PRICING INTRADAY CAPACITY

Date: October 17, 2014

OFGEM

PMI CONSULTING

CONTENTS

1. Introduction

The Office of Gas and Electricity Markets is a non-ministerial government department and an independent National Regulatory Authority. It works within the European Regulators' organisations (CEER and ACER) to develop the requirements of a comprehensive regulatory framework for cross-border competition and investment. It is involved in establishing more detailed thinking, discussion and options to assist TSOs to develop a possible solution for pricing intraday capacities.

Power Markets Innovation Consulting is a single-consultant company founded starting 2013. Thibault Henri has specialized in the design and in the functioning of power markets and offers his thorough expertise to contribute to the efficiency of the electric system. PMI Consulting has been involved in day-ahead market coupling projects and intraday market projects in Europe.

Ofgem has assigned PMI to propose options how to price intraday interconnection capacity and to assess how these options are compliant with the requirements of the draft Guideline on Capacity Allocation and Congestion Management and with the requirements of the Framework Guidelines.

The report is divided into six main sections:

- Section 2 presents the main conclusions of the report;
- Section 3 recalls why pricing intraday capacity in continuous markets does not have an easy and natural solution like in day-ahead;
- Section 4 presents the list of requirements and the proposed options;
- Section 5 focuses on the assessment of the fulfilment of each requirement by each proposed option;
- Section 6 briefly addresses areas for further analysis;
- Section 7 shows a list of discarded options;

2. Conclusions

Three options (options 3 being divided in four variants) have been assessed with regards to the requirements from the draft Guideline on Capacity Allocation and Congestion Management and the Framework Guidelines.

The compliance has been assessed with regards to an explicit interpretation of the requirements. When several interpretations of a requirement might exist because of a lack of clarity in the used terminology, it has been highlighted if the interpretation is restrictive or non-restrictive.

The conclusion whether a proposed option complies with the requirements strongly depends on the interpretation of the requirements. Different interpretations might result into other conclusions. The interpretations have been discussed with and validated by Ofgem as valid interpretations (which does not prevent other interpretations to be also considered as valid).

The result of the assessment is the following:

- Option 1 (Congestion forecast during trading session); and option 3.c. (Auctions combined with continuous local trading) are fully compliant with the requirements.

- Option 2 (Ex-post calculation of capacity price) shows almost compliant since mitigations measures can be put in place concerning the lack of fulfilment of requirement 5.

- The compliance of options 3.b. (Auctions interrupting continuous trading) and 3.d. (Auctions only) mainly depends on the practical implementation.

- Option 3.a. (Auctions in addition to current unchanged continuous trading) is not compliant.

- In addition, seven other options have been presented, assessed and discarded because of a gross or obvious violation of the requirements. These results are shown in Annex.

Option 1 (Congestion forecast during trading session) preserves the current functioning of intraday continuous markets in North-Western Europe. It is likely to be the easiest option to implement in practice. It does not necessitate huge changes in the organization of already coupled intraday markets which are operated by NordPoolSpot, APX and Epex Spot. In addition, some parameters in the option make it flexible, so that it can be gradually assessed (or even removed) if desirable.

Option 3.c. (Auctions combined with continuous local trading) is the most satisfactory both from a theoretical point of view and from a long term perspective. The economic utility of capacity would be priced according to the exact need of capacity by the market; the possibility to trade as close to real-time as possible would be maintained through local continuous trading. The changes resulting from the implementation of this option are significant and imply an effort from PXs and TSOs. A more detailed analysis of the impact and

the possible choices for implementation should precede the decision to implement this option.

Although it can be made compliant with a non-restrictive interpretation of the requirements, option 2 is far from being easy to implement in practice. This option can be seen as a default option if no agreement can be made on the implementation of option 1 or option 3.c.

3. Pricing Intraday Capacity: Problem Identification

The European electric system relies on electricity exchanges between so-called bidding zones, also called bidding areas, which are interconnected by cross-zonal interconnections. These cross-zonal interconnections can be alternating current interconnections or physical interconnections such as direct current interconnectors.

The principles and mechanisms of the pricing of cross-zonal interconnection capacities in intraday trading under implicit capacity allocation have been a topic of discussion for some years and in many places[1].

This section does not intend to recall the history and the steps of these discussions, but to explain why the topic has not found a natural solution: indeed, a fundamental contradiction exists between electricity current continuous trading and the principles of the calculation of congestion rent which is currently applied in the day-ahead auction-based coupling.

3.1. Reasons for pricing interconnection capacity

3.1.1. General economic theory

The economics of cross-zonal interconnections relies on common goods theory and essential facilities theory. The need for pricing cross-zonal capacity is threefold:

(i) *Capacity pricing reveals scarcity*.

When capacity is abundant i.e. greater than the amount which is needed by zonal electric systems to get balanced between each other, the market price of capacity is zero. Indeed, though being useful and even necessary to the exchanges of electricity, a market player who would try to sell capacity would not find any counterpart at a positive price; a market player who would try to reserve part of the capacity for himself would not take any advantage of it.

When capacity is scarce i.e. lower than the amount which is needed by zonal electric systems to get balanced between each other, the market price of the capacity is positive. Indeed, a market player who would possess additional capacity would take advantage of it (e.g. from additional trades): the market price of capacity is the money counterpart of this advantage.

The following statement can therefore be made:

Cross-zonal capacities have a natural market price which reflects the scarcity of them.

(ii) Prices are signals for infrastructure investments.

The corollary of the previous statement is that the price of cross-zonal capacity provides the community with a natural assessment how valuable capacity is for them. If capacity price is

[1] See NRA-TSO-PX meeting on 10 Oct 2011 and Workshop on Regional Intraday Implicit Auctions for Electricity on 2 Dec 2013.

high, then capacity is useful for the electric system and one should invest in interconnection infrastructures; if capacity price is low or zero, then capacity is of little value for the electric system and one should not invest in interconnection infrastructures.

In addition, when private investors are concerned (such as some cable operators), the investment plans rely on a forecast of capacity market price; as a consequence, understanding how this price is revealed by the functioning of the electric system is a key element in the decision to invest in interconnection infrastructures.

The following statement can therefore be made:

Capacity pricing contributes to an optimal utilization of interconnection infrastructures.

(iii) Pricing prevents the fraudulent utilizations of capacity.

Let us assume that capacity is scarce and not priced. Then market participants would have interest to trade cross-zonal against themselves in order to reserve and block cross-zonal capacity and take an advantage of it.

In particular, big market participants are likely to be present at both sides of the interconnections and therefore to benefit from this advantage; whereas small market participants might be present at one side of the interconnection only and might therefore not benefit of such opportunities.

On the contrary, pricing capacity at the price which corresponds to this possible advantage removes any interest to capture it at the detriment of other market participants.

In other words, the following statement can be made:

Capacity pricing contributes to a fair and non-discriminatory competition between market participants.

3.1.2. Specifics of electricity trading

a) Consequences of the absence of electricity storage

Compared to other commodities, such as gas, the specificity of electricity trading relies in the absence of efficient storage technology (storage is technically possible but far too much expensive to lead to practical storage devices; in addition electricity storage is possible through other commodities, e.g. water in pumping stations: electricity is not stored as such and the price of electricity is made of the price of the storage facility which can be considered as a production unit).

The consequence for balance responsibles is that they need to balance the injections and the off-takes perfectly (otherwise TSOs balance and apply a penalty). Power markets have the function of offering a solution to get balanced.

Moreover, as events (such as: changes in weather forecast; changes in the availability of a production unit) may happen between the time when a balance responsible has balanced

and the time of delivery, a balance responsible needs to continue balancing until the time of delivery. The specific function of the intraday market is to allow a short-term balancing until the delivery period (market products can be hourly, quarterly, etc.).

b) Access to cross-zonal capacity: explicit vs. implicit

Like other power markets with a different term, the functioning of the European intraday markets relies on electricity trading between bidding zones through cross-zonal interconnections. For instance, an increase in power production in the North of Germany can be balanced by intraday trading between France and Germany through the cross-zonal interconnection between France and Germany.

The access to cross-zonal capacity can be explicit or implicit:

- "Explicit" means that capacity is procured as a parallel allocation mechanism: traders need to buy or sell capacity in parallel of the electricity trading;
- "Implicit" means that capacity allocation is fully integrated to electricity trading: if needs be, capacity allocation is automatically associated to a trade of electricity when it is made, without requiring additional actions from market participants;

The drawbacks of explicit allocation of capacity are the following:

- At the time capacity is allocated, trades are unknown, so that both traded quantities and trading prices are unknown;
- Or at the time traded are made, capacity has not been allocated, so that a risk exists that trades are not executed if corresponding needed capacity is not allocated;
- A consequence can be an over- or an under-reservation of capacity: capacity which would be useful for some market participants has been blocked by other markets participants who do not need it;
- A consequence is the absence of correlation between the price of the allocated capacity and the scarcity of it;
- The general consequence is that explicit capacity allocation is sub-optimal with regards to social welfare (i.e. the sum of the surplus of sellers and buyers and the congestion rent of TSOs);

For those reasons, coupling initiatives have been put in place in order to generalize the implicit allocation of cross-zonal capacities in the European electric system.

c) Modality of power market organization

The modality of a market concerns the question whether the market is auction-based or continuous.

The principles of auction are the following:

- Orders are sent by market participants into a single platform (TSOs also send the amounts of available cross-zonal capacities); after gate closure, a central system matches the orders according to available capacities;
- Orders are blind: when sending an order to the platform, each trader is unaware of the prices and quantities which are sent by other market participants;

- It is not possible to add orders after gate closure (*a fortiori*, after the calculation of prices and the execution of orders); it is not possible to remove any order after gate closure: orders in the platform after gate closure can be executed if demanded by the system and the market processes, although they might not;

The principles of the current continuous trading which is implemented in CWE and Nordic bidding zones are the following:

- Orders are continuously sent to a single platform: the only gate closure is the end of the trading session when delivery time approaches and trading is no longer possible;
- Order matching is calculated by the system continuously during the trading session: no special instant exists;
- Order books are seen by market participants[2]: even though orders are anonymous, offered prices and quantities are seen by all market participants; as a consequence, orders which are sent to the platform depend on existing orders in order books;

Generally speaking, the modality of a market has no relationship with the term of delivery. The term of delivery in power markets can be long-term, day-ahead or intraday.

In European power markets, day-ahead markets are auction-based and many current intraday markets are continuous.

