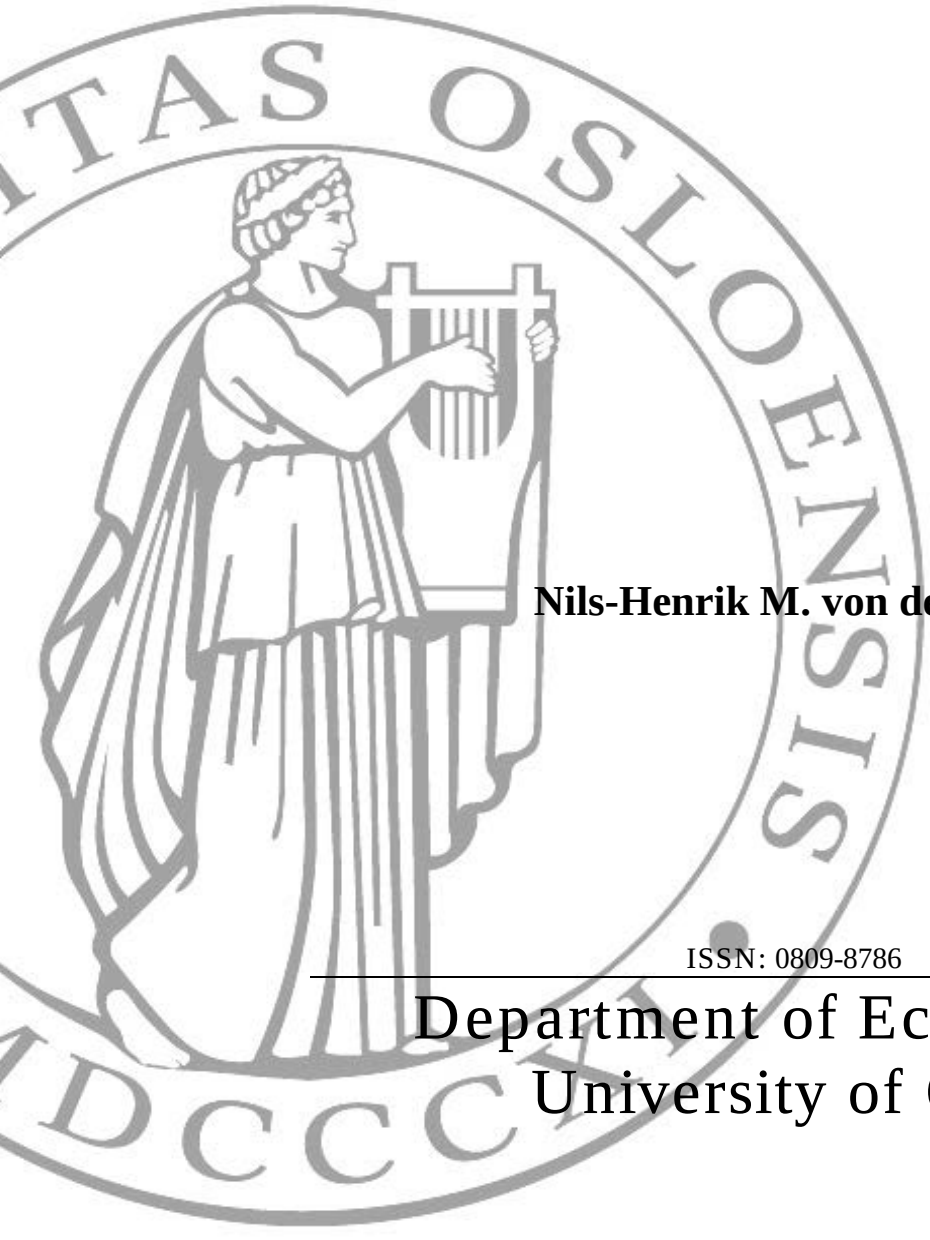
MEMORANDUM

No 13/2013

Transparency in Electricity Markets



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TRANSPARENCY IN ELECTRICITY MARKETS[1]

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UNIVERSITY OF OSLO

Memo 13/2013-v1

MAY 22, 2013

[1] This paper builds on work undertaken for Statkraft on information provision to market participants (von der Fehr, 2010) and for Statnett on transparency in electricity markets (von der Fehr, 2012). I am grateful for useful comments from Richard Green and Thomas Tangerås, as well as participants at the NEECI workshop in Oslo, the Florence School of Regulation REMIT course and a seminar at IEFE.

Abstract: The European Commission is introducing new regulations on submission and publication of data in electricity markets (SPDEM) and on wholesale energy market integrity and transparency (REMIT). I discuss issues relevant for undertaking an evaluation of such regulations. I argue that, for market performance, more information is not always better; indeed, more information may undermine market performance by facilitating behaviour that is either not cost efficient or aims at exercising market power or establishing and maintaining collusion. Moreover, ensuring rational economic behaviour and an efficient and competitive market outcome does not require general access to information at a very detailed level or with a high degree of immediacy. I conclude that to achieve the aims of efficiently functioning wholesale electricity markets, fair and non-discriminatory access to data and a coherent and consistent view of the European wholesale electricity market, it does not seem advisable to go quite so far with respect to immediacy and detail as intended by the new regulations.

Keywords: electricity, market performance, information, transparency, regulation

JEL Classification: D40, D80, K21, L10, L40, L51, L94

INTRODUCTION

The European Commission is introducing new regulations on submission and publication of data in electricity markets (SPDEM) (EU, 2013).[2] The work builds on input from the European Regulators' Group for Electricity and Gas (cf. ERGEG 2010a-f) and has been subjected to public consultation (EU, 2011c). In parallel, the Commission has adopted regulations on wholesale energy market integrity and transparency, the so-called REMIT (EU, 2011b).

