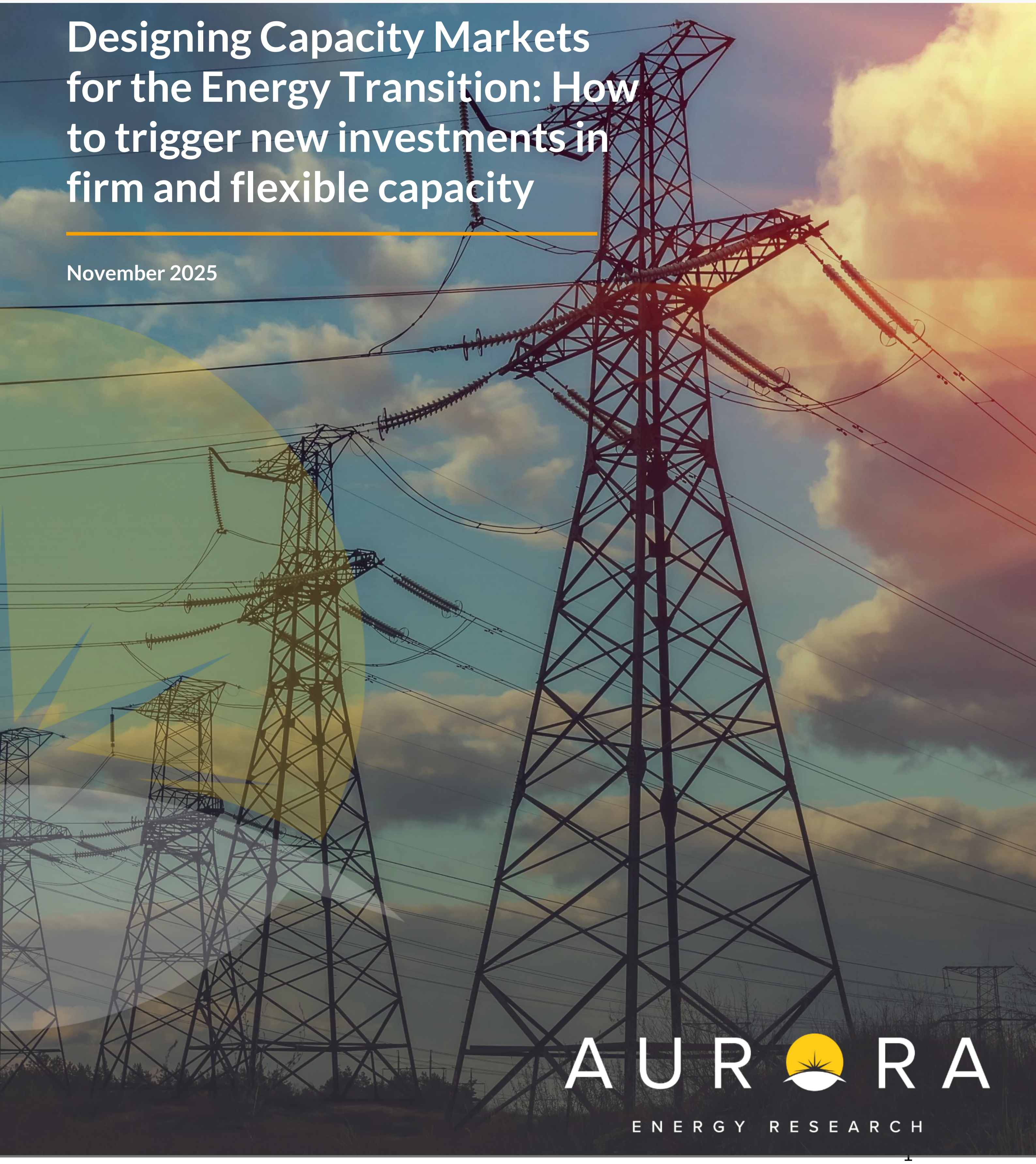
Designing Capacity Markets for the Energy Transition: How to trigger new investments in firm and flexible capacity

November 2025



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Executive Summary

Across Europe, capacity markets (CMs) are increasingly vital for ensuring security of supply as coal leaves the system, nuclear ages, and renewables expand. While national CM designs vary, EU rules require robust CM resource adequacy assessments. The nature of the adequacy gap subsequently guides technology choices: short and sharp peak coverage gaps need fast-ramping assets; seasonal gaps require long-duration flexibility; and structural long-term shortages call for new firm and flexible capacity such as gas power plants[1], interconnectors, long-term storage, and demand-side solutions (cf. *Introduction*).

TSOs in several countries stress the need for firm, dispatchable capacity to manage extended scarcity events and are exploring ways to retain a minimum share of new gas power plants in the mix (cf. *Findings and trends derived from existing capacity markets; Appendix*). However, while gas power plants once dominated CM awards - with 33.5 GW of supported newbuilds - their share in awarded capacity contracts has declined in recent CM auctions, losing ground to battery storage (BESS) and demand-side response (DSR). Batteries, benefiting from falling costs and multiple revenue streams, now often outcompete gas power plants despite lower derating factors.

In addition to assessing the current role of newbuild gas power plant capacity in European CMs, this report evaluates CM design features that most influence the competitiveness of flexible gas power plants (cf. *Capacity market design parameters and their impact on the prospects of newbuild gas power plants*). When adequacy assessments confirm a need for new dispatchable capacity, the following design elements can most effectively support investment:

- **Price caps:** Must be transparent and reflect actual newbuild economics. Overly restrictive caps deter investment; overly generous ones risk consumer costs.
- **Derating factors:** Competitiveness hinges not just on gas power plant ratings but on how alternatives - such as intermittent renewables and especially batteries - are assessed. Short-duration storage should be rated according to their contribution to scarcity events.
- **Auction segmentation:** Differentiating short-term flexibility from long-duration dispatchable resources like gas power plants may improve investment signals but must be carefully designed to avoid competition distortions and raising costs.
- **Locational requirements:** Recognising regional needs (e.g. Irish CM) can boost payments for gas power plants in constrained zones.
- **Contract duration and lead time:** Long-term contracts (up to 15 years under EU rules) and sufficient lead time (e.g. 4 years) reduce financing risk and support newbuild viability.
- **Delivery requirements:** In cases of longer-lasting scarcity gaps, higher minimum discharge durations can ensure procurement of sufficiently capable new gas assets.

[1] In this report, the term "gas power plants" refers to all thermal power generation technologies that use gaseous fuels like natural gas or hydrogen. This includes gas engine plants, combined-cycle gas turbines (CCGTs) and open-cycle gas turbines (OCGTs).

The report also examines how CMs align with broader goals like decarbonisation and system stability. While these are important, the primary purpose of CMs should remain resource adequacy. Other objectives - such as emissions reduction or system services - are best addressed through dedicated instruments. If integrated into CM design, they must be applied transparently and proportionately to avoid complexity, market distortions, and reduced competition.

Introduction

Across Europe, coal phase-outs, an ageing nuclear and gas fleet, and the rapid expansion of intermittent renewables are fundamentally reshaping the generation mix. This transformation creates a growing need for new firm and flexible capacity to reliably meet future demand (cf. Figure 1). Yet, current investment in such capacity is not on track to meet needs. The loss of trust in wholesale scarcity price signals due to government interventions, combined with expectations of limited operating hours in future power systems, undermines the business case for new gas power plants. To address this challenge, many EU Member States are increasingly introducing Capacity Mechanisms (CMs) to provide incentives for new, firm capacity.