The two following paragraphs will present the specificities of capacity pricing in such a continuous market compared to an auction-based market. The complexity of capacity pricing results from the continuous nature of the intraday market, not from the intraday term itself.

3.2. Capacity pricing in auction trading

3.2.1. Economic point of view

The natural market price of cross-zonal capacity is the money counterpart of the economic benefit of having a marginal amount of capacity when it is scarce.

Let us assume an auction-based market, in which prices (in a given hour) have been calculated in two bidding zones A and B. Let us assume that the capacity from A to B is scarce i.e. that the price in B is higher than in A: a market player who would have an additional marginal amount of capacity from A to B could buy electricity in A and sell at a higher price in B; the economic advantage from this virtual operation is the price difference between A and B.

The intuitive reasoning above can be summarized in the following statement:

The natural market price of cross-zonal capacity is the price difference between the two bidding zones.

[2] Although some PXs offer products such as iceberg orders, it can be taken as a general principle that orders are visible.

Technically, available capacities can be seen as constraints (since no capacity can be allocated beyond the maximum available capacity) in a welfare optimization model. The following statements result from the theorem of Lagrange multipliers at the optimum:

- Multipliers of constraints related to the execution of orders are zonal prices;
- Multipliers of constraints related to available capacities are price differences;

Lagrange multipliers are also referred to as dual variables or shadow prices: in the dual optimization problem, the dual variable corresponding to an available capacity constraint, i.e. the shadow-price of the capacity constraint, is the difference between zonal prices. The shadow-price of capacity is the amount of marginal welfare increase which would result from a marginal increase of capacity[3].

3.2.2. Practical implementation

Coupling initiatives have been implemented by TSOs and PXs. The pricing algorithm optimizes welfare:

- Inputs are order books and capacity constraints;
- Capacity constraints can be maximum available transmission capacity constraints;
- Capacity constraints can be other network constraints (e.g. maximum ramping constraints);
- Outputs are prices and net positions at the optimum;

Congestion rent is calculated from this basis; the price of the capacity is the difference between zonal prices:

- When zonal prices are equal, congestion rent is zero;
- When zonal prices are different, congestion rent is the product of the price difference by the amount of the electricity exchange between the two bidding zones;

The calculation of capacity prices relies on the fundamental principle that the price solution corresponds to a maximum of social welfare.

[3] These results hold when the optimization model is convex. When non-convexities are introduced in the model (e.g. block orders), increasing the available capacity might result into a lower welfare, although a price difference existed between bidding zones. Usually, the introduction of non-convex products is supported by a series of tests which show that the magnitude of the non-convexities is small, so that the convex model can still be considered as a valid approximation of the real market configuration: the price of capacity is still considered equal to the price difference between bidding zones. In this report, non-convexity issues are not addressed: the welfare optimization model is always assumed to be convex.

3.3. Capacity pricing in continuous trading

3.3.1. Purpose of intraday market

Intraday markets give market participants the possibility to get balanced between the publication of day-ahead market results and the time of delivery. In particular, the following functions are fulfilled by intraday markets:

- Refining balance position: day-ahead markets can lead to unexpected results in some market configurations (e.g. the level of prices does not allow expected orders to be executed); intraday markets leave room to adapt to these results;
- Adapting to changes in market conditions: during intraday trading session, market conditions reflect the real-time equilibrium between the forecast of production and the forecast of consumption; some events can change market conditions (e.g. a breakdown of a power unit; a change in wind forecast; a change in consumption levels); intraday markets allow market participants to react to such events; in particular, intraday markets are a key instrument for an efficient integration of renewable energy;

It can be that changes in market conditions occur on one side of an interconnection only:

- Prices might be equal in day-ahead results (the interconnection is not congested), whereas intraday prices might become different in the two bidding zones;
- Prices might be different in day-ahead results (the interconnection is congested and capacity has a positive price), whereas intraday prices might become similar in both bidding zones; trading in the opposite direction (compared to day-ahead) is even possible;

3.3.2. Functioning of existing continuous markets

- In a continuous process, orders are put into the market continuously. Once in order books, the price and quantity of orders can still be modified by traders, whereas trades are being executed.

  In an auction-based process, orders can be modified until gate closure: during this period of time, no trade is executed; then, in a second step, trades are executed and modifying orders is no longer possible.

- In a continuous process, a trader can see the prices and quantities of the orders which are already in the order book; then the price which he sends into the order book is strongly influenced by the prices of the orders which are already in the order book. As a consequence, the limit price of an order (i.e. the willingness to pay / to be paid) is never known[4], but by the trader: this information is not communicated to the market and does not directly contribute to the formation of execution prices.

[4] Technically however, order prices are still interpreted by the system as limit prices, according to market rules. In a continuous market, the distinction must be made between: (i) the intrinsic limit price of an order; (ii) the price of an order in order book (which is a technical limit price); (iii) the execution price when a trade is made.

In an auction-based process, traders are blind: the price of an order does not depend on the other orders in order book, since these orders are unknown; then each trader enters a price which is equal to the limit price i.e. which corresponds to his limit willingness to pay / to be paid.

- In addition, in a given hour, a bidding zone has one single execution price in an auction-based market: this single price is the execution price for all orders in the order book. In a continuous market, the execution price varies over time; there are as many execution prices as trades: indeed an execution price is a price for a single trade (or a single group of trades which are executed simultaneously); after execution, other prices will result from the remaining orders in order book. The continuous market can be seen as a real-time negotiation place with always changing market conditions over time.

  As a consequence, it might be that prices tend to be higher in a given bidding zone A than in another bidding zone B at some point of time; and lower in A than in B at another point of time. In other words, trading can be in both directions during trading session. Then determining whether capacity is or becomes scarce can prove challenging: an observed scarcity at some point of time might turn into an abundant capacity a few hours later.

3.3.3. Capacity pricing and current implementation of intraday continuous markets

The statements in this paragraph are valid under implicit capacity allocation.

The pricing of cross-zonal capacities relies on the following assumptions in an auction-based market and these assumptions are not fulfilled in a continuous market:

- The price in each bidding zone is defined clearly and uniquely;
- The information related to all orders is known (by the pricing system) before determining whether capacity is scarce or not;
- The willingness to pay / to be paid, i.e. the limit prices of orders, is known (by the system) and this information allows a welfare optimization process which is not performed per trade but for all orders simultaneously;

Moreover, the following statements help to understand additional reasons why the natural capacity price in the auction market cannot be determined in a similar manner in a continuous market:

- While capacity has not been fully used by market participants, then capacity remains available without being associated to any executed trade: possessing additional capacity does not procure any economic benefit over other market participants: the price of the capacity is zero;
- When capacity has been fully used, then it might become scarce (i.e. possessing additional marginal capacity would procure an economic advantage); but no cross-zonal trade is possible any longer, so that pricing capacity leads to no practical effect in terms of congestion rent and TSO revenue;

These statements can be summarized as follows:

In a continuous market, capacity is abundant and therefore has a zero price when it is non-zero; it becomes scarce only when it becomes zero, then the value of its price has no effect in practice.

The conclusion is the following: contrary to an auction-based market, a continuous market does not lead to a natural price of cross-zonal capacities which would result from economic theory in relationship with a welfare optimization process.

4. Possible Options within the Requirements of the Target Model and CACM Regulation

4.1.1. General remarks on current intraday continuous trading

This section aims at clarifying three points:

(i) The current continuous capacity allocation is not optimal and cannot identify scarcity.

(ii) The current continuous implicit capacity allocation has a Special Auction in some markets. The Special Auction should be distinguished from the auction which is proposed in Option 3.

(iii) In the current design of the intraday market, capacity can be priced in two particular configurations; this price does not directly reflect the scarcity which results from continuous trading.

(i) Lack of optimality of current capacity allocation

Current capacity allocation satisfies the first-come first-served principle. The main consequence with regards to the requirements related to capacity pricing is that capacity allocation is not optimal. Indeed, capacity is offered for free until it is fully used; the willingness to pay for it is not reflected in a capacity price, as if capacity had no market utility.

As a result, capacity can be allocated to a trade between orders having little utility for capacity and therefore having a low willingness to pay for it but which have been sent early in the trading session; whereas other orders having a higher utility for capacity and therefore a higher willingness to pay for it but coming later in the trading session will not benefit of the initially offered capacity.

Example. Assume capacity is 50MW from A to B; a buyer in bidding area B sends an order 100MW@10€; a seller in bidding area A sends an order 50MW@10€ at time t_0; the matching results in the full utilization of capacity and the remaining part of the buy order in B is 50MW@10€. Assume that at time $t_1 > t_0$, a seller in A sends an order 50MW@5€; since no capacity is left, the sell order cannot match against the buy order; although capacity was abundant at t_0 (i.e. at t_0, possessing a marginal additional amount of capacity provides no advantage), the opportunity cost of offering capacity for free at t_0 instead of waiting until t_1 is 5€.

Offering capacity for free neglects opportunity costs[5] related to the possibility to allocate capacity over time to orders with a higher utility for capacity:

- The utilization of the transmission infrastructure is not optimal;

[5] However from a practical point of view, offering capacity for free can facilitate the starting of a market coupling or the stimulating of cross-border trading during a period of time. When the functioning of the market is stabilized, neglecting opportunity cost is detrimental to the optimality of capacity allocation.

- The allocation of cross-zonal capacity is not optimal;

- The price of capacity (i.e. zero) does not reflect capacity scarcity in the future;

- The current intraday markets cannot identify capacity scarcity in such cases when the opportunity costs are positive;

(ii) Special Auction in some current intraday markets

Currently some intraday markets[6] implement a Special implicit Auction to manage the case when capacity increases due to TSO recalculation: orders in newly interconnected bidding zones can have cross-prices, so that the newly available capacity can be used to match these cross-priced orders.

The Special Auction satisfies the following principles:

- Neither any opening of order books nor any gate closure are part of the process, contrary to day-ahead auction;

- The Special Auction aims at solving the cross-price configuration, since buy orders in order books must always have lower prices than sell orders;

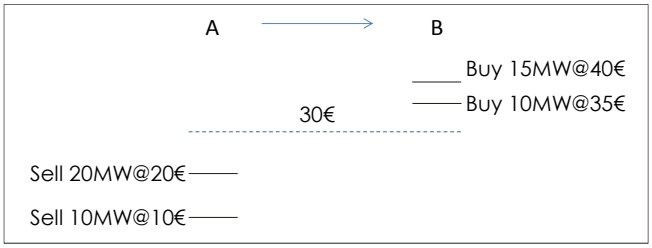
- The Special Auction allocates capacity implicitly;

- The price which results from the Special Auction is not a dual variable of an optimization problem: indeed, buy orders with a higher limit price than the special auction price can be non-executed; and sell orders with a lower limit price than the special auction price can be non-executed.

