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Commission guidance

on the design of two-way contracts for difference

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I. Introduction

The European electricity system is undergoing **a fast-paced transition.** The share of fossil fuel assets is decreasing and **clean generation is being deployed at rapid scale** to achieve European energy and climate policy objectives in terms of decarbonisation, competitiveness and resilience. This transition is increasingly based on private investments in clean energy sources driven by market signals, but it has also relied significantly on State aid. While it is important to increase the share of market-driven investments, state support may remain necessary where market failures occur, and where the requisite investments would not materialise in the absence of state support.

The reform of the electricity market design[1] resulted in Article 19d being added to the Electricity Regulation[2]. This provision requires that direct price support schemes for investments in certain types of new renewable electricity generation facilities[3], as well as for new nuclear electricity generation facilities, take the form of two-way contracts for difference or equivalent schemes with the same effects (2w-CfDs). Article 19d, such 2w-CfDs must be designed to avoid undue distortions to competition and trade in the internal market. The mandatory conditions complement the existing framework set out in the Renewable Energy Directive (RED III)[4] and aid rules such as the Guidelines on State aid for climate, environmental protection and energy (CEEAG) and the Clean Industrial Deal State aid Framework (CISAF)[5].

The action plan for affordable energy[6] further acknowledged the role of long-term contracts such as 2w-CfDs in reducing electricity costs and decoupling electricity bills from fossil-fuel price volatility and in supporting additional investment in generation technologies with low marginal costs.

By fostering investments in clean energy assets through the State budget, 2w-CfDs may lead to **lower wholesale electricity prices.** This occurs as cleaner and cheaper generation replaces more expensive, mostly fossil fuelled plants in the merit order[7]. As a result, the marginal cost

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[1] Regulation (EU) 2024/1747 of the European Parliament and of the Council of 13 June 2024 amending Regulations (EU) 2019/942 and (EU) 2019/943 as regards improving the Union's electricity market design, OJ L, 2024/1747, 26.6.202, amending Regulation (EU) 2019/943

[2] Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast), OJ L 158, 14.6.2019, pp. 54–124

[3] The obligation for direct price support schemes to take the form of 2w-CfDs applies to the following renewable generation technologies: wind, solar, geothermal and hydropower without reservoir.

[4] Directive (EU) 2024/1711 of the European Parliament and of the Council of 13 June 2024 amending Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources, OJ L, 2024/1711, 26.6.2024.

[5] C/2025/3602.

[6] Action plan for affordable energy COM(2025)79 final

[7] The wholesale electricity markets price formation currently involves an optimisation of electricity supply, electricity demand and available cross-border capacity for trade. The electricity price within a zone will be determined by the marginal production cost of the cheapest electricity supply mean available needed to meet the consumption needs. To identify the cheapest supply means available to meet demand, all available supply assets are ranked according to the level of their bids, which are based on their marginal production costs in a so-called merit order. The price level at which the cheapest demand bid and the most expensive supply offer meet defines

of the unit setting the market price will be lower, thereby decreasing wholesale electricity prices. Moreover, through support to generation installations, 2w-CfDs can also provide multiple benefits to energy consumers such as (a) delivering additional clean generation capacity at competitive costs and (b) reducing price volatility, while also providing consumers with a hedge against periods of high electricity prices. In particular, 2w-CfDs set a maximum remuneration for their beneficiaries and will therefore enable Member States to recover revenues in times of high market prices. So, even if the volumes of low-cost generation are not sufficient to displace the more expensive generation from the merit order, the 2w-CfD serve as a hedge for consumers. Revenues above that maximum remuneration can be redistributed to consumers, thereby effectively protecting them against high energy prices. Finally, 2w-CfDs provide high certainty to investors by ensuring stable revenues from new investment in electricity generation that become less reliant on volatile electricity prices caused by fossil fuels-based generation (which typically sets the price in the day-ahead market). 2w-CfDs therefore facilitate access to capital at lower financing cost (e.g. lower borrowing interest rates and risk premium) for their beneficiaries and **thereby lower the costs of the investments**. This leads to a lower electricity bill for consumers relative to the counterfactual. Overall, the instruments make the roll-out of clean and abundant energy cheaper, while supporting the long-term predictability and affordability of energy.

Considering the increasing share of assets supported by 2w-CfDs and the magnitude of the investments needed to achieve the affordability, decarbonisation and energy security objectives of the EU[8], a **smart design of the 2w-CfDs** will be critical. 2w-CfDs will need to be smartly designed to ensure that the European electricity market functions efficiently, that the supported assets are integrated into the market while keeping system costs under control, and that competition is fostered.

Since it is crucial for these contracts to be correctly designed to reap all the benefits described above, this document aims to provide guidance to Member States on how to design 2w-CfDs in a way that supports efficient investments. This guidance will help Member States to design their support schemes in light of the existing regulatory framework. It will also provide examples of how the design criteria for 2w-CfDs set out in the Electricity Regulation and Renewable Energy Directive can be met. It does not aim to provide an exhaustive view on the compliance of all possible design features of a 2w-CfD scheme with the EU legislation[9].

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the wholesale electricity price. The addition of low marginal cost production installations such as renewable energy sources can lead to units with a lower marginal cost fixing the wholesale price and therefore to a lower wholesale market price. It is however important to note that multiple factors influence the wholesale price formation, such as, for example, the amount of flexibility available in the electricity system.

[8] As indicated in the Commission staff working document on the impact assessment accompanying the communication 'Securing our future Europe's 2040 climate target'.

[9] For example, this guidance will not include recommendations on how to incorporate non-price criteria in auctions. This is mandated by (i) Article 26 of the Net-Zero Industry Act (NZIA) (Regulation (EU) 2024/1735 of the European Parliament and of the Council of 13 June 2024 on establishing a framework of measures for strengthening Europe's net-zero technology manufacturing ecosystem, OJ L, 2024/1735, 28.6.2024) , (ii) Regulation (EU) 2025/1176 of 23 May 2025 specifying the pre-qualification and award criteria for auctions for the deployment of energy from renewable sources and (iii) the Commission Recommendation of 13 May 2024

While the Commission encourages Member States to duly consider the principles set out in this guidance, this document is intended purely for guidance purposes. Only the text of the EU legislation itself has legal force. Any authoritative reading of the law has to be derived from the text of the Renewable Energy Directive and the Electricity Regulation, as well as any other relevant piece of EU legislation and directly from the case law of the Court of Justice of the EU.

II. What are contracts for difference?

a. Definition and main principles

The Electricity Regulation mandates that direct price support for the types of clean electricity generation installations listed in the Regulation is granted in the form of 2w-CfDs. These are defined as contracts between a power-generating installation operator and a counterpart, usually a public entity, that provides both minimum remuneration protection and a limit to excess remuneration[10]. The period covered by 2w-CfDs might vary from 10 to 60 years depending on the technology, the amortisation period and the market revenue risks[11]. Electricity generated by installations supported by 2w-CfDs is usually traded on electricity markets[12].

Investments in clean energy assets by means of 2w-CfDs between the developer and the State provide the developer with revenue certainty. This has a direct implication in lowering the investor's risk and therefore lowers the costs of capital. By attracting additional low-marginal-cost energy generation assets, this can displace higher cost generation units from the merit order and result in lower wholesale energy prices.

Within the definition provided in the Electricity Regulation, many design options are possible and there has been substantial evolution of such contracts[13]. It is to be expected that these different 2w-CfD designs will evolve further with additional research, implementation and as the design of the European electricity market design itself evolves. Therefore, this guidance

on auction design for renewable energy, OJ L, 2025/1176 ('Act on implementing on Article 26 of the NZIA'). Similarly, the conditions under which financial legislation apply to 2w-CfDs are not further described in this guidance.

[10] Article 2 (76) of Regulation 2019/943 as amended by Regulation (EU) 2024/1747.

[11] When deciding on the exact duration, the contract length must be proportionate to the level of investment required and not exceed the expected operational lifetime.

[12] These electricity markets include bilateral contracts such as power purchase agreements (PPAs).

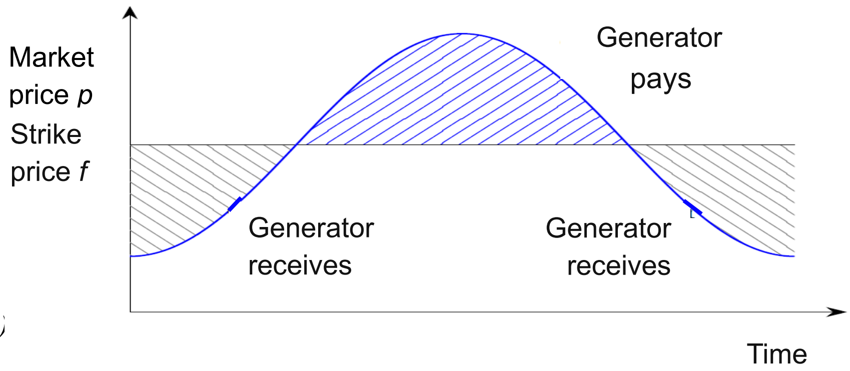
[13] See for instance, Kitzing et al (2024): Contracts-for-Difference to support renewable energy technologies: Considerations for design and implementation, Research Report, RSC/FSR, Robert Schuman Centre, Florence School of Regulation, European University Institute; Newbery, D. (2023a). Efficient Renewable Electricity Support: Designing an Incentive compatible Support Scheme. *The Energy Journal*, 44(3); Newbery, D. (2023b). Efficient Renewable Electricity Support: Designing an Incentive compatible Support Scheme. *The Energy Journal*, 44(3), 1–22; Schlecht, I., Maurer, C., & Hirth, L. (2024). Financial contracts for differences: The problems with conventional CfDs in electricity markets and how forward contracts can help solve them. *Energy Policy*, 186, 113981; Fabra, N., (2023) "Reforming European Electricity Markets: Lessons from the Energy Crisis", *Energy Economics. 126;* Elia Group. (2022): Sustainable 2-sided Contract for Difference design and models for combination with Power Purchasing Agreements - Two-part explanatory note. Unpublished; or Kröger, Neuhoff, Richstein (2022) Contracts for Difference Support the Expansion of Renewable Energy Sources while Reducing Electricity Price Risks, DIW Berlin Report.

should not be read as preventing Member States from choosing other designs, provided that they comply with the EU legislation (including State aid rules).

In practice, the financial flows of 2w-CfDs depend on a strike price[14], usually determined in a competitive bidding process[15], a reference market price, and a reference volume. A competitive bidding process is the most efficient price discovery mechanism that results in lowering the cost of the investment[16]. The reference price is calculated by averaging market prices over reference periods that can vary in length based on the chosen 2w-CfD design. The electricity generation or reference volumes are calculated to determine the volumes against which the 2w-CfD remuneration will be paid. This reference volume can be the actual volume produced by the installation, a volume independent from the actual volume produced by the installation, or a mix of both.[17]

In most 2w-CfD designs, the payout is determined by the difference between the strike price and the reference price, and by the electricity generation or reference volume. When the reference price is lower than the strike price, the generator's market revenues are complemented by the 2w-CfD counterparty to reach the level of the strike price. When the reference price is higher than the strike price, the generator must transfer[18] the part of its revenue above the strike price. For an illustration, see Figure 1 below.