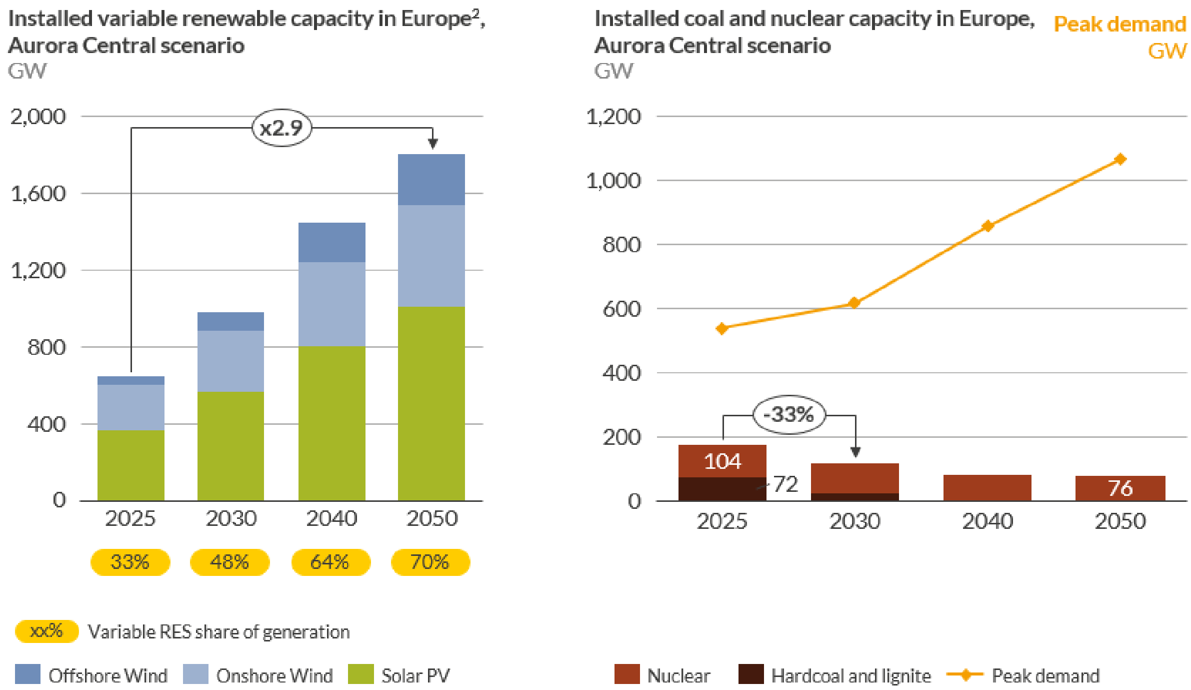

Figure 1: Aurora Central Scenario projections for wind, solar, coal, and nuclear capacity in Europe[2]

While national CMs differ in design, the EU has introduced legally binding guidelines to ensure consistency across Member States. A key requirement concerns the assessment of capacity needs in a CM, ensuring that sufficient resources are available to reliably meet demand (EU Electricity Regulation 2019/943). The central tool for this is the European Resource Adequacy Assessment (ERAA), conducted annually by the European Network of Transmission System Operators for Electricity (ENTSO-E). Using probabilistic modelling across multiple climate years, the ERAA evaluates adequacy over a forward looking 10-year horizon and assesses whether Europe has enough resources to cover both short- and long-term electricity demand. It serves as the EU's common benchmark, while still allowing for complementary national adequacy assessments. The nature of the identified adequacy gap determines the choice of technologies best suited to address the specific capacity need:

[2] EU27 plus United Kingdom and Norway, minus Malta and Cyprus.

- **Short, sharp peak coverage gap**: Risks concentrated in a few hours per year necessitate fast-ramping resources such as demand response, shorter duration batteries, and gas engine power plants with fast ramp up capabilities.

- **Seasonal flexibility gap**: Shortfalls clustering over several weeks require longer-duration storage technologies (e.g. thermal, mechanical, molecule-based or electrochemical), interconnectors targeting seasonal complementarities, and firm dispatchable plants - such as gas and hydrogen power plants - capable of operating through prolonged shortages.

- **Structural long-term capacity gap**: Risk of undersupply persisting across many years, often driven by plant retirements, coal phase outs, or growing electricity demand, call for new firm and flexible capacity, increased interconnection capacity, long-term storage, and demand-side response.

Besides the duration of the adequacy gap (i.e. whether it is short or long in the number of hours or days it lasts), it is also important to distinguish between the time horizon over which such gaps are expected to occur. Some adequacy challenges may arise only in the near term - for example, during a transition period over the next two to three years - while others may be structural and persistent over the longer term. Accordingly, the ERAA provides both short-term and long-term adequacy assessments. Short-term adequacy issues, expected within the next few years, can often be addressed by CM measures that incentivise the retention of existing capacity, such as one-year contracts. In contrast, long-term adequacy risks - typically assessed ten years ahead - require investment in new generation capacity and therefore different CM measures, such as multi-year contracts that provide the revenue certainty needed to enable new-build projects.

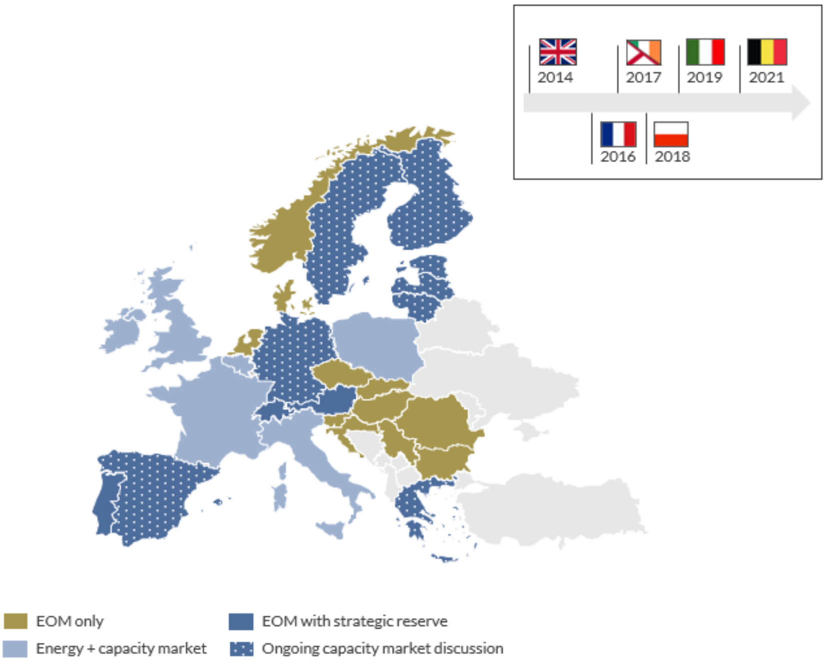

Figure 2: Examples of power market designs in Europe

Historically, a significant share of procured capacity in European CMs like in Great Britain, Ireland, France, Italy, and Belgium has been gas-fired. Most of this was awarded to existing plants to maintain their operation and safeguard short-term security of supply, while 33.5GW supported newbuild projects to address structural adequacy gaps.

Transmission System Operators (TSOs) in several countries stress the continued importance of firm capacity to manage longer-duration stress events and are exploring measures to ensure at least a minimal share of new gas-fired projects remains part of the mix. In recent years, however, awards to newbuild gas capacity have stagnated (cf. Figure 3), losing its dominant role in capacity market auctions to battery storage (BESS) and, to a lesser extent, demand-side response (DSR). Batteries, supported by falling costs and additional merchant revenues, have been able to bid more competitively despite lower derating factors, allowing them to capture the majority of newbuild awards. [3] While a brief overview of European CMs is provided below (Table 1), a more detailed assessment of each market can be found in the Appendix - with a particular focus on the role and outlook for gas power generation.

Findings from mature CMs in the United States - such as CAISO, PJM, and ISO-NE - which have historically also depended on thermal generation, indicate a similar stagnation in the addition of new flexible gas-fired capacity in recent auctions. Lessons from these markets regarding CM design can inform potential approaches in Europe, including options like locational and seasonal differentiation of auctions. These design considerations will be discussed in detail in the next section on CM design parameters.

