

part of eex group



# Market integration of renewables – mission accomplished?

15.11.2020

## Contents

Executive Summary	3
Introduction	4
Prices and volumes – How do renewables share and shape the dynamics of the power market?	4
The Power Exchange as enabler of efficient renewable integration – in the past and in the future	6
How to ensure full market integration of renewables?	7
Post-subsidy plants: Strengthening the price signal by keeping them in the market	9
Contracts for difference: What makes the difference?	11
Guarantees of origin for renewable electricity: More transparency needed!	12
Power purchase agreements: No threat to spot market liquidity	12

## Market integration of renewables – mission accomplished?

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

#### Executive Summary

Increasing the share of renewable energy is at the heart of the European Green Deal. Ambitious political targets for renewables deployment as well as falling renewable generation costs are accelerating the transition towards a system where renewables are the dominant source of energy. In this context, subsidies and support schemes for renewables are no longer a silver bullet to achieve the climate goals. A key challenge for a successful energy transition is to ensure the full integration of renewable generation into the electricity market and to provide market-based remuneration for renewables. This cost-efficient approach will ultimately benefit the end-consumer.

Currently implemented support schemes are not suitable in the long-term. They distort the energy market and hamper an efficient grid integration of renewables. Furthermore, they favour lock-in effects that increase the period for which renewable energy sources (RES) would receive regulated payments rather than promoting a gradual phase-out of subsidies. As a result, they contribute to raising the costs of the energy transition.

A subsidy-free future for renewable energy is both necessary and feasible. 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, trading close to delivery and products with finer granularities.

Under the future market design, renewables should fully contribute and fully react to the price signal. Revenues can be generated from different markets, such as wholesale energy markets, markets for Guarantees of Origins, system services and PPAs. For this, a well working energy market with stable and liquid bidding zones and a robust emission trading system price are needed.

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, limited in time, market-based, harmonised at a European level, and the subsidy amount shall be determined by competitive mechanisms (such as auctions).

## Introduction

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. Under feed-in-tariffs, renewables act as a must-run capacity according to the produce-and-forget principle, because of the unlimited priority feed-in rule and because they receive a certain amount of FIT for each kWh produced independently from the wholesale market price. 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. This is essential to achieve the objectives of the EU Green Deal and should be placed at the core of the energy policy initiatives taken at EU level and by national governments.

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 facilitate the integration of renewables in the power system.

## Prices and volumes – How do renewables share and shape 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 down to the kWh produced. For renewables, the Intraday market is most relevant because trading is possible until delivery and generation ramps can be handled with finer granularity products, such as 15- and 30-minute products.