Example. Assume no capacity from A to B. Assume sell orders in A: 10MW@10€ and 20MW@20€; assume buy orders in B: 10MW@35€ and 15MW@40€.

Now assume 11MW capacity are made available by TSO due to recalculation. The results are:

- Execution of sell order 10MW@10€ (better ranked sell order) and partial execution of sell order 20MW@20€ up to 1MW; and partial execution of buy order 15MW@40€ (better ranked buy order), up to 11MW;



- Common execution price 30€ (middle between 20€ and 40€); although 30€ cannot be a marginal price in A since sell order 20MW@20€ is not fully executed; and 30€ cannot be a marginal price in B since buy order 15MW@40€ is only partially executed and buy order 10MW@35€ is not executed;

- The day-ahead auction would result into the execution of the same orders; however the following prices would be calculated instead: price in B equal to 40€ (price of

[6] See static.epexspot.com/document/28296/20140425_EPEX_SPOT_RR_FR_CORR.zip, Operational Rules, p. 25

marginal order); price in A equal to 20€ (price of marginal order); congestion rent equal to 20€ (difference between prices in A and B);

The configuration depicted in the example shows that the Special Auction is different from the day-ahead coupling auction. In particular, it does not satisfy the optimality properties of the day-ahead coupling auction.

An improvement could be to make the Special Auction similar to the day-ahead auction; however limiting capacity pricing to this improvement is not compliant with the requirements (see Option F in Annex).

(iii) Market configurations which can currently have a positive capacity price

In the current design of intraday markets, capacity is offered for free to the market and there are only two configurations when capacity scarcity can be observed:

- Capacity has been fully used (either before the opening of the intraday trading session or during intraday trading session); then capacity is zero and a theoretical price can be calculated; this price has however no practical effect since the remaining capacity which is subject to this price is zero;

- Capacity is zero at one moment in time; then it is increased by a positive value (because of a TSO recalculation or because of netting after trading in the opposite direction): in case the prices of the orders at both ends of the interconnection are cross, then a Special Auction is triggered and the result of the auction can be a full utilisation of the newly available capacity: a capacity price could be derived from the auction results, similarly to day-ahead market;

Example. Assume that capacity from A to B in zero and that the best sell order in A is 100MW@20€ and the best buy order in B is 100MW@30€; now assume that capacity increases from zero up to 40MW: then the auction calculates the following results:

- *Sell order in A executed up to 40MW @20€;*
- *Buy order in B executed up to 40MW @30€;*
- *Capacity price is 10€ and congestion rent is 40MW x 10€;*

The Special intraday Auction in some markets currently calculates a capacity price equal to zero, as if the congestion rent were split between the buyer and the seller:

Example. Taking the same example as above, the results from the current Special Auction in some intraday markets are the following:

- *Sell order in A is executed up to 40MW @25€;*
- *Buy order in B is executed up to 40MW @25€;*
- *Capacity price and congestion rent are zero;*

The capacity price resulting from the Special Auction only reflects the capacity scarcity at one moment in time when the auction is performed; capacity scarcity as a probable lack of capacity at other moments in the trading session when capacity is almost totally used cannot be identified by the Special Auction mechanism;

In the options below in section 4.1.4, capacity can be priced at other moments in the intraday trading session, and not only like in the current intraday session. The purpose of the options is indeed to reconcile the rationale and requirements for capacity pricing and the design of the continuous trading which is used in intraday markets.

The capacity which might be subject to pricing is: (i) the available capacity at the beginning of the intraday session; (ii) the possibly remaining capacity after Special intraday Auction in case the Special Auction does not use the whole amount of capacity which has been newly made available after TSO recalculation during trading session.

4.1.2. Who pays for capacity when it has a positive price?

The section aims at clarifying whether, if implemented, capacity price would be paid by the buyer or by the seller; by the aggressor or by the aggressed order.

In intraday continuous market, market rules define the execution price of a trade when orders are matched.

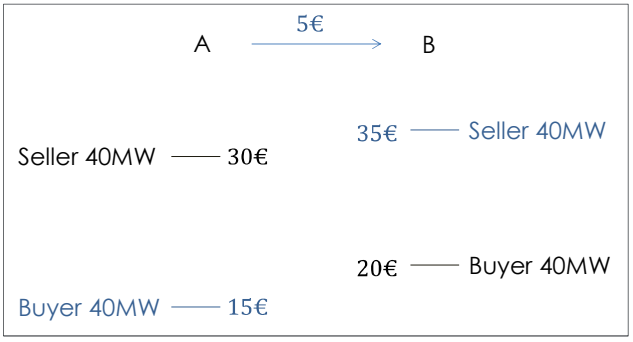
Example. The price of the trade is the price of the aggressed order.

Example. Sell order in A: 40MW @30€; Buy order in B: 40MW@20€; capacity is available for free as today. If the seller clicks the buy order; then the execution price is 20€; conversely if the buyer clicks the sell order, then the execution price is 30€.

Now we assume that capacity has a positive price; as a consequence, orders are displayed with a different price in each local view.

Example. Assume capacity is priced at 5€; the sell order in A is seen in B at a price which takes the capacity price into account; and the buy order in B is seen in A at a price which takes the capacity price into account;

Now, if the seller in A clicks the buy order, the execution price in A is that of the aggressed order in A i.e. 15€:



- *Price received by the seller: 15€;*
- *Price paid by the buyer: 20€;*
- *Congestion rent: 5€;*

Conversely, if the buyer in B clicks the sell order, the execution price in B is that of the aggressed order in B i.e. 35€:

- *Price received by the seller: 30€;*
- *Price paid by the buyer: 35€;*
- *Congestion rent: 5€;*

The example can be summarized by the following statements:

- It is not correct to assert that capacity is always paid by the buyer or by the seller; by the aggressor or by the aggressed order;

- Execution price remains defined by market rules: execution price is the price of the aggressed order in each local view;

- Each executed order is executed in its own bidding zone;

- Executed orders are executed against the clearing house: the difference between the execution price received by the seller and the execution price paid by the buyer is TSO's congestion rent; congestion rent is not paid by the seller only or by the buyer only, but by both simultaneously;

4.1.3. Requirements from draft Guideline on CACM and Framework Guidelines

The requirements below are extracted:

(i) From the draft Guideline on Capacity Allocation and Congestion Management[7] (working version in progress);

(ii) And from the Framework Guidelines which were published by ACER in 2011[8].

The table below includes some remarks on the requirements.

#	Requirement	Remarks and comments
1	CACM - Article 3 - Objectives of cacm cooperation (a) promoting effective competition in the generation, trading and supply of electricity;	Capacity price must reflect the difference between prices in neighbouring interconnected bidding zones.
2	CACM - Article 3 - Objectives of cacm cooperation b) ensuring optimal use of the transmission infrastructure;	The utilization of interconnection capacity should be optimal: capacity pricing should reflect capacity scarcity.
3	CACM - Article 3 - Objectives of cacm cooperation d) optimising the calculation and allocation of cross-zonal capacity;	Capacity price should optimize the allocation of cross-zonal capacity: capacity pricing should reflect capacity scarcity.
4	CACM - Article 3 - Objectives of cacm cooperation (g) contributing to the efficient long-term operation and development of the electricity transmission system and electricity sector in the Union;	Capacity price should contribute to decisions for long-term investments.
5	CACM - Article 3 - Objectives of cacm cooperation (h) respecting the need for a fair and orderly market and fair and orderly	- Capacity price should be non-discriminatory, transparent; - Market participants should have access to the same information related to capacity

[7] http://ec.europa.eu/energy/gas_electricity/electricity/doc/204108-cacm_formal_proposal_for_comitology.pdf

[8] http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Framework_Guidelines/Framework%20Guidelines/Framework%20Guidelines%20on%20CACM%20for%20Electricity.pdf

	price formation;	price; - The contribution of capacity price into price formation should not favour or disadvantage any group or category of market participants;
6	CACM - Article 3 - Objectives of cacm cooperation (j) providing non-discriminatory access to cross-zonal capacity;	Capacity price and pricing mechanism should be neither detrimental nor profitable for a group or category of market participants.
7	CACM - Article 49 - Objectives of the continuous trading matching algorithm (a) aims at maximising economic surplus for single intraday coupling per trade for the intraday market timeframe by allocating capacity to orders for which it is feasible to match in accordance with the price and time of submission;	Capacity price should reflect the scarcity of interconnection capacity.
8	CACM - Article 49 - Objectives of the continuous trading matching algorithm (e) is repeatable and scalable;	- No random process is allowed (i.e. the same sequence of orders associated to the same network features should produce the same price and net position results); - The methodology for pricing capacity must be applicable to any interconnection;
9	CACM - Article 53 – Pricing of intraday capacity 1. The intraday cross-zonal capacity charge shall reflect market congestion and shall be based on actual orders.	- Capacity pricing must reflect the scarcity of it; - Capacity price must be based on prices (execution prices or limit prices of orders in order books) in interconnected bidding zones; - The assumption behind the statement in the requirement is the ability to detect and measure congestion in intraday continuous markets;
10	CACM - Article 53 – Pricing of intraday capacity 2. This mechanism shall ensure that the price of intraday cross-zonal capacity is available to the market participants at the time of matching the orders.	The requirement might not concern the pan-European target model.
11	FGs – 5. Intraday Capacity Allocation The key feature of the intraday market is to enable market participants to trade energy as close to real-time as possible in order to (re-)balance their position.	Capacity pricing should not prevent market participants to trade as close to real-time as possible.
12	FGs – 5. Intraday Capacity Allocation The pan-European intraday target model supporting continuous implicit trading, with reliable pricing of intraday transmission capacity reflecting congestion (i.e. in case of scarce capacity).	- Capacity pricing should be applicable at the pan-European level; - Capacity pricing should reflect congestion; - The assumption behind the statement in the requirement is the ability to detect and measure congestion in intraday continuous markets;

The table below presents the list of requirements and corresponding interpretations related to each requirement or group of requirement.