Figure 1: Positive and negative payouts in a 2w-CfD



Source: Fabra (2022)

[14] One of the 2w-CfD models discussed in the literature provides for using a price corridor bounded by two strike prices, a floor as the lower limit and a cap as the upper limit, within which the operator is exposed to market prices.

[15] Article 19(d)(2) of the Electricity Regulation establishes the obligation to determine the remuneration associated with the 2w-CfD through an *"open, clear, transparent and non-discriminatory competitive process"*. However, it also recognises that *"where no such competitive bidding process can be conducted, two-way contracts for difference or equivalent schemes with the same effects, and the applicable strike prices, shall be designed to ensure that the distribution of revenues to undertakings does not create undue distortions to competition and trade in the internal market"*.

[16] See for instance, European Commission, Directorate-General for Energy (2022), Chema Zabala, Alfa Diallo: "Study on the performance of support for electricity from renewable sources granted by means of tendering procedures in the Union 2022" and Report from the Commission on the performance of support for electricity from renewable sources granted by means of tendering procedures in the Union, COM(2022) 638 final.

[17] Examples of such production-independent volumes can be a limited volume determined *ex ante* by the auctioning authority or, in the case of production-independent 2w-CfDs, the production potential of the installation, a reference profile reflecting the production of an average reference project, among other possibilities.

[18] In addition to the clawback resulting from the 2w-CfD, other types of clawbacks may be required to avoid overcompensation, as indicated by the State aid guidelines. The clawback resulting from the 2w-CfD may be maintained over the operational lifetime of the supported asset.

b. Categories of contracts for difference

Two main categories of 2w-CfDs can be defined at this stage: production-based 2w-CfDs and production-independent 2w-CfDs. Contracts of the first category determine a reference volume and contract payments based on the volume produced by the beneficiary. The second category decouples the reference volume, and therefore the contract payments from the actual generation and looks instead at metrics related to the production capacity of the installation or to the production of a reference plant. Besides 'pure' production-based and production-independent contracts, the 'fusion' 2w-CfDs, combining features of both types of 2w-CfDs, are possible[19]. For example, the 2w-CfD could be production-based during times in which the scheme is not expected to lead to distortions[20] but production-independent for the rest of the time (e.g. when electricity market prices are expected to be below marginal cost of production of the supported installation).

Production-based 2w-CfDs were in the past decade and remain today the most common type of 2w-CfDs implemented by Member States. In their simplest design, those schemes can distort the beneficiaries' incentives[21] as they incentivise the maximisation of production, independently of the associated value of this production for the electricity system, reflected by market revenues. For instance, producers may be incentivised *i)* to maximise their production despite overall excessive electricity generation and prices in intraday or balancing markets, with market prices being below the marginal cost of production of the installation or *ii)* to take investment decisions that maximise the produced volumes of the installation but do not maximise the value of the electricity produced for the electricity system. Unless there is a shift to smarter 2w-CfD designs, these distortions can be expected to increase. An example of such smarter design includes the consideration of not providing incentives to generate in periods where the value of that energy is negative. This can normally be addressed by not remunerating for production during hours with negative prices. The importance of the intraday market segment is expected to increase. It will therefore be essential to ensure that negative price signals are also considered when determining the remuneration criteria of 2w-CfDs. Thus, better designs of 2w-CfDs are necessary to minimise the overall costs of the energy transition borne by consumers in their energy bills.

Production-independent 2w-CfDs solve most of these problems. Since the payment to the beneficiary is independent from the actual generation, the beneficiary is incentivised to adapt its production and market behaviour to maximise its market revenues. This incentivises beneficiaries to operate the installation in a similar manner to how this would be done by an operator without support. Different types of production-independent 2w-CfDs exist in the academic literature. They vary mostly by the way in which they define the reference volume,

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[19] See for example Commission Decision SA.115179 (2024/N) – Italy FER X TCTF Italian transitional support for electricity production from RES plants close to market parity. Other possible designs have been discussed in the literature, which include different designs for the reference price, reference volume or the strike price(s). See for instance Kitzing et al. (2024) for a large overview of the possible design choices. Other designs may include flexibility bonus or penalties. See for instance Fabra (2023).

[20] References to 'distortions' in the context of this guidance should be understood as effects of the 2w-CfDs providing incentives to the beneficiary to behave differently from an 'unsupported' generator. For instance, 2w-CfDs have distortive effects if they incentivise the beneficiary to produce in times in which the market price is below the beneficiary's marginal cost of production or if the beneficiary does not produce even though market prices are above its marginal cost of production. These examples of distortions are not exhaustive.

[21] This assumes that the marginal cost of production is below the strike price.

which can for example be based on the capability of the asset to produce at a certain time or be based on the production of a (virtual) reference power plant. The major challenges with this type of 2w-CfDs pertain to establishing the reference volumes, which may involve greater complexity, for example, due to the need to deploy complex modelling capabilities or to prevent potential gaming risks[22].

In general, the removal of market distortions created by 2w-CfDs comes with some trade-offs. For example, improved market responsiveness will reduce overall system costs, i.e. it will benefit consumers overall, but it may also increase the individual revenue risks of beneficiaries.

c. Cross-border two-way contracts for difference

The design of cross-border 2w-CfDs – which have so far been used rarely, but are expected to increasingly be used for cooperation in cross-border exchanges – should in principle be similar to that of other 2w-CfDs and therefore be in line with the applicable legal framework and design principles described in this document. However, a difference with regards to the 2w-CfDs that are developed throughout this guidance is that the design of cross-border 2w-CfDs involves the host Member State and one or multiple financially contributing Member State(s).

Member States involved in a cross-border 2w-CfD may apply different levels of in-depth cooperation. At the lowest level of cooperation, the host Member State may unilaterally design and implement the scheme and receive financial contributions from the cooperating Member State(s).

At a middle level of cooperation, the cross-border 2w-CfD is jointly designed with the contributing Member State(s), but the implementation is left to the host Member State. This joint design may be project specific or may be a framework design for a cluster of projects.

Finally, the cross-border 2w-CfD may be designed and implemented together by the host countries and the contributing Member State(s). Again, this cooperation may be project-specific or a framework agreement for a range of projects.

III. Benefits of smarter contracts for difference

The European Commission has proposed a 2040 climate target of a 90% net reduction in greenhouse gas emissions compared to 1990 levels[23]. Electrification with a fully decarbonised power system by 2040 is the main driver of the energy transition. The share of electricity in final energy consumption is expected to increase from around 30% in 2030 to above 45% by 2040[24]. To achieve such levels, large investments in new power plants need to take place over the coming years, estimated in the order of EUR 140 billion annually during the next decade

[22] This may imply calculating the reference volume to mimic the production profile of specific renewable asset installations. This implies the deployment of effective meteorological sensors and sophisticated electricity production modelling to set the reference production curve or associating a 'reference power' with a supported project in a way that prevents gaming risks and removes implementation costs and administrative burden.

[23] Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality COM(2025)524 final

[24] European Commission, 2040 Climate Target Plan (SWD(2024) 63 final).

alone[25]. To maximise the value of the investments in new generation installations for European consumers by making the electricity system more resilient, they need to be sufficiently diversified. Furthermore, the installations need to have access to a robust electricity grid and be complemented by non-fossil flexibility resources. In addition, further developing locational signals will also enable this system to function efficiently and will allow the cheap electricity produced by the clean generation assets to be channelled to where and when it is most needed by consumers.

Against this background, smarter designed contracts for difference can contribute to lowering the overall costs of the electricity system in several ways compared to a counterfactual where contracts are not designed smartly or they are not offered.

a. Reducing investment costs through increased price certainty

The recovery of investor costs through trading short-term electricity market products entails risks. This is particularly the case for renewable sources which are weather-dependent and whose production can be highly correlated within each technology group. Long-term contracts, either with private entities (e.g. fixed-price PPAs) or such as State-supported 2w-CfDs, may thereby **limit the market risks of investors while protecting electricity consumers against the impacts of market-price volatility**. The cost of capital is one of the biggest costs for new energy investments as the assets are characterised by high capital expenditure (CAPEX) and low operational expenditure (OPEX). By ensuring a minimum level of remuneration protection backed by the State guarantee, 2w-CfDs ease access to cheaper capital compared to merchant investments and thereby efficiently lower electricity-generation costs. For example, supporting new investments through 2w-CfDs for offshore wind could **decrease capital costs** by 3.7 to 5 percentage points compared to a project with no State support.[26]

b. Maximising the value of the investments by ensuring that the electricity system functions efficiently

Considering the expected increasing role than 2w-CfDs will play in supporting investments, the right design of those support schemes is therefore key to **ensuring that the electricity system functions efficiently**. Increasing the market-responsiveness of generation installations subject to 2w-CfDs compared to previously approved schemes could (i) better reflect the benefits of the generation capacity to the overall system costs, (ii) increase system efficiency, and (iii) ultimately lower energy system costs. For instance, negative prices have soared over the recent years (from 0 to 465 of hours in the Dutch day-ahead market from 2018 to 2024[27]), increasing price volatility and uncertainty, leading to increased demand for State support for generation installations and for balancing mechanisms. Therefore it is important that support schemes provide the right incentives to adapt the generation output to the market price levels and that optimal siting and technological decisions be taken to maximise market revenues and

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[25] European Commission, 2040 Climate Target Plan (SWD(2024) 63 final).

[26] The Impact of Two-Sided Contracts for Difference on Debt Sizing for Offshore Wind Farms - Mak Đukan, Dogan Keles, Lena Kitzing, 2025

[27] https://www.creg.be/sites/default/files/assets/Publications/Studies/F2590EN.pdf

to avoid these episodes.[28] Considering the increased volumes traded in the intraday market (+53% in 2024 compared to 2023)[29] and the increase in balancing costs[30], providing adequate incentives for generation installations to react to intraday and balancing markets is key to ensuring system efficiency and minimising societal costs. In support schemes approved in recent years, reactivity to day-ahead price signals was increasingly considered. However, the reactivity to intraday and balancing markets has been very low, leading to severe distortions. One sign of this has been the increased hours of negative price in the intraday markets: in 2024 in Germany, 13% of hours saw negative prices in the intraday markets while the day-ahead prices were positive[31].

c. *Reducing renewable curtailments with adequate investment incentives*

Another benefit of a well-designed CfD is that it **reduces generation curtailment** due to grid constraints. In today's system, a generation installation can be curtailed by the system operator and will be compensated for it through a redispatching mechanism. The reasons for such curtailment are generally linked to grid congestion.

This redispatching system does not incentivise generation investors to locate installations in areas of low congestion close to electricity demand, and where the grid is ready to host these new generation capacities. Nor does it encourage them to take technological decisions that could ensure better integration of the new assets in the electricity system, for example by limiting the beneficiaries' contribution to congestion. Locational incentives for new investments must therefore be improved to maximise the benefit of renewables for the energy system. This can complete similar locational incentives in network charges.

