Discussion paper: Clean Energy Package – Does the market design reform mark the beginning of the end of the EU target model?

What of the target model for electricity that the EU's Third Energy Package introduced? What has happened – has it been implemented? abandoned? or are the reforms of electricity market design included in the Clean Energy Package (CEP) merely an extension and improvement of the target model? In this discussion paper we argue that the market design provisions of the CEP represent a strengthening of the principles embedded in the target model. However, concessions were made in the negotiations, new challenges await, and new trade-offs will have to be made. It is therefore still too early to conclude on the fate of the target model.

Introduction

In 2009, after nearly three decades of reform and discussions, the EU took a major step towards the realization of a truly integrated European electricity market by adopting the Third Energy Package. Instrumental in the efforts to integrate the various markets was the harmonization of market design provisions aimed at establishing efficient cross-border trade by creating common marketplaces and trading rules. Although not strictly defined, the 'target model' served as a template for the internal electricity market provisions in the package.

The market design was further reformed with the adoption of the Clean Energy Package (CEP) in 2019. However, there is no mention of the *target model* in the CEP communication. What happened? Is the target model dead and buried?

That question is relevant for research in the REMAP project, where we seek to explain changes in market design by examining market developments and policy processes in the implementation phase of the Third Package.

The REMAP project aims to describe, identify and explain deviations from the target model, including specific market design choices in Germany, Great Britain and Sweden. We focus on the following main design features:

- Framework for generation from renewable sources (RES)
  - the design of RES support schemes – the extent to which they are market-based, technology-neutral, etc.
  - other RES provisions, such as priority dispatch, balancing responsibility, and curtailment
- Policies and regulations applying to interconnectors and trade
- Capacity remuneration schemes
- Bidding zones and congestion management

Market design

The overarching objective of the internal electricity market is to create a pan-European market with closer integration of power markets, to ensure efficient use of energy resources across the EU/EEA area. In this regard, a 'target model' emerged as a common reference for power-market design in relation to the Third Energy Package. Earlier liberalization of European power markets had been implemented without a common market-design approach, resulting in a host of different market designs (Hancher, 1997)[1]. This diversity did not cater for a market environment that could promote cross-border trade.

The target model served as an informal reference model for the development of a truly integrated Internal Electricity Market (IEM) (Glachant, 2016).[2] Based on and within the framework of this

[1] Hancher, L. (1997): Slow and not so sure: Europe's long march to electricity market liberalization. *The Electricity Journal*, vol 10(9), pp 92-101.

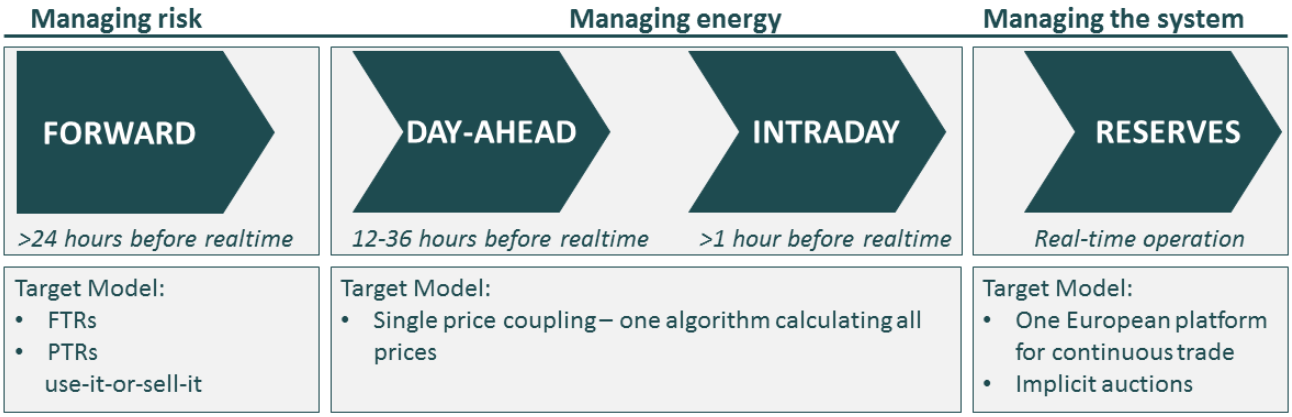
[2] Glachant, J.-M. (2016): The Long March towards an EU Power Target Model (1.0)...and the Journey towards a 2030 Target Model (2.0). Florence School of Regulation, Energy, *Policy Briefs,* 2016/06, Electricity.

reference model, processes emerged for aligning and standardizing a range of market-design features across the Member States, such as product definitions, gate closure times, and capacity allocation principles, with the aim of removing barriers to efficient cross-border trade.

