



Working Paper

Energy Turnaround Products

Datum / Date

10/2/2015

Ort / Place

Leipzig

Dokumentversion / Document Release

0001A

1. Current challenges

At present, discussions are underway in Germany considering as to whether the current regulatory framework conditions are sufficient in order to ensure a secure power supply. One reason for this is that in the current market climate, (with relatively low wholesale prices) conventional power plants are becoming increasingly uneconomical to operate. There is consensus that today's power market (which is also frequently called an "energy-only market") has to be developed into a "power market 2.0" - which is characterised by flexible solutions for the synchronisation of demand and supply with the extreme fluctuations of the feed-in from renewable energies.ⁱ However, there is disagreement with regard to the question of whether additional government interventions, in the form of the creation of a capacity mechanism, for example, are necessary.

So far, this question cannot be answered conclusively. One thing is certain, however: At present, there are over-capacities in conventional power plants within the German/Austrian market area.ⁱⁱ At the same time, the progressive restructuring of the system (with its ever-growing share of renewable energies) increases the requirements placed on flexible generation capacities in order to compensate for the fluctuating generation from renewable energies. In the event that there is no wind and that the sun does not shine (keyword: "dark calm"), flexible conventional power plants can, above all, generate the electricity required to maintain the security of supply. In order to ensure this flexibility, investments in the modernisation of existing electrical installations or the construction of new facilities will be necessary in order to provide the secure capacity needed. This encompasses storage facilities and load reduction or transfer through demand-side measures, in addition to conventional power plants.

A declining average price level can be expected in light of the growing share of renewable energies with low or no marginal costs, in contrast to this, volatility and the frequency of (positive or negative) price peaks will increase (particularly, on the short-term Intraday Market). There is uncertainty with regard to the frequency, amount, extent and the timing with which price peaks will appear in the future. While the effects of positive and negative price peaks in short-term trading on the retail prices for electricity in short-term trading are largely negligible, price peaks can contribute to making the financing of flexible generation capacities a sensible option (for example: gas-fired power plants). Since stable and pre-

dictable income from the sale of power is of fundamental importance for the financing of power plants, products are needed that are able to translate the uncertainties connected with price peaks into planned and secure revenue, in addition to that gained from short-term trading.

From the perspective of EEX Group, the power market can provide solutions in order to give flexibility with market-based prices, these solutions can transform risks in such a way that they can be controlled in the long run. This paper provides an overview on how flexibility can be traded and marketed with the help of standardised products.

The fundamental assumption on which these *energy turnaround products* are based is that the market price signal has a control function in the short run and a financing function for flexibility in the long run. A short-term demand for flexibility is created by the generation of renewable energies which cannot be planned with absolute reliability. Market players need tools enabling them to adjust their positions in the short run and to avoid imbalances between generation and consumption. With a view to the long-term financing of flexibility, the challenge is to assess risks arising from short-term volume fluctuations and to transfer these into financial risks which can be controlled with the help of long-term trading products for the hedging of risks.

In order to establish new and innovative products both on the short-term and long-term power trading markets, the existing power market has to be optimised and the European internal electricity market also has to be strengthened.ⁱⁱⁱ

In the past, the energy market has already proven that it can respond to new challenges and evolve further. The successes which have been achieved so far, and the experience and expertise in product development within EEX Group on which this is based, are outlined below.