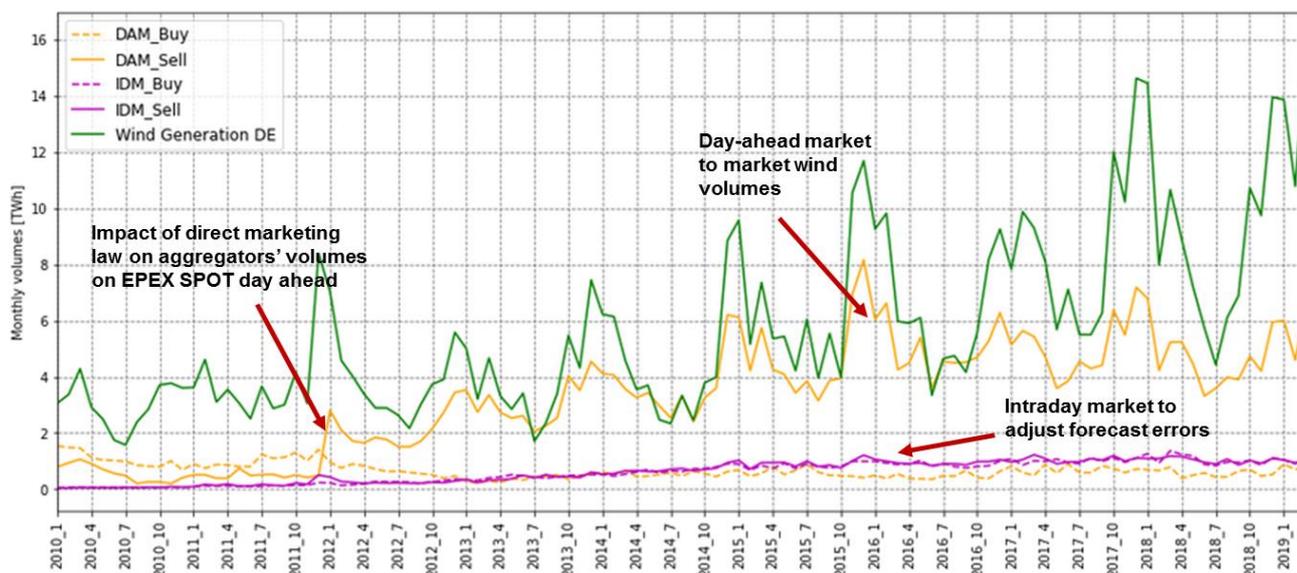


Figure 1: Volumes in TWh of aggregators<sup>1</sup> on the German spot market, Source: EPEX SPOT

<sup>1</sup> 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.

Figure 1 above provides an example of 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). The analysis is based on 22 aggregators trading on the EPEX SPOT German Day-Ahead and Intraday markets.

A further impact on the spot market price can be observed upon market entry of renewables: The Intraday price of the 15-minute Intraday 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 markets are in general quite close to each other. To be precise, both price distributions are centred 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.

In general, when it comes to the impact of renewables on the wholesale market price, a rapid rise in renewable capacity has depressed market prices over the last few years. In times of high wind and/or solar production in combination with low consumption, one can often observe low and even negative prices. An important reason for negative prices is a lack of flexibility of the whole electricity system: as the system cannot integrate all the renewable capacity that is produced, the extra supply pushes prices down. In principle, negative prices set incentives for market actors to invest in more flexible production capacities.

However, we have observed examples where the support schemes distort the price signal and hinder the necessary investment in flexibility solutions. This is notably the case in Germany, where negative prices are reinforced by specific feed-in-premium rules. These rules disincentivise renewable producers to react to negative prices by producing less.

In a situation of full market integration, generators usually bid at marginal costs, i.e. OPEX. In contrast, the FIP scheme sets certain incentives for aggregators 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). Opportunity costs with FIP include CAPEX. As a result, renewables generators will bid at negative prices. This goes against the principles of the European State Aid Guidelines for Energy & Environment for 2014-2020, under which there should be no subsidy payments for renewables when the market price is negative to disincentivise renewable feed-in at negative prices.

Currently implemented support schemes are not suitable in the long-term. Although auction-based market premiums have proven to be an improvement in terms of market integration compared to feed-in tariffs, they are still not the most efficient incentive when the renewable share will further increase.

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. In the long-term,

the wholesale market price of electricity decorrelates from the cost of electricity generation. The gap is paid by the end-consumer through the renewable taxes (e.g. EEG levy in Germany).

## 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 activity shifts 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. 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 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 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 decentralised 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.

- 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 ensure 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).

