-10 type of winter (the 95th percentile of winters, as called in the MAF report) which represents a very pessimistic outcome and, as we discuss below, is irrelevant when considering the introduction of a CRM, as the reliability standard is not meant to be a ceiling for a worst-case scenario. The LOLE slightly exceeds the reliability standard in this case, however the risks are still very low, with the energy not supplied representing around 0.002% of total annual energy (or 8.6 GWh of energy not supplied, compared to 338,000 GWh of total annual energy).

It is worth noting that this type of extreme winter is already considered in the average LOLE calculation. The MAF only presents extra results on the pessimistic side, e.g., what would the risks be if a very cold winter were to occur. It does not do an optimistic forecast, e.g., what would the risks be in case of a warm winter. This results in a biased representation of the risks.

²⁰ European Commission, 2018 February.

²¹ For example, RTE, the French TSO, has been publishing English versions of its equivalent assessments along with the French versions, since 2005. See RTE. Forecast assessment of electricity supply-demand balance. [Webpage]. Retrieved from <https://www.rte-france.com/en/article/forecast-assessment-electricity-supply-demand-balance>

²² For example, while it was approving the Italian application for a CRM, the Commission was also undertaking a study on the quality of electricity market data that identified, among others, several shortcomings in the completeness and accuracy of the available data. European Commission. (2018, March). *Study on the quality of electricity market data of transmission system operators, electricity supply disruptions, and their impact on the European electricity markets*. Brussels, Belgium: Author. Retrieved from https://ec.europa.eu/energy/sites/ener/files/documents/dg_ener_electricity_market_data_-_final_report_-_22032018.pdf

The MAF 2018 also considers a low-carbon sensitivity for 2025, which assumes the closure of 23.4 GW across Europe as a result of environmental policies, including the closure of 3.6 GW of high-emitting plants in Italy, presumably coal generation (the base case scenario assumes 5.8 GW of installed coal capacity in 2025 in Italy). This sensitivity represents an extremely pessimistic outlook of the future — an unrealistic view. A key problem with using this sensitivity is it assumes the market doesn't exist.²³ ENTSO-E and national transmission system operators did not take into account the impact of these closures on market prices and resource profitability. As a result, one would expect higher wholesale energy prices as a result of a tighter supply situation. These, in turn, would slow the pace of retirement (outside any closures identified to achieve the country's climate objectives), improve the attractiveness of new investment and incentivise the re-activation of moth-balled power plants and the development of demand response (DR) and other resources.²⁴ Furthermore, the MAF is generally a conservative assessment of the risks to security of supply that makes a series of low-probability assumptions. On top of that, the latest MAF doesn't reflect the recently agreed CE4All package because it was published before adoption of the legislation. This means that the MAF's results are more conservative than the real-life scenarios that developed after the adoption of the package. Some of these sources of conservatism are further detailed in the textbox on page 11.

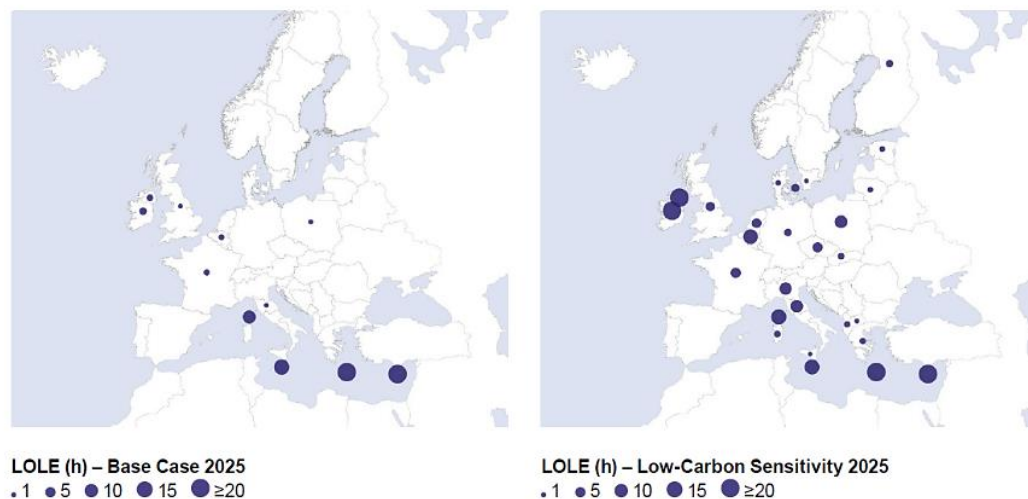
The low-carbon sensitivity represents an extremely pessimistic, unrealistic outlook of the future — and, more importantly, it assumes the market doesn't exist.

The case for extraordinary market intervention appears to rest entirely on these highly improbable sensitivities. Under this extreme case, the risks for northern Italy (north and central-northern regions), in particular, are projected to increase considerably. Similarly, the energy not supplied is projected to increase to around 0.01% of total energy. Although such outcomes would be highly improbable under normal market conditions, the prospect of an out-of-market intervention, as proposed here, will make them more likely. They become, in effect, self-fulfilling prophecies that are then used to justify the measure that renders them more likely. It should be noted that this figure does not reflect any emergency actions that a TSO can take, such as reducing the voltage level or maximising the output of plants above their rated capacity. Hence, the relevant figure that could affect consumers is effectively lower (the LOLE/energy not supplied are expectations of what might happen). The results of the base case and low-carbon sensitivity for 2025 are depicted in Figure 4.²⁵

²³ The MAF states that: "This is considered as a stress test, as the decommissioned high carbonised generation was not replaced by any other resource." However, it is highly questionable whether the closure of 24 GW of generation could be considered a sensitivity, given the sheer size of the closures in question. In our view, such a scenario should have been modelled separately, including the impact of these closures on power prices and the profitability of plant.

²⁴ For example, if one would assume scarcity pricing in place, as per the CE4All and network codes, the estimated loss of load hours would imply prices at the level of value of lost load (or higher), which would be a significant signal for resources to enter or remain in the market, and for suppliers to hedge against this risk.

²⁵ European Network of Transmission System Operators for Electricity, 2018.

Figure 4. Loss of load expectation for the base case and low-carbon sensitivity

Source: European Network of Transmission System Operators for Electricity. (2018). *Midterm adequacy forecast*.

It appears that the decision to introduce a CRM in Italy is based on consideration of outcomes like this. The problem with this approach is that it misapplies the reliability standard. According to industry best practices, the reliability standard is not a ceiling for a worst-case scenario like ENTSO-E's low-carbon sensitivity; rather, it is a statistically weighted annual average, based on the imputed value consumers place on "lost load" or loss of power supply. By default, a system designed to apply an annual average performance standard — established based on the imputed value of lost load to consumers as a worst-case ceiling and enforced by a mandatory capacity market — will result in an oversupplied market. Prices will be systematically suppressed, and consumers will pay several times more for the marginal supply resources — in the tens or hundreds of times more — than the value they place on having those supply resources available.

Procuring supply-side resources to serve all normal demand under a worst-case scenario implies that consumers are content to pay a very high price at the margin to be able to carry on under extraordinarily adverse conditions as if nothing were out of the ordinary. This forces consumers to pay a multiple of the value of lost load (VoLL) upon which the standard was established in the first place,²⁶ which for Italy appears to have been set at around 18,500 €/MWh.^{27, 28} Rather than applying the standard based on the assumed VoLL, it applies the standard in a way that implies a VoLL in the hundreds of thousands of euros.²⁹ For a small fraction of this cost, a significant share of consumers would most likely be willing to shift the

²⁶ In the CE4All, VoLL is defined as the maximum price consumers are willing to pay to avoid a supply interruption.

²⁷ It is unclear whether the Italian authorities have undertaken a reliability standard study and, if so, whether this included determining the VoLL for consumers. The authors of this paper could not find the relevant documentation. Under the CE4All, every Member State with a CRM needs to estimate its reliability standard based on a methodology to be developed by ENTSO-E.

²⁸ Based on a reliability standard of three hours LOLE/year and a cost of new entry of 55,000 euros/MW/year. Italian Regulatory Authority for Electricity Gas and Water – ARERA. (2017). *Mercato Italiano della Capacità Ultimi Parametri Tecnico-Economici* [Italian capacity market – Latest technical parameters]. Retrieved from <https://www.arera.it/allegati/docs/17/592-17.pdf>

²⁹ For example, if the LOLE for the base case drops to 0.1, the equivalent marginal price consumers are willing to pay to avoid disconnections (or VoLL) is 185,000 euros/MWh (or 185 euros/kWh). For reference, the average wholesale electricity price for the most representative household in 2018 in Italy was 0.9 euros/kWh, so around one 200th of VoLL. European Commission. *Energy prices and costs in Europe*. [Webpage]. Retrieved from <https://ec.europa.eu/energy/en/data-analysis/energy-prices-and-costs>

timing of their demand as an alternative solution for maintaining reliability. These would be mostly industrial and commercial consumers in the short term, but also residential consumers especially as smart technologies become more mainstream.³⁰ By incentivising this demand response, one could achieve a system with the same level of security of supply at significantly lower costs by avoiding the construction of generation, network and other assets that would only be required in very extreme situations.

An illustrative example of the costs to consumers

For illustrative purposes, let's assume that a consumer faces a price of 2,000 euros/MWh (or 2 euros/kWh). If the consumer uses a 2-kW blow-dryer and needs 15 minutes to dry his or her hair, the associated cost would be 1 euro. If the power price was at the implicit ceiling of 185,000 euros/MWh, the equivalent cost would be 92.5 euros. Surely for something far less than 92.5 euros, many people would be happy to postpone their shower by an hour or two until demand has dropped and electricity prices have recovered to normal levels. In practice, there is a wide range of energy services that would be readily flexible in response to energy prices that reflected the true value of that flexibility, for varying periods of time, without any real cost or inconvenience to the end user.

