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Market integration of renewables – mission accomplished?

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Market integration of renewables – mission accomplished?

How to ensure an efficient market design for system security and to the benefit of the consumers

Introduction

Considerable amounts of renewables are already being successfully integrated into the European power market today. EPEX SPOT contributes to market integration of renewables with innovative trading systems and products. Ambitious political renewable expansion targets as well as falling renewable generation costs are accelerating the transition towards a system of predominantly renewable electricity supply. This transformation has major impacts on electricity trading at the exchange. Renewables and in particular wind and solar make up a considerable part of EPEX SPOT's volumes and also have an impact on the wholesale price.

The regulatory framework has always been key for the market integration of renewables. It began 20 years ago with the introduction of feed-in tariff (FIT) schemes to integrate renewables into the system, yet without exposing them to price risks. The gradual transition from feed-in tariffs to feed-in premium (FIP) schemes set important incentives for the most efficient commercialisation of renewables at the exchange, yet with still very limited price exposition of renewable producers. Future challenges consist in fully achieving market integration of renewables, based on subsidy-free remuneration from market revenues only. Renewables integration shall be one of the components of the EU Green Deal to allow markets to unleash their full potential. The accomplishment of market integration shall also be at the heart of the revised German Renewable Energy Law to come into force in January 2021 ("EEG 2021").

This paper provides answers to currently discussed questions concerning an efficient future market design for renewable energies. It highlights how competitive and liquid wholesale markets can contribute to achieving full market integration of renewables.

Prices and volumes – How do renewables share the dynamics of the power market?

The spot markets are the physical markets to fundamentally balance production and consumption (Day-Ahead) and correct forecast errors until delivery (Intraday). Even though renewable production forecasts have significantly improved over the last years, intermittent renewable production still cannot be predicted to the kWh produced precisely. For renewables, the intraday market is most relevant because, on this market, trading is possible until delivery and generation ramps can be handled with finer granularity products, such as 15- and 30-minute products.

An EPEX SPOT analysis of 22 aggregators that are trading on the EPEX SPOT German Day-Ahead and Intraday markets shows how aggregators use the Day-Ahead market to market their wind volumes (day-ahead sell volumes correlate with wind generation) and use the Intraday market to adjust forecast errors (buy and sell volumes are low and close to each other) (see figure 1).