[3] A notable example is Poland, where the national TSO, PSE, has recently even initiated discussions about holding separate auctions in its capacity market to specifically support the newbuild of generation technologies, that could primarily be gas power plants (cf. the section on auction segmentation in this report).

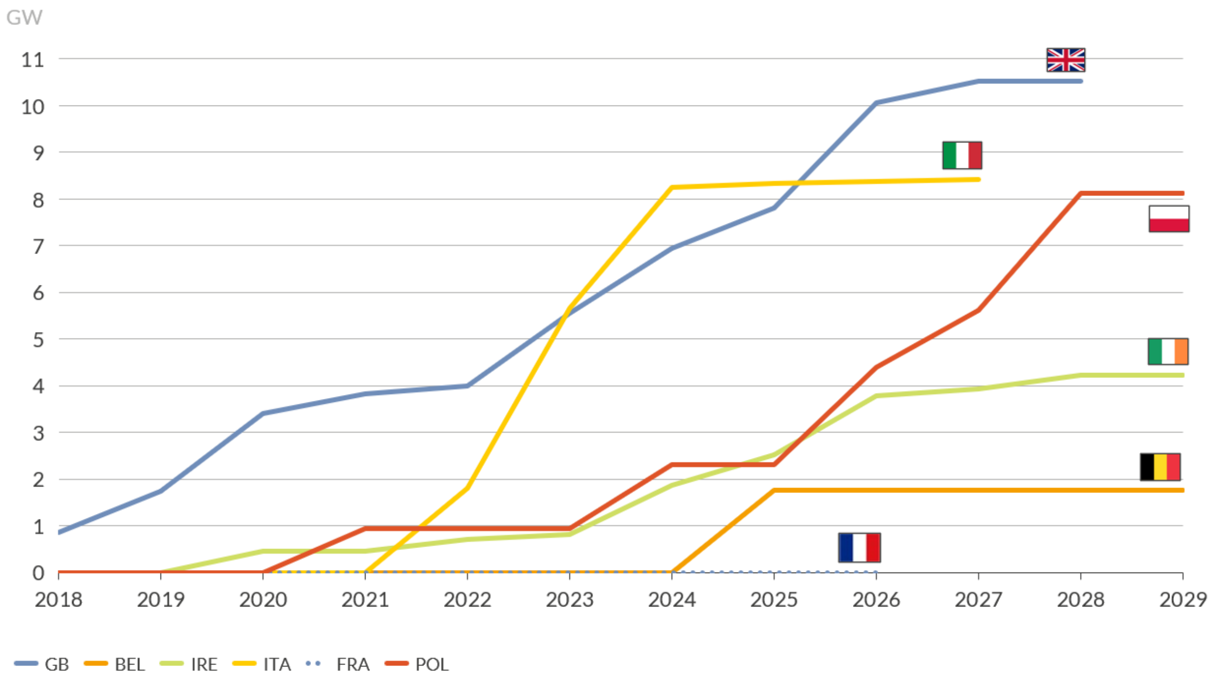

Figure 3: Cumulative amount of contracted newbuild gas power plant capacity across all auction rounds by delivery year

	GB	Ireland	Italy	France	Poland	Belgium
Type of CM	Central	Central	Central	Decentral	Central	Central
Maximum contract length (newbuilds)	15 years	10 years	15 years	N/A	17 years[4]	15 years
Earliest – latest auction	20152025	2018-2025	2019-2025	2017-2025	2016-2025	2022-2024
Earliest – latest delivery year	2018-2028	2018-2028	2022-2027	2017-2026	2021-2029	2025-2028
Number of auctions	21	16	6	17	32	5
Total capacity procured across all auctions (de-rated)	544GW	76GW	254GW	992GW	108GW	10GW
Gas-fired capacity (% of total procured capacity)	324GW (60%)	50GW (66%)	195GW (77%)	67GW (7%)	11GW (10%)	9GW (90%)
Newbuild gas-fired capacity (Nameplate)	10.7GW	4.2GW	8.4GW	0GW	8.1 GW	1.7GW

Table 1: Overview of key facts about CMs in Europe

[4] Above EU-limit.

CM design parameters and their impact on the prospects of newbuild gas power plants

CMs consist of a variety of design elements that together determine how effectively they deliver on their core objective of ensuring resource adequacy. Many of these elements directly influence the competitiveness of newbuild flexible gas power plants compared to other technologies as well as to already existing capacity. This chapter identifies the CM design parameters with the greatest impact on the economics of such plants and provides guidance on how these parameters can be structured to support new investments in flexible dispatchable capacity—where resource adequacy assessments confirm a system need for additional secure generation. Table 2 provides an overview of some of the main CM design parameters, ordered by their observed impact on the competitiveness of newbuild gas power plants as observed in existing CMs. This is followed by an overview of policy recommendations supporting newbuild gas-fired capacity (if that is deemed necessary by the resource adequacy assessment) as well as a detailed evaluation of each of the design elements.

Design element	Description	Observed relevance for the success of newbuild gas power plants in CM auctions
Price caps	Maximum price level paid out in CM auctions	High
Derating factors	Determine how much eligible capacity a plant can offer in the auction as a fraction of its nameplate capacity	High
Auction segmentation	Division of CM auctions in multiple segments, e.g. short-term flexibility vs. long-term dispatchable capacity	High[5]
Locational requirements	Requirements relating to the physical location of the plant in the power system	Medium
Contract duration	Duration during which the capacity provider receives the capacity remuneration	Medium
Lead times	Time between auction date and the period in which the capacity needs to be available	Low
Emission requirements	Maximum emission thresholds that determine the eligibility for CM auctions	Low
Delivery requirements	Capacity providers must meet operational delivery standards, including how quickly they can be dispatched after a system operator call (ramp-up time) and the minimum duration they must be able to sustain delivery once activated.	Low

Table 2: Capacity market design elements and their relevance for the prospects of new flexible gas power plants in European capacity markets.

[5] In discussion in Poland, not observed in effect yet.

Policy recommendations to incentivise the buildout of new flexible gas capacity

> **Disclaimer**: When resource adequacy assessments indicate the need for additional dispatchable generation, such as gas power plants, the design options below may help facilitate investment. However, CMs should ensure that identified adequacy gaps can be addressed in a technology-neutral manner, allowing all suitable resources to contribute effectively to system adequacy.

Price caps: These should be set transparently and consistently (e.g., using the Net CONE methodology) at levels that reflect the true cost of developing new gas capacity. This ensures investment attractiveness and fair competition among resources.

Derating factors: Assigning lower derating factors to short-duration storage - especially in systems already saturated with storage - can reflect their limited reliability and availability. In turn, this approach enhances the relative competitiveness of longer-duration, dispatchable resources within capacity mechanisms.

Auction segmentation: Though not yet implemented, a dual-auction approach (as discussed in Poland) could reduce direct competition between technologies and offer clearer investment signals for gas. However, poor design could distort competition and increase costs.

Locational requirements: Mechanisms such as regional core shares or bonus/malus systems can raise clearing prices in constrained areas, strengthening investment signals for gas projects where they are most needed.

Contract duration: Utilizing the maximum contract length permitted under EU rules (15 years for new builds) enhances revenue stability and reduces investor risk, improving bankability for newbuild gas power plants.

Lead times: Targeted auctions with sufficient lead time like T-4 auctions are proven standard to support new gas investments effectively.

Emission requirements: Favouring transparent, technology-neutral incentives over complex prescriptive rules can provide a clear investment framework for new gas projects while maintaining consistency with broader policy objectives.

Delivery requirements: In cases of longer-lasting scarcity gaps, higher minimum discharge durations can ensure procurement of sufficiently capable new gas assets.