It is also of interest to compare the expected risks to security of supply due to resource adequacy with the actual supply losses due to network unavailability.³¹ In 2016, the actual duration of loss of energy due to network unavailability, at both the transmission and distribution level, was 144 minutes per consumer (System Average Interruption Duration Index, or SAIDI), which is approximately the average historical consumer experience of service interruption as measured by the SAIDI.³² The *worst-case* supply-related loss of load under the low-carbon sensitivity is significantly lower, about 53 minutes per customer³³ and, as explained earlier, is an overestimation of what consumers would actually experience, as it is prior to any emergency actions that can be initiated by the TSO. More importantly, by applying the standard as a ceiling under the worst-case scenario, the *annual average* supply-related loss of load would effectively be negligible — in the range of one minute per year per customer or less — compared to 144 minutes per year per customer from interruptions related to the transmission and distribution systems. This discrepancy strongly suggests that consumers' money would be better spent on improving network infrastructure instead of building new power plants, which would improve their experience of service reliability by far less.

³⁰ This development, in conjunction with the availability of smart meters, could offer significant opportunities for residential consumers to participate more actively in the market. Italian residential consumers have already had smart meters since the early 2000s, while a second generation of more advanced, smart meters is scheduled for roll out by 2030.

³¹ From a customer's perspective, the reason for being without power is unimportant. Whether it is because of inadequate resources or because of a failure on the network, the outcome is the same — a loss of energy.

³² This figure represents the planned and unplanned SAIDI (System Average Interruption Duration Index), including exceptional events. Council of European Energy Regulators. (2018). *Benchmarking Report 6.1 on the Continuity of Electricity and Gas Supply*. Brussels, Belgium: Author. Retrieved from <https://www.ceer.eu/documents/104400/-/-/963153e6-2f42-78eb-22a4-06f1552dd34c>

³³ This corresponds to the energy not served, as estimated for the worst-case scenario. ENTSO-E estimates this to be around 0.01% of total annual demand.

ENTSO-E's Europe-wide resource adequacy assessment is conservative

The MAF 2018 makes a series of conservative assumptions. For example:

- It assumes that peak demand in Italy alone will increase by around 4 GW from 2020 to 2025.³⁴ Given that demand has broadly remained flat for the past two decades and the economic outlook for the country is rather modest,³⁵ it is unclear what would drive this peak demand increase. The MAF doesn't provide any explanation about the assumed growth.
- Generator availability is generally low and applied in a crude way, without any differentiation between countries. For example, the assessment assumes that all generators will undertake part of their typical annual maintenance during the winter (e.g., for coal and gas generators, this stands at around four days in the winter or 15% of 27 total days annually). It is questionable why generators in markets that face peak demand conditions in the wintertime would schedule their maintenance at the time when prices are expected to be highest and forgo the opportunity to boost their profitability. At the same time, 27 days of annual maintenance could be considered slightly on the conservative side; three weeks of planned maintenance, on the other hand, could have been a more balanced assumption. A more thorough examination of the unplanned outage rates for plants would also appear prudent. For example, unplanned unavailability for new CCGT plants is assumed to be 5% in the MAF, despite experience in advanced markets, like the Electric Reliability Council of Texas, demonstrating that this is closer to 2% during the peak season, when it matters the most.³⁶
- At the same time, it is unclear whether, and to what extent, the assessment takes into account the effects of energy efficiency and explicit demand response. The assessment doesn't consider the effects of future implicit demand response, i.e., consumers responding to retail prices. It projects historical demand patterns into the future while applying assumed profiles for additional new loads, such as electric vehicles and heat pumps. The assumptions for the latter are also unclear, e.g., whether the charging of electric vehicles occurs during off-peak or peak hours. This could have a significant impact on the levels of risk in the medium term to longer term.

Moreover, as mentioned, the MAF 2018 doesn't reflect the CE4All agreement. For example, the assessment doesn't reflect the obligation to gradually open interconnectors, which would enable greater sharing of resources between Member States and the ability to direct the flow

³⁴ Data provided by ENTSO-E. Peak demand is projected to increase from 57.8 GW in 2020 to 61 GW in 2025. The values represent the average peak demand across all the climatic years modelled by ENTSO-E in the Mid-Term Adequacy Forecast.

³⁵ Gross domestic product growth year-on-year was 0.1% for 2019 and 0.7% for 2020. European Commission. Economic forecast for Italy [Webpage]. Retrieved from https://ec.europa.eu/info/business-economy-euro/economic-performance-and-forecasts/economic-performance-country/italy/economic-forecast-italy_en

³⁶ Potomac Economics, the independent market monitor for the Electric Reliability Council of Texas (ERCOT), shows that forced outages were only 2% in the months of July and August of 2018, when the highest demand in the state occurs. It also indicates that generators likely took longer planned outages during the shoulder months in order to ensure greater availability during the peak season, in line with market economics. Potomac Economics. (2019). *2018 State of the market report for the ERCOT electricity markets*. Fairfax, VA: Author. Retrieved from <https://www.potomaceconomics.com/wp-content/uploads/2019/06/2018-State-of-the-Market-Report.pdf>

of power to areas where it is needed most.³⁷ The MAF assumes that the sizing of balancing reserves is performed at the national level, while CE4All legislation establishes regional sizing as the way forward. This regional sizing approach will reduce the overall need for reserves, thus freeing up resources to the market.³⁸

Options for improving the Italian capacity market

The introduction of a CRM in Italy is not a new story. Italian authorities contemplated it back in 2003, following rolling blackouts in the country.³⁹ They introduced a capacity payment to generators in 2004 as a transitional measure and postponed the introduction of a market-wide CM. The push for a CRM was reignited in the early 2010s, at the peak of the resource surplus in the Italian system.⁴⁰ A market-wide mechanism in Italy, in the form of a centralised reliability options scheme, was finally submitted to the European Commission in August 2017, which then approved it in February 2018.⁴¹ Following the agreement on the CE4All package, the Italian authorities resubmitted a slightly modified version of the previously approved CM that also included an emissions performance standard. The modified CM proposal introduced conditions that would make any plants emitting more than 550 grams of CO₂ per kWh ineligible for reliability options payments from the outset of the mechanism's implementation.⁴² The European Commission approved the modified design in June 2019,⁴³ and the Italian

³⁷ For example, the Agency for the Cooperation of Energy Regulators' (ACER) 2017 Market Monitoring Report shows that less than around one-third of the realistically available cross-border capacity is currently offered to the market in the core — excluding the Central Western — region, which covers the majority of continental Europe. Agency for the Cooperation of Energy Regulators and Council of European Energy Regulators. (2018). *ACER/CEER Annual report on the results of monitoring the internal electricity and natural gas markets in 2017 – Electricity markets wholesale volume*. Ljubljana, Slovenia and Brussels, Belgium: Authors. Retrieved from https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/MMR%202017%20-%20ELECTRICITY.pdf

³⁸ This is obvious, for example, in Germany, where the amount of balancing reserves has decreased by 20% since 2008, following the decision to shift from subregional sizing (for each TSO-area separately) to national sizing of the reserves. At the same time, the costs of balancing reserves dropped by 70%, while wind and solar capacity tripled.

³⁹ Italy faced rolling blackouts in the summer of 2003 due to increased demand, and a general blackout in September 2003 following the loss of all interconnectors with its neighboring countries, triggered by the trip of one of its interconnectors with Switzerland which was caused by tree flashover. For more information, see for example: Mastropietro, P., et al., 2018; Union for the Coordination of the Transmission of Electricity (UCTE). (2014, April). *FINAL REPORT of the Investigation Committee on the 28 September 2003 Blackout in Italy*. Retrieved from https://www.entsoe.eu/fileadmin/user_upload/library/publications/ce/otherreports/20040427_UCTE_IC_Final_report.pdf

⁴⁰ Mastropietro, P., et al., 2018. One might wonder why the authorities decided to introduce a mechanism that is meant to keep the lights on at a time of excessive oversupply in the market.

⁴¹ European Commission, 2018, February.

⁴² Any capacity emitting more than 550 grams of CO₂ per kWh can “participate in the capacity mechanism if it commits not to emit more than 350 kg CO₂ of fossil fuel origin on average per installed kW_e, for any given delivery year.”

⁴³ European Commission. (2019, 14 June). *State aid: Commission approves introduction of stringent emission limits in Italian capacity mechanism* [Press release]. Retrieved from https://europa.eu/rapid/press-release_IP-19-3001_en.htm. The non-confidential version of the decision will be published on the State Aid register.

government signed the decree into law later in the summer.⁴⁴ The first auction was held in November 2019 for delivery in 2022.⁴⁵

A critique of selected elements of the Italian capacity market

The market-wide Italian capacity market is a centralised reliability options design.⁴⁶ Under the scheme, the system operator, Terna, is responsible for determining the volume of resources needed to achieve the country's reliability target and procures resources through a competitive auction. Resources that are successful in the auction receive the clearing price and, in return, are obliged to be available throughout the delivery period (or be penalised if they are unavailable, especially when required).⁴⁷ In addition, successful resources are obliged to pay back to Terna the difference between a market reference price⁴⁸ and a pre-determined "strike price," whenever the former exceeds the latter. This is called the payback obligation (or financial call option) and is a unique feature of a reliability options design.⁴⁹

This is not a comprehensive analysis of the new Italian CM. What follows are analyses of and recommended modifications to five elements of the CM that are of particular concern.⁵⁰

1. Contract duration: The CM has established contracts of different durations during the full implementation phase: Three-year contracts for existing resources and 15-year contracts for new resources.⁵¹ Existing capacity that undergoes significant refurbishment (by default, generation) can qualify as new capacity as long as the associated costs of the investments are

⁴⁴ The decree was approved by the Italian regulator, ARERA, and signed by the current government into law in June 2019. Ministero dello sviluppo economic [Ministry of Economics]. (2019, 28 June). *Approvato da ARERA il decreto sul Capacity Market* [ARERA approved capacity market] [Press release]. Retrieved from <https://www.mise.gov.it/index.php/it/198-notizie-stampa/2039889-approvato-da-arera-il-decreto-sul-capacity-market>

⁴⁵ The Italian CM will be implemented in two phases the first and full implementation phases.