Both sets of regulations are characterised by detailed requirements. For example, SPDEM mandates that *"the planned unavailability of 100 MW or more of a generation unit including changes of 100 MW or more in the planned unavailability of that generation unit, expected to last for at least one market time unit up to three years ahead... be published as soon as possible, but no later than one hour after the decision regarding the planned unavailability is made"* (EU, 2013, article 15), and that *"actual generation output (MW) per market time unit and per generation unit of 100 MW or more installed generation capacity... be published five days after the operational period"* (EU, 2013, article 16); corresponding rules apply to consumption units and transmission infrastructure. Among other requirements, REMIT mandates that *"Market participants... shall provide the Agency [i.e. ACER] with a record of wholesale energy market transactions, including orders to trade. The information reported shall include the precise identification of the wholesale energy products bought and sold, the price and quantity agreed, the dates and times of execution, the parties to the transaction and the beneficiaries of the transaction and any other relevant information"* and that *"Market participants shall provide the Agency and national regulatory authorities with information related to the capacity and use of facilities for production, storage, consumption or transmission of electricity or natural gas or related to the capacity and use of LNG facilities, including planned or unplanned unavailability of these facilities"* (EU, 2011b, article 8).

The purpose of the analysis presented in this paper is not to undertake a complete evaluation of the SPDEM and REMIT regulations (although it will probably become

[2] These were formerly known as FEDT (kfr. EU, 2012), but here I refer to them here with the acronym SPDEM.

evident that I consider these to be overly detailed, onerous and with certain elements that risk weakening, rather than strengthening, market performance); instead, the analysis aims to outline and discuss issues that would be relevant when undertaking such an evaluation.

The analysis may be summarised in five points. The first relates to the common misunderstanding that in electricity markets - and other markets for that matter - more information is always better.[3] This is wrong, for at least four reasons. Firstly, individual decision makers value information to the extent that it improves on the quality of their decisions; irrelevant information is of no value, and can indeed be detrimental to good decision making if it blurs or distorts relevant information. Secondly, requiring market participants to reveal private information may induce behaviour intended to conceal or distort this information. Thirdly, transparency may facilitate behaviour that undermines competition and leads to a market outcome characterised by monopoly or (tacit) collusion. And finally, collecting, processing and disseminating information is costly.[4]

The second point derives from the essential character of markets as mechanisms for collecting, processing and disseminating relevant information; the process of price formation aggregates information scattered among market participants and conveys its essence through market prices. An efficiently functioning market does not rely on equal access to information by all market participants; on the contrary, an efficiently functioning market provides the relevant information to participants.[5]

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[3] Cf. the statement on page 1 of ERGEG (2010c):*"The more information is disclosed about an economic activity the better."*

[4] Overgaard and Møllgaard (2008) provide a general discussion of the pros and cons of information provision in a market context, as well as references to much of the relevant literature and discussions of case studies; see also Halliday and Seabright (2001), Kühn (2001) and Møllgaard and Overgaard (2001, 2006).

[5] In SPDEM it is stated, with reference to the data requirements mandated by this regulation, that *"The availability of such data is indispensable for market participants' ability to take efficient production, consumption and trading decisions"* (EU, 2013). This is a rather strong statement, given the fact such information has typically not been available in electricity markets around the world, some of which have been performing very well. Indeed, the argument for why such information must be made available is not always easy to understand. For example, it is difficult to see why market participants *"need to be provided with detailed information on where, when and why units are not or will not be available to generate or consume and when they are expected to return in operation"*. The claim that *"In order to be able to move power from where it is available to where it is most needed and adjust portfolios accordingly, the market should be provided with information about planned and unplanned unavailability of existing cross-border transmission infrastructure and plans about infrastructure developments"* seems to run counter to the fact that power flows according to physical laws, not human decisions.

The third point is that issues related to information differ fundamentally between types of agents. In the analysis below I make a distinction between market participants, system operators and regulators. By market participants I mean buyers and sellers of electricity and derived or associated products, including consumers, generators and traders; by system operators I mean private entities or public agencies responsible for system operations, including ensuring security and quality of supply;[6] and by regulators I mean agencies responsible for over-seeing the functioning of the electricity industry, including competition authorities and financial authorities. While a clear distinction between market participants and other agents is not always drawn,[7] their information requirements tend to be rather different, and so are the issues involved in providing them with information; such a distinction therefore seems important for a meaningful analysis.

The fourth point concerns the difference between providing relevant information to market participants and avoiding that they manipulate or abuse such information. Ensuring relevant information provision mainly concerns information that should be made available to market participants, while avoiding manipulation and abuse of information mainly concerns information that should be made available to regulators (although, as will be discussed below, there is an issue of market trust also). There is consequently a fundamental difference both in the underlying rationale and the regulations required to deal with these issues.

The fifth and final point is that one should distinguish between collection and dissemination of information. These activities involve different issues and so must be considered separately. Of course, there is a close link between what information can be disseminated and what information must be collected. However, this link is not absolute; in particular, in what form and to whom information is disseminated may be different from in what form and from whom information is collected.

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[6] System operators sometimes act in the role of market participants, for example when buying or selling on balancing markets; I disregard this dimension here. Market organisers serve a parallel role to system operators, but I do not discuss them specifically.

[7] ERGEG (2010c) uses the term *"market actors"*, by which it means *"TSOs, generators, users and traders"*. In EC (2011b), *"market participant"* is defined as *"any person, including transmission system operators, who enters into transactions, including the placing of orders to trade, in one or more wholesale energy markets"*.

The paper is organised as follows. In the next section I discuss information relevant for market participants´ economic decisions and hence market performance. In the subsequent section, I discuss regulation to avoid market participants undermining market participation by manipulating information or exploiting informational advantages. The following section contain a discussion of why requiring market participants to reveal private information on the one hand, and making such information public on the other, may both undermine market performance. The last section contains a short summary and conclusions.

RELEVANT INFORMATION AND MARKET EFFICIENCY

In this section, I discuss what sort of information is relevant for rational economic behaviour of individual market participants – in the sense that it may improve upon their economic decisions. I also explain why more information is not necessarily beneficial, neither for individual market participants nor for overall market performance. In addition, I discuss information requirements for system operations and to what extent such information should be made public.

TEMPORAL SUPPLY AND DEMAND DECISIONS

In many circumstances, information about other market participants, or market conditions more generally, are irrelevant for the economic decisions of individual market participants.