Detailed evaluation of each of the design options

Price caps

Price caps are one of the most influential parameters in capacity market design, as they determine the maximum remuneration that a project can secure in an auction. If the cap is set too low, it may fail to reflect the true cost structure of new thermal capacity and thereby suppress investment. In contrast, if it is set too high, it might drive up clearing prices without necessarily improving security of supply. In a few markets like Ireland and Italy, different caps are applied for existing and newbuild capacity, acknowledging the higher investment costs of new projects (cf. Figure 4).

In recent years, price caps have proven to be highly relevant for the competitiveness of newbuild gas power plants in European capacity markets. Overly restrictive caps have directly limited participation and delayed investment, with Ireland providing the clearest example. In a recent auction (T-4, 2027/28), the market failed to procure sufficient capacity highlighting that the cap was too low to support new investments. In response, the regulator increased the cap for new builds by 40% to 230€/kW in the upcoming auction (T-4, 2028/29), which was particularly relevant to meet locational requirements. However, this adjustment was not derived from the nationally established methodology based on the *Cost of New Entry* (CONE), but applied as an ad-hoc fix. While the regulator acknowledged the need for change, it was criticised by stakeholders for undermining methodological robustness, drifting away from the transparent Net CONE approach, and increasing the risk of overbidding at the expense of consumers.

Key take-away: Price caps should be set transparently and in line with the Net CONE methodology[6], ensuring they reflect the actual economics of newbuild capacity while avoiding unnecessary costs to consumers.

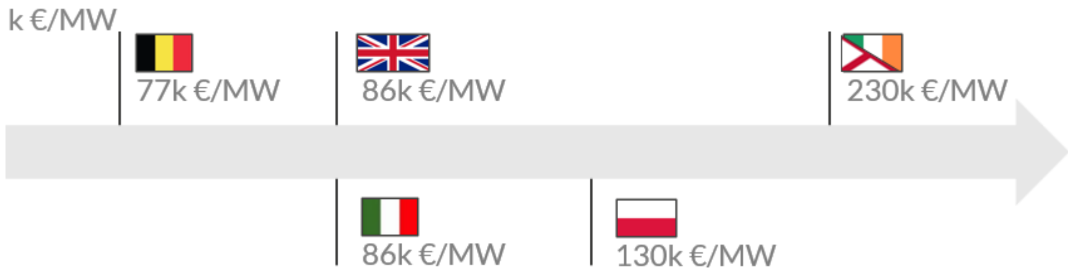

Figure 4: CM price caps in Europe in the latest T-4 auctions for newbuild

[6] ENTSO-E is mandated to develop methodologies for estimating the Cost of New Entry (CONE) and other parameters within its ERAA framework, as approved by ACER. However, due to differences between markets and surrounding uncertainties, affecting CONE estimation, individual member states are allowed to and often conduct their own survey-based studies. For example, in Great Britain, the CONE for a reference technology like CCGT is estimated and then adjusted using a multiplier to determine the capacity market price cap. A recent suggestion by the European Commission for ENTSO-E to publish standardized CONE values and de-rating factors to simplify state aid approval for new CMs has been pushed back by ENTSO-E, which argues that each market has specific characteristics that must be considered individually, and that ERAA should remain focused on assessing resource adequacy rather than prescribing how to address it.

De-rating factors

De-rating factors determine the share of a plant's nominal capacity that can be offered into a capacity auction, based on its expected availability and reliability[7]. For gas power plant capacity high availability and dependable performance typically result in comparatively high de-rating factors. This appropriately recognises the value of such plants relative to technologies with lower availability or more uncertain performance.

The main competitiveness concern for newbuild gas power plants arises not from their own de-rating treatment, but from how competing technologies - most notably BESS - are de-rated. If de-rating factors assigned to batteries are set too high relative to their limited discharge duration, short-duration storage may be over-rewarded and displace dispatchable generation that is needed to cover longer-lasting adequacy gaps. Generally, de-rating factors for batteries have been adapted in several markets in recent years to reflect their marginal contribution to resource adequacy. As the overall capacity of BESS in the system increases, the incremental value of additional BESS assets in covering scarcity events diminishes—especially when those events are long in duration or structurally recurring. This has led to progressively lower de-rating factors over time, ensuring that remuneration aligns with actual system contribution and avoids overcompensation.

Comparable reforms are being discussed in ISO-NE in the United States, to implement differentiating derating ("accrediting") rules for dispatchable versus intermittent capacity. The objective is to ensure that capacity ratings more accurately reflect each technology's actual contribution to system reliability.

Key take-away: Where adequacy assessments reveal a structural, long-term capacity gap, de-rating factors should be calibrated to correctly reflect the capability of different technologies to meet that need. This implies avoiding overly optimistic (high) de-rating factors for short-duration storage technologies that cannot reliably cover extended scarcity events just by themselves. At the same time, care must be taken not to unduly penalise short-term flexibility providers such as BESS.

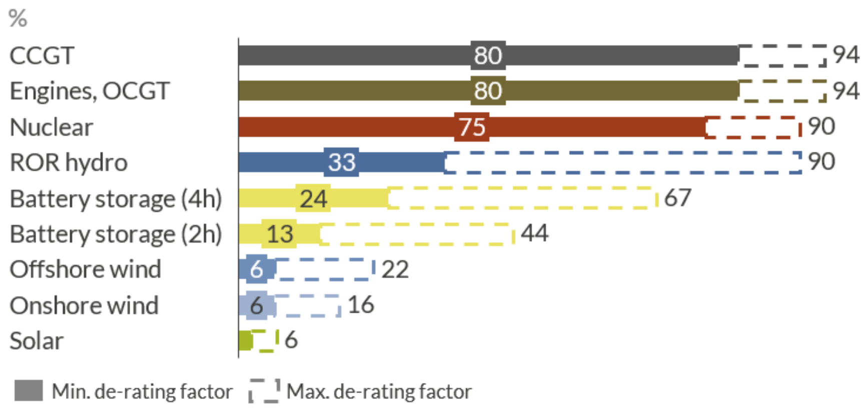

Figure 5: Minimum and maximum de-rating factors for the latest EuropeanT-4 auctions

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[7] De-rating factors are typically assessed at the national level, reflecting the expected availability and reliability of different technologies within each market. While the European Commission recently proposed that ENTSO-E publish standardized de-rating factors to streamline state aid approval for new capacity mechanisms, ENTSO-E pushed back on this suggestion. It argued that de-rating factors must be tailored to individual market conditions. ENTSO-E also emphasized that its ERAA framework should remain focused on assessing resource adequacy, not prescribing implementation measures.

Auction segmentation

Auction segmentation is a capacity market design feature where separate auctions are organised for different capacity types, allowing regulators to balance the need for firm generation with flexible resources. The rationale is to ensure that markets deliver not only sufficient capacity overall, but also the right mix between dispatchable plants capable of running for extended periods and fast-responding technologies that provide short-term balancing. Without segmentation, investments in new gas power plants with higher missing money risk being priced out by more competitive resources like battery storage, even though these may not be able to guarantee the same long-duration security of supply.

While no European capacity market has yet adopted segmentation, Poland is actively debating its introduction. The country faces rising adequacy concerns as coal plants retire and most capacity market contracts for coal expire by 2029. Recent auctions have failed to secure new gas-fired capacity, with battery storage dominating newbuild contracts. Yet current Polish storage projects, mostly two to four hours in discharge duration at rated capacity, are insufficient to cover many prolonged future scarcity periods. Additionally, Aurora research on the Polish market indicates that for instance in 2029 only half of scarcity events will be preceded by reliable charging conditions, limiting the adequacy value of batteries. In response—alongside launching supplementary auctions—transmission operator PSE has proposed a dual auction model: one for dispatchable, long-duration generation (mainly gas), and another for flexible capacity such as batteries and demand-side response. The debate remains open, with a survey by the Energy Regulatory Office showing that 84% of stakeholders see today's design as unbalanced, but only 42% favour separate auctions.