⁴⁶ For more information on the concept of a reliability options capacity market, see for example: Cramton P., and Stoft S. (2007). *Forward Reliability Markets: Less Risk, Less Market Power, More Efficiency*. Retrieved from <https://stoft.com/wp-content/uploads/2007-09-Cramton-Stoft-Forward-reliability-markets-Less-risk-less-market-power-more-efficiency.pdf>; Poyry. (2015). *Decentralised reliability options – Securing energy markets*, Retrieved from http://www.poyry.co.uk/sites/www.poyry.co.uk/files/media/related_material/decentralised-reliability-options-full-report.pdf

⁴⁷ We haven't reviewed the penalty regime of the capacity market in detail for the purposes of this paper. However, it appears that the penalties are rather lenient on contracted capacity and the CM doesn't disincentivise it strongly enough from being unavailable when required. For example, under the pay-for-performance reforms in the Eastern U.S. capacity markets, one could lose their entire payment for the year (and more, in some cases) for failure to be available during just the scarcity hours, no matter how few of them there are, and no matter whether they were available for the rest of the year. This would not appear plausible in the case of the Italian CM.

⁴⁸ The reference price is defined as a function of the price in the day-ahead (Mercato del Giorno Prima or "MGP") and balancing (Mercato per il Servizio di Dispacciamento or "MSD") markets, depending on whether the contracted capacity cleared in one or the other market or didn't clear at all. For more information, see: European Commission, 2018 February.

⁴⁹ The immediate purpose of the payback obligation is to provide the counterparty a hedge against peak prices, in return for paying the option fee. In a centralised reliability options scheme, like Italy's, the second-order purpose is effectively to cap energy market prices, as it removes any incentive for generators to increase their offer prices above the strike price. In this way, it functions as a market power mitigation measure, just as a price cap does. A decentralised reliability options scheme can have a similar effect; but because it's decentralized, the effect is more diluted, with the possibility that a significant amount of generation would continue to rely solely on other arrangements, including reliance on scarcity pricing.

⁵⁰ For detailed information about how the Italian CM works, see: Terna. Mercato Della Capacità [capacity market] [Webpage]. Retrieved from <https://www.terna.it/it/sistema-elettrico/mercato-capacita>. European Commission, 2018 February, and Mastropietro, P., et al., 2018, also offer descriptions of the Italian CM design in English.

⁵¹ European Commission, 2018 February.

above a certain threshold. The TSO has estimated this threshold to be around 209,000 euros per MW.⁵² This threshold effectively means that only generation projects will most likely qualify for 15-year contracts, as demand-side projects tend to have significantly lower capital costs but higher operating costs. The Irish CM has set a similar rule, whereby new and refurbished capacity has to invest more than 300,000 euros per MW to qualify for longer duration contracts (10-year contracts in the Irish case).⁵³ The results of the latest T-4 auction for 2022/23 suggest that only generators and, in particular, one single company (ESB) was successful in securing a 10-year contract.⁵⁴ It is also significantly more difficult, if not impossible, for demand response providers to anticipate the available resource in their portfolio within such long time frame (effectively 19 years, if one considers the lead time to the delivery period).

This distinction for new capacity projects is unnecessary, discriminatory and distortive for the following reasons:⁵⁵

- It's unnecessary because experience from long-established CMs demonstrates that significant investment can occur even if only one-year contracts are awarded. This is illustrated in Figure 5,⁵⁶ which shows investment in new resources in the PJM CM, which only offers one-year contracts for all types of resources, new and existing, supply-side and demand-side. Similar experience can be shown from other North American markets that incorporate capacity mechanisms.
- The distinction is discriminatory because the contract length creates a bias in favour of investment in supply-side options, given the threshold for a resource to qualify as new.
- The rule is also distortive, as 15-year contracts can make it difficult to withdraw a CM and send the wrong signals to generators. A 15-year contract reassures them that the state is willing to relieve them of all risks associated with future market conditions and places the risks on consumers, the stakeholders least capable of understanding and managing such risks. Given the uncertainties facing the power system today, regarding both future demand for electricity and the technologies likely to emerge on both the supply side and the demand side to meet demand, these risks to consumers increase many times over.

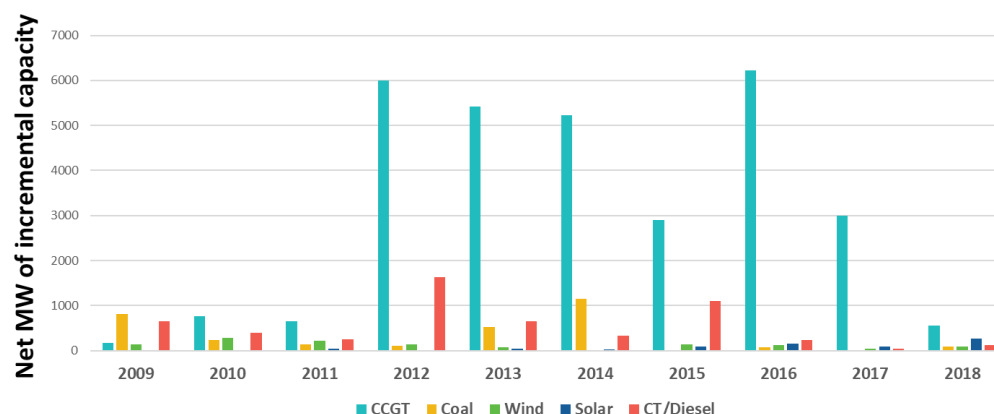
⁵² Mastropietro, P., et al., 2018.

⁵³ European Commission. (2017, November). *State aid No. SA.44464 (2017/N) – Ireland Irish Capacity Mechanism*. Retrieved from https://ec.europa.eu/competition/state_aid/cases/267880/267880_1948214_166_2.pdf.

⁵⁴ Eirgrid and SONI. (2019, May). *SEM Capacity Market: Final Capacity Auction Results - 2022/2023 T-4 Capacity Auction*. Retrieved from <https://www.sem-o.com/documents/general-publications/T-4-2022-2023-Final-Capacity-Auction-Results-Report.pdf>. James Goldsmith. (2019, April 12). One step beyond: First T-4 auction results [Blog post]. Retrieved from <https://www.cornwall-insight.ie/2019/04/12/one-step-beyond-first-t-4-auction-results/>

⁵⁵ Baker, P. (2018, October). *Capacity market review in Great Britain: Response to the call for evidence*. Brussels, Belgium: Regulatory Assistance Project. Retrieved from <https://www.raponline.org/knowledge-center/capacity-market-review-gb-response-to-call-for-evidence/>

⁵⁶ PJM. 2021/2022 RPM base residual auction results. Retrieved from <https://www.pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2021-2022/2021-2022-base-residual-auction-report.ashx>

Figure 5. Investment in new generation resources under the capacity market in PJM

Source: Based on data from PJM. 2021/2022 RPM base residual auction results.

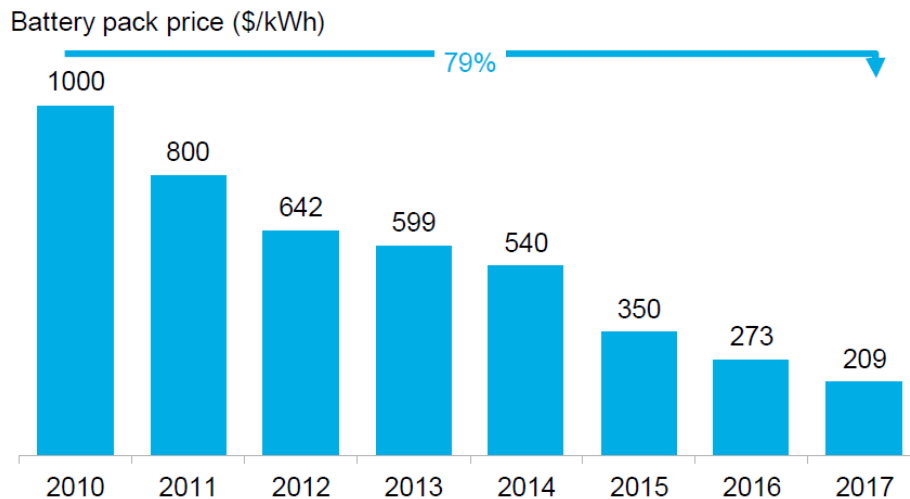
The length of these multiyear contracts creates a significant risk of carbon lock-in⁵⁷ and could raise a high hurdle for new technologies trying to enter the market, such as battery storage. With the first contracts scheduled to be finalised in 2019, it is highly likely that these will be awarded primarily to existing and new gas generators, meaning they will eliminate the room for new types of resources to enter the market. In the meantime, the costs of clean technologies like renewables and battery storage are expected to continue falling. The costs for battery storage have dropped by almost 80% from the beginning of the decade until recent years, as illustrated in Figure 6.⁵⁸ This could make them more economic solutions over the long term than resources that are currently cheaper. For example, given the abundant solar resources in the country, it is highly likely that the combination of solar and storage could be more economic than existing or new open cycle gas turbines (OCGTs) in the short term to medium term.

In addition, long-term contracts don't magically erase the risks, among them technology, demand and fuel risks, but essentially move them from generators to consumers.⁵⁹ For example, if a generator signs a 15-year contract today for delivery from 2023 to 2038 and the projected demand growth doesn't materialise (e.g., due to a new financial crisis or because of energy efficiency gains as a result of policies), this would render this resource unnecessary. Consumers will still pay for it throughout the duration of the contract, however, even though the resource is not used. For this reason, long-term contracts are clearly preferred by generators, but history tells us that such lopsided risk allocation is unnecessary to meet demands for resource adequacy.

