NEMOs – efficient competition and efficient market coupling

Report to

The Norwegian Water Resources and Energy Directorate

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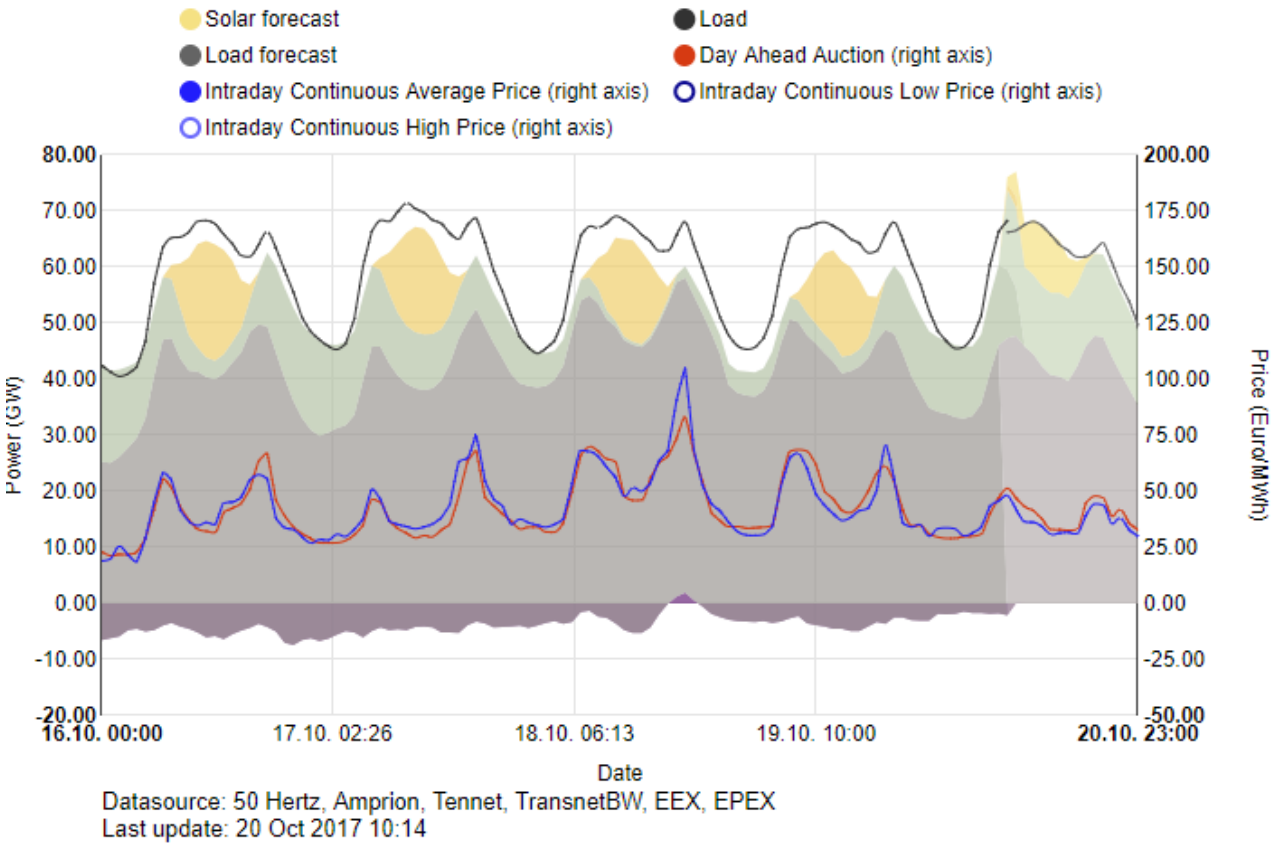

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Objective:

The objective of this study is to analyse to which extent the CACM regulation provides for real and efficient competition between NEMOs.

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EXECUTIVE SUMMARY

In our report, we first compare the governance rules for power exchanges with the more general governance rules for financial exchanges. There are several similarities in these rules, but also some important differences, e.g. when it comes to the authority of regulators and financial requirements to exchanges. Financial regulators have more extensive powers, and may revoke licences on short notice if they are sufficiently concerned about the performance of a financial exchange. The financial requirements applicable for power exchanges seem lighter than those for financial exchanges.

We find that the MCO cooperation creates a platform for the exchange of information between NEMOs and potentially also collusion affecting the competition between power exchanges. The MCO functions have monopolistic attributes. An alternative route to effective competition between power exchanges would be to separate the MCO functions from NEMOs. This requires amendments to the CACM-regulation, as the Regulation currently treats the NEMOs as vertically integrated companies. It would also require careful attention as to how to regulate a MCO monopoly, in particular regarding ownership, quality, costs, as well as transparent and non-discriminatory access to the services provided. If the MCO functions are organised within a separate organisation, the power exchanges may compete on the market for power exchange services on parameters like access to customers, trading fees, services, quality, etc. A practical model could be to require TSOs to set up a joint company responsible for the MCO, and in turn subject that entity to particular rules guaranteeing transparent and non-discriminatory access to the services.

The current requirement on NEMOs to organise the MCO functions jointly also establishes a significant barrier to entry. Entering the market for power exchanges is already quite complicated before we consider the MCO functions. There is a market for MCO services, but exchanges considering to buy the services rather than organising them internally are facing an oligopolistic market with two large plus a few other potential players.

Markets within a bidding zone are outside CACM governance. There are such markets for the intraday timeframe in several of the largest bidding zones. A big bidding zone can mean that the needed critical liquidity is already existing within the bidding zone even if there is no possibility for cross-border matching. This gives asymmetric conditions for competition between NEMOs with big bidding zone(s) as their home market and NEMOs with small bidding zone(s) as their home market. NEMOs operating local markets (outside CACM) thus have incentives to resist attempts to divide large bidding zones into smaller ones in case of internal structural congestions.

Another problem arises if local intraday markets result in a demand for explicit allocation of transmission capacities in the intraday timeframe. Explicit allocation of transmission capacities in the intraday timeframe will tend to benefit relatively large market participants and counteract the efforts to create a level playing field among market participants. We recommend therefore that the current opening in CACM for explicit auctions in intraday timeframes is changed to be quite restrictive.

The current absence of detailed rules regarding clearing and settlement in CACM opens for different models and means that more detailed rules must be developed by NRAs and most of all in different agreements between NEMOs. The "Preferred Shipping Agent model" seems to imply that central counter parties (CCPs) would need to clear with other CCPs based on the rules of the other CCP. The consequence of such an implementation is that a CCP with high clearing fees is favoured in relation to a CCP with low clearing fees. An incentive is thus given to all CCPs to try to increase their clearing fees. This contrasts with a well-functioning market and the CACM ambitions to create a level playing field among NEMOs. If the MCO tasks are separated from the NEMOs and organised as a MCO monopoly, it

seems very advantageous to include calculation of scheduled exchanges and settlements in the MCO monopoly. In such a case, a NEMO will have no trade settlements with other NEMOs – only with the MCO.

The importance of fast and reliable calculation of the market coupling can hardly be overestimated. It is of utmost importance to maintain trust in the price formation in the short-term markets. We find it important that NRAs perform a thorough assessment of appropriate deadlines for initiating fallback procedures. The deadlines must reflect how dependent market participants are on reliable day-ahead prices. We also find it important that a coming update of the CACM regulation requires establishment of fallback procedures that result in day-ahead prices based on as extensive market coupling as possible in situations where full market coupling is not possible.

This leaves us with four major recommendations:

1. Assess the alternative regime that the MCO functions are organised within a separate organisation. Such a model seems likely to mitigate both anti-competitive features of the current approach as well as its embedded barriers to entry and cost disadvantages.
2. Address the issue of local markets and their potential negative impact on competition among NEMOs as well as pressure towards explicit allocation. The current opening in CACM for explicit auctions in intraday timeframes should be changed to be quite restrictive
3. The "Preferred Shipping Agent model" seems to give central counter parties an incentive to try to increase their clearing fees. This contrasts with a well-functioning market and the CACM ambitions to create a level playing field among NEMOs. If the MCO tasks are separated from the NEMOs and organised as a MCO monopoly it seems very advantageous to include calculation of scheduled exchanges and settlements in the MCO monopoly.
4. A coming update of the CACM regulation should require establishment of fallback procedures that result in day-ahead prices based on as extensive market coupling as possible in situations where full market coupling is not possible. The deadlines must reflect how dependent market participants are on reliable day-ahead prices.

