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Research Report

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Suggested Citation: Brunekreeft, Gert (2015) : Empirics of Intraday and Real-time Markets in Europe: The Netherlands, DIW - Deutsches Institut für Wirtschaftsforschung, Berlin

This Version is available at:

<https://hdl.handle.net/10419/111268>

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Empirics of Intraday and Real-time Markets in Europe: The Netherlands

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May 29, 2015

1. Intraday and Real-time Markets in the Netherlands

1.1. General

In line with neighbouring countries, the Netherlands knows the usual dual structure: energy trading is a non-exclusive commercial market activity and system power balancing is an exclusive mandate for the TSO, TenneT in Arnhem. The main energy markets are APX in Amsterdam and ICE ENDEX; APX covers day-ahead and intraday market. ICE ENDEX covers mostly futures and forwards. TenneT is responsible for the balancing market and for reserve capacity procurement. In overview in figure 1 below:

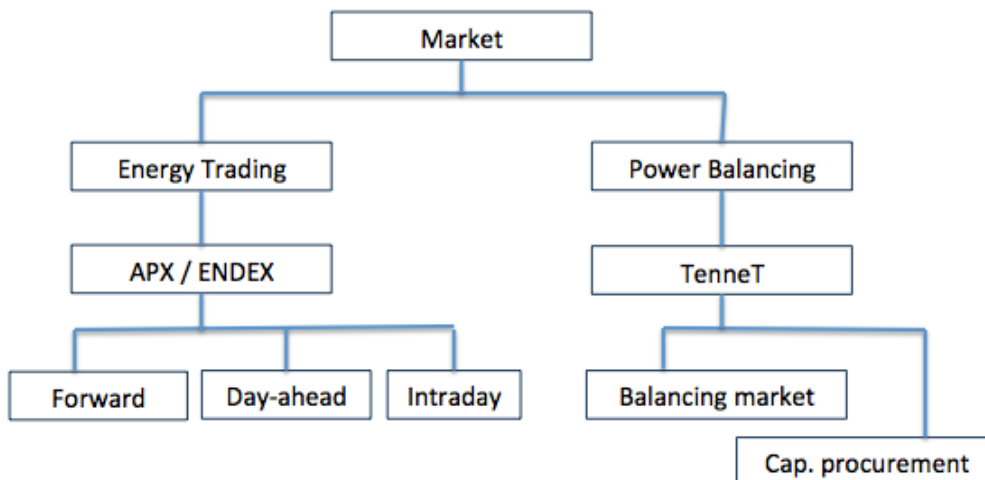


Figure 1: The market in the Netherlands in overview.

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1.2. Intraday

The intraday market in the Netherlands was started in September 2006 and is managed and operated by APX in Amsterdam. The following features of the intraday market (taken mainly from the APX website: <https://www.apxgroup.com/trading-clearing/continuous-markets-intraday/>):

- It is coupled to the Belpex Continuous intraday market in Belgium and the Nord Pool Spot intraday markets in the Nordic region and OTC to Germany.
- Products in hourly intervals as well as freely definable block orders up to 5 minutes prior to delivery.
- The minimum price is -99,999.90 €/MWh and the maximum price: 99,999.90 €/MWh. In contrast, the limits on the day ahead market are -3,000 €/MWh and +3,000 €/MWh.
- APX is the central counterparty to all trades; all contracts are traded anonymously, then cleared and settled on behalf of members.
- All trades will be notified to the Dutch Power grid operator TenneT BV by double-sided nominations, to be sent by APX and the trading member.

Moreover, ex-post nominations for zonal trade till 10:00 the next day are allowed (NMA (now called ACM), 2012); for x-zonal trade ex-ante nominations are required.

The rules of the intraday market are not really debated currently. It seems, however, that the intraday market has not developed its full potential yet. Liquidity appears to be relatively low. ACM (2014, p. 31) suggests that the number of transactions on the intraday was very low till 2012, but has been increasing quite strongly since 2012. It is still low, however. Figure 2 below indicates trading volumes on the intraday markets in Netherlands and Germany; clearly, even after correcting for market size, the volume in the Netherlands is low. Two remarks are in place. First, the figures below do not include OTC transactions. Second, in contrast to Germany, the Dutch TSO TenneT does not trade with renewables. TenneT (2014, p. 31) suggest that intraday prices in the Netherlands are not always representative due to the lack of liquidity on the market.