#	**Requirement**	**Interpretation**
1	CACM - Article 3 - Objectives of cacm cooperation (a) promoting effective competition in the generation, trading and supply of electricity;	A clear definition of optimality is not available in current intraday continuous markets. The statement in the requirements should be understood as a requirement that capacity pricing should be economic and efficient: - Flows should be in the right direction (adverse prices are not allowed); - Capacity allocation should reduce price difference between interconnected bidding areas; - Capacity price should reflect the difference between prices in neighbouring interconnected bidding zones (in particular, the prices of the two directions of an interconnection cannot be simultaneously positive);
2	CACM - Article 3 - Objectives of cacm cooperation b) ensuring optimal use of the transmission infrastructure;	
3	CACM - Article 3 - Objectives of cacm cooperation d) optimising the calculation and allocation of cross-zonal capacity;	
4	CACM - Article 3 - Objectives of cacm cooperation (g) contributing to the efficient long-term operation and development of the electricity transmission system and electricity sector in the Union;	Capacity price should be market driven; pricing capacity according to historical costs of infrastructure is not allowed.
5	CACM - Article 3 - Objectives of cacm cooperation (h) respecting the need for a fair and orderly market and fair and orderly price formation;	- The methodology for pricing capacity should comply with usual market rules and usual principles of market coupling; - The methodology for pricing capacity should be transparent to market participants and non-discriminatory;
6	CACM - Article 3 - Objectives of cacm cooperation (j) providing non-discriminatory access to cross-zonal capacity;	
7	CACM - Article 49 - Objectives of the continuous trading matching algorithm (a) aims at maximising economic surplus for single intraday coupling per trade for the intraday market timeframe by allocating capacity to orders for which it is feasible to match in accordance with the price and time of submission;	1. The statement related to "maximising economic surplus" should be understood as a general statement that capacity price should reflect scarcity. 2. The wording "per trade" should be understood as a general statement that usual market rules should be fulfilled: (i) orders must be ranked by price and timestamp; (ii) the best ranked supply order is matched against the best ranked demand order.
8	CACM - Article 49 - Objectives of the continuous trading matching algorithm (e) is repeatable and scalable;	- No random process is allowed (i.e. the same sequence of orders associated to the same network features should produce the same price and net position results); - The methodology for pricing capacity must be applicable to any interconnection;
9	CACM - Article 53 – Pricing of intraday capacity	1. Capacity pricing should not be arbitrary; 2. Non-restrictive interpretation: deriving a

	1. The intraday cross-zonal capacity charge shall reflect market congestion and shall be based on actual orders.	probability of congestion from actual past orders is allowed;
10	CACM - Article 53 – Pricing of intraday capacity 2. This mechanism shall ensure that the price of intraday cross-zonal capacity is available to the market participants at the time of matching the orders.	Non-restrictive interpretation: market participants should know in advance, or at the time of matching, the price or at least the mechanism for establishing the price of cross-zonal capacity and should not have to pay a price higher than their willingness to pay; market participants should know the higher possible price at the time of matching;
11	FGs – 5. Intraday Capacity Allocation The key feature of the intraday market is to enable market participants to trade energy as close to real-time as possible in order to (re-)balance their position.	Capacity pricing should not prevent market participants to trade as close to real-time as possible.
12	FGs – 5. Intraday Capacity Allocation The pan-European intraday target model supporting continuous implicit trading, with reliable pricing of intraday transmission capacity reflecting congestion (i.e. in case of scarce capacity).	- Capacity pricing should be applicable at the pan-European level; - Capacity pricing should reflect congestion;

In addition to the requirement table, the wording "continuous" is worth noticing:

(i) No requirement in the CACM explicitly states that the intraday market should be continuous as understood in section 3 about existing intraday markets (especially in NWE bidding zones).

(ii) However, CACM seems to implicitly assume that intraday markets are continuous; for instance, the title of article 49 reads "Objectives of the continuous trading matching algorithm".

(iii) Requirement 11 above from Framework Guidelines states as a key feature the possibility to trade as close to real-time as possible; this possibility which is offered to market participants is the purpose of the intraday market, in particular when the integration of intermittent generation and the taking into account of unexpected events are concerned.

It seems that, at least in some occurrences in the CACM and in the FGs, the wording "continuous" refers to the possibility to trade as close to real-time as possible and not to a particular modality of the market organisation. The trading period is the period between the opening of intraday market and the gate closure time: the duration of the period implies that the trading process is described as "continuous".

As a consequence, the two following interpretations of the wording "continuous" are used in the assessment:

- Restrictive interpretation: the wording "continuous" in the Guideline on CACM and in the FGs means continuous as in the existing continuous intraday markets;

- Non-restrictive interpretation: the wording "continuous" in the Guideline on CACM and in the FGs means that the trading process lasts during several hours from the opening of order books until gate closure time;

4.1.4. Proposed options for intraday capacity pricing

The section below presents three options which fit the requirements (or a possible interpretation of the requirements, where it has been assessed that the requirements can be subject to different possible interpretations).

Other options are discussed in academic literature and in the documents which supported the workshops in 2011 and 2013 at the initiative of NRAs and ENTSO-E. The Annex contains options which have been discarded because of a gross or obvious violation of the requirements.

The idea behind option 1 is that capacity price should reflect the opportunity cost, which is equivalent to reflect scarcity understood as a probable lack of capacity: if congestion is likely to occur, capacity price should reflect this probability. However capacity price should be neither exogenous nor arbitrary: option 1 is not similar to yield management techniques.

Option 2 relies on the idea that actual scarcity can be observed for certain after the end of trading session only. Even if it is not possible to set capacity price during trading session, a price cap could guarantee market participants that they will not pay beyond their willingness to pay.

Option 3 attempts to introduce auctions in intraday trading, with gradual variants combining the current continuous trading with auctions.

Option 1. Congestion forecast during trading session

The idea of the option is to reflect capacity scarcity as the opportunity cost resulting from an early allocation whereas orders with a higher need for capacity appear later in the course of the trading session.

In the option, a model is implemented to update the probability of congestion over time. As long as capacity is used in one direction, the probability of congestion increases.

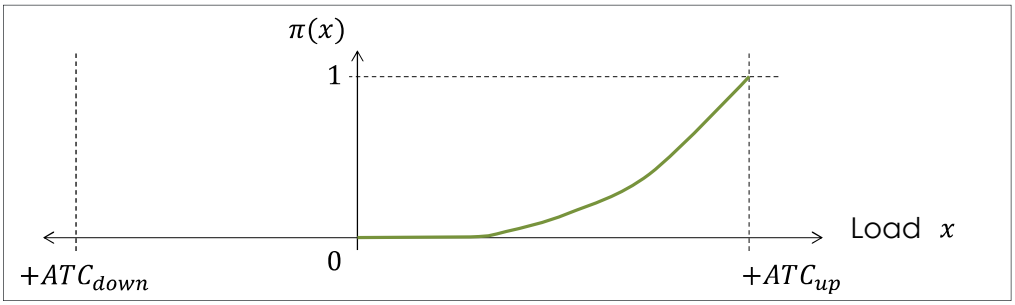
Capacity price depends on the load of the interconnection and increases when load increases.

More specifically, denoting the load x ∈ $[-ATC_{down}, +ATC_{up}]$, then the probability $\pi_{up}(x,t)$ at a given time to be congested in the up direction varies from 0 to 1 when x varies from 0 to $+ATC_{up}$. The price $p_{up}(x,t)$ is derived from the probability as follows:

$$p_{up}(x,t) = \pi_{up}(x,t)p_0,$$

where p_0 is a reference price which characterises the general level of capacity scarcity.

For instance in the graph below, the probability that congestion occurs is zero until the interconnector is loaded by 30%; then the probability increases slowly; then it increases more rapidly when the interconnector becomes almost saturated. Capacity price follows the same variations.



Capacity price should be a decreasing function of time when load remains constant; indeed at a given load value, the probability of congestion decreases when time increases. Similarly, capacity price should be an increasing function of load at each moment in time; indeed, at a given time before gate closure time, the probability of congestion increases when load increases.

The following principles are satisfied:

- Capacity price is based on actual market conditions and actual orders.
- The probability curve and the reference price are known by market participants.
- Capacity price reflects capacity scarcity: the more capacity is scarce, the higher the price; capacity price is directly connected to the expected abundance of capacity: no attempt to "test" the willingness of market participants to pay for capacity is made. If congestion is expected to be unlikely, capacity price is always low.

The main drawback is the following: possibly at the end of trading session, capacity has been priced although the interconnection is not congested; however capacity prices are in line with the likelihood of congestion; even though this likelihood might not materialize.

Questions for implementation

a. How to calculate the probability of congestion and the reference price?

The probability of congestion can be derived from a statistical analysis of the load of the interconnection in the intraday market in the past.

The reference price can be derived from average day-ahead capacity prices.

b. What if capacity is priced but trading occurs in the opposite direction?

The system can keep the maximum load in memory and set the probability to zero until the maximum load is reached again; so that TSO is not paid twice for the same capacity.

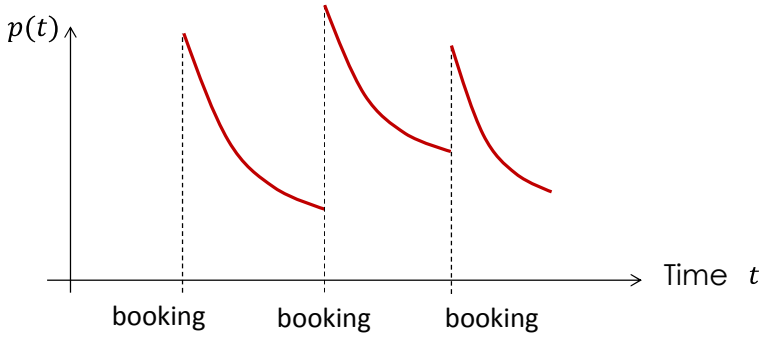
c. What if orders are matched simultaneously?

Orders can be matched simultaneously if one (big) order is matched against several (small) orders. Matching occurs as if several trades were made between each "small" order and each part of the "big" order; these trades are executed at a given execution time (which is identical for all simultaneously executed trades) and the capacity price which applies is the capacity price at this time.

d. Is it possible to price capacity when hourly products are matched against half-hourly products?

Yes, indeed each trade between one hourly product and two half-hourly products can be considered as two simultaneously executed trades between half-hourly products.