1 INTRODUCTION

An aim of Commission Regulation 2015/1222 establishing a guideline on capacity allocation and congestion management (CACM) is to ensure an efficient single day ahead- and intraday coupling of power markets throughout Europe. Single day ahead and intraday coupling refers to processes where all collected orders are matched and cross-border capacity is allocated simultaneously for different bidding zones. To ensure both an efficient price discovery process and efficient allocation, different tasks must be performed. CACM divides these essential tasks between a market coupling operator function (MCO) and a nominated electricity market operator function (NEMO). The MCO responsibility is to match orders and to ensure an optimal allocation of cross-border interconnector capacity for the day-ahead and for the intraday market across all bidding zones, while the NEMO function provides the interface between the MCO function and the market participants. The vision is that both the MCO function and the NEMO function should be performed by nominated electricity market operators (NEMOs).

The Norwegian Water Resources and Energy Directorate (NVE) has commissioned DNV GL to analyse to which extent the CACM regulation provides for real and efficient competition between NEMOs. Key questions in the request for tender are:

- Does CACM create a level playing field for NEMOs?
- What are the consequences of requiring NEMOs to co-operate for provision of MCO functions?
    - Could alternative arrangements potentially work?
- CACM regulates cross-border exchange, while some intra-day trades are strictly and purely internal in one bidding zone. Some NEMOs only offer services within one bidding zone. How does this impact competition?
- Are the governance rules, from CACM as well as from other regulations, sufficient and efficient?

The request for tender covers a broad spectre of issues. DNV GL has therefore chosen to include Professor Erling Hjelmeng, University of Oslo, and Björn Hagman, Hagman Energy, in the project team.

In section 2 we provide an overview of current governance rules for financial exchanges and the governance rules for power exchanges. Issues aimed at ensuring efficient competition between NEMOs are analysed and discussed in section 3.

An overview of current NEMOs is enclosed in Appendix 1. Appendix 2 provides a brief explanation of the common algorithm applied in the day-ahead market coupling.

2 CURRENT GOVERNANCE RULES FOR POWER EXCHANGES

The EU member countries have designated in total seventeen NEMOs organising day-ahead and intraday coupling. Nine of the countries have defined NEMO as national monopoly, with one NEMO each (except Spain and Portugal, which both have designated OMIE). For the remaining countries, there is a total of nine potentially competing NEMOs. However, there is only two countries (Austria and Poland) with three competing NEMOs. In nine countries, there are two NEMOs designated or operating with passport rights. Typically, nearly all of the day-ahead trade in these countries is with only one of the two available NEMOs. In seven of the countries that have opted for competing NEMOs, there is currently only one designated NEMO (and none with passport rights). The two largest exchanges, EPEX Spot and Nord Pool, have a market share of approximately 1/3 of the total European exchange trade for the day-ahead and intraday timeframe each. An overview of the seventeen NEMOs is enclosed in Appendix 1.

Some of the NEMOs also organise forward markets. These NEMOs are governed by CACM for their NEMO business and by financial legislation for their forward market business.

The EEX Group has divided the markets between different group companies. EEX Power Derivatives organises forward markets and EPEX SPOT organises day-ahead and intraday markets. However, the group company European Commodity Clearing (ECC) organises the clearing for both the forward markets and the day-ahead and intraday markets. Nasdaq OMX acquired in 2008 the power derivatives business from the Nord Pool Group and today, Nord Pool organises no forward markets.

As a starting point for our analysis, in section 2.1 we shortly describe the governance rules in CACM for NEMOs. We focus on rules regarding the role of NEMOs, the designation of NEMOs and the monitoring of the MCO function. In section 2.2 we describe the governance rules for financial exchanges. We focus on the authorisation of financial exchanges and the monitoring of financial exchanges. It can be concluded that CACM in many ways is more light-handed in its rules than the rules for financial exchanges. There is no legal basis for fast suspension or withdrawal of a designation as a NEMO. This is in sharp contrast to the governance prescribed for financial exchanges.

One reason for the stricter regulation of financial exchanges is that they are of system-critical importance. However, it is also of system-critical importance that power exchanges organising day-ahead or intraday trading will not fail. The consequences of a failure can be as severe as the consequences of a failure of a financial exchange. One billion euros are traded each week in the day-ahead market.

2.1 Governance rules in CACM for power exchanges

2.1.1 Role of NEMOs

CACM defines 'nominated electricity market operator (**NEMO**)' as an entity designated by the competent authority to perform tasks related to single day-ahead or single intraday coupling (article 2(23)). In addition, a 'market coupling operator (**MCO**) function' is defined as the task of matching orders from the day-ahead and intraday markets for different bidding zones and simultaneously allocating cross-zonal capacities (article 2(30)).

NEMOs shall carry out MCO functions jointly with other NEMOs (article 7(2)). These functions shall include:

- Developing and maintaining the algorithms, systems and procedures for single day-ahead coupling and for single intraday coupling.

- Processing input data on cross-zonal capacity and allocation constraints provided by coordinated capacity calculators.
- Operating the single day-ahead coupling and the single intraday coupling algorithm.
- Validating and sending single day-ahead coupling and single intraday coupling results to the NEMOs.

Cooperation between NEMOs shall be strictly limited to what is necessary for the efficient and secure design, implementation and operation of single day-ahead and intraday coupling. The joint performance of MCO functions shall be based on the principle of non-discrimination and ensure that no NEMO can benefit from unjustified economic advantages through participation in MCO functions (article 7(4)).

NEMOs shall act as market operators in national or regional markets to perform in cooperation with TSOs single day-ahead and intraday coupling (article 7(1)). Each NEMO shall verify that the single day-ahead coupling results have been calculated in accordance with the orders and each NEMO shall inform market participants of the execution status of their orders without unjustifiable delay. As soon as intraday coupling orders are matched, each NEMO shall publish for relevant market participants at least the status of execution of orders and prices per trade.

TSOs and NEMOs shall jointly organise the day-to-day management of the single day-ahead and intraday coupling (article 10). They shall meet regularly to discuss and decide on day-to-day operational issues.

NEMOs shall act as central counter parties for **clearing and settlement** of the exchange of energy resulting from single day-ahead and intraday coupling (article 7). Central counter parties shall act as counter party to each other for the exchange of energy between bidding zones with regard to the financial rights and obligations arising from these energy exchanges (article 68). Central counter parties shall ensure that collected congestion incomes are transferred to the TSOs. Each central counter party shall maintain anonymity between market participants.

TSOs in **bidding zones with more than one NEMO shall develop a proposal for necessary arrangements** for such bidding zones to ensure that the relevant NEMOs provide the necessary data and financial coverage for such arrangements (article 45 (DA) and article 57 (ID)). These arrangements must allow additional NEMOs to join these arrangements.

Each TSO, in coordination with all the other TSOs in the capacity calculation region, shall develop a proposal for robust and timely **fall-back procedures** to ensure efficient, transparent and non-discriminatory capacity allocation in the event that the single day-ahead coupling process is unable to produce results (article 44).

2.1.2 Designation of NEMOs

Article 4 in CACM includes rules regarding NEMOs designation. Each member state shall ensure that at least one NEMO is designated in each bidding zone on its territory. NEMOs shall be designated for an initial term of four years.

The designating authority shall assess whether NEMO applicants meet the NEMO designation criteria. Those criteria shall apply regardless of whether one or more NEMOs are appointed. When deciding upon NEMO designations, any discrimination between applicants, notably between non-domestic and domestic applicants, shall be avoided. NEMO designations shall only be refused where the designation criteria in article 6 are not met.

A NEMO designated in one member state shall have the right to offer day-ahead and intraday trading services with delivery in another member state. It must notify the designating authority of another member state if it proposes to perform single day-ahead or intraday coupling in that member state two months before commencing operation.