Consider for example a generator who has to make supply offers to a day-ahead spot market for output from a wind park. Since variable costs of wind turbines are negligible, or at least substantially lower than typical spot-market prices, the generator will want to produce as much as possible, given prevailing wind conditions and technological constraints. The generator can achieve this by setting the offer price at nil.[8] The generator can gain nothing from information about (predicted) spot prices,

[8] If wind-based electricity generation is subject to output-related subsidies, wind generators would in fact face negative variable costs and hence would be willing to produce also when market prices fall below zero, something that may occur in markets characterised by a combination of large amounts of wind capacity and thermal capacity with considerable start-up costs. Again, the optimal pricing rule would be to bid at (negative) variable cost.

nor about the behaviour of other market participants; the generator only needs to know that the offer will be accepted whenever price is positive, which is when the generator can operate the wind park at a profit.[9]

The same is true for an owner of a solar park or a run-of-river hydro plant (i.e. with no storage facility). Indeed, also thermal generators only need information about their own production facilities in order to make economically rational short-run production decisions. Unlike wind, solar and hydro, thermal generation normally incurs substantial variable costs, in the form of fuel expenses. However, as long as generators are allowed to make bids that reflect the underlying costs structure, generators can ensure that units are despatched only when market prices are such that all costs are covered and hence operations are profitable.

Matters are more complicated if the market does not allow generators to make bids that fully reflect their underlying cost structure, including quasi-fixed costs such as start-up and ramping costs. This would be the case in an energy-based spot market where block bids are not allowed. In such a case, a thermal generator has to base its offer for any given hour (or half-hour) on expectation about its output pattern over the relevant period, which will determine how it can recover quasi-fixed costs. In order to do so, the generator does not need to know actual demand and supply patterns, only market prices; knowing market prices over the relevant period allows the generator to tailor its bids so as to obtain an output pattern that ensures cost coverage. Since in most electricity markets day-ahead prices can be forecasted with a very high level of accuracy, generators are typically able to plan their operations rationally.

Access to price information is also all that is required for efficient behaviour on the demand side of the market, including for consumers with access to alternative energy sources. Consumers need to know prices in order to make economically rational decisions about how much electricity to consume at any given point in time, and as long as they know these, they do not need to know the underlying process of price formation.

[9] I disregard considerations of market power here; below, I explain how a generator with market power may gain from information about market conditions, a potential argument for restricting access to such information.

More generally, the assumption of "perfect information" in the economic theory of perfect competition refers to prices, not to technology, tastes or other underlying characteristics of supply and demand. Indeed, it is a common misunderstanding that well-functioning markets requires omniscient participants;[10] perfect competition only requires that market participants are informed about prices (cf. Overgaard and Møllgaard, 2008, p. 4).

INTERTEMPORAL DECISIONS

Unlike run-of-river hydro generators – and wind, solar and thermal generators – hydro generators with storage capacity cannot base their decisions on current prices alone; they need to know future prices also. The cost to a hydro generator of producing at any given point in time is the foregone future revenues that would obtain if the water was kept in storage instead. Therefore, for hydro generators with storage capacity costs depend on future electricity prices and hence short-run supply decisions cannot be based solely on knowledge about the characteristics of own production facilities.

A similar situation faces all generators when it comes to decisions about when to close down in order to do maintenance, repair and upgrading of existing plants. Ideally, a generator would want to stop production in periods when foregone earnings are the smallest, taking into consideration that such stoppages must occur at certain intervals (as well as restrictions resulting from systems operations or regulatory requirements). In order to make economically rational decisions about planned outages, generators need to know how prices develop over time.

Also decisions about investment (and disinvestment), whether on the demand or the supply side of the market, are based on how prices develop over time. Similarly, entry into, and exit from, the market will be based on (average) prices over the planning horizon.

[10] Cf. the statement in ERGEG (2010c, p. 1) that *"Also in economic theory, one of the characteristics assigned to perfect competition assumes perfect information being available to buyers and sellers of a commodity"*.

More generally, decisions that concern timing – or has an intertemporal dimension – requires information about future, as well as current, prices. Medium-term decisions – such as decisions on planned outages – will to a large extent be based on observed pricing cycles, which in electricity markets tend to be quite pronounced, over the day, over the week and over seasons. Moreover, price information may be gathered from markets for futures or forwards, which allow trading of electricity at future dates. Longer-term decisions on investment and entry and exit will be based on information from long-term contractual markets.

Again, in order to make informed decisions market participants need to know prices, not the underlying process of price formation. At least, this is the case if markets exist and function well.

THE VALUE OF ADDITIONAL INFORMATION

Above, it was argued that what market participants need in order to make informed decisions is information about prices, not how prices are formed. Clearly, this requires that information about prices exists at the time when decisions have to be made; if this is not the case, information about the underlying process of price formation may be required in order to forecast prices.

In the spot, or day-ahead, market, price formation follows a well-known pattern and depends, first and foremost, on time of day, day of week, season and external conditions such as the weather. In addition, certain idiosyncratic events, such as the unavailability of a large generation or consumption unit, may affect prices. Therefore, in addition to publicly available information, such as weather forecasts and current prices, market participants only need access to information about major events, such as planned outages of large plants, in order to make precise forecasts of day-ahead prices.[11]

[11] Price forecasting is more difficult under certain market conditions, especially when the market is tight, since then relatively small changes in demand and/or supply may result in large changes in prices; in such events, more detailed information, especially about capacity availability, may be required in order to make precise price forecasts.

In the longer term, the most readily available – and presumably most reliable – information about future prices are prices in future or forward markets.[12] If such markets do not exist, prices forecasts will have to rely on information on market fundamentals, such as demand growth, new investment and the like.

Price forecasting generally involves processing forecasts of market fundamentals with the help of some – implicit or explicit – theory or model of how these fundamentals affect price. While the relationship between fundamentals and price is typically established by examining historical data – whether with econometric techniques or more impressionistic methods – forecasting of prices requires that market fundamentals can be forecasted also; there is no help in knowing the relationship between price and market fundamentals unless one also knows how the fundamentals will develop.