Option 1 aims at reflecting the opportunity cost. Generally speaking, for instance in airline companies, opportunity costs are revealed by means of yield management techniques: seat price decreases over time until a booking is made; then price suddenly increases, in order to allow clients with a high willingness to pay for a seat at a higher price; then price decreases again over time in order to adapt to the willingness to pay, until the next booking.



Option 1 however does not replicate this price pattern over time. The following paragraphs explain the difference between general yield management models and option 1. Our interpretation of the requirements is the following:

- Capacity price should reflect scarcity; as a consequence, a straightforward application of yield management techniques in which prices are exogenous and comply with a pricing strategy which maximises profit is not in line with requirement;

- Capacity price should be determined implicitly as a consequence of capacity utility for energy exchanges; as a consequence, the willingness of market participants to pay for capacity is not a parameter to consider, especially if capacity is abundant; only the opportunity cost is to consider i.e. the utility cost for the collectivity if capacity is allocated at a given moment in time instead of being allocated later;

1. Is the price in option 1 exogenous?

In yield management techniques, several parameters are exogenous values which are set to maximize the profitability of the commercial process: price value after booking, shape of the

decreasing curve, sequence of price peaks; in particular the sequence of price peaks can be increasing or decreasing, depending on the trading strategy.

In option 1, no parameters are exogenous: each parameter is derived from actual orders in the energy market. The shape of the price curve is not set beforehand: it is only the result of the calculation of the probability of congestion at each point in time.

2. What about implicit pricing?

Yield management techniques apply to goods which are sold as such; price is set by a market in which demand and supply for this good are compared.

Capacity price should not be set explicitly in a market in which demand and supply for capacity are compared. On the contrary, capacity price should be implicitly derived from the energy market; technically, capacity price is not a *primal* variable in a welfare optimization model but a *dual* variable. Applying general yield management techniques would be equivalent to setting capacity price as a primal variable and to sell capacity as a good as such. As an example, the price of plane seats will never be zero in case the plane capacity is abundant compared to the demand; whereas capacity price should be zero when capacity is abundant.

Another intuitive way to understand this contrast is to observe that yield management techniques aim at maximizing the profit from the selling of the good; whereas capacity pricing should reveal the utility of interconnection capacity for the energy market. This utility is not linked to the profit for TSO which operates capacity.

3. What about netting?

In the booking of plane seats, no netting is possible: no customer of the airplane company will buy negative plane seats, which would lower seat scarcity.

In energy markets, capacity is used in both directions depending on the direction of prices. When capacity is used in a given direction, it is abundant in the other direction and therefore priced at zero in this other direction.

4. What is the relationship between price and scarcity in yield management techniques and in option 1?

In yield management techniques, price reflects the opportunity cost; however, price is not directly connected to the scarcity or abundance of the good: price might be high at a given moment in time, although a very small quantity of the good is sold at the end of the trading process. Indeed yield management techniques try to reveal the willingness to pay which can be high even when the good is abundant; revealing and profiting from the highest willingness to pay is a key issue in order to maximise profit.

In option 1, capacity price increases gradually when capacity is used: a high capacity price at a given moment in time is directly connected to the probability that the interconnection is congested at the end of the trading session. Therefore, a high price will not intend to reveal a high willingness to pay but to maximise the effective utility of capacity by selecting between trades which are ready to pay for it because they have a higher utility of it.

Option 2. Ex-post calculation of capacity price

The idea is to keep the intraday trading session as today and to wait until gate closure to observe scarcity.

Scarcity is observed when the interconnection is loaded up to the Available Transfer Capacity i.e. when the remaining capacity is zero.

Then the capacity price should be the price difference between the two bidding zones. Several possible choices exist to define the price in each bidding zone:

- The price in each bidding zone is the average execution price (weighted by matched quantities) after the interconnection has become congested (if trading in the opposite direction occurs after congestion, the last time congestion has occurred is selected);
- The price in each bidding zone is the execution price of the last trade, which is assumed to reflect the market conditions at gate closure time;
- The price in each bidding zone is the middle of price spread at gate closure time;

In each case, capacity price is implicitly derived from energy price.

After the calculation of capacity price, every trade using capacity is charged the capacity price; the price is paid by market participants in addition to the trading price.

However, no additional operation is required by market participants: capacity has been automatically purchased when trades have been executed (even though its price was not certain). Capacity purchase was implicitly performed when trades were executed.

A price cap is defined beforehand in order to allow market participants to control the risk that the actual final price of a trade does not correspond to their willingness to pay. The price cap is not arbitrary and would depend on capacity reference prices.

Changes in market rules would be needed.

Example. Assume the price cap is 10€/MWh; assume that the calculated capacity price is 12€/MWh. Then each cross-border trade in the direction of capacity is charged 10€/MWh: the buyer pays 5€/MWh to the clearing house in addition to the negotiated price; the seller receives 5€/MWh less from the clearing house, compared to the negotiated price.

The following principles are satisfied:

- Capacity price is based on actual market conditions and actual orders;
- Capacity price reflects scarcity;
- Price cap guarantees to market participants that final prices correspond to their willingness to pay;

Questions for implementation

a. How to calculate the capacity price cap?

The price cap can be the maximum day-ahead capacity price which was calculated during the last year in the day-ahead auction.

More generally speaking, it can be defined from the day-ahead capacity prices in the past;

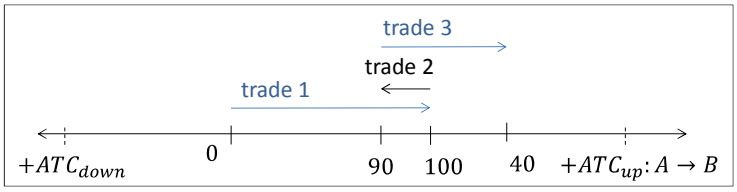
b. Which trades are charged to pay for capacity?

Trades which should be charged are trades which have contributed to the utilization of the scarce capacity.

However in case trades are made in both directions during the trading session, the same capacity should not be charged twice; then the parts of the trades which should be subject to capacity price correspond to the utilization of capacity beyond the already charged amount of capacity.

Trades in the opposite direction cannot prove the abundance of capacity as such; indeed the effect of big trades on the utilization of capacity cannot be compensated by small trades in the other direction. In another words, trades in the opposite direction does not imply the absence of capacity price for trades which have been executed before.

Example. Assume a cross-border trade of 100MWh requiring 100MWh capacity from A to B; then a cross-border trade of 10MWh in the opposite direction (releasing 10MWh capacity from A to B); then again a cross-border trade requiring 50MWh from A to B.



The first trade is charged of 90MWh capacity from A to B, which corresponds to its effective contribution to capacity saturation; the second trade in the opposite direction is not charged for capacity, since the interconnection is loaded in the direction from A to B; the third trade is charged of 50MWh from A to B.

Option 3. Auctions during trading session

N.B. The wording "auction" is used in this section with the same meaning as the current day-ahead auction; it does not refer to the special intraday auction process which is referred to in Option F (see Annex). However, pricing capacity in the special intraday auction process remains valid in all cases.

Trading session is split into time periods. At the end of each time period, an auction is performed as in day-ahead market.

Possible variants are:

a. The sequence of auctions behaves as an additional intraday market next to the current continuous intraday market;

   Participation to either the continuous market or to the auction market is non-mandatory.

b. The auctions interrupt the continuous trading session;

   Participation to either the continuous market or to the auction market is non-mandatory. However continuous trading is not possible during the performing of the auction process.

c. The continuous trading session is limited to local trading; and cross-border trading through intraday market coupling is possible in auctions only;

   Participation to either the continuous market or to the auction market is non-mandatory. However cross-border matching is possible in the auction only.

d. Auctions become the only intraday market modality (i.e. continuous trading is no longer allowed);

Variant c. aims at avoiding a possible lack of liquidity which might occur in variants a. and b. Indeed if capacity is offered for free during the continuous trading session and if capacity is likely to have a positive price in the auction process, then market participants might remain on the continuous market only and might not participate to the auction process. A lack of liquidity will:

- Send wrong energy price signals;
- Send wrong capacity price signals;
- Raise side-effects due to non-convexities (if block orders are allowed);

The following principles are satisfied:

- Capacity price is based on welfare optimization in auction and then has all the nice properties of the capacity price in day-ahead;

- In particular, capacity price reflects scarcity;

Questions for implementation

a. How many auctions to perform?

Auctions can be performed several times during the intraday trading session. If auctions include block orders, then auctions should concern all products in a single calculation; in addition, having all products in the same auctions would help to limit the number of auctions.

Auctions can be performed regularly during the trading session (for instance every hour or every two hours): to be determined according to the time needed to perform an auction. Generally speaking, an auction assumes the following steps:

- Opening of order books;
- Gate closure and running of the auction system;
- Check of results and publication;
- Nomination and clearing;

Depending on the time needed for each step, the total duration can vary; since intraday auction might be less complex than the current day-ahead auction (possibly less complex products; fewer block orders; fewer hourly orders), one might expect the intraday auctions to be performed more quickly than the day-ahead auction.

b. Should the capacity price from an auction be kept for pricing capacity during the following period of continuous trading?

The question is related to variants a. and b. The capacity prices which are derived from auction results can be used during the continuous trading session. This could help to solve the liquidity issue in the auctions, since the advantage of having capacity for free in the continuous auction would be removed.

However if the whole amount of available capacity is offered in each auction, the results of the auction will be the following:

- Either capacity has a positive price; therefore the remaining capacity is zero during the rest of the trading session;

- Or capacity has a zero price; therefore it can remain offered at a zero price during the trading session until the next auction;

As a consequence, the question is meaningless if the whole amount of available capacity is offered from the beginning of the trading session; on the contrary, it can still be raised if capacity is offered to the market gradually: for instance, if an hourly product is subject to 5 auctions during the intraday session, the available capacity could increase by 1/5 after each auction i.e. 20% offered at the beginning until the end of the first auction; then 20% more offered after the end of the first auction until the end of the second auction. The part of capacity to offer in each period could be derived from the historical utilization of capacity over time during trading session.

In addition, given that many trades might be executed close to the end of the trading session, the intraday session could be ended by a final auction (the drawback however would be the need to perform an auction every hour).

c. What about the complexity of managing several auctions in addition to the continuous trading session?

Managing a continuous intraday session 24/7 can be challenging for smaller market participants; adding an auction process can prove even more challenging, especially in variants a. and b. At some point, small market participants might claim that the complexity in intraday market operations is discriminatory.