The NEMO designation criteria are given in article 6. An applicant shall only be designated as a NEMO if it complies with all of the following requirements:

a) it has contracted or contracts adequate resources for common, coordinated and compliant operation of single day-ahead coupling and/or single intraday coupling, including the resources necessary to fulfil the NEMO functions, financial resources, the necessary information technology, technical infrastructure and operational procedures or it shall provide proof that it is able to make these resources available within a reasonable preparatory period before taking up its tasks in accordance with article 7;

b) it shall be able to ensure that market participants have open access to information regarding the NEMO tasks in accordance with article 7;

c) it shall be cost-efficient with respect to single day-ahead and intraday coupling and shall in their internal accounting keep separate accounts for MCO functions and other activities in order to prevent cross-subsidisation;

d) it shall have an adequate level of business separation from other market participants;

e) if designated as a national legal monopoly for day-ahead and intraday trading services in a Member State, it shall not use the fees in article 5(1) to finance its day-ahead or intraday activities in a Member State other than the one where these fees are collected;

f) it shall be able to treat all market participants in a non-discriminatory way;

g) it shall have appropriate market surveillance arrangements in place;

h) it shall have in place appropriate transparency and confidentiality agreements with market participants and the TSOs;

i) it shall be able to provide the necessary clearing and settlement services:

j) it shall be able to put in place the necessary communication systems and routines for coordinating with the TSOs of the Member State.

The designation criteria shall be applied in such a way that competition between NEMOs is organised in a fair and non-discriminatory manner (article 6(2)).

2.1.3 Monitoring of NEMOs and the MCO function

The designating authorities shall monitor and ensure compliance with CACM by all NEMOs offering day-ahead and intraday trading services within their member state, regardless of where the NEMOs were designated (article 4(5)). The authorities in charge of NEMO designation, monitoring and enforcement shall exchange all information necessary for an efficient supervision of NEMO activities.

The member state where the NEMO has been designated shall ensure that **designation is revoked if** the NEMO fails to maintain compliance with the designation criteria and is **not able to restore compliance within six months of being notified of such failure** by the designating authority (article 4(8)).

If a designating authority of a member state finds that a NEMO active but not designated in its country fails to maintain compliance with the designation criteria with respect to its activities in this country, it must notify the NEMO of its non-compliance (article 4 (9)). If the NEMO does not restore compliance within three months of being notified, the designating authority can suspend the right to offer intraday and day-ahead trading services in this member state until such time as the NEMO restores compliance.

The entity or entities performing the MCO functions shall be monitored by the regulatory authorities or relevant authorities of the territory where they are located (article 82). Other regulatory authorities or relevant authorities and ACER shall contribute to the monitoring where adequate. The regulatory authorities or relevant authorities primarily responsible for monitoring a NEMO and the MCO function shall fully cooperate and shall provide access to information for other regulatory authorities and ACER in order to ensure proper monitoring of single day-ahead and intraday coupling.

2.2 Governance rules for financial exchanges

Rules for markets in financial instruments are given in the Markets in Financial Instruments Directive (MiFID). 'Financial instrument' is defined as those instruments specified in Section C of Annex I to MiFID. The list includes commodity derivatives. Markets for electricity derivatives are thus covered by MiFID.

MiFID was decided in 2004 and implemented in 2007 when it replaced the Investment Services Directive (ISD). MiFID is transposed into national laws. More detailed regulations are issued by competent authorities, such as regulations governing investment services and activities, and regulations governing operations of trading venues.

MiFID has been substantially amended several times. A new updated directive (MiFID II) was approved in 2014. MiFID II includes fewer exemptions and expands the scope of the original MiFID to cover a larger group of companies and financial products. The Regulation on Markets in Financial Instruments (MiFIR) was decided at the same time as MiFID II. The European Market Infrastructure Regulation (EMIR) was decided in 2012.

Many of the obligations under MiFID II are further specified in regulatory and implementing technical standards developed by the European Securities and Markets Authority (ESMA). MiFID II is transposed into national laws and regulations which enter into force on 3 January 2018.

One purpose with MiFID II was expressed in point 4 of the preamble to the directive:

> *"The financial crisis has exposed weaknesses in the functioning and in the transparency of financial markets. The evolution of financial markets has exposed the need to strengthen the framework for the regulation of markets in financial instruments, including where trading in such markets takes place over-the-counter (OTC), in order to increase transparency, better protect investors, reinforce confidence, address unregulated areas, and ensure that supervisors are granted adequate powers to fulfil their tasks."*

The scope of financial instruments is extended in MiFID II to include physically settled energy contracts traded on an organised trading facility (OTF), except for those already regulated under Regulation (EU) No 1227/2011 on wholesale energy market integrity and transparency (REMIT). The new definition includes e.g. auctions of and secondary markets in physical emission allowances. The exception to the new definition includes day-ahead and intraday trading in electricity since such trading is within the scope of REMIT. Markets for day-ahead and intraday trading will thus continue to be outside the scope of MiFID/MiFID II.

2.2.1 Authorisation of exchanges

Authorisation as a regulated market under MiFID II shall be granted only where the competent authority is satisfied that both the market operator and the systems of the regulated market comply at least with the requirements laid down in the directive (article 44 in MiFID II). The operator of the regulated market shall provide all information, including a programme of operations setting out inter alia the types of business envisaged and the organisational structure, necessary to enable the competent authority to satisfy itself that the regulated market has established all the necessary arrangements to meet its obligations.

Authorisation shall be refused if the competent authority is not satisfied that the members of the **management body** of the market operator are of sufficiently good repute, possess sufficient knowledge, skills and experience and commit sufficient time to perform their functions, or if there are objective and demonstrable grounds for believing that the management body of the market operator may pose a threat to its effective, sound and prudent management and to the adequate consideration of the integrity of the market (article 45 in MiFID II). The overall composition of the management body shall reflect an adequately broad range of experience.

The competent authority shall be provided with information regarding the **ownership** of the market operator, and in particular, the identity and scale of interests of any parties in a position to exercise significant influence over the management. The persons who are in a position to exercise, directly or indirectly, significant influence over the management of the regulated market shall be suitable (article 46 in MiFID II).

The regulated market shall have arrangements to identify clearly and manage the potential adverse consequences, for the operation of the regulated market or for its members or participants, of any **conflict of interest** between the interest of the regulated market, its owners or its market operator and the sound functioning of the regulated market, and in particular where such conflicts of interest might prove prejudicial to the accomplishment of any functions delegated to the regulated market (article 47 in MiFID II). It shall be adequately **equipped to manage the risks to which it is exposed**, to implement appropriate arrangements and systems to identify all significant risks to its operation, and to put in place effective measures to mitigate those risks. It shall have arrangements for the sound management of the technical operations of the system, including the establishment of effective contingency arrangements to cope with risks of system disruptions. It shall have available sufficient financial resources to facilitate its orderly functioning, having regard to the nature and extent of the transactions concluded on the market and the range and degree of the risks to which it is exposed.

ESMA shall develop draft regulatory technical standards further specifying the requirements to ensure trading systems of regulated markets are resilient and have adequate capacity (article 48 in MiFID II).

2.2.2 Monitoring of exchanges

Competent authorities shall monitor that regulated markets **comply at all times with the conditions for initial authorisation** (article 44 in MiFID II).

It shall be ensured that the management body monitors and periodically assesses the effectiveness of the market operator's governance arrangements and takes appropriate steps to address any deficiencies (article 45 in MiFID II). The market operator is required to notify the competent authority of the identity of all members of its management body and of any changes to its membership. Changes in the management body have to be approved by the authority.

The market operator shall inform the competent authority of and to make public any transfer of ownership which gives rise to a change in the identity of the persons exercising significant influence over the operation of the regulated market. The competent authority shall refuse to approve proposed changes to the controlling interests of the regulated market and/or the market operator where there are objective and demonstrable grounds for believing that they would pose a threat to the sound and prudent management of the regulated market (article 46 in MiFID II).

The exchange shall have, on an ongoing basis, sufficient financial resources to facilitate its orderly functioning, having regard to the nature and extent of the transactions concluded on the market and the range and degree of the risks to which it is exposed (article 47 in MiFID II).