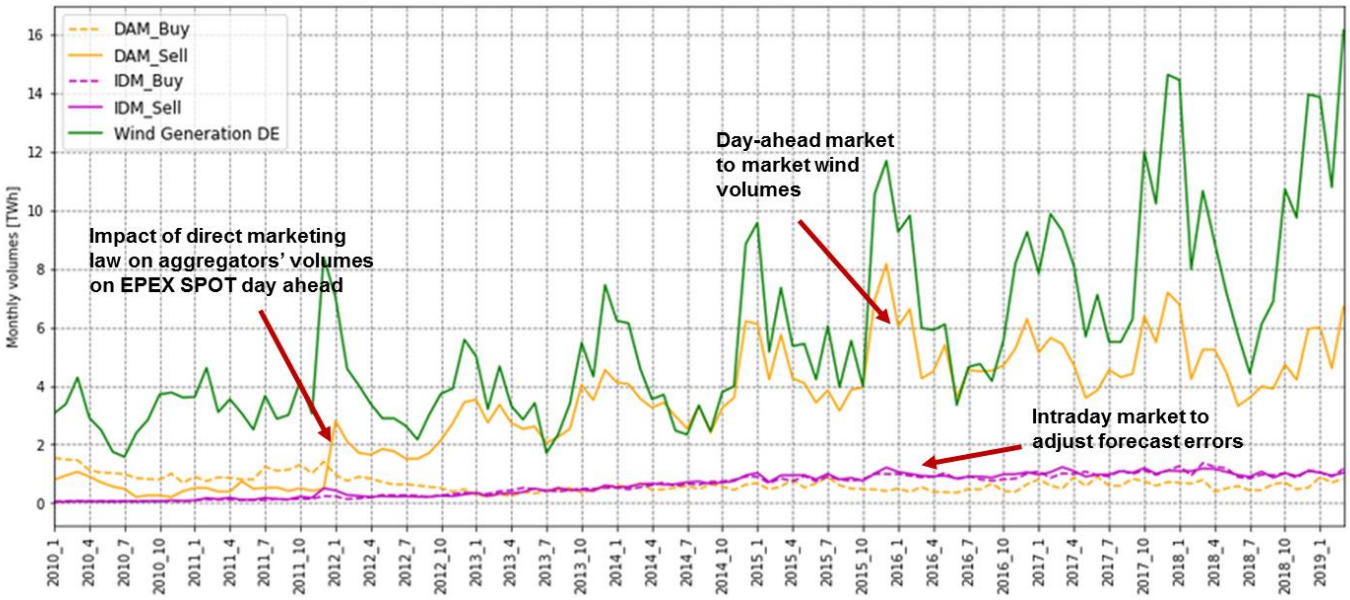

Figure 1: Volumes in TWh of aggregators[1] on the German spot market, Source: EPEX SPOT

When it comes to the impact of renewables on the wholesale market price, in general, over the last few years, a rapid rise in renewable capacity has depressed market prices. In times of high wind and/or solar production in combination with low consumption, one can often observe low and even negative prices. Under FIT, renewables act as a must-run capacity according to the produce-and-forget principle, because of the unlimited priority feed-in rule ("Einspeisevorrang") as well as because they receive a certain amount of FIT for each kWh produced independently from the wholesale market price. This changed with the transition to the FIP scheme that sets certain incentives for aggregators to react to the market price signal and to leave the market when their opportunity costs are reached (i.e. at the negative amount of the FIP, e.g. in DE between -50 to -100 EUR/MWh). Yet, in a situation of full market integration, generators usually bid marginal costs, i.e. OPEX. Opportunity costs with FIP include CAPEX. The European State Aid Guidelines for Energy & Environment for 2014-2020 have established the principle of no subsidy payments for renewables when the market price is negative to disincentivize renewable feed-in at negative prices. Yet, an important reason for negative prices is a lack of flexibility of the whole electricity system. In general, negative prices set incentives for market actors to invest in more flexible production capacities. Yet, in Germany for instance, a significant share of negative prices is due to the FIP regulation and not only to physical constraints. Therefore, the investment incentives naturally given by these negative prices are limited considerably, as it is very risky to make investment decisions based on a regulation that can vanish easily. Full market integration of renewables is not a "mission accomplished" yet and this paper outlines the missing steps to do so in the following.

A further impact on the spot market price can be observed upon market entry of renewables: The intraday price of the 15-min-call-auction oscillates around the Day-Ahead price ("saw-tooth pattern"). This is caused by the rising and sinking sun: In the morning hours when the sun is rising, there is less solar production in the first quarter of an hour than in the last quarter of an hour, thus less supply in the first quarter than on the average of the hour, leading to higher prices than the average hourly price. In the afternoon when the sun is sinking, it is the opposite phenomenon. This pattern is due to the requirement of rebalancing Day-Ahead hourly contracts with respect to the 15-minute imbalance settlement period. At the end of the trading window, however, prices approximate the expected imbalance price. Average prices (i.e. base or peak prices) of Day-Ahead and Intraday

[1] In this chart, 22 companies whose declared main business model is aggregation of RES energy are taken into account. Therefore some utilities also acting as aggregators have been excluded.

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are in general quite close to each other. To be precise, both price distributions are centered around the same value. In 2018 for example, the average spread between the Day-Ahead and the continuous 60-minute Intraday market was 0.11 €/MWh.

The Power Exchange as enabler of efficient renewable integration – in the past and in the future

Today in the EU, there are 191 GW of installed wind capacity and 130 GW of installed solar capacity (2019). As European Power Exchange, EPEX SPOT provides a market platform and trading products to successfully integrate these rapidly growing amounts of renewables into the market. We make markets fit for renewables. These are some examples of our ongoing product and market innovations across Europe that have become a central pillar of the energy transition:

