SEM Integration Project

Pathways to the Target Model

12/1/2012

Contents

1 Executive Summary

The objective of this paper is to provide a report to the SEM Committee by December 2011 on the identification of feasible options for SEM to pursue which will give effect to compliance with the Target Model for the internal electricity market by 2016, in accordance with Article 1.2, which will apply to Ireland.

The paper concludes that it is possible to evolve the SEM market in compliance with the Target Model, whilst maintaining the key fundamental principles underpinning the current market design, and investigates 4 potential pathways for achieving this.

Background

Two significant developments have taken place earlier this year and are key drivers in the development of the European Internal Energy Market (IEM). The first is the Third Energy Package, which came into effect on 3rd March 2011. The Third Energy Package charges the Regulatory Authorities and the TSOs with the development of framework guidelines and network codes respectively. These guidelines and codes set out the policy framework and the detailed arrangements, respectively, which must prevail for cross border trade across all timeframes. The second development was the decision at the European Energy Council meeting on 4th February 2011 that "the internal market should be completed by 2014[1] so as to allow gas and electricity to flow freely. This requires in particular that in cooperation with ACER national regulators and transmission systems operators step up their work on market coupling and guidelines on network codes applicable across European networks". Specifically required are arrangements for:

1. Forward,
2. Day-Ahead,
3. Intraday, and
4. Balancing

Following publication of the final version of the Framework Guideline on Capacity Allocation and Congestion Management (CACM) on 29 July 2011, the SEM Committee on 8 August 2011 published its SEM Market Integration Project Initiation Document. The purpose of that document was to provide information on the CACM Framework Guideline and establish a project to consider the way forward for SEM to implement the requirements set out in the CACM Framework Guideline within the timeframe 2012-2016.

In order to fulfill this obligation a Project Team has been established between EirGrid and the Regulatory Authorities, with the Regulatory Authorities taking the lead, to look at the options for SEM to comply with the Target Model. The Regulatory Authorities have asked

[1] The FG CACM has provided for an extension to 2016 which will apply to Ireland.

the TSO's and Market Operator (MO) to analyse options for evolving the SEM to make it compliant with the Target Model. This paper sets out to achieve this by providing four potential pathways to compliance, which are described later.

The SEM market was developed using a number of criteria that sought to capture the primary characteristics of a well functioning electricity market. We considered a number of these criteria when developing the high-level designs, the criteria being[2]:

- Security of Supply;
- Stability and Dispatch Efficiency;
- Practicality;
- Equity
- Competitiveness
- Market Power
- Price formation and Liquidity
- Transparency
- Risk Management
- New Entrants
- Renewables

In addition to these, other key criteria required going forward includes:

- Participant impact
- Compliance with European legislation
- Efficient use of Interconnection

It should be noted this paper is primarily concerned with investigating the potential design options and it is the next phase of the project which will consider the merits of the design options in detail against these criteria or any others considered valid.

The Target Model and SEM

There are a number of important differences between the SEM market and the Target Model; the pathways described seek to fill those gaps. Some of the key gaps are as follows:

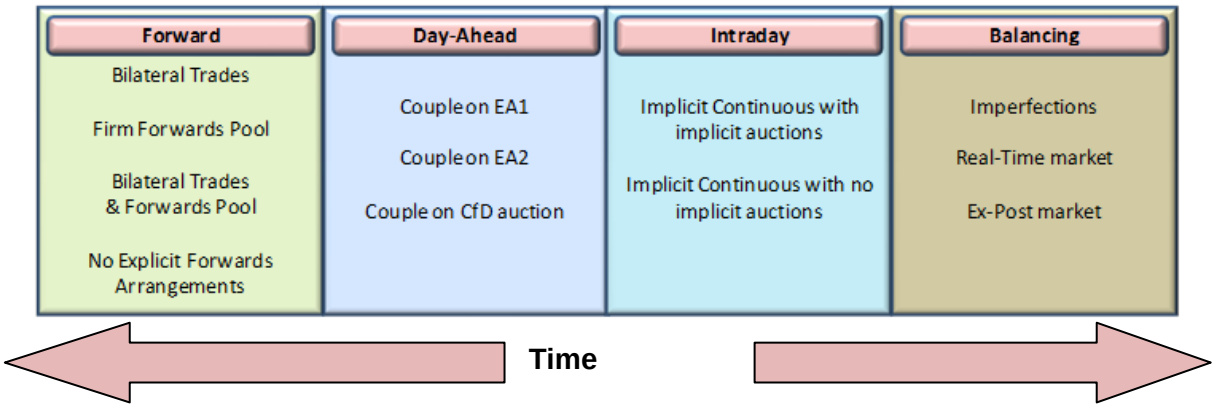
- SEM has ex-post pricing while the Target Model has ex-ante pricing;
- SEM is not coupled to any other market at the day-ahead stage, the Target Model couples at the day-ahead stage; and
- SEM has only 3 gates but the Target Model has continuous intraday trading.

All the evolutionary options for the SEM described here entail the addition of extra marketplaces for trading in the forward timeframe to complement the Day-ahead and Intraday marketplaces.

[2] The Single Electricity Market (SEM) Proposed High Level Design 31 March 2005 AIP/SEM/06/05

Pathways

When considering any arrangements for developing SEM, all four timeframes need to be fully taken into account. The matrix below highlights the market timeframes for consideration. Various options are available as a solution in each timeframe. Each of these can be combined to form a pathway. Some of the design elements are not compatible and are not explored further; however, a number of functioning designs emerge.



Before 11.00 on D-1	**11.00 on D-1**	Continuous from 11.00 gate to Hour ahead	**Hour-1 to delivery**

We detail in the body of the report four possible Pathways. Each of the Pathways is laid out in the same manner to provide the ability to assess each on the same basis. It should be noted that while commercial submission to the individual markets is voluntary, generators will be required to submit technical data including forecast availability at a gate closure time yet to be determined so as to ensure there is an accurate technical data set for the System Operators to use. A participant must participate in the market overall; participation in each of the individual market timeframes is an option for participants, however all must have submitted the required data to allow the System Operator dispatch them away from their preferred schedule if required. This is the case for each of the pathways described.

The options follow across the diagram above and are as follows:

Pathway 1: Bilateral Trades, Couple on EA1: This pathway is made up of a bilateral trading market in the forward timeframe, with market coupling occurring at the EA1 stage. This option is better suited to no within day implicit auctions. It can work with either of the proposed Ex-Post market designs but may be more compatible with the Real Time market price solution.

Pathway 2: Firm Forwards Pool, Couple on EA2: This pathway is made up of a firm forward pool market in the forward timeframe with market coupling on EA2. This option can

work with within day auctions. The pool model makes this design more suitable to an ex-post market with a pool price.

Pathway 3: Bilateral Trades & Firm Forwards pool, Couple on EA2: This pathway is made up of a Bilateral Trade market in the forward timeframe, along with a forward pool with market coupling on EA2. This option can work with or without within day auctions and either of the proposed Ex-Post market design.

Pathway 4: No Explicit Forwards arrangements, couple on CFD auction: This option uses an arrangement similar to the current Contracts for Difference trading to interface with the pan European systems. The intention here is retain SEM arrangements and overlay a financial cross border coupling arrangement at the day-ahead and intraday stages. The forward arrangements refer to forward energy trading and not existing capacity auctions.

Each pathway has its merits but some would seem better than others when set against some of the criteria used to assess the SEM design. This evaluation would of course require detailed analysis.

	Pathway 1	Pathway 2	Pathway 3	Pathway 4
Transparency				
Risk Management				
Price formation and liquidity				
Dispatch efficiency				
New entrants				
Renewables				
Participant Impact				
Competitiveness				

On the basis of the evaluation against the key criteria pathway 2 is seen to score best. Whether this model is preferred overall will of course depend on how the various criteria are weighted.

Other Considerations

There are a number of other key elements that are crucial in an All-island context and must be taken in consideration when considering the design options for SEM, some of the key elements being

- Capacity Payments
- Constraints Payments
- Ancillary Services Arrangements
- System Security
- Treatment of Renewables

A capacity payment pot and the constraints payment mechanism could be used alongside any of the pathways described. The exact interaction of these mechanisms with the new market arrangements will need to be developed in detail and should be a key part of the detailed design process but are out of scope for this report and have not been considered here. In the same way an ancillary service mechanism will be vital going forward and can work with the pathways described.

In terms of System Security the maintenance of central dispatch and the provision of accurate data to allow the System Operators to price the schedule are vital. Units can self nominate but ultimately the decision to bring units on or off and set the level of output has to lie with the System Operator. A unit can be moved from its preferred schedule and as such must have supplied data to allow the System Operators make decisions on which units to dispatch should they have to deviate from the market schedule.

With regards to renewables one must consider the level of imbalance price exposure wind farms should face, if any, and how to factor in priority dispatch. There are a number of ways to handle these issues through each of the pathways described. The System Operators will continue to respect priority dispatch policies. In terms of imbalance prices wind generators could be protected or exposed to these prices depending on the prevailing polices adopted. Again these are considerations for the detailed design and consultation phase.

The Costs

A comprehensive Cost Benefit Analysis was not possible given the time constraints in developing this paper. This should be considered in the next phase of the development of the SEM options for compliance with the European Target Model. There are a number of elements that feed into the cost of designing a new market or alternatively making significant changes to the existing design. At a high level these include:

- Vendor design, software, hardware costs

- RA project costs
- TSO/MO project costs
- Market Participant costs
- Legal costs

The development of the SEM and launch of the market in 2007 is the most recent and relevant example to consider for cost analysis. The SEM cost approximately €54 million to implement and of that vendor costs for the core market engine were approximately €12 million. This is illustrative in that it indicates quite clearly that the biggest cost in the market development are the creation of the processes and procedures, the legal arrangements and the resources required to deliver the project. Effectively there was a ratio of 1:4 of the market engine costs to the total costs. In addition to this there were the costs of the market participants which cannot be estimated.

For the options considered here we have spoken to 3 vendors, two looking at the provision of the underlying market engine solution and 1 looking at the delivery of a CFD and coupling option. In order to understand the relative merits of each option a detailed costing of the entire cost of the market delivery would be required.

Both ABB and another vendor provided a cost indication for the delivery of the required systems to deliver the market engine to support the pathways described. ABB gave a range of €6-12 million depending on things such as the requirement to deliver a new trading day which is a relatively expensive change to the current systems. The second vendor estimated a cost of approximately €6 million for the delivery of a market engine based on the designs described. They presume that they do not have to design special interfaces for linkages to the European mechanisms; additional effort here would require additional cost. The second vendor also suggested ongoing support and maintenance costs of €1.3 million per annum.

The CFD option coupled with the market engine changes based on service provider costs and our understanding of the central systems costs that would be necessary, was estimated at approximately the lower end of the ABB cost range of €6.5 million.

As mentioned above this market engine cost is only one element of the total cost of delivering a market solution and in the case of SEM it was approximately 25% of the cost of the overall delivery excluding participant costs.

Conclusions

The TSO and MO were asked to investigate if the SEM could evolve to be compliant with the European Target Model for energy. Having investigated the Target Model and the requirements to align with it, 4 potential pathways have been identified.

Evolving the SEM rather than starting from scratch has a number of benefits, some of those being:

- It allows for compliance with the relevant European legislation and for alignment with the EU Target Model.
- The existing vendor could be maintained and this would necessitate fewer interface/systems changes for both the Market Operator and the participants, however it is possible to bring in a new vendor if it was considered this would provide a benefit overall. Either option can be pursued.
- The pathways described here are flexible, they allow for the Market Operator to act as a power exchange (or for an external power exchange to be appointed and act alongside a Market Operator as in Great Britain (GB)) for Ireland and to potentially link to the power exchange hub[3] proposed for GB.
- The evolution option is likely to lead to less legal changes and would mean that the fundamental underlying legal structure could be retained.
- Certainty: the maintenance of the core elements of the SEM market will provide certainty for market participants.

There are a number of other issues to be considered when developing the market. For example there are a some system operation issues to be considered, however if the model chosen maintains central dispatch (as would be required on a small island system such as Ireland) and provides a methodology for System Operators to price dispatch in real time, then each of the pathways described can work. Of course the exact system operations issues would have to be investigated during detailed design.

An evolution of the SEM market is a possible way forward to comply with the EU Target Model. This will provide further opportunities to trade with our European neighbours and deliver greater prospects to export our renewable resources. The design pathways laid out they all have their merits. Pathway 2 as described would appear to deliver the most immediate benefits, however one would have to consider the longer term benefits other market designs could deliver. All pathways are flexible and it is feasible to link to the proposed GB power hub through an Irish power exchange or through the Market Operator.

This paper represents a high level investigation of the potential for evolution of the SEM which is just the first part of the move towards Target Model compliance. Given our independent central position in the SEM market and our role in Europe through ENTSO-E (developing the network codes which will govern the Target Model) and Europex, it is the firm contention of the TSO's and MO that we would be best placed to continue this work with the RA's, following the SEM Committee decision in 2012. The next step is to develop these pathways into detailed designs which can deliver a fully functional efficient transparent, competitive and secure energy market for Ireland as part of the European Internal Energy Market.

[3] National Grid UK are currently running a tender to put in place a power exchange hub where the liquidity over the two interconnectors and power exchanges from GB to Europe could be centralised

2 Introduction

The purpose of this paper is to answer the question as to whether the current SEM arrangements can evolve to be compliant with the European Target Model for electricity.

A Project Team was established, with the Regulatory Authorities taking the lead and supported by the MO/TSOs, to look at the options for SEM to comply with the Target Model. The main objective of the Project Team is to develop an Options Paper for the SEM Committee on 21 December 2011, which outlines a number of potential ways forward to develop the SEM in line with the Target Model by 2016 as well as considering more radical new market design options. The paper fully takes on board the comments of interested stakeholders raised in the one-to-one meetings in early September and technical workshops in October and November.