Key take-away: Segmentation should be pursued cautiously to balance technology neutrality with targeted investment signals. While it can help overcome critical investment failures—such as the lack of new gas build in Poland, it risks distorting competition, disadvantaging lower-carbon options, and increasing costs for consumers. Transparent resource assessments that reflect the real adequacy contribution of each technology would therefore be essential when adopting a dual auction approach.

Locational requirements

Locational requirements in CM design determine where capacity must be located to address grid constraints or align with local adequacy needs. For flexible gas power plants - especially small-scale, engine-based assets - locational criteria can serve as a significant competitive advantage. By directing auctions or offering incentives for capacity in specific regions, markets can reward these plants for supporting local grid stability and providing dispatchable power where it matters most.

Newbuild gas engine plants often benefit from being sited near electricity and heat loads or constrained zones. Locational requirements can raise clearing prices or ensure procurement in those zones, helping new gas power plants being built where existing assets may lack value. Without such locational differentiation, capacity auctions may overlook local needs, favouring least-cost but poorly sited alternatives.

In practice, this design parameter has been highly relevant for newbuild gas competitiveness where locational needs bind. For instance, Ireland employs Locational Capacity Constraint Areas (LCCAs), including separate zones for Greater Dublin, Ireland outside Dublin, and Northern Ireland. Each of these LCCAs includes regional minimal procurement requirements that reflect the physical realities of the grid. If the auction fails to clear enough capacity within a given LCCA to meet its minimum threshold, the market operator will step in to procure the cheapest available capacity within that area, which may involve prioritizing more expensive options above the clearing price (cf. Figure 6). This mechanism ensures that local adequacy is maintained, even at a premium, and creates strong locational signals for investment in newbuild gas where it is most needed.

Similarly, PJM's CM in the Unites States defines Locational Delivery Areas (LDAs) to reflect transmission constraints and regional adequacy needs. LDAs define subzones within the capacity market where limited transfer capability or higher reliability risks justify distinct capacity requirements and, potentially, higher clearing prices. This mechanism ensures that capacity is not only procured at least cost overall but also deliverable to load centers when needed.

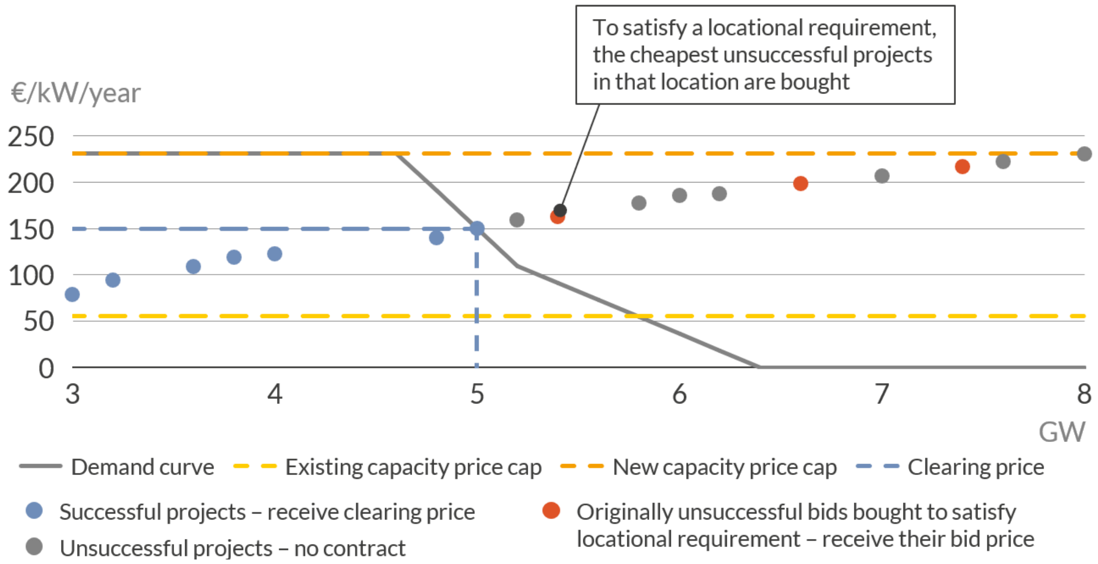

Figure 6: Indicative Irish CM merit order of supply and demand

Key take-away: Where newbuild flexible gas-fired capacity is required - and where grid constraints or localised adequacy gaps exist - CM design should incorporate location-differentiated procurement. This can take the form of:

- Definition of regions with specific adequacy needs, as in Ireland's LCCAs or PJM's LDAs, ensuring capacity in key regions.
- Regional access requirements, i.e. access to the CM only for assets in defined locations as in Belgium.
- Transparent, stable zoning regimes as in Italy
- Competitive bonus/malus system, i.e. bonuses assigned to a bid based on whether the asset location offers advantages to the grid. This system was proposed in the draft of Germany's *Power Plant Strategy*.

Lead times

The length of lead times between auction and capacity delivery are crucial for determining whether newbuild projects can realistically participate in capacity markets. Short delivery periods, such as one-year-ahead (T-1) auctions, generally favour fast-to-deploy technologies like batteries or existing plants, but can act as a barrier for newbuild gas power plants, which typically require longer lead times for permitting, financing, and construction. By contrast, auctions with multi-year lead times significantly improve the feasibility and competitiveness of gas-fired assets.

Most established capacity markets already reflect this need: GB, for example, conducts its main auctions four years ahead of delivery (T-4), providing sufficient certainty and time for project development. These designs have allowed new gas power plants to compete on a level playing field.

Key take-away: Capacity markets that aim to stimulate newbuild investment should include targeted auctions with sufficient lead time, ideally T-4. Experience in the UK and other markets shows that multi-year ahead auctions are well suited to supporting the financing and delivery of newbuild gas power plants.

Contract duration

Contract length is an important parameter for the competitiveness of newbuild investments. Longer contracts provide stable revenue streams and reduce investor risk, making them especially attractive for capital-intensive assets such as new flexible gas power plants. By contrast, short contract durations tend to favour existing plants, which do not need to recover large upfront costs.

Most capacity markets already accommodate this requirement by offering multi-year contracts for newbuilds. The maximum duration, however, differs between markets. For example, Poland allows contracts of up to 17 years, while the maximum in the Irish CM is 10 years. The French CM does not provide multi-year contracts. The European Union the State Aid Guidelines set a maximum of 15 years.

Key take-away: Capacity markets that seek to incentivise newbuild flexible gas-fired capacity should make full use of the 15-year maximum contract length permitted under EU rules. Longer contracts provide revenue certainty, lower financing risks, and thereby reduce both the cost of capital and overall project costs. This ensures that new projects can compete on a level playing field with existing assets.

Figure 7: *Contract durations and capacity objectives*

Emission criteria

CO_2 emission criteria determine which resources are eligible to receive capacity payments and under what conditions. In the EU, these criteria are anchored in Article 22 of Regulation (EU) 2019/943, which sets two limits for assets seeking CM support: 550g CO_2/kWh and 350kg CO_2/kW per year.

Applying the EU emission limits consistently can help shift capacity awards toward new, cleaner plants (e.g., modern gas engines/turbines) and away from higher-emission units (e.g., coal or ageing gas). That dynamic supports a level playing field for newbuild flexible gas by making the carbon performance requirement clear and predictable, which lowers perceived policy risk and financing premia relative to legacy fleets. For instance, after the EU 550g rule took effect, Polish auctions saw coal fall away and gas dominate awards, underscoring how emission criteria can steer the outcome of CMs.

Some countries have introduced additional emission criteria:

- **Great Britain:** In Great Britain, the CM applies emission limits complemented by decarbonisation readiness requirements for newbuild and substantially refurbished combustion plants seeking multi-year agreements. From the 2026 T-4 auction onwards, such plants must demonstrate that they are capable of converting to hydrogen or retrofitting carbon capture and storage (CCS) during their operational life. However, there is no mandate to switch fuels or retrofit CCS, making the measure low-cost and not expected to materially affect competitiveness.