The Commission's Joint Research Centre estimates that EU redispatching costs can be expected to increase to up to EUR 100 billion per year by 2040[32]. Without the electricity system becoming more flexible and without greater demand for electricity, more locational incentives and the build-out of new grid assets, the production of renewable electricity will increasingly be curtailed and further exacerbate congestion challenges.

d. *Reducing energy costs by attracting additional low-cost clean generation to the market and displacing high-cost fossil-fuel generation*

2w-CfDs are likely to attract additional investments in clean generation installations with low OPEX. These additional investments will make it possible **to reduce wholesale electricity prices** by displacing more expensive generation assets, mostly fossil fuelled, out of the merit order. Furthermore, even when the wholesale electricity price is set by high-cost generation installations, 2w-CfD act as an instrument for decoupling electricity bills from the volatile costs

[28] https://www.creg.be/sites/default/files/assets/Publications/Studies/F2590EN.pdf
[29] CACM Annual report 2024 - https://www.nemo-committee.eu/assets/files/cacm-annual-report-2024.pdf
[30] Best available data suggest that EU-level total balancing costs in 2024 are at least 2–3 times higher than in 2018, but there is no officially published consolidated series that would support an exact percentage figure, according to the ENTSO-E Market and balancing reports 2020-2025.
[31] It is however relevant to note that the difference in sign between the day-ahead and intraday timeframe could be due to changes in the generation and consumption forecasts after the day-ahead market, for example due to weather changes.

of fossil fuels. By setting a maximum remuneration for the supported installations, 2w-CfDs allow Member States to recover revenues in times of high market prices. Revenues above that maximum remuneration can be redistributed to consumers which effectively protects them against high energy prices.

In light of the figures and the elements described in this Section, it appears key for better incentives to be provided so that installations are located in areas of low congestion and therefore in areas at low risk of curtailment. This will reduce overall electricity system costs and benefit EU consumers and producers.

IV. Legal framework

Under the EU energy *acquis*,[33] the design of 2w-CfDs needs to follow specific criteria. In that regard, the relevant legal framework is set out in Article 4 of the Renewable Energy Directive (Directive (EU) 2018/2001 – RED)[34] and in Articles 19d and 19a of the Electricity Regulation (Regulation (EU) 2019/943).[35]

Article 19d(1) of the Electricity Regulation requires that direct price support schemes for investment in facilities for new generation of electricity from renewable[36] or nuclear generation take the form of 2w-CfDs as of 17 July 2027 (or 17 July 2029 for offshore renewable installations connected via hybrid interconnectors). It further stipulates that participation of market participants in such schemes should be voluntary.

Article 4 of the RED and Article 19d of the Electricity Regulation do not mandate using one specific type of 2w-CfD. However, they require compliance with specific design principles.

Article 4 of the RED sets out certain design principles for support schemes for electricity from renewable sources. In particular, it requires such schemes to provide incentives for the integration of electricity from renewable sources into the electricity market in a market-based and market-responsive way, while avoiding unnecessary distortions of electricity markets and taking into account possible system integration costs and grid stability. Furthermore, Article 4 of the RED requires these support schemes to be designed to maximise the integration of electricity from renewable sources into the electricity market and to ensure that renewable energy producers are responding to market price signals and maximise their market revenues. This support must be granted in an open, transparent, competitive, non-discriminatory and cost-effective manner. Article 19d of the Electricity Regulation adds further detail on design elements for 2w-CfDs and extends this framework to nuclear generation. The aim of these new

[33] This guidance focuses on the relevant applicable rules in the EU energy acquis and does not intend to cover all rules that possibly apply to 2w-CfDs under the EU law, such as State aid rules or financial legislation.

[34] See Articles 4 and 6 of the RED.

[35] Beyond energy law, State aid rules play an important role for designing EU-compliant 2w-CfDs. In this regard, reference is made, in particular to the Guidelines on State aid for climate, environmental protection and energy - 2022/C 80/01 (CEEAG).

[36] For the purposes of this guidance, the term ‘renewables’ refers to new generation facilities of electricity from wind energy, solar energy, geothermal energy and hydropower without reservoir.

provisions is to improve the preservation of market responsiveness of support schemes taking the form of 2w-CfDs.

Article 19d(2)(a) and (b) of the Electricity Regulation clarify that 2w-CfDs need to ensure that the supported installations act in a 'market-responsive' way, whereas Article 19d(2) (e) and (5) of the Electricity Regulation establish conditions on how revenues stemming from the clawback mechanism should be used by the State. Furthermore, Article 19a(5) and (6) of the Electricity Regulation furthermore clarify the possible interplay between 2w-CfDs and PPAs. Article 19d of the Electricity Regulation also contains provisions on the avoidance of undue distortions to competition and trade in the internal market (Article 19d(2)(d)), the level of remuneration protection (Article 19d(2)(c)), penalty clauses in the case of early contract termination (Article 19d(2)(f)) and the Member States' right to exempt small-scale installations from the provisions under Article 19d(1) of the Electricity Regulation (Article 19d(6)).

Article 26 of Regulation (EU)2024/1735[37] requires that certain non-price criteria are used in 30% of the renewable energy auction volume per year per Member State (or at least 6GW per year per Member State). Those non-price criteria comprise (i) pre-qualification criteria on responsible business conduct, cybersecurity and data security, and the ability to deliver; (ii) as well as pre-qualification or award criteria on the auctions' resilience and the sustainability contribution. They are further specified in Commission Implementing Regulation (EU) 2025/1176[38]. Where a Member State chooses a 2w-CfD to be part of the 30% of renewables auctions covered, the non-price criteria above need to be incorporated.

The approval of these schemes should be done in line with State aid rules. In the case of renewable installations, these are mostly dealt with using the CEEAG and the recently approved CISAF. In the case of nuclear installations, the analysis is performed directly under Articles 107 and 108 TFEU.

In practice, in particular the implementation of the requirements of market-responsiveness and the combination of 2w-CfDs with PPAs have raised practical questions. Accordingly, this document provides guidance on designing 2w-CfDs that comply with the requirements and on their potential combination with PPAs. This provides more clarity on the requirements that 2w-CfDs should meet to comply with EU law.

V. Smart design of 2w-CfDs

In view of the long duration of 2w-CfDs and in a context of massive investments needed to reach the 2030, 2040 and 2050 climate targets, the design of 2w-CfDs needs to unlock the necessary investments and ensure that the support granted does not result in distortions to the

[37] Regulation (EU) 2024/1735 of the European Parliament and of the Council of 13 June 2024 on establishing a framework of measures for strengthening Europe's net-zero technology manufacturing ecosystem and amending Regulation (EU) 2018/1724, OJ L, 2024/1735, 28.6.2024, ELI: http://data.europa.eu/eli/reg/2024/1735/oj.

[38] Commission Implementing Regulation (EU) 2025/1176 of 23 May 2025 specifying the pre-qualification and award criteria for auctions for the deployment of energy from renewable sources, OJ L, 2025/1176, 18.6.2025, ELI: http://data.europa.eu/eli/reg_impl/2025/1176/oj.

functioning of electricity markets and ensures that installations are efficiently integrated in the electricity system.

First, power-generating installations supported by 2w-CfDs must be enabled to operate and participate efficiently in the electricity markets. Incentives to ensure market responsiveness of the supported installations have proved to be a key design element of 2w-CfDs. It is therefore crucial to ensure that all future 2w-CfD schemes place this design element at their core, in accordance with the legal framework.

Second, another crucial aspect not only for support schemes for renewables but also for nuclear energy policy in the next decade is to continue to promote the deployment of these schemes at the lowest possible cost for society. This requires limiting the scope for revenue cannibalisation[39] or mitigating the overall system costs (e.g. grid expenditure, flexibility costs, security of supply costs, or redispatching costs). This can be achieved by promoting types of installations, including hybrid installations combining multiple technologies (e.g. RES and storage) of high system value, and prioritising their development in locations that maximise their contribution to the electricity system.

To achieve both objectives, it is crucial to design 2w-CfDs in a way that ensures market responsiveness of the supported assets. This implies, in addition to complying with the legal framework, to find a balance between reducing the overall risk for the beneficiary to a sustainable level and transferring some of the investment risks to the State. Some of the risks might be better suited for 2w-CfD beneficiaries to manage (e.g. decisions on when to carry out maintenance of an installation). To achieve this objective, the most suitable design features may depend on many factors such as: (i) the generation technologies supported; (ii) the liquidity of the relevant wholesale electricity market; (iii) the level of grid congestions within the Member States' bidding zone(s); and (iv) the production and consumption patterns of bidding zones. To reduce the beneficiary's revenue risk, Member States could design their 2w-CfDs in ways that **limit the price risk[40] and/or the volume risk[41]**. Limiting both the price risks and volume risks is indeed essential to limit the funding costs (and therefore the capital costs) incurred by beneficiaries. Striking a balanced approach on these trade-offs is therefore

[39] Cannibalisation occurs when the revenue and value of a specific energy technology declines due to increased penetration of that technology. Cannibalisation is then a parameter that, if present, can affect both the profitability and the risk for investors, in particular of renewable electricity generation assets.

[40] This is for example the case for production-independent 2w-CfDs with a reference period corresponding to the market time unit. A producer investing in a project capable of producing electricity in the same production pattern as the reference production profile will be guaranteed to be paid at the strike price for every MWh they may have produced. This is without prejudice to the benefit of designing a reference production profile in a way that is beneficial for system needs.

[41] This is for example the case for 2w-CfDs where Member States decide to support a generation installation in times where this installation is not producing, such as during negative price hours in the day-ahead and intra-day market (i.e. production independent or fusion 2w-CfD). Thus, the total remuneration of the beneficiary does not depend on the frequency of occurrence of negative price hours and the production volume supported by the 2w-CfD (in MWh/year) can be better forecasted by the beneficiary, for example based on historic average production. Note that this reduces the beneficiaries' risks and therefore lowers the strike price resulting from competitive bidding. On the other hand, this transfers a risk to the State, which will have to compensate the beneficiary during an increased number of negative price periods, therefore it remains crucial that the 2w-CfD is designed to provide adequate market responsiveness incentives for example by including longer reference periods.

essential to limit direct and indirect costs related to 2w-CfD, to maximise their benefits for both electricity consumers and taxpayers.

In line with Article 19d(2)(a) and (b) of the Electricity Regulation, 2w-CfDs should maintain the incentives of comparable unsupported generators, or where relevant third parties, to cumulatively contribute to the objectives described below.

1. Generate electricity to support the system needs

Market-based behaviour in reaction to price signals leads to an efficient use of resources and reflects system needs. For instance, in moments of abundance of available electricity, signalled by zero or negative market prices, additional generated volumes will put additional pressure on the system, leading to increased system costs. To absorb these additional volumes, the electricity system needs to be made more flexible, in particular by developing storage and demand response, which will increase price stability. Similarly to installations operating under market conditions generation assets supported under a 2w-CfD should therefore retain their incentives to react to price signals, ensuring that the electricity generated brings value to the electricity system. Similarly, in times of scarcity, beneficiaries should be incentivised to maximise their production by ensuring that they can generate additional profits.