⁵⁷ Three-year and 15-year contracts would lock in resources for seven and 19 years into the future, if one considers the lead time to delivery.

⁵⁸ BloombergNEF. (2018, 19 December). Lithium-ion battery price survey results: Volume-weighted average. Retrieved from <https://www.facebook.com/%20BloombergNEF/videos/our-2018-battery-price-survey-has-found-that-the-volume-weighted-average-price-o/2243145969343197/>

⁵⁹ A common argument in favor of long-term contracts is that they reduce the financing costs by securing income over a long period. While this is true, the downside risks of long-term contracts, such as the risk of stranded costs as the costs of new technologies drop rapidly, are more significant, therefore making the choice of long-term contracts unfavorable overall.

Figure 6. Evolution of battery storage costs from 2010 to 2017

Source: BloombergNEF. (2018). 2018 Battery price survey.

Recommendation: Remove long-term contracts from the capacity market in favour of one-year contracts for all resources. This would promote investment in new resources as needed while avoiding the risk of carbon lock-in and unnecessary shifting of costs and risks to consumers.

2. Strike price: The strike price is defined as the short-run marginal cost of an OCGT. The strike price does not have a fixed value but is instead linked to the price of natural gas in the market. This allows it to vary depending on the market dynamics of the fuel.⁶⁰ The Italian authorities have selected an OCGT as the expected type of new peak generation unit, with the highest variable costs.⁶¹

This approach to the strike price, like that of contract duration, implicitly favours supply-side resources over demand response. Demand response often has lower capital costs than a peaking generator, but higher variable or operating costs. This means that demand-side resources with higher variable costs than OCGTs will likely not participate in the Italian CM, even though they might be a more inexpensive solution overall.^{62, 63}

A more substantial problem is that the strike price impacts the energy market, which then cannot function as it should. In a centralised reliability options scheme, the strike price effectively acts as an implicit price cap for the energy market; in the case of Italy, this is in fact a very low one. Prices will unlikely rise beyond the strike price, as most if not all supply resources will be expected to be contracted under the scheme and will have no incentive to bid beyond

⁶⁰ For example, as of June 2017, the Italian TSO estimated the variable costs of an OCGT to be around €125/MWh. European Commission, 2018 February. Currently these costs are closer to €150/MWh.

⁶¹ One of the several implicit decisions taken by authorities under a CM, and not the market itself, effectively pre-determining the outcomes of a CM.

⁶² As previously explained, any resources successful in the CM are subject to the “payback obligation,” meaning that when the market reference price exceeds the strike price, they have to return the difference to the system operator. Since the operating or variable costs of DR will most likely be higher than those of an OCGT, they wouldn’t be able to recover their full variable costs every time they deliver in the market.

⁶³ One might argue that DR needn’t participate in the CM but could rather participate in the energy and balancing markets, thus being able to bid at prices reflecting its actual operating costs. However, as we explain below, the Italian market will most likely be oversupplied, severely limiting the space for DR to be profitable in the market. It is also worth noting that as of 2018, the participation of DR in Italy was only eligible in some pilot projects for ancillary services.

that level under the payback obligation. Compounding the issue is the fact that a centralised reliability options scheme virtually ensures that the market will be oversupplied (see 3rd and 4th point in this section). Without an administrative scarcity pricing mechanism, balancing prices will be incapable of sending the right signals to market actors and, with the near certainty of overprocurement, the benefits consumers can reap from competition between low-cost energy market resources and higher-cost capacity market resources will never be realised. Market players are meant to recover their variable and capital costs through the energy and balancing services markets. When the market price cannot rise above a certain level, it means that resources need to recover a greater share of their capital costs through the capacity market, while the value recovered through the energy market would drop, making its role more marginal than being at the core of the power system.

Recommendation: Establish a significantly higher strike price. Italy can look to the Irish model, which sets the strike price at the level of the variable costs of demand response, around 500 euros per MWh.⁶⁴ That would allow the energy market to better fulfil its role and, at the same time, create a more level playing field for demand response.

3. Risk of overprocurement: Under the centralised Italian reliability options scheme, Terna is responsible for estimating the amount of resources required to achieve the desired level of reliability for all retail supply, as commonly happens in CMs. Centralising this responsibility with the system operator poses a significant risk of overprocurement, a phenomenon that has been repeated consistently across all existing centralised capacity schemes. The system operator bears the risks associated with customer disconnection, especially reputational and operational risks,⁶⁵ but not the costs for securing supplies through the CM. These are borne by consumers. In other words, the system operator is by nature prone to procure more than less.

This has been observed in existing markets in which capacity market commitments are much shorter in duration, but the risk multiplies many times over when multiyear commitments are made, especially 15-year commitments. When combined with the information asymmetry between the system operator and the regulator or the government, the system operator is clearly powerfully motivated to skew the procurement of capacity toward higher levels.⁶⁶ Independent of the implicit incentives, the task of assessing sufficient capacity to ensure generation adequacy is by default a task rife with uncertainty and difficulty, such as assessing the level of demand years in advance or evaluating the technology options (both supply-side and demand-side) likely to emerge over a 15-year period.⁶⁷

⁶⁴ The variable price was estimated based on experience with activating DR prior to the introduction of the CM. European Commission, 2017 November. The main challenge in Italy's case would be estimating the variable costs for demand response in the country. One source could be the interruptibility scheme that was in place, although this represents only a very traditional subset of potential demand response (i.e., industrial loads that have the capability of peak shaving a few times per year).

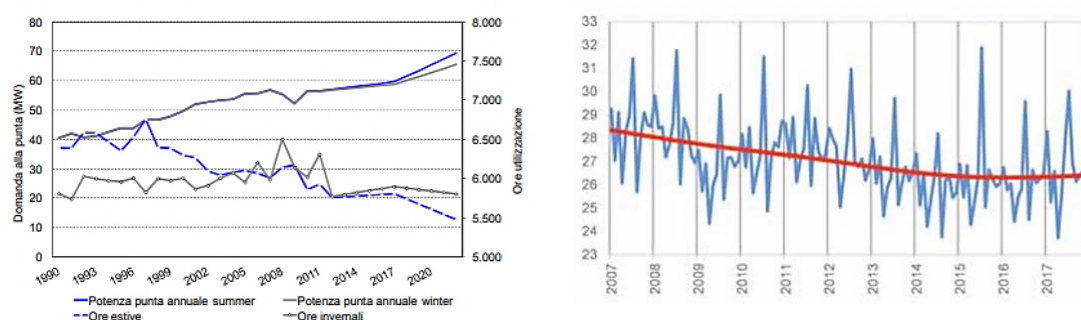
⁶⁵ The financial risks would be borne by suppliers that have a responsibility of serving their customers.

⁶⁶ Similar evidence is available for other markets, too. For example, an analysis of National Grid's demand forecasting over recent years shows an average over-estimation of around 1.5 GW. Baker, P. (2018, 30 October). Britain's capacity market for electricity: Lessons for Europe [Blog post]. *Euractiv*. Regulatory Assistance Project. Retrieved from <https://www.euractiv.com/section/electricity/opinion/britains-capacity-market-for-electricity-lessons-for-europe/>

⁶⁷ Even though this risk can be somewhat managed through the series of auctions that the Italian system encompasses for the delivery year, it is also true that it doesn't eliminate the risk of overprocurement, while it can also lead to suboptimal decisions in an auction by misjudging future demand.

Figure 7⁶⁸ depicts Terna's peak demand projections as of 2013 (graphic on left). It shows that Terna was projecting peak demand would start increasing from 2013 onward, following a prolonged period of general stagnation (see also Figure 2). Terna also projected that demand would reach 60 to 62 GW, an increase of around 5 GW, depending on the season (the higher peak demand corresponds to the summer season, blue solid line on the graph).⁶⁹ The graphic on the right depicts the monthly fluctuations and the long-term trend of change for demand from 2007-2017 (corrected for weather effects), as assessed by the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA). The agency concludes that demand stabilised from 2014 onward, with a slight upward trend in 2017. This suggests that the demand projections by Terna turned out to be overly optimistic.

Figure 7. Terna's peak demand projections as of 2013 (left) and demand trends (GWh) from 2007-2017 (right)



Source: Terna. (2013). *Piano di Sviluppo 2013* [Network development plan 2013]

Projected demand in first CM auction

Terna projects a similar trend for the evolution of demand in the years to the first auction in 2022. The TSO has estimated a firm capacity requirement of 65.4 GW.⁷⁰ Assuming that the reliability standard equates to a de-rated margin of around 3.5%,⁷¹ this would suggest a peak demand of 63.2 GW for which the TSO is procuring capacity. This level of peak demand is significantly higher than the current levels of peak demand experienced in Italy. Peak demand in 2018 was 55 GW in the winter and just 58 GW in the summer.

Recommendation: Establish a body responsible for an objective and independent review of Terna's assessments, with an obligation to provide the Italian government (or regulator) with recommendations for procurement volumes. In addition, the regulator can consider

⁶⁸ Left Graph: Terna. Piano di Sviluppo 2013 [Network Development Plan 2013]. @courtesyTerna. Retrieved from <https://download.terna.it/terna/0000/0109/54.pdf>. Right Graph: Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile [Italian National Agency for New Technologies, Energy and Sustainable Economic Development]. (2018, January). *Analisi trimestrale del sistema energetico italiano Anno 2017* [Quarterly analysis of the Italian energy system Year 2017]. Rome, Italy: Author. Retrieved from <http://www.enea.it/it/seguici/pubblicazioni/pdf-sistema-energetico-italiano/01-bollettino-trimestrale-2018.pdf>

⁶⁹ Realised peak demand in 2018 was close to 58 GW (not weather-corrected).