- **Belgium:** Beyond applying the EU limits, Belgium requires fossil fuel–based capacity providers to conduct a feasibility study (technical and economic) for emissions reduction by end-2027, and to submit an emissions reduction plan by end-2028 showing how they will contribute to 2050 climate neutrality, with an ambition for zero or negative emissions by 2050. If these are unmet, a candidate is excluded from capacity auctions.
- **Poland:** Poland couples emission performance with contract length. New or modernised units meeting a 450g CO_2/kWh standard receive a two-year contract extension (the so-called “green bonus”), enabling up to 17-year agreements - improving financing conditions for cleaner newbuild assets.

Key take-away: Consistent application of the EU emission limits for CMs (550g/350kg) across auctions, with limited, time-bound exemptions only where strictly necessary to safeguard short-term adequacy. Where policymakers seek to tilt investment further toward cleaner capacity, do so transparently—for example, via contract-length incentives tied to stricter performance (as in Poland’s 450g standard)—rather than layering complex, prescriptive rules inside CM eligibility (see section 4 below). This approach preserves clarity for investors, maintains technology neutrality within the EU framework, and keeps CMs focused on adequacy while still supporting system-wide decarbonisation.

Operational delivery standards

Operational delivery standards define how capacity providers must perform once they are called upon by the system operator. These typically include the maximum response time allowed and the minimum duration for which the unit must be able to sustain delivery. Such requirements are fundamental to capturing the true system value of different technologies and should therefore be carefully designed and clearly specified within CM frameworks.

If resource adequacy assessments identify a risk profile dominated by short, sharp peaks—where supply gaps occur for only a few hours per year—then maximum response times can be set low to ensure that fast-ramping resources are procured. For instance, in the Great Britain Capacity Market, capacity providers must be ready to deliver their committed capacity during a System Stress Event within a 4-hour timeframe once a CM Notice is issued. Under such conditions, technologies like gas engine plants and BESS, which can respond almost instantly, are advantaged compared to slower-starting technologies such as CCGTs.

By contrast, if adequacy assessments reveal a structural and sustained capacity gap (*Dunkelflaute* event), then the design should focus on ensuring sufficient continuous delivery capability. In such cases, requirements for minimum discharge duration should be set at higher levels to favour resources capable of providing multi-day or even multi-week adequacy, such as gas power plants. This becomes particularly important where de-rating factors alone do not lead to a balanced technology mix in line with system needs. Increasing discharge duration requirements would structurally favour gas power plants (and other long-duration resources) over short-duration batteries.

Key take-away: Operational delivery requirements should be closely aligned with the results of resource adequacy assessments. Where system risks are short-term, setting maximum response times to low levels will reward fast-response technologies. Where adequacy concerns are longer-lasting, higher minimum discharge periods should be required to ensure sufficient procurement of dispatchable thermal capacity.

Additional design suggestions derived from CMs in the United States

Seasonal auction to separate winter and summer procurement periods: ISO-NE is exploring separating capacity auctions into distinct summer and winter procurement periods, reflecting the seasonal variation in reliability needs. Resources would be accredited based on their contribution to system adequacy in each season, ensuring that dispatchable assets are available when scarcity events are most likely. As dispatchable assets are capable of operating during extended scarcity events, existing gas units are likely to continue clearing, particularly during winter periods. For Europe, a similar approach could be conceptually valuable, particularly in regions where peak demand and system stress vary significantly between seasons (e.g., high winter heating loads in northern countries versus summer peaks driven by air conditioning in southern Europe).

Grid connection fast track for dispatchable resources: In the United States, markets like PJM have implemented fast-track grid connection processes for dispatchable resources in constrained areas. Applying a similar approach in Europe could support the entry of new gas power plants in regions where grid connection bottlenecks might otherwise limit participation, ensuring that reliable generation can be delivered where it’s most needed.

Interaction of system adequacy with other policy objectives

Objectives and trade-offs in capacity market design

Capacity markets are fundamentally designed to ensure security of supply by incentivising reliable generation capacity. However, when additional policy objectives - such as decarbonisation and grid stability – are layered in, these instruments can become overburdened. Imposing requirements like reactive power provision or hydrogen compatibility on newbuild gas power plants raises their bid costs - reducing competitiveness in CM auctions. Similarly, mandating fuel-switching introduces cost and risk that elevate financing costs. It is therefore useful to explore in more detail how specific categories of additional objectives - namely system services and decarbonisation - interact with capacity market design and affect the competitiveness of newbuild flexible gas power plants.

System services

System services (e.g., reactive power, inertia, fault current support) are increasingly vital in power systems with high shares of variable renewables. Requiring gas power plants to provide these services can enhance overall system stability but also raises costs. Additional capabilities—such as synchronous condensers, grid-forming inverters, and advanced control systems—increase both capital and operational expenditures, which in turn can translate into higher CM bids and reduced competitiveness for affected technologies.

There are advantages and disadvantages to both integrating and separating these requirements within CM design. Integrating system-service obligations into CMs can, in theory, deliver system-level efficiency gains, as the same investment contributes simultaneously to adequacy and stability. However, this approach also risks increasing the cost of meeting adequacy needs, adding complexity, and distorting competition if requirements are too prescriptive or not uniformly valued across technologies.

By contrast, separate procurement through ancillary service tenders maintains clarity of purpose: capacity markets focus on adequacy, while dedicated mechanisms ensure fair remuneration for system-service capabilities. Yet, this separation can sometimes miss opportunities for synergies or co-optimisation.

In practice, the most balanced approach is likely case-specific. Where system-service capabilities are integrated into CMs, participation should remain optional and be accompanied by additional remuneration that reflects the value of the extra services provided. This preserves competition, ensures fair compensation, and keeps the CM's primary function - securing sufficient capacity - at the centre of its design.

Decarbonisation

It is important that capacity mechanisms remain aligned with long-term climate targets. The existing EU emission criteria should therefore be consistently enforced and can be gradually tightened over time, ensuring that fossil-based capacity is phased down in line with decarbonisation pathways and that investment increasingly shifts toward low-carbon flexibility. At the same time, adding further prescriptive requirements inside CM design - for example detailed fuel-switching obligations or technology-specific conditions - risks creating unnecessary complexity, raising costs for some technologies, and ultimately reducing competition. Targeted decarbonisation measures are better pursued through complementary instruments outside of CMs, such as the EU ETS or fuel-switching support schemes (e.g. hydrogen CfDs), where they can be implemented more effectively without overloading the adequacy function of capacity markets.

Evidence from existing capacity markets

As described in the previous chapter, experience from existing capacity markets across Europe shows that while the primary objective remains resource adequacy, several mechanisms have begun to incorporate limited decarbonisation measures in addition to the baseline EU emission performance standards. These measures generally aim to keep CMs consistent with long-term climate goals, without imposing heavy compliance burdens or transforming them into full decarbonisation instruments. In all countries, broader decarbonisation is pursued through dedicated programs outside of the CM, such as renewable support schemes and, in some cases, targeted schemes for low-carbon hydrogen production (e.g. France's hydrogen CfD).

By comparison, explicit requirements for the provision of system services within capacity markets have not been adopted in existing European markets. Frequency-related ancillary services are typically procured through TSO-led market mechanisms, while non-frequency services - such as inertia, reactive power, and voltage control - are in most countries provided by assets owned or operated directly by the TSOs.