Competent **authorities shall be given all supervisory powers, including investigatory powers and powers to impose remedies, necessary to fulfil their duties** (article 69 in MiFID II). They shall have access to any document or other data in any form which the competent authority considers could be relevant for the performance of its duties. They have the power to require or demand the provision of information from any person and if necessary to summon and question a person with a view to obtaining information and they can carry out on-site inspections or investigations. They have the power to require the freezing or the sequestration of assets and require the temporary prohibition of professional activity. They also have the power to require the removal of a person from the management board.

Member States shall lay down rules on and ensure that their competent authorities **may impose administrative sanctions and measures applicable to all infringements** of the directive and the national provisions adopted in the implementation of the directive (article 70 in MiFID II). Such sanctions and measures shall be effective, proportionate and dissuasive. The competent authorities shall in some infringement cases have the power to impose withdrawal or suspension of the authorisation of an institution.

3 ENSURING EFFICIENT COMPETITION BETWEEN NEMOS

Competition will generally stimulate efficient and effective performance of suppliers, even in the market for such services as exchanges and market places. However, this general result relies on some key assumptions, such as the economic properties of the tasks in question, existing market participants and existence of barriers to entry. The prime example of a market where competition is not considered as a useful regulatory approach, is the market for electricity network services, which has obvious monopolistic attributes and is therefore regarded as a natural monopoly.

In this section, we explore the market for power exchanges for the day-ahead and intraday timeframe as regulated in the CACM. In section 3.1, we analyse the economic properties of MCO functions, and conclude that these have monopolistic properties. Requiring NEMOs to cooperate for MCO functions can tend to reduce the competitive pressure and provide a platform for cooperation beyond what is absolutely necessary with respect to the MCO functions. As the basic regulatory principle to stimulate efficient organisation of power trade is competing power exchanges, it is important to avoid potential causes for reduced competitive pressure. Separating the MCO functions into a separate organisation as discussed in section 3.2 therefore seems as an attractive alternative model which should be assed further.

In section 3.3 we discuss the barriers to entry. In section 3.4 we identify problems related to the current regulation of clearing and settlement, in particular concerning the relations between competing NEMOs. The fact that competing NEMOs must use a common algorithm also have implications for innovation and product development. In section 3.5 we explain why this is a further motivation for separating the MCO functions from the NEMOs. The NEMO hierarchy and cooperation is described in more detail in section 3.6.

Markets within a bidding zone are outside CACM governance. The consequences from this are analysed in section 3.7. The CACM regulation presumes some sort of performance based regulation of NEMOs. In section 3.8 we elaborate on ideas for how to measure performance of MCO and NEMO functions. Although not directly related to competition among NEMOs, we discuss the importance of proper fallback procedures if the market coupling fails, see section 3.9.

3.1 The current setup facilitates anti-competitive behaviour

The sketch below illustrates the work stream pertaining to day-ahead market coupling. The work stream for intra-day market coupling is not significantly different, and the discussion below cover both timeframes (unless otherwise is explained directly). The boxes to the left in the sketch indicate whether the tasks listed are NEMO or MCO functions. The roles of market participants and TSOs are important but not carefully illustrated in this sketch. The letters in parentheses after the various explanations refer to art. 6.1.3.1 of the MCO Plan.

The MCO tasks are performed by collecting grid information from TSOs and then applying an algorithm which matches market orders while taking the available cross-border capacity into account. The result of this clearing process is planned power flows on cross-border interconnectors for a given time frame, and corresponding prices and net positions.

Gathering network information and allocating transmission capacity in a centralised procedure is a necessary condition to achieve optimal capacity allocation across the concerned bidding zones. The process of allocating cross-border capacities has monopolistic attributes; it would be impossible to achieve optimal allocation with parallel (and competing) processes.

This evidences the difference between MCO and power exchange services. While the latter are competitive, the MCO services are not. As well, for the time being, there is no separate market for MCO services, as these are currently provided in-house by a few vertically integrated companies designated as NEMOs. The NEMOs also cooperate with regard to provide MCO services.

The MCO cooperation creates a platform for the exchange of information and potentially also collusion affecting the power exchange services (see also section 3.5 about the necessity of cooperation). It is recalled that the market sharing agreement in the Power Exchanges case (regarding non-competitive behaviour by EPEX and Nord Pool) arose in the context of legitimate cooperation on a technical level.[1]

In the Commission's decision on Power Exchanges, the close connection between the activities carried out by NEMOs was described as follows:

1 Case AT.39952 – Power Exchanges, paras. 25.

"The infringement concerns services provided by power exchanges to facilitate trading of spot electricity products (hereinafter referred to as "spot electricity trading services"). Such trading services include services to facilitate the actual trading itself (that is running a power exchange), the management of the implicit allocation of cross-border interconnection capacities through market coupling, and services to third parties for the development and operation of spot electricity trading.

The services to facilitate the actual trading itself consist of three core functions: (i) the collection of buy and sell orders; (ii) the matching of those orders to determine the most efficient transactions between buy and sell orders; and (iii) the financial and physical execution of the trades.

The management of the implicit allocation of cross-border spot interconnection capacities through market coupling consists in allocating capacities between buyers and sellers according to buy and sell orders, on the one hand, and the size of the available interconnection capacities, on the other hand.

The services to third parties for the development and operation of spot electricity trading include, among other things, the licensing of a trading system, providing know-how, running market operations on behalf of another power exchange, training and market coupling services."[2]

In that case, the Commission found that Nord Pool Spot and EPEX had infringed TFEU Article 101 (Treaty on the Functioning of the European Union) by entering into a market sharing agreement, under which the parties were to respect each other's "home markets". The agreement covered "all the spot trading services of the parties".[3]

Consequently, the current system facilitates anti-competitive behaviour; as well it establishes barriers to enter the market (see section 3.3). Although the Power Exchanges case demonstrated that TFEU Article 101 applies to anti-competitive agreements in the market for power exchange services, the vertical integration of MCO and power exchange services in combination with the need to cooperate on the MCO level increases the risk for anti-competitive conduct. This may in turn jeopardize the effective enforcement of competition law.

For these reasons, there are considerable short-comings under the current competition law regime with regard to promoting effective competition in the market for power exchange services. This is partly due to the structure of the market and the need for market coupling functions, partly to the CACM regulation as it requires vertical integration and cooperation with regard to the MCO functions.

3.2 Monopolistic attributes call for a different approach

While the monopolistic attributes are clearly recognised in the CACM regulation, it appears as if the conclusion is not drawn completely. Instead, by requiring competing NEMOs to cooperate in solving the monopolistic tasks, a risk of weakening the competitive pressure for the contestable tasks is created.

Thus, an alternative regime for introducing effective competition between power exchanges would be to separate the MCO functions from NEMOs. This requires amendments to the CACM regulation, as it currently treats the NEMOs as vertically integrated companies. It would also require careful attention as to how to regulate a MCO monopoly.

2 Case AT.39952 – Power Exchanges, paras. 4-7.

3 Case AT.39952 – Power Exchanges, paras. 29.

Once the MCO functions are separated, as indicated above, the power exchanges may compete on the market for power exchange services. The MCO functions will preferably be carried out by one dedicated undertaking. As such, MCO functions may be regarded as a natural monopoly, and should be subject to regulation pertaining to access, ownership, quality, costs, etc.

Application of the general abuse prohibition in TFEU 102 will not be sufficiently comprehensive or detailed to fulfil that function, and specific regulation is needed.[4] As well, whoever is designated as a provider of the MCO services, it will be necessary to introduce a "hard" separation, at least as a requirement of organisational independence from power exchange activities. A "soft" separation in terms of for example Chinese walls/separate accounts would in our view not be sufficient to avoid potential competition concerns.

Such regulatory issues are currently not addressed under the CACM, since that Regulation presupposes that the operations are carried out by several undertakings in parallel and based on rotation.

However, a clear benefit with the current organisation of the MCO tasks (i.e. within NEMOs) is the arrangements for hot and warm backup for these tasks, see section 3.6 for further details. The importance of fast and reliable calculation of the market coupling can hardly be overestimated. Setting up a separate MCO company should not come at the expense of 'security of supply' of market prices and capacity allocations. A cost efficient way of achieving a comparable level of operational stability and resilience must therefore be developed if this alternative is chosen.