The Project Objectives of the TSOs/MO are to adhere to the SEMIP Project deliverables provided in the Project Initiation Document:

- Consideration of the transitional and enduring market arrangements;
- Consultation with relevant stakeholders;
- Identification of a number of feasible options for SEM evolution to meet Target Model;
- Recommendation on the best option(s) for the RAs to pursue.

This report sets out the current structure of the SEM, the components of the Target Model based on the Framework Guideline for Capacity Allocation and Congestion Management.

It identifies specific gaps between these two models under a number of headings and sets out a number of options to close these specific gaps. Following this a number of internally consistent pathways are set out to align the SEM with the Target Model. High level benefits and costs are set out for each pathway.

3 Background

The predominant European market design consists of bilateral self commitment markets with organised Day-ahead and intraday trading through mostly voluntary power exchanges[4]. By contrast, the SEM is a centralised market, with *ex-post* pricing and scheduling and dispatch determined on the basis of complex bids from generators; it uses a complicated non linear algorithm to determine unit commitment and to arrive at half hourly prices and market quantities over the trading day; it also has an explicit capacity payments mechanism.

The European Energy Target Model reflects the prevailing European design and aims at the creation of the internal market through the 'coupling' of the bids and offers submitted through power exchanges using available cross border capacity.

3.1 PID Deliverables

On 8th August 2011, the SEM Committee published its Market Integration Project Initiation Document. Annexed to the Document is the FUI Regional Electricity Work plan for 2011-2014. The Project Initiation Document outlines the key project deliverable of the MO/TSOs, which is to consider options to enable the SEM to evolve and meet the requirements of the Target Model as defined in the Framework Guideline on CACM.

The objective is to provide a report to the SEM Committee by December 2011 on the identification of feasible options for SEM to pursue which will both give effect to compliance with the Target Model for the internal electricity market by 2016(in accordance with the article 1.2 derogation which will apply to Ireland).

The TSOs/MO are tasked with considering the following:

Enduring market arrangements that meet the Day-ahead and intraday provisions of the CACM in their entirety, i.e. those that involve more extensive changes to the SEM high level design, but which would ensure compliance with the full provisions of the Day-ahead and intraday arrangements in the CACM network code. Costs for these options will be indicative.

3.2 Consultation

As part of the process of identifying feasible options for SEM to evolve, the MO/TSOs engaged with a number of relevant European stakeholders, particularly regulators and TSOs / PXs in the FUI region and elsewhere in Europe.

The MO/TSOs were required to consult power exchanges involved in the PCR project, System Operators in the NWE region, including National Grid, the SEM's central system vendor (ABB), SEM and BETTA participants and other HVDC interconnector owners/operators in the FUI region (e.g., Brined). Also, as the SEM has some similarities

[4] Exceptions are the semi mandatory markets of MIBEL (Iberia) and GME (Italy) and Nordpool for cross border trade.

with the Iberian electricity market (e.g., capacity payments, complex bids, liquid pool), the RAs required the MO/TSOs to look at how the South West Region and the Iberian market is intending to comply with the CACM network code and liaise with *OMEL* (the Iberian power exchange) and *Red Electrical de Espuma* (the Spanish System Operator).

Over the months of September and October, the MO/TSOs and Regulatory Authorities met with various TSOs, PXs, Market Operators and system vendors in Europe to progress our understanding of developments elsewhere and consider how they might be of assistance in providing possible solutions for SEM market integration.

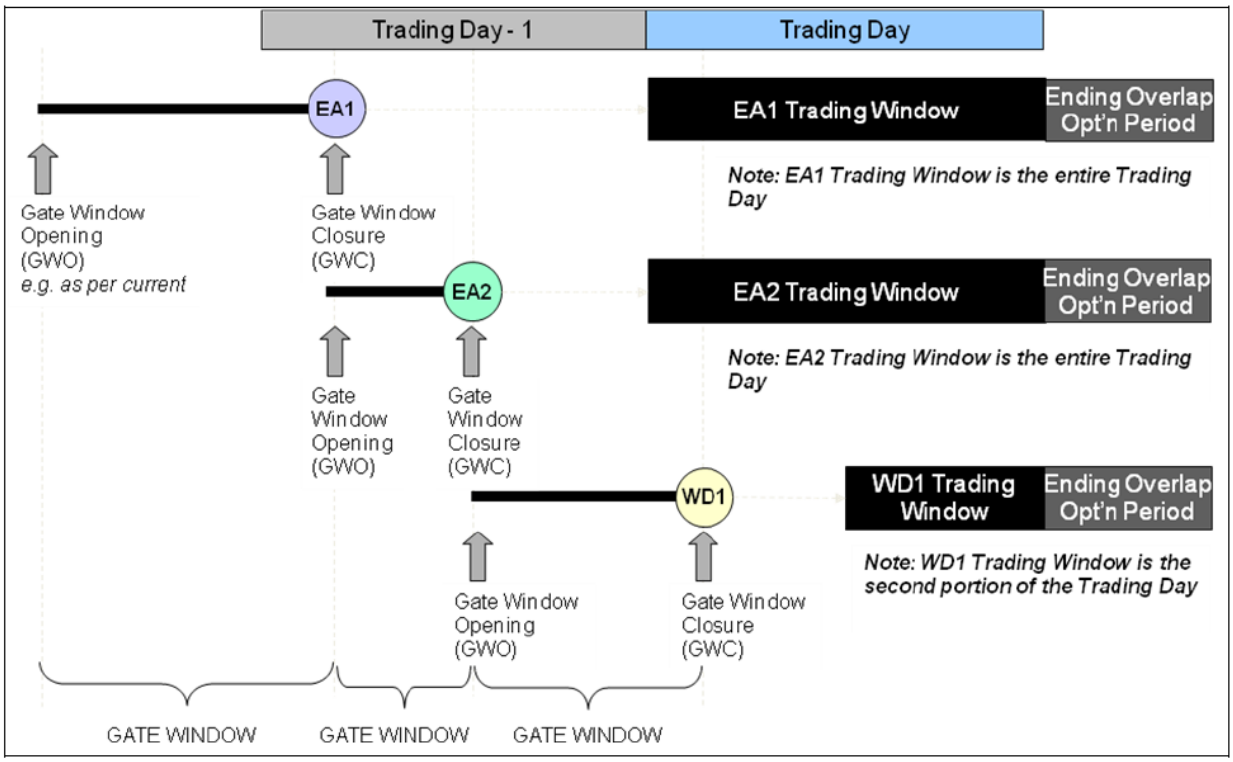
In addition the TSO's have used there membership of the ENTSOE network code drafting teams and Target Model development teams to inform this work as the network codes and Target Model will dictate the prevailing requirements in Europe going forward.

4 SEM and the European Target Model

4.1 SEM Overview

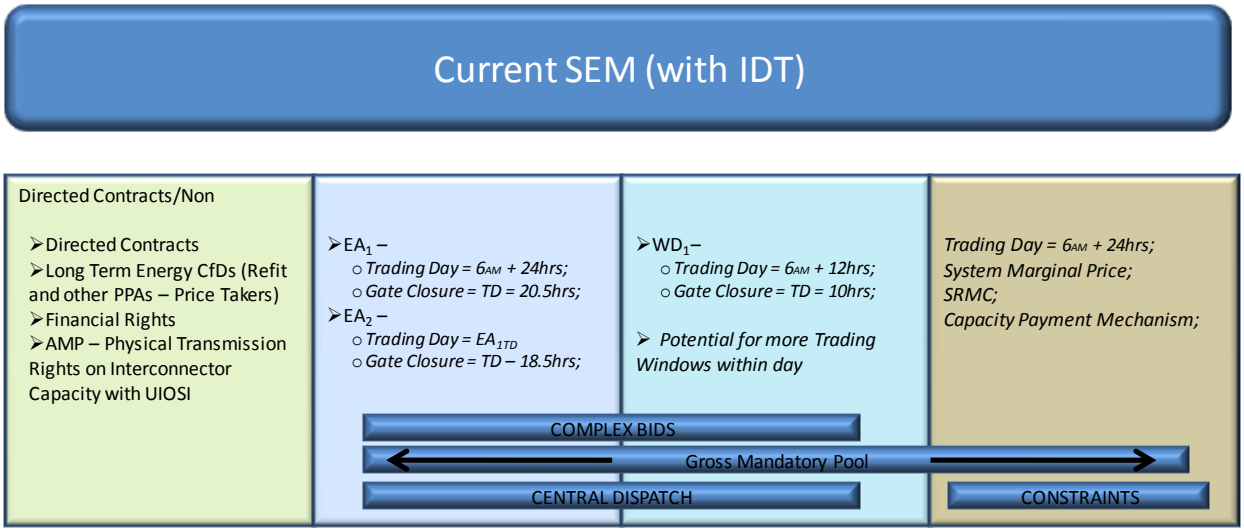
The Single Electricity Market (SEM) is a mandatory gross pool market where all electricity is sold through a central pool. It was identified in the SEM High Level Design Paper in 2005 that this market was more likely to provide economic signals and price discovery required for new entry and to facilitate the participation of renewable generation. It is also a more transparent market design than the bilateral contracts market, which is a key feature of gross pool markets.

A central commitment market model is utilised with generators dispatched based on offers that reflect their short run marginal costs. Generators' offers include start-up costs and price-quantity pairs as distinct items. Generators also provide technical parameters such as minimum running levels, ramp rates and minimum run times. There is a long gate closure period to enable the System Operators dispatch the system based on the complex bids submitted by generators, with ex-ante gate closure at 10.00 on D-1. There is also a 24 hour optimisation period with pricing done ex-post. This is markedly different from the self commitment market model that has a relatively short gate closure period, optimisation done for each trading period and pricing ex-ante.



A single system marginal price (SMP) is set for each trading period, based on an ex-post optimised schedule for the entire trading day. A capacity payment mechanism is also an important feature of the SEM market.

Across the four main timeframes directed contracts and long term energy CfDs are available in the forward timeframe but there is limited activity. Physical transmission rights with Use-it-or-sell-it (UIOSI) are available on Moyle and will be available next year on the East West Interconnector. At the day-ahead stage, generators submit offers before the first gate closure (EA1) at 09.30am on D-1. The gate for the first intraday implicit auction closes shortly afterwards at 11.30am. Within day, a second and final intraday auction gate is closed at 8.00am on D. The market is settled and cleared ex-post with the system marginal price and capacity payments all calculated during this timeframe.



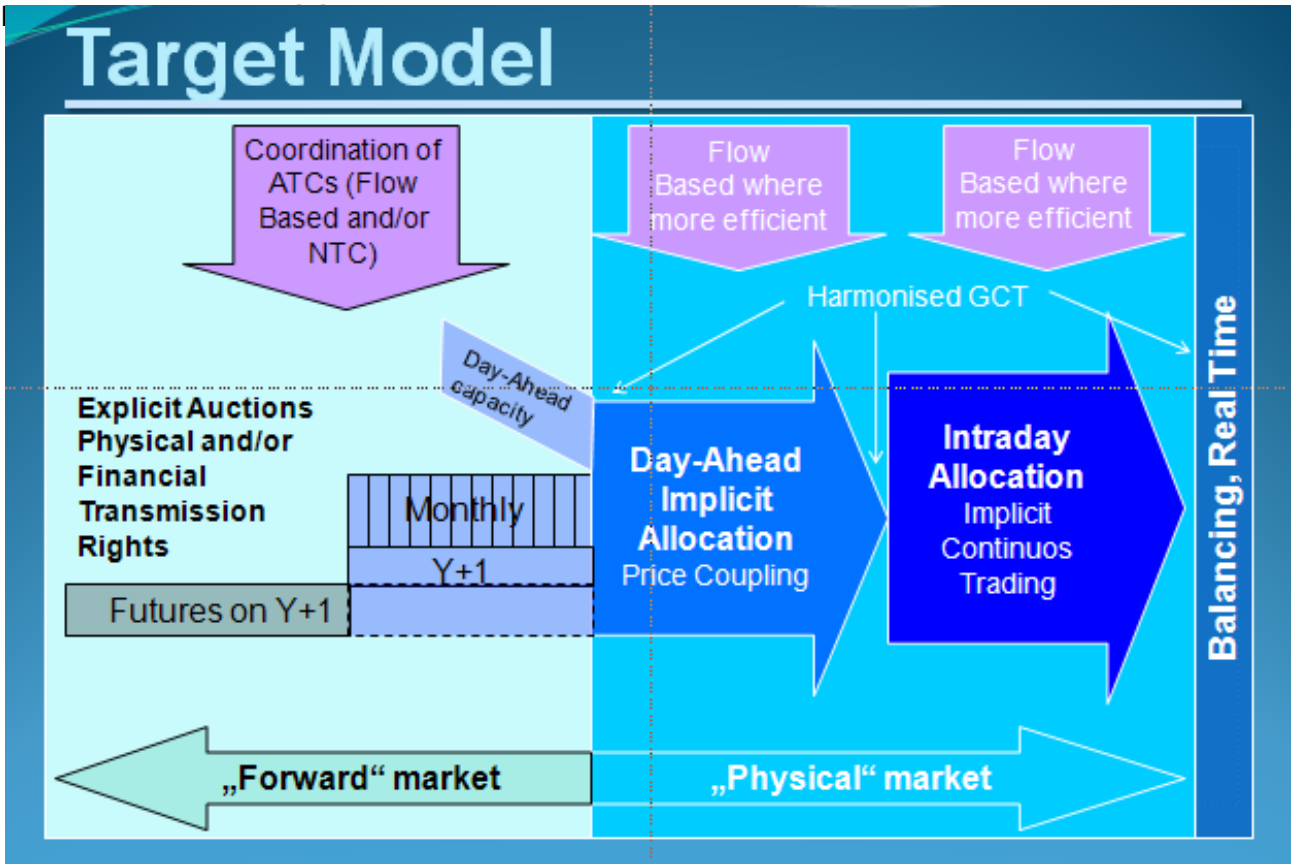
4.2 Background to Target Model

The Target Model provides a blueprint and roadmap for closer market integration by setting out clear proposals for the coordination and harmonisation of Europe's electricity markets[5].