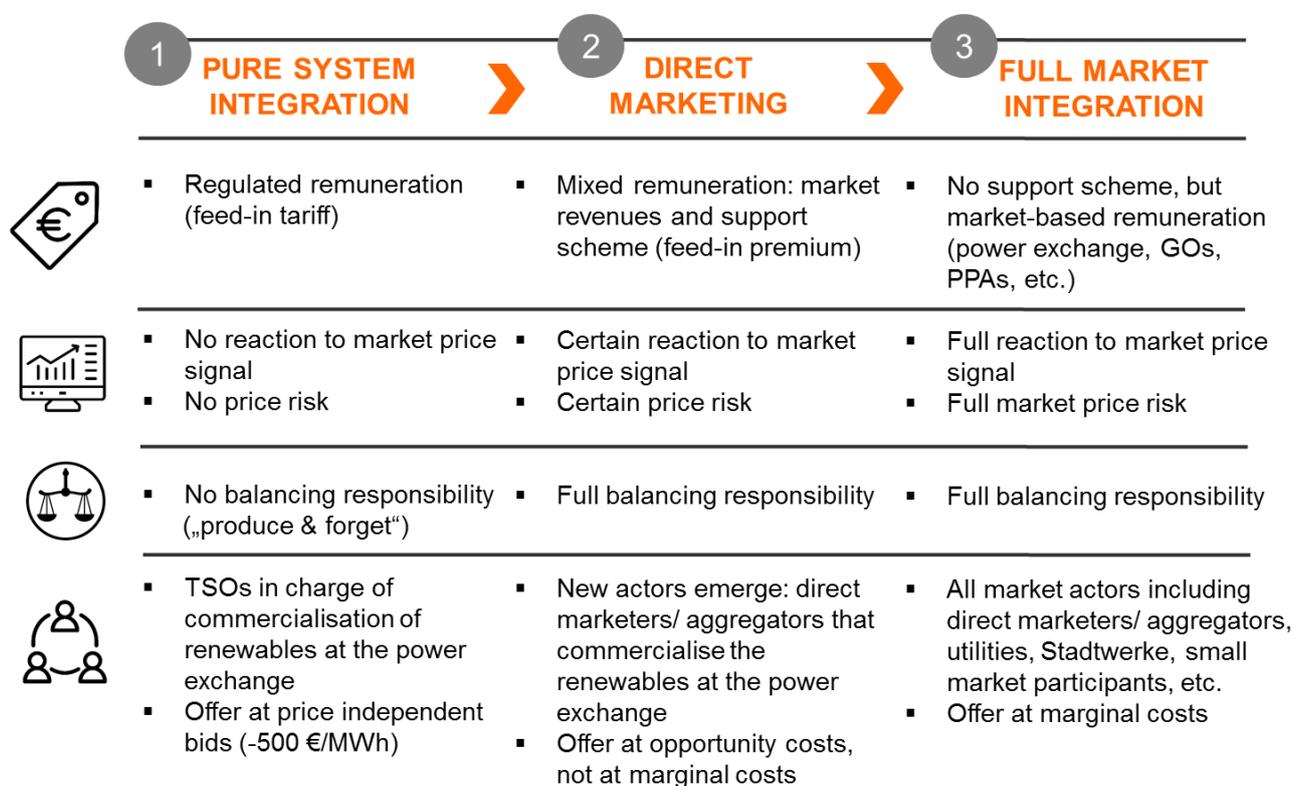


Figure 2: 3 Steps of market integration of renewable energies, source: EPEX SPOT

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, market integration of renewables takes place between step 2 and step 3 in many European countries.

Compared to the early years of renewables development, the demand-side is also playing a much bigger role today in incentivising new RES capacity. The phase-out of nuclear and coal across different countries, increasing demand for green electricity and climate policy goals only reinforce the need to build new renewable power plants.

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, the price signal is not biased downwards, which is essential to stimulate investment in generation capacity. Through efficient competition, financing costs and thus levelised costs of electricity will decrease. Renewables will be fully exposed to the market price signal and will fully react to it. 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, a well-functioning CO<sub>2</sub> market and Guarantees of Origins (GO) market are also 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 transitional 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.