3.2.1 Application of competition rules under an alternative regime

A possible implementation of the alternative regime would be to require TSOs to set up a joint company responsible for the MCO, and in turn to subject that entity to particular rules guaranteeing transparent and non-discriminatory access to the services provided. This might be an attractive strategy for TSOs, as these are heavily dependent on a successful execution of the MCO tasks and spend significant resources on development of MCO functions anyway. However, it would still be necessary to ensure operational interdependence from individual TSOs to avoid complicating the task of regulating the latter and to ensure equal treatment of all market areas.

Arguably, secondary legislation can also be considered in order to enhance effective competition in the market for power exchange services. It is recalled that competitive aspects in trade with financial instruments are subject to specific secondary legislation, and similar mechanisms should be considered with regard to physical trade.

If access to MCO services on a transparent and non-discriminatory basis is ensured, power exchanges (NEMOs without MCO functions) may compete on parameters like access to customers, trading fees, services, quality, etc.[5] Competition between power exchanges will be protected by the general prohibition against anti-competitive behaviour (TFEU Article 101) and additional regulatory instruments will not be required to address such issues. Compared to the situation under the current regime, a platform conducive to anti-competitive collusion will be eliminated, and potential issues pertaining to abusive behaviour in the market for MCO operations will be sorted out under the regulatory regime. As well, mergers and acquisitions (structural changes) will be subject to the EU Merger Regulation or national merger control.

4 This experience has also been made in other sectors, for example energy and telecommunications.

5 For a recent analysis of competition between market venues see the Commission's decision in Case M.7995 DEUTSCHE BÖRSE/LONDON STOCK EXCHANGE GROUP (29/03/17).

Given the current oligopolistic structure of the market for day-ahead and intraday power exchange services, efficient competition is not an obvious and automatic result of moving the MCO functions to a separate company. There is an explicit risk of cross subsidies in several 'directions': Financial power exchanges may have an incentive to offer short term exchange services free of charge to attract customer to their financial markets and/or clearing services. Alternatively, short-term power exchanges may seek to exploit poor competition and charge excessive prices for their services. Which of these incentives are the strongest may vary geographically and over time, and neither of the results are attractive from a market or society point of view.

3.3 Barriers to entry

CACM puts several requirements on NEMOs, some of which are easily comparable with requirements on financial exchanges. Relevant examples are the requirement to have adequate financial resources, technical infrastructure and operational procedures. These implies that entering the market as a new entrant is unlikely to happen overnight. It also suggests that the most likely entrant (if any) would originate from existing exchanges (in other markets). The requirements do not seem to result in extraordinary high barriers to entry in the market for power exchange services, as compared to other exchange services.

However, the requirements concerning the MCO function seem to raise the barriers to entry to a higher level. One way to characterize the MCO related tasks is that these involve everything that is unique to the handling of multiple bidding zones (or more precisely, to use the matching of orders also for the purpose of allocating scarce transmission capacity). An important part of this task is developing and maintaining the price coupling algorithm and software. This requires highly unique competencies, not commonly involved in ordinary financial exchange operations. Previous experience from other markets than short-term electricity markets is unlikely to mitigate this barrier. This may be a prohibitive competence barrier for new entrants and even for most power exchanges previously working with only one bidding zone.

Undertakings wishing to enter the market for power exchange services either have to join the MCO cooperation by setting up an own operation of MCO functions, or to purchase this operation as a service from an incumbent NEMO (see section 3.6 for details). The market for MCO services is probably best described as an oligopoly. There are two quite large players plus a few more with potential capacity to offer MCO services.

If newcomers are trying to enter the market, refusal to grant access to such services may have anticompetitive effects. The provision of MCO services must be regarded as an essential input for power exchange companies. It is, however, unlikely that individual NEMOs may be found to hold a dominant position. Arguably, a refusal to deal may constitute an abuse of a collective dominant position. That being said, the enforcement of TFEU Article 102 is not straight-forward in such settings.[6]

As the efficiency and performance of the algorithm is of vital importance to TSOs, these tasks also require and attract significant attention from TSOs. Some of the tasks required to 'develop' MCO services are thus anyway performed by TSOs, either separately or jointly. This implies that parts of the MCO related costs are duplicated, if not tripled or more.

6 According to Richard Whish, collective dominance constitutes "one of the most complex and controversial issues in EU competition law". (Competition Law, 8th ed, p. 607).

All in all, the current organisation with respect to the MCO role seem to create significant cost and competence barriers to entry in the market for organisation of short-term power trade. This concern is a further motivation for our proposal of separating the MCO tasks from the NEMOs as described in section 3.2.

3.4 Implications for competition by clearing and settlement rules

The market coupling results in trades between bidding zones and trades between NEMOs. Settlement of trades requires both physical settlement (energy delivery) and financial settlement (transfer of money). Net positions and prices are fixed results from the single market coupling.

The physical energy delivery is performed in cross-border nominations and in the balancing plans of NEMOs or their balance responsible parties.

The financial settlement is in the opposite direction to the physical settlement. The importing NEMO sells more to market participants than it buys and the difference shall be transferred financially to exporting NEMOs and to TSOs. The financial transfer to TSOs is zero if there is equal prices in the concerned bidding zones and thus no congestion rent.

CACM does not include central settlement in the MCO functions defined in article 7(2). Instead, NEMOs are responsible for acting as central counter parties (CCPs) for clearing and settlement of the exchange of energy resulting from the market coupling (article 7(1) (g)).

CACM gives some rules regarding clearing and settlement. Special arrangements shall be developed in bidding zones where more than one NEMO is designated and/or offers trading services (articles 45 (DA) and 57 (ID)). CCPs shall act as counter party to each other for the exchange of energy between bidding zones with regards to the financial rights and obligations arising from these energy exchanges (article 68). A shipping agent may act as a counter party between different central counter parties for the exchange of energy, if the parties concerned conclude a specific agreement to that effect. All CCPs or shipping agents shall ensure that collected congestion incomes are transferred to the TSOs no later than two weeks after the date of settlement. Article 80 deals with cost sharing between NEMOs and TSOs.

Absence of detailed rules regarding clearing and settlement in CACM opens for different models and means that more detailed rules must be developed by NRAs and most of all in different agreements between NEMOs.

The chosen model in the CWE region is the so called "Preferred Shipping Agent model". This model implies that the relevant NEMOs can choose to transfer the energy across bidding zones themselves or use another shipping agent for this purpose. It is currently only described at a high level without addressing central design issues. The model seems to imply that CCPs would need to clear with other CCPs based on the rules of the other CCP. Collateral shall be placed based on the collateral requirements of the other CCP and clearing fees shall be paid based on the clearing fees of the other CCP.

The consequence of such an implementation is that a CCP with high clearing fees is favoured in relation to a CCP with low clearing fees. Unlike ordinary competitive arrangements, this arrangement does not incentivise CCPs to reduce their clearing costs. Instead, an incentive is given to all CCPs to try to increase their clearing fees. This contrasts with a well-functioning market and the CACM ambitions to create a level playing field among NEMOs. Furthermore, adding fees to energy exchanged between NEMOs/CCPs will discriminate trading between NEMOs as additional cost will be associated. Such a

situation would distort competition between NEMOs by favouring trading within NEMOs at the cost of trading between NEMOs.

If the MCO tasks are separated from the NEMOs and organised as a MCO monopoly (as discussed in section 3.2), it seems very advantageous to include calculation of scheduled exchanges and settlements in the MCO monopoly. In such a case, a NEMO will have no trade settlements with other NEMOs – only with the MCO. Congestion rents can be paid directly from the MCO to the TSOs. This also means that TSOs can communicate input and output data directly with the MCO monopoly instead of via a NEMO. The simplified reporting and settlement structure should result in extensive cost reductions compared to the costs associated with the Preferred Shipping Agent model. It will also enable a level playing field and true competition among NEMOs adding value for the market participants.

3.5 Competition implications from one common algorithm

The CACM requires that the resulting allocation should be efficient. This naturally leads the CACM to require the use of common algorithms. This implies that the matching of all orders for the same timeframe must take place in one operation. However, this requirement and the vision of 'vertically integrated' power exchanges with NEMO and MCO functions in one company, provide some challenges.