At the European Council meeting on 4th February 2011 it was decided that "**the internal market should be completed by 2014** so as to allow gas and electricity to flow freely. This requires in particular that in cooperation with ACER national regulators and transmission systems operators' step up their work on market coupling and guidelines on network codes applicable across European networks". This effectively brings forward the timeline for implementation of the Target Model from 2015, the date agreed by the Project Coordination Group (PCG)[6]. The Framework Guideline (ACER) and Network Code on CACM (ENTSO-E) are based on the Target Model.

[5] Additional information on the European Target Model and European Regional Integration is provided in Appendix A and B.

[6] See Appendix B.



4.3 Framework Guideline and Network Code on CACM

The Framework Guideline provides for transitional arrangements for the Day-ahead and the intraday markets of island systems with central dispatch, as long as these transitional arrangements:

- are justified on the basis of a cost-benefit analysis;
- do not unduly affect other jurisdictions;
- guarantee a reasonable degree of integration with the markets in adjacent jurisdictions;
- do not extend beyond 2016.

The key features set out in the Framework Guidelines are as follows:

- Capacity Calculation method using either a Flow-Based (FB) or an Available Transfer Capacity (ATC) method based on a Common Grid Model;
- Definition of zones as a bidding area;
- Harmonised set of rules for borders and a single platform for the allocation of long-term transmission rights (PTR and FTR) at the European level;
- Implicit auctions via a single price coupling algorithm which simultaneously determines volumes and prices in all relevant zones, based on the marginal pricing principle;
- Continuous implicit trading that may be complemented by regional auctions where there is sufficient liquidity;
- Arrangements for firmness and force majeure.

The European Commission formally requested ENTSO-E to commence work on the development of the network code (which, when adopted, will take the form of a binding EC Regulation) on CACM in September 2011. ENTSO-E is tasked with providing a final version to ACER on 30 September 2012 for its opinion. Work is ongoing on a draft network code that can be released for formal consultation in Q2 2012. EirGrid is playing a key role in the development of these network codes through its membership of ENTSOE and furthermore through its role as drafter for some of the key network codes.

4.4 Other Network Codes

The CACM is one of 12 network codes being developed. Two others that could have a significant impact on SEM evolution would be Data exchange & settlement rules and Transparency rules. The former could generate fundamental changes to the process to be followed for all interface types, data formats for type 2 and type 3 interfaces, and the transport and protocol for type 3 interfaces.

4.5 Gap Analysis

The below table outlines some of the key differences between the SEM market and the European Target Model. A more complete description of the Target Model and network codes is provided in the appendices in section 9.

Characteristic	*SEM Design*	*European Target Model*
Market Design	Pool	Bi-lateral Contracts
Trading Day	06AM for 24 hours	23PM for 24 hours
Trading Period	30 minutes	1 hour (for Day Ahead and Intra-Day contracts)
Gate Closure	Trading Day – 20.5hrs (EA1)	Trading Day – 12hrs (Day- 1)
Offers/Bids	Generator Complex Offers (with Commercial and Technical components) Demand does not bid.	Simple Offers and Bids Sophisticated Offers (Block Bids, Linked Bids, Minimum Revenue, Energy Limited)
Intra-Day	2 Implicit Auctions	Continuous Implicit Trading
Form of dispatch	Central Dispatch	Self Dispatch
Firm Pricing	Ex-Post	Day Ahead and Intraday
Financial Contracts	Limited contracts market	Forwards financial and physical markets
Cross Border Settlement	Interconnector Units settle cross border trades.	Shipping agent settles cross border trades.
Capacity Payment	Explicit Capacity Payments	Not considered in the FG CACM

5 Pathways: Closing the Gaps

5.1 Description of the Pathways approach

Our approach to developing options for compliance with the European Target model is to develop a set of Pathway models for compliance which facilitate trade across the various market timeframes in a compliant manner. The CACM Framework Guideline focuses on the forward, day-ahead and intraday timeframes. A separate Framework Guideline on balancing is currently being developed by ACER. Therefore, there will be a Framework Guideline and Network Code for all four market timeframes –

- Forward,
- Day-ahead,
- Intraday, and
- Balancing.

When considering any arrangements for developing SEM, all four timeframes need to be reviewed.

All the evolutionary options for the SEM we describe entail the addition of extra sub-markets for trading in the forward timeframe to complement the day-ahead and intraday. The core design elements of the SEM as a mandatory market are retained in that a Participant must participate in one of the four market timeframes; however, the participant does have a choice over market participation in each of these individual timeframes. The concept of this is to provide options for Participants to allow them select where it is most efficient and to their benefit to trade rather than forcing participation into either a specific model based on existing SEM arrangements or the European Target Model. It should be noted that while participation in the individual markets is open to participants, generators will be required to submit commercial and technical offer data including forecast availability into a gate closure yet to be determined to ensure there is an accurate technical/commercial data for the System Operators to use. In this way a generator can opt not to participate in the earlier markets by declaring themselves as unavailable for this market timeframe and making themselves fully or partially available into one of the later timeframes. Ultimately if the System Operator decides the generator is required a set of relevant data must be available to make this decision with. Central dispatch remains under all the pathways considered.

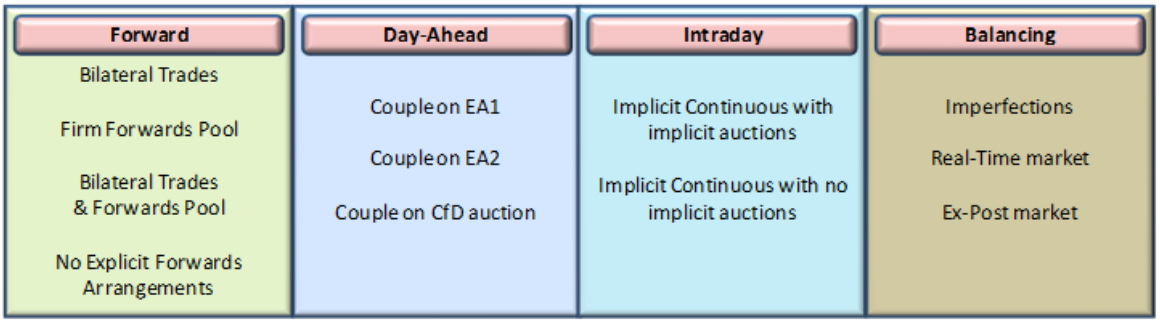
In this manner, for example, a Participant with a slow-moving baseload plant may not find the option of trading in the day-ahead or intraday markets appealing as the proximity to real-time dispatch may mean this generator cannot feasibly offer trades (e.g. – a generator with a notice time of more than 12 hours that is not currently running cannot offer trade for parts of the day-ahead market that fall within this 12 hours). For generators such as this, the forward options may provide a platform to trade that is amenable to their technical characteristics. Similarly, a generator whose fuel purchases are inextricably tied to the current gas trading

arrangements may prefer trading in a wholesale market where the Trading Day aligns with the gas trading day as opposed to the day-ahead market which trades from 23:00 UTC.

Without a forward market, this class of generators would be forced into either the day-ahead or intraday markets. Inability to trade effectively in these markets would mean that some form of balancing market is required.

To provide for this, in the balancing timeframe an Ex-Post price is retained; however, options for the derivation of this price could be based on balancing principles rather than marginal pricing, achieved by using price as bid of the generators dispatched in real time or some form of balancing buy or sell price based on an optimisation.

This approach results in a number of high level options for each timeframe shown in the diagram below.



These options can be summarised as follows –

Forward	
Bilateral Trades	Interconnector Units can acquire physical capacity rights for interconnectors via explicit auctions. Firm physical trading outside of SEM is permitted in the form of Bilateral contracts. Resulting positions are nominated into the SEM in advance of the market coupling. Contract quantities are treated as physically firm from a market perspective. Participants with explicit capacity rights on the interconnectors must use them at this stage or sell them/lose them to the day-ahead timeframe.
Firm Forward Pool	Generators and Supplier Units submit complex offers/bids into a voluntary ex-ante pool similar to the current EA1. Prices and quantities are physically firm. Participants with explicit capacity rights on the interconnectors must use them at this stage or sell them/lose them to the day-ahead

Forward	
	Timeframe.
Bilateral Trades & Forward Pool	A combination of the above options. Participants would be able to trade bilaterally and submit physical nominations or trade in the forward pool.
No Explicit Forward Arrangements	Existing ex-ante runs of the SEM pool can continue but no positions are firm, except for interconnectors which continue to be bid into the pool as proposed for intraday trading.

Day-ahead	
Couple on EA1	Simple/sophisticated offers/bids are submitted into the EA1 run. These orders will be sent to the Single Price Coupling Algorithm that will determine firm prices and quantities for each order. The timings of EA1 with respect to Gate Closure are harmonised according to European standard. This will most likely see the EA1 run changing to include 1 hour Trading Period, Trading Day from 23:00 for 24 hours. All interconnector capacity that has not been used in any forward mechanism will be allocated implicitly via Single Price Coupling Algorithm. Explicit Capacity holders are either compensated for their unused capacity at the congestion price (UIoSI) or not at all (UIoLI).
Couple on EA2	Coupling on EA2 would operate in a similar manner to coupling on EA1 as described above. Because this option would still allow for an EA1 run in the forward timeframe e.g. for a Forward Pool, this means that the SEM will still have options for trading at ½ hour intervals across the existing Trading Day and an opportunity for holders of interconnector capacity rights to trade their volumes before the day-ahead implicit coupling auction. All interconnector capacity that has not been used in the forward will be allocated implicitly via Single Price Coupling Algorithm. Explicit Capacity holders are either compensated for their unused capacity at the congestion price (UIoSI) or not at all (UIoLI). This will most likely see the EA2 run changing to include 1

Day-ahead	
	hour Trading Period, Trading Day from 23:00 for 24 hours.
Couple on CfD auction	Simple/sophisticated offers/bids are submitted into the CfD market. These orders are sent to the Single Price Coupling Algorithm that determines prices and quantities for each order. These prices and quantities are the strike prices and quantities of CfDs that have the ex-post SMP as a reference price. An additional condition requires that the quantity of the CfD is firm in the SEM. This aspect differs from the CfDs currently used around SEM, which do not have physically firm quantities and would be a form of physical trading outside of the SEM. These physical quantities will then have to be nominated as firm into the EA2 run of the SEM. The timings of EA1 and EA2 with respect to Gate Closure are harmonised according to European standard including 1 hour Trading Period, Trading Day from 23:00 for 24 hours. All interconnector capacity that has not been used in the EA1 is allocated implicitly via Single Price Coupling Algorithm. Capacity holders are either compensated for their unused capacity at the congestion price (UIoSI) or not at all (UIoLI).

Intraday	
Implicit continuous with implicit auctions	This option will retain the current IDT design of additional within-day market runs with the support also for continuous offer/bid matching for allocation of cross border capacity. This would have the potential to allow an auction solution for adjusting positions within the SEM; however, as allocation of cross border capacity must be through continuous trading, these auctions may only serve to concentrate trade in SEM for the purposes of price discovery. It may be desirable to treat continuous trades as financial and then convert them to physical trades via the implicit auctions as is proposed in the Iberian market. In this case, this would seem to imply that auctions in the intraday timeframe are best compatible with designs that include a Forward Pool auction and may not be as relevant for the other designs.
Implicit continuous without	This option will rely exclusively on the continuous offer bid matching for cross border flows and any within day

implicit auctions	adjustments.

Balancing	
Imperfections	The SEM will still need to provide for circumstances where a generator is dispatched away from their firm market position. This is best achieved through the retention of explicit payments for constraints and uninstructed imbalances.
Real Time markets	For Participants who have not finalised their market positions using the earlier timeframes (suppliers who haven't purchased sufficient volumes), or who have been unable to meet physical delivery of energy as a result of their own actions (generators who have tripped or re-declared themselves as unavailable), energy will be bought and sold using the price of the most expensive generator dispatched at the time. In this way, they are exposed to the system cost of their inability to correctly forecast their consumption or deliver their firm quantities.
Ex-post markets	This model will make use of perfect hindsight and will optimise available generation (that is, those who are physically available and who are not already committed to firm market trades from the earlier timeframes) around the deltas in the system load. Using the marginal pricing principle, this will determine the price. The price calculation could be refined to discourage participants away from leaving all trades to the Ex-Post balancing pool.

Each of these can be combined to form a pathway. Some of the design elements are not compatible and will not be explored further (for example, a Firm Forward Pool with Coupling on EA1); however, a number of functioning designs emerge.

In the day-ahead and intraday timeframes, Participants will be required to submit commercial offer data in a format that is agreed on a European wide basis. These bids must also be feasible; that is, where a Participant submits a bid for trade in a given hour and it's generator

is not capable of delivering this trade (for reasons relating to heat states, notices times or some other technical requirement of the generation plant), these bids will not be accepted by the Market Operator and not passed to either the Coupler or the Shared Order Book.