Comparison of German and Dutch intraday prices and volumes

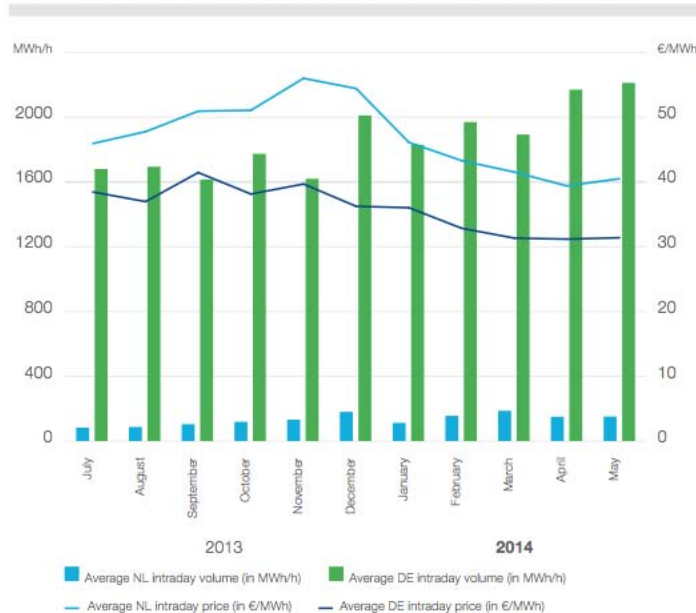


Figure 2: Comparison of German and Dutch intraday prices and volumes, Source: TenneT, 2014, p. 28.

The following figure compares day-ahead and intraday prices with TenneT's imbalance prices.

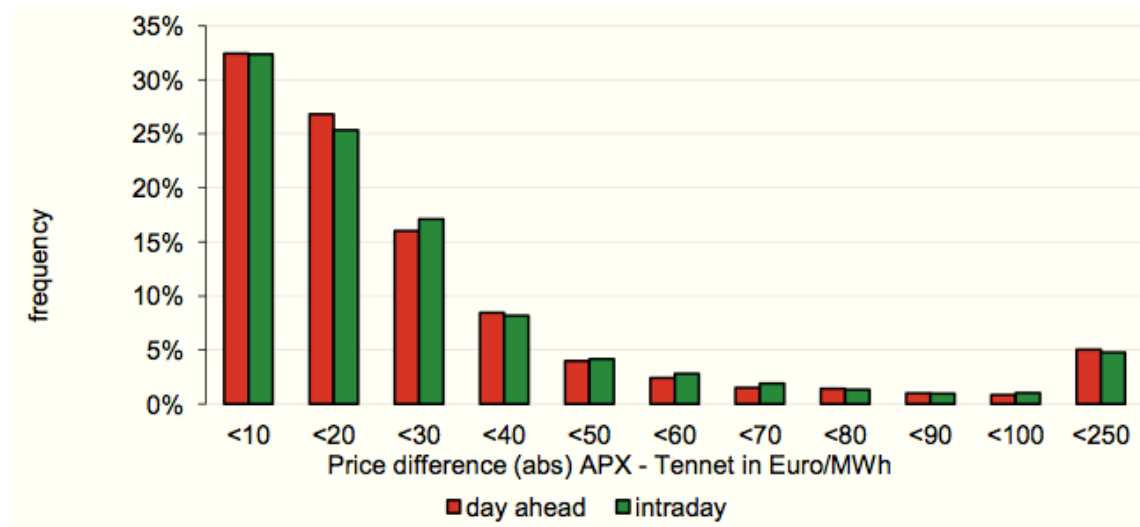


Figure 3: Difference of day-ahead and intraday prices versus TenneT's (NL) balancing price.

Source: ACM, 2014, p. 36.