Looking ahead, in a system dominated by renewables supply, both the Day-Ahead and Intraday markets will continue to deliver very important and reliable price signals. It is clear that the importance of the Intraday market will further grow, as trading close to delivery will be even more critical. The Day-Ahead market will nonetheless remain fully relevant, even if a higher share of renewables in the power system tend to decrease the spot power market price as the marginal costs of renewables are very low. The Day-Ahead auctions incorporate all the available information at a certain moment in time, and not just information about the generation costs. The price on the Day-Ahead market will also reflect the value attributed to electricity by the demand-side. In times of scarcity, it is the value that consumers attribute to their consumption that will set the price. These price peaks allow RES to achieve a producer rent and cover their investment costs. Scarcity will still occur as in the optimal scenario; the installed capacity of renewables should be as efficient as possible. This means that capacity will not be installed to cover the very last kWh of electricity peak demand, but to reach an optimal balance. Furthermore, different technologies like demand-side solutions, storage mechanisms and batteries will contribute to an efficient spot price formation even without a large part of traditional production in the system.

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, harmonised 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: Strengthening the price signal by keeping 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<sup>2</sup>, which is a relevant parameter for the electricity sector.

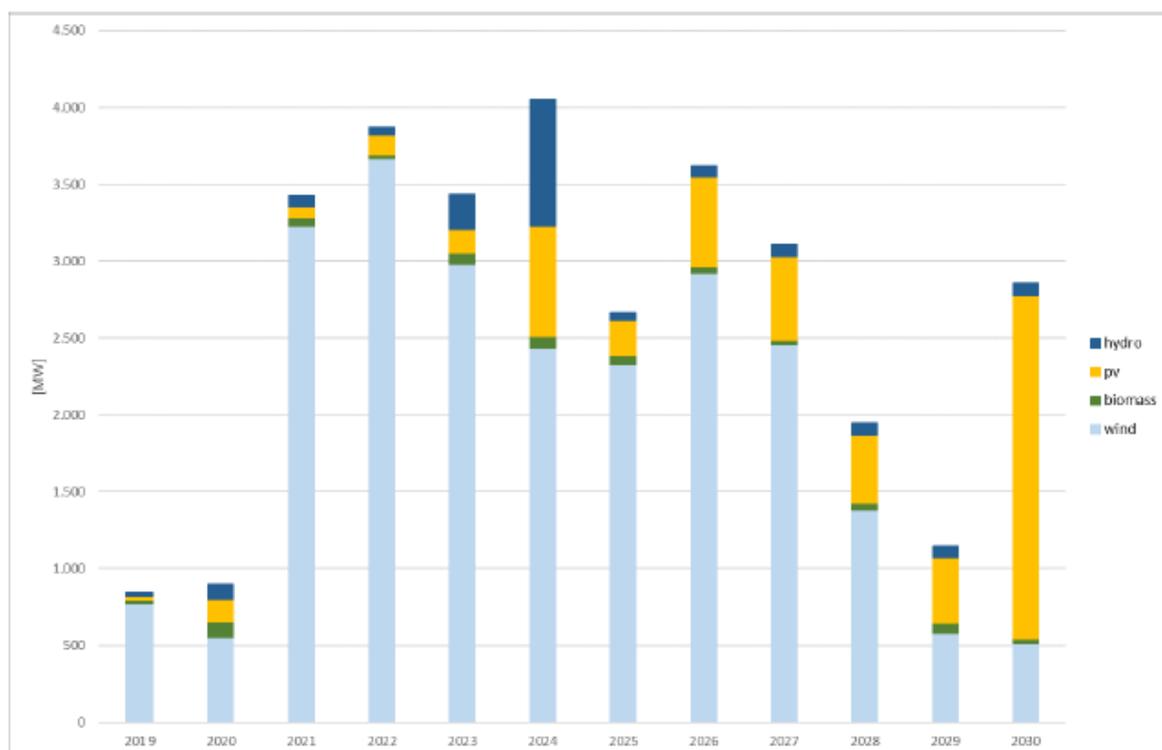


Figure 3: Installed capacity reaching end of support in 18 European Member States, source: CEER, 2020

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

<sup>2</sup> out of a total of 61 GW installed wind capacity and 49 GW installed solar capacity in Germany in 2019