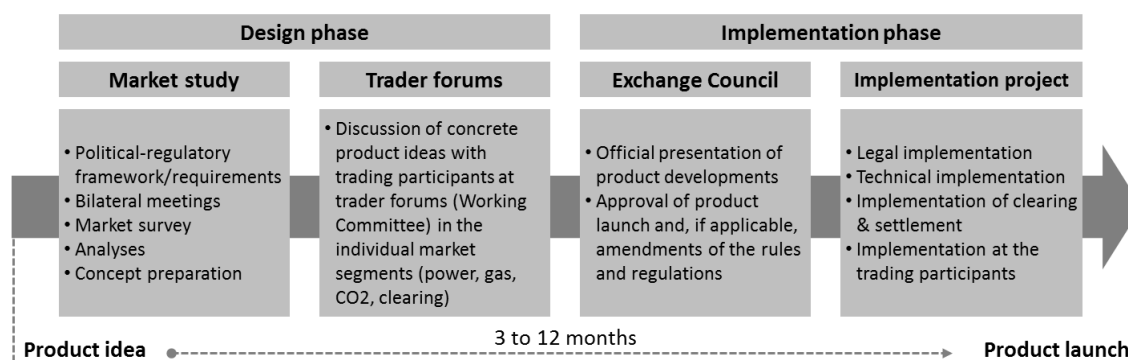
2. Trading participants develop new product concepts together with the exchange

2.1. DIGRESSION: Product innovation process on the energy exchange

On all of its trading markets, EEX continuously examines both the further development of existing trading products and the development of new products. Suggestions from the circle of the trading participants and changes in the political and regulatory framework conditions of the energy markets provide an impetus for this.

Product development and introduction are divided into a design and an implementation phase. During the design phase, ideas are analysed and detailed concepts for new products are prepared. These are, in principle, developed in cooperation with the market participants. And, afterwards, only those product ideas which facilitate sufficient standardisation and meet with the required degree of acceptance on the part of the trading participants are actually put into practice in the implementation phase. The following illustration provides an overview of the product development cycle.

Figure 1: Schematic diagram of the product development cycle on EEX. Source: EEX



The required degree of acceptance is ensured by the early inclusion of the trading participants, e.g. in the form of market surveys, but also by means of bilateral meetings with experts from the companies and associations actively operating on the energy market. As soon as specific concepts are formulated, these are presented and discussed at the trader forums that are held regularly. Furthermore, the approval of the exchange council is required for the introduction of new products and the expansion of existing products. The exchange council is a body of the exchange according to the German Exchange Act and en-

sures that the trading participants' interests are considered in the further development of the market.

If a product concept has been fully developed and is supported by the trading participants, it is implemented. Depending on the scope and complexity of the project, these are divided into several segments, which, for example, include the legal implementation (adjustment of the rules and regulations, contractual provisions), the technical implementation (trading system and settlement system) and also the implementation on the part of the trading participants.

2.2. Examples of product initiatives on the power market

During the past 15 years of liberalisation, the energy markets, their products as well as all players operating on these markets have evolved to the same degree. This is shown by the increasing maturity of the markets (with their high liquidity and informative price signals) as well as by the growing number and professionalism of the market players.

Trading on the short-term Spot Market (which is operated by EPEX SPOT within EEX Group) has been offered on every day of the year for several years. On the very short-term Intraday Market, trading is continuously possible around the clock (so-called 24/7 trading) up to 45 minutes before delivery. A further shortening of this lead time is currently being prepared.

Since December 2011 EPEX SPOT has offered trading on a fifteen-minute basis in order to improve the management of short-term deviations in generation and consumption. This market segment has evolved rapidly over the last three years and now accounts for approximately 20 percent of the trading volume on the German Intraday Market. Since the Intraday Market is increasingly used to compensate for shortfalls between forecast and actual generation in the marketing of renewable energies, the fifteen-minute products are also playing an increasingly important role. In order to ensure access for the largest possible group of trading participants, bundle liquidity and develop a reference price for 15-minute contracts, EPEX SPOT expanded trading in fifteen-minute contracts with an opening auction on 9th December 2014. This auction is held at 15:00 every day and permits simultaneous trading for all 96 quarter-hours of the following 24 hour period.^{iv}

On the long-term Derivatives Market, the product range covers the entire period from individual days to weeks, months and quarters and extending to entire years. The shorter terms, such as days and weeks, in particular, have gained in importance in parallel to the growing share of renewable energies over recent years.