Figure 3 makes two suggestions. First, at least on average, day-ahead and intraday prices do not differ strongly, and second, differences with TenneT's balancing prices can be substantial and large price differences occur actually quite frequently. On the one hand, this may be the result of different bidding time frames; balancing market is 15 minutes, whereas intraday is more fine-tuned. On the other hand, this may suggest that the intraday market does not function that well yet. To make a definite conclusion would require a more detailed analysis though. Yet, as we will see below, perhaps the intraday market is not that important in the Netherlands, as the balancing market seems to work very well; if the balancing responsible party (BRP) can manage financial risks of imbalance on the balancing market, there is no real need to do the same on the intraday market.

1.3. Balancing markets: rules and incentives for BRPs.

The balancing market in the Netherlands, as developed and operated by TenneT, can best be characterized by three main features:

- First, the imbalance price is a *marginal* price for upward and downward reserves; the marginal price is precisely the energy price of the marginal bid in the settlement period. This is irrespective of secondary or tertiary control.
- Second, in addition to the marginal price there is an "incentive component"; basically this could be seen as a penalty for deviations on top of the marginal price. The level of the incentive component is determined by TenneT each year by means of a predetermined algorithm; basically, the incentive component gets higher if the severity of system imbalances increases beyond some predetermined level. Since a couple of years, the incentive component is set at 0.00 €/MWh.
- Third, transparent "near-real-time" information of total system imbalance and imbalance prices, with a granularity of one minute.

The settlement period is 15 minutes. The BRPs deliver its trade position for all settlements periods of 15 minutes for the next day to TenneT. These can be changed (for x-zonal trading) up until 1 hour before actualization. For zonal trading ex-post nominations are allowed.

The costs for capacity payments for reserve capacity are socialized into network tariffs, and for energy payments are passed through to the BRPs (cf. Pront and Buist, 2014, p. 18 ff.).

Following straightforward incentives under marginal pricing, there is a strong and clear correlation between the imbalance price and imbalance volume, indicated in figure 4:

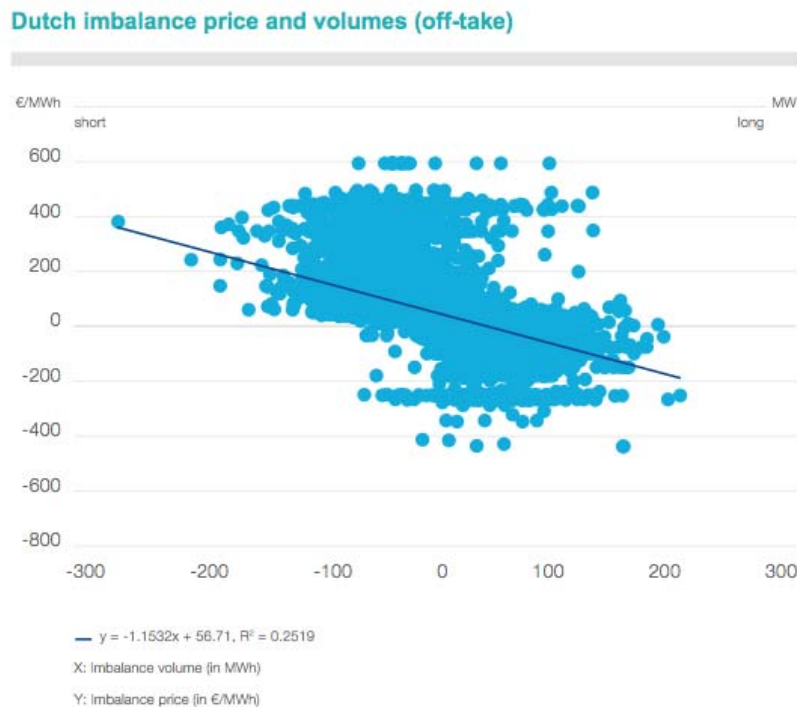


Figure 4: Imbalance price and volume (offtake) in The Netherlands

Source: Tennet, 2014, p. 37.

The system aims to exploit the potential for market response. A system with transparent real-time information of marginal prices sets incentives for BRPs to re-balance the system instead of their own trade position. In the Netherlands, under these incentives, BRPs have an incentive to deviate from their own trade position, which by mechanism re-balances the overall system. How does this work?

