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An Integrated Platform for Increased FLEXIbility in smart TRANSmission grids with STORage Entities and large penetration of Renewable Energy Sources

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D3.2 Enhanced market design for flexibility I

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Summary Report

1.1 Scope of Deliverable

This document comprises deliverable 3.2 for FLEXITRANSTORE Task 3.2. The task is phased: deliverable 3.2 (M15) provides an initial appraisal of options for an enhanced market design; deliverable 3.5 (M26) provides the final appraisal of options, the enhanced market design, final TSO-DSO settings, functionalities of the market design, and comparisons with existing functionality.

Task 3.2 is split into two parts. Deliverable 3.2 (M15) provides an initial appraisal of options for an enhanced market design; deliverable 3.4 (M26) provides the final appraisal of options, the enhanced market design, TSO-DSO settings, functionalities of the market design, and comparisons with existing functionality. The second deliverable will include interaction with the FLEXITRANSTORE demos to test concepts and validate proposals.

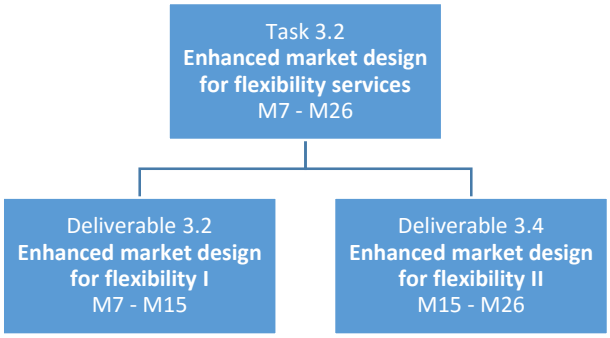

Figure 1: Task 3.2 structure

The work for the first phase (this document, described as 3.2, duration M7-M15) includes the following:

- Analysis of **options for enhanced wholesale market design** for flexibility, with a focus on those that can impact the viability of the FLEXITRANSTORE demos in providing flexibility services to wholesale markets. Specifically:
  - We analysed the **design space** for ancillary services, balancing, and intra-day markets;
  - We looked for **metrics for measuring flexibility** within each;
  - We attempted to map the **suitability of different flexibility options** within each;
  - We also analysed capacity market design to understand its impact on other markets where flexibility is required.
- A first pass description of new settings in the balancing, ancillary services and intraday markets, including a straw-man **proposal for the market simulation** to be executed in WP9;
- A **joint action plan** that describes the work to be undertaken to complete Task 3.2.

1.2 Concept and Background

Power system flexibility is an inherent feature in the design and operation of all power systems. Power systems must ensure a spatial and temporal balancing of generation and consumption at all times, and power system flexibility represents the extent to which given system can adapt generation and

consumption to maintain system stability in a cost-effective way. High flexibility is therefore the ability of a power system to maintain continuous service in the face of rapid and/or large swings in supply or demand.

This ability can be deployed either directly, by an external signal that is part of a commercial contract that procures flexibility as a service, or indirectly as a response to a financial incentive that drives behaviour by market participants that supports positive outcomes on the network, for example via energy prices and tariffs.

FLEXITRANSTORE WP3 focuses on flexibility as a commercial opportunity: in later stages of the work, we will define business models and business cases for flexibility that can be harnessed by wholesale market participants.

The report for the first phase includes a summary of options for enhanced wholesale market design for flexibility, a description of the design space for ancillary services, balancing, and intra-day markets, proposals for metrics for measuring flexibility within each, and mapping the suitability of different flexibility options within each.

1.3 Methodology and key activities

Within the deliverable we first appraised technology options for flexibility, based on the four market outcomes we proposed in deliverable 3.1. Our analysis highlights that current settings hinder the participation of energy storage, demand response, and aggregation in the intraday timeframe, where they are particularly well suited to provide solutions.

We identified a range of market settings across Europe for ancillary services and balancing markets, and demonstrated how they are applied inconsistently, hindering the participation of new forms of flexibility in various markets. We proposed settings that have the potential to improve participation in intra-day markets. We also identified metrics that can be used to measure flexibility.

We proposed the introduction of 15-minute products and 5-minute gate closure time, as well as unrestricted price formation and locational order books as settings for the intraday market. We propose several scenarios for further testing in WP9.

Adjusting the parameters of the various components of wholesale markets will affect the behaviour and performance of those markets. It is possible to adjust parameters within the market to improve flexibility; a certain combination of settings will lead to an optimal market for flexibility. As part of deliverable 3.2 we investigated the design space for intraday, balancing and ancillary services markets to understand which settings would have the greatest impact on flexibility.

We also investigated flexibility metrics for each market. We will use the metrics to observe the impact of our changes to market settings in later work, identifying causality between the settings within the design space and measurements for flexibility. We also intended to show correlation between regulatory actions and changes in flexibility.

We then analysed existing settings within markets, in an attempt to identify trends that would indicate which settings have the greatest impact on flexibility.

In deliverable 3.1 we identified a number of routes to market for flexibility. In deliverable 3.2 we have expanded the analysis by considering the suitability of different technologies in different scenarios.