In the intraday timeframe, the CACM requires the implementation of Implicit Continuous trading using Shared Order Books (Described in detail in the appendices in section 12) and Capacity Management Modules (see section 12). While this is challenging, it will be part of the Network Codes and must be delivered. The key question left open in the CACM is the inclusion of implicit auctions where there is sufficient liquidity. This could allow for the retention of within-day auctions set out in the current intraday Trading design; however, it is unclear if

a) this will deliver any long lasting benefit,
b) it will be possible to include cross border capacity in these auctions, or
c) the liquidity will be sufficient to allow it.

Part of our focus has been on the real time aspect and how deviations from firm market positions are managed in the balancing markets. Considering that any trades in the ex-ante[7] timeframe should be considered as firm but not subject to system constraints, the physical delivery of these will be subject to TSO decisions in real-time. As such, they must be considered "market firm" but not "physically firm" except where explicitly stated in the CACM network code. Therefore, in the Ex-Post timeframe, there must be allowance for circumstances where a generator is dispatched away from their market firm position because of a system constraint/ security concern. This would mean the retention of explicit Constraint Payments and Imperfections Charges. We believe this will be necessary in any of these options. This would also mean the retention of Uninstructed Imbalance Payments/Charges to account for deviations from dispatch.

The other question relates to deviations from firm market positions where these are for reasons not related to TSO decisions, such as a generator trip. In these events, the generator responsible for the original firm trade must bear the burden of replacement power required in real time to meet this trade. This can be done through a real-time market or an ex-post market. The distinction between these options is around the price used to balance the overall market.

In the real-time market, the price in the final ex-post phase will be determined based on the bid price of the units which were dispatched in real time to cover the deviation. This can be achieved by running a price calculation algorithm similar to the current SEM design using the output of the Dispatch Quantity in place of the Market Schedule Quantity to determine the generator at the top of the merit order.

In the ex-post market, the price is based on the marginal pricing principle and will involve an ex-post "perfect hindsight" optimisation of the dispatch problem. This means setting a MSP

[7] By "ex-ante", we mean any of the markets that are available prior to real time.

demand based on additional generation required in real time not previously traded in the ex-ante timeframes. This can be achieved retaining some of the key elements of the existing MSP software's Ex-Post design (not necessarily the current vendor's software if a change was desired). The current design of the MSP demand can be retained. Firm market positions for generators are recorded and can be used as min avail positions or these generators can be set as price takers. As the pre-real time markets are all balanced, the sum of the contracted generator quantities will match up with the contracted supplier demand volumes. Therefore, the difference between total generator dispatch and the contracted positions will be made up of generators who tripped, renewable generators who deviated from forecasts and suppliers who deviated from their purchases. An optimal market position can be determined from this, making use of incremental and decremental generator bids submitted to the SEM and final participant positions can be calculated from the variance between this final position and their earlier contracted positions. Settlement of this delta quantity will be against the Ex-Post balancing prices.

All options for the forward timeframes could be considered as implementable with either of the balancing options. In our analysis, we have taken the view that as the ex-post market option has more elements of the existing pool arrangements it is more suited to matching with the forward pools while the real-time option may be more suited to the addition of a forward bilateral market.

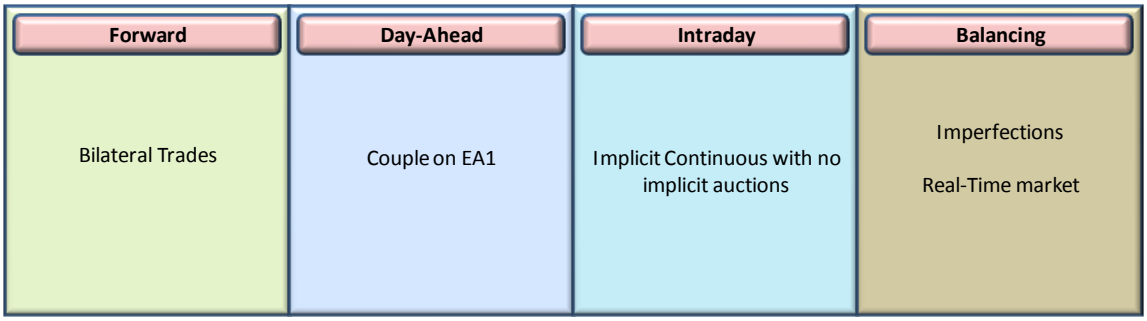
Participants will be able to submit complex commercial and technical offer sets into the balancing market. Generators should be able to submit decremental prices and quantities in addition to incremental prices and quantities. This will allow the balancing market determine if a generator's position from an earlier market can be unwound as part of the final optimisation. Suppliers will not be able to submit commercial offer data into the market as they are unable to respond in this timeframe and will have their final quantities calculated based on contracted quantities from earlier markets and their final metered demand. The Gate Closure for the balancing timeframe can align with the current EA1 Gate Closure; however, it should be investigated if later Gate Closures and different commercial offer sets for each Trading Period can be accommodated.

Using this approach, we have arrived at four pathways for the evolution of the SEM to comply with the European Target Model as well as to provide additional trading benefits to Participants. In considering these pathways, we have revisited the original High Level Design of the SEM and reviewed the criteria that were used to assist in the design of the pathways.

In the next section, we provide a high level overview of each of the pathways considered. Further detail on each is included in Section 11

5.2 Pathways

5.2.1 Pathway 1: Bilateral Trades, Couple on EA1



This pathway is made up of a limited bilateral trading market for Participants with explicit capacity on the interconnectors in the forward timeframe, with market coupling occurring at the EA1 stage. This option is better suited to no within day implicit auctions. It can work with either of the proposed Ex-Post market designs but may be more compatible with the Real Time market price solution.

In the forward timeframe, Participants will be able to enter into bilateral contracts for the purchase and sale of electricity and to submit these contracted quantities to the Market Operator as nominations in advance of a defined gate closure subject to limitations. This would be expected to be in line with the current EA1 gate closure. The trading window for this market will be the existing Trading Day starting at 06:00 for 24 hours. This will be a voluntary market; however, a generators are still required to submit the required data (e.g.: TOD) to allow the System Operators dispatch them away from their preferred schedule if required.

In the day-ahead timeframe, Participants can submit simple and sophisticated bids to the Market Operator in advance of the day-ahead gate closure at 11:00. This is called “Couple on EA1” because there is no explicit run of the SEM before the day-ahead market coupling. Commercial submissions that are feasible[8] will be transferred to the central European market coupler for inclusion. The results will be published to the Market Operator. Results will then be published from the Market Operator to the System Operators and all Participants in this timeframe. This will be a voluntary market. The Shipping Agent[9] responsible for the cross border elements of trade will be a Participant in the SEM and will be included at this point[10].

[8] Further detail on feasibility of commercial submissions to the day-ahead timeframe is included in Appendix 12.2.3

[9] See section 12 for explanation of the Shipping Agents role

[10] Further detail on day-ahead market coupling is included in Appendix 12.2

In the intraday timeframe, Participants will be able to submit simple/sophisticated bids to the Market Operator. Feasible bids will be collected and submitted to the pan-European Shared Order Book function[11] where, in conjunction with the Capacity Management Module, purchases and sales will be matched. A Shipping Agent will also be required in this process to ensure correct financial settlement of trades across different markets. In the results of this timeframe, an export will be seen as a purchase of electricity from the SEM and will be settled by the Market Operator as a payment to a generator and a charge on the Shipping Agent, and vice versa for imports (charges on suppliers for consumption and payments to the Shipping Agent as a pseudo generator). The Shipping Agent will equally be paid by another Market Operator in another market where the consumer of the electricity is charged.

For the balancing timeframe, Generators will be required to submit complex commercial offer sets into the balancing market. These can include both incremental and decremental prices. The Gate Closure for the balancing market could align with the Gate Closure for the Bi-Lateral trading arrangements. This will ensure that enough commercial data is available to the System Operator with enough notification that they can determine a feasible operations schedule, taking account of the firm contract positions as well as deviations in terms of actual system load and wind generation. It may be possible that gates for balancing COD can be closer to real time allowing for multiple sets of COD across the trading day.

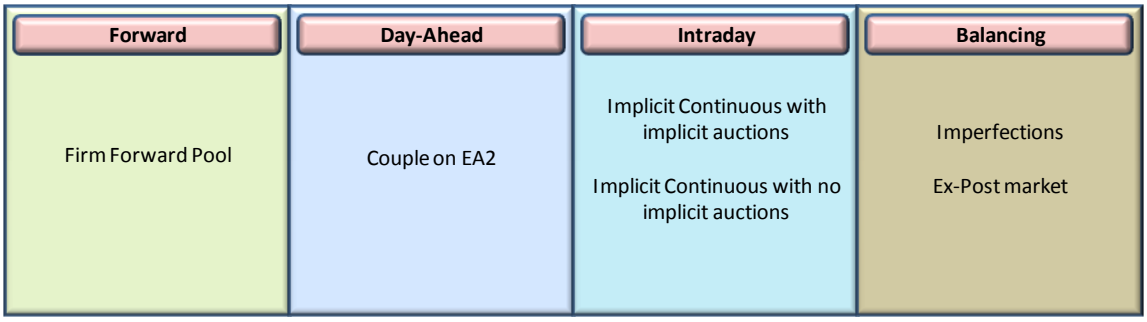
After their use by the System Operators for real time dispatch, these bids will be used in the determination of the prices in the balancing market. Quantities will be determined based on the difference between a Participant's contracted quantities from the earlier timeframes against the requirement in real-time and the market price will be determined as the bid cost of the marginal unit dispatched.

The inclusion of an Imperfections mechanism in the Ex-Post settlement will compensate generators when they are dispatched away from their contracted positions. Final settlement in the SEM will be based on the results of the day-ahead, intraday and balancing markets. Bi-Lateral trade arrangements will be settled between the counter parties to the trade.

Depending on the volume of trade settled in the bilateral market, this could see a reduction in the collateral requirements of the SEM.

[11] See second 12 for a full explanation

5.2.2 Pathway 2: Forward Pool, Couple on EA2



This pathway is made up of a firm forward pool market in the forward timeframe with market coupling on EA2. This option can work with within day auctions. The pool model makes this design more suitable to an ex-post market with a pool price.

In the forward timeframe, Participants will submit complex commercial and technical offer sets for their generation (including interconnector units and demand side units) to the Market Operator in the same manner as under the current T&SC. Participants will also be able to submit purchase bids in respect of their suppliers or to submit nominations in respect of their own demand forecasts. These submissions will be made to the Market Operator in advance of a defined gate closure. This would be expected to be close to the current EA1 gate closure. The trading window for this market will be the existing Trading Day starting at 06:00 for 24 hours. This will be a voluntary market.

Generator and Supplier quantities are firm from one market timeframe to the next ensuring that a Participant cannot double sell a quantity but can unwind from an earlier position using a later market timeframe.

The operation of the day-ahead and intraday timeframes is the same in this pathway as in all others.

For the balancing timeframe, Generators can make the same commercial submissions as in the other pathways with the same gate closures applicable.

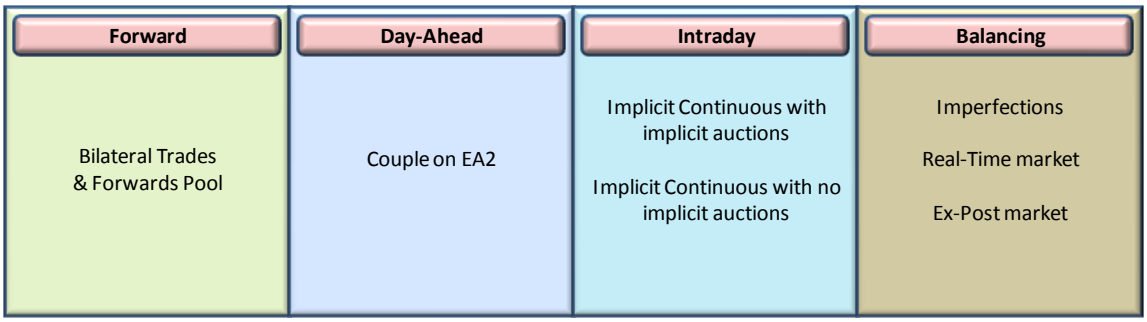
After their use by the System Operators for real time dispatch, these bids will be used in the determination of the prices in the balancing timeframe. Generators unable to meet their contracted positions due to circumstances other than system constraint, such as a station trip, will be charged in the balancing timeframe on the difference between their firm market positions from the earlier timeframes and their actual delivery. This can be achieved by retaining the existing ex-post MSP run with some alterations around the calculation of the schedule demand and the commitment of price maker generators which can be altered to reflect contracted positions and availability[12]. This will then determine a perfect hindsight

[12] Further detail on this is included in Appendix 12.4

optimisation of the schedule. Balancing settlement will be determined by offsetting firm contracted quantities from the earlier timeframes against the ex-post quantities.

The inclusion of an Imperfections mechanism in the Ex-Post settlement will compensate generators when they are dispatched away from their contracted positions. Final settlement in the SEM will be based on the results of the forward pool, day-ahead, intraday markets with a final imbalance calculation in the balancing timeframe.

5.2.3 Pathway 3: Bilateral & Forwards Pool; Couple on EA2



This pathway is made up of a Bilateral Trade market in the forward timeframe, along with a forward pool with market coupling on EA2. This option can work with or without within day auctions and either of the proposed Ex-Post market design.

In the forward timeframe, Participants can enter bilateral trading arrangements sufficiently in advance of the day-ahead market. The gate closure for submission of bilateral contract volumes will be at D-2 to allow sufficient time for the calculation of the forward pool and the day-ahead market coupling on EA2.