⁷⁰ Terna. (2019, 28 June). Mercato della Capacità - Disposizioni tecniche di funzionamento: Allegato 1 alla DTF n. 2 (anno di consegna 2022) [Capacity market – Technical operating provisions: Annex 1 to technical rule no. 2 (year of delivery 2022)]. Rome, Italy: Author. Retrieved from https://download.terna.it/terna/CM_DTF2_allegato2022_8d73227d2ed7fdd.pdf

⁷¹ Based on information from Great Britain's capacity market.

introducing an incentive that rewards the TSO if it gets different parameters of the CM right (e.g., peak demand forecast, de-rating factors) and a penalty if they get it wrong.

4. De-rating factors: The de-rating factors of the different resources are based on their historical availability. Terna is planning to use different methodologies to assess these depending on the type of resource. Given the recent history of oversupply in the Italian market and the attendant lack of economic incentives for generators to maintain very high levels of availability during peak season, these are expected to lead to underestimation of the realistic availability of different resources, especially during peak demand periods, and overprocurement of resources.

The expected average unavailability for thermal generation is 20% to 25%. This is significantly higher — and, subsequently, the average availability is significantly lower — than realised plant availability in well-functioning markets⁷² and assumed availability in other studies, such as the MAF.⁷³ By using historical data, Terna effectively underestimates the realistic availability of CCGTs.

This could have a huge impact on the available capacity in the market. For example, if the system operator uses a 20% unavailability factor applied indiscriminately across the year, instead of a more realistic estimate of 5% for CCGTs during peak season (as would be expected given the significant economic incentives created by the reliability options scheme, a result that's been observed repeatedly in other markets), and assuming all currently installed CCGT capacity of 22 GW clears the market, then this effectively implies a surplus of 3.3 GW or the equivalent of around eight typical CCGT units.⁷⁴

For renewable energy resources, Terna is planning to use different methodologies. For hydro resources, including pumped-storage hydro plants, it will estimate their availability based on historical data during the peak hours over the five years prior to the auction.⁷⁵ The expected unavailability factors vary from 40% to 60%. It is unclear why pumped-storage hydro plants would experience such high unavailability factors.⁷⁶ The de-rating factors for wind and solar technologies also appear to be on the conservative side.⁷⁷

⁷² For example, in Texas the average availability of CCGTs was about 98% during the peak summer season of 2018 when the market was experiencing tightness. See footnote 36.

⁷³ The latter assumes an annual rate of forced outages of 5% for new CCGTs and slightly higher rate of 8% for older ones.

⁷⁴ Needless to say, none of this surplus capacity would be able or have a reason to exit the market as it is part of a unit or complex of generation units.

⁷⁵ It is unclear and inconsistent to use high-demand hours only for renewable energy sources and not for thermal generation. Hydro plants with water storage capabilities, like pump hydro, can be turned on and off at will, depending on water availability in their reservoir, similarly with a thermal generation. European Commission, 2018 February.

⁷⁶ For example, in Great Britain's CM the de-rating factor for all pumped-hydro storage is estimated at 96.11%, based on historical availability. See for example: National Grid. (2017). *Duration-Limited Storage De-Rating Factor Assessment – Final Report*. Retrieved from <https://www.emrdeliverybody.com/Lists/Latest%20News/Attachments/150/Duration%20Limited%20Storage%20De-Rating%20Factor%20Assessment%20-%20Final.pdf>. Such low availability could be explained if these plants need to operate continuously to help meet demand, which could exhaust the water in their reservoirs. However, the Italian system experiences lower demand during the night hours and it's improbable this would be the case, also given the significant overcapacity of the Italian system in the past.

⁷⁷ For wind and solar, the de-rating factors are estimated as “the 50th percentile of the historical contribution (i.e., the median value) during the peak hours over the previous five years. For instance, the expected average de-rating factor is ~85% to 90% for wind installations and ~90% to 95% for solar installations.” European Commission, 2018 February. (Footnote continues on next page)

Recommendation: Establish a detailed review of Terna’s proposed methodology and de-rating factors by the Italian government and regulator and compare these with international experience. If there are significant differences between the two, the Italian authorities can have Terna amend its methodologies and de-rating factors accordingly, unless the TSO can convincingly explain the differences.

5. Demand response treatment: It appears from the general treatment of demand response that it is considered inferior to supply-side alternatives.⁷⁸ Yet public authorities are also expecting the CM to deliver new generation resources. Demand response is eligible for participation in the capacity market, but it cannot earn the auction price. In return, any successful demand response in the CM is discharged from its obligation to contribute toward recovering the costs for the CM.⁷⁹ Unlike generators, demand response only needs to be available during the six highest demand hours of the week. As a result, their capacity is significantly de-rated to take into account that the rules governing their participation are less stringent than for generators, even though these hours will most likely represent the hours when resources are needed the most. A scarcity event is usually caused by a combination of higher than normal demand and lower than normal supply availability.

Overall, it appears that the Italian authorities have anticipated a traditional role for demand response, similar to that in “interruptibility schemes,” where industrial loads are expected to offer a few hours of peak demand shaving per year in return for a payment. It is characteristic that the CM decree gives the right to the system operator to interrupt loads successful in the CM.

While demand response has traditionally seen disadvantageous treatment in CMs (both in Europe and the U.S.), markets that have established equivalent treatment of supply-side and demand-side resources meet a considerable share of their procurement obligation through demand response, e.g., close to 5% to 6% in PJM, as shown in Figure 8.⁸⁰ What is more, demand

The methodology used by the TSO is inferior to the widely recognised statistical methodology for estimating the contribution of variable renewables at peak time — the capacity credit. The capacity credit effectively represents the amount of firm capacity that can replace entirely the installed capacity of a type of variable RES and give the same level of risk as measured by the LoLE.

The unavailability factor for solar appears to be low, given that solar power should be available at the peak demand days of the summer (temperature is the key driver of peak demand in the summer, and the availability of sun is a key driver of temperature) and unavailable at the peak days of the winter (as peak demand tends to happen during the night hours). According to historical information and Terna’s demand projections, the highest demand periods are expected in the summer, especially in June and July; therefore, one would expect a significantly higher availability factor for solar.

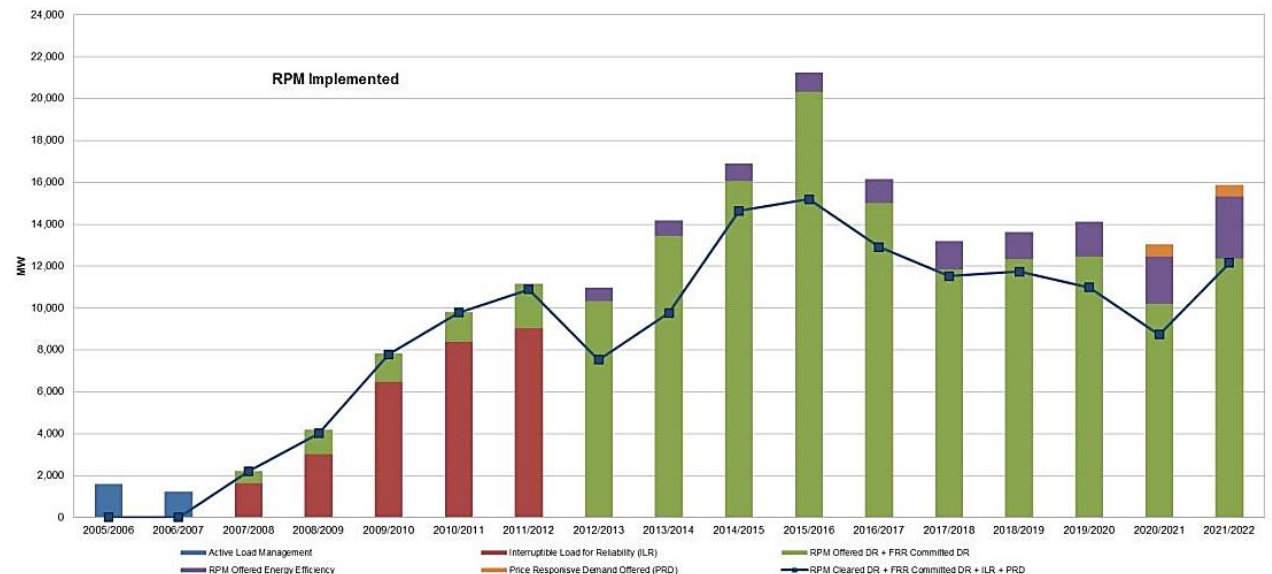
⁷⁸ The business association of “market players driving digital and decentralised energy solutions” including demand response solutions, SmartEn, has assessed the Italian CM design as very negative for demand response. More specifically, SmartEn offers the following criticism in relation to the Italian CM: i) Does not allow demand-side flexibility solutions to compete with supply-side resources, as it cannot earn the clearing price; ii) does not allow aggregation; iii) does not fully value DR, because it is restricted to participating during typical peak hours and is excessively de-rated on that basis, iv) requires all DR sites to give the TSO the ability to trip them directly. SmartEn. (2019, May). *State aid for resource adequacy: Recommendations for the revision of the Guidelines*. Brussels, Belgium: Author. Retrieved from https://www.smarten.eu/wp-content/uploads/2019/05/smartEn-position-paper-Revision-State-Aid-Guidelines_FINAL.pdf

⁷⁹ According to the Italian authorities, the revenues (auction price and energy prices) and costs (CM costs and payback obligation) for DR equal each other in every scenario. Therefore, it is logical not to provide any remuneration for DR in the CM nor to receive any payments from it, to avoid transactions that offset each other. The modelling supporting the Italian authorities’ claims has not been made public as far as we understand. We are not aware of any other CM that has used similar reasoning for demand response. European Commission, 2018 February.