5. Assessment of options

The table below summarizes the assessment of the options. **Option 1 (Congestion forecast during trading session); and option 3.c (Auctions combined with continuous local trading) are fully compliant with the requirements**.

Option 2 (Ex-post calculation of capacity price) shows almost compliant since mitigation measures can be put in place concerning the lack of fulfilment of requirement 5.

Option 3.a. (Auctions in addition to current unchanged continuous trading) is not compliant since capacity allocation could satisfy the first come first served principle only, without any corresponding price, which is not optimal.

The compliance of options 3.b. (Auctions interrupting continuous trading) and 3.d. (Auctions only) mainly depends on the practical implementation.

#	Requirements / Options	1	2	3			
				a	b	c	d
1	CACM - Article 3 - Objectives of cacm cooperation (a) promoting effective competition in the generation, trading and supply of electricity;	✓	✓	×	×/✓	✓	✓
2	CACM - Article 3 - Objectives of cacm cooperation b) ensuring optimal use of the transmission infrastructure;	✓	✓	×	×/✓	✓	✓
3	CACM - Article 3 - Objectives of cacm cooperation d) optimising the calculation and allocation of cross-zonal capacity;	✓	✓	×	×/✓	✓	✓
4	CACM - Article 3 - Objectives of cacm cooperation (g) contributing to the efficient long-term operation and development of the electricity transmission system and electricity sector in the Union;	✓	✓	✓	✓	✓	✓
5	CACM - Article 3 - Objectives of cacm cooperation (h) respecting the need for a fair and orderly market and fair and orderly price formation;	✓	×	✓	✓	✓	✓
6	CACM - Article 3 - Objectives of cacm cooperation (j) providing non-discriminatory access to cross-zonal capacity;	✓	✓	×	×	✓	✓
7	CACM - Article 49 - Objectives of the continuous trading matching algorithm (a) aims at maximising economic surplus for single intraday coupling per trade for the intraday market timeframe by allocating capacity to orders for which it is feasible to match in accordance with the price and time of submission;	✓	✓	✓	✓	✓	✓
8	CACM - Article 49 - Objectives of the continuous trading matching algorithm (e) is repeatable and scalable;	✓	✓	✓	✓	✓	✓
9	CACM - Article 53 – Pricing of intraday capacity 1. The intraday cross-zonal capacity charge shall reflect market congestion and shall be based on actual orders.	✓	✓	✓	✓	✓	✓
10	CACM - Article 53 – Pricing of intraday capacity 2. This mechanism shall ensure that the price of intraday cross-zonal capacity is available to the market participants at the time of matching the orders.	✓	✓	✓	✓	✓	✓
11	FGs – 5. Intraday Capacity Allocation The key feature of the intraday market is to enable market participants to trade energy as close to real-time as possible in order to (re-)balance their position.	✓	✓	✓	✓	✓	×
12	FGs – 5. Intraday Capacity Allocation The pan-European intraday target model supporting continuous implicit trading, with reliable pricing of intraday transmission capacity reflecting congestion (i.e. in case of scarce capacity).	✓	✓	✓	✓	✓	✓

5.1.1. Option 1: Congestion forecast during trading session

#	Fulfilment	Assessment
1	✓	- The utilization of capacity with positive price reflects higher prices in the direction where capacity is used; - Capacity allocation from A to B tends to increase prices in A and to decrease prices in B: price difference is reduced; - Capacity price increases as long as capacity becomes more used; therefore a higher utilization of capacity reflects a higher price difference between interconnected bidding zones; - The more capacity is used, the more it is allocated to trades which have a higher willingness to pay for it; - The more capacity is scarce (i.e. the less the remaining capacity is), the higher the price is;
2	✓	
3	✓	
4	✓	- Capacity price reflects the opportunity cost; - Capacity price reflects the market conditions of current intraday session; it also depends on capacity prices in day-ahead results over time; as a consequence, capacity price reflects the market utility of capacity; - No arbitrary element are used to make capacity price; the parameters to calculate capacity price are taken from the behaviour of the market;
5	✓	- Capacity price applies to all market participants; it does not discriminate between market participants; - The methodology to calculate capacity price is transparent; the historical parameters to calculate capacity price can be made available to market participants; - The impact of capacity price is the same on every order in order book;
6	✓	
7	✓	- A higher capacity price reflects a higher scarcity; - A lower capacity price reflects a lower scarcity; - A zero capacity price reflects capacity abundance; - Capacity price does not impact the application of market rules on order ranking and matching;
8	✓	- No random parameter or process is part of the calculation of capacity price; - Capacity pricing can apply to any interconnection in any direction; - The same historical data produce the same parameters to calculate capacity prices; the same utilization of capacity during trading session produces the same capacity price;
9	✓	- Capacity prices are not arbitrary since they reflect capacity scarcity; - The option is based on the calculation of a probability that capacity is congested at the end of the trading session; the calculation of the probability is based on orders in the past and on the utilization of the capacity during trading session;
10	✓	- The parameters and the methodology to calculate capacity price are known before the beginning of the trading session; - At the time of matching the orders, capacity allocation is implicit and capacity price is implicitly paid as the difference of execution prices against the clearing house; - Capacity price is included in the limit price of orders which are displayed in order book local views;
11	✓	Capacity pricing has no impact on the current possibility to trade as close to real-time as possible.

12	✓	- Capacity pricing could apply to any interconnection at the level of the pan-European intraday market; - Capacity pricing reflects market congestion;

In addition, the following points complement the assessment:

- The option is compatible with the restrictive interpretation of the wording "continuous": indeed, no change is envisaged in the continuous modality of the intraday market.

- The option is compatible with block order trading, including cross-border block order trading; indeed, capacity prices apply in each hour of the block order, so that capacity price is implicitly contained in the price of the block order which is displayed in the local view of the order book.

5.1.2. Option 2: Ex-post calculation of capacity price

#	Fulfilment	Assessment
1	✓	- Since capacity price is zero during trading session, then flows are always in the right direction: indeed capacity price is calculated after trading session on the basis of observed flows; - Capacity allocation from A to B tends to increase prices in A and to decrease prices in B: price difference is reduced; - The capacity price which is calculated at the end of trading session reflects the difference between prices in neighbouring interconnected bidding zones;
2	✓	
3	✓	
4	✓	- Capacity price reflects the market conditions of current intraday session; as a consequence, capacity price reflects the market utility of capacity; - No arbitrary elements are used to make capacity price; the parameters to calculate capacity price are taken from the behaviour of the market;
5	×	**- Since capacity price is calculated at the end of the trading session, orders are subject to capacity payment only if trade was a cross-border trade, though order books cannot distinguish between local orders and cross-border orders;** **- Final execution price is not known during trading session but at the end of trading session;** - Capacity price methodology applies to all market participants; it does not discriminate between market participants; - The methodology to calculate capacity price is transparent;
6	✓	
7	✓	- A higher capacity price reflects a higher scarcity; - A lower capacity price reflects a lower scarcity; - A zero capacity price reflects capacity abundance; - Capacity price does not impact the application of market rules on order ranking and matching;
8	✓	- No random parameter or process is part of the calculation of capacity price; - Capacity pricing can apply to any interconnection in any direction; - The same historical data produce the same parameters to calculate capacity prices; the same utilization of capacity during trading session

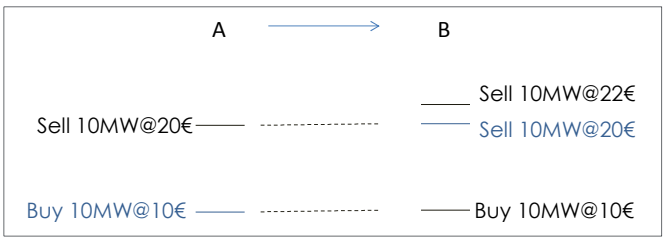
		produces the same capacity price;
9	✓	- Capacity prices are not arbitrary since they reflect capacity scarcity; - Capacity price is based on the actual congestion at the end of intraday session and on actual orders in interconnected bidding zones;
10	✓	- The parameters and the methodology to calculate capacity price are known before the beginning of the trading session; - The maximum value for capacity price is known in advance; the methodology for the calculation of this cap value is transparent for market participants; - If market conditions change, markets participants can anticipate congestion and adapt the limit price of the orders according to the price cap value, so that the final execution price at the end of trading session (which includes capacity price) is not beyond the willingness to pay;
11	✓	Capacity pricing has no impact on the current possibility to trade as close to real-time as possible.
12	✓	- Capacity pricing could apply to any interconnection at the level of the pan-European intraday market; - Capacity pricing reflects market congestion;

In addition the following points complement the assessment:

- The option is compatible with the restrictive interpretation of the wording "continuous": indeed, no change is envisaged in the continuous modality of the intraday market.

- The option is compatible with block order trading, including cross-border block order trading; indeed block order trading can be implemented like in the current intraday market and block order trades using capacity can be charged for capacity in each applicable period.

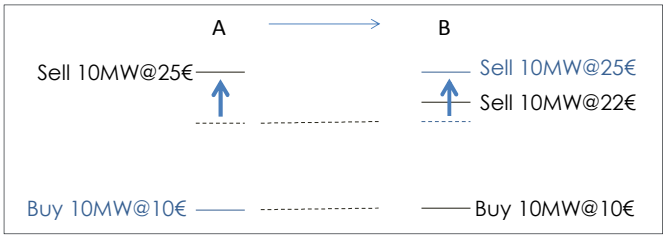
The remarks on requirement 5 (fair and orderly price formation) are mentioned as a point for attention and not as a blocking point. The reasoning behind is explained through the example below.



Assume information is available to market participants, so that a probability of congestion can be derived by market participants as part of their trading strategy; and assume the capacity price cap is available to market participants. We consider the initial configuration when capacity is abundant (cross-border representation of orders in local views are in blue; orders are in black in their own local view); then the buyer in B could negotiate with the seller in A which looks more competitive than the local seller in B.

Assume capacity price is capped at 10€; the payment of this cap price would be split into 5€ additional payment by the buyer and 5€ to be subtracted from the price received by the seller. Since the seller limit price is 20€, if he does not want to take the risk of being paid less than 20€, then he will move his price up by 5€: in the local view in B, the local sell order

is now more competitive. The seller in A can also calculate the risk that the capacity price has a positive value and conclude that he can move his price up by less than 5€.



In other words **capacity price can be considered as an additional transaction cost**, which has a known value in average (even if this actual transaction cost varies every day depending on market conditions) and which has a known maximum value.