- **Trading close to real-time/ Lead time reduction**: With increasing renewables penetration, trading gets closer to real-time when forecasts are most precise. E.g. on the German 60-minute continuous Intraday market, 30% of the volumes are traded one hour before delivery in 2019 (vs. only 15% on 2012). EPEX SPOT continuously shortened the market gate closure time on all its continuous Intraday markets. For example, already since 2015, trading is possible until 5 minutes before delivery in Belgium and The Netherlands, since 2017 in Germany (within one control area), and since 2018 in France and Austria.
- **15- and 30-minute products**: Intraday products with smaller granularity, in particular 15- and 30-minute products, give market participants better possibilities to adjust hourly forecast deviations, fine-tune customer portfolios and manage production ramps. As the first Power Exchange in Europe, EPEX SPOT introduced in 2011 cross-border trading of quarter-hour products on the continuous intraday markets in Austria, Germany, and Switzerland. Our 15- and 30-minute products are a big success. E.g. on the German 15-minute Intraday opening auction, 112 market participants have traded 6.9 TWh in 2019 (compared to 4 TWh in 2015). With these products, we offer the possibility to balance BRPs to the required imbalance settlement period, e.g. 15 minutes in Germany.
- **Algorithmic trading**: Decentral renewable expansion goes hand in hand with the digitalisation of the energy sector. Algorithmic trading leads to a rapidly growing number of orders and trades (+300% over the past 3 years with up to 2 million orders per day in our M7 intraday trading system). With algorithmic trading, these orders are not submitted via our manual trading system Comtrader, but via an Application Programming Interface (API). EPEX SPOT counts about 140 API connections currently. API-generated trades account already for about 40% of the 60-minute Intraday trades and even for 60% of the 15-minute Intraday trades. EPEX SPOT continuously adapted its trading systems to welcome this high load and to keep the round trip time (reaction time of the system to input) as small as possible. We increased the tick size (bidding increment) to 0.10 EUR/MWh and it has been further reverted to 0.01 EUR/MWh with the go-live of the European Single Intraday Coupling (SIDC) in 2018. Thereby, we ensure fast, stable and secure trading with our robust M7 Intraday trading system and are prepared to welcome growing shares of renewables in the electricity and trading system.
- **Local Flexibility markets**: Flexibility markets for congestion management in the distribution grid will become key for the successful integration of renewables into the electricity system. EPEX SPOT is part of the enera project, the first exchange-based flexibility market in Europe that has been successfully launched in February 2019. The curtailment of renewables could be avoided, new flexibility potentials were opened up and market participants were able to tap into flexibility potential that had been neglected so far.
- EPEX SPOT works on **market-based sector integration** and develops amongst others together with Siemens a concept to connect the Siemens Building Energy Management Systems with EPEX SPOT markets. The approach is to **further open up EPEX SPOT's markets to decentralized market players**. This will be possible using Building Energy Management Systems and optimisation algorithms and connecting them to the flexibility and wholesale markets operated by EPEX SPOT.

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- EPEX SPOT has accompanied the direct marketing of renewables by launching **price indices** representing price developments close to real-time, such as the ID3 index reflecting the trades of the last three hours until 30 minutes before delivery. These indices are used by market participants in their contracts with renewable generators.

How to accomplish the mission of full market integration of renewables?

The following figure (figure 2) gives a general overview of the 3 steps of market integration in the past (1), present (2) and future (3).