Access to more detailed information may improve the ability to explain or relate price to market fundamentals, but such information may not improve price forecasts, given the need to forecast market fundamentals as well. For example, having access to output data from individual generating units may allow for a better modelling of the relationship between generation and market price than if one had to rely on aggregate data only. However, to use such a more disaggregated model for forecasting, one would need forecasts of generation at the plant level, and since such forecasting is typically much more difficult than forecasting aggregate entities, a more disaggregated model may offer little or no improvement over an aggregated model.[13]

Making more detailed historical data available to market participants is therefore helpful for forecasting purposes mainly to the extent that market participants are able to forecast the various variables. It may be interesting to learn that the unplanned outage of a particular unit lead to a certain jump in price, but to use this knowledge to

[12] Long-term contracts typically do not offer the same degree of temporal price resolution as short-term or spot contracts; in order to forecast spot prices, one must therefore combine information about means or averages from long-term contract prices with information about short-run variations around the mean from hourly, weakly and seasonal price patterns.

[13] A more detailed model may however allow for better forecasting of price variation or risk; by combining forecasts of aggregate variables with a detailed model and historic information about capacity availabilities, one may be able to capture the distribution of prices and hence risk.

forecast price one would need to know if and when a similar outage is going to happen again. Detailed historical data may be used to calculate probabilities of such incidents and hence to quantify uncertainties and price risk. Nevertheless, making data available does not necessarily lead to more equal access to relevant information or "a level playing field" as far as forecasting is concerned.

Of course, if one does have access to information about future values of variables at a more detailed level it will improve forecasting. Individual market participants do have access to such information about their own activities; for example, a generator will know – or can plan – the extent to which various parts of its generation park is available at some future date.

It follows that larger market players have an informational advantage relative to their smaller counterparts; for example, a large generator knows more about future capacity availability than a small generator, simply because the former controls a larger part of total capacity than the latter. To some extent, such information asymmetries may be levelled by requiring market participants to make available forecasts or plans for their activities. However, since plans are always subject to change, and only the relevant market participant can know the extent to which any announced plan is realistic, requiring that such information be made public cannot overcome the inherent information asymmetry that results from differences in size.

PRICE FORMATION AND INFORMATION AGGREGATION

The insight that providing more information about underlying market fundamentals does not necessarily improve the functioning of markets derives from the essential character of markets as mechanisms for collecting, processing and disseminating relevant information; price formation is information aggregation.

Through their bids and offers market participants reveal information, be it about underlying fundamentals, such as costs and valuations, or about their beliefs concerning these entities. The market, by ranking bids and offers, and by bringing them together, ensures that price is based on information of the best informed market participants; since the market is cleared at the intersection of demand and supply, price is determined by intermediate or average, as opposed to extreme, bids and

offers; overly optimistic and pessimistic bids and offers fall outside of the range that determines market price.

Access to better information improves the accuracy of market participants' bids and offers and hence price formation. However, since price formation, through aggregation of bids and offers, tends to correct for unsystematic variation at the level of individual market participants (caused, for example, by errors or misconceptions), the overall gain from providing more information to individual market participants may be limited or none at all. An efficiently functioning market does not rely on equal access to information by all market participants; on the contrary, an efficiently functioning market provides the relevant information to participants.[14]

SYSTEM OPERATION AND INFORMATION REQUIREMENTS

A unique feature of electricity markets is that balancing cannot be left to market participants alone; a system operator with powers to intervene in the decisions of individual market participants is required in order to ensure that physical balance is achieved at all times. In this section, I briefly discuss information relevant for (transmission) system operators and to what extent market participants should share in this information.

System operators are responsible for ensuring quality and security of supply by balancing production and consumption of power at all times. In order to undertake their responsibilities, system operators regulate (ration) consumption and production. This is partly done by market-based transactions (such as contractual arrangements for balancing power and other system services, as well as operations on wholesale energy markets), and partly by direct intervention in use of the network (forced reductions or increases in consumption and/or production). In addition, system operators may be responsible for developing transmission and distribution networks, by maintaining existing capacity and investing in new capacity.

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[14] Fairness considerations, and concerns about trust in markets, may lead to a different conclusion, but that is another matter; for efficiency, what is important is that market participants make bids and offers that reflect their own particular pieces of information, not that this information is the same across all participants. The statement in ERGEG (2010c, p. 8) that *"insufficient transparency has adverse effects on market competition and price formation as not all the market actors have access to the same information and an unlevel playing field is created"* is consequently misleading. See also the discussion below about trust in prices and markets.

To succeed with their tasks system operators need continual information about power flows and capacities in the network. This information is obtained by metering power flows at various points (nodes) and by monitoring the capacity of the system, especially over interconnectors and other potential bottlenecks. Monitoring of the system does not require detailed information about individual consumption and production units (generation plants), only of aggregate flows over transmission lines.

However, more detailed information is, at least to some extent, required for forecasting developments of power flows and capacities. Much of the forecasting is based on historical data, but in addition system operators need to know about changes in consumption and/or production that cannot be extracted from such data. Generators (and sometimes large consumers) are therefore required to inform system operators about their plans, and various measures are in place to ensure that generators abide by these plans. It is particularly important that system operators are aware of large and unusual changes in the availability of capacities, such as planned outages for maintenance and repair. To the extent that system operators do not control all of the networks (such as interconnectors to neighbouring regions), they must be informed about available transmission capacity.

System operators also need to have information about available resources for balancing and other system services. To the extent that system services are obtained by (market-based) contractual arrangements (such as bids and offers in balancing markets, contracts for interruptible power and the like), the required information is obtained as part of the contractual process. Otherwise, the (potential) suppliers of system services must be obliged to make the information available to system operators.

To the extent that system operators are responsible for development of networks, in capacity as transmission system operators (TSOs), they also need information relevant for long-term planning purposes. To a large extent planning will rely on forecasts based on general and publicly available information on economic, social and demographic trends. However, in some cases network development will be contingent on specific, large scale projects on either the consumption or production side of the market, such as the building of large energy-intensive industrial plants or the

establishment of large generation facilities. In these cases, transmission system operators need detailed information about the specific project, so as to tailor network capacity expansions to the requirements of the project.[15]

It follows from the above that there is a fundamental difference in the role of the price system for market participants and system operators. System operators need information about power flows and available capacities in order to physically balance the system; in other words, system operators do not operate on the basis of prices but on the basis of physical flows and technical constraints.[16] Market participants, on the other hand, make economic decisions; they therefore need information about prices, not the underlying physical characteristics that determine prices. While information about load and available consumption, production and transmission capacities - sometimes even down to individual units - is vital for system operations, the relevant elements of this information tend to be transmitted to market participants through prices.