The following mitigation measures can make price formation more orderly and fair; the mitigation measures aim at giving market participants the needed information to control the risk that the final price which is executed by the clearing house might be out of their willingness to pay:

- Publish remaining available capacity during trading session, in order to help market participants anticipating the occurrences when capacity is priced;
- Publish capacity price cap and the methodology for the calculation of the price cap;
- Publish statistical information related to intraday capacity prices;

5.1.3. Option 3: Auctions during trading session

#	Fulfilment	Assessment
1	a. ✗ b. ✗/✓ c. d. ✓	**- In variant a. capacity is not priced in the continuous market, like today, which is not compliant with the requirements;** **- In variant b. the option is not fully compliant with the requirements if the whole amount of capacity is offered from the beginning of the trading session: indeed, (i) if congestion occurs during the auction, then capacity has a positive price but the price applies only to orders which have taken part to the auction and not to all orders which have contributed to capacity saturation; (ii) if congestion occurs during the continuous session, then capacity has a zero price**; - In variants c. and d. capacity price actually reflects price difference between bidding zones; - Capacity allocation reduces price difference in all variants; - Flows are in the right direction in all variants;
2		
3		
4	✓	- Capacity price is market driven as in day-ahead;
5	✓	- Capacity price applies to all market participants; it does not discriminate between market participants; - The methodology to calculate capacity price is transparent and complies with usual market rules; **- In variants a. and b. the complexity of the sequence of auctions and the interactions between auctions and continuous trading might be challenging for small market participants; an excessive complexity would be discriminatory for small market participants;**
6	a. b. ✗ c. d. ✓	
7	✓	- A higher capacity price reflects a higher scarcity; - A lower capacity price reflects a lower scarcity; - A zero capacity price reflects capacity abundance; - Capacity price does not impact the application of market rules on order ranking and matching;

8	✓	- No random parameter or process is part of the calculation of capacity price; - Capacity pricing can apply to any interconnection in any direction; - The same historical data produce the same parameters to calculate capacity prices; the same utilization of capacity during trading session produces the same capacity price;
9	✓	- Capacity prices are not arbitrary since they reflect capacity scarcity; - Capacity price is calculated on the basis of orders in auction order books;
10	✓	- The calculation of capacity price is part of the auction process like in day-ahead; - At the time of matching the orders, capacity allocation is implicit and capacity price is implicitly paid as the difference of prices against the clearing house, like in day-ahead;
11	a. b. c. ✓ d. ×	**- In principle, an auction can be performed very close to real-time; however this depends on operational constraints such as: (i) the time needed to perform an auction; (ii) the organization of fallback procedures in case the auction fails; (iii) the possibility of implementing local continuous trading during delivery period if needed;**
12	✓	- Capacity pricing could apply to any interconnection at the level of the pan-European intraday market; - Capacity pricing reflects market congestion;

In addition, the following points must be remarked:

- The option is not compatible with the restrictive interpretation of the wording "continuous"; however it is compatible with the non-restrictive interpretation since trading is allowed as close to real-time as possible and trading process lasts during several hours, allowing market participants to get progressively balanced and to adapt to changes in market conditions.

- The compliance with some requirements strongly depend on the practical organisation of the auctions (e.g. how many auctions; when; how much capacity offered in each auction; how much time needed by each auction).

- The option is compatible with block order trading, including cross-border block order trading; indeed, auction process can link periods through block orders like in day-ahead auction.

6. Areas for further analysis

After the selection of an option, the following points can be subject to a further analysis, depending on the selected option.

6.1.1. Implementation issues

Some implementation questions have been listed in the description of each auction.

Above all, the liquidity issue should be a point for attention when refining the details of the implementation, especially in option 3. A lack of liquidity might send wrong price signals (energy price and capacity price) and would harm the utilization of complex products such as block orders.

Generally speaking, the implementation of the selected option and the corresponding changes in trading systems should allow efficient trading from market participants' perspective.

Moreover, the implementation of the selected option is likely to imply changes in trading systems. An accurate follow-up of the implementation of these changes will guarantee that the final result is in line with the initially selected option and with the requirements of CACM and FGs. Especially with regards to the points related to the information which is available to market participants (see options 1 and 2), it is of utmost importance that this information be easily available and ready for use including to small market participants.

6.1.2. Economic assessment

The options in the report are high-level options and leave much room for the setting-up of details (see option 1: the calculation of reference prices). Setting the details will be a key step for the efficiency of the selected option.

Simulations can be envisaged, based on historical data, to estimate the results of the implementation of an option; for instance in option 2, a calculation of capacity prices (including capacity price caps) could help to assess whether the option is acceptable for market participants in practice.

In addition, the implementation of capacity pricing might not be achieved on every interconnection: an analysis could be made on the impact on the market and on capacity use if some interconnections are priced while others remain offered for free.

Last, a quantitative assessment of the congestion rent could be compared with the expected implementation costs: even though an option might be in line with the requirements of the Target Model, a high implementation cost would make the option meaningless if the resulting congestion rent were too small in comparison. If capacity prices are expected to be very low, it could be assessed whether another mechanism than capacity pricing, imperfect but cheaper, could measure the market utility of capacity and distribute the corresponding revenue to TSOs.

6.1.3. Capacity pricing and the future developments of intraday markets

The selected option should be assessed with regards to the future developments of the intraday market e.g.:

- The introduction of flow-based coupling in intraday; some interconnections such as DC interconnections will remain ATC interconnections and subject to capacity pricing as defined in the report.

  Other coupled bidding zones might become coupled by flow-based mechanism. Then the question might arise whether flow-based capacities can be priced in intraday as they are in day-ahead and whether the selected option is compatible with flow-based capacity pricing.

- The developments of the pan-European intraday market and the possible harmonisation of balancing markets could impact the use of capacity close to the beginning of delivery period and during delivery period. The question might arise whether the selected option for capacity pricing is compatible with the development of balancing markets in the next years. The allocation of capacities in the balancing period might benefit from an efficient capacity pricing mechanism.

7. Annex

The options below have been discarded; for each option, the principle is presented as well as the assessment why the option has been discarded.

Option A. Tariff

The option consists in applying a price which would be kept fixed over a long period of time (e.g. several days) compared to the term of the intraday trading.

A variant would consider arbitrary capacity prices, which are excluded from the requirements.

Another variant would consider a price which would reflect scarcity over a long run, based on statistical indicators from actual orders and trades in the past.

> *E.g. Imagine that capacity from GB to NL is scarce in average over the last recent year; an average price is derived and applied in every trading session. However, in a given day, it is possible that the capacity in the opposite direction from NL to GB is saturated, with intraday prices higher in GB than in NL.*

This variant does not comply with the requirement that capacity price should reflect scarcity; indeed trades can be done in the opposite direction, resulting into a positive price which is applied to an abundant capacity.

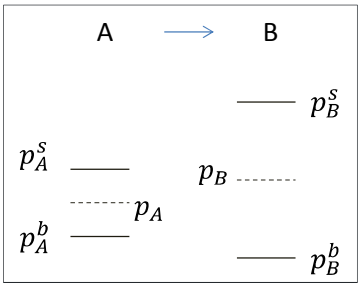
Option B. Infrastructure cost driven

The option consists in applying a constant price which reflects the costs for achieving the interconnection infrastructure.

This option is against the requirement that capacity price should be market driven and should reflect scarcity. On the contrary, market driven capacity prices should provide signals for investments in new infrastructures.

Option C. Real-time pricing based on the middle of price spread

Capacity price between two bidding areas A and B should reflect the price difference between A and B. However, in a continuous market, prices in A and B are not defined at any moment (we only have matching prices for each trade); the idea is to define the real-time price in A (resp. in B) as the middle of the spread between the best ranked buy and sell orders:



$$p_A = \frac{1}{2}\,(p_A^s + p_A^b);\; p_B = \frac{1}{2}\,(p_B^s + p_B^b)$$

If $p_A < p_B$ then the capacity from A to B will have a positive price $p_C = p_B - p_A$. Provided sufficient capacity exists, the sell order in A will be seen in B with a price equal to:

$$p_A^{s\prime} = p_A^s + p_C = p_B + \frac{1}{2}\,(p_A^s - p_A^b) > p_B > p_B^b$$

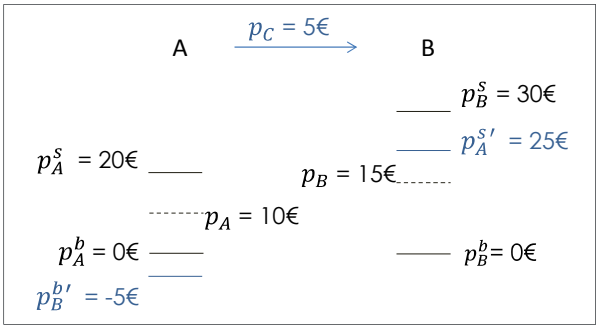
Similarly, the buy order in B will be seen in A with a price equal to:

$$p_B^{b\prime} = p_B^b - p_C = p_A - \frac{1}{2}(p_B^s - p_B^b) < p_A < p_A^s$$

Since these inequalities are satisfied at each moment in time, the buy order in B and the sell order in A can never move to the same price (in either local view A or B of the trading system) and therefore will never match against one another.

Since the buy order in B and the sell order in A are the best ranked orders, the conclusion is that the pricing mechanism prevents matching from A to B: this capacity pricing mechanism prevents the utilisation of capacity, which is obviously against the requirements.

Example. Assume order books in A like in the drawing: in the beginning, the middle of the price spread in A is at 10€ and in B at 15€. Then capacity price from A to B is priced at 5€.



As a consequence, the best sell order in A is priced at 25€ in the local view in B, which is still better than the best sell order in B (which is at 30€); conversely the best buy order in B is seen at -5€ in the local view in A. Traders cannot distinguish between black local orders and blue cross-border orders.

Now assume the best buy order in B starts to negotiate with the sell order he sees as the best sell order i.e. the sell order at the apparent price of 25€, which is the sell order in A. More precisely, assume that he gradually increases the price by 1€ over time: then the middle of the spread in B gradually moves up, and so does the capacity price and also therefore the local apparent price in B of the sell order in A. The table below summarizes this gradual progress:

Prices	t_0	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}	t_{11}
p_B^b	0	1	2	3	4	5	6	7	8	9	10	11
p_B	15	15.5	16	16.5	17	17.5	18	18.5	19	19.5	20	20.5
p_C	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5
$\boldsymbol{p_A^{s\prime}}$	**25**	**25.5**	**26**	**26.5**	**27**	**27.5**	**28**	**28.5**	**29**	**29.5**	**30**	**30.5>30**
$p_B^{b\prime}$	-5	-4.5	-4	-3.5	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5

As long as p_B increases, he sees $p_A^{s\prime}$ increasing and crossing the price of p_B^s; when p_B reaches 10€, the negotiation will go on with the local sell order in B.