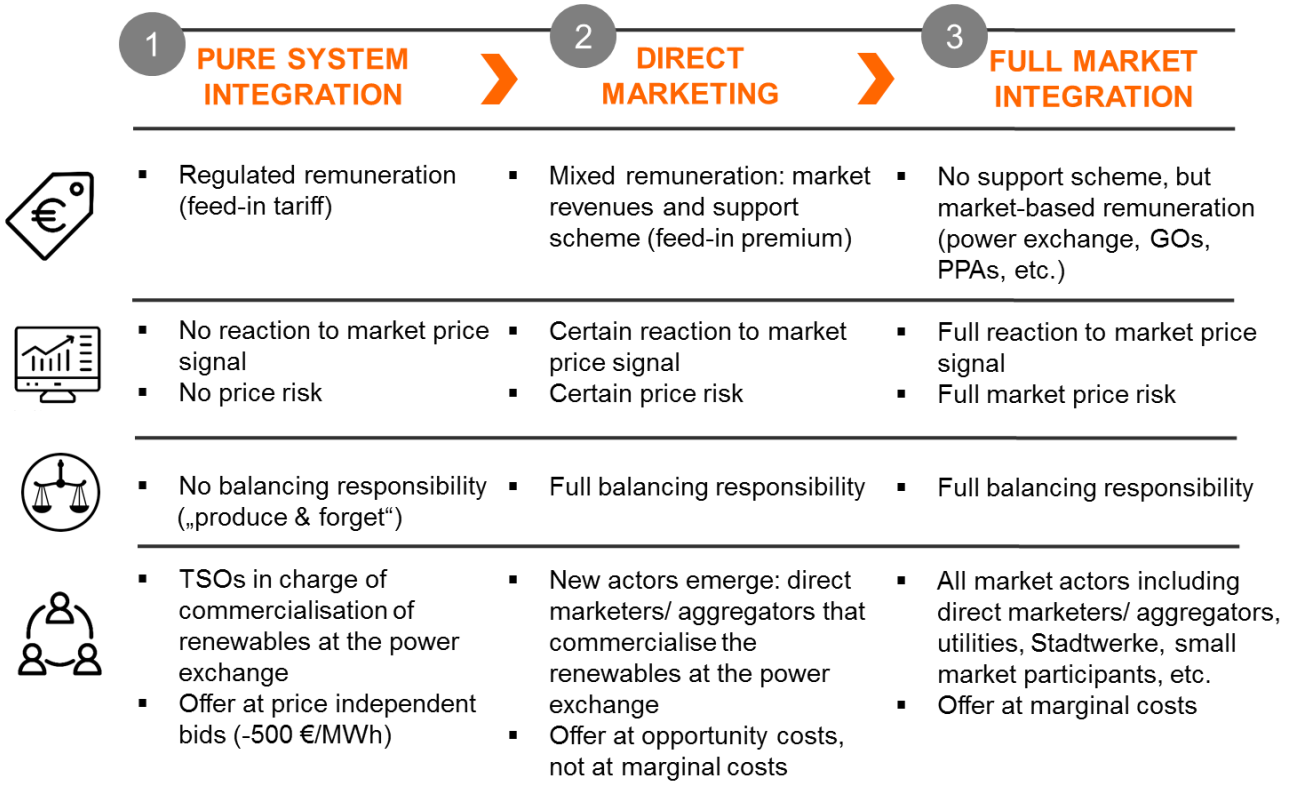

Figure 2: 3 Steps of market integration of renewable energies, source: EPEX SPOT

In many European countries, the first step of pure system integration of renewables started twenty years ago with the introduction of guaranteed feed-in tariffs. These early support mechanisms have been highly successful in terms of renewable penetration that grew much faster than anticipated. As a result, renewable construction costs have decreased much faster than anticipated, while renewable support and system integration costs have increased much faster than anticipated. A reform of the system was needed and with the introduction of the feed-in premium and renewable tender processes, a second step of market integration of renewables began. Today, in many European countries market integration of renewables takes place between step 2 and step 3. The challenge is how to accomplish market integration and further drive down support scheme costs on the one hand, while not jeopardising the achievement of renewable and climate targets on the other hand.

The key to fully integrate renewable energy sources is providing market players with incentives to bid at their real marginal costs in the power derivative and spot market, meaning dispatch based on the merit order, and at the same time allowing them to recover their investment costs by reaping producers' rent or other revenue streams. Then, even with a high share of renewables, the market price signal will remain undistorted. In particular, it is not

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biased downwards, which is essential to stimulate investment in generation capacity. Through efficient competition, financing costs and thus levelized costs of electricity will decrease. Renewables will fully react to the market price signal and will be fully exposed to the market price signal. Remuneration will be based on market-based revenues, coming from the remuneration of the commodity, i.e. the Power Exchange price for every MWh produced, as well as from the remuneration for the quality of the electricity (guarantee of origin) and other system services that can be provided (balancing, congestion management and ancillary services). Therefore, next to competitive and liquid wholesale markets, also a well-functioning CO_2 market and Guarantees of Origins (GO) market are needed. This will contribute to renewables being able to refinance themselves on the market. Also, electricity consumers or taxpayers do not need to pay for subsidies anymore. Currently, GO prices are low (for standard GOs mostly between 0.15 and 0.20 €/MWh), but prices are expected to increase due to rising demand and political renewable expansion targets. It will not be an easy path to attain full market integration of renewables, as this also includes the right regulatory decisions for a transitionary renewable support scheme, but many market players have already developed promising business models for market-based renewable remuneration schemes, such as new direct marketing models. The future market design should focus on market-based remuneration instead of subsidies, such as wholesale market revenues, revenues from GOs, from PPAs etc.