Last not least, this broad product range, the optimised processes and the integration of European power markets makes a contribution to the improved synchronisation of demand and supply and, hence, to the flexibilisation of the electricity system. They contribute to a situation in which the participants concerned in both supply and demand meet in liquid trading on the exchange at virtually all times and can manage and close out both the short-term physical demand for power (or excess supply of power) as well as the associated financial risks.

3. New product innovations for the power market

3.1. Requirements for new products

a) Definition of physical trading on the Spot Market and financial trading on the Derivatives Market

On the existing power market, the Spot Market constitutes the central tool for short-term physical trading and, hence, for the synchronisation of generation and consumption. As a result, the Spot Market will assume a control function which is primarily provided via the Spot price signal.

The focus of the Power Derivatives Market, on the other hand, is on financial coverage of the trading participants' trading risks. On principle, the connection between the Spot and Derivatives Market is based on the fact that any risks on physical markets – which are, for example, determined by price volatilities or price peaks – induce a demand for financial protection. To this end, the short-term price and volume risks on the Spot Market are covered with the help of financial trading products on the Derivatives Market. Since the Derivatives Market permits long-term hedging of financial risks and ensures stable market prices for investments, it has an important function in the financing of investment projects.

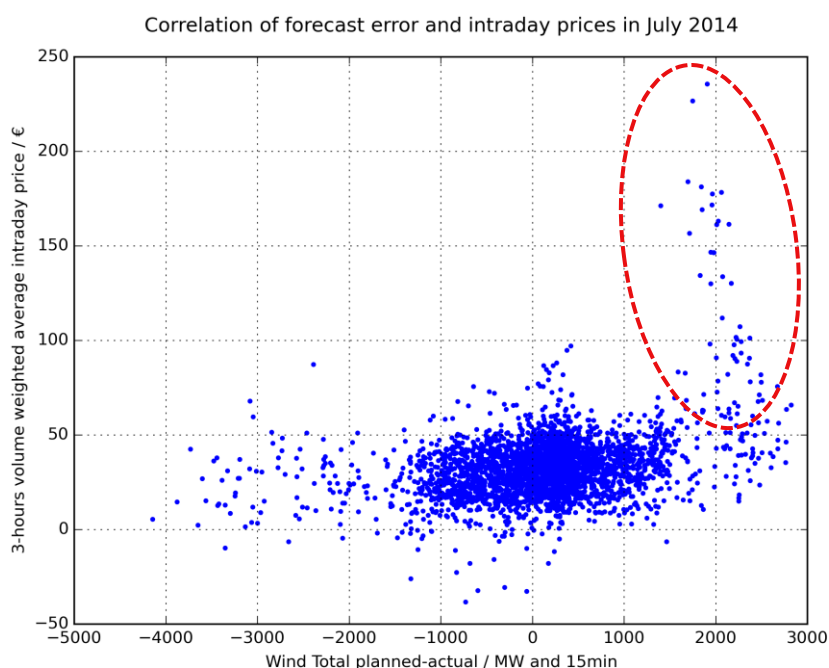
Compared with physical products, financial trading products have the additional benefit that – with little effort - they can also be traded by trading participants that only operate in financial trading and do not have any connection with physical generation or consumption and are willing to take up risks which other trading participants want to have covered. As a result, the products on the exchange Power Derivatives Market give a broad customer base access to the market, which in turn reduces the costs of hedging of risks – from which, in turn, all electricity consumers benefit.