2. Take optimal investment decisions to foster efficient system integration

Possible beneficiaries of 2w-CfDs will need to take investment decisions to deploy new installations. The decisions can, for example, concern the location of the installation, the number of assets in an installation or their power rating (e.g. through over-planting decisions), their orientation, the potential addition of flexibility investments and other technological choices. The impact of such decisions on the electricity system can be significant and, considering the duration of 2w-CfDs as well as the life expectancy of the installations supported, have long-term effects. Beneficiaries of 2w-CfDs should therefore be incentivised to take decisions according to the best forecasts of system needs. For instance, photovoltaic panels should be oriented in a way that maximises their value for the system.

In parallel, flexibility solutions need to be developed efficiently to ensure that the electricity generated can be absorbed by the electricity system. Similarly, this could be reflected by providing incentives for the beneficiary to, amongst other things, design and invest in equipment that delivers the economically efficient level of flexibility for the electricity system, for example by ensuring that nuclear power plants are capable of modulating their power output[42]. Beneficiaries could be incentivised to take over-planting decisions, to conclude grid connection contracts for a power level below the installed capacity or to concentrate wind turbines in a particular location despite the yield being reduced due to the wake effect.

[42] The current version of the European Utility Requirements prescribes that nuclear power plants must be capable of daily load cycling operation within certain boundaries. For more details, see SWD/2025/160 final, section 2.2.2.

3. Offer ancillary and congestion management services[43]

The Electricity Regulation gives preference to the market-based provision of services, as laid down in Article 3. Accordingly, 2w-CfDs should maintain the beneficiary's financial incentives to use the installation to provide ancillary and congestion management services, according to the technical capabilities of the generation installation.

4. Perform maintenance at appropriate times, given the electricity system needs

Maintenance should be scheduled in line with system needs. This means, amongst other things, to maintain the beneficiary's incentives to plan its maintenance based on the costs of maintenance and the foregone market revenues. This is necessary to ensure that low costs generation is available when it is most needed to lower wholesale electricity prices, for instance, in times of scarcity.

5. Offer their output at their marginal cost and considering their technical constraints

As under competitive circumstances beneficiaries are expected to offer their production at marginal cost, a 2w-CfD should not incentivise them to offer their production below their marginal cost. In particular, beneficiaries should not receive any aid for electricity production during periods when the market value of that production is negative[44].

For the purpose of this document, the marginal cost of solar and wind electricity production is assumed to be zero.[45] Consequently, it is crucial that these technologies do not receive support when the market value of produced electricity is negative. By contrast, certain technologies – such as nuclear power plants – have marginal costs of production. For these assets, simply withholding support for electricity production during periods of negative market prices is not sufficient to ensure that they offer their production at marginal cost. Therefore, for such assets with upward and downward dispatching capabilities, support should not be provided for production during hours when the market value of the produced electricity is below the marginal cost of production. This includes both direct production costs and the cost of technical constraints, such as ramping costs or the opportunity cost of participating in other market segments or time periods.

6. Ensure that beneficiaries participate efficiently in different electricity market segments, pursuing a profit maximising strategy

Market participants aim to maximise their profits in the different market timeframes such as the day-ahead, intraday and balancing timeframes. As design features of 2w-CfDs (such as the reference price definition) can incentivise market participants to trade on specific market segments only, 2w-CfDs should be designed in such a way as to preserve adequate economic

[43] Article 2(48) of Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (recast) (OJ L 158, 14.6.2019, p 125) defines 'ancillary services' as services necessary for the operation of a transmission or distribution system, including balancing and non-frequency ancillary services, but not including congestion management.

[44] See paragraph 123 of the CEEAG. Please note that in certain circumstances, the costs of operating the unit also encompass the costs of ramping up and down, for example for nuclear installations.

[45] The marginal cost of production of solar or wind generation assets (i.e. the cost of producing one additional MWh) is considered to be very low, close to EUR 0/MWh. Considering that there is no precise figure on these exact costs, for this guidance, it is assumed to be EUR 0/MWh.

incentives for the power-generating facility to operate and participate efficiently in all timeframes of the electricity markets.

7. Ensure minimal impact on the liquidity of forward electricity markets[46]

Depending on the technology concerned, forward markets can play an important role for market participants to hedge themselves against price volatility. Since 2w-CfDs also have a hedging function, their use may risk reducing liquidity in forward markets. Such liquidity is critical for market participants to be able to hedge their exposure to price risks.[47] Thus, where applicable, 2w-CfDs should ensure that supported installations continue to have incentives to participate efficiently in the forward electricity market.

8. Support a fair and non-distortive 2w-CfD revenue distribution

In line with Article 19(d)(5) of the Electricity Regulation, Member States have the possibility to distribute back to the final customers the revenues clawed back, when electricity prices are above the 2w-CfD strike price, provided that:

i. 'distortions to competition and trade in the internal market resulting from the distribution of revenues to undertakings' are avoided; and

ii. 'distribution of revenues to final customers shall be designed to maintain incentives to reduce their consumption or shift it to periods when electricity prices are low and not to undermine competition between electricity suppliers.'

As an alternative, the proceeds from 2w-CfD may also be used to finance the costs of the direct price support schemes or investment to reduce electricity costs for final customers, such as RES schemes or non-fossil support schemes, subject to State aid rules.

Lastly, allocating 2w-CfDs through a competitive bidding process, which is open, transparent and non-discriminatory, lowers the costs for developing generation capacity, and ensures that 2w-CfDs strike prices reflect the generated electricity's long-term value for the electricity system. Allocating 2w-CfDs through competitive bidding processes is usually mandatory under State aid rules and under sectoral legislation.

VI. Individual design elements

The Commission recognises that there are many possible design choices. Member States remain free to design 2w-CfDs within the applicable legal framework. However, in view of the potential benefits that well-designed 2w-CfDs could deliver (as outlined in Section III) and the challenges involved (outlined in Section IV), the Commission considers it important to provide guidance on how to identify 2w-CfD design elements that comply with EU rules. Although 2w-CfDs inherently provide a high degree of certainty to investors and therefore lower investment costs compared to merchant-based schemes, the other benefits highlighted in Section III will require 2w-CfDs to be smartly designed. In particular, the design principles set out in subsections a. to c. will be key to ensuring an electricity system that functions efficiently

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[46] For the purpose of this note, 'forward markets' refer to products for a delivery as of two days ahead of the real-time electricity consumption and production, and include exchange-traded products such as futures.

[47] This is particularly relevant for suppliers that need to comply with specific risk management practices under Article 18a of Directive (EU) 2019/944.

while the design principle set out in subsection d. will support a reduction in renewable curtailments. The correct implementation of these design principles will reduce the overall costs for consumers to achieve the transition towards a clean electricity system. To address the challenges described in Section V, four main design elements are developed in this Section. As part of the State aid approval process of support schemes in the form of 2w-CfDs, the Commission will assess each of the considerations developed in the following subsections. Therefore, designing a 2w-CfD in a manner that builds upon the recommendations developed in each of these subsections will facilitate and accelerate the assessment of these support schemes.

a. Preventing distortions of bidding behaviour in day-ahead, intraday, balancing and ancillary service markets

2w-CfDs need to be designed in a way that does not distort the bidding behaviour of beneficiaries. This is because electricity market prices provide important signals on the state of the electricity system. They contain locational information (usually per bidding zone) and a temporal element (per market time unit, which can be as short as 15 minutes for spot markets or annual for forward products). Negative prices reflect a situation of excessive generation given the existing demand in a bidding zone at a particular time. Under negative prices, generators are incentivised to lower or stop their production, which, in the specific situation, supports the system because negative prices are a signal of excess generation that the system cannot absorb. It is therefore critical that 2w-CfDs do not remove those incentives by altering the bidding behaviour of the 2w-CfD beneficiaries and therefore distort the functioning of the electricity system, increasing the costs borne by consumers.

Not only should Member States avoid providing any incentives to beneficiaries to produce electricity when prices are negative, they should also provide incentives to beneficiaries to bid at their marginal cost of production.[48] Accordingly, during periods when market prices are below the marginal cost of production or negative, the 2w-CfD should not remunerate the beneficiary for its electricity production. However, a remuneration that is independent from actual production may still be provided, since this remuneration is granted irrespective of whether the beneficiary's power plants have generated electricity. Such remuneration should ensure that exposure to the market revenues or costs in case of negative prices continues to provide adequate bidding incentives. Importantly, to avoid bidding distortions, this remuneration must therefore not depend on the beneficiary's decision to produce or not produce. This remuneration may either be paid for the specific market time units which are problematic (e.g. with negative prices) or may be adjusted to increase the revenues received for non-problematic market time units (e.g. those for which prices are positive and above the marginal cost of production of the relevant installations).

[48] As indicated in the 2022 guidelines on State aid for climate, environmental protection and energy (CEEAG) paragraph 123.

Incentives to maximise production in times of high prices are also needed, especially in the case of dispatchable generation assets[49], including nuclear power plants or hybrid installations of renewable generation and storage. This is because those power plants and hybrid installations can produce 'on demand', supporting the system in times of scarcity (which is reflected by high prices) or displacing less efficient generation assets.

Production-independent 2w-CfDs theoretically provide optimal incentives to react to day-ahead, intraday or balancing prices. Member States or the relevant independent authorities designing the scheme should, however, ensure that the design of the reference volume of such 2w-CfDs does not provide the wrong incentives or facilitates gaming possibilities[50]. For production-based 2w-CfDs, or fusion 2w-CfDs, indices could be used to calculate both the intraday prices (considering intraday auctions and continuous trading up to the gate closure time) and the balancing price, to determine when prices drop below zero or marginal costs. Therefore, support should not be paid based on the electricity produced.

Illustration box 1

In fusion 2w-CfDs, in most periods, payments are based on actual production of the installation. The payments are however decorrelated from the effective production, and can instead be production independent in some periods, for example to reduce the volume risk for the beneficiaries.

For adequately incentivising beneficiaries supported by a 2w-CfD to participate in the balancing markets and to react to intraday price signals, the following design features ensure that fusion 2w-CfDs maintain correct incentives to limit market distortions.

Such 2w-CfD could be deemed production-independent under the following conditions:

- The installation of the beneficiary has to reduce or stop production following a request from the transmission system operator (TSO). As safeguard in this circumstance, one could consider making it legally binding on beneficiaries to offer downward balancing services[51]. This condition would prevent that the aid provided to the beneficiaries distorts balancing markets.

- The installation of the beneficiary has to reduce or stop production following a request from the distribution system operator or the TSO for congestion management purposes[52]. This avoids a situation where the aid provided to the beneficiaries distorts system operations.

- The day-ahead prices are negative.

[49] Such assets do not typically produce electricity at their maximum production capacity but rather at a setpoint that minimises the marginal cost of production. In the case of expected high prices, the assets can increase their production.

[50] For instance, the design of the reference volume could incentivise potential beneficiaries to maximise the nominal generation capacity of their installation but not to build the necessary installations in such a way as to achieve this nominal capacity. For example, in the case of wind turbines, the turbines could be designed around a capacity of 10 MW to obtain access to a reference profile for a capacity of 10 MW while the size of the blades could be designed in a way that could only achieve 6 MW of generation. This would minimise investment costs while securing high revenues if the strike price was higher than the reference price.