From the point of view of the seller in A, he sees a buy order with an increasing price, which looks promising; but when this buy order gets to 10€ in the local view in A, it suddenly disappears, because it has been matched locally in B.

Cross-border trading remains possible if one directly clicks a cross-border order; however the example shows that the negotiation process under this capacity pricing mechanism is not compatible with cross-border matching.

Instead of calculating capacity price is below:

$$p_C = p_B - p_A = \frac{1}{2}(p_B^s + p_B^b) - \frac{1}{2}(p_A^s + p_A^b),$$

one could generalize the idea in order to make it coherent with a fair negotiation process, e.g.:

$p_C = a\,(p_B^s - p_A^s) + (1-a)(p_B^b - p_A^b)$, or $p_C = \max(p_B^s - p_A^s, p_B^b - p_A^b)$, or $p_C = \min(p_B^s - p_A^s, p_B^b - p_A^b)$.

Option C corresponds to $a = 1/2$. Similarly, this generalization of capacity price prevents negotiation process to be efficient.

In addition, in such options congestion rent is paid even if capacity is and remains obviously abundant: capacity price does not reflect actual scarcity or predictable scarcity i.e. opportunity cost.

Option D. Capacity price based on day-ahead results

The idea is the following: the level of scarcity is determined on the basis of the day-ahead results which are assumed to reflect the market conditions of the day; and the capacity price is kept unchanged during the trading session, e.g.:

- If an interconnection is congested in day-ahead, the price of the capacity is that in day-ahead: if it happens that market conditions reverse in intraday, so that trading is possible again in the congested direction, the price of the capacity will be kept unchanged;
- If the interconnection is not congested, the price of the capacity will be kept zero during the intraday trading session;

Now assume that a capacity from A to B is congested in day-ahead with a positive capacity price; assume that either a recalculation by TSOs or changes in market conditions (resulting into intraday trading in the opposite direction and capacity netting) increase the capacity from A to B: this additional capacity is now abundant in the course of the intraday session and is however priced at a positive price. This is against the requirements that capacity price should be efficient and reflect scarcity.

The fundamental reason why this option is not satisfactory is that there is no reason for intraday capacity scarcity to be that of day-ahead; on the contrary, the purpose of the intraday market is to allow market participants to adapt to changes in market conditions (in particular when the integration of fluctuating renewable sources is concerned); such changes might modify the level of scarcity of interconnection capacities.

Option E. Recapitulation auction after gate closure

The idea is to keep the continuous trading session as today and to match all the executed trades in an auction after gate closure in order to calculate the price of capacity. Indeed:

- This is only after the end of the trading session that we can observe whether capacity is scarce;

- There are other examples in power markets where bids from continuous markets are integrated to a final common auction[9];

The purpose of the auction is not to offer new trading possibilities: only the already matched trades are part of it; the goal is to calculate capacity price as a result of trades which have been executed during the continuous session.

Two reasons make such a mechanism non-compliant with the requirements:

(i) Market participants do not know the capacity price before the end of the trading session; possibly, they can pay any price for capacity, so that no measure can be taken when bidding in the intraday session to protect against high capacity prices;

(ii) In the Italian market, when bidding in the spot market, market participants have a risk that their long term bids cannot be executed if the bid corresponding to capacity is not matched: then they do not have the capacity which they need to finalize their bid;

For these reasons (price risk; quantity risk), such a pricing mechanism cannot fulfil the requirements: this option does not comply with an orderly and fair price formation.

Option F. Limiting capacity pricing to Special intraday Auctions

Currently Special intraday Auctions are used when capacity increases from zero up to a positive value (because of TSO recalculation; see section 4.1.1).

The option consists in limiting capacity pricing to these market configurations when the Special intraday Auction is triggered. Then capacity price would remain zero during the rest of the intraday trading session. In particular, like in the current implementation, the following situations can occur:

- Capacity might be fully used during continuous trading session, but still with a zero price;
- The level of capacity scarcity is not derived into a price which would give signals for investments;
- The usual zero price of capacity does not reflect capacity scarcity, either during the trading session as an actual or as a probable scarcity; or after the trading session as a result of the trades over time;
- A zero capacity price allows market participants (in particular big market participants which are more likely to trade at both ends of the interconnection) to reserve capacity at the detriment of other market participants;

The option is therefore not in line with the requirements.

However, pricing capacity in the Special Auction cases should not be discarded.

Option G. Capacity as a market product offered by TSOs

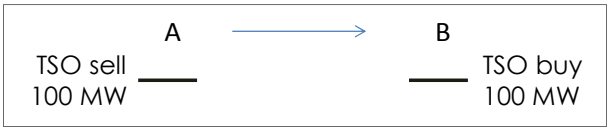
In this option, TSOs trade capacity as a market product in intraday market session.

[9] In the Italian market, long term bids are included to the day-ahead auction, since market participants must bid in the spot market for the capacity they have reserved for long term exchanges.

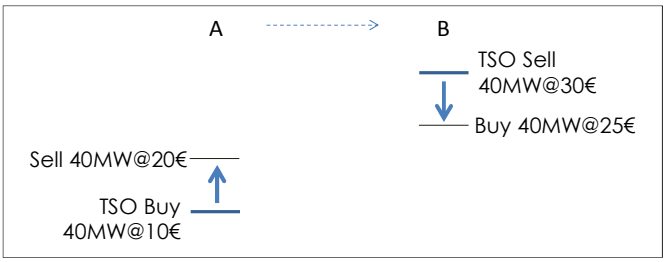
At the beginning of the trading session, TSO unbalances its net position at both ends of the interconnection according to the available capacity (by trading against itself) and offers capacity continuously during trading session by getting balanced as other market participants.

Example. Assume TSO offers 100MWh capacity from A to B; then:

- *It trades against itself by selling 100MWh in A and buying 100MWh in B;*
- *The result is a positive net position of +100MWh in A and a negative net position of -100MWh in B;*



- *Capacity is no longer available and cross-border trading from A to B will occur through TSO as an intermediary party between any buyer in B and any seller in A;*
- *Allowing 100MWh to the market is equivalent to buying 100MWh in A and selling 100MWh in B:*
  - *At the end of the trading session, TSO must have balanced by setting its net position to zero in A and B;*
  - *During trading session, TSO buys in A and sells in B;*
  - *TSO's buy orders in A and sell orders in B must be executed simultaneously with the same quantity: this simultaneous execution corresponds to the existing cross-border matching;*
  - *During the trading session, TSO behaves as a market participant aiming at making profitable trades: if the market needs capacity from A to B, TSO will release this capacity gradually and will use the trading platform to negotiate with other market participants;*
  - *In the example in the drawing, TSO sees the opportunity to buy in A at 20€ and to simultaneously sell in B at 25€; it can decide to move its buy order up and its sell order down in order to match simultaneously, the results being a capacity price of 5€; it can also decide to wait until market conditions evolve to a higher capacity price;*

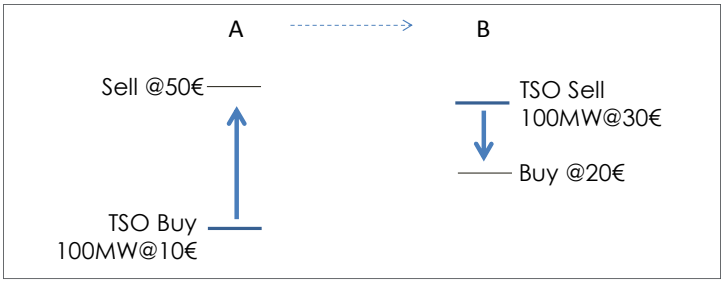


The following principles are satisfied:

- Capacity price is based on actual market conditions and actual orders;
- Capacity price reflects scarcity: it is a direct result from real-time negotiations between TSO and market participants;

A drawback of the option can be the financial risk for TSOs: they have to balance their net position even if capacity is abundant.

Example. In the drawing, the best sell order in A is never lower than 50€ during the trading session; whereas the best buy order in B is never higher than 20€. Then, in order to get balanced at the end of the trading session, TSO needs to buy at the expensive price of 50€ and to sell at the cheaper price of 20€; the negative price of capacity reveals the abundance of capacity.



Possible variants can be implemented in order to mitigate the financial risk for TSOs:

- Allow TSOs not to be balanced at the end of the trading session;
- Allow TSOs not to offer the whole available capacity from the beginning of trading session, in order to control the exposure to market prices;

Both mitigations are equivalent to a possibility not to offer the available capacity to the market: TSOs' trading strategies should be regulated so that the market is not deprived of a useful capacity which would help market participants to match cross-border at a better price.

Questions for implementation

a. What if capacity operator and market participants have common interests?

The option assumes that TSOs act as independent entities from any other market participant. The implementation of the option might result into requirements related to the unbundling of TSOs from other market participants.

b. Do cross-border trades still occur?

Technically no: each-cross border trade is a trade against TSO; however, since TSO has to trade as buyer and seller simultaneously at both ends of the interconnection, a trade against TSO is associated with another simultaneous trade against the same TSO at the other end of the interconnection: these two trades can be seen as a single cross-border trade and actually correspond to current cross-border trades.

c. How does this option work when capacity is recalculated?

When capacity from A to B increases due to recalculation, then TSO uses it by selling this amount in A and simultaneously buying this amount in B, like at the beginning of the trading session; this TSO trade does not interfere with the orders in order book: the only change is in TSO net position.

When capacity from A to B decreases due to recalculation, part of TSO initial trade against itself is cancelled, which leaves less room to TSO to trade in the market against market participants.

d. What about balancing?

The natural market price of capacity could be used as a reference for the capacity which is dedicated to the balancing process; in addition, the mechanism could enhance the compatibility between the intraday trading session and the balancing process during the period when they overlap.

The option is discarded because of the following reasons, although it fulfils the requirements:

- Technically TSOs would not provide ID capacity to the market which they are legally obliged to do;
- There may be legal restrictions on TSOs trading in other markets which would also make this option illegal;