Currently implemented support schemes are not suitable in the long-term. Although market premiums have proven to be an improvement compared to feed-in tariffs, they are still not the most efficient incentive when the renewable share will further increase. Under the feed-in premium scheme, renewable plants do not offer at marginal costs, but at their opportunity costs. The switch away from regulated feed-in-tariffs towards auctions for renewable capacity (e.g. in Germany) is a crucial step forward to expose the true cost of renewable energy.

The final target should be the full market integration of renewables, i.e. that in the long term, renewables act as any other generation source on the market and are subject to the same rules as all other generation assets. Subsidies including the feed-in premium lead to short- and long-term market price distortions. For example, on the short-term, the aggregated bidding curve of direct marketers shows that they do not leave the market at 0 EUR/MWh, but only at negative prices between -50 and -100 EUR/MWh which corresponds to the negative value of the market premium. On the long-term, the wholesale market price of electricity decorrelates from the cost of electricity generation. The gap is anyway paid by the end-consumer through the renewable taxes (e.g. EEG levy).

However, during the transition phase to full market integration, certain support mechanisms are likely to be still needed. All support schemes shall be as least distortive as possible, market-based, harmonized at a European level, and the subsidy amount shall be determined by competitive mechanisms (such as auctions). This includes that new plants shall be built where it is most efficient, irrespective of national borders and support schemes. In this way, the recent proposal of the European Commission for European wide renewable tenders goes into the right direction. To ensure sufficient new renewable installations during the transition phase to full market integration, one can also imagine support for renewables in form of upfront capacity payments (for each kW installed) instead of feed-in premium payments (for each kWh produced). In terms of market integration, capacity payments would mean a further step towards full market integration as renewable generators would offer their electricity at marginal costs, as any other electricity source.

Post-subsidy plants: No silver bullet to keep them in the market?

By the end of 2020, first wind and PV plants will fall out of the feed-in tariff system after 20 years of subsidies. The following table gives an overview of the installed capacities in 18 European Member States reaching the end of support. In Germany, the largest renewable energy market in Europe, this will concern 16 GW of wind installations and 2 GW of PV installations until 2025[2], which is a relevant parameter for the electricity sector.

[2] out of a total of 61 GW installed wind capacity and 49 GW installed solar capacity in Germany in 2019

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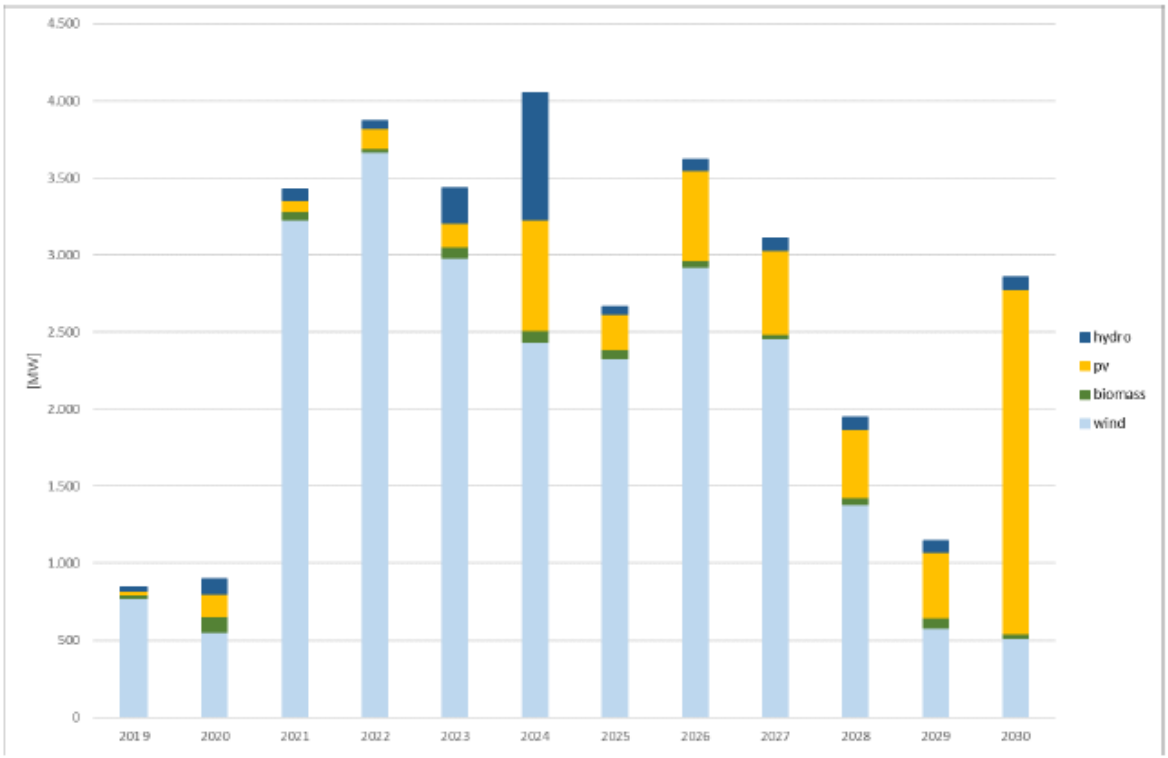