Participants can also submit complex commercial and technical offer data into the forward pool even while entering into bilateral agreements. When the gate closure for the bilateral market is complete, submitted firm contracted quantities will be imported into the forward pool. In resolving the pool, the market will exclude offered quantities from generators where these have already been met by bilateral contracts. The forward pool will assume that if an amount of energy from a submitted bid stack is already contracted that it will be the cheapest quantities that were contracted first. For Suppliers, it will be assumed that when they submit commercial offer data and/or nominations into the forward pool that this is in addition to any firm contracted quantities from the bilateral market.

The operation of the day-ahead and intraday timeframes is the same in this pathway as in all others.

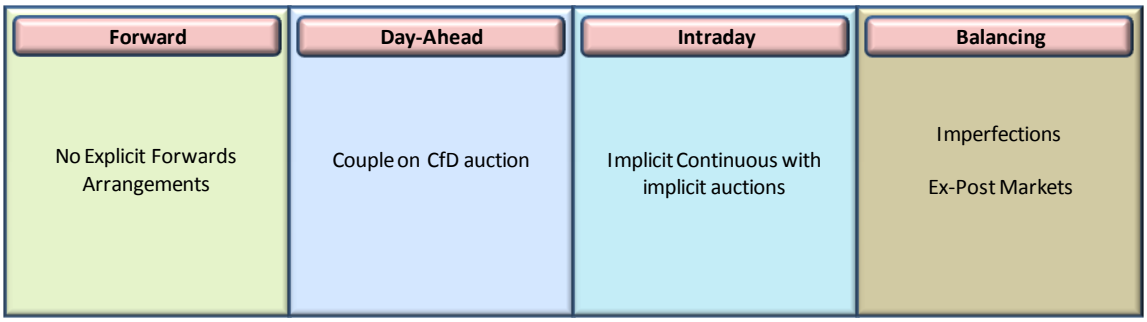
For the balancing timeframe, Generators can make the same commercial submissions as in the other pathways with the same gate closures applicable.

In the Ex-Post timeframe, incremental and decremental quantities will be calculated as already set out in the other pathways. The balancing market can be resolved in a in a multi-stage process –

- Resolve imbalances for Participants who participated in the bilateral market;
- Determine the price for these imbalances based on the real-time dispatch requirements;
- Resolve imbalances for Participants who participated in the pool;
- Determine the price for these based on an ex-post perfect hindsight optimisation;
- Settle each product separately.

Final settlement in the SEM will be based on the results of the day-ahead, intraday and balancing markets. Bi-Lateral trade arrangements will be settled between the counter parties to the trade.

5.2.4 Pathway 4: No explicit Forwards; Couple on CfD Auction



This option uses an arrangement similar to the current Contracts for Difference trading to interface with the pan European systems. The intention here is retain SEM arrangements and overlay a financial cross border coupling arrangement at the day-ahead and intraday stages.

In the forward timeframe, Participants will bid into the EA1 trading window as per the current T&SC. This option will have minimal change with regards to the operation of the EA1 with respect to

- Complex commercial offer data submission;
- Gate closure timings and post timings;
- Only Participants with firm capacity rights can bid to trade cross border(interconnector auctions remain);
- Optimisation of generation against demand and wind generation forecasts;
- Calculation of ex-ante System Marginal Price for the SEM.

In the day-ahead timeframe, Participants will bid into the CfD platform which will have gate closure scheduled between the publication of the EA1 results and gate closure for the EA2 MSP run. Participants will submit simple and sophisticated bids which will be processed to the central market coupler at the appropriate gate closure. While the prices and quantities that are returned to the CfD platform are financial, it will be necessary to ensure that a physical energy flow matches the CfD. This can be achieved by submission of nominations into the EA2 gate matching the results of the CfD coupled auction. This will require that the

trading day for the EA2 (and as a result, also the EA1) MSP run will have to align with the proposed trading day for the day-ahead market (starting from midnight CET).

In the intraday timeframe, Participants will submit compatible commercial orders into the CfD platform.

In the balancing timeframe, the Market Operator will complete the current ex-post market optimisation. Existing settlement rules will remain as currently designed; however, settlement of the results of the day-ahead and intraday results may be managed outside of the SEM market systems by an additional service provider, making use of separate settlement systems. The interfaces here would need to be very tight.

5.3 Pathways Review

In terms of criteria for review of the pathways, we considered the criteria as used to evaluate the different market models during the original consultation for the high level design of the SEM. As set out in section 2 of AIP/SEM/06/05, these were –

- Transparency
- Risk Management
- Price formation and liquidity
- Dispatch efficiency
- New entrants
- Renewables

We have reviewed each of the pathways under these headings and can summarise our initial opinions as follows[13]. It should be noted that only after a fuller analysis of these option could a full judgement on the merits of each option be arrived at. In addition the preferred option will be very much decided on which criteria are used and how each criterion is weighted, we have not weighted the factors here and instead consider them all on an equal basis.

5.3.1 Transparency

In terms of meeting the transparency requirements, the SEM achieves this by implementing a gross mandatory pool through which all energy (above the de-minimise level) is traded.

In all pathways there is a loss of transparency as some element of trade will be resolved in the intraday timeframe. This is an unavoidable consequence of compliance with the framework guidelines as simple and sophisticated offers are less transparent than complex offers. As the day-ahead market will be based on an optimisation, this will ensure transparency of the prices that will resolve. This will be ensured through publication of information and detail on the algorithm.

[13] Further detail can be found in Appendix 11

Maintaining as much of the current SEM mechanism in the forward and balancing timeframe will ensure greater transparency. Again, this is ensured through timely publication of information and ensuring information on the objective function of these sub-markets is available.

Moving trade into bilateral market arrangements will reduce the transparency in the SEM depending on the level of trade that moves to this mechanism and the limitations applied.

The end result of this is that the mechanisms which retain the SEM design transparency or augment this with a forward pool provide the best overall transparency. Any solution involving bilateral arrangements will likely result in a reduction in transparency.

5.3.2 Risk Management

Exposure to price and volume uncertainty are key issues in terms of risk management for Participants. In bilateral arrangements, the risk can be reduced through the use of long-term contracts; however, these could have equally negative effects of tying some generators in to prices that may be lower than a market average. Using a forward pool with firm pricing can further increase the risk on participants though typically forward prices will be less than ex-post prices and Participants can manage their volume to trade greater amounts at the lower prices. CfDs can be used outside of the SEM as a method of managing this price risk.

Coupling on a CfD market has its own challenge with regard to volume risk and the Participant being exposed where their day-ahead and intraday quantities are not realised in the ex-post market.

5.3.3 Price formation and liquidity

Price formation in all pathways is dependent on the volume of trade that moves into each timeframe. Liquidity in the day-ahead and intraday timeframes is dependent on the availability of cross border capacity and on the capability of generators to make short notice trades. Price in these timeframes will be determined by pan-European arrangements.

With bilateral arrangements in the forward timeframe, price formation and liquidity in the SEM becomes limited to the ex-post timeframe only with clear indication of the imbalances prices to be used. While the coupling on CfD markets retains all liquidity in the SEM and clear price formation in the ex-post timeframe, true prices may be determined in the CfD markets outside of SEM therefore removing the value of the liquidity in the pool.

In comparison to these pathways, the addition of a forward pool provides options to retain considerable liquidity in the SEM pools and should support better clarity around price calculation.

5.3.4 Dispatch efficiency

The voluntary nature of the individual market (accepting that in all instances generators must supply data to allow the System Operators dispatch them if required) timeframes raises concerns with respect to dispatch efficiency for all approaches; however, those that retain elements of the current SEM such as an ex-ante optimisation of generation based on economic merit would provide the best results in this area. As such, the option to Couple on CfD will provide a good solution here as the ex-ante changes are minimal; however, the requirement of this design to align with the European trading day will impact on the quality of the solution. This is as a result of the significantly shortened time between gate closure and the start of the trading day. This may lead to System Operators having to prepare an operations schedule in an earlier timeframe with less than complete information on all generators.

While bilateral arrangements can provide certainty of dispatch in terms of firm contracted quantities, the financial efficiency of these is difficult to determine due to the lack of transparency around these contracts.

As such, the forward pool in retaining the current SEM trading day and the existing time between gate closure and start of the trading day has the potential to provide best dispatch efficiency; however, this is completely dependent on the participation of the Suppliers in the SEM. If more liquidity moves to the day-ahead and intraday, the quality of the dispatch solution from the forward pool could be compromised.

In all instances the System Operators will retain central dispatch, the quality of the dispatch will be how economic it is and how far it deviates from the preferred market schedule.

5.3.5 New entrants and Competition

Pool mechanisms are traditionally more attractive to new entrants than bilateral arrangements where dominant market players can wield market power to limit access. This is also better for existing market participants. As such, the pathways that retain the pool elements provide the best opportunities for new entrants to the SEM. The combination pathway would provide some potential for new entrants but if the bulk of the liquidity moves to the bilateral timeframe, this will pose difficulties for new participants.

5.3.6 Renewables

Bilateral pathways may not offer the best options for renewable generators as they may be locked into long term contracts, similar to Power Purchase Agreements, at prices that are lower than the market average. This will limit the incentive for renewable generators to invest as they will be unable to access market prices other than through participation in the day-ahead and intraday markets which will involve more active participation by these generators than has been the case to date. Failure to trade in these timelines will leave them exposed to real-time prices (with the bilateral pathways).

The pool models offer better opportunities for renewable generators, offering some guaranteed access to wholesale market prices, while also allowing for the option to trade in the day-ahead and intraday timeframes should the Participant be sufficiently able to. The forward pool with a balancing market may be less beneficial than the Couple on CfD option which ensure access to the ex-post SEM price; however, the decision on the calculation of the ex-post price in the balancing timeframe with the forward pool could minimise this.

5.3.7 Participant Impact

Pathways that retain as much of the current design of the SEM will of course mean least impact on Participants in terms of system development, work practices, etc. As such, those pathways that include additional bilateral trading arrangements may necessitate additional systems and processes for Participants to manage which include systems for maintenance of trades but also with respect to the financial settlement of these trades which will happen outside of the SEM. However, as Participants currently manage out of market contracts through CfDs, PPAs and other schemes, the impact may not be significant.

Pathways that retain pool arrangements will see less change as interfaces required for ex-post pools and current bidding arrangements can be re-used.

There is an unavoidable impact with the addition of new trading opportunities at day-ahead and intraday stages. Managing this through the existing market arrangements may have less impact on Participants than managing this through a CfD platform as Participants will have to develop systems and practices to interface with this additional trading platform as well as interfacing with the SEM systems. Also the costs of developing and administrating the CfD platform and the settlement of the results have to be determined. This option could see increased responsibility on Participants with respect to managing the physical trades as they may be required to interface with two separate Market Operators – one managing the SEM, and a separate operator managing the day-ahead and intraday markets.

5.3.8 Competitiveness

Successful competition in the electricity market can be measured by access to real prices afforded to retail consumers. As such, bilateral markets where prices can be determined based on the contracts that a given supplier has as opposed to market clearing prices, may not promote the best level of competition in retail electricity sales. The introduction of bilateral markets will also benefit larger integrated utilities which can result in less competitive pricing in retail markets.

Pathways that provide best opportunities to trade would therefore increase the competitiveness in the market. The forward pool option which provides four timeframes to Participants in which to trade their sales and purchases though may have other issues with respect to the delivery of a reference price for out of market contracts. While the couple on CfD option provides three options, the limitation of firmness in day-ahead and intraday

trading opportunities to cross border energy only limits access of market players to the pan European electricity prices.

Taking the points noted here, we suggest a potential scoring of each of the pathways demonstrated in the table below. On the basis of this high level evaluation it would seem that Pathway 2 is best for these criteria; however, the weighting of these criteria would decide the best option overall.

	Pathway 1	Pathway 2	Pathway 3	Pathway 4
Transparency				
Risk Management				
Price formation and liquidity				
Dispatch efficiency				
New entrants				
Renewables				
Participant Impact				
Competitiveness				

6 Other considerations

There are a number of other key considerations that are crucial and must be taken in consideration: some of which can be considered as part of this paper and others which must be considered in a wider policy scope. Those elements being:

- Capacity Payments
- System Dispatch/Security
- Ancillary Services
- Renewables

6.1 Capacity Payment Mechanism

Throughout this paper, we have assumed that all pathways largely are compatible with a Capacity Payment Mechanism. This mechanism provides a stable payment to generators for eligible availability. This combined with a generator's ancillary services payments and any infra-marginal rent from the energy payments covers a generator's fixed and capital costs (i.e. non-variable costs).

A question does arise as to the treatment of capacity payments at the interface between SEM and GB i.e. for interconnector capacity. Currently, an interconnector unit purchases physical transmission rights on the interconnector from the interconnector owner (through the interconnector administrator). If they are scheduled in the SEM, they will pay or be paid capacity payments only for the energy that flows on the interconnector. They may also earn infra-marginal rent on the spread between the SEM and GB prices.

In the day-ahead and intraday stages, the shipping agent will take the role of the interconnector unit, in that they will carry out the settlement of trades between the SEM and other markets. As such, according to the current rules they would pay or be paid capacity payments for the additional energy that flows and would earn infra-marginal rent on the spread between the GB price and the SEM. The latter component is referred to as congestion rent. The shipping agent is a purely administrative function and will pass these payments and costs onto the interconnector capacity owner.

Where the interconnector capacity has been purchased through explicit auctions, in the case of Use-It-Or-Sell-It, the congestion rent will go to the capacity owner i.e. the owner of the physical transmission rights or to the interconnector owner in the case of unsold capacity. A question arises as to whether the capacity owner should pay or be paid the capacity payment. In particular, in the case where the interconnector is exporting, the capacity payment would be negative. If the congestion rent i.e. the spread between the SEM and GB price is less than the capacity payment, the interconnector capacity owner would have to pay a negative payment to the shipping agent.