⁸⁰ PJM. (2018, 23 May). *2021/2022 RPM base residual auction results*. Norristown, PA: Author. Retrieved from <https://www.pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2021-2022/2021-2022-base-residual-auction-report.ashx#page=13>

response is often more reliable than its cleared capacity when the system is actually facing periods of stress, as experience in these markets shows.⁸¹ On the other hand, the Italian CM obligates the system operator to set only 1% of the resource requirement aside for the T-1 auction, which is meant to be mainly for demand response.

Figure 8. Demand-side participation in the PJM capacity market



Source: PJM. 2021/2022 RPM base residual auction results.

Recommendation: Put demand-side resources on equal footing with supply-side resources. It makes sense, for instance, to allow demand response to bid in blocks of 100kW, as is the case in U.S. capacity markets, whereas a larger minimum bid size than that is appropriate for traditional grid-connected generation. Demand-side resource should be treated on an equitable basis in terms of their obligations and remuneration with supply-side resources.

Reforms for the Italian energy market

Here we briefly discuss recommendations for other market reforms for the Italian authorities to consider in order to fulfil the objective of reliable service at least cost.⁸² We note, however, that these reforms will only have limited success unless the Italian authorities appropriately reform or entirely abolish the recently adopted CM.

Price formation – Implementation of administrative scarcity pricing

As the Italian power sector transitions toward a system increasingly dominated by variable renewables, securing supplies will be about more than just investing in generating capacity.

⁸¹ PJM. (2019, August). *Load management performance report*. Norristown, PA: Author. Retrieved from <https://www.pjm.com/-/media/markets-ops/dsr/2018-2019-dsr-activity-report.ashx?la=en>

⁸² We recognise that the Italian authorities are considering or planning some market reforms, as outlined in the Commission's State Aid decision.

Securing supplies in all time frames will require the right set of operational capabilities.⁸³ It is widely recognised that flexibility will be a key element in a decarbonised power system.

The value of investment in more flexible resources can only be seen in energy prices reflecting real-time conditions on the electricity system. Therefore, getting the wholesale market price right will be essential for developing the necessary operational capabilities and “keeping the lights on” cost effectively.

Administrative scarcity pricing, also called administrative reserve shortage pricing,⁸⁴ should be the first priority for intervention in the balancing and energy markets.⁸⁵ Scarcity pricing enhances investors’ profitability in the market and has proven to be more effective than a typical capacity mechanism for reaping the value of resource capabilities. This happens not only through higher prices during actual scarcity periods, but through increasing risk-hedging arrangements by wholesale market actors (these could take the form of bilateral contracting or forward trading of hedging products).⁸⁶ The latter underpins the investment needed to meet reliability in a cost-effective manner.

Under the legacy practices of market formation, the energy price is defined by the short-run marginal cost of the marginal unit in the market, ignoring the demand for reserves. However, the correct way to form prices is to take into account the demand for reserves that are required to keep the lights on. These reserves might or might not be used depending on actual circumstances. When the system operator uses balancing reserves to meet the demand for energy, the opportunity cost is no longer the short-run marginal cost of the marginal unit, but rather the cost of being closer to a system shortfall.⁸⁷

Administrative scarcity pricing functioning and evidence from U.S. markets

Electricity prices are defined by an administrative scarcity pricing function once the level of reserves drops below the required level of reserves, as assessed by the system operator. The probabilistic demand for operating reserves reflects the cost (VoLL) and probability of lost load, as measured by the loss of load probability. In the Texas market, when the level of reserves drops below the minimum level of reserves deemed necessary to ensure the integrity of the system, the price is set at the VoLL. The functioning of administrative scarcity pricing is illustrated in Figure 9.⁸⁸

⁸³ While this has always been the case, new challenges surface as our power systems are being decarbonised (e.g., reduction in system inertia as synchronous, traditional generation is being replaced by asynchronous, renewable generation).

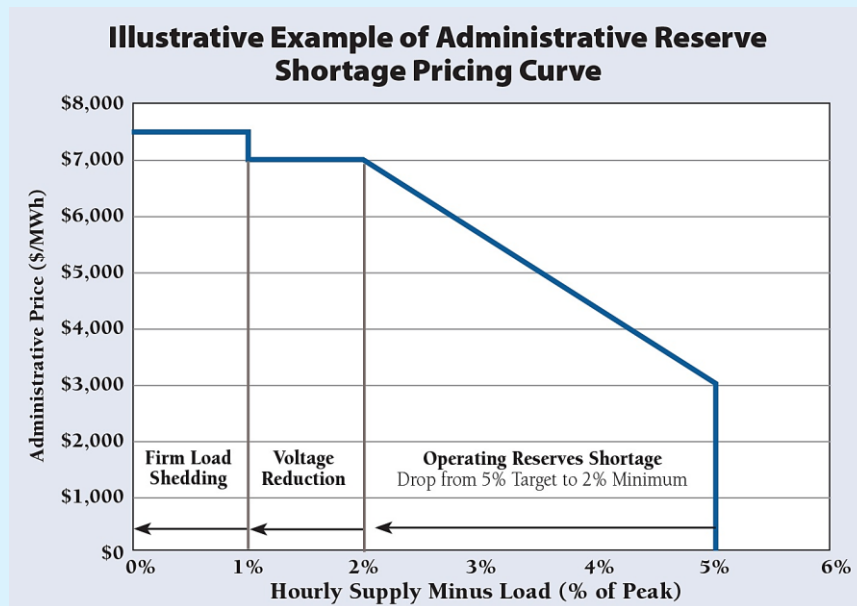
⁸⁴ In the U.S., it is commonly referred to as “operating reserve demand curve.”

⁸⁵ Hogan, M. (2016). *Hitting the mark on missing money: How to ensure reliability at least cost to consumers*. Brussels, Belgium: Regulatory Assistance Project. Retrieved from <https://www.raonline.org/knowledge-center/hitting-mark-missing-money-ensure-reliability-least-cost-consumers/>

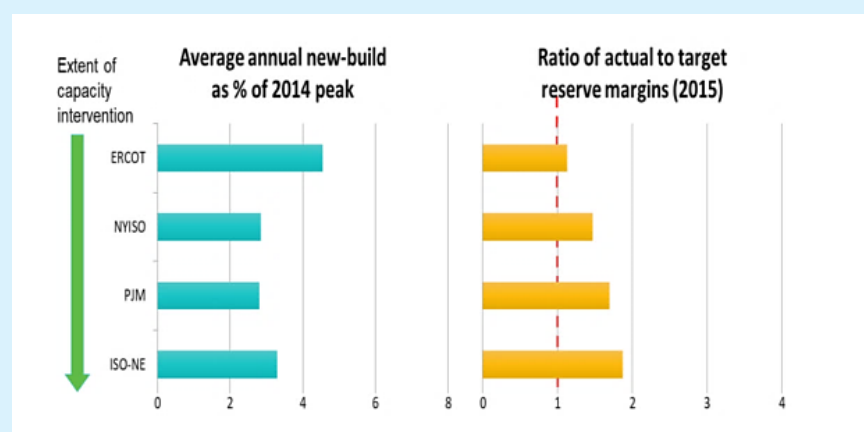
⁸⁶ Suppliers would be seeking to hedge their demand against the risk of very high prices being realised in the market, which could penalise them severely. For example, suppliers in Texas had hedged 95% of demand prior to the start of last summer, which was expected to be rather tight.

⁸⁷ A good example of a balancing market is that of Great Britain, as modified by the Electricity Balancing Significant Code Review (EBSCR). Ofgem’s recent reform of the balancing market introduced the following four key elements: i) marginal pricing of balancing actions, ii) a single balancing price, iii) a VoLL for disconnections and emergency actions from the system operator, and iv) a scarcity pricing function.

⁸⁸ For an extensive description of the concept, see: Hogan, W.W. (2014, 27 February). *Electricity Scarcity Pricing and Resource Adequacy*. Santa Monica, CA: Harvard Energy Policy Group. Retrieved from https://sites.hks.harvard.edu/fs/whogan/Hogan_HEPG_022714.pdf; Hogan, W.W. (2013, 25 April). *Electricity Scarcity Pricing Through Operating Reserves*. *Economics of Energy & Environmental Policy*, 2(2).

Figure 9. Illustration of administrative scarcity pricing function

It is instructive to see what happens in energy markets, complemented by administrative scarcity pricing, such as that in Texas. Figure 10 shows the level of investment in new resources in different U.S. and Australian markets with different levels of intervention through a CRM, along with the reliability levels achieved in these markets compared to their established reliability standards. Experience from the Texas market (ERCOT) demonstrates there is significant new investment, while reliability is met closest to the required standard, avoiding overcapacity.⁸⁹ On the other hand, markets with capacity mechanisms, such as PJM, are marked by significant overcapacity. Also revealing is that Texas has the lowest power prices in the U.S. compared to markets of all other regional transmission organisations and independent system operators.⁹⁰

Figure 10. Investment and reliability in U.S. markets with and without capacity markets

Source: Based on data from ERCOT, NYISO, PJM and ISO-NE

⁸⁹ For recent experience in Texas, see for example: Hogan, M. (2019, October). A Hearty Bowl of Texas Soup: How ERCOT Keeps the Lights On [Blog post]. Retrieved from <https://www.raonline.org/blog/a-hearty-bowl-of-texas-soup-how-ercot-keeps-the-lights-on/>

Market integration and domestic network development

Another area with significant potential for improvement is further integration of the Italian market with the rest of Europe and better use of its interconnector capacity. The Italian market is coupled with the single European electricity market for the day-ahead, but not with the intraday and balancing markets. Coupling the Italian market with these markets also will help to ensure that energy flows where it's needed most when it matters most, thus improving security of supply in the country.