[51] On this specific point, see State aid case SA.115179 (2024/N), recital 55(b).

[52] On this specific point, see State aid case SA.115179 (2024/N), recital 55(a).

- When the intraday market prices are negative[53]. Considering that the intraday market is a market composed of different segments (multiple intraday auctions and an intraday continuous market), identifying the intraday price for a certain market time unit can mean having to rely on a price index. To make sure that the intraday price index is representative of market signals, the price could be determined based on the result of the intraday auction(s) when the churn factor of the auction is sufficiently high (i.e. indicating sufficient liquidity)[54] to limit the potential manipulation risk of beneficiaries. Furthermore, hours when prices are negative in the intraday continuous market should also be considered, providing that this segment is sufficiently liquid. To do so, an index based on the weighted-average price of the last hours of trade, where most of the traded volumes are concentrated, could be calculated.

In any case, the producer should always remain financially responsible for the imbalances it creates, as laid down in Article 5 of the Electricity Regulation. Therefore, no 2w-CfD payout should be based on the imbalance prices. Specific measures can, however, be laid down to ensure that beneficiaries have the possibility of being remunerated through the 2w-CfD when providing ancillary and congestion management services, provided that such designs do not distort the strategy adopted by beneficiaries when bidding for these ancillary services.

Summary box 1

Member States should ensure that supported generation installations retain all incentives to bid in the day-ahead, intraday, balancing and ancillary services markets. Several options are possible in this regard and could be combined to achieve optimal results. All options require careful consideration to come up with a design that avoids bidding distortions[55]. To date, the main design options are (i) production-independent 2w-CfDs paying special attention to how the reference volume is designed; (ii) production-dependent schemes with specific mechanisms to correct for bidding distortions, such as by identifying periods when payments should not be made for the production of electricity; and (iii) fusion schemes based on production-dependent 2w-CfDs with payments that are at times decorrelated from the effective production to avoid system distortions.

b. Fostering efficient maintenance decisions

Generation installations need to be maintained on a regular basis. While the frequency of the need for such maintenance depends on the type of installation and other factors, maintenance should be performed at times when the system is less in need of the installations' production (e.g. in moments of low demand or excessive generation). Otherwise, beneficiaries could be performing maintenances inefficiently, shutting down production capacity at times of high system needs, which could increase not only prices but also security of supply risks. To be

[53] On this specific point, see State aid Decision SA.115764 (2025/N), recital 12 for three offshore wind parks in France provides for relying on intraday market price indices to identify negative prices.

[54] The churn factor could, for example, be measured as the share of electricity traded in the auction divided by the total electricity consumed nationally.

[55] To date the academic literature and the case practice have identified a number of possible distortions. However, the possibility cannot be ruled out that further practice and research will identify additional distortions and necessary tweaks to address them.

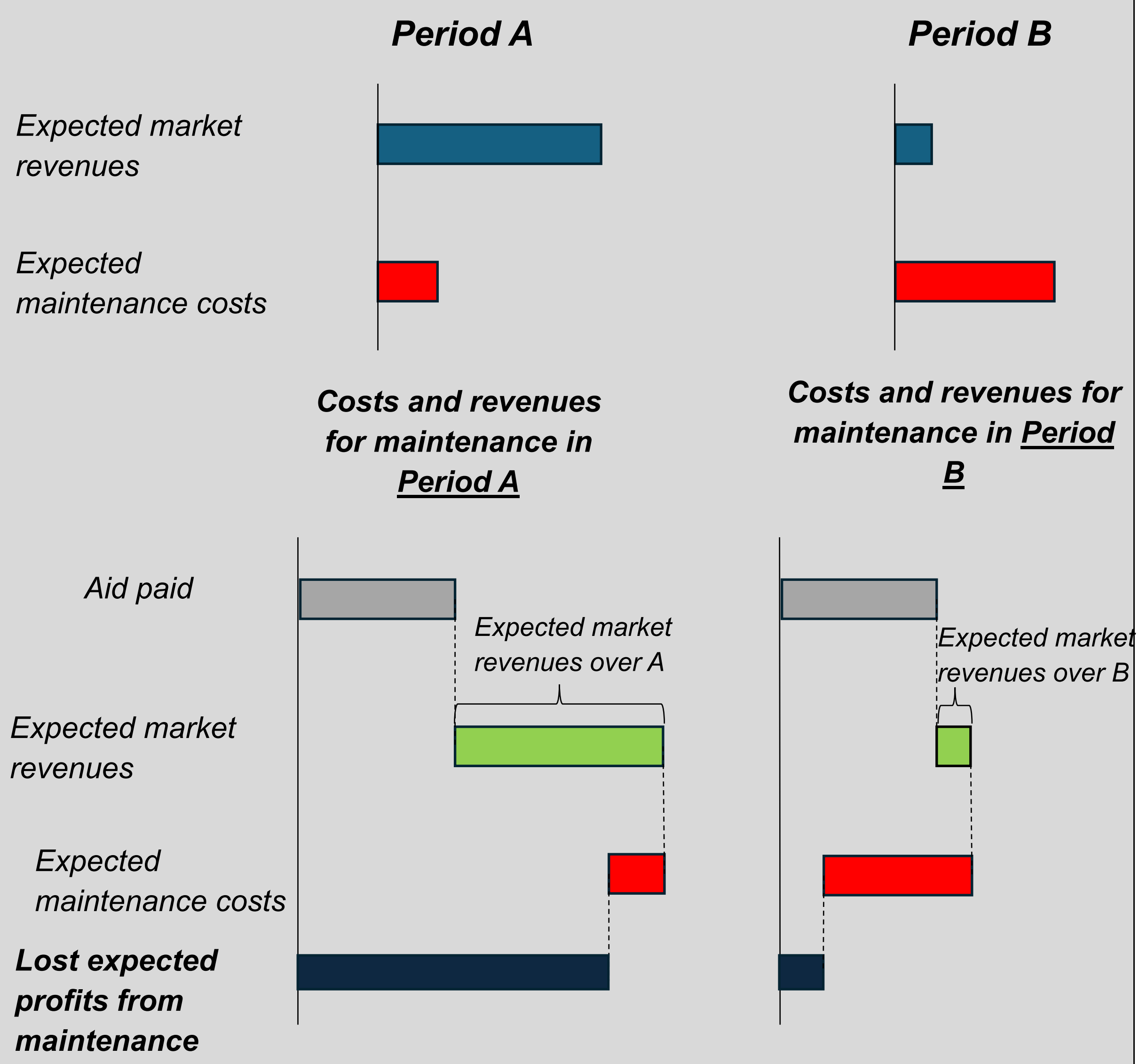
efficient, that maintenance needs to be performed when the cost-benefit scenario is most favourable, i.e. when the costs of performing such maintenance (e.g. engineers, transportation methods, etc.) are lowest relative to expected capture revenues (calculated as the generated volume multiplied by market prices (capture prices)).

To foster efficient maintenance decisions, Member States can opt for production-independent 2w-CfDs. These contracts can provide optimal incentives if the contracts payments continue to occur during maintenance periods. When opting for production-based or fusion 2w-CfDs, incentives for performing efficient maintenance can be provided by calculating a reference price established over a period which is sufficiently long. The length of this period will depend on the technology and its maintenance cycles. The beneficiary should be incentivised to perform the maintenance of its installation in the period which minimises its costs. The costs of such maintenance will first be caused by the performance of the maintenance itself and can therefore be highly dependent on weather conditions. On top of this, the beneficiary should also consider the foregone market revenues that could have been accumulated during the maintenance period.

Illustration box 2

For production-independent 2w-CfDs and fusion 2w-CfDs, ensuring that the payments also apply during planned maintenance periods provides adequate incentives to perform maintenances efficiently. Efficient maintenance is performed in ways that minimise system costs, by for instance performing maintenance when is the system is in less need for additional electricity generation.

In this example, a beneficiary decides to plan its maintenance during either a period A or a period B. In both periods, the aid paid to the beneficiaries over the periods remains the same independently of whether the beneficiary plans to perform its maintenance during period A or during period B. When deciding on the timing for its maintenance, the beneficiary therefore does not factor the aid payment into account.



When comparing the expected benefits (or losses) between the two scenarios (i.e. performing maintenance during period A or B), beneficiaries will compare the differences between (i) the expected market revenues over one period and (ii) the expected maintenance costs over the other period. In the illustration above, the operator loses less expected profits (i.e. expected profits = expected market revenues plus expected aid revenues minus expected maintenance costs)[56] by performing maintenance during period B. It would therefore be incentivised to produce during the period A, as performing maintenance during this period will result in a higher loss of expected profit compared to doing it during period B. Period A will most likely coincide with a high-price period where these extra volumes produced by the installation will support reducing the wholesale market prices. This decision is made even though the maintenance costs during period B are expected to be higher.

All in all, such a design feature incentivises the beneficiary to maximise its expected benefits as if it were not supported by a 2w-CfD and brings wholesale prices down by making assets available when they are most needed for the electricity system[57].

For production-based and fusion 2w-CfDs, applying a quarterly or a yearly reference period, depending on the generation technology, provides sufficient incentives to perform maintenance in a cost-efficient manner. This reference period might be reduced to a month for technologies with shorter maintenance periods, provided that the reference period remains significantly longer than the maintenance period. The calculation of a reference price over longer periods leaves the possibility for beneficiaries to optimise their behaviour over a longer period, for example through arbitrage on different market segments or planning of maintenance at specific times. Introducing longer reference periods, however, might need to be accompanied by a specific adaptation to the clawback, such as dynamic clawbacks[58], to ensure that market-responsiveness incentives remain constant throughout the duration of the reference price calculation.

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[56] For the purposes of the example, it is assumed that the expected cost other than the expected maintenance costs remain constant throughout the whole production period or equal to zero. However, they will need to be taken into consideration in the expected cost-benefit analysis.

[57] Note that the maintenance decision is taken based on expected profits ahead of the actual maintenance period. Once this maintenance is set, it is likely to be difficult to change the period set for maintenance. Actual cost and benefits may diverge from expectations. However, all operators in the market, whether benefiting from public support or not would take the decision based on expectations.

[58] For production-based 2w-CfDs with a long period over which the average reference price is calculated, the premium payment/clawback for each reference period is less dependent on whether the beneficiary produces at a given time and short-term variations in the market-based revenues are passed through to the producer. In situations where, at the end of the period, the beneficiary may be able to estimate that the average reference price will result in a clawback, taking into account expected spot prices in the remaining time within the period over which the average is calculated, the producer may be wrongly incentivised to cut production even if spot prices are still positive and it would be in the interests of the system that production occurs. This is because the beneficiary would otherwise need to pay the clawback on the additional volume produced without having received the equivalent spot-market revenue for that volume. In this type of distortive situation, the 2w-CfD could include a dynamic clawback, whereby the clawback is reduced only for volumes produced in hours with low spot prices and limited to the end of the reference period and only at times when beneficiaries would be able to determine that they would be clawed-back to maintain the incentive for renewable plant producers to feed-in electricity in times of (low) positive prices. In this kind of distortive situations, the scheme could adjust the clawback to be equal to the minimum of the average clawback or the spot price. In those instances in which the clawback is above the spot price, the developer would in principle be incentivised to stop production. However, if the clawback for that particular moment is changed to be equal to the spot price, the developer would be indifferent and would still produce when it is beneficial for the system. For further details on dynamic clawbacks see Kitzing et al (2024).