A common algorithm implies, at least when the algorithm activities are designed as an integral part of NEMOs and their MCO activities, that competing NEMOs are obliged to cooperate about the most complex tasks of their operations. While that is easily understandable from a 'solving the task efficiently'-point of view, it also puts some limitations on how competitive the NEMOs are likely to behave for the genuine NEMO functions. The necessary cooperation also provides the otherwise competing NEMOs with ample opportunities to tacit collusion and even to coordinate actions they are not supposed to discuss.

A common algorithm means that the potential reward for one NEMO to be extraordinary innovative in terms of developing order formats better suited to the demand from market participants, can be limited. Order formats are part of the algorithm design, and thus any improvements will immediately be available for all NEMOs at the same time (if implemented). Thus, there is an obvious benefit in terms of dissemination of any improvement in products (order format). On the other hand, there is a corresponding disadvantage with respect to incentives to innovate, that innovative order formats are not possible parameters for competition between NEMOs.

Similarly, a common algorithm also means that gate closure for trades as well as publication of results will be equal across NEMOs. Providing coupling results timely can thus not be a parameter for competition either.

The potential reward for other innovations and improvements within the NEMO domain (i.e. except order format and the matching of orders) are not affected by the requirement of using one algorithm. Relevant examples might be integration between market participants' individual IT-systems and the front-end for the NEMO, efficient organisation of settlements with market participants, and utilisation of collaterals.

3.6 Hierarchy in the NEMO cooperation

For NEMO decisions, a differentiation between NEMOs is given in article 9. Each NEMO shall have a number of votes equal to the number of member states where it is designated. If more than one NEMO

is designated in a member state, the member state shall allocate its vote among these NEMOs taking into account their respective volume of transacted electricity in the preceding year.

All NEMOs have developed a plan that sets out how NEMOs will jointly set up and perform the MCO functions according to CACM. The MCO plan was approved by all NRAs on 26 June 2017.

An All NEMO Committee shall be formed by the appointed representatives of each NEMO. The All NEMO Committee shall facilitate cooperation between NEMOs for all common tasks necessary for the efficient and secure design, implementation and operation of day-ahead and intraday market coupling. Day-ahead related decisions shall be taken only by NEMOs designated for day-ahead, and intraday-related decisions shall be taken only by NEMOs designated for intraday.

The roles, principles and rules related to the execution of day-ahead operational roles including the performance of day-ahead MCO function will be set in a NEMO DA Operational Agreement. There are three options for a NEMO designated for day-ahead. It can be a DA MCO Function Asset Co-owner, a DA MCO Function Asset Licensee or a Serviced NEMO. The co-owners have joint ownership to the DA MCO Function Asset. The licensees have a license providing them with the right to use the DA MCO Function Assets to perform the day-ahead MCO functions. Serviced NEMOs have delegated some of their MCO tasks to another NEMO, according to a bilateral service provision agreement.

To perform the daily operations one NEMO is appointed as coordinator and one NEMO is appointed as backup coordinator ('hot back-up'). These roles are rotated and the NEMOs playing these roles shall receive reasonable compensation from all the benefiting NEMOs. There is also a role as operator which means that other NEMOs can perform in parallel the same processes ('warm back-up'). To perform as a coordinator/backup coordinator/operator, a NEMO must be a co-owner or a licensee and satisfy specific technical requirements established by the NEMO DA Operations Committee and ratified by the All NEMO Committee in order to guarantee safe and reliable operation.

A serviced NEMO at least delegates its responsibility for real-time operational processes to its servicing NEMO. There will be no direct communication between a serviced NEMO and process operators during the market coupling sessions, other than through its servicing NEMO.

A NEMO ID Operational Agreement will include a precise set of procedures for all steps in the continuous intraday coupling process. Market participants do not connect to the shared order book directly. They enter their orders in local trading systems of NEMOs, which in turn connect to the shared order book via an interface. The validation inherently performed by the matching algorithm shall make sure that the network constraints and the matching rules are respected when matching of orders and pricing results are determined. The MCO plan describes briefly the primary systems that are part of the intraday system but is not clear about the roles in operating the system.

The hierarchy between competing and cooperating NEMOs described above give rise to various concerns. Issues related to more cooperation than absolutely necessary, doubling of costs, oligopolistic concentration in the market for MCO services, and potential barriers to entry are already described above. Transferring the MCO functions to a separate entity would reduce these problems.

3.7 Markets within a bidding zone are outside CACM governance

Markets aimed at trading within a bidding zone are outside CACM governance if no capacities between bidding zones are allocated to these markets. The MCO plan approved by all NRAs defines local intraday products as all products not set up in the intraday solution and not eligible to be matched in the intraday solution.

There are currently local intraday markets in several of the largest European bidding zones (countries). Local intraday markets within a bidding zone may also in the future be attractive to organise, especially in a big bidding zone. A big bidding zone can mean that the needed critical liquidity is already existing within the bidding zone even if there is no possibility for cross-border matching. The matching will be less costly when no MCO functions are needed.

There is no requirement for a NEMO organising a local market to share its order book with other exchanges. This means that it will be hard for other NEMOs to enter that local market and compete with the NEMO since liquidity gives liquidity. At the same time, the NEMO organising the local market will not face the liquidity barrier to entry when it enters into bidding zones with no local products. Order books to the single intraday coupling shall be shared according to CACM.

This gives asymmetric conditions for competition between NEMOs with big bidding zone(s) as their home market and NEMOs with small bidding zone(s) as their home market. Theoretically, both NEMOs can organise local markets within their original bidding zone(s), but the potential profitability of a local market is dependent on the size of the bidding zone.

Another consequence is that a NEMO with a big bidding zone as its home market gets a strong incentive to stand out against a division of the bidding zone even if there is a structural congestion within the bidding zone. Such a consequence adds to the current difficulties to implement a more appropriate bidding zone configuration in Continental Europe.

A third problem arises if local intraday markets result in a demand for explicit allocation of transmission capacities in the intraday timeframe. The general experience from current auctions of long-term transmission rights are that they are bought by larger utilities and trading companies. Retailers, industrial consumers and smaller utilities are seldom among the buyers of transmission rights. There is thus a risk that explicit allocation of transmission capacities in the intraday timeframe will tend to benefit relatively large market participants and counteract the efforts to create a level playing field among market participants. There is also a risk that day-ahead market coupling capacities will be reduced in consequence of PTRs kept for trading purposes in the intraday timeframe. Currently, only a small share of PTRs is nominated day-ahead. They are instead given to the market coupling and compensated by the day-ahead price spread.

If there is a demand for explicit allocation of transmission capacities in the intraday timeframe, it is important that the NRAs stand up for the target model and emphasise the importance of implicit allocation. We thus recommend that the opening in articles 64-67 for explicit auctions in intraday timeframes (in addition to implicit allocation) is changed to be quite restrictive.

It is also important that FTRs are chosen if LTTRs are to be auctioned between well-functioning day-ahead markets. This eliminates the risk that day-ahead market coupling capacities will be reduced in consequence of PTRs kept for trading purposes in the intraday timeframe.

3.8 How to measure performance for NEMO and MCO functions

CACM stipulates that NEMOs should be entitled to recover incurred costs, provided these are reasonable and proportionate, despite a choice of competition as a major feature of regulating the sector. This resembles the economic regulation of DSOs and TSOs, and implies that regulators are supposed to consider if all the costs of a NEMO, including those related to MCO functions, are reasonable. As with the economic regulation of DSOs and TSOs, what costs are reasonable depends on the performance/the output of the entity to be examined.

As we suggest separating the MCO functions to a separate company, performance based regulation of the MCO company is indeed a consequence. Whether it is a desirable approach towards NEMOs without MCO tasks, is less obvious.

The cost side of the equation should not pose unusual challenges for experienced regulators. Measuring the performance of NEMO and MCO functions requires careful attention. Two types of key performance indicators are time before publishing auction results and number of errors. Both can be applied to the MCO and the NEMO functions separately. Delays in reporting may be due to factors out of control for the NEMO, e.g. errors or delays in TSO parameters for the network model (relevant for the MCO function), or errors in received orders (primarily affecting the NEMO functions). Errors in e.g. settlements may also be due to factors outside the immediate control of the NEMO. On the other hand, a key success factor for a NEMO should presumably be to ensure external parties submit correct information in due time.