In addition, the current commercial offering of the Italian interconnectors to the markets is about two-thirds of the optimal capacity according to analysis by the Agency for the Cooperation of Energy Regulators (ACER).⁹¹ In other words, the level of interconnector capacity offered to the market could increase, which would allow for higher imports from the neighbouring markets. It is worth noting that Italy is directly interconnected with countries that are expected to have a healthy security of supply in the medium term, according to the latest MAF analysis, (Switzerland, Slovenia and Austria) and others that are already implementing or contemplating the implementation of a CM (France and Greece).⁹²

Italy would also benefit from continuing to strengthen its internal network. The MAF clearly demonstrates that the risks to security of supply are not uniform across the country but vary between regions. There are zones with a tighter situation, especially northern Italy, and others with a comfortable balance between supply and demand. Further strengthening of the internal network will help to move power from the regions of surplus to those facing a tighter situation. The development of the domestic network will also be necessary to move increasing amounts of variable resources between regions (e.g., solar generation from southern to northern Italy).

Terna's 2019 network development plan and security of supply

Figure 11⁹³ shows the impact of Terna's proposed network development, as of 2019, on resource adequacy. This considers a series of developments, some already in the making and others prospective.

The graphic shows that if Terna implements its planned and prospective developments, the risks to security of supply will almost evaporate. Terna only recently received approval for its plans to develop the Italian networks at a cost of 6 billion euros for the next four years.⁹⁴ The total costs of the network developments in Terna's 2019 network development plan amount to

⁹⁰ For more information, see: U.S. Energy Information Administration/ Wholesale Electricity and Natural Gas Market Data [Webpage].

Retrieved from <https://www.eia.gov/electricity/wholesale/#history>

⁹¹ The figure refers to the zone in Northern Italy, where the bulk of Italy's interconnectors are connected (see also following footnote).

Agency for the Cooperation of Energy Regulators and Council of European Energy Regulators. (2018, October). *Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2017 – Electricity Wholesale Markets Volume*. Ljubljana, Slovenia and Brussels, Belgium: Authors. Retrieved from

https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/MMR%202017%20-%20ELECTRICITY.pdf

⁹² ENTSO-E's Mid-Term Adequacy Assessment of 2018 assumes that the Net Transfer Capacity of Italy, with its directly interconnected neighbours, is a total of 11.4 GW. The bulk of these interconnections is with North Italy (Switzerland: 4.5 GW, France: 4.1 GW, Austria: 0.7 GW, Slovenia: 1.6 GW), while the South Italian zone is interconnected with Greece (0.5 GW). In addition, Italy is expected to be interconnected with Montenegro by 2025 with a 1.2 GW link.

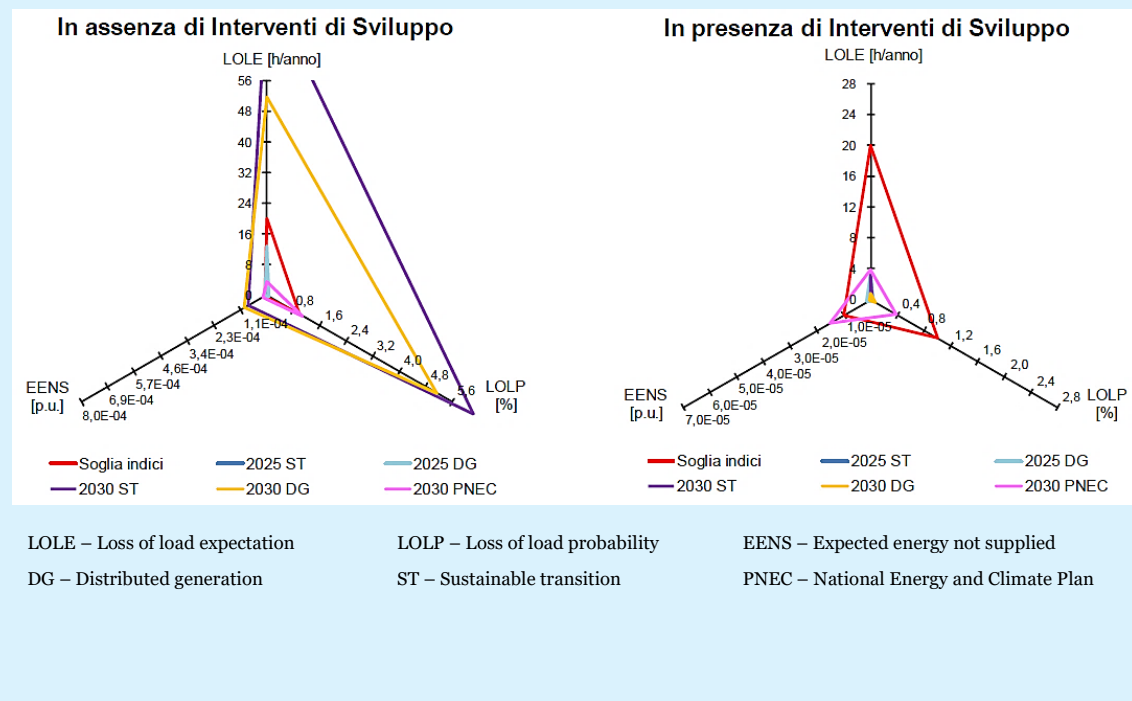
⁹³ Left graphic depicts values without network development interventions, while right graphic shows values with network development interventions. Terna, 2019. @courtesyTerna.

⁹⁴ Terna. (2019, 21 March). 2019-2023 Strategic Plan Approved [Press release]. Retrieved from <https://download.terna.it/terna/0000/1184/97.PDF>.

13 billion euros.⁹⁵ This raises the question of the value of implementing a CM on top of them, which could cost consumers several billion additional euros (according to the Italian government, the implementation of the CM will cost between 0.9 and 1.4 billion euros per year).^{96, 97}

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Figure 11. Impact of Terna's 2019 network development interventions on security of supply indices



⁹⁵ Terna, 2019.

⁹⁶ European Commission, 2018 February.

⁹⁷ The distributed generation and sustainable transition scenarios are from the Ten-Year Network Development Plan (TYNDP) developed by ENTSO-E and national TSOs.

⁹⁸ Terna. (2019, 21 March). 2019-2023 Strategic Plan Approved [Press release]. Retrieved from <https://download.terna.it/terna/0000/1184/97.PDF>.

⁹⁹ Terna, 2019.

¹⁰⁰ European Commission, 2018 February.

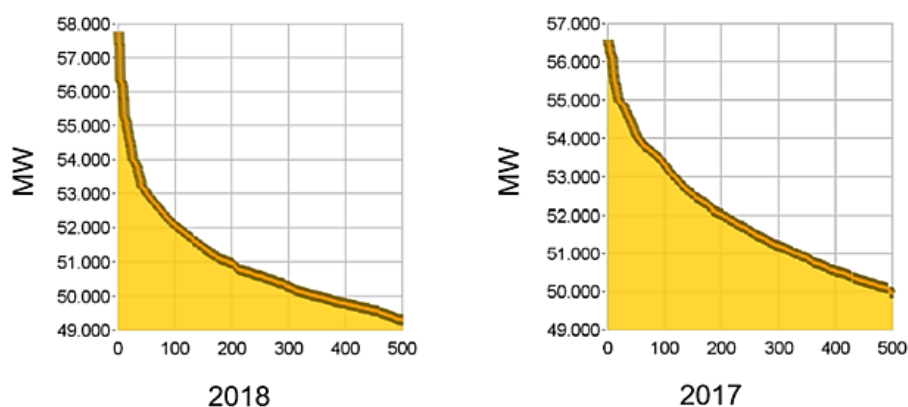
¹⁰¹ The distributed generation and sustainable transition scenarios are from the Ten-Year Network Development Plan (TYNDP) developed by ENTSO-E and national TSOs.

Enhancing system flexibility, demand response

An important step to improve reliability and reduce costs for Italy would be to increase investments in demand-side management through enabling the greater deployment of demand response, both implicit and explicit, as a power system resource.¹⁰²

Figure 12¹⁰³ shows the Italian load duration curve for the 500 highest demand hours in 2018 and 2017. From these graphs one can conclude that demand only spikes for a limited number of hours per year. Peak demand shaving for only a few hours per year would help to secure reliability cost effectively and avoid investing in generation resources and other assets, such as network lines, that are rarely needed.¹⁰⁴ While the industrial sector has traditionally provided demand response at peak hours, the advent of smart technology (such as smart meters, smart appliances and demand-side management technologies) and new business models on the demand side can help to untap the potential in the commercial and residential sectors, too. Italy has already embarked in the rollout of a second generation of smart meters with the aim of gradually replacing the entire first generation of smart meters by the early 2030s. This presents a significant opportunity to realise this potential.¹⁰⁵

Figure 12. Italian load duration curve for the 500 highest demand hours



The most important measures to increase the deployment of demand response include:

- Implement time-varying retail prices. The Italian retail market consists of both a free and a regulated market. While the bulk of the non-domestic (commercial and industrial) market purchases electricity in the free market, residential consumers mainly buy electricity

¹⁰² Hurley, D., Peterson, P., and Whited, M. (2013, May). *Demand Response as a Power System Resource*. Montpelier, VT: Regulatory Assistance Project. Retrieved from <https://www.raponline.org/knowledge-center/demand-response-as-a-power-system-resource/>.

¹⁰³ Terna. Pubblicazioni Statistiche – Carichi [Statistical publications – Load] [Webpage]. @courtesyTerna. Retrieved from <https://www.terna.it/it/sistema-elettrico/statistiche/pubblicazioni-statistiche>

¹⁰⁴ Peak demand shaving is one form of demand response.