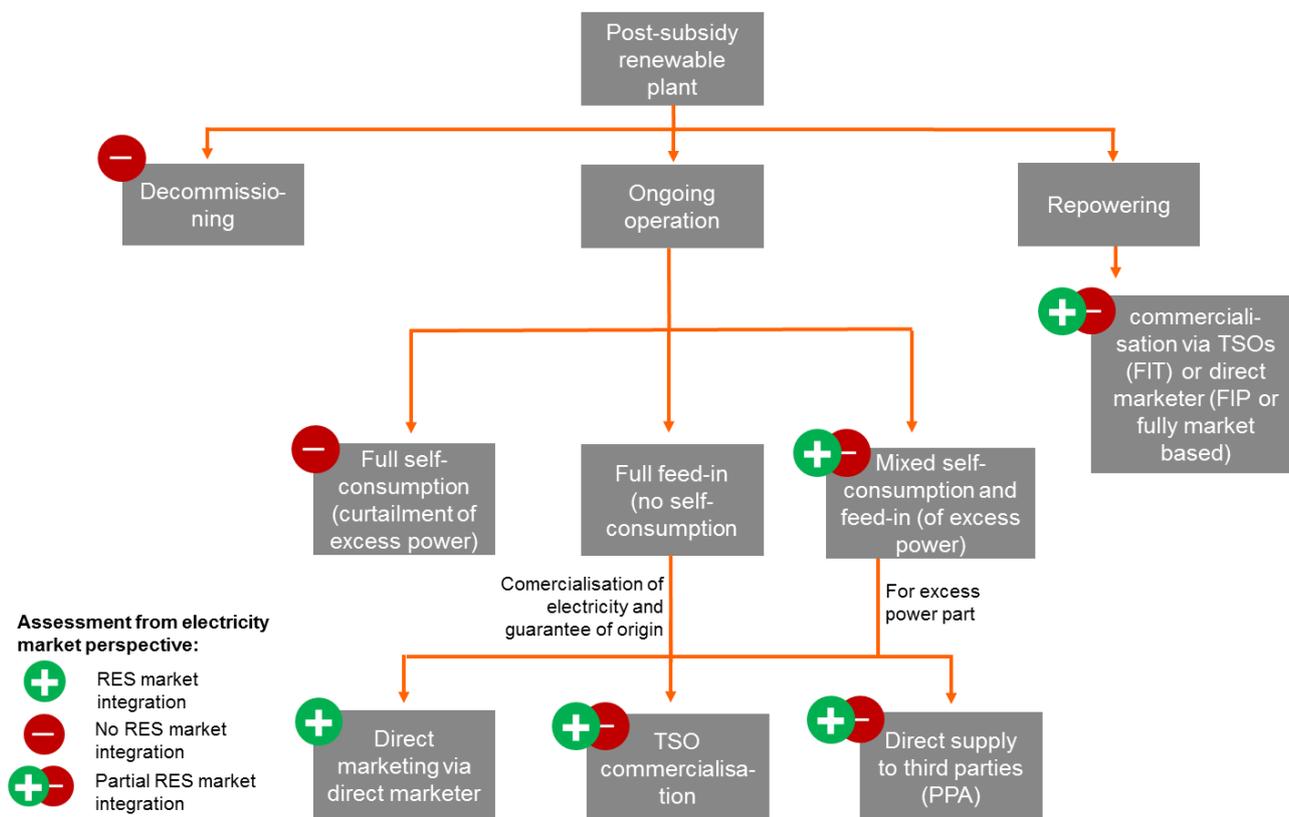


Figure 4: Options for post-subsidy plants and impact on renewable market integration, source: EPEX SPOT

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, on the one hand, of the commercialisation of the electricity on the markets and, on the other hand, of 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, subsidised 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, from a regulatory and economic perspective, the current challenge 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 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 normalised generation profiles instead of the duty of 15-min balancing and in order to avoid costly smart meters. Also, standardised issuing procedures for GOs can reduce administrative costs. A simple prolongation of feed-in tariffs for plants that are already fully written off after 20 years of subsidies would

be difficult to justify politically. This would also thwart efforts of companies that are developing new business models for the future operation of the post-subsidy plants.