System planning

The physical exchange of power takes place in real-time, where generation must always equal consumption. As a practical approximation, trades leading up to real-time, i.e. in the day-ahead and intraday markets, are made on an hourly or half-hourly basis.

Figure 1 Overview of the target model



The target model builds on three main elements:

- Main reference prices are set in competitive wholesale markets (Day-Ahead: DAM) according to the bids and offers made by market participants
- Markets are coupled and trade determined according to differences in DAM prices
- Gaps between the DAM solution and the real-time situation are closed by activating reserves and balancing energy in Intraday (IDM) and Balancing (BM) markets

One implication of these principles is that generators' revenues will depend primarily on the energy supplied, which is why the market design according to the target model is also known as 'energy-only'. Further, it is implicitly assumed that wholesale prices will adequately represent the merit order and thus provide a sufficient basis for efficient trade.

The EU target model

Figure 1 shows the relationship between the various market timeframes in a stylized energy-only market according to the European target model.[3]

The target model serves both market efficiency purposes through interrelated price formation in different timeframes, and the transmission system operators' (TSOs) need to plan for secure real-time operation.

The day-ahead market plays a pivotal role in both long- and short-term planning in the power market. In short-term (daily) planning, the DAM solution is the basis for the TSO planning of system operation and congestion management, and the need for reserves and balancing energy. This need for balancing resources stems from two sources of deviations:

- deviations within the hour (or half-hour)
- deviations due to forecasting errors and outages of generation plants, industry plants and grid elements

Imbalances and deviations which occur during real-time operation must be handled by the TSOs, which in turn means that the TSOs must have access to reserves, i.e. generation or consumption that can change operation on short notice. The costs associated with the reservation and activation of reserves in balancing markets are borne by the market participants who are responsible for the imbalances.

Intraday trades, i.e. those taking place between the day-ahead gate closure and real-time, enable market participants to update plans and reduce real-time imbalance costs. Liquid intraday markets provide possibilities for more efficient balancing: they allow for more accurate matching of supply with demand closer to the time of delivery. Further, intraday trade does not require the same response times as balancing resources.

[3] FTR = Financial Transmission Right, PTR = Physical Transmission Right

Efficient price formation

From a welfare economic perspective, the key role of the market design is to provide efficient price signals to generators and consumers, which in turn can incentivize efficient trade-offs in short-term operations and market behaviour, as well as in long-term investment decisions.

The idea – and ideal – of the target model is for trade and resulting prices in the various timeframes to cater for efficient utilization of generation capacity and demand-side resources with different characteristics. Provision of flexibility and reliable capacity is rewarded in the day-ahead market through scarcity pricing, for its ability to adapt within different timeframes in the intraday market, and for rapid responses in the balancing markets. The cost of flexibility is expected to increase as one moves closer to real-time and the shorter the notification time becomes, due to the varying technical constraints of flexibility providers.

Thus, resources requiring long notification times and slow ramping can offer flexibility services in the intraday or day-ahead timeframe, whereas resources with fast reaction times should be utilized in the balancing timeframe. If the price is higher in the intraday timeframe than the expected remuneration in the balancing timeframe, the most flexible resources would be offered in the intraday market – with prices in the two markets converging and the price differences reflecting the availability and cost of resources with differing flexibility characteristics.

The provision of market prices based on marginal costs should also provide locational price signals, forming the basis for efficient congestion management and trade between different areas. To manage bottlenecks in internal as well as cross-border interconnectors, market prices should be adjusted so that prices in surplus areas are reduced and prices in deficit areas increased, until the resultant trade is feasible within the transmission capacity between the areas. Thus, market prices should also reveal the marginal value of increasing the transmission capacity and inform efficient grid development. Further, different area prices would signal the short- and long-term value of demand and supply within the areas – stimulating increased demand and reduced supply in surplus areas, and reduced demand and increased supply in deficit areas.

Is the target model suitable for renewables?

In parallel with its provisions for an efficient internal energy market, the Third Energy Package adopted targets aimed at increasing the share of renewables-based generation.