Summary box 2

Member States should ensure that supported generation installations retain all incentives to perform efficient maintenance. This can be achieved by designing production-independent 2w-CfDs and remunerating installations during maintenance periods or by calculating the 2w-CfD reference price over quarterly or yearly periods for production-based 2w-CfDs. Dynamic clawbacks might be needed to ensure that market-responsiveness incentives remain constant throughout the duration of the reference price calculation.

c. *Incentives to participate efficiently in the forward electricity market*

Electricity forward markets are key to allowing market participants to hedge and protect themselves against price fluctuations. Market participants, whether producers or consumers, naturally hedge to reduce their risks. 2w-CfDs, by fixing a strike price over a long period of time, provide a long-term hedge for beneficiaries. 2w-CfDs provide a much longer-term hedge compared to the most traded products on forward markets, which currently offer liquid products of one year, and up to three years ahead in some markets. However, 2w-CfDs do not allow a direct hedge by consumers, which is possible through exchange-traded instruments such as forward market products, and over-the-counter instruments such as PPAs[59]. Instead, 2w-CfDs provide an indirect hedge through the Member State which under this instrument procure electricity for typically 15-20 years at a given price.

2w-CfDs can reduce the incentives to hedge and therefore to participate in the forward electricity market. This is particularly the case when the reference price in the 2w-CfD is calculated over short periods (e.g. hourly). However, they may maintain incentives to trade in forward market increase, for example when using longer-term averages as reference periods (e.g. annual)[60].

Most of the forward electricity markets suffer from low liquidity, leading to higher hedging costs and unequal market access[61] across the EU at the expense of electricity consumers needing predictability on electricity costs. This has direct consequences for consumers who might pay excessive prices or even lack access to fixed electricity price contracts. The hedging disincentives created by support schemes have been identified by the Agency for the Cooperation of Energy Regulators (ACER) as a key problem of the EU forward markets[62].

Considering that forward market products are currently mostly issued in the form of baseload products (a constant profile for a full month, quarter or year), participation in forward markets is particularly relevant with a relatively constant production profile such as nuclear

[59] PPAs are discussed in Section VII.

[60] This can for example be the case when beneficiaries of the 2w-CfD try to 'beat the market' and capture higher market revenues through profitable trading decisions in the forward market, while limiting the risks. In particular, when reference price in the 2w-CfD are long (e.g. annual), the developer may have the incentive to trade in forward to hedge its risk.

[61] The liquidity of the different electricity forward markets is very low in most bidding zones, with only few bidding zones having sufficient liquidity. See the paper referred to in footnote 62 for additional information.

[62] ACER Policy Paper on the Further Development of the EU electricity forward market https://www.acer.europa.eu/sites/default/files/documents/Position%20Papers/Electricity_Forward_Market_PolicyPaper.pdf

installations. In the case of individual intermittent renewable generation installations, this is less evident with the existing market products.

For such installations, specific design elements in the support schemes should be introduced, for example through longer reference periods or, by definition, of the reference price or of the reference period, to preserve incentives to operate and participate efficiently in forward markets. In the case of nuclear installations, the reference price in the 2w-CfD may be set in a way that considers multiple market segments (e.g. forward and day-ahead market). However, setting the reference price is not straightforward. This is because there can be different forward products available in each Member States and that the consideration of forward market prices in the reference price of 2w-CfDs needs to be balanced with the need to maintain adequate incentives to react to short-term price signals and adequate investor risks. To maintain such incentives, the reference price of 2w-CfDs can be calculated ex post, based on the volumes actually traded in different market segments and the average prices of those markets over a specific period.

Illustration box 3

Using a reference price that is simply calculated on one market segment (e.g. day-ahead), would result in the power plant bearing additional risk by selling on a different market from the one on which the difference payments are calculated. This is particularly relevant in the context of nuclear generation installations.

To avoid this problem, a possible workaround is to calculate the reference price as the average of each market price for markets on which the beneficiary will sell (e.g. forward, day-ahead, intraday), weighted by the volume of the beneficiary's actual sales on each of these markets, and a defined market price (e.g. the average price of the year-ahead forward market products), weighted by spare capacity. Using market prices (as opposed to realised prices) to build the reference price incentivise the beneficiaries to 'beat the market'. Note that weighting by the actual sales implies that the composition of the reference price is not defined exogenously, which could artificially bias the trading strategy of the beneficiary but endogenously based on the actual trading strategy of the beneficiary.

The weighted-average reference price used in this illustration allows for the power plant to be hedged on each market (forward, day-ahead, intraday) where it is active, and therefore allows the power plant to actively sell on each of these markets. To limit risks of gaming during reference periods of low production, a reference market segment is defined for calculating the reference price.[63]

To foster efficient dispatching decisions, the power plant should however be incentivised to react to shorter-term price incentives, even when electricity was sold on a physical longer-term market. To make sure that this is the case, a solution is for the plant to have the ability to buy-

[63] Without this mechanism, in the case of a reference period with low production, the power plant could strongly modify the reference price (that applies to the full reference volume), by simply switching sales from one market to another.

back electricity on the market to meet its selling obligations while modulating its production in parallel.[64]

Alternatively, the State may mandate one or multiple market participants independent from the operator of the generation installations and selected through a competitive process, to perform forward market hedging on behalf of the State. This hedging could be performed for the volumes generated by a pool of supported installations. This would help lower the risk for the State, which otherwise is exposed to long-term payment obligations and spot price fluctuations, support forward market liquidity and make available the volumes of supported electricity to consumers. The advantage of this approach is that the market participant mandated by the State could adapt its trading behaviour to market trends.

Similarly, this market participant mandated by the State could offer parts of the procured volumes in the form of PPAs, which provide longer-term hedges[65]. This would also allow the State to hedge its exposure to short-term prices that it gained from signing 2w-CfDs. The benefit of this approach is that it will result in more standardised PPA products which may be available to retailers and a larger number of customers, including customers in other Member States. If a Member State has contracted multiple 2w-CfDs, they could be pooled in the PPAs or forward market bids offered to the market. In this way, the profiles of different intermittent production installations could be bundled to present a more uniform hedging profile, better representing consumers' needs. All this trading should occur on a market basis to prevent distortions.

Summary box 3

Member States should ensure that supported generation installations retain similar incentives as non- supported generation installations to participate efficiently in electricity markets, including forward markets. Ensuring that 2w-CfDs do not systematically divert volumes away from forward markets is particularly relevant for nuclear installations and other generation technologies with a more constant generation profile.

d. Maximising the value of investments for the electricity system and EU consumers

When investing in new generation installations, investors must take a certain number of investment decisions. While some of those decisions are in general fixed by the 2w-CfD tendering conditions (e.g. on the type of generation installation), a number of decisions remain in the hands of the investor. Examples of such decisions where the right decision can help maximise the welfare contribution of the investment can concern (i) the location of the installation (in the case of solar or onshore wind); (ii) the orientation of the installation (in the case of solar); (iii) wind farm technological choices[66]; (iv) nuclear power plant design to allow

[64] For example, if the plant committed to sell on the forward market, and the day-ahead or intraday price is below the power plant's marginal costs, the power plant should be able to buy-back the electricity already sold on forward markets to modulate its production output.
[65] Subject to compatibility with State aid rules (see Section VII.b. below).
[66] Such as the ratio between the length of the blade and the size of the turbine or the land concentration of wind turbines.

for more flexible production; (v) the installed capacity compared to the maximum injection capacity to the grid; (vi) the addition of flexibility investments[67]; or (vii) the specific model of the generation installation. Those decisions can have significant and long-lasting effects on the electricity system. Proper incentives to take optimal investment decisions, maximising the value of the investment for the overall electricity system, therefore need to be included in the support scheme design[68]. These optimal investment decisions benefit consumers as they incentivise, for instance, electricity to be made available in hours of higher demand, thus lowering the market price for all.

To ensure adequate investment decisions, it is essential that beneficiaries remain exposed to price signals as described in this guidance. Where market price formation fully and adequately reflects system needs and local specificities, exposing investors to these prices helps to steer investment decisions as regards their location, orientation, combination with flexibility and the choice of the generation installation.

Production-independent 2w-CfDs can theoretically provide optimal investment incentives, if adequately designed. Member States or the relevant independent authorities designing the scheme should pay particular attention to the design of the reference volume of such 2w-CfDs, as this is expected to have a considerable influence on the strength of incentives to maximise the value of investments for the electricity system.

In addition, the granting authority should inform potential beneficiaries about the methodology setting the reference price and volume to potential beneficiaries well ahead of the competitive bidding process. This will enable them to best take it into account in their bid and in their investment decisions.

Illustration box 4

The development of hybrid installations (of a generation asset combined with another one, for example, a battery), is rapidly increasing. It is as a way to make an efficient use of scarce grid connections efficiently and develop projects faster. By combining the generation assets with flexibility solutions, the installation becomes dispatchable. Therefore, the design of a support scheme for these assets requires that the installation continues to have the incentives to dispatch according to market signals.

A good practice, especially for the development of hybrid installations, is to allow beneficiaries of a supported power-generating installation to invest in behind the meter flexibility solutions, such as batteries, thus allowing the beneficiary to save grid connection fees for the asset behind the meter and potentially contributing to the reduction of grid congestion. Such investments

[67] For renewables, additional flexibility investments can refer to co-locating battery storage systems. For nuclear, it can refer to installing equipment or taking design choices which further enhance the plant's load-following ability.

[68] Ensuring that the investment avoids undue distortions to competition and trade in the internal market and that it contributes to system value may include 2w-CfD design elements incentivising efficient construction. Such design elements could reflect reaching certain construction milestones on schedule and in accordance with the planned budget. Some Member States have introduced penalties for project non-completion or underperformance.

can be made together with the investments in the production installation or later over the lifetime of the production installation supported by the 2w-CfD. In such cases, it is important that aid is only provided to support the production installation, which was initially covered by the support scheme, for example through a dedicated and certified submetering point.

Moreover, Member States may plan to introduce a production-independent 2w-CfD, to comply with the Electricity Regulation rules described in this guidance. These Member States may decide to adjust the reference volume based on which the beneficiary would be incentivised to adopt a more system-friendly behaviour. In practice, this could lead to the beneficiary investing in flexibility solutions on a merchant basis, without state support. However, Member States should be cautious when adjusting the reference volume to limit the revenue risk for beneficiaries to a level that:

- maintains the financing costs of beneficiaries in line with the intended objective; and
- preserves the competitiveness of the competitive bidding process.