## 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, 2<sup>nd</sup> bar). If the difference is negative, the CfD requires a payback (figure 5, 3<sup>rd</sup> bar). The incentive for traders on the spot market is always to perform better than the market value to maximize individual profits.

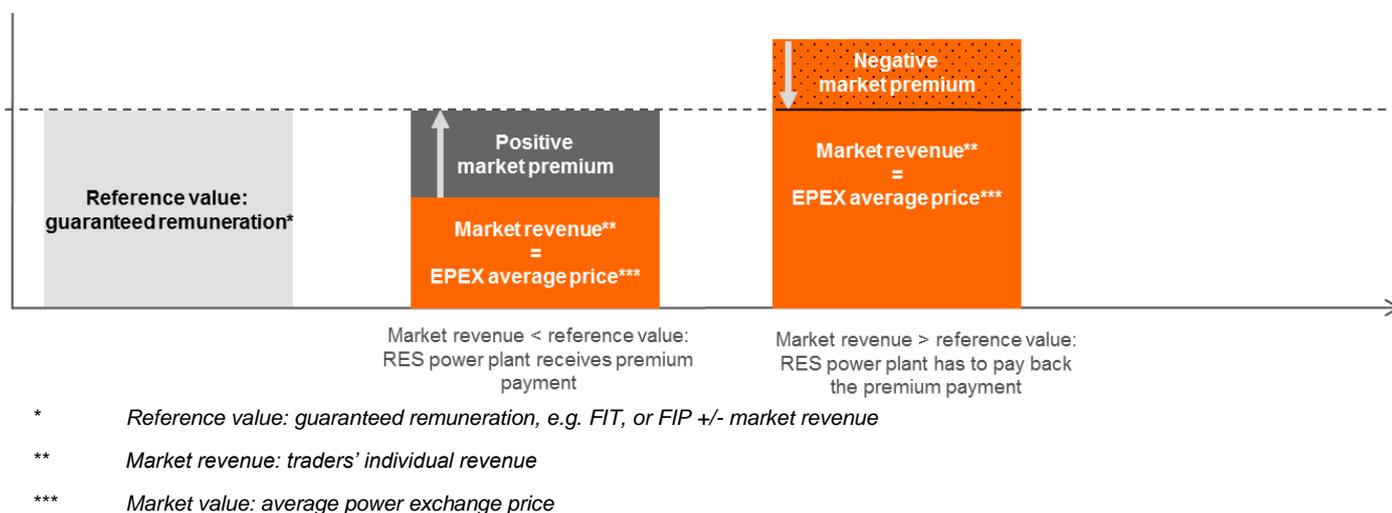


Figure 5: The functioning of the contract for difference (CfD), Source: EPEX SPOT

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, 2<sup>nd</sup> 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, 3<sup>rd</sup> 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 parameters are 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 socialised 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 remunerated in a fully market-based manner.

## 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 recognised 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 organised 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 organised market for GO trading and no reference price exists for GOs, only price assessments offered by 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: No 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-subsidised 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.

## Contacts

### **Kora Töpfer**

Senior Public & Regulatory Affairs Officer

publicaffairs@epexspot.com

### **Arnault Martin**

Products & Markets Quantitative Analyst

a.martin@epexspot.com

## 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.

**EPEX SPOT SE**, 5 boulevard Montmartre, 75002 Paris (France), info@epexspot.com, www.epexspot.com

**Public & Regulatory Affairs**, publicaffairs@epexspot.com

**Offices:** Transformatorweg 90, 1014 AK Amsterdam (The Netherlands); Regus at The Chancellor Office, Rahel-Hirsch-Straße 10, 10557 Berlin (Germany); Marktgasse 20, 3011 Bern (Switzerland); Treesquare, Square de Meeûs 5-6, 1000 Brussels (Belgium); 11 Westferry Circus, Canary Wharf, London E14 4HE (United Kingdom); Mayerhofgasse 1/19, 1040 Vienna (Austria)