Case study: The German Kraftwerkssicherheitsgesetz (KWSG)

The KWSG was a legislative initiative by the German 'traffic light' coalition government (2021-2024) intended to kick-start investment in new dispatchable capacity during the 2020s and to serve as a bridge towards a more permanent CM planned for 2028. It was designed to ensure supply security as coal and nuclear leave the system, while at the same time contributing to decarbonisation and system stability objectives. To this end, the draft law combined elements of capacity adequacy, prescriptive decarbonisation requirements, locational elements, and technical mandates for grid stability.

This bundling of multiple objectives within one law illustrates the risks of overloading a capacity mechanism. The draft required hydrogen conversion within eight years of commissioning and imposed additional system service mandates (e.g., grid-forming capability, synchronous condenser operation). The result was a highly complex design that introduced significant uncertainty for investors. Complexity not only raised transaction costs but also slowed the policymaking process itself: after years of development, the draft law could not be passed before the government's term ended. The high complexity of the draft was one of the reasons for delay and loss of political momentum.

Lessons learned and design recommendations

Mixing resource adequacy, grid stability, and decarbonisation within a single mechanism requires careful balancing—especially when gas power plants must remain competitive to ensure the provision of long-term dispatchable capacity. Compounding requirements without targeted support risks sidelining flexible, dispatchable generation essential for resource adequacy. The KWSG in Germany exemplifies both ambition and over-complexity; its challenges offer valuable design lessons for any jurisdiction aiming to align CMs with broader energy transition goals.

In a recent position paper on capacity mechanisms ENTSO-E acknowledges that in the future CMs might evolve to reward contributions to system needs. At the same time, ENTSO-E also warns that such an expansion must be handled with caution to avoid excessive complexity in market design.[8]

Design challenge	Impacts on gas power plant competitiveness	Mitigation approach
System service requirements	Increases investment costs and operational costs, making bids less competitive without appropriate compensation	Based on a case-by-base assessment: Either procure via dedicated ancillary service markets outside of CMs with explicit remuneration Or, in cases where system cost synergies of an inclusion in the CM designs are high, make the provision of system services optional and tie to an appropriate compensation
Prescriptive decarbonisation pathways	Higher investment costs, construction & operational risks (e.g. availability of hydrogen supply) raise financing costs	Emission thresholds within CMs only; use dedicated decarbonisation instruments (EU ETS, fuel-switching CfDs) outside of CMs
Complex, multi-objective design	Creates regulatory uncertainty; delays	Simplify mechanisms; decouple adequacy from other objectives

Table 3: Overview of recommendations to align capacity markets with policy objectives that go beyond resource adequacy

[8] ENTSO-E (2025), “The role of Capacity Mechanisms to enable a secure and competitive energy transition”.

Appendix

This section provides a more detailed assessment of each CM in the mentioned countries - with a particular focus on the role and outlook for gas-fired generation.

Great Britain

GB's central CM was introduced to ensure security of electricity supply by paying for reliable capacity to deliver during system stress events—i.e., peak-hour shortfalls when demand is high and wind output may be low (short, sharp peak coverage gap). The CM is in operation since 2014, and among the most mature in Europe having awarded 544GW capacity in total. Each year, procured capacity has increased, reflecting rising peak demand and a stronger focus on longer-duration stress events. Although GB added the most gas-fired capacity among European CM markets with 10.5GW of newbuild, investment has increasingly shifted toward BESS and DSR over the last four auctions. BESS has gained traction, supported by improved de-rating factors in the latest T4 auction and declining cell costs, while DSR aggregators are scaling up under the National Energy System Operator (NESO)'s CP2030 Action Plan to drive a major expansion of consumer-led flexibility.

Recent auction results

In the most recent T-4 auction for delivery in 2028/29, newbuild gas projects underperformed, while batteries and DSR got awarded most capacity. No new combined-cycle gas turbines (CCGTs) entered the auction, the only planned open cycle gas turbine (OCGT) (Corby 2) failed to secure a contract, and reciprocating engines won just 170MW with success rates dropping from above 90% in prior years to 51% this time.

Belgium

Belgium's central CM was approved by the European Commission to ensure security of supply in view of the 2025 nuclear phase-out - a structural adequacy risk as large baseload exits (structural long-term capacity gap). The CM was introduced in winter 2018/19 and procured around 10GW capacity so far (1.7GW gas-fired newbuilds). The scheme is maturing but T-4 auctions in the last two years (in 2023 and 2024) were undersubscribed, significantly driving up price caps. Auction outcomes were influenced by uncertainty over nuclear policy. While a full phase-out had originally been planned, the government has extended the lifetimes of nuclear sites Doel 4 and Tihange 3 until 2035, with further nuclear options still under discussion. Nevertheless, with other nuclear units set to retire, the TSO continues to emphasise a long-term structural supply gap, reinforcing the need for the CM.

Recent auction results

In the latest auction, newbuild contracts were led by BESS and DSR. New gas-fired projects have faced difficulties since 2022 given the uncertainty over nuclear policy and nuclear lifetime extensions, with only 9MW of gas engines securing contracts in the 2024 T-4 auction—less than 5% of total newbuild capacity. The last significant thermal additions were two large CCGTs awarded in 2021 together providing around 1.7 GW and expected online in 2025–26. Alongside the growing competitiveness of batteries, stricter national decarbonisation targets beyond EU requirements have further constrained prospects for new gas power plants (cf. deep dive on Emission criteria**).**

Ireland

The all-island CM was established because authorities identified increased generation adequacy risks in a small, weakly-interconnected system with rising variable renewables - hence a need for reliable capacity (short, sharp peaks and elements of structural gap). Ireland's central CM has been in place since 2017 with 76GW capacity procured in total. Newbuild contracts were long dominated by thermal plants, adding 4.2GW. More recently, however, fewer new gas power plants have been procured, as investors face challenges recovering costs for newbuild assets. As the system operator has subsequently flagged security of supply risks, reforms were prompted to strengthen investment signals for thermal, including raising the auction price cap (cf. deep dive on Price caps) and introducing incentives for early delivery.

Recent auction results

The T-4 2027/28 auction secured only 76% of the target capacity, the lowest result to date. In response, the T-4 2028/29 auction increased the price cap for newbuilds to 230€/kW (up from 164€/kW). This more than tripled procurement to almost 1GW compared with around 0.3GW previously. While the auction's overall clearing price reached €150/kW, additional projects located in grid-constrained areas were accepted at even higher prices exceeding the previous cap.[9] Gas-fired capacity, though still significant, lost its majority share, securing 355MW of 953MW total. By contrast, batteries performed strongly, supported by falling costs and increasing merchant revenues opportunities in the future.

Italy

Italy's CM was introduced to guarantee long-term adequacy and provide stable investment signals for capacity needed as demand evolves - i.e., a structural long-term capacity gap tool. The central CM has procured around 254GW since its launch in 2019. In earlier auctions, significant volumes of newbuild capacity were awarded to gas-fired OCGTs and CCGTs. Since the 2025 delivery year, however, almost no new gas-fired capacity has cleared. This reflects sharply reduced demand for newbuild projects in the TSO's resource adequacy assessment, as earlier gas additions already met capacity needs for now, combined with growing competition from batteries. Despite lower newbuild requirements, the TSO stresses the ongoing need for the CM to keep existing plants in the system and be able to react to inadequacies, particularly in winter.

Recent auction results

In the most recent auction for delivery year 2027, only 0.6GW newbuild capacity was cleared, with gas-fired capacity only making up roughly 5% of newbuild and batteries capturing the remaining major share. The auction cleared at 47€/kW, equal to the price cap for existing plants, forcing newbuild projects to compete directly with incumbents. This highlights both the competitiveness of batteries and the difficulty for new gas-fired capacity to secure contracts.

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[9] Under Ireland's locational rules, otherwise unsuccessful bids in areas affected by capacity constraints can be procured at their original bid prices to satisfy local capacity needs.