However, wholesale price formation may not always and fully reflect possible grid congestions and local market specificities. Even where market prices differ based on location, these differences may not be sufficiently high to steer investments to where they are most needed. It can therefore be necessary for Member States to introduce, in addition to the features mentioned above, specific correction measures to provide stronger locational incentives. This may help lower overall system costs by directing investments to areas with low congestion and by minimising the need for costly corrective actions. Such measures could, for instance, take the form of correction factors in the remuneration of the support scheme or energy system non-price criteria used for ranking bids, as long as these criteria are set in an objective, transparent and non-discriminatory manner. Such criteria must account for not more than 30 % of the weighting of all the selection criteria and the Member State must provide reasons for the proposed approach and ensure it is appropriate to the objectives pursued. Note that when using additional non-price criteria, the Member State will need to demonstrate that these do not affect the competitiveness of the auctions to select beneficiaries, among other requirements under State aid rules[69].

In parallel, to ensure the future-proofness of the contracts to market design changes that are beneficial for the electricity system, the 2w-CfD contractual arrangements should contain provisions detailing how the payments would be adjusted in the case of such potential changes, such as a bidding zone reconfiguration or a change to the granularity of the market time unit.

Finally, to maximise the benefits of the investments for the public, whenever electricity prices are high, revenues are clawed back and must be distributed to final customers in line with the requirements laid down in Article 19d(5) of the Electricity Regulation. Revenues that are clawed back can also be used to finance the 2w-CfD itself or could be used to finance the costs of direct support schemes referred to in Article 19d of the Electricity Regulation, such as other 2w-CfDs to promote investments in the production of renewable energy. If any remaining 2w-

[69] This type of criterion is covered by Article 26 of the NZIA, further specified by the Implementing Act on Article 26 of the NZIA.

CfD proceeds were distributed selectively to undertakings, Member States would need to inform the Commission, and, if necessary, notify such a measure under State aid rules.

Summary box 4

Member States should ensure that supported generation installations retain a sufficient exposure to market prices to ensure optimal investment decisions. This can be achieved through production-independent 2wCfDs with reference projects that do not mimic the production capability of the beneficiary's installation or through production-based or fusion 2w-CfDs with long reference periods. However, additional specific features, such as locational incentives, might be introduced when necessary to cater for grid congestions and minimise the need for costly corrective actions.

VII. Combining contracts for difference with power purchase agreements

a. *What are power purchase agreements?*

A PPA is defined in Article 2(77) of the Electricity Regulation as 'a contract under which a natural or legal person agrees to purchase electricity from an electricity producer on a market basis.' These contracts are typically signed for durations between 5 and 10 years or longer periods (up to 20 years) in the current practice. They may involve a fixed or variable price. Amongst other things, fixed-price PPAs aim to provide price predictability. The long-term predictability of the contract supports project promoters in financing new projects, including renewable or potential future nuclear energy projects. For off-takers, they originally represented a means to directly access clean electricity. The price volatility experienced during the 2021-2022 energy price crisis also highlighted how PPAs can be used by consumers as part of a hedging strategy aimed at protecting their activity from future price fluctuations. They may also facilitate the financing of electrification projects.

In the current practice, different types of PPAs exist, allocating the different risks among the contract counterparties. For example, PPAs can either follow a pay-as-produced model, where the off-taker receives electricity based on the generation of certain installations, or apply a baseload model, allocating the risk of adapting the electricity supply to the customer's baseload profile to the generator[70]. The signatories can also agree on arrangements that fall between the pay-as-produced and the baseload model. The PPA price is not necessarily fixed over the whole contract period. It may change over months, seasons or years, according to the specifications of the contract.

Another distinction can be made between physical and financial PPAs. In a physical PPA, the off-taker is a balancing responsible party and the electricity producer transfers the electricity produced to the off-taker portfolio, without having to trade on electricity markets and sometimes, but not necessarily, does so through a direct connection. This translates into

[70] This means, in practice, that the developer has to secure electricity for the off-taker when the installation to which the contract is linked is not generating; this gap is often referred to as 'shaping costs'. Risk allocation in PPAs also changes over time: while in the past the off-taker would often shoulder the cost of risks related to curtailment or negative prices, as these events become more frequent developers are often forced to cover part or all of that cost.

metering measurement at the respective grid connection points and involves direct payments from the off-taker to the generator for the electricity exchanged. In a financial PPA, both generator and off-taker rely on electricity markets for their physical dispatching by respectively selling electricity to and buying it from other market actors at the prices set by the market. Both sides then proceed to a direct financial settlement based on the difference between the price of electricity in the market and the price defined in the contract.

b. Combination of 2w-CfDs and PPAs

Article 19a of the Electricity Regulation establishes the principle that renewable energy support schemes must 'allow the participation of projects which reserve part of the electricity for sale through a renewable PPA or other market-based arrangements'[71]. This should be allowed by means of national legislation, or be explicitly mentioned in tender documents or both.

This provision clarifies that the use of two contracts, 2w-CfDs and PPAs, can be combined for a single renewable generation installation. There are different ways to operate this combination in practice, but at least two aspects should be allowed under all 2w-CfD schemes:

- 2w-CfD candidates should be allowed to participate in the tendering process of 2w-CfDs with only a portion of their installed generation capacity[72]. Member States should develop transparent calculation methodologies and/or allow submetering to make this implementable in practice, while avoiding risks of anticompetitive behaviour (e.g. developers being able to influence over time which capacity or production volumes are considered under the 2w-CfD or PPA to their advantage). In addition, Member States willing to further incentivise the development of liquid PPA markets may limit the maximum share of the production output covered under the 2w-CfD. This can incentivise beneficiaries to conclude market-based PPAs to secure predictable revenues for their production share that is not subject to a 2w-CfD.
- The granting of 2w-CfDs should not be conditioned on the sale of the electricity on certain market segments. Beneficiaries should remain free to decide how to sell the electricity generated by their installations (and may in any case choose to sell volumes covered by 2w-CfDs under PPAs provided that such participation does not negatively affect competition in the market).

However, the developer must be able to honour the commitments taken through the different contracts.

[71] Other market arrangements include the direct sale of electricity in organised electricity markets without the existence of a long-term arrangement. This option will not be discussed in this guidance

[72] For example, a 50 MW wind farm project should be allowed to apply to a 2w-CfD for 30 MW of capacity. The remaining capacity could then, for instance, be sold under a PPA.

i. Risks and mitigation measures

There are three main risks of combining public support and private offtake in a single project:

- First, the risk of the extension of public support to the off-taker (cross-subsidisation), which should be properly assessed under State aid rules. Since public support enables the financing and execution of the project by the developer, the private off-taker may benefit from better conditions than would otherwise be the case without that support. The reference price of the 2w-CfD should therefore not be calculated in a way that could encourage beneficiaries to sign PPAs at prices lower than the market price.
- Second, the risk of distortions on the PPA market following the combination of 2w-CfDs with PPAs by altering their terms and price compared to products concluded on a market basis[73].
- Finally, the combination of 2w-CfDs with physical PPAs, which can remove incentives for the parties to trade on organised wholesale electricity markets, creates the risk of reducing liquidity in other electricity markets.

A mitigation measure to reduce the risk of extending public support to the private off-taker would be to oblige the beneficiary to choose the off-taker of the PPA through an open, transparent and non-discriminatory competitive bidding process. This would enable price discovery of how much undertakings are willing to pay to access that generation. To make sure that such outcomes would reflect the intrinsic value of these contracts, such sales should be designed with a view to allowing the highest share of interested parties to participate. Examples of good practice would be: i) to set the minimum offtake volume at a low level (e.g. 1 MW); ii) to set the contract length in a way that does not discriminate against small consumers, e.g. about five years; iii) to allow all electricity consumers, including retail suppliers to participate in such auctions; and iv) to allow cross-border stakeholders to participate in these auctions. This should not negatively affect competition in the market, in particular where the two parties involved in that PPA are controlled by the same entity. Another benefit of this option is that it maximises revenues for developers, thereby keeping the required State support for the deployment of the generation capacity to a minimum.

A side effect of the auctioning process is that it would necessarily result in the highest bidders winning the PPA contracts and may deprive access to PPA markets to those potential customers facing barriers to entry.[74] To ensure that this type of arrangement does not lead to the increase of market power of certain off-takers, one could limit the amount of capacity that can be contracted by off-takers, including their subsidiaries, with a significant degree of market power or set up different baskets in the auction to select off-takers. Mitigating the risk of cross-subsidisation of PPA off-takers will also address the need to minimise the potential distortions on the PPA market. In this respect, the PPA should be set on market terms, as also prescribed by the Electricity Regulation. While PPAs are to be set on market terms, for example through

[73] To this effect, see the definition of a PPA provided under the ER, Article 2(77) of which refers to the purchase of electricity on a market basis.

[74] Alternatively, similar results could theoretically be achieved by offering PPAs in liquid market platforms. Experience with PPAs platforms is however limited in the EU.

a competitive auctioning process, the 2w-CfDs beneficiaries should remain free to decide whether to sell their electricity through a PPA. If the State wishes to pursue other policy objectives, such as a targeted support to certain industries, other State aid possibilities do exist[75]. A limitation of the potential pool of off-takers for the PPAs would necessarily create such distortions, to the detriment of other potential off-takers in the market and potentially contrary to State aid rules.

To minimise the risk of withdrawing liquidity in other electricity markets it is recommended to limit the use of PPAs to financial PPAs, which keep incentives for their signatories to trade on organised electricity markets.

ii. Options to combine 2w-CfDs and PPAs

Following the provision in Article 19a of the Electricity Regulation, the State is only obliged to allow bidders to reserve part of the generation for PPAs or other market-based arrangements. This, in principle, does not require specific design features in the auction design or in the 2w-CfD design but can include the risk mitigation measures mentioned above.

Developers will decide on the possible combination with PPAs based on the attractiveness of the public support offer relative to the outside option of signing a PPA or using other market arrangements.

One way of achieving such combination of 2w-CfDs and PPAs is for the support scheme to limit the capacity or generation that can be covered by the 2w-CfD to a share of the total capacity or generation. In such a case, the developer would need to find alternative revenue streams for the remaining unsupported capacity or generation, potentially including through PPAs. Consequently, adopting risk mitigation measures becomes particularly important in these cases to ensure that these arrangements do not result in cross-subsidisation.

This option seems particularly suited for offshore wind installations, where the seabed is leased by the State to developers. The State can then limit the public support to an amount of generation that does not correspond to the estimated total that can be built in the given area and allow developers to build above the capacity supported by the scheme (‘over-planting’). Beneficiaries are thus forced to find other financing sources to ensure the full build-out and benefit from the economies of scale[76].

Conversely, for onshore installations the State is typically not aware of the size of the area to be used and cannot decide the amount of generation or capacity to be supported on that basis. In these circumstances, the State can fix a maximum percentage of the generation of the installation that can benefit from public support[77]. Please note that, since the percentage of generation not covered by public support may be small, beneficiaries can also opt for full merchant exposure, as they may not require a complementary long-term contract to finance the installation. The lower the share covered by public support, the higher the incentive to sign

[75] See for instance the new instruments included in section 4.5 of the CISAF.
[76] See Commission Decision on case SA.114440 (2024/N) – Estonia TCTF: Scheme to support offshore wind.
[77] State aid SA.115179 (2024/N) – Italy FER X TCTF Italian transitional support for electricity production from RES plants close to market parity.

another long-term contract in the form of a PPA, instead of other market arrangements such as trading in organised markets.