However, as pointed out above, to the extent that idiosyncratic events are not fully captured in price formation, information about such events may be shared with market participants; this is especially important in cases in which such information will affect behaviour in ways that facilitate system operations (such as when a generator that would otherwise not be available decides to start up and hence reduce a scarcity problem because it is made aware that prices will be higher than expected).

In other words, from an efficiency point of view information collected by the system operator should be made available to the market when such information can be expected to affect the decisions of market participants in a way that improves overall market performance. In practice, this means information about major incidents that cannot be foreseen by market participants and that are likely to make system

[15] Correspondingly, system operators may provide information about network capacity to market participants in order to facilitate their investment planning. For example, in the UK National Grid has long published a so-called seven year statement to tell would-be developers where there is spare capacity on the network, to help steer investors to better locations.

[16] This is not to say that system operators cannot - or do not - make use of markets to facilitate their operations - including ensuring an efficient dispatch - for example by basing regulation on bids from balancing markets, as explained above; the point here is that while these may be helpful instruments, operational decisions have to be based first and foremost on physical characteristics of the system.

operations more difficult, such as the unavailability of large generation and consumption units, as well as reduced capacity in the transmission system.[17] As we discuss below, since there is a risk that providing individual market participants with more detailed information may affect their behaviour in such a way as to undermine market performance, it is not obvious whether, when or how such information should be made available; rather than informing the market and risking such behaviour, it may be better that the system operator ensures that it has access to sufficient resources to balance the system.

A particular issue concerns information about markets established by system operators, including markets for congestion management, balancing and other system services. When agents participate on different markets they need to know the various prices on these markets in order to make decisions about where to trade (such as a generator who has to chose how much of its capacity to offer on the spot market and how much to offer on the balancing market). This means that system operators need to establish and inform participants about current and future prices on their markets (or information required in order to forecast these prices).

TRUST AND MARKET PARTICIPATION

The above discussion was based on the implicit premise that information provided to market participants is correct; in particular, prices can be trusted to reflect actual market conditions. This is not necessarily the case; in particular, some agents may benefit from misleading market participants by either distorting information or by exploiting information that is unavailable to others. The latter is often called insider trading while the former is termed market manipulation.

[17] It is difficult to see that the very detailed requirements in EU (2013) on what information system operators should make available to the market, especially concerning congestion management and balancing, are warranted; at best, much of this information is likely to be of little or no real value to market participants; at worst, it may undermine market performance by facilitating the (ab)use of market power.

In the recently introduced regulations on wholesale energy market integrity and transparency market manipulation is explained as follows (EU, 2011b):

> *"Manipulation on wholesale energy markets involves actions undertaken by persons that artificially cause prices to be at a level not justified by market forces of supply and demand, including actual availability of production, storage or transportation capacity, and demand. Forms of market manipulation include placing and withdrawal of false orders; spreading of false or misleading information or rumours through the media, including the internet, or by any other means; deliberately providing false information to undertakings which provide price assessments or market reports with the effect of misleading market participants acting on the basis of those price assessments or market reports; and deliberately making it appear that the availability of electricity generation capacity or natural gas availability, or the availability of transmission capacity is other than the capacity which is actually technically available where such information affects or is likely to affect the price of wholesale energy products."*

Insider trading and market manipulation clearly involves issues of fairness; it may seem unfair that some market participants should benefit from an informational advantage that is denied to others, especially if this advantage is caused by deception. However, there is also an efficiency argument against such behaviour; as explained in the above-mentioned regulations (EU, 2011b), their rationale is to

> *"ensure that consumers and other market participants can have confidence in the integrity of electricity and gas markets, that prices set on wholesale energy markets reflect a fair and competitive interplay between supply and demand, and that no profits can be drawn from market abuse".*

In other words, market participants need to trust prices in order to be willing to trade on them. If markets cannot be trusted, agents are likely to either drop the product in question or find other means to secure their needs, for example by vertical

integration. Thereby, market performance is undermined, or the market disintegrates completely, to the detriment of individual agents and economic efficiency.

Insider trading and market manipulation is typically counteracted by banning the behaviour and by requiring agents to provide relevant information to the rest of market. From the point of view of creating and maintaining trust, the former measure is likely to be more important than the latter; as explained above, knowing that prices offered in the market reflect fundamental market conditions is more important than being able to relate these prices to those underlying fundamentals. Moreover, if market participants are required to reflect private information in their bids and offers, information will be revealed to the market through the process of price formation.

In other words, it may be necessary to require market participants to inform regulatory authorities (and possibly market makers and system operators) about price relevant information, in order to avoid insider trading and market manipulation. However, the extent to which, and in what form, such information should be provided to the market depends, as explained above, on whether this information is relevant to market participants. Moreover, and as is explained below, since such information may facilitate behaviour that is detrimental to market performance, publication may have to be limited even in cases in which (some) market participants might have welcomed more information.

RELEVANT INFORMATION FOR REGULATION

At the national level, the responsibility for regulations aimed at market behaviour is normally shared between electricity regulation authorities, competition authorities and financial authorities, with the exact division of tasks differing between countries. At the European level, the Agency for Coordination between Energy Regulators, ACER, both coordinates and complements the work of national regulators, particularly by monitoring the functioning of gas and electricity markets in general, and of wholesale energy trading in particular (www.acer.europa.eu). The monitoring tasks of ACER are laid down in Regulation (EU) No 1227/2011 on wholesale energy market integrity and transparency (REMIT) (EU, 2011b).

Regulation of market behaviour typically involves some sort of continual monitoring or surveillance on the one hand and in-depth investigations of specific incidents or cases on the other. Information relevant for these two types of activities tends to be very different.

Market surveillance aims at detecting behaviour that may undermine market performance. This typically involves monitoring indices of market performance, such as prices, capacity availability and traded volumes. Such aggregate information - which tends to be based on information from market organisers or other public sources - may be complemented by more detailed information from individual market participants, such as changes in ownership and plant closure and individual trades. For example, unusual movements of the market price, in combination with intense trading activity by particular market participants, may signal a possible case of abuse of insider information or market manipulation.