Poland

Poland's CM was introduced to address resource adequacy problems and ensure long-term security of electricity supply amid an ageing thermal fleet and coal exit. The central CM has been operating since 2017 and procured around 108GW capacity so far, of which existing coal power plants have captured a substantial portion. Strong investor interest and competitive battery storage pricing have pushed clearing prices lower, leaving newbuild gas projects largely outcompeted in latest auctions. Yet PSE, the Polish TSO, highlights that firm capacities like gas are essential to cover longer-duration stress events. To support new gas projects, the Ministry of Climate and Environment has introduced measures such as lower BESS derating factors for the 2030 auctions. In addition, a dual-track approach is being considered to separate dispatchable and flexible capacity mechanisms, better managing competition between gas-fired generation and battery storage (cf. deep dive in Auction segmentation).

Recent auction results

In the most recent T-5 2029 auction, battery storage, DSR, and foreign units captured nearly all newbuild awards. No large new gas-fired projects, including the planned Kozienice and Gdańsk units, secured contracts. Some gas capacity was awarded through smaller or overtime auctions, with PGE Energia Ciepła obtaining two contracts of 45.4MW each for its Combined Heat and Power (CHP) plants.

France

France's capacity obligation mechanism was created to safeguard security of supply during winter peaks - a short, sharp peak coverage gap problem in a system with strong seasonal swings. France introduced its decentralised one-year capacity market in 2017 with 992GW procured in total. Under the scheme, suppliers and capacity providers must demonstrate availability during forecasted peaks, verified on specific days designated by the TSO. As contract durations are usually limited to one year and nuclear generation continues to dominate the system, the mechanism has offered virtually no incentive for newbuilds. Therefore, capacity additions for gas power plants have stagnated since the market's creation, and the scheme has mainly ensured the continuing operation of existing assets. France intends to reform its capacity mechanism beginning in 2026, following government reviews that identified inefficiencies and limited price transparency in the existing decentralized system. Pending approval from the EU, the new framework will adopt a central longer-term, auction-based approach with both T-1 and T-4 auctions, expected to provide stronger investment signals for new capacity.

Recent auction results

The December 2024 auction cleared 10.2 GW at 0€/kW, reflecting oversupply driven by the recovery of the nuclear fleet. Capacity prices remain closely tied to nuclear availability, highlighting its decisive role in shaping outcomes. As a result, existing gas plays only a marginal role, with no newbuilds expected until the auction design changes.

Estonia

Estonia has introduced a one-off, long-term balancing mechanism to secure frequency services, granted under an EU exemption to address adequacy risks as oil shale and other thermal units are phased out by 2030 and the system adapts to the loss of Russian grid inertia. While not a capacity market in the classical sense, it is an emergency intervention worth noting for its likely impact on the buildout of new gas power plants, with capacity expected online from 2028–2029.

Hence, while the auction is formally technology-neutral, certain design parameters - most importantly the requirement to supply electricity to the grid continuously for 24 hours - rule out the participation of BESS, make it difficult for batteries to compete, which is why new gas peakers are widely expected to dominate the outcome. Bids submitted by August 2025 (allocation results still pending) range from 15.1 to 55 €/MW per hour of reserve.

United States capacity market deep dive

CAISO operates a Resource Adequacy (RA) framework targeting short, sharp peak coverage gap, rather than a traditional centralised CM. In this system, load-serving entities must procure sufficient resources to meet forecasted peak demand plus a reserve margin, ensuring reliability during periods of high system stress. While the RA framework helps maintain adequacy, it does not provide strong incentives for newbuild natural gas power plants, as California's policies prioritise decarbonisation. Current market tightness has supported the retention of existing gas, but growth has centered on demand response and battery storage consistent with clean energy goals.

To address mid-decade reliability gaps, the California Public Utilities Commission (CPUC) implemented the Mid-Term Reliability (MTR) procurement orders in 2023, mandating 11.5GW of new capacity by 2026. The program relied on long-term Power Purchase Agreements (PPAs) strongly favouring battery energy storage and other zero-emitting, long-lead-time resources. Additionally, the current review of the Reliable and Clean Power Procurement Program (RCPPP), which could incentivise newbuild procurement like the MTR, does not benefit new gas as a long-term reliability solution.

PJM operates the largest and most established centralised CM in the US, designed to ensure sufficient resources to meet forecasted peak demand plus a target reserve margin. After an initial boom in the 2000s and 2010s, newbuild gas activity has slowed. Gas projects face lower accreditation values under the shift from the Unforced Capacity-based accreditation methodology (UCAP)[10] to effective load-carrying capability (ELCC)[11] ratings, alongside supply chain backlogs, and long construction timelines. As of April 2025, gas projects represented less than 5% of the connection queue, and the July auction saw new builds and uprates[12] across all technologies account for under 2% of total cleared capacity.

Despite record-high clearing prices in the latest auction, that reached the cap of 329$/MW-day, only one new CCGT was procured. This outcome was driven less by price levels and more by the long-standing interconnection queue, where gas power plants must compete with other technologies for grid access. In such cases, price incentives alone—such as clearing at the cap or allowing higher prices in constrained areas—seem to be insufficient to unlock new capacity. In response to growing reliability concerns, PJM introduced a fast-track interconnection process for dispatchable resources and launched the Reliability Resource Initiative, advancing six new gas power plants and 33 uprates. However, these projects are not expected online before 2030. Additional reforms, including updates to the ELCC methodology and revised LDA

[10] Calculated as the portion of a generator's capacity expected to be available, accounting for forced outages.
[11] System-level measure of how much a resource reduces the risk of loss-of-load, capturing correlated risks, time-varying availability and saturation effects.
[12] Increase in the amount of capacity that an existing generating resource can offer into the market.

requirements, aim to improve accredited values for dispatchable resources, thereby strengthening long-term investment signals for gas and other firm capacity.

ISO-NE operates a forward capacity market (FCM) that procures resources three years ahead of delivery. Historically, natural gas has dominated newbuild capacity because of its relatively low costs and the region's dependence on gas-fired generation. However, rapid growth in renewables and battery storage, driven by state clean energy policies, is reshaping the market. The substitution auction, which lets retiring plants transfer their capacity commitments to new projects, is mostly reserved for state-supported renewables, limiting opportunities for new gas power plants. The most recent auction held in 2024 cleared only 30MW of newbuild gas, out of 1.5GW of newbuild capacity, as new gas projects face tight economics and high qualification requirements.

Looking forward, ISO-NE plans to potentially transition to a short-term capacity market with accreditation reforms in 2028[13], introducing separate summer and winter procurement periods. Here, ISO-NE would measure a resource's contribution to system reliability on a seasonal basis. As dispatchable assets capable of operating during extended scarcity events, existing gas units are likely to continue clearing—particularly during winter periods. In addition, modifications to accreditation rules differentiating between dispatchable and intermittent capacity and procurement timing are currently discussed, which could potentially enhance the viability of new gas-fired capacity.

[13] Not confirmed yet, uncertainty remains on how the market structure will evolve going forward.

List of abbreviations

Abbreviation	Meaning
BESS	Battery Energy Storage System
CfD	Contracts for Difference
CHP	Combined Heat and Power
CM	Capacity Mechanism
CCGT	Combined Cycle Gas Turbine
CONE	Cost of New Entry
DSR	Demand-Side Response
ELCC	Effective Load-Carrying Capability
ENTSO-E	European Network of Transmission System Operators for Electricity
ERRA	European Resource Adequacy Assessment
EU ETS	European Union Emissions Trading System
FCM	Forward Capacity Market
GW	Gigawatt
KWSG	Kraftwerkssicherheitsgesetz
LCCA	Locational Capacity Constraint Area
LDA	Locational Deliverability Areas
MTR	Mid-Term Reliability
NESO	National Energy System Operator
OCGT	Open Cycle Gas Turbine
PPA	Power Purchase Agreement
RA	Resource Adequacy
RCPPP	Reliable and Clean Power Procurement Program
TSO	Transmission System Operator