



## OPPORTUNITIES, CHALLENGES AND RISKS FOR RES-E DEPLOYMENT IN A FULLY INTEGRATED EUROPEAN ELECTRICITY MARKET

This workpackage was one of the first activities in the project, which was intended to list the challenges and thus pave the way for the subsequent technical work packages in Market4RES. The work comprised three following focus areas.

### Market failures, distortions, challenges and benefits in the European electricity market

The first report "D2.1 Market failures, distortions, challenges and benefits in the European electricity market" established a foundation for work carried out in Market4RES project. The report elaborates on the theoretical and regulatory analysis of the European 'energy-only' market model as well as on several relevant policy instruments having been implemented to promote the accelerated market integration of RES-E generation technologies.

The major aim of the activity is to understand the historical development of the European electricity market and the background as well as driving forces of the currently existing European 'Target Model' discussion. Doing so, it is important to understand and study the major shortcomings of electricity market design and market distortions, on the one hand, but also the achieved electricity market benefits in a system with high shares of RES-E generation in an inter-temporal context over the last decade, on the other hand.

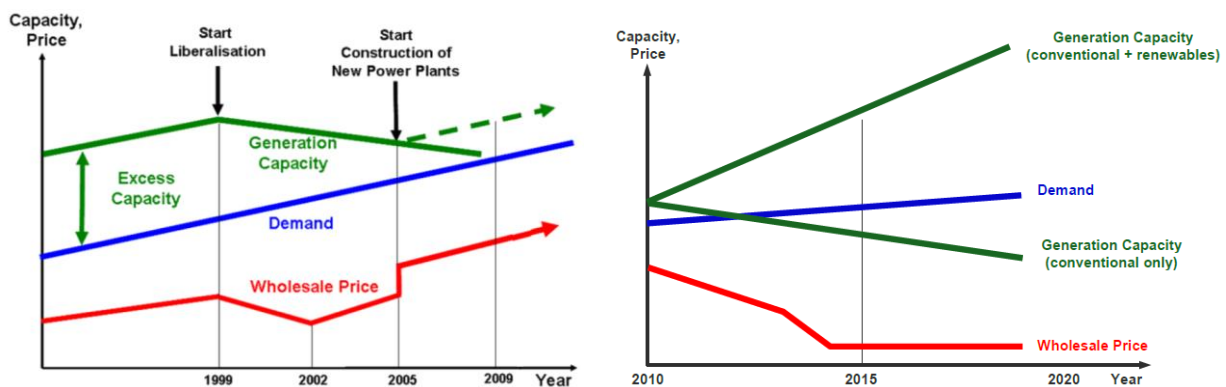


Figure 1. *Development of generation capacity, demand and wholesale electricity market price in Central Europe from 1999 to 2009 and future trend from 2010.*

### The major lessons learned can be mainly summarized as follows:

- In the early phase of European electricity market liberalisation the design of market structures and policy instruments have been perfectly fitting to meet the intended policy objectives and expected market developments.
- The massive efforts to promote the accelerated integration of RES-E generation technologies have been a success story, knowing that the financial support (subsidies) is substantial, and this support is a market intervention apart from the forces of the electricity market itself.



- In the course of time, however, adverse effects of significant RES-E penetration have been occurring in terms of low average wholesale electricity prices in general and extremely volatile, partly negative prices in particular.
- Subsequently, this has led to the situation that conventional electricity generation technologies have difficulties with covering their costs while financial support instruments (subsidies) further stimulate investments into wind and PV generation. This has led to increasing profitability risks of many of these conventional generation technologies. Some of them have already been – or are expected to be – mothballed.
- Although the importance to promote Demand Side Management implementation into the electricity market has been discussed over a long period of time, until now no significant and promising best-practice cases qualified to be scaled up do exist.

You can find more details about the analysis in Deliverable D2.1, available at: [www.market4res.eu/wp-content/uploads/D2.1\\_Market4RES\\_20150217\\_Final.pdf](http://www.market4res.eu/wp-content/uploads/D2.1_Market4RES_20150217_Final.pdf).