¹⁰⁵ See for example: Italian Regulatory Authority for Energy, Networks and Environment (ARERA). (2019, 31 July). Annual Report to the Agency for Cooperation Between European Energy Regulators and the European Commission on the Business Carried Out and the Tasks of the Italian Regulatory Authority for Energy, Networks and the Environment. Milan, Italy. Retrieved from https://www.ceer.eu/documents/104400/6693346/C19_NR_Italy_EN.pdf/7ba9f5e5-9a1c-6ac1-15d2-071327560057

through the regulated market.¹⁰⁶ The Italian authorities have implemented time-of-use tariffs as part of the regulated tariff. The bulk of domestic consumers on the regulated tariffs are on the two-tier tariff. The standard offer includes a flat and a three-tier tariff, but only a minority of consumers have signed up for them. The design of the tariff, however, doesn't send a strong enough signal to consumers to shift demand away from the highest demand hours, as the price differential between the peak and off-peak prices is rather small.¹⁰⁷

The Italian authorities should review whether the established time-of-use tariffs are delivering the expected savings and whether there is potential for making them more cost-reflective. In addition, the Italian authorities could consider the implementation of a regulated, dynamic tariff, similar to the one implemented by the Spanish authorities, while the market is transitioning to a fully competitive market.¹⁰⁸ It will also be important to ensure that the free market delivers innovative products that empower consumers to save on their bills and meet customers' needs. Experience from markets with a longer history of liberalisation suggests that consumers gain access to more dynamic, time-varying tariffs as a result of effective competition.^{109, 110}

- In addition, regulated network tariffs should be volumetric and time-varying, particularly for new flexible loads that could have a significant impact on peak demand, such as electric vehicles and heat pumps. They can be optional for consumers who wish to explore their flexibility.¹¹¹ The largely capacity-based network tariffs currently in place do not send signals to consumers to be flexible and shift their consumption away from hours of peak demand to hours when there is ample network capacity available.

¹⁰⁶ ARERA. (2018, August). Annual report to the international cooperation agency of national energy regulators and to the European Commission on the regulatory activities and fulfilment of duties of the Italian regulatory authority for energy, networks and environment. Retrieved from https://www.ceer.eu/documents/104400/6319351/C18_NR_Italy-EN/4e56e751-cdde-c0c0-2aa3-964bf03226c1. The mass retail market (consumers connected to low voltage, including both domestic and non-domestic consumers) is moderately concentrated according to ARERA's analysis, with one supplier, Enel, serving more than half (around 55%) of the market as of 2017.

¹⁰⁷ For example, the off-peak price (F23) was offered at a discount of around 17% for January 2019. For more information, see: ARERA. Offerte standard per i clienti finali – PLACET [Standard offers for end customers – PLACET]. Retrieved from <https://www.arera.it/it/consumatori/placet.htm>. At the same time, the wholesale prices appear to experience significantly greater variance. For example, the lowest hourly, day-ahead price on 14 January 2019 was 40 €/MWh and the highest 87 €/MWh, and on 23 January 2019, the lowest and highest prices were 60 and 95 €/MWh respectively. Data source: ENTSO-E Transparency Platform.

¹⁰⁸ For more information, see: Red Eléctrica de España. Active energy invoicing price [Webpage]. Retrieved from <https://www.esios.ree.es/en/>.

¹⁰⁹ Real-time pricing is currently available in seven EU countries and Norway and is gradually becoming available in Member States that have phased out, or are in the process of phasing out, regulated prices. There is no real-time pricing in countries where the majority of households are under regulated prices. European Commission. (2019). *Energy prices and costs in Europe*. Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions [Staff working document]. Brussels, Belgium: Author. Retrieved from https://ec.europa.eu/energy/sites/ener/files/documents/swd_v5_text_6_part_1_of_4.pdf

¹¹⁰ The recently adopted CE4All legislation establishes the right of suppliers to offer dynamic pricing contracts and of consumers with a smart meter in place to request such a contract from any supplier that has more than 200,000 customers.

¹¹¹ Kolokathis, C., Hogan, M., and Jahn, A. (2018). *Cleaner, smarter, cheaper: Network tariff design for a smart future*. Brussels, Belgium: Regulatory Assistance Project. Retrieved from <https://www.raponline.org/knowledge-center/cleaner-smarter-cheaper-network-tariff-design-for-a-smart-future/>

- Currently, demand response is only allowed to participate in the provision of specific ancillary services.¹¹² It would be beneficial for the Italian authorities to ensure demand response and aggregation can participate in all market segments, from ancillary services to the balancing market and day-ahead market.
- Another important measure would be to consider introducing locational (or nodal) pricing to signal where congestion exists on the system. This will help to optimise investments, improve system operation through enhanced utilisation of networks and generation assets, and access flexibility where it is needed the most, at lowest overall cost over time.

Transitional measures — strategic reserve

While the Italian market transitions, it might be prudent to safeguard security of supply through an insurance type of policy, if there are legitimate concerns about the risks to security of supply. These policies can remain in place until the market reforms have taken full effect. A safety net could take the form of a strategic reserve implemented either on top of the existing interruptibility scheme or replace it.¹¹³ The strategic reserve could be filled in with capacity that would otherwise shut down for good, or resources that cannot be profitable in the market in the absence of necessary market reforms. A key benefit of the strategic reserve is that it doesn't intervene in the energy market and allows price formation. Its use should be priced at value of lost load, thus sending a strong signal to the market about the need for new resources.

Conclusions

Based on our analysis, a capacity market in Italy is unwarranted. It is questionable whether Italy truly has a resource adequacy problem. The implementation of the capacity market appears to be driven by overweighting highly improbable outcomes that, for example, ignore the existence of a market and its purpose. This is in addition to a generally conservative Europe-wide resource adequacy assessment. These effectively imply that Italian consumers are willing to spend hundreds of thousands of euros per megawatt-hour on marginal generation to address these unlikely outcomes, even though alternatives with significantly lower costs are available to secure supplies.

We recommend that the Italian authorities undertake a thorough and balanced analysis of the risks to electricity security of supply and determine whether market intervention in the form of a CRM is necessary. This process should be fully transparent and subject to public scrutiny.

The design of the capacity market itself will likely result in overprocurement, excessive costs for consumers and carbon lock-in. The system operator bears the risks associated with customer disconnections but not the costs for securing supplies through the CM. This creates a significant bias for overprocurement on the part of the TSO, who is responsible for assessing the volume of capacity to procure. In addition, there are clear indications that the capacity market supports the development of fossil-fuel generators while stymieing the development of cleaner and more

¹¹² SmartEn. (2018). *The smartEn Map: European Balancing Markets Edition 2018*. Retrieved from https://www.smarten.eu/wp-content/uploads/2018/11/the_smarten_map_2018.pdf. According to the report: "Currently these pilot projects are only working for RR [secondary reserve] but there are draft projects for FCR [primary reserve] and voltage regulation. Future projects may involve FRR [tertiary reserve]." More than 600 MW participated in these projects in 2017.

¹¹³ Italy has implemented separate interruptibility schemes across its main islands and the mainland since 2010. The current period of the interruptibility scheme runs until 2020. It is not clear what purpose the interruptibility scheme has served given the significant resource surplus over demand in the country. For more information on the scheme itself, see: Terna. Servizio di interrompibilità [Interruptibility service] [Webpage]. Retrieved from <https://www.terna.it/it/sistema-elettrico/mercato-elettrico/servizio-interrompibilita>

cost-effective resources, such as demand response and storage. This undermines the energy transition. Very importantly, the current design of the CM, with its highly restrictive strike price, will take significant value out of the energy market and undermine its purpose as well. These developments contradict the recently adopted Clean Energy for All Europeans package, which aims at delivering the energy transition at least cost by achieving reliability through the energy and balancing markets.

In order to achieve reliability at least cost, we recommend that the relevant authorities adjust the design of the capacity market — if there is to be one in the future — to ensure it doesn't undermine the operation of the energy market and to bring the two markets into alignment. Its design should create a level playing field between generation and demand-side resources. Treating demand-side options comparably with supply-side resources minimises costs to consumers and increases system flexibility.

It is critical that the capacity market does not undermine the energy transition by creating stronger, unnecessary incentives for fossil-fuel generators that can be more expensive than other solutions. We recommend developing safeguards to eliminate the risk of resource overprocurement stemming from the system operator's intrinsic bias to procure more than is necessary or economically justified.

Finally, the Italian authorities should prioritise wholesale market reforms and other measures to achieve the aforementioned goals while the power system decarbonises. These include: i) the implementation of administrative shortage pricing in the balancing market; ii) the further integration of the Italian market into the EU's single electricity market and enhanced use of its interconnection capacity; iii) the further development of the internal transmission network; and iv) the empowerment of consumers to actively participate in the market either through explicit or implicit demand response.

If there are legitimate concerns about the risks to security of supply while the market is transitioning, the authorities could consider the implementation of a strategic reserve until those reforms have taken full effect to support reliability and a better functioning market overall.

Additional Resources

Related papers, reports and research from RAP

Hitting the mark on missing money: How to ensure reliability at least cost to consumers

<https://www.raonline.org/wp-content/uploads/2016/09/rap-hogan-hitting-mark-missing-money-2016-september.pdf/> (2016)

Regional resource adequacy assessments: The key to ensuring security of supply at a reasonable cost

<https://www.raonline.org/knowledge-center/regional-resource-adequacy-assessments-the-key-to-ensuring-security-of-supply-at-a-reasonable-cost/> (2018)

Demand response as a power system resource

<https://www.raonline.org/knowledge-center/demand-response-as-a-power-system-resource/> (2013)

Capacity market review in Great Britain: Response to the call for evidence

<https://www.raonline.org/knowledge-center/capacity-market-review-gb-response-to-call-for-evidence/> (2018)

Ensuring reliability of the power system and capacity mechanisms

<https://forum-energii.eu/en/analizy/niezawodnosc-a-moc> (2016)

Cleaner, smarter, cheaper: Network tariff design for a smart future

<https://www.raonline.org/knowledge-center/cleaner-smarter-cheaper-network-tariff-design-for-a-smart-future/> (2018)

Start with smart: Promising practices for integrating electric vehicles into the grid

<https://www.raonline.org/knowledge-center/start-with-smart-promising-practices-integrating-electric-vehicles-grid/> (2019)



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