Figure 3: Installed capacity reaching end of support in 18 European Member States, source: CEER, 2020

Several options are possible for these plants after the end of the FIT payments:

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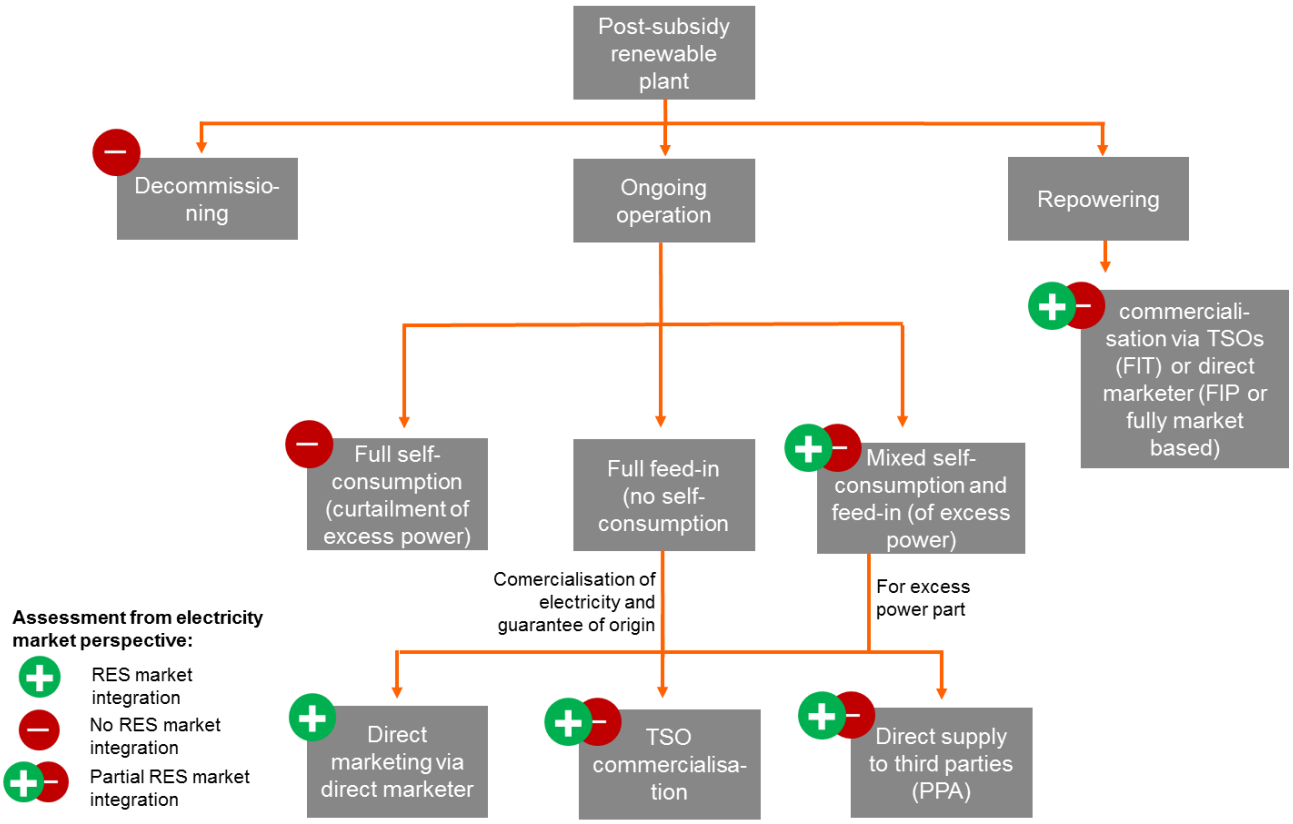

Figure 4: Options for post-subsidy plants and impact on renewable market integration, source: EPEX SPOT

For the well-functioning of the electricity market and the success of the energy transition, it is key that **the post-subsidy plants fully remain in the market** and are not decommissioned or simply switched to self-consumption mode. These plants need to remain in the market to complete the full market integration of renewables and to contribute to liquid and competitive electricity markets in Europe with reliable price signals.