In principle, one could imagine that regulators monitored in complete detail all activities of market participants, in order to ensure that they abide by the rules. In practice, this is impossible, given the amount of information and processing capability that would be required.[18] Indeed, such detailed monitoring would run counter to the ideas underlying the establishment of markets in the first place. Deregulation and the creation of markets were based on the realisation that centralised operation and detailed regulation did not produce the desired results, and that decentralisation of decision power and the discipline of competition was necessary to improve performance of the industry. Market monitoring cannot aim at perfect regulation, but must instead concentrate on detecting serious cases of abuse of market power or market manipulation, as well as developments that may lead to such abuse. For this, only relatively limited information is necessary.

However, once a potential case of irregular behaviour has been detected, much more detailed information is required to investigate whether abuse actually has taken place. The exact details of the information required will depend on the nature of the

[18] As pointed out in EU (2011a), *"There are several hundreds of companies involved in wholesale electricity and gas trade in Europe and up to 10 000 transactions take place every day"*. It is difficult to see how ACER, which will collect information about all these transactions, can make effective use of this massive amount of information for market monitoring purposes.

case; for example, information needs will differ between a competition case concerning collusion and a case of market manipulation based on inside information. Information needs may also depend on the identity of the parties involved and their activities. The collection of information must therefore be tailored to the individual case and cannot be determined in advance or according to a general formula. Efficient investigation requires that the regulatory authorities have the necessary power to access relevant information, not that the nature of this information is regulated in detail.[19]

COSTS OF COLLECTING AND DISSEMINATING INFORMATION

In the previous sections, I have discussed what sort of information is relevant to regulators, system operators and market participants, respectively. I have also discussed why more information is not necessarily to the benefit of either individual agents or overall market performance. In this section, I discuss why the collection and dissemination of information may in fact undermine market performance. Requiring market participants to reveal information - whether to the market in general or to system operators or regulators - not only involve administrative costs, but may also lead to behaviour intended to conceal or distort this information. Moreover, making information publically available can undermine market performance by facilitating market power and collusion.

ADMINISTRATIVE COSTS

Collecting, processing and publishing information is costly, not only to those undertaking these tasks but also to other parties involved. In fact, such costs are much greater than is often realised. The total administrative costs imposed on businesses from complying with information obligations stemming from various sorts of

[19] This concern seems to be taken well care of as far as insider trading and market manipulation is concerned, where regulations require that the relevant authorities, among other powers, should be able to *"have access to any relevant document in any form, and to receive a copy of it; demand information from any relevant person, including those who are successively involved in the transmission of orders or conduct of the operations concerned, as well as their principals, and, if necessary, the right to summon and hear any such person or principal; carry out on-site inspections; require existing telephone and existing data traffic records"* (EU, 2011b, Article 13).

regulations are typically estimated at around three per cent of gross national product (GNP) (http://www.administrative-burdens.com/); this does not include costs to the regulatory authorities themselves.

The amount of administrative costs involved depends on the information requirements and the way that such information has to be reported. The Commission is clearly aware of this (EU, 2011b):

> *"Reporting obligations should be kept to a minimum and not create unnecessary costs or administrative burdens for market participants. The uniform rules on the reporting of information should therefore undergo an ex-ante cost-benefit analysis, should avoid double reporting, and should take account of reporting frameworks developed under other relevant legislation. Furthermore, the required information or parts thereof should be collected from other persons and existing sources where possible. Where a market participant or a third party acting on its behalf, a trade reporting system, an organised market, a trade-matching system, or other person professionally arranging transactions has fulfilled its reporting obligations to a competent authority in accordance with Directive 2004/39/EC of the European Parliament and of the Council of 21 April 2004 on markets in financial instruments (3) or applicable Union legislation on derivative transactions, central counterparties and trade repositories, its reporting obligation should be considered fulfilled also under this Regulation, but only to the extent that all the information required under this Regulation has been reported."*

In practice, reducing the administrative burden of information requirements is easier said than done. In particular, government agencies tend to request more rather than less information ("to be on the safe side"), and they often require information to be reported in formats that do not comply with how the reporting agents themselves collect and store information; agents therefore typically have to establish special routines and systems for assembling, storing and reporting the requested information. It is very rare that the sort of cost-benefit analysis advocated by the Commission is undertaken in practice.

INCENTIVES TO GATHER INFORMATION

Collecting information, validating it and subjecting it to systematic analysis is costly. Therefore, agents will only undertake such activities when the benefit from being better informed outweighs the cost.

If market participants are required to make their private information publicly available, their incentive to gather information may be reduced. The reason is that if information is no longer privileged, but available to others also, it may cease to be of value.

For example, a generator benefits from scheduling its capacity in such a way as to ensure maximum output in periods of high prices, and hence has an incentive to undertake analyses that improves its ability to forecast prices and to develop operational procedures to further its responsiveness to prices. However, if the generator has to make information public (such as capacity availability, planned outages, water storage levels and production patterns) that effectively reveals its price forecasts and operational procedures, others may copy it and hence reduce or eliminate the gains from improved market behaviour. As a consequence, since the generator's gain is reduced, it may no longer have an incentive to undertake such analyses.

Since, as explained above, improved decision-making at the individual level may also improve overall market performance, weakening incentives to gather information may undermine functioning of the market.

INFORMATION DISTORTION

If information controlled by a particular agent is valuable to others, and especially if their access to such information reduces his or her own profitability, the agent has an incentive not to make this information generally available; if forced to do so, the agent has an incentive to distort the information so as to make it less useful to others.

Distortion may be achieved by delaying, under-reporting or misreporting information. Regulatory authorities may reduce the problem of distortion – by standardising the frequencies and formats with which information is to be made

available, as well as by introducing controls to ensure that agents adhere to regulations – but will rarely be able to eliminate it. It is in practice difficult to ensure complete compliance with any sort of regulation, and the challenge tends to become larger the more detailed, complicated and demanding the regulatory requirements are. For example, it may be difficult to ensure the realism of information concerning planned unavailability of generation units or forecasts of generation capacity long into the future.