Assume that the system is short and assume a BRP being long. Assume that the imbalance price is positive; also assume that the imbalance price is relatively high, precisely because it is the marginal price. As the imbalance price is positive and high, it is likely profitable for a BRP to increase feed-in or reduce take-off, thus making itself even longer and thereby it makes the overall system longer (i.e. less short). This is profitable if the marginal price of the system is higher than the marginal cost of the BRP; by mechanism, we would expect this to be the case as a rule. Other cases can easily be constructed, giving similar incentives. The following incentives prevail:

- The BRP has an incentive to use its imbalance strategically and while doing so it rebalances the overall system; basically, it pays to go against the flow.

- The BRP does not necessarily have an incentive to stay close to its own trade position.

Note that this does not require the use of penalties for imbalances; in fact, these would achieve the opposite, as they would set incentives to close the BRP's own imbalance. This is why the incentive component in The Netherlands is set at zero. Note also that for BRPs, which cannot process real-time information, keeping a balanced portfolio will be a good risk-averse strategy. Lastly, note that this way a BRP can actually manage imbalance risks at the balancing market; the two markets, balancing and intraday, are clearly complements to some extent; which of the two would be preferred by a BRP depends on relative well-functioning of the markets, price volatility and risk-averseness.

There is a specific feature, which is somewhat problematic. As TenneT (2014, p. 31) notes "If during a single imbalance settlement period of 15 minutes the TSO needs to regulate both upwards and downwards to maintain the power balance in the system, there will be two separate imbalance prices: one for infeed and one for off-take."

Why is this? By mechanism design, a settlement period of 15 minutes would have only one imbalance price. If the imbalance in one period changes from positive to negative (or the other way around), for one of these imbalances, the imbalance price would be wrong and would set the wrong incentives. In fact, everything would go the other way around and the system would destabilize. To repair this, TenneT introduces two different prices in such cases: one for feed-in and one for off-take, which basically works as a system of penalties. The price for positive imbalance (being long) is based on the marginal price for downward regulating energy (which is relatively low), the price for negative imbalance (being short) on the marginal price of upward regulating energy (which is relatively high). Under these prices, the BRPs have an incentive to stay close to their trade position, which repairs the perverse incentives mentioned above.

We note that transparent real-time information to the BRPs is key; otherwise incentives and actions can go into the wrong direction and increase system imbalance.

1.4. Balancing reserves procurement

The other side of the imbalance market is capacity procurement by TenneT in order to regulate the system. We concentrate on the three types of reserve capacities: primary (PRC), secondary (SRC) and tertiary (TRC) reserves. Detailed description and analysis can be found in eg. Laurisch (2014) and Frontier Economics (2011).

Primary reserve capacity (PRC) used to be a mandatory unpaid service and was not auctioned; the rule was that all units larger than 5 MW had to provide reserve of 1% of capacity for PRC (cf. Frontier Economics, 2011, p. 13). This has been changed since 2014. Now PRC is voluntary. It is tendered on the German reserve platform, jointly with Switzerland and Austria (Laurisch, 2014, p. 26); 30% of capacity must come from the Netherlands, or put differently, up to 70% can come from the common platform. PRC is only rewarded a capacity payment and no energy payment.

Secondary reserve capacity (SRC) is the key reserve market in the Netherlands and is genuine balancing capacity. Participation is voluntary (see Frontier Economics, 2011, p. 15). TenneT tenders publicly for capacity; capacity payments according to pay-as-bid principle follow from the winning bids. Once contracted, all contracted units larger 60 MW must make a daily energy bid for SR energy

price ladder.² If scheduled, the units receive an energy price based on the marginal balancing energy price. In addition to the mandatory bidders (i.e. those contracted by TenneT), who do receive a capacity payment, other bidders can participate voluntarily: the “energy-only” market. These do not receive a capacity payment, as they are not contracted; they only receive the energy payment.³

The capacity prices with the capacity providers are not published; the number of participating parties is small and the information is sensitive as publication might affect bidding. However, since 2014 TenneT is obliged to publish an average capacity price (Laurisch, 2014, p. 29).