However, the target model has been criticized for being ill-suited for renewable generation capacity. Keay (2013)[4] argues that the target model is not appropriate for a system which needs large investments in renewable generation capacity. Glachant (2016)[5] points out that the target model is designed with reference to a system dominated by CCGT gas generation and thus not necessarily well-suited for a system dominated by intermittent renewables-based generation.

According to Glachant, two important questions emerge related to these shortcomings:

- How to submit renewable generation to the same market discipline as other generation technologies
- How to ensure capacity adequacy based on market-based investments in the future

The first question implies that investment in and operation of RES generation is incentivized by subsidies and priority provisions and not in line with the principles of the target model, while the second questions the ability of the target model to incentivize market-based capacity investments in a system dominated by intermittent RES generation. Both questions call for changes in market design. Thus, the market design should be adapted to the changes in system characteristics resulting from the increase in RES generation, and in particular to the expected increase in imbalances. While renewable generators should be exposed to market conditions, they should also have the opportunity to manage imbalances due to weather-induced forecast errors in the intraday timeframe and to offer flexibility in intraday as well as balancing markets, at competitive prices.

In order to increase the availability of flexibility and keep the total cost of imbalances down, demand should similarly be able to participate and respond to market prices. Scarcity pricing and price fluctuations, plus demand for intraday and balancing resources, should stimulate and reward efficient demand response as well.

Shortcomings in market design leading up to the Clean Energy Package

A 2016 study[6] of the efficiency of market design features in the EU Member States, as part of the Impact Assessment of market design reform options for the CEP, concluded that market functioning should be improved, in order for the market to remain the main driver for investments, and to reduce invasive interventions in the market such as capacity remuneration mechanisms. It was feared that such intervention could introduce additional market distortions and further undermine market-based investment incentives.

[4] Keay, M. (2013): The EU "target model" for electricity markets: fit for purpose? Oxford Energy Comment.
[5] See footnote 2.
[6] Tennbakk, B., A. von Schemde and D. Six (2016): Electricity Market Functioning: Current Distortions, and How to Model Their Removal. *European Commission, EUR 2016.1213 EN*

The transition from systems dominated by large and relatively flexible conventional generation capacity to intermittent small-scale (distributed) renewable energy sources revealed market distortions that impeded the functioning of the internal market. Different design features acted as barriers to trade, and different support schemes and priority access for renewables-based generation capacity distorted efficient price formation.

Such distortions included:

- In DAM, different price caps, possibility of negative prices, shadow auctions, barriers to demand-side participation; varying RES support scheme designs, support levels and exposure to market prices; varying practices regarding bidding zone delimitation, curtailment, ATC calculation and coordination
- In IDM, limited cross-border trade, low liquidity, gate closure, price caps, interference from TSOs
- In BM, barriers to participation, varying technical requirements, varying procurement practices, often involuntary curtailment without transparent and standard procedures
- Additionally, capacity mechanisms with varying designs, different G-tariffs, hedging opportunities and retail price regulations

Status of market design in the REMAP focus countries

As to the status of market design in the REMAP focus countries, we offer the following observations:

More market-based RES support schemes

Although RES support schemes are not yet fully market-compatible, there has been clear movement towards more market-based RES support in the focus countries:

- In Germany, fixed feed-in tariffs were replaced by feed-in premiums and RES capacity auctions following the reform of the EEG in 2012, with the aim of creating stronger exposure to market prices.
- In Great Britain, RES generation is subsidized according to Contracts for Differences, introduced in 2015–2016, according to which low-carbon generation receives a subsidy equal to the difference between the market price and a strike price, where the latter is determined in technology-specific auctions.
- Sweden introduced a green certificate scheme already in 2003, with a fully market-based and technology-neutral feed-in premium for RES generation. The scheme has been extended several times and was expanded with the inclusion of Norway in 2012.

Mixed policies towards interconnection and trade

The picture is mixed when it comes to policies directly concerning efficient trade and the use of interconnectors:

- Germany is closely connected to the neighbouring countries, but has had several disputes concerning the calculation of net transmission capacity (NTC) made available for cross-border trade: as with Poland and the Czech Republic over loop-flows, and with Denmark over reductions in trade to avoid wind power curtailment.
- Great Britain has increased its interconnector capacity and trade with neighbouring countries substantially, and trade is apparently seen as important for a safe, cost-efficient transition of the electricity sector.
- Sweden has since the 1990s been a fully integrated part of the Nordic electricity market, where trade has been based on price differences. Sweden has been involved in disputes over NTC values, specifically with Denmark, but the issue was largely resolved with the introduction of bidding zones in 2011.