Both the broad access to the market for many different players and the standardisation of products (which bring together as many of the trading participants' requirements as possible) constitute a decisive precondition for bundling liquidity, thus enabling stable market prices and low hedging costs. A sufficiently high liquidity alone can ensure that a buyer or a seller finds a counterparty in order to conclude a transaction or change existing positions at any time.

b) Definition of the Day-ahead and Intraday Market as the underlying asset for the Derivatives Market

The importance of short-term markets and products increases as a result of the increasing direct marketing of renewable energies. In this context, the predominant volumes from renewable energies are marketed on the basis of forecasts on the Day-ahead Market. Since the target volumes deviate from the actual volumes as a result of forecasting inaccuracies, increased activities can be observed on the Intraday Market. This can lead to a situation in which the marketers of wind energy need to procure shortfall quantities on the market in situations with a lower feed-in of wind energy. On account of changing weather characteristics, deviations between the expected and actual wind generation output are not usually restricted locally and this not only affects individual trading participants, but usually several other trading participants as well. As a result, the increasing demand, combined with a lower supply in such situations frequently leads to higher prices on the Intraday Market. The connection between the extent of the forecast error and the level of the power prices on the Intraday Market is illustrated in Figure 2.

Figure 2: Example of the connection between forecast errors and intraday prices. Sources: 50Hertz/EPEX SPOT

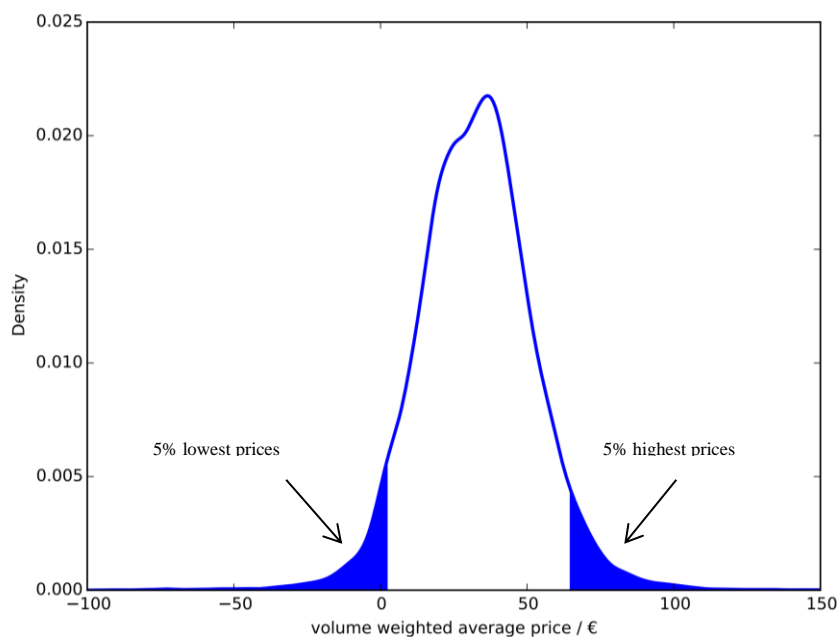


So far, constant bands or blocks of several consecutive hours are predominantly marketed on the power market. On the other hand, marketing of individual hours plays a minor role. For this reason, the average prices of the Day-ahead auctions on EPEX SPOT – across all hours of a given day (Phelix Base) for the base load products and the average of the 12 hours from 8:00 am to 8:00 pm of a given day (Phelix Peak) for peak load products - constitute the underlying of the Phelix Future on the Derivatives Market. However, this calculation of the average hardly considers individual hours with scarcity prices which are increasingly found on the Intraday Market instead of on the Day-ahead Market. As a result, only the essential financial risks can be hedged in the long run with derivatives products so far. However, due to the increasing feed-in from volatile renewable sources of energy, covering of price peaks, (especially from Intraday trading) is gaining in importance.

In future, the price signals of the Intraday Market are to be reflected in the underlying assets for new products on the Derivatives Market. Instead of using a reference price on the Day-ahead market as the reference price as has been the case so far, individual (quarter) hours should also be used as the underlying asset across the entire price distribution of the Intraday Market.

Logically, the focus is on those hours which cause risks for the trading participants on account of a particularly high or particularly low price. The following figure illustrates this consideration with the help of the price distribution on the German Intraday Market in 2014. The 5% of the highest and lowest prices are shown here as an example.