Market participants may also distort information indirectly, by changing behaviour in such a way as to affect values of the indicators that are to be reported. Suppose for example that generators are required to report output from individual generating units on an on-going basis. Suppose also that such information may be used to infer generator strategies, their underlying costs or their assessment of future market conditions (eg. implied water values of a hydro generator). Then generators may have incentives to shift output between generating units in such a way as to conceal behavioural patterns; in other words, generators may want to deviate from cost-minimising or efficient despatch in order not to elicit information to competitors or other market participants.

Note that it is exactly when private information is valuable to other market participants – and hence the argument for requiring such information to be revealed may seem the most obvious – that the incentive to distort information tends to be strong. When information is of little or no value to others, there is little or no incentive to resist its publication; however, when information is valuable to other parties, and especially when they may act upon this information in ways that are detrimental to the agent in question, the incentive to distort information is correspondingly strong.

INFORMATION OVERLOAD

Large amounts of information require a correspondingly large processing capability in order to turn the various pieces of information into a coherent and meaningful picture. At best, providing more information may simply not be very useful if decision makers do not have the necessary processing capability; at worst,

more detailed information may blur the overall picture and so undermine rational decision-making.

Consider the case of water reservoirs in the Nordic market. If one were to make use of information about storage levels in individual reservoirs for price forecasting one would, at the very least, need information about inflow into each reservoir over the relevant period. This not only requires very detailed hydrological knowledge, but also considerable processing capability, in order to determine how individual reservoirs contribute to overall supply conditions. It may be more useful to have information about water storage at a level that corresponds to areas of similar hydrological conditions and base forecasts on overall or average inflow to the different areas.

More generally, regulatory authorities may improve market participants' access to information by making it available in a form that facilitates its use, and this is not necessarily in its most detailed and basic form. Especially for smaller players, who may have limited ability to undertake sophisticated analyses themselves, providing information in a format that is suitable for simpler and more straightforward analyses may be particularly helpful.[20]

MARKET POWER

The market power of an individual agent depends on market conditions, and hence more detailed information about these conditions may facilitate the exercise of market power, thereby undermining market performance.

Consider for example a generator situated in an area where transmission capacity in and out of the area is sometimes congested. In periods in which transmission capacity is not congested, the generator faces competition from generators in neighbouring areas; if the generator offers a high price to the wholesale spot market, it risks being undercut by lower offers from generators outside of the area. However, in

[20] The data relating to generation, transportation and consumption of electricity which need to be made available to market participants according to the proposed EU guidelines (EU, 2013) are very detailed; even disregarding concerns about costs of collection and dissemination, it is difficult to see why market participants would require so detailed information.

periods in which transmission capacity is congested, especially when the load configuration is such that import to the area is constrained, the generator faces competition only from generators situated within the same area; its offer price is then more likely to be accepted, even when it is high.

If such a generator knows beforehand whether or not transmission capacity will be congested, and hence the extent to which it faces competition from other generators, it may tailor its price to market conditions; it can offer a high price when transmission capacity is congested and a correspondingly lower price when capacity is not congested. If the generator does not know whether or not congestion will occur, it cannot tailor its price to market conditions to the same extent; its pricing strategy will then have to take into account that competition may or may not be strong, and, especially if the generator is cautious or risk-averse, it will have to price sufficiently low that it can meet potential competition from generators outside of the area.

It follows that more precise information about market conditions – including load configuration, availability of competing generators and transmission capacity – may facilitate the exercise of market power and thereby potentially undermine market performance.[21]

It also follows that the fact that market participants may be willing to incur costs to obtain information is not necessarily a sign that such information is valuable from an overall perspective; information may be privately profitable because it furthers exploitation of market power but socially unprofitable for exactly the same reason.[22]

[21] In ERGEG (2010c, p. 8), it is stated that *"This asymmetry of information that results from a lack of transparency also creates opportunities for market manipulation"*. However, while asymmetric information may provide individual market participants with profit opportunities – eg. by trading on perceived differences in price expectations – market manipulation requires the ability to move prices, i.e. market power.

[22] ERGEG (2010c, p. 23) uses the fact that market participants are willing to pay for real-time information about generating units and their operations as an argument for why such information should be made publicly available. As explained below, this argument fails to account for collective (as well as unilateral) market dominance.

Transparency may also affect the ability and incentive of market participants to coordinate their behaviour and hence the extent to which market outcomes are characterised by collusion rather than competition.

To see this, note that for a seller of electricity the benefit from cutting prices – which in itself involves a loss in the form of lower margins – comes from increased sales. In principle, increased sales may result from attracting more buyers to the market and from inducing larger sales to existing customers, but in electricity markets – where aggregate demand tends to be relatively inelastic – increased sales for any given seller must come at the expense of its competitors. A strategy to capture market share can therefore succeed only if the price-cutting supplier becomes cheaper than its competitors; that is, if competitors do not reduce their prices also.

In other words, an aggressive pricing strategy is more likely to succeed the longer it takes before competitors follow suit, which again depends on how fast they discover that the supplier in question has cut price, and how quickly they react on this information. If a price cut is discovered fast, and if competitors are able to adjust their prices quickly, then an aggressive pricing strategy is not going to be successful.

It follows that providing more timely and accurate information about the behaviour of individual market participants is likely to reduce incentives for competing on price. In other words, transparency may facilitate an outcome that resembles collusion or monopoly, rather than competition.[23]

The result that market transparency may facilitate (tacit) collusion is not a theoretical artefact but has been demonstrated in practice. A case of particular interest is the Danish market for concrete, since here market transparency was the result of

[23] For a textbook treatment of transparency and collusion, see Motta (2004, ch. 4.2.2), who writes: *"Since observability of prices and quantities help firms to reach the most collusive outcomes..., competition policy should pay special attention to practices that can help firms monitor each other's behaviour."* See also O'Donoghue and Padilla (2006, ch. 3.3.2) for a discussion framed within the context of European competition policy; they write: *"Hence, formal and informal exchanges of commercially sensitive information among competitors, whether bilateral, multilateral or mediated through trade associations, must be viewed with suspicion. Information on individual prices and quantities is more helpful for firms to sustain collusion than aggregate information about demand from market studies. High frequency data and data disaggregated across markets helps detect deviations and draw inferences about demand and thus sustain collusion."*

government intervention. The case is analysed in detail in Albæk, Møllgaard and Overgaard (1998), but a short version of the story is given in Overgaard and Møllgaard (2008):