All apply capacity remuneration schemes

All three countries have introduced and gained approval for capacity remuneration schemes, in contradiction to the energy-only concept of the target model:

- Germany has established a security contingency reserve for lignite plants and a strategic reserve whereby providers receive capacity remuneration according to the results of a pay-as-cleared auction, including demand-side participation.
- Great Britain has implemented a market-wide capacity market in which all capacity is remunerated according to a pay-as-clear auction.
- Sweden has a strategic reserve which is in principle temporary but has been extended several times.

Bidding zones and congestion management differ

Whereas Germany fiercely resisted pressure to introduce bidding zones, Sweden introduced them in 2011 (and seems to have lived happily with them since), and Great Britain has managed to keep to one bidding zone without particular controversy thus far.

Overall impression: Convergence, but important differences

Several reforms in the Member States indicate a movement towards more market-based principles and application of the target model. However, we find market-design adaptations spurred by climate-policy considerations and obligations, and to some extent by EU 'pressure' (as with bidding zones in Sweden). Our overview of some core market-design features evolving in the Member States shows the variation in how issues have been addressed and solved. Further, the Member States appear less inclined to embrace the target model when its core principles clash with national interests, in particular with security-of-supply considerations.

The market design reform in the Clean Energy package

In the Clean Energy Package, electricity market design is addressed by the Electricity Market Directive and the Electricity Market Regulation. In addition, some relevant market design issues are included in the Renewable Energy Directive.

The proposals from the Commission give the clear impression that the basic elements of the target model still guide the development of European electricity market design, which can be seen in provisions such as:

- Renewable energy should be exposed to market conditions on a level playing-field with conventional generation, with priority dispatch limited to a few minor exceptions and RES generators made responsible for settling any imbalance relative to their scheduled output
- RES support schemes are to be market-based and phased out once the technologies are mature
- Capacity mechanisms should be used only as a last resort; needs assessment should be based on a common methodology, be open to cross-border participation, and be temporary
- Increased focus on cross-border trade – in different timeframes – and on strengthening the incentives for investing in interconnector capacity

The reforms are clearly an attempt to make the day-ahead market more efficient, especially as regards cross-border trade. Moreover, the focus on the efficiency of intraday and balancing markets has increased in order to enable market-based accommodation of the growing share of renewable generation capacity, while also improving the incentives for cost-efficient dispatch and investments.

Is the target model still relevant?

As noted in the introduction, the target model is no longer mentioned as reference for the market-design reforms put forward in the CEP. Does that mean that the target model is dead and buried? That depends on how we interpret the target model: as a set of guiding principles, or as a blueprint for market design.

If the target model is seen as a 'loose' framework model based on the three main elements mentioned above, then some of the weaknesses noted here have less to do with the principles embedded in the target model, and more to do with details of market-design features such as product definitions and market sequence, curtailment rules, access to intraday markets and the organization of balancing markets. However, other features, such as capacity mechanisms, are clearly not part of the target model, and could be regarded as contrary to the main concepts of that model.

Thus, understood as an 'informal' reference for the market design, i.e. as a set of guiding principles for the European electricity market, the target model still seems to be alive and well. It could be argued that the CEP reform and market-design developments in the three countries examined here indicate a strengthening of principles embedded in the model. There are signs that the energy-only principle is receding as capacity remuneration in different forms is implemented – but can capacity remuneration exist alongside the target model without compromising the creation of a truly integrated internal electricity market in Europe?

Market design requires trade-offs, and solutions that are suitable for a system dominated by coal, gas and nuclear are not adequate for the future system that will be dominated by RES generation. To achieve efficient operation and investments in a RES-dominated system, the market design must be developed to cater for new modes of providing flexibility, including demand-side participation. The transformed system will face different security-of-supply challenges; power generation and flexibility services will have to be provided by more distributed resources and vast investments will be needed in grid capacity, within and across system areas. Issues related to the distribution of costs and benefits among Member States are likely to become more pronounced, and will have to be tackled by developing new policies. With the trade-offs that will follow in the wake of these developments, the question arises: to what extent will energy-based cross-border trade and exchange capacity be prioritized in competition with increasing system operation costs and system-security challenges?

Important questions remain: Will the basic energy-only market design be able to deal with and develop an electricity system dominated by intermittent, renewable energy, where end-users play an active part? Can the right trade-offs be found within the target model in the future – or will it be scrapped completely in the next rounds of electricity market reform?

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