Figure 4: Distribution of prices on the Intraday Market, January to December 2014. Source: EEX/EPEX SPOT



3.2. Product innovations: Energy turnaround products on the Power Derivatives Market

a) *Cap Future* – Hedging of price peaks on the short-term Intraday Market

The concept of the *Cap Future* is derived from the *Phelix Future* as the tried and tested market standard; however, its concept deviates from it significantly. Instead of the reference to the average prices of the Day-ahead Market in the known base (base load, hours 0 to 24) and peak (peak load, hours 8 to 20) profiles, an Intraday price index is envisaged as the underlying asset. This ensures that the underlying asset reflects scarcity prices and permits volatility but is also sufficiently robust at the same time.

The integration of price thresholds (so-called caps) permits the targeted hedging of price peaks which are above (or below) this threshold and with regard to which it is not known in advance whether these will materialise, or when, and to which extent, they will occur (Figure 5).^y Unlike the Phelix Futures (in the case of which the average price during a certain delivery period is fixed), the Cap Future refers to the average of the part of the price distribution which is above the cap, regardless of the time at which the respective prices emerge.

Figure 5: A Cap Future fixes the expected value of all prices above a certain price level. Source: EEX



The buyer of a Cap Future receives a payment to the amount of the difference between the market price for the hours concerned and the amount of the cap from the seller for those hours during which the Intraday price is above the cap. As a result, a Cap Future has the effect of an insurance against an imbalance which cannot be foreseen and, hence, the substitute procurement on the Intraday Market at potentially high market prices for the buyer. For the seller, on the other hand, the price of the Cap Future achieved has the effect of being a premium for the willingness to assume the price risk in the event that the cap is exceeded.

In order to achieve a standardisation of the products which should be as extensive as possible, only a few products with different caps should be offered for trading. These caps should be based on the merit order of the power plants available on the market. As a result of discussions with the trading participants, sensible caps of EUR 0 per MWh for the lower price limit and in a range of EUR 70 to 80 per MWh for the upper price limit were specified. As an alternative to this, the amount of the price threshold can be objectively connected to the maximum price (positive and negative) of the Day-ahead market in order to exclusively record the price peaks arising on the Intraday Market. The price thresholds for the practical implementation can be determined and adjusted annually on the basis of the highest or lowest Day-ahead price of the previous year. The decision on the final design is taken in coordination with the market.

The following example (which is based on historical Intraday hour prices from February 2014) illustrates the operation of the Cap Future. A Cap Future with a term of one week, which comprises all 168 hours of this week, is assumed. The cap amounts to EUR 70 per MWh. Table 1 shows only those hours during which the Intraday price was above the cap; during the remaining hours in the period under review, the price index was below the cap and, as a result, it does not contribute to a higher payment from the Cap Future.

Table 1: Example of the operation of the Cap Future. Source: EEX

Hour	Intraday price index	Payment to the buyer
24/2/2014 18:00	EUR 86.95 per MWh	EUR 16.95 per MWh
24/2/2014 19:00	EUR 76.61 per MWh	EUR 6.61 per MWh
25/2/2014 18:00	EUR 73.63 per MWh	EUR 3.63 per MWh
26/2/2014 18:00	EUR 80.71 per MWh	EUR 10.71 per MWh
28/2/2014 18:00	EUR 71.32 per MWh	EUR 1.32 per MWh
Total		EUR 39.22 per MWh

Application scenarios and contract specifications of the Cap Futures are shown as examples below.