In the current SEM this does not occur as an interconnector unit would not execute a trade that left them with a negative payment. This is achieved by including the capacity payment in the energy offers. Extending this approach to the day-ahead and intraday arrangements may require that some form of interconnector flow based charge is applied in the central coupling algorithm. This would lead to a dead-band on the interconnector i.e. the price spread must exceed a certain amount before there is flow in either direction. It would also need to be investigated further in terms of whether it could be accommodated in the central coupling algorithm. The alternative is that interconnectors are not subject to capacity payments – positive or negative.

6.2 System Dispatch

Many of the arrangements for the Target Model were developed around larger systems in GB and on mainland Europe. These systems are several orders of magnitude larger than the all-island system and this needs to be kept at the forefront of discussions when considering which option best meets the requirements of European legislation but also best meets the reliability and security standards for the island of Ireland.

Many of the larger European systems operate a self dispatch model with generators and suppliers effectively managing exchanges of power between them with the System Operators only dispatching balancing plant. This approach has never existed in Ireland; it was not considered appropriate at the launch of SEM and is not considered appropriate now. Some of the reasons are:

- The size of the largest infeed relative to the size of the demand is a measure of the granularity of the system. For a large system like the GB system, the loss of the largest infeed is much less of an issue than it is for the all-island system. This is because on the all-island system, the loss of a large CCGT or the interconnector may result in a loss of up 20% of the controllable generation that is running at the time. The impact of this characteristic is that the System Operators firstly need to dispatch all generation on the system to provide reserve (potentially constraining their output) and secondly if the largest infeed should trip then all that reserve needs to be called upon either automatically or through the issue of dispatch instructions.

- The level of intermittent generation in Ireland can already reach up to 50% of system demand adding unique operational challenges not experienced in other power systems. Centralised control of the output of all generation on the island is required to manage this intermittency.

- Again, because of the relative size of generators to system demand, transmission constraints on the all-island system, planned or unplanned, can have a significant impact on the technically feasible generation pattern that requires centralized control of the output of all generation.

- Centralised dispatch can be used as a mechanism to maximize the usage of renewable generation and so assist in meeting renewable targets.

As such, it is believed that the requirement for central dispatch of all generation remains a core requirement of the all-island system.

Achieving the ambitious renewable targets for Ireland and Northern Ireland will require robust system operation policies that are cognisant of the size of our system. In this regard, market arrangements that help this rather than hinder it are required.

6.3 Ancillary Services

The Ancillary Services mechanism will become even more important under the new market arrangements. The intraday market gate closure is likely to be just 1-2 hours ahead of real-time and as a result this reduces the time available for the System Operators to schedule an achievable and secure market schedule from the available plant portfolio.

The flexibility of plant and the incentivisation of this flexibility will be vital under the new market arrangements. This paper acknowledges the requirement for well functioning arrangements but does not attempt to detail those arrangements

6.4 Renewables

There are a number of considerations with regard to wind energy. Two of those considered here are:

1. Priority Dispatch
2. Exposure of Wind Generators to Imbalances

6.4.1 Priority dispatch

Following the recent decision on Scheduling and Dispatch in the SEM[14], the SEM Committee has decided to adhere to an 'absolute' interpretation of priority dispatch whereby economic factors are only taken account of in exceptional situations and where this can be done in a manner that does not threaten the delivery of renewables targets.

Priority dispatch is facilitated in the SEM by affording qualifying parties the option to register as Price Takers. It is necessary to give priority to renewable generators and to high efficiency CHP generators who are afforded priority dispatch under mandatory EU requirements over plant afforded priority dispatch by the exercise of discretion by a Member

[14] http://www.allislandproject.org/GetAttachment.aspx?id=5d635a6f-f9b4-494c-bd3a-722af770354c

State in the context of EU provisions and this will be reflected in dispatch decisions and processes of the TSOs.

It is noted that the hierarchy laid out in the priority dispatch paper does not apply where there is a need to address a specific issue in dispatch to maintain the secure operation of the electricity system that requires the dispatching down of a specific generator/generators.

In line with the above, System Operators will continue to be required to observe the relative priorities above until such time as they are revised.

If a Wind Generator has sold more in the day-ahead or intraday than is actually available then the SO will dispatch what is available. If the Wind Generator has sold less in the day-ahead or intraday mechanism than they have available on the day then the SO is obliged to dispatch the additional generation. As generators, under the Grid Code, they are not permitted to reduce their available capacity unless for reasons set out in the Grid Code such as scheduled outages, etc. These measures should ensure that priority dispatch is respected. The only consideration then is how any deviations are settled.

6.4.2 Exposure of Wind Generators to Imbalances

As prices in the SEM are calculated ex-post, there is no issue with the accuracy of the availability profiles of Wind Generators as actual availability values are used. Moving to market arrangements where ex-ante prices and quantities are firm requires the use of forecast information. While this is true of all Generator Units i.e. all units are subject to unforeseen failure, the volume of forecast error between day-ahead and actual availability could be significant and a wind generator unit exposed to this in the balancing market could incur losses as a result.

There are a number of ways of approaching this; however, initially it may be useful to consider two extremes:

1. Wind Generators are treated the same as any Generator Unit and are exposed to Imbalance Settlement.

   In this case, the Wind Generator would pay or be paid the amounts arising from any imbalances between their traded quantities and their actual delivered energy. This would class the forecast error as a generator constraint best resolved by the generator similar to the availability of a conventional generator. It would then be up to the generators to invest in methods of mitigating this forecast error.

2. Wind Generators are treated differently to other Generators and are insulated from Imbalance Settlement

As the forecast error of Wind Generators may be significant and if it is recognised that there is an inherent forecast error that cannot be mitigated by the Wind Generator, the error could be treated as an instructed imbalance or constraint and the cost would be socialised via the imperfections charge. This would class the wind forecast error as a system constraint similar to reserve or transmission constraints and would be managed by the System Operators.

An important consideration here is to what extent a wind generator can mitigate wind forecast error.

7 Costs & Benefits

Given the time constraints present in developing this paper, it was not possible to undertake a comprehensive Cost Benefit Analysis to determine the pros and cons of different options. This can be considered in the next phase of the development of the SEM options for compliance with the European Target Model. There are a number of elements that feed into the cost of designing a new market or alternatively making significant changes to the existing design. At a high level these include:

- Vendor design, software, hardware costs
- RA project costs
- TSO/MO project costs
- Consultant costs
- Market Participant costs
- Legal costs

The development of the SEM and launch of the market in 2007 is the most recent and relevant example to consider for cost analysis. The SEM cost approximately €54 million to implement and of that vendor costs for the core market engine were approximately €12 million. This is illustrative in that it indicates quite clearly that the biggest cost in the market development are the creation of the processes and procedures, the legal arrangements and the resources required to deliver the project. Effectively there was a ratio of 1:4 of the market engine cost to the total costs. In addition to this there were the costs of the market participants which cannot be estimated.

For the options considered here we have spoken to 3 vendors, two looking at the provision of the underlying market engine solution and 1 looking at the delivery of a CFD and coupling option to layer over the existing arrangements. In order to understand the relative merits of each option a detailed costing of the entire cost of the market delivery would be required.

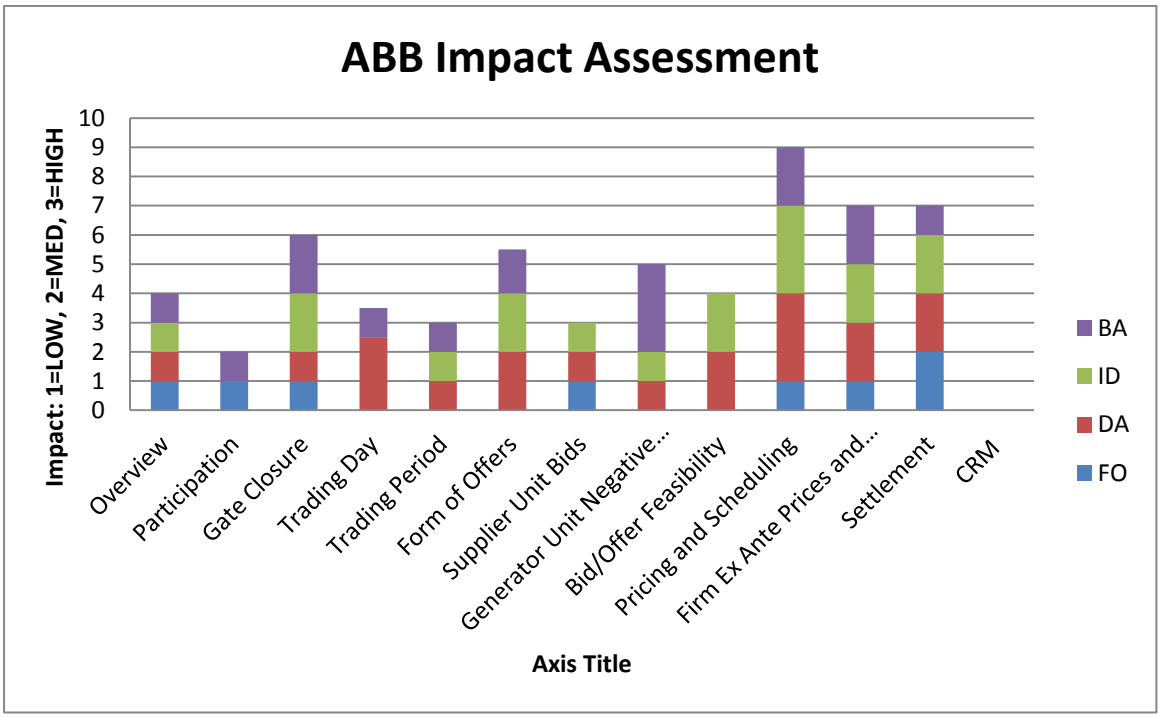
What we provide here in this paper in terms of the estimates of the cost of implementation is purely a high level estimate of the costs of the market engine vendor costs. It does not seek to identify and quantify the remainder of the other costs, which ultimately will need to be factored into an implementation project.

7.1 Vendor Costs

The evolution pathways do not require the continuation of the current market engine vendor as the core elements of a pool can be supplied by any vendor and we have included a high-level estimate of the costs of a new market engine solution for comparison purposes.

The costs for Pathways 1-3 would be similar for a core market engine delivery. This is due to the fact that the interface and systems changed are broadly similar across each pathway.

The costs for Pathway 4 - the CFD option - would require a move to a Trading Day based Central European Time away from our current standard based on the gas trading day, this has significant cost implications. The graph of the major cost elements below clearly show that one of the largest costs would be around implementing the trading day change in the ABB systems.



We have asked a vendor to provide us with the costs of providing a market coupling solution through a CfD mechanism. This has an implementation cost of € 0.4 million and an ongoing maintenance cost of € 0.3 million per annum. It is noted that this cost only covers the day-ahead market coupling and does not consider a solution for the intraday timeframe. The vendor advised they were unable to provide a cost for an intraday solution due to the lack of clarity that exists around the current requirement on a European level.

The costs cover the provision and operation of a day-ahead trading platform, capable of interfacing to the central European coupler. The costs do not cover

- Participant interfacing which will need to be developed separately,
- shipping functions, or
- financial settlement of contracts.

Other changes required to the central market systems not considered in these costs are

- changing to a European trading day of 23:00 for 24 hours,
- accommodating firm nominations for generators in the EA2 auction, or
- accommodating firm nominations for suppliers in the EA2 auction.

Taking note of costs provided by ABB with respect to the addition of these items into the central market systems will mean this option will have a further cost of € 6.5 million.

A hardware upgrade is not required for the evolution options as it is being implemented for IDT and this is keeping the market engine costs lower overall.

Both ABB and another vendor provided a cost indication for the delivery of the required systems to deliver the market engine to support the pathways described. ABB gave a range of €6-12 million depending on things such as the requirement to deliver a new trading day which is a relatively expensive change to the current systems. The second vendor estimated a cost of approximately €6 million for the delivery of a market engine based on the designs described. They presume that they do not have to design special interfaces for linkages to the European mechanisms; additional effort here would require additional cost. The second vendor also suggested ongoing support and maintenance costs of €1.3 million per annum.

As mentioned above the market engine costs provided by these vendors are only one element of the total cost of delivering a market solution and in the case of SEM it was approximately 25% of the cost of the overall delivery, excluding participant costs.

7.2 Costs of evolution over revolution

The option to evolve SEM in line with one of the 4 pathways outlined in this paper needs to be compared to the opportunity costs of developing a market from scratch (note: the proposal to completely redesign the market is not part of this assessment). There is no "quick fix" or "band-aid" solution available to achieve compliance with the Target Model and failure to comply is also not an option. Therefore there will be a cost to achieving compliance with the EU Target Model regardless of the option chosen.

7.3 Benefits

The report does not go into the benefits of each option other than to provide a number of assumptions on why one option is preferable to another. Some of the factors considered in evaluating the different options centred on compliance with the relevant legislation, the level of transparency provided, the mitigating impact it had on market power, the ability to facilitate renewable generation and the overall positive impact it had on market participants. Some benefits were prevalent across all options such as the provision of increased opportunities to trade across all timeframes; increased choice on how and where to trade; the ability to hedge in the long term market timeframe; the provision of a day-ahead reference price and trading opportunities closer to real time. The paper does not seek to identify an exhaustive list of potential benefits or to quantify how much these benefits are worth under each option. Again, this is something that should be properly addressed in a detailed implementation project at the next stage in the process.