In addition, exchanges are commonly required to submit performance reports regularly, where deviations from 'ideal operations' are identified and examined, eventually also including analyses of the potential need for changes in routines, systems or rules.

Short-term, the electricity prices and resulting positions itself are, or should be, purely a result of the algorithm, the submitted orders and the network model. Measuring dynamic efficiency would require some sort of ex post judgement and search for better calculation results, preferably improving the ability of the algorithm to find a global optimum within reasonable time.

Note that traditional liquidity or turnover metrics are not relevant to measure how 'good', 'effective' or 'efficient' an exchange for the day-ahead and intraday horizon works. Such metrics are generally caused by market design, market structure (sizes and types of competing market participants), contracting traditions, risk preferences, etc. Also, it appears unlikely to see many competing NEMOs, or a large number of NEMOs with full in-house MCO functionality.

A fair and reasonable evaluation of a NEMO's costs and the division of costs between MCO functions and other NEMO functions is thus everything but easy.

3.9 Fallback procedures

Although not directly affected by the competitive pressure between NEMOs, the issue of fallback procedures is part of the same objective: efficient markets. We are worried CACM has not given sufficient priority to this topic. The importance of fast and reliable calculation of the market coupling can hardly be overestimated.

There is always a risk that results are not delivered within the described deadline. The results that are produced in the day-ahead coupling are status of orders and prices and net positions for each hour and bidding zone.

Article 44 in CACM deals with the establishment of fallback procedures. Each TSO, in coordination with all the other TSOs in the capacity calculation region, shall develop a proposal for robust and timely fall-back procedures to ensure efficient, transparent and non-discriminatory capacity allocation in the event that the single day-ahead coupling process is unable to produce results.

This requirement focuses on the capacity allocation within a capacity calculation region. A possible solution to this requirement is to cancel the implicit day-ahead auction and instead organise an auction of transmission rights between the bidding zones within the capacity calculation region and let the

market participants use the intraday market to trade themselves in balance. This is a very problematic approach, especially in the Nordic area.

The rise of day-ahead markets has opened for other and far more efficient buying and selling strategies from participants in the electricity market than bilateral trading. Consumers and retailers can buy their electricity in the day-ahead market and generators can sell electricity in the day-ahead market. Physical trade in the day-ahead market instead of bilateral physical contracts enables competition on equal terms and cost reductions for most participants since all participants in a bidding zone meet the same day-ahead price independent of their size. The turnover in the Nordic day-ahead market is nowadays about 90 % of the total Nordic consumption. Basic price risks are hedged by means of financial contracts with reference to the published day-ahead price.

Such market participants are thus extremely dependent on a well-functioning day-ahead market. To leave market participants on their own without day-ahead prices is not an acceptable option. Extended deadlines beyond 13:50 CET will be far better for market participants if the alternative is a cancelled day-ahead market. In addition, there is a strong need to establish fallback procedures that result in day-ahead prices based on as extensive market coupling as possible in situations where full market coupling is not possible. Otherwise, the trust in the market may be jeopardized and transparent market-based trading may be replaced by bilateral trading. A further consequence may be withdrawal from the electricity market by financial traders and potentially significantly increased hedging costs for the fundamental participants.

It should be noted in this context that it is not only problems in the MCO function that can cause delayed results. There will be a partial decoupling of the concerned bidding zones if network data are not submitted at 11:45 CET or if one power exchange has not submitted order data by 12:40 CET. Some NRAs, e.g. Ofgem, demands a second possibility to give bids if the first calculation results in a price above a defined level. In such a situation, also minor process failures may cause that results are not delivered within the described deadline.

We find it important that NRAs perform a thorough assessment of appropriate deadlines for initiating fallback procedures. The deadlines must reflect how dependent market participants are on reliable day-ahead prices.

We also find it important that a coming update of the CACM regulation requires establishment of fallback procedures that result in day-ahead prices based on as extensive market coupling as possible in situations where full market coupling is not possible. Day-ahead prices are highly important to market participants, not only to ensure efficient allocation in the day-ahead time frame, but also as reference prices for forward contracts used for hedging. The need for trust in the day-ahead market and the forward market implies that it is important that NEMOs share order books when fallback procedures eventually are triggered.

APPENDIX 1: DESIGNATED NEMOS

The seventeen designated NEMOs are the following:

BSP Regional Energy Exchange LLC (BSP)

BSP Regional Energy Exchange d.o.o (BSP is acronym for Borzen South Pool) is responsible for managing the day-ahead market in Slovenia. It was founded in 2008, and offers a day-ahead and intraday market. The day-ahead market started its operation in 2008 organized as an auction, while the intraday market was opened in 2012 with continuous trading.

The ownership to BSP is split fifty-fifty between the government owned power market operator company Borzen and Elektro-Slovenija, the Slovenian TSO. BSP is designated as NEMO in Slovenia.

Croatian Power Exchange Ltd. (CROPEX)

CROPEX is responsible for managing the day-ahead market in Croatia. It was established in May 2014 by the Croatian energy market operator and the TSO, which both holds a fifty-percentage ownership share in the company. CROPEX offers an auction based day-ahead market and a continuous trade intraday market. The intraday market was newly opened in Croatia, marking its first 100 days of operation in August 2017. COPEX is designated as NEMO in Croatia.

EirGrid plc

EirGrid is the TSO for Ireland, where it is designated as NEMO. Together with SONI, the TSO for Northern Ireland, EirGrid operate the Single Electricity Market (SEM), the wholesale electricity market for Ireland and Northern Ireland. SEMO is the SEM operator, and runs a gross mandatory pool market operating with dual currencies and in the two jurisdictions. SEMO is managed as a contractual joint venture.

Currently, SEMO is preparing I-SEM, which is acronym for The Integrated Single Electricity Market, and will facilitate market coupling with the rest of Europe.

EPEX SPOT SE

EPEX Spot is organizing a day-ahead market in eight different countries; Germany, France, the United Kingdom, Netherlands, Belgium, Austria, Switzerland and Luxembourg. These markets represent 50% of the total European consumption. During 2016, a total of 529 TWh was traded on EPEX Spot exchange making it the largest physical power exchange in Europe.

EPEX Spot was created in 2009 through a merger of the German power exchange EEX AG and the French energy exchange Powernext SA. EPEX Spot was later integrated with the APX group in 2015, merging the German and French markets, with those of Great Britain and the Benelux countries.

EPEX Spot provides a day-ahead market organized as an auction in all the eight countries in which it operates. It also offers continuous intraday trading.

It is designated as NEMO in Austria, France, Germany, Luxembourg, Switzerland, the Netherlands and the United Kingdom. EPEX Spot has been acknowledged as a „Passport NEMO" in Denmark, Finland, Poland and Sweden.

Following the introduction of a capacity mechanism in France, EPEX SPOT has set up an organized market for auctions for French capacity guarantees. The first auction was held in 2016.

The ownership of EPEX SPOT SE is split between EEX Group (51 %) and HGRT (49 %). HGRT is a holding, owned by the transmission system operators Amprion, APG, Elia, RTE, Swissgrid and Tennet.

EPEX Spot Belgium B.V. (Belpex)

In 2015, EPEX SPOT integrated its business with former APX Group, which operated the power spot markets in Belgium (through Belpex), the Netherlands and the United Kingdom. Belpex is designated as NEMO in Belgium.

EXAA Abwicklungsstelle für Energieprodukte AG

EXAA was launched in 2002 and offers a day-ahead market for Austria. The ownership of EXAA is divided between 12 shareholders, with APCS Power Clearing & Settlement AG and Wiener Börse AG as the two main shareholders with a majority ownership of the company. EXAA is a designated NEMO in Austria.

Gestore dei Mercati Energetici S.p.A. (IPEX)

Gestore dei Mercati Energetici (GME) operates the power, gas and environmental markets in Italy. The power market part of GME goes under the name IPEX, which is acronym for the Italian power exchange. This power exchange operates a forward physical market (MTE), a market for the trading of daily products (MPEG) with continuous trading mode, a day-ahead auction market (MGP), and an intraday auction market (MI) based on 5 sessions.