Table 2: Examples of application scenarios. Source: EEX

Trading participant	Possible applications
Direct marketer of wind energy	Protects against Intraday price peaks in the event of substitute procurement after deviations from the forecast; protection against negative prices on the Intraday Market also possible
Generator with a conventional power plant	Sale of parts of the generated power via Cap Futures – sales prices corresponds to the capacity payment/option premium
Bulk consumers	Financial coverage of load transfer during periods of scarcity
Must-run power plants	Protection against negative prices on the Intraday Market
Pumped-storage power plants	Fixing the spread between high and low prices

Table 3: Examples of the elements of the contract specification. Source: EEX

Parameter	Description
Type	Future with daily profit and loss settlement
Underlying asset	Intraday price index - Hourly
Term	- Weeks (168 hours) - If applicable, expansion by months (720 hours)
Cap	- Upper cap in the range between EUR 70 per MWh and EUR 80 per MWh - If applicable, lower cap at EUR 0 per MWh - If applicable, coupling with the highest/lowest Day-ahead price of the previous year

EEX is planning to introduce Cap Futures for trading on the exchange in 2015 in accordance with the following schedule.

Table 4: Outlook of the roadmap for the introduction of Cap Futures. Source: EEX

Time frame	Milestone
Q1 2015	Conclusion of the Cap-Future design phase: <ul style="list-style-type: none"> - Development of an Intraday price index - Determination of the essential product parameters/specifications (e.g. determination of the price thresholds and the term of the contract)
Q2 2015	Approval by the Exchange Council
Q2/Q3 2015	Implementation project
Summer 2015	Product launch

b) Option products

The demand for and supply of flexibility can also be represented via option products on the Derivatives Market. For example, a call option had the effect of an insurance against imbalances and, hence, of a substitute procurement at potentially high market prices for the Buyer. In return, the Seller of this option receives an option premium for the provision of secure output. This principle can also be transferred to hedging of very low and even negative prices. In this case, the buyer of a put option acquires the right to sell his energy volumes at the price agreed in advance as soon as an exercise price determined in advance is reached. The seller of this option, on the other hand, undertakes to accept these volumes. He, in turn, receives an option premium for the provision of this put option. On principle, a financially settled put option can be compared to a Cap Future, provided the exercise price of the option corresponds to the upper cap.

In addition to individual option contracts, several options can also be combined into a product bundle in order to represent individual segments of a delivery period (such as e.g. hours of a given month) individually in one option in each case.

- In the case of so-called *Strips of Options*, an option with a fixed exercise price is defined for each individual segment of the delivery period (e.g. the 720 hours of a month with 30 days). After this, all partial options of a delivery period are summarised in one contract with all partial options having the same exercise price. However, *Strips of Options* with different exercise prices (so-called option series) can also be offered. Partial options are exercised automatically as soon as they become profitable; this means as soon as the underlying asset is above the exercise price.
- On the other hand, so-called *Swing Options* can be offered. On principle, these are identical with *Strips of Options*, in which, however, the number of exercisable contracts per delivery period is restricted in addition. For example, such a product would comprise a payment for the ten most expensive hours of the delivery period.

These option products are already traded over the counter today. However, these products are usually tailored individually to the buyer's and seller's requirements and are to a degree, difficult to assess. Therefore, standardising the options in such a way that liquid trading with a number of different participants can evolve on organised markets, such as those of EEX, constitutes a challenge.