The market-based revenues of these plants will consist of the commercialisation of the electricity on the markets on the one hand and the revenues from the guarantees of origin for the green value of this electricity. The remuneration from GOs will be a new source of revenue for the post-subsidy plants because, under most subsidy schemes, subsidized plants are not allowed to receive and sell GOs (so-called prohibition of multiple sales, such as in Germany's renewable energy law EEG 2017 § 80). However, the current challenge from a regulatory and economic perspective for the post-subsidy plants is that under current conditions, direct marketing is not an economic option for many of these plants because fixed costs for direct marketing in particular exceed market revenues for smaller assets. However, direct marketing costs will further decrease in the future with ongoing digitalisation, automation of processes and smart meter roll-out.

Therefore, interim solutions are adequate to keep the post-subsidy plants in the market and avoid their decommissioning or switch to self-consumption. Possible changes of the regulatory framework could be to allow standard load profiles or normalized generation profiles instead of the duty of 15-min balancing and in order to avoid costly smart meters. Also, standardized issuing procedures for GOs can reduce administrative costs. A simple prolongation of feed-in tariffs for additional years for plants that are already fully written off after 20 years of subsidies would be difficult to justify politically and would also thwart efforts of companies that are developing new business models for the future operation of the post-subsidy plants.

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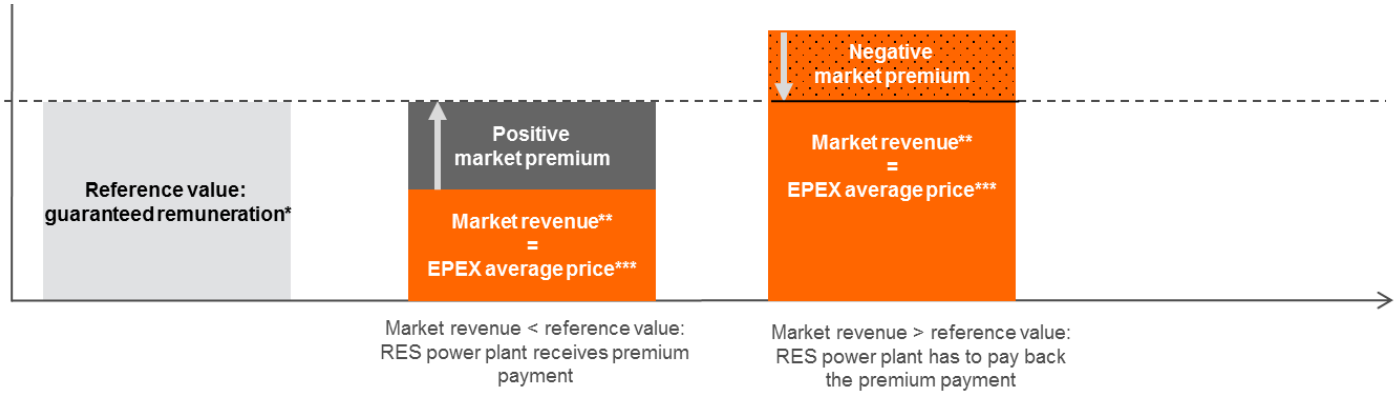
Contracts for difference: What makes the difference?

The idea of a contract for difference (CfD, also called symmetric feed-in premium in contrast to the asymmetric feed-in premium, as in place in Germany for instance) is written on the difference of the guaranteed remuneration (reference value) and the market value. If the difference between guaranteed remuneration and market value is positive, the renewable producer receives the usual market premium (figure 5, 2nd bar). If the difference is negative, the CfD requires a payback (figure 5, 3rd bar). The incentive for traders on the spot market is always to perform better than the market value to maximize individual profits.