The Italian power exchange was established in 2000, and is designated as NEMO for the Italian power market. It is 100 % owned by the Italian company Gestore dei Servizi Energetici, which is wholly owned by the Italian ministry of economy and finance.

HUPX Hungarian Power Exchange Company Limited by Shares

HUPEX is responsible for managing the day-ahead market in Hungary. It was established in 2010, as part of the liberalization of the Hungarian power sector. It offers both a day-ahead and intraday market, together with a physical futures market. The day-ahead market is organized as an auction, while the intraday market is organized as continuous trade with 15 minute products. HUPEX is fully owned by the Hungarian government. EPEX Spot is service provider for HUPX, which is designated NEMO for Hungary.

Independent Bulgarian Energy Exchange EAD (IBEX)

IBEX is desginated as NEMO in Bulgaria. It was founded in 2014, and started operating the Bulgarian day-ahead market in January 2016. It has a service agreement with Nord Pool and a 10-year power market operation license issued by the Bulgarian energy and water regulatory commission. IBEX is owned by the Bulgarian Energy Holding AED.

LAGIE – Operator of Electricity Market S.A.

The Hellenic Electricity market operator (LAGIE) is responsible for managing the day-ahead and future market in Greece. Following the liberalization of the Greek electricity market around 2000, LAGIE was a part of the Hellenic Transmission System Operator S.A. (HTO). HTSO, following a corporate spin-off, transferred its Transmission Branch to a new company, ADMIE (the Transmission System Operator), and maintained the Market Branch.

LAGIE operates a day-ahead mandatory pool market, in which energy and ancillary services are simultaneously traded and are dispatched on the available units. It is designated as NEMO in Greece. The equity of LAIGE is fully owned by a state-owned corporation.

Nord Pool AS

Nord Pool is offering exchange services in four Nordic countries, the three Baltic countries and the UK. Nord Pool was established in 1996 as a joint Norwegian-Swedish power exchange, the world's first cross-border power exchange. It expanded to Finland in 1998 and Denmark in 2000. In 2008, the power derivatives business (forward contracting) was acquired by NASDAX OMX. Today, Nord Pool offers trading, clearing, settlement and associated services in the day-ahead and intraday markets.

During 2016, a total of 529 TWh was traded on Nord Pool and it is one of the two main power exchanges in Europe measured in yearly traded volume (TWh). Nord Pool is designated as NEMO in Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Ireland, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, Sweden, and the United Kingdom.

Nord Pool is owned by the Nordic transmission system operators Statnett SF, Svenska kraftnät, Fingrid Oy, Energinet.dk and the Baltic transmission system operators Elering, Litgrid and Augstsprieguma tikls.

OKTE a.s.

OKTE is the designated NEMO in Slovakia. It is a subsidiary (100 %) of the Slovak TSO. OKTE organize short-term cross-border trading and provides clearing of imbalances within the Slovak Republic. EPEX Spot is service provider to OKTE.

OMI-Polo Español S.A. (OMIE)

OMI-Polo Español S.A. (OMIE) is responsible for managing the day-ahead market at the Iberian Peninsula, i.e. Spain and Portugal. It was established in Spain in 1998 and later extended to cover the whole Iberian market in 2007.

OMIE offers both day-ahead and intraday market. The intraday market is organized as an auction with six trading sessions. The ownership of OMIE is split fifty-fifty between the Spanish company OMEL and the Portuguese company OMIP SGPS. OMIE is designated as a NEMO in Spain and Portugal.

Operatorul Pieţei de Energie Electrică şi de Gaze Naturale (OPCOM) SA

OPCOM is a Romanian electricity and gas market operator responsible for managing the short-term electricity market in Romania. It was established in 2000, and offers an auction based day-ahead market for electricity. OPCOM also offers a market place for forward contracts and bilateral trading of electricity. The equity share of OPCOM is wholly owned by a state-owned corporation. EPEX Spot is service provider to OPCOM, which is the designated NEMO in Romania.

OTE A.S.

The Czech electricity and gas market operator OTE is responsible for managing the day-ahead market for gas and electricity in the Czech Republic. It was founded in 2001, and started its first market operation in 2002. It organizes the short-term electricity market in a block, day-ahead and intraday market.

OTE, which is the designated NEMO for the Czech Republic, is fully owned by the Czech government, with the ministry of industry and trade trusted to exercise the shareholders right.

SONI Limited

SONI is the TSO for Northern Ireland, where it is designated as NEMO. Together with EirGrid, the TSO for Ireland, SONI operate the Single Electricity Market (SEM), the wholesale electricity market for Ireland and Northern Ireland. SEMO is the SEM operator, and runs a gross mandatory pool market operating with dual currencies and in the two jurisdictions. SEMO is managed as a contractual joint venture.

Currently, SEMO is preparing I-SEM, which is acronym for The Integrated Single Electricity Market, and will facilitate market coupling with the rest of Europe.

Towarowa Gielda Energii S.A. (TGE)

Towarowa Gielda Energii (TGE) was established in 1999, and within the first six month it launched a power exchange which enabled day-ahead trading in the Polish power market. Today, TGE is designated as a NEMO in Poland and offers trading, clearing, settlement and associated services in both day-ahead and intraday markets in Poland. It also operates a commodity forward instruments market for physical delivery of electricity in the Polish market. TGE is 100 % owned by the Warsaw Stock Exchange.

APPENDIX 2: THE COMMON DAY-AHEAD ALGORITHM

Item 4 in the preamble to the CACM mentions i.a. *"the (…) calculation process, in which all Union bids and offers, collected by power exchanges, are matched, …"*. Item 5 refers to *"a specific algorithm to match bids and offers in an optimal manner".* While it is indeed possible to calculate equilibrium prices without the use of a single, common algorithm, using a common algorithm is a prerequisite to ensure that such prices are efficient. "Efficient prices" is here synonymous to efficient utilisation of available transmission capacity (or more precisely of the transmission capacity made available to the algorithm) subject to the set of prices found or determined by the algorithm.[7] It is also possible that a common algorithm ensures efficient utilisation of generation and consumption assets[8], but that depends on the specific design of the algorithm and which order formats it supports.

The algorithm currently used in Europe is commonly known as Euphemia, which is an acronym for Pan-European Hybrid Electricity Market Integration Algorithm. Developed under the supervision of prof. Van Vyve[9], it has been applied since February 2014. It is developed to solve the (mathematical) problem associated with the coupling of the day-ahead power markets in Europe. Solving the problem implies matching all bids and offers and determine which orders are to be executed and which are to be rejected and thus which are the clearing prices, such that

- Social welfare (consumer surplus + producer surplus + congestion rent) is maximised, and
- Power flows don't exceed capacity constraints defined jointly by TSOs.

One of the challenges with applying a common algorithm, is that history, electricity market regulation, technology for power production and 'trading traditions' differs significantly across Europe. Euphemia thus had to cope with quite different order formats as well as 'electrically' motivated constraints. The latter include first and foremost the network capacity. The electrical constraints do not pose serious challenges for the algorithm. However, some of the order formats are quite challenging and causes the mathematical problem to have multiple solutions. 'Multiple solutions' means that the algorithm can find equilibrium prices, but without being able to determine if the solution is the best possible.

More specifically, the block order format transforms the mathematical problem to a non-convex one, which is not easily solved. Block bids are commonly used for sales orders, where the seller offers a specified quantity for several (specified) hours unless the average price for those hours is below his limit. This format has been quite common in North-European markets for thermal power plants with significant start- and stop-costs. Similar user requirements have previously been accommodated in the Iberian market with order types with minimum income conditions (MIC orders). One of the design criteria for Euphemia, dictated by its owners, was that both order types were to be supported.

A key feature, which is necessary to fulfil the optimality criterion in item 5 of the preamble, is the implicit allocation of transmission capacity. Within its embedded limitations, Euphemia achieves this aim as it can deal with both a traditional ATC (available transmission capacity) approach and a flow based approach.

7 If each bidding zone applied its own, unique algorithm, the resulting cross-border flow would hardly be optimal.

8 At least to the extent it is reasonable to assume market participants behave rationally and that wholesale prices are reasonably reflected in end user prices.

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