c) *Weather derivatives*

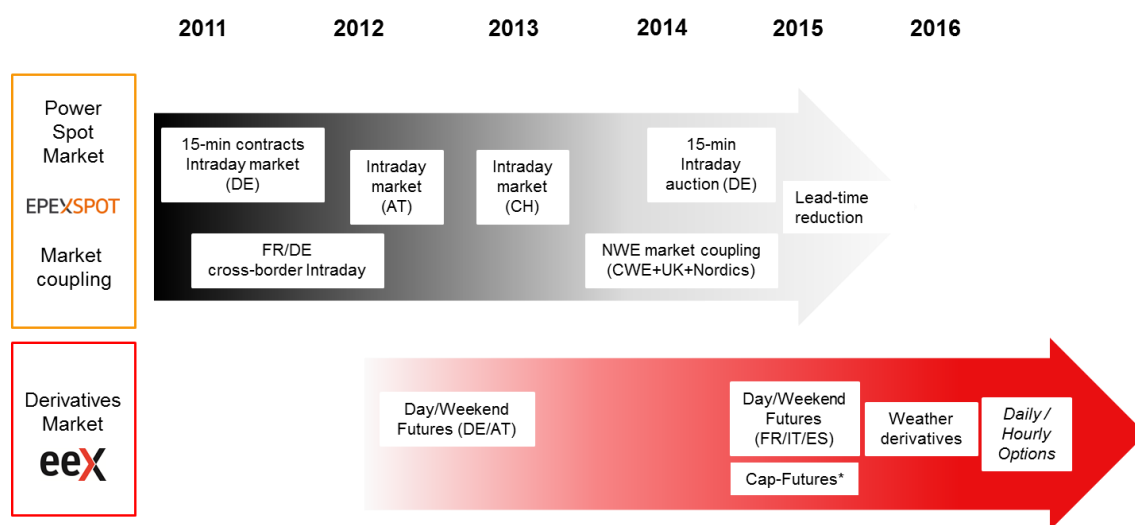
On the current power market, the power prices on the wholesale market of the exchange already comprise a number of price-relevant influencing factors, including weather factors such as wind load, the intensity of solar radiation or temperatures. As a result of the growing share of renewable energies, the importance of these influencing factors (which are specific to renewable energies) and of the uncertainties connected with these in direct marketing via the wholesale market are also increasing. For this reason, EEX is analysing how these uncertainties can be covered individually with the help of standardised trading products, in addition to trading in the power price. This pursues the aim of offering additional products in the form of *weather derivatives* which are complementary to the existing power products and the new flexibility products described above.

d) Overview of planned product innovations

The energy turnaround leads to a higher degree of complexity in the energy market. In spite of the central function of standard trading products – whether in the form of the Phelix Futures or of new products, such as the *Cap Future* – there will not be any “one-size-fits-all” products which can cover all the risks of all market players on their own. The more individual the risks to be covered become, the more difficult it is to reflect these in standardised products in order to equally fulfil the trading participants’ different requirements to a comprehensive extent.

Therefore, new products have to be considered as being supplementary solutions along with existing products. With the products which have already been introduced for trading in the past, progress has already been made en-route towards the “Power Market 2.0”. The figure below summarises the further planned market-based solutions for the Spot and Derivatives Market described above.

Figure 6: Overview of planned product innovations. Source: EEX/EPEX SPOT



*Hedging of price risks on the intraday market

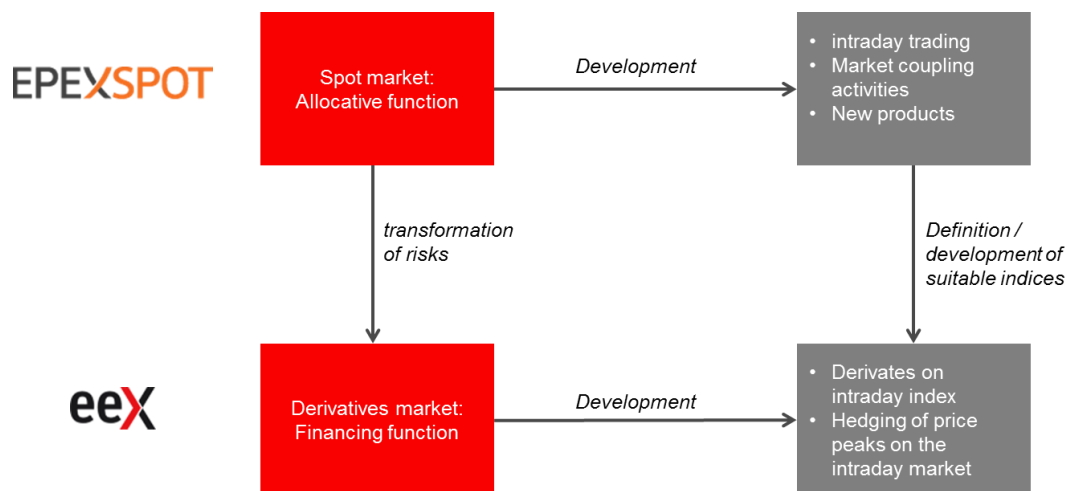
In 2015, EEX Group will introduce the next energy turnaround product with the *Cap-Future*. This is aimed at providing further market-based tools to the market in order to meet the challenges described, such as price risks from the volatile feed-in, which is difficult to forecast - without any further profound regulatory interventions. Further products, such as *Strips of Options*, *Swing Options* or weather derivatives are to be offered as supplementary products in the future.