* *Reference value: guaranteed remuneration, e.g. FIT, or FIP +/- market revenue*

** *Market revenue: traders' individual revenue*

*** *Market value: average power exchange price*

Figure 5: The functioning of the contract for difference (CfD), Source: EPEX SPOT

The CfD concept is discussed against the background of falling renewable generation costs and increasing wholesale power market prices. CfD are already used amongst others in the UK, France, Denmark and Poland. The renewable plant operator still gets a market premium payment if the market revenue is below the reference value (see figure 5, 2nd bar), i.e. he is protected against the risk of low wholesale market prices, as under the flexible feed-in premium scheme. However, unlike in the flexible feed-in premium scheme, he has to pay the difference between market revenue and reference tariff if market revenues are higher (see figure 5, 3rd bar). This means that chances and risks of high and low power prices for renewable plant operators and electricity consumers are equally balanced.

On the spot market, incentives for the most efficient commercialisation of renewables are comparable under CfD and under feed-in premium scheme, given the parametrization is the same. Nonetheless, CfDs are a clear step backwards on the way to successful market integration. For the futures power market, CfD would have a considerable impact. The main difference between CfD and FIP is that the market price level risk is fully socialized under CfD, whereas under FIP a gradual assumption of this risk by the tenderers is allowed. The socialisation of the market price level risk leads to the loss of incentives for renewable investors to hedge the risk on the market. However, there are already today suitable possibilities to hedge these risks on the market, so there is no need for a socialisation of these risks. On the contrary, in this way, CfD would mean a step back in terms of renewable market integration. Instead of developing new support schemes, the focus shall be on developing ways how to phase-out current subsidy schemes and achieve full market integration of renewables where renewables are fully market-based remunerated.

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Guarantees of origin for renewable electricity: More transparency needed!

A GO is an electronic document that proves to the final customer that a quantified amount of electricity originates from a specific renewable energy, or is produced by cogeneration. A GO tracks green energy from the producer to the final customer, ensuring full transparency for these consumers. It is recognized EU-wide. Every country has its own state-appointed registry holder, e.g. in France, it is EEX, in Germany UBA. Growing installed renewable capacities, the need to meet climate targets and the phasing out of renewable subsidies demonstrate the necessity for a well-functioning GO market. GOs can create additional market-based sources of revenues for renewable plants. The European GO market is expanding year after year with a GO supply that has exceeded 600 TWh and demand that surpassed 500 TWh in 2018.

An organized and transparent market for GOs is needed to offer market participants a way to value the green part of a MWh. GOs can already be traded OTC today, but there is no organized market for GO trading and no reference price exists for GOs, only price assessments offered by some price reporting agencies. Exchange-based trading of GOs offers multifold advantages for market participants compared to just bilateral trading. First of all, on top of neutrality and financial security of transactions, a transparent price signal will be generated. Based on supply and demand, the exchange as a neutral player will calculate and publish a price for GOs. The lack of transparency in the current GO market is one of the main barriers for further development of the liquidity of the current GO market.

Power purchase agreements: A threat to spot market liquidity?

PPAs have been becoming increasingly popular for the past several years as a purely market-based remuneration source for non-subsidized renewables. Though actually, bilateral contracts for the delivery of a predefined amount of electricity to a certain price between a supplier and a consumer, are nothing completely new. Bilateral contracts have always existed. Therefore, PPAs might not have a revolutionary effect on the electricity market or on electricity trading at the power exchange. The spot market is the physical market to balance production and forecast deviations. Also in times of PPAs, this remains relevant since renewables are subject to constant fluctuations which even PPAs cannot pin down to the exact MWh. Only the Day-Ahead and the Intraday markets can efficiently integrate fluctuating renewables.

This mechanism works hand in hand with the long-term market. EEX promotes the standard power futures as an instrument for PPA long-term hedging, following the market trends, e.g. with PPA Hedging in Spanish Power. This facilitates subsidy-free renewable energy by offering energy traders and renewable energy investors the opportunity to manage PPA price risk over the long term.

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About EPEX SPOT

The European Power Exchange EPEX SPOT SE and its affiliates operate physical short-term electricity markets in Central Western Europe, the United Kingdom and in Denmark, Finland, Norway and Sweden. As part of EEX Group, a group of companies serving international commodity markets, EPEX SPOT is committed to the creation of a pan-European power market. Over 300 members trade electricity across twelve countries on EPEX SPOT. 49% of its equity is held by HGRT, a holding of transmission system operators.

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