1.4 Key results/Main findings

Requirements for flexibility in intra-day markets

We identified the following as requirements for flexibility in intra-day markets:

Market / timeframe	Characteristics	Requirements for flexibility in this timeframe
Intraday markets	• Defined by various products, trading options • RES/load affected by gate closure times • Increased liquidity reduces reliance on balancing energy requirements • Trading results in revenue only associated with the trade – no long term certainty on revenue beyond historical performance or certainty regarding forecasting • Participation limited by market settings related to bid size and minimum duration	• Predictability – must be able to commit to schedule requirements • Reaction time and ramping requirements governed by gate closure – normally 1hr in EU • Headroom/footroom that allows alteration in committed energy close to real time • Ramping and start up costs are relevant but only if variability forces change in operating characteristics in a timeframe that incurs additional costs • Must be able to respond for minimum duration at a minimum size – sets lower limit on storage or DSR participation, for example

Table 1 - Requirements for flexibility in intra-day markets

Metrics for measuring flexibility in medium term markets

In Deliverable 3.1 we defined liquidity in markets as a measure of the ability to buy or sell a product – such as electricity - without causing a major change in its price and without incurring significant transaction costs. An important feature of a liquid market is the presence of a large number of buyers and sellers willing to transact at all times. Liquidity is a key performance indicator for the wholesale electricity market and one of the measures used when monitoring the effectiveness and levels of competition in wholesale markets.

In the electricity market liquidity is essential since it enables the sell and purchase of energy (and capacity) whenever market players require. In other words, in a liquid market, suppliers have greater certainty that they will satisfy the customer needs since they will be able to purchase electricity whenever they want while generators will be confident that they can sell their generated power by their power stations. Based on the above definition, the liquidity can be directly related to the flexibility of the system, in the sense that high liquidity in a market denotes a more flexible power system than a market with low liquidity.

A frequently applied indicator for liquidity in financial and energy markets is the trading volume in a market (e.g. EU, 2007). The trading volume is easily observable using open-source data and therefore provides a suitable metric for characterizing market liquidity.

In addition to the trading volume, from the perspective of a market participant, the question of the price impact of a trade is of interest. When liquidity is insufficient, there is an increased risk that a market participant will cause significant shifts in the price of trades, causing an adverse impact on profitability. Fluctuations of this sort comprise a much larger share of the total value of a trade than the fees paid to

power exchanges, which are usually lower than 1%, or the internal transaction costs, such as IT systems or trading staff, which are incurred as a result of making the trade (Weber).

WP9 has proposed liquidity as the key metric to determine improvements to the intra-day market caused by changes to market settings. Further, more detailed analysis is provided in Deliverable 3.1.

Changes to settings to improve flexibility in intra-day market

In the previous section we described liquidity as a key metric in defining the flexibility of the intraday market. In proposing improvements to market design to promote flexibility, we therefore start by considering changes that will improve liquidity.

The Annual Report of the ACER and CEER on the Results of Monitoring the Internal Electricity and Gas Markets in 2016 (Electricity Wholesale Markets Volume) indicated that reducing intraday product duration would have a positive effect on liquidity. Steps have already been taken in some member states: for example, new intraday products have been recently introduced or are planned to be introduced as follows:

1. 30-minute products continuous ID trading in France, Germany and Switzerland were introduced in March 2017,
2. There are plans to introduce 15-minute product auctions in the Netherlands and 30-minute product auctions in France.

Market operators such as EPEX see the introduction of 15 or 30 minute products as a 'quick win' that is easily achieved. Where it has been implemented, it is used extensively by parties wanting to balance their portfolio, in particular solar generators that are trying to manage ramping constraints imposed by their network connections. In Germany, for example, the short duration products now represent more than 20% of energy traded in the German intra-day market.

In deliverable 3.1 we also identified shifts to gate closure time, use of auctions to pool liquidity, and forced participation in the intraday market as possible settings that would improve liquidity and hence flexibility of the intraday market.

EPEX has identified a number of settings that will improve the functionality and flexibility of the intraday market, beyond settings that specifically relate to improving liquidity[1]:

1. Unrestricted price formation, within acceptable limits set by the market platform, allow appropriate signals to be provided for short-term generation and consumption decisions as well as for long-term investment decisions in new generation capacity;
2. Related to (1), regulatory price caps prevent or distort free price formation and they should be removed. Only EU-wide harmonized technical price limits – set by market operators – are necessary for the effective operation of the intraday market;
3. Coupling between time frames, such as implementing single day-ahead and intraday coupling
4. Redrawing bidding zones to reflect transmission constraints, meaning imbalance price areas are drawn based on the existence of bidding zones;

[1]https://www.epexspot.com/document/37956/EPEX%20SPOT%20Vision%20for%20Future%20Power%20Market%20Design

5. Use of locational on demand order books on ID continuous market to solve local congestion issues. The same volume could be placed on both the global market and the locational order book.

1.5 Conclusions

This document provides an initial appraisal of options for an enhanced market design. We analysed the design space for the intraday market identified a range of market settings across Europe for intra-day markets, noted the inconsistency hindering the participation of new forms of flexibility. We proposed settings that have the potential to improve participation in intra-day markets.

These proposals will be considered for testing within WP9. We outlined a focus for future work. We summarised our analysis of existing initiatives and highlighted a lack of activity regarding settings or platforms that promote simultaneous access to multiple markets in the intraday timeframe. We will focus on this area in future work. Finally, we noted the relevance to the FEG platform, and highlighted where WP3 will develop use cases.