## **Implementation status and market-focused diagnoses of the target model**

In the last ten years the penetration of renewable generation in power systems in Europe has increased significantly. Power production will have to be dominated by RES-E generation in the coming decades in order to achieve environmental objectives set in the 2020, 2030 and 2050 time frames within the EU. The Target Model developed by the European Commission in cooperation with ENTSO-e and ACER represents an attempt to make the penetration of large amounts of renewable generation compatible with the satisfactory functioning of power systems in Europe from a techno-economic point of view.

The Target Model comprises a set of documents, the Network Codes, or framework guidelines, related to different aspects of the functioning of the system. Among other issues, Network Codes deal with the design of market required to achieve a well-functioning Internal Energy Market. Network Codes focused on the functioning of markets are the so-called Market Network Codes. Together with Connection and Operation Codes, they make the whole set of rules, and principles, developed to increase the efficiency in the functioning of the European interconnected system.

More about the diagnoses of the target model as well as the Network Codes and the process of deployment of the Internal Energy Market can be found in the second project report "D2.2 Implementation status and market-focused diagnoses of the Target Model" available at: [www.market4res.eu/wp-content/uploads/D22\\_20150519\\_FINAL.pdf](http://www.market4res.eu/wp-content/uploads/D22_20150519_FINAL.pdf).

## **Empirical case study analyses emphasising the challenges in the very short-term, short-term and long-term electricity markets in Europe**

Three different market regions with different RES-E penetration levels in the European electricity market have been assessed in the third report "D2.3 Empirical case study analyses emphasising



the challenges in the very short-term, short-term and long-term electricity markets in Europe". These are the Nordel system, the Central-Western European system and the Iberian system.

## The analysis reveals that with increasing shares of RES-E:

- **average spot and futures prices tend to fall** (phenomenon that can be explained by the “merit-order effect”). There appears to be a positive correlation between price trends and RES-E share percentage, though other factors are also important in setting spot and futures prices;
- **negative prices occur more frequently** on the spot market due to the intermittency of these energy sources. Three major elements can explain the occurrence of negative prices: the high production subsidies and the lack of appropriate market incentives to address negative market prices, the limited flexibility of conventional power plants, the must-run conditions of conventional power plants;
- **price volatility tends to increase;**
- **RES-E curtailment is sometimes needed** to manage oversupply and system security. Spain in particular makes extensive use of curtailment due to its high wind production levels, lack of interconnection to neighbouring markets (particularly France and Portugal), must-run conditions of some non-RES units, and low demand levels at off-peak times.

## When looking at the impact of market coupling on electricity prices, it can be noticed that:

- **market coupling optimises the spot prices** and flows between interconnectors since generators benefit from increased export capacity and consumers from more import capacity. Moreover, there is a noticeable convergence of average monthly and yearly futures prices after the CWE market coupling announcement. Market coupling must however be paired with sufficient interconnection capacity to realise its full effect;
- **volatility on the spot markets increases when interconnectivity is low** and real price volatility decreases only come with huge investments in infrastructure. On the futures market, the analysis revealed that monthly futures price volatility within and between countries in the Central-Western European (CWE) region decreases after the market coupling in September 2010;
- **Interconnection capacity in addition to flexible operation units can help promote spot price stability** during high production periods. Increased RES-E with more interconnections tends to lead to lower and more stable prices. Higher interconnection capacity and average export volumes leads to lower monthly futures prices.

## Finally, the analysis of nuclear maintenance and phase-out events and of the relationships of commodity prices reveals that:

- **building interconnection capacity is a key to ensuring security of domestic supply and stable spot price levels** during low production periods. The announcement of the shutdown of a nuclear plant temporarily drives yearly futures prices up, but other factors such as higher shares of RES-E and the possibility to import cheaper energy from neighbouring countries through interconnectors play a greater role in influencing prices in the long term;



- if there is some **observable correlation between the TTF Gas prices and the day-ahead market prices**, at least for the Netherlands, the correlation between the European Brent oil prices and day-ahead market prices is nearly not existent. Monthly futures natural gas prices are mostly positively correlated with the monthly futures power prices.

More details about the empirical case study analyses can be found on the project website:  
[www.market4res.eu/wp-content/uploads/D2.3\\_Market4RES\\_FINAL2\\_20150614.pdf](http://www.market4res.eu/wp-content/uploads/D2.3_Market4RES_FINAL2_20150614.pdf).