4. Conclusion: New products and liquid trading will make the energy turnaround a success

The energy turnaround, along with the increasing share of renewable energies, necessitates the further development of the existing power market. The green paper on power market design, which was published by the Federal Ministry for Economic Affairs and Energy in October 2014, provides a number of proposals for a "Power Market 2.0". This includes, in particular, the development of technical flexibility and market-based compensation.

EEX Group actively supports the transition to a power market 2.0. And it has already begun moving in this direction with numerous measures initiated by the market itself. Based on liquid trading in standardised products, the power market is developing solutions in order to provide a market-based price for flexibility. In this context, the market price signal has a control function in the short run, while, in the long run, it will assume a financing function for flexibility. EEX and EPEX SPOT are planning to introduce new products with the help of which, flexibility can be marketed efficiently both in the short and the long term (Figure 7).

Figure 7: Further development of the Power Spot and Derivatives Market. Source: EEX/EPEX SPOT



Marketing of renewable energies makes trading more short-term. This leads to higher activities on the Intraday market since the target volumes marketed on the Day-ahead market deviate from the actual volumes because of inaccurate forecasts. As a result, EPEX SPOT is adjusting its product portfolio on the Power Spot Market accordingly – for example through an expansion of its fifteen-minute products.

The short-term marketing risks can be managed via derivatives referring to an Intraday index in the long run. Such derivatives are being developed by EEX at present. Intraday indices as the underlying asset and hedging of individual hours via standard trading products are real innovations and turn flexibility into a tradable commodity with a market-based price.

The tradability of flexibility does not only permit hedging of the volatile feed-in of renewable energies but, at the same time, also the provision of flexibility in order to bridge this gap. The remuneration of flexibility on the market can create incentives for investments in physical plants.

As a result, products, such as the Cap Future, have an effect which can be compared with capacity products. They not only make a contribution to the further market integration of renewable energies, but also constitute a market-based alternative to the introduction of a separate capacity mechanism.

Contact

Daniel Wragge
Head of Political & Regulatory Affairs

+32 2 627 1933 (Brussels)
+49 341 2156 204 (Leipzig)

daniel.wragge@eex.com

Robert Gersdorf
Senior Expert Political & Regulatory Affairs

+49 341 2156 365 (Berlin)
+49 341 2156 218 (Leipzig)

robert.gersdorf@eex.com

ⁱ In October 2014, the Federal Ministry for Economic Affairs and Energy presented a green paper on the future power market design. Proposals for the further development of the energy-only market constitutes a central element thereof: <http://www.bmwi.de/BMWi/Redaktion/PDF/G/gruenbuch-gesamt,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf>

ⁱⁱ Local scarcities in generation capacities are almost exclusively due to the delayed grid expansion or local specificities, such as a lack of construction sites.

ⁱⁱⁱ Since 2014, the Day-ahead markets of 17 countries in the north-west European (NWE) and south-west European (SWE) regions have been coupled. As a result of this, the border capacities of all interconnectors both within and between the regions are managed optimally. Moreover, coupling with further regions, such as central-southern Europe (CSE) and central-eastern Europe (CEE) is already being prepared.

^{iv} http://www.epexspot.com/en/press-media/press/details/press/Successful_launch_of_15-Minute_Intraday_Call_Auction_in_Germany.

^v In line with this, lower or negative prices can also be hedged with a Cap Future.