Tertiary reserve capacity (TRC) is considered emergency capacity and is less important as a market.

The following table provides an overview of the market rules; the table is taken (but adjusted) from tables in Laurisch (2014, p. 26, 28 and 32):

	PRC	SRC	TRC
Procurement	Tender (since 2014)	- Public tender - Once contracted, mandatory bids for energy	Sealed bid auction
Pricing rule	Pay-as-bid	C: pay-as-bid E: marginal pricing	C: pay-as-bid E: marginal pricing
Auction period	Week	C: year E: 1 PTU (5 PTUs in advance for free bids)	C: year E: 1 PTU (5 PTUs in advance for free bids)
Product	One product: base; symmetric	C. symmetric base product E: 1 PTU (15 mins)	C. base product; only pos. CR (negative to be introduced shortly) E: 1 PTU (15 mins); only pos. CR
Capacity payment	Yes	Yes (if contracted) No (if energy-only)	Yes No (if energy-only)
Energy Payment	No	Yes	Yes
Minimum bid	1 MW	4 MW	20 MW (4 MW for free bids)
Approx. market size	±110 MW	±300 MW	+300 MW

Table 1: Overview of the rules of the balancing capacity procurement in The Netherlands

Source: adapted from Laurisch (2014), Frontier Economics (2011) and TenneT.

² This is a bit awkward; how can mandatory bidding be secured, as a bidder could bid prohibitively high to avoid being scheduled?

³ There is an interesting issue here, which deserve closer academic examination. Is energy bidding for parties that are contracted („capacity plus energy“) and “energy-only” parties symmetrical? In other words, does the fact of being contracted and receiving a capacity payment affect strategic bidding for energy?

2. Envisaged developments

Overall, the system seems to work well and market parties seem to be quite satisfied. There are no obvious big points of debate currently. Small points for future change may nevertheless be considered.

- Current balancing is network wide; there is no local balancing. Currently, there simply is no need for local congestion management because the network constraints are not very severe. In case of insufficient grid capacity, this may change in the future. Pront and Buist (2014) suggest that local congestion management may be a future issue.
- Cross-border harmonization is certainly an ongoing issue. Cross-border balancing requires detailed harmonization. One of the issues to be settled is the duration of the settlement period. In the Netherlands this is 15 minutes, which works well. Harmonization with neighbouring countries may as yet be poor; a detailed comparison between the Netherlands and Germany in Laurisch (2014) suggests that a lot of work needs to be done.
- Pront and Buist (2014) raise the interesting issue whether balancing markets/trade should be subject to financial regulation.
- A detailed question is how to deal with the “within-settlement problem”, as explained above, where TenneT makes two imbalance prices to control possibly perverse incentives if both upward and downward control are used within one settlement period. This may be a good correction, but it is a bit artificial. Perhaps there is a more elegant way to deal with the problem.
- Lastly, Frontier Economics (2011) steps in detail into the auction rules for the bidding procedures. For example, there is a question how to organize the scoring rules efficiently (i.e. how to select the winning reserve units). For instance, Brunekreeft et.al. (2013) show that different scoring rules do have an effect on bidding incentives and outcomes. However, the degree of detail would be beyond the scope of this chapter.

3. Short summary and conclusions

Overall it may be concluded that so far the overall system in the Netherlands works well. The intraday market does not seem to function entirely satisfactorily yet; the traded volumes and liquidity are considered relatively low. However, this may be related to the perception that the balancing market works well. At least to some extent, the intraday market and balancing market are complements. The balancing market, as operated by TenneT, has two key features:

- It relies on *marginal* energy pricing.
- It relies on transparent, near-real-time information.

The intention of this system is twofold:

- Efficient price signals
- Improve market response

A system with transparent real-time information of marginal prices sets incentives for BRPs to re-balance the system instead of their own trade position. In the Netherlands, under these incentives, BRPs have an incentive to deviate from their own trade position, which by mechanism re-balances the overall system.

The main important next step would be to examine compatibility with systems abroad in case of market coupling, and if not, in which direction harmonization of rules should go.

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