> *"In the early 1990s, the Danish Competition Authority found evidence of a lack of competition in the ready-mixed concrete industry. In particular, it was concerned that some buyers were paying prices too high because it was rumored that other customers received significant confidential discounts. Because at that time the Danish Competition Act emphasized the role of price transparency in promoting competition, the authority decided to gather and publish firm-specific transactions prices for two grades of ready-mixed concrete in three regions of Denmark. The intention was to inform buyers of bargain deals in the hope that this would lead buyers to exert stronger downward pressure on prices. Following the initial publication, however, average prices went up by 15 to 20 percent in less than six months. This compares with inflation of 1 to 2 percent per year and stable or decreasing costs of inputs.*
>
> *Tacit collusion is the most likely explanation for the price increase. The price increase cannot be explained by an increase in demand or increasing costs. Because ready-mixed concrete can only be transported a short distance (20 to 30 kilometers, depending on local infrastructure), competition is local. In the relevant market around the city of Aarhus only four firms were active and pricing was reported for each. These four firms thus constitute a tight oligopoly. That improved transparency led to improved coordination of their pricing policies appears a natural conclusion.... While prices were initially widely dispersed, after a year of publication the firms seemed to have found a mutually acceptable price level.*
>
> *Evidence indicates that the firms stopped granting large individualized discounts because of the improved transparency, which was an implicit goal of the policy. But the authority also unwittingly assisted firms in reducing competition by providing the reliable detection of cheating that is a prerequisite for sustaining collusion. This case also illustrates that in an oligopolistic market*

setting if suppliers are able to react to improved information dissemination before buyers, buyers may be hurt rather than helped by transparency."

Another example of transparency requirements with unfortunate consequences is legislation passed by the US Congress concerning railroad freights mandating disclosure of firm-specific information, where increased freight rates were a direct result of the improved scope for tacit collusion (Fuller, Ruppel and Bessler, 1990; Schmitz and Fuller, 1995).

In both these cases, regulations required publication of prices. While such information is particularly conducive to coordinating behaviour among competitors and sustaining collusive outcomes, information about supply or output are likely to play much the same role. Specifically, since an increase in supply is a sign of reduction in price, monitoring output is likely to serve as a good substitute for monitoring price.[24]

Electricity markets are often seen as particularly conducive to tacit collusion, since participants meet very frequently – every day in the spot market – and hence have the opportunity to react quickly to changes in competitor behaviour. However, in most electricity markets, neither bids/offers nor volumes of individual market participants are publicly observable. Therefore, even if other factors tend to facilitate coordinated or collusive behaviour, lack of transparency with respect to individual behaviour makes such coordination or collusion difficult. Requiring publication of detailed information on generator output may change this and make collusion more likely.

CONCLUSION

For market performance, more information is not always better. Indeed, more information may undermine market performance by facilitating behaviour that is either not cost efficient or aims at exercising market power or establishing and maintaining collusion. Moreover, ensuring rational economic behaviour and an

[24] See Porter (1983) for an example of a cartel that relied on monitoring supply or market shares.

efficient and competitive market outcome does not require general access to information at a very detailed level or with a high degree of immediacy.

It is therefore difficult to see why information at the level of individual market participants, or indeed consumption and generation units, should be made publicly available. Such information is obviously warranted for system operation and, possibly, market surveillance, but not for rational and competitive behaviour by market participants; indeed, information about individual market participants is exactly what may facilitate collusion and so undermine market performance.[25] For market participants, information at the market level (bidding area) would seem to suffice.[26]

It is also difficult to see the necessity of making information about actual operations immediately available. Again, access to information in real time is of course vital for systems operations (although not for market surveillance), but not for rational decisions of market participants; on the contrary, more immediate access to actual operations may facilitate coordination and collusion.[27] For market participants, information about actual operations should be of interest to the extent that it improves their understanding of how the market functions and hence their ability to forecast market prices, but this does not require immediate access to such information.

Information about future supply and demand conditions is clearly valuable in order to allow market participants to forecast prices. However, again it would seem to

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[25] Overgaard and Møllgaard (2008) discuss how the EU Commission, for antitrust reasons, has tended to restrict the exchange of information that allows the tracking of individual firms; in particular, in *"the EU Commission's Cartonboard and Wastepaper cases...the Commission argued that to prevent identification of individualized information, aggregation of the data of at least three, respectively, four firms would be required."* (see also Halliday and Seabright, 2001). They also write: *"examples in which the exchange of detailed, firm-specific information on prices and quantities is necessary for efficient planning and resource allocation seem rare."* Kühn (2001) writes: *"Individualized information exchange about past prices and quantities should also be considered an anti-competitive agreement in the sense of Art. 81(1). I have shown that it is very difficult to justify information exchange of individualizd data in theory and in individual cases. It is very hard to construct hypothetical situations in which very disaggregated data on past actions is really necessary to achieve substantial efficiency gains."*

[26] Kühn (2001) writes: *"No prohibition of aggregated data should be contemplated. In contrast to disaggregated data the potential for efficiency enhancing exchange of aggregate data is much greater."*

[27] Halliday and Seabright (2001) writes, on EU competition policy on information exchange, that *"...an influential factor as to the acceptability of an information exchange is the frequency with which the information is exchanged. The more frequently information is exchanged the easier it is to assess market development and, consequently, respond swiftly and appropriately to them. The slower the frequency of exchange of information, the more limited the scope for the useful commercial exploitation of the information."*

suffice to provide such information in an aggregated form, both with respect to level and time period. Detailed information about available consumption, generation and transmission capacity may provide opportunities for coordination and exercise of unilateral market power, but is not warranted for competitive market behaviour.

To sum up: while the regulations contemplated or already introduced by the Commission appear to be heading in the right direction, the steps they take seem overly long. To achieve the aims of efficiently functioning wholesale electricity markets, fair and non-discriminatory access to data and a coherent and consistent view of the European wholesale electricity market, it does not seem advisable to go quite so far with respect to immediacy and detail as intended by these regulations.

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