The State, as a counterparty of the 2w-CfD, could also sell part of that electricity in the form of shorter term PPAs.[78] This would provide a hedge for both developers that need longer term investment commitments and customers who may not be in a position to sign long-duration contracts and require shorter term contracts. Those PPAs should be issued for maturities of about five years and awarded via a competitive bidding process open to suppliers and consumers, including across borders. As the State acts as an intermediary, attention should be paid to the existence of State guarantees. When there is a guarantee backed by the State, it should include provisions to avoid lowering liquidity in electricity markets, such as by using financial PPAs, and should not provide support to the purchase of generation from fossil fuels.

Finally, Article 19a also refers to the use of non-price criteria (either as pre-qualification or as award criteria) to encourage the combination of 2w-CfDs and PPAs but only for the purposes of 'facilitating the access of customers that face entry barriers to the PPA market'. The Regulation does not define this category of customers, but the Member State choosing this option would need to duly justify that the groups of customers chosen clearly fall into that category: SMEs or energy communities would be typical examples. Note that when using additional criteria, the Member State will need to demonstrate that these do not affect the competitiveness of the auction to select beneficiaries and do not translate into unjustified State aid to the PPA off-takers, among other requirements under State aid rules.

Summary box 5

When considering the combination of 2w-CfDs and PPAs in an auction, Member States should take into account the risks of cross-subsidisation, of distortions to the PPA market and of reducing the liquidity of other electricity market segments and put in place the appropriate mitigation measures.

[78] 1.c See also Section VI.c where a similar mechanism for forward trading is discussed. The duration of such PPAs should be established in a way that ensures that the PPAs offered do not impact the liquidity of forward markets. In practice, this means that such PPAs should be issued for durations longer than the duration of sufficiently liquid forward market products, for example for about five years.

VIII. Conclusion

The transition towards a clean electricity system requires fast-paced investments in generation installations. The investments can be supported by Member States in the form of 2w-CfDs as mandated by the recent electricity market design reform. The reform has resulted in rules being laid down in Articles 19a and 19d of the Electricity Regulation that Members States should take into account when designing 2w-CfDs for the technologies concerned, to reap the benefits of the contracts.

Considering the magnitude of such investments and the potential of support schemes to distort market functioning as well as system integration, the choice of appropriate 2w-CfD designs is critical. Support schemes generally support installations for very long periods and any distortion would have a significant and unpredictable impact on future market functioning. Furthermore, 2w-CfDs represent a hedge for both the beneficiaries and the State. Both parties could offer the benefit of this hedge to electricity consumers, to the extent that it does not lead to distortions.

In order to support a cost-efficient transition towards a decarbonised electricity system while supporting security of supply and affordability for consumers, 2w-CfDs should be designed in a way that:

- **avoids distortions on bidding in day-ahead, intraday, balancing and ancillary service markets** by (i) incentivising production in times of high value for the electricity system, (ii) ensuring that the producer remains financially responsible for its imbalances in line with Article 5 of the Electricity Regulation;
- **preserves incentives for efficient maintenance decisions** by ensuring that remuneration incentivises maintenance at times of lower system need for generation;
- retain similar **incentives, comparable to those for non-supported installations to operate and participate efficiently in the forward electricity markets**; and
- **retains incentives to take optimal investment decisions** by ensuring that supported generation installations retain sufficient exposure to market prices.

The combination of 2w-CfDs with PPAs should be designed in a way that:

- **avoids the risk** of cross-subsidisation to the off-taker of the PPA;
- **avoids creating distortions on PPA markets**; and
- **reduces the risk of lowering liquidity** in other electricity markets.

Annex I: Individual design elements summary

The good practices laid down in this table are not an exhaustive list to comply with the requirements of the Electricity Regulation. The table provides examples of design features supporting the market-responsiveness of 2w-CfDs that cannot be considered firm in light of further research and experience. Although compliance with the design features may be context specific, alignment with the design features below may accelerate the assessment and the approval process.

Design element	Example of good practices
Preventing distortions of bidding behaviour in day-ahead, intraday, balancing and ancillary service markets	**For production-dependent 2w-CfDs:** No remuneration during market time units with market price below marginal costs of production (e.g. during negative prices for wind and solar) in both the day-ahead and the intraday markets[79]. **For fusion 2w-CfDs:** Aid payment should be independent from the actual production during market time units with market prices below costs (e.g. during negative prices for wind and solar) in both the day-ahead and the intraday market, while preserving incentives to participate in ancillary services and balancing markets. **For production-independent 2w-CfDs:** Provided that the aid paid is independent from the operational decision to produce (or not), it can be assumed that the beneficiary is not incentivised to produce electricity in times of negative prices in both the day-ahead and the intraday market. For dispatchable power plants such as nuclear power plants, only production independent 2w-CfDs would be considered as a good practice. **For all types of 2w-CfDs:** No 2w-CfD payout should be based on the imbalance prices (i.e. the balancing market cannot be considered as a relevant reference market).

[79] For example, the intraday market price can be calculated through indexes taking into account the weighted price of traded volumes over the last hours before gate closure time and consider the relevant market segments only if they are sufficient liquid. This limits risks of strategic behaviour by the beneficiaries.

Fostering efficient maintenance decision	**For production-dependent 2w-CfDs:** A reference period[80] of three months is generally sufficient to make efficient maintenance decisions for wind and solar generation installations. **For fusion 2w-CfDs:** If there are no 2w-CfD payments planned during maintenance, a reference period of three months would help take efficient maintenance decisions for wind and solar installation generations. If aid is paid during maintenance periods (in particular planned maintenance) under the same conditions as the aid payments outside maintenance periods, it can be assumed that the maintenance decision is market responsive. **For production-independent 2w-CfDs:** If aid is paid during maintenance periods (in particular planned maintenance) under the same conditions as outside maintenance periods, it can be assumed that the maintenance decision is based on market revenues and therefore was taken in an efficient manner.
Incentivising efficient participation in the forward electricity market	**For all types of 2w-CfDs:** The reference period needs to be long enough to ensure that beneficiaries are incentivised to efficiently hedge against future price fluctuations. For installations, with a relatively constant production profile such as nuclear installations, the reference price can be defined as the average of each market price for markets on which the beneficiary will sell (e.g. forward, day-ahead, intraday), weighted by the volume of the power plant actual sales on each of these markets. Using average market prices (as opposed to realised market prices) to build the reference price incentivises the beneficiaries to 'beat the market'. Note that weighting by the actual sales implies that the composition of the reference price is not set exogenously, which could artificially bias the trading strategy of the beneficiary but is set endogenously on the basis of the beneficiary's actual trading strategy.

[80] The reference price can be an arithmetic average or a weighted average of the reference price over the reference period, provided that the output of the beneficiary does not influence the weights applied to the average.

	An alternative good practice is for the State to mandate one or more market participants, who are independent from the operator of the generation installations and selected through a competitive process, to carry out forward market hedging on behalf of the State.
Maximising the value of investments for the electricity system and EU consumers	**For production-dependent 2w-CfDs:** The reference period needs to be long enough, such as three months, to ensure that beneficiaries have an incentive to invest in an installation maximising the market value. **For fusion 2w-CfDs:** When the 2w-CfD is production based, the reference period needs to be sufficiently long, such as three months, to ensure that beneficiaries have an incentive to invest in an installation that maximises market value. This is especially relevant as the incentives to locate/optimise the investment to avoid production during times of negative prices or prices below cost price hours are dampened, given that beneficiaries receive support during those times on a non-production manner. **For production-independent 2w-CfDs:** Particular attention to the design of the reference volume of such 2w-CfDs should be paid, as this is expected to have a considerable influence on the strength of incentives to maximise the value of investments for the electricity system. In addition, potential beneficiaries should be informed about the methodology for setting the reference price and volume well ahead of the competitive bidding process. This will enable them to best take it into account in their bid and investment decisions. **For all types of 2w-CfDs:** Locational incentives could be introduced when necessary to address grid congestions issues, maximise the value of the investment for the system and minimise the need for costly corrective measures. These incentives could include correction factors in the support scheme’s remuneration or energy system non-price criteria used to rank bids. Any measure must be designed in line with State aid rules and be duly justified. To ensure that contracts are robust against market design changes, the 2w-CfD contractual arrangements should contain provisions detailing how the payments would be adjusted in response to such changes. This could involve changes such as a bidding zone reconfiguration or a change to granularity of the market time unit.

Annex II: Glossary

Fusion 2w-CfDs: Fusion 2w-CfDs refers to contracts in which, in certain time periods, the reference volumes on whose basis the contract payments are calculated are the volumes of electricity actually produced. In other time periods, the reference volumes are calculated based on other references, such as the production capacity of the installation.

Payouts from 2-wCfDs: Payouts from 2w-CfDs are defined as the financial flows between the beneficiary and the entity contracting the 2w-CfDs. The financial flows can be directed from the 2w-CfD contractor to the beneficiary when the reference market price is lower than the strike price and can be directed from the beneficiary to the contractor when the reference market price is higher than the strike price.

Production-based 2w-CfDs: Production-based 2w-CfDs refers to contracts in which the reference volumes on whose basis the contract payments are calculated are the volumes of electricity actually produced by the beneficiary.

Production-independent 2w-CfD: Production-independent 2w-CfDs refers to contracts in which the reference volumes, on whose basis contract payments are calculated, are based on the production capacity of the installation or based on the production of a reference plant. Unlike production-based 2w-CfDs, the reference volumes are not calculated based on the actual production of the installation.

Over-planting: Over-planting refers to a situation where a beneficiary builds an installed capacity that is higher than the capacity supported by the 2w-CfD.

Reference market price: The reference market price is the electricity price which is compared to the strike price when calculating the 2w-CfD contract payments. When the reference market price is calculated over reference periods longer than the market time unit, the reference market price is calculated as an average of the market price over all the market units of the reference period. This average calculation can be arithmetic or weighted by the electricity production generated by the technology of the supported installation (e.g. the overall wind production in a bidding zone), but not by the production of the supported asset itself (otherwise the calculation is equivalent to a reference period corresponding to the market unit).

Reference period: The reference period is the period over which the reference market price is calculated.

Reference volume: The reference volume is the volume on whose basis the 2w-CfD contract payment is calculated. It can be calculated based on the metered output of the supported installation in the case of production-based 2w-CfDs or be independent from the metered output for production-independent 2w-CfDs.

Clawback mechanism: The clawback mechanism is the rule requiring a beneficiary to pay back revenues when the market price rises above the agreed strike price.

Opportunity cost: Opportunity cost refers to the foregone profit a generator, consumer, or flexibility provider incurs when choosing one action (e.g. producing, consuming, or providing reserves) instead of another alternative. For example, a power plant's opportunity cost of offering capacity in the balancing market is the revenue it gives up by not selling that electricity in the day-ahead market.