8 Conclusions

The TSO and MO were asked to investigate could the SEM evolve to be compliant with the European Target Model for energy. Having investigated the Target Model and the requirements to align with it, 4 potential pathways to compliance have been identified.

Evolving the SEM rather than starting from scratch has a number of benefits, some of those being:

- It allows for compliance with the relevant European legislation and for alignment with the Target Model.
- The existing vendor could be maintained and this would necessitate fewer interface/systems changes for both the Market Operator and the participants, however it is possible to bring in a new vendor if it was considered this would provide a benefit overall. Either option can be pursued.
- The pathways described here are flexible, they allow for the Market Operator to act as a power exchange (or for an external power exchange to be appointed and act alongside a Market Operator as in Great Britain (GB)) for Ireland and to potentially link to the power exchange hub[15] proposed for GB.
- The evolution option is likely to lead to less legal changes and would mean that the fundamental underlying legal structure could be retained.
- Certainty: the maintenance of the core elements of the SEM market will provide certainty for market participants.

The 4 pathways are as follows

- Pathway 1: Bilateral Trades, Couple on EA1
- Pathway 2: Firm Forwards Pool, Couple on EA1
- Pathway 3: Bilateral Trades & Firm Forwards pool, Couple on EA1
- Pathway 4: No Explicit Forwards arrangements, couple on CFD auction

The 4 potential pathways have been developed with a number of criteria in mind aligned with those used for the development of the SEM market. These criteria are useful for both developing the design and also for considering the relative merits of the designs.

Each pathway has its merits but some would seem better than others when set against some of the criteria used to assess the SEM design. This evolution would of course require detailed analysis.

[15] National Grid UK are currently running a tender to put in place a power exchange hub where the liquidity over the two interconnectors and power exchanges from GB to Europe could be centralised

	Pathway 1	Pathway 2	Pathway 3	Pathway 4
Transparency				
Risk Management				
Price formation and liquidity				
Dispatch efficiency				
New entrants				
Renewables				
Participant Impact				
Competitiveness				

On the basis of an evaluation against the key criteria pathway 2 is seen to score best. Whether this model is preferred overall will of course depend on how the various criteria are weighted.

Other Considerations

There are a number of other key elements outside of the market that are crucial in an All-island context and must be taken into consideration when considering the design options for SEM, some of the key elements being:

- Capacity Payments
- Constraints Payments
- Ancillary Services Arrangements
- Treatment of Renewables
- System Security

A capacity payment pot and the constraints payment mechanism could be used alongside any of the pathways described. The exact interaction of these mechanisms with the new market arrangements will need to be developed in detail and should be a key part of the detailed design process but are out of scope for this report and have not been considered here.

In terms of System Security the maintenance of central dispatch and the provision of accurate data to allow the System Operators to price the schedule are vital. Units can self nominate but ultimately the decision to bring units on or off and set the level of output has to lie with the System Operator. A unit can be moved from its preferred schedule and as such must have supplied data to allow the System Operators make decisions on which units to dispatch should they have to deviate from the market schedule.

With regards to renewables one must consider the level of imbalance price exposure wind farms should face, if any, and how to factor in priority dispatch among other factors. There are a number of ways to handle these issues through each of the pathways described. The System Operators will continue to respect priority dispatch policies. In terms of imbalance prices wind generators could be protected or exposed to these prices depending on the prevailing polices adopted. Again these are considerations for the detailed design and consultation phase.

The Costs

Given the time constraints present in developing this paper, it was not possible to undertake a comprehensive Cost Benefit Analysis to determine the pros and cons of different options; this can be considered in the next phase of the development of the SEM options for compliance with the European Target Model.

The development of the SEM and launch of the market in 2007 is the most recent and relevant example to consider for cost analysis. The SEM cost approximately €54 million to implement and of that vendor costs for the core market engine were approximately €12 million. This is illustrative in that it indicates quite clearly that the biggest cost in the market development are the creation of the processes and procedures, the legal arrangements and the resources required to deliver the project. Effectively there was a ratio of 1:4 of the market engine cost to the total costs. In addition to this there were the costs of the market participants which cannot be estimated.

For the options considered here we have spoken to 3 vendors so that the vendors, two looking at the provision of the underlying market engine solution and 1 looking at the delivery of a CFD and coupling option. In order to understand the relative merits of each option a detailed costing of the entire cost of the market delivery would be required.

Both ABB and another vendor provided a cost indication for the delivery of the required systems to deliver the market engine to support the pathways described. ABB gave a range of €6-12 million depending on things such as the requirement to deliver a new trading day which is a relatively expensive change to the current systems. The second vendor estimated a cost of approximately €6 million for the delivery of a market engine based on the designs described. They presume that they do not have to design special interfaces for linkages to the European mechanisms; additional effort here would require additional cost. The second vendor also suggested ongoing support and maintenance costs of €1.3 million per annum.

The CFD option coupled with the market engine changes based on service provider costs and our understanding of the central systems costs that would be necessary, was estimated at approximately the lower end of the ABB cost range of €6.5 million.

An evolution of the SEM market is a possible way forward to comply with the EU Target Model. This will provide further opportunities to trade with our European neighbours and deliver greater prospects to export our renewable resources. Pathway 2 as described would appear to deliver the most immediate benefits, however one would have to consider the longer term benefits other market designs could deliver. All pathways are flexible and it is feasible to link to the proposed GB power hub through an Irish power exchange or through the Market Operator.

Pathway 2 when set against some of the key criteria used to evaluate the SEM market development seems to stack up the most positively. It has the benefit of maintaining the best elements of SEM while ensuring compliance with the Target Model and creating a model flexible enough to make future changes if required. .

This paper represents a high level investigation of the potential for evolution of the SEM which is merely the first part of the move towards Target Model compliance. Given our independent central position in the SEM market and our role in Europe through ENTSO-E (developing the network codes which will govern the Target Model) and Europex, it is the firm contention of the TSO's and MO that we would be best placed to continue this work with the RA's, following the SEM Committee decision in 2012. The next step is to develop these pathways into detailed designs which can deliver a fully functional efficient transparent, competitive and secure energy market for Ireland as part of the European Internal Energy Market.

9 Appendix A: European Regional Integration

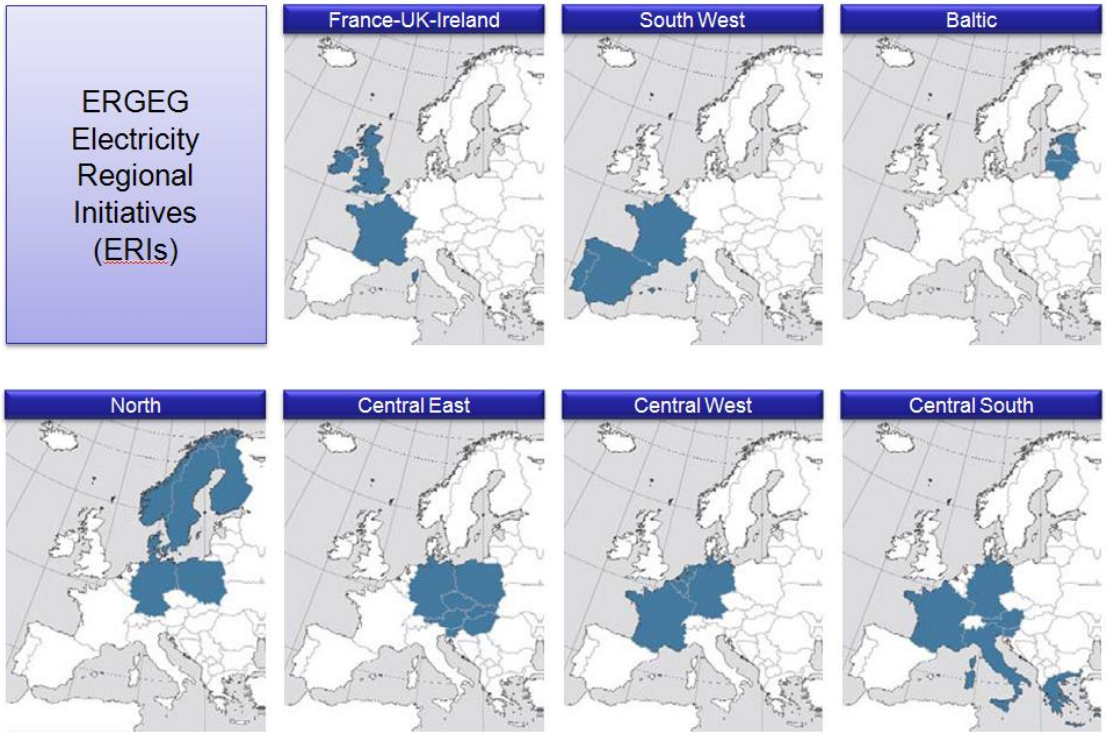
9.1 Electricity Regional Initiatives (ERIs)

In spring 2006 ERGEG launched the Electricity Regional Initiatives (ERI) following a consultation on the creation of regional electricity markets. The ERI created seven regional electricity markets across Europe as an interim step to creating a single European electricity market, focusing on three priority areas:

- harmonisation and enhancing congestion management on interconnections;
- harmonising regional market transparency; and
- developing balancing market exchanges at borders

Section 3 of the European Congestion Management Guidelines provides for requirements on coordination between countries in these seven regions. Each ERI consists of a Regional Co-ordination Committee (of regulators), together with Implementation and Stakeholder working groups. The seven regions have similar aims in terms of integrating fragmented national electricity markets into regional markets but their priorities and achievements reflect different

The EC published a Communication on 7 December 2010 on the future role of regional integration and presented to the Florence Forum on 13-14 December. It proposed involving the EC, ACER and the Member States more in the regional initiatives and establishing a new Regional Steering Committee (RSC) group with the EC, regulators and Member States all participating. The current regional distribution with seven regions is still considered appropriate.



9.2 France-UK-Ireland (FUI)

Ireland is part of the France-UK-Ireland regional group. The main aim of this group is to progress market integration within the region and with other regions. The TSOs (EirGrid and SONI), regulators (CER and UR), Moyle and other interested stakeholders actively participate in the work of the FUI.

The development of framework guidelines, network codes and energy infrastructure plan will require significant engagement, coordination and cooperation with all stakeholders in FUI. Binding network codes will place increasing pressures on national Member States to integrate at the regional and European level.

Significant work has been done in FUI in 2011 on the access rules of all FUI interconnections to coordinate on long term auctions. The TSOs will continue to work with the Regulatory Authorities to identify areas where further coordination can take place over the short and medium term.

Work on day-ahead market coupling and implicit continuous trading intraday is continuing in the North West Europe (NWE) regional group. In SEM, the SEM Committee has approved the introduction of intraday trading with the addition of two gates to enable market participants' trade closer to real time.

9.2.1 FUI Work Plan 2011-2014

The Regulatory Authorities have already submitted to the European Commission the FUI regions input to the European Energy Work plan 2011-2014. The work plan establishes milestones and commitments for the FUI region to meet the objective set by Member States at the European Council meeting on 4 February 2011 to complete the internal market by 2014.

The FUI electricity region input was jointly prepared by all relevant National Regulatory Authorities, in discussion with Member State representatives and Transmission System Operators.

The FUI region consists of France, the United Kingdom and the Republic of Ireland, with Ofgem acting as the lead regulator. There are three distinct electricity markets, the British Electricity Transmission and Trading Arrangements (BETTA) market in Great Britain, the Single Electricity Market (SEM) in the Republic of Ireland and Northern Ireland and the French electricity market.

The FUI Work Plan sets out priorities to achieve the 2014 objective in each of the following areas:

- Priority I: Implementation of the CACM FG Target Model
- Long term capacity allocation
- Day-ahead: Single European price market coupling
- intraday trading
- Cross-border balancing
- Capacity calculation
- Priority II: Interconnections and available capacity
- Framework for interconnector investment
- New interconnector projects
- Priority III: Regional reporting
- Regional Investment Plan
- Regional transparency report
- Regional report on the management and use of interconnections

10 Appendix B: European Target Model

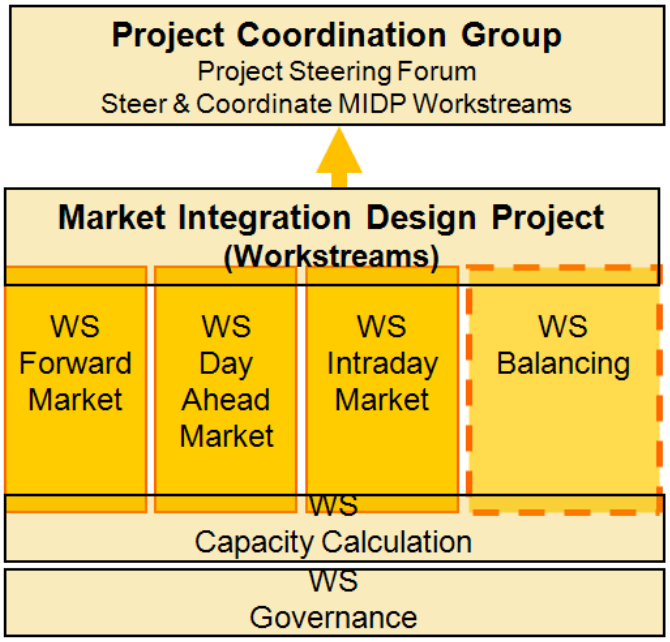
10.1 Background to the European Target Model

The Electricity Regulatory Forum, or Florence Forum, was set up to discuss the creation of an internal electricity market. Participants include national regulatory authorities, Member State governments, the European Commission, transmission System Operators, electricity traders, consumers, network users, and power exchanges. Since 1998 the Forum has meet once or twice a year.

The Florence Forum requested a report in September 2007 on the "Development and Implementation of a Coordinated Model for Regional and Inter-Regional Congestion Management" which was jointly prepared by ETSO and Europex.

On the back of work done on the ETSO-Europex Study the Florence Forum invited ERGEG to establish a Project Coordination Group of experts (PCG), with participants from the EC, Regulators, ETSO, Europex, Eurelectric and EFET, involving Member States' representatives as appropriate. The PCG was tasked with developing a practical and achievable model to harmonise interregional and then EU-wide coordinated congestion management, and of proposing a roadmap for implementation with concrete measures and a detailed timeframe, taking into account progress achieved in the ERGEG Electricity Regional Initiatives. A Market Integration Design Project (MIDP) was also set up under the PCG involving TSOs and Power Exchanges to address the practical design issues.

Organisation Structure of PCG and MIDP



The PCG presented a European **Target Model** for the electricity market and a tentative roadmap for implementation to the Florence Forum in December 2009.

An Ad Hoc Advisory Group (AHAG) of all stakeholders was set up in December 2009 to replace the PCG and continue the work done to date. The key tasks assigned to AHAG were to:

Further develop the Target Model & road map presented by the PCG/MIDP

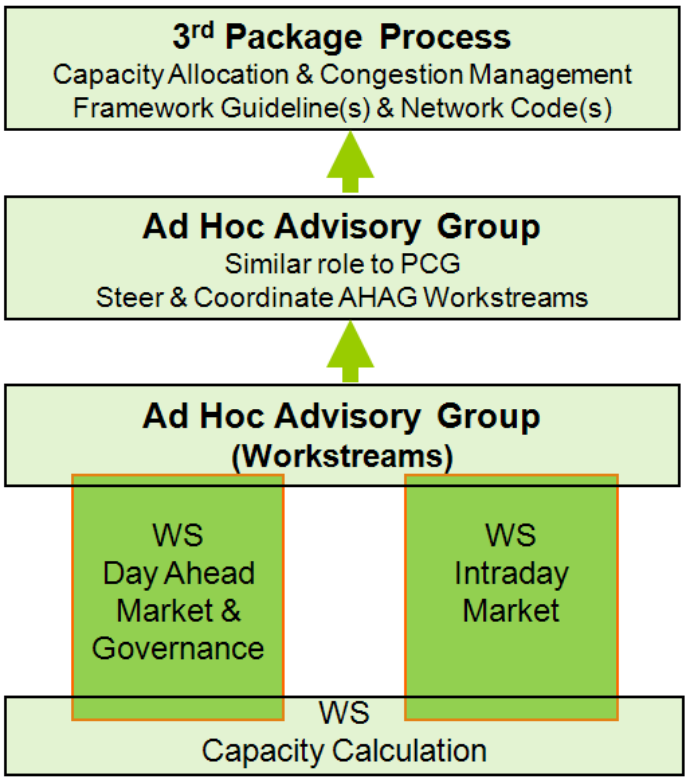
Input to ERGEG's work on the Framework Guidelines on Capacity Allocation and Congestion Management as appropriate.

Pave the way for Network Code making and implementation

Three implementation projects were launched to progress the work of AHAG:

- Day-ahead – chaired by the European Commission tasked with designing a governance framework and implementation of a day-ahead market coupling solution;
- intraday – chaired by ENTSO-E tasked with developing a Target Model for intraday;
- Capacity Calculation - chaired by ENTSO-E tasked with developing a common grid model.

Organisation Structure of AHAG



At the 19th Florence Forum on 13-14 December 2010 it was decided the work of the AHAG should continue with new terms of reference under ACER. The name for this new version of AHAG is AESAG - ACER Electricity Stakeholders Advisory Group. The role of AESAG is to provide an informal, voluntary-based process that focuses on implementation and can contribute to the Framework Guideline.

The AESAG comprises representatives of the European Commission, European Regulators and of the relevant stakeholder organisations of the European electricity sector including the transmission System Operators, power exchanges and market participants (consumers, traders, electricity companies). These are represented through the following organisations: ENTSO-E, Europe, Eurocentric, EFET, IFIEC, CEFIC, CEDEC and GEODE. All the involved stakeholder organisations nominate representatives. ACER chairs the AESAG.

At the Florence on 23 and 24 May 2011, the Forum supported the European Commission's request for a concrete "EU Energy Work plan 2011-2014" at a Pan-European and regional level which, in order to focus the Regional Initiatives on the results, they should deliver by 2014, as decided at the European Council in February 2011. AESAG is working on a number of roadmaps for the following:

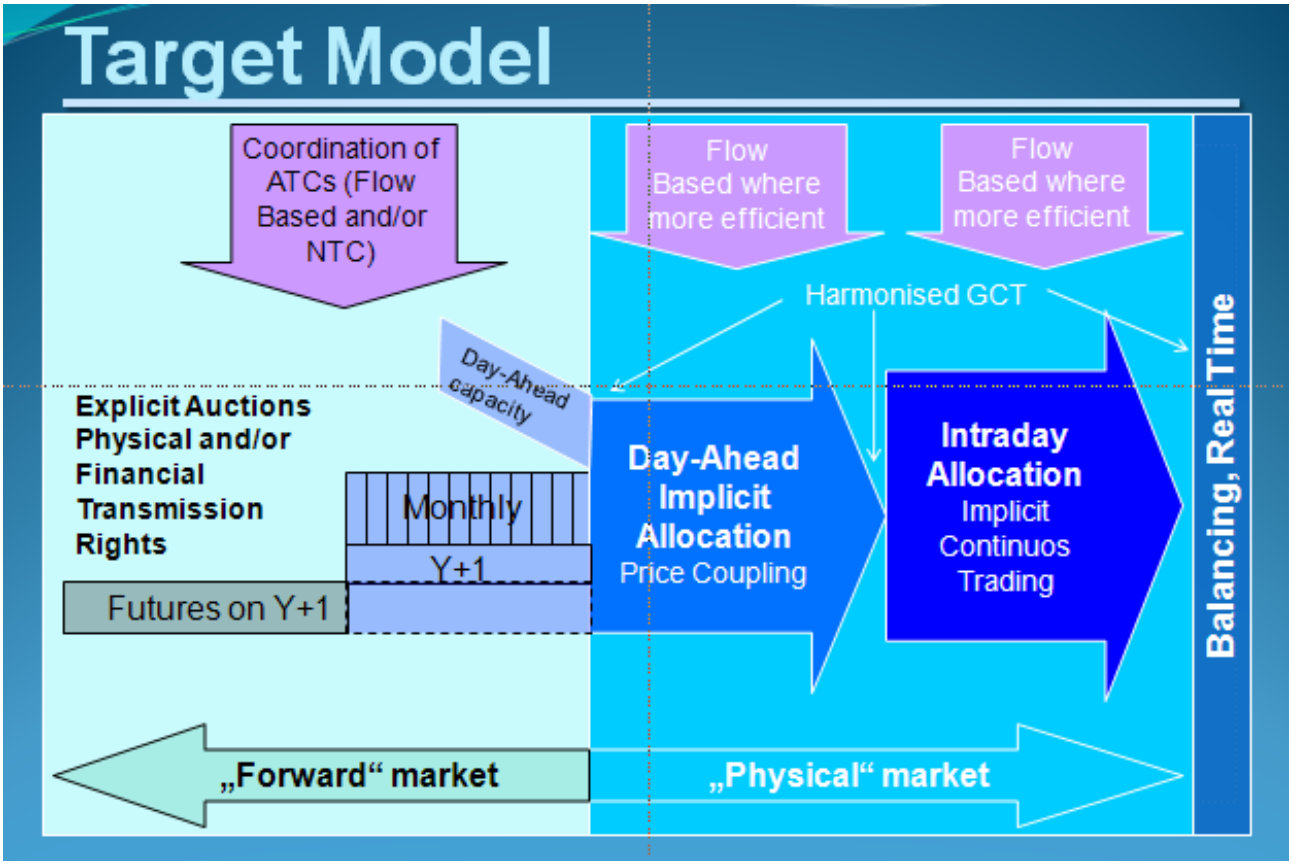
- Single European price market coupling
- Continuous implicit cross-border trading
- Single European platform for the allocation and nomination of long term transmission rights
- Flow-based allocation method in highly meshed networks
- Pilot projects for the integration of balancing markets.

10.2 **European Target Model**

The Target Model was established following agreement by all stakeholders in the PCG. It provides a blueprint and roadmap for closer market integration by setting out clear proposals for the coordination and harmonisation of Europe's electricity markets.

At the latest European Council meeting on 4th February 2011 it was decided that "**the internal market should be completed by 2014** so as to allow gas and electricity to flow freely. This requires in particular that in cooperation with ACER national regulators and transmission systems operators step up their work on market coupling and guidelines on network codes applicable across European networks". This effectively brings forward the timeline for implementation of the Target Model from 2015, the date agreed by the PCG. The Framework Guideline (ACER) and Network Code on Capacity Allocation and Congestion Management (ENTSO-E) are based on the Target Model.

European Target Model



10.3 Third Energy Package

In September 2007, the European Commission made a series of proposals to further open up the gas and electricity markets following its Sector Inquiry. In July 2009 the Third Package for the internal EU gas and electricity market was adopted by the European Parliament and the Council. The Third Package entered into force on 3rd September 2009 giving Member States 18 months to transpose the EU legislation into national law. On 3rd March 2011, the Third Package was transposed into national law by the Member States.

The Third energy package consists of two Directives, one concerning common rules for the **internal market in gas** (2009/73/EC), one concerning common rules for the **internal market in electricity (**2009/72/EC) and three Regulations, one on conditions for access to the **natural gas transmission networks** (EC/715/2009), one on conditions for access to the **network for cross-border exchange of electricity** (EC/714/2009) and one on the establishment of the **Agency for the Cooperation of Energy Regulators ACER** (EC/713/2009). The two Directives have to be transposed into national law by Member States by 3 March 2011. The three Regulations do not need such transposition by Member States and are directly applicable in all Member States as of this date.

10.3.1 Framework Guidelines

Regulation 714/2009 provides that ACER submit to the European Commission within six months a non-binding framework guideline for the development of network codes. The Framework Guidelines specify detailed areas for network code development. The Framework Guideline deals with the integration, coordination and harmonisation of congestion management methods, insofar as such harmonisation is necessary in order to facilitate electricity cross border trade.

ERGEG submitted an Initial Impact Assessment on the Framework Guidelines for Capacity Allocation and Congestion Management on 8th September 2010. It then submitted the Final Draft Framework Guidelines on Capacity Allocation and Congestion Management for Electricity on 3rd February 2011 outlining the principles to apply to capacity calculation, forward, day-ahead and intraday markets in Europe. ACER is currently consulting on the final version of the Framework Guideline with the deadline on 10 June 2011.

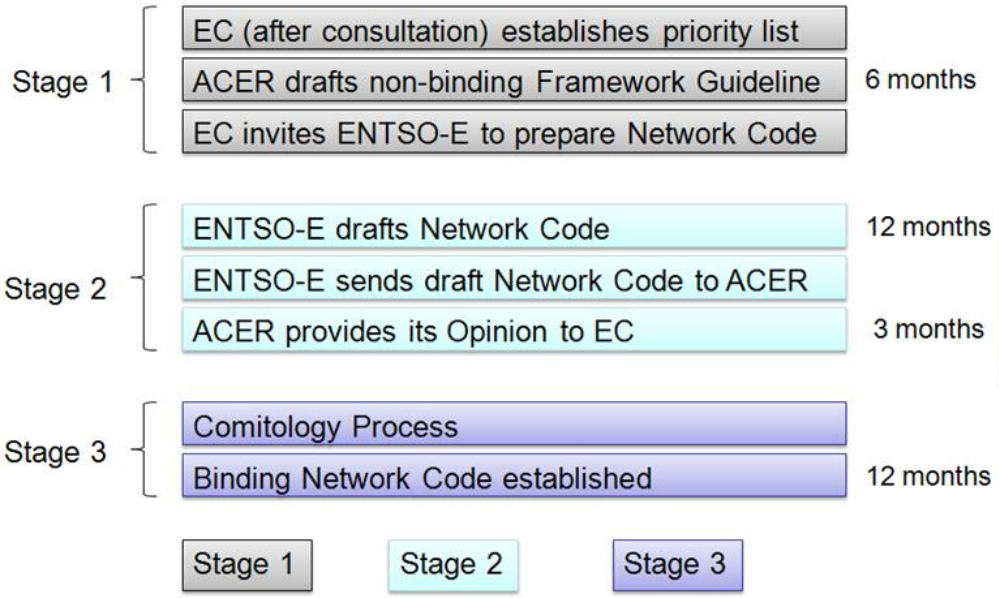
10.3.2 Network Codes

Regulation 714/2009 sets out one of the primary tasks of ENTSO-E in developing network codes in 12 areas identified below:

1. Network security and reliability rules including rules for technical transmission reserve capacity for operational network security;
2. Network connection rules;
3. Third-party access rules;
4. Data exchange and settlement rules;
5. Interoperability rules;
6. Operational procedures in an emergency;
7. Capacity-allocation and congestion-management rules;
8. Rules for trading related to technical and operational provision of network access services and system balancing;
9. Transparency rules;
10. Balancing rules including network-related reserve power rules;
11. Rules regarding harmonised transmission tariff structures including locational signals and inter-transmission System Operator compensation rules; and
12. Energy efficiency regarding electricity networks.

The European Commission formally asked ENTSO-E to start working on the Network Code on Capacity Allocation and Congestion Management in September 2011. This Network Code is now being developed by ENTSO-E with a final draft to issue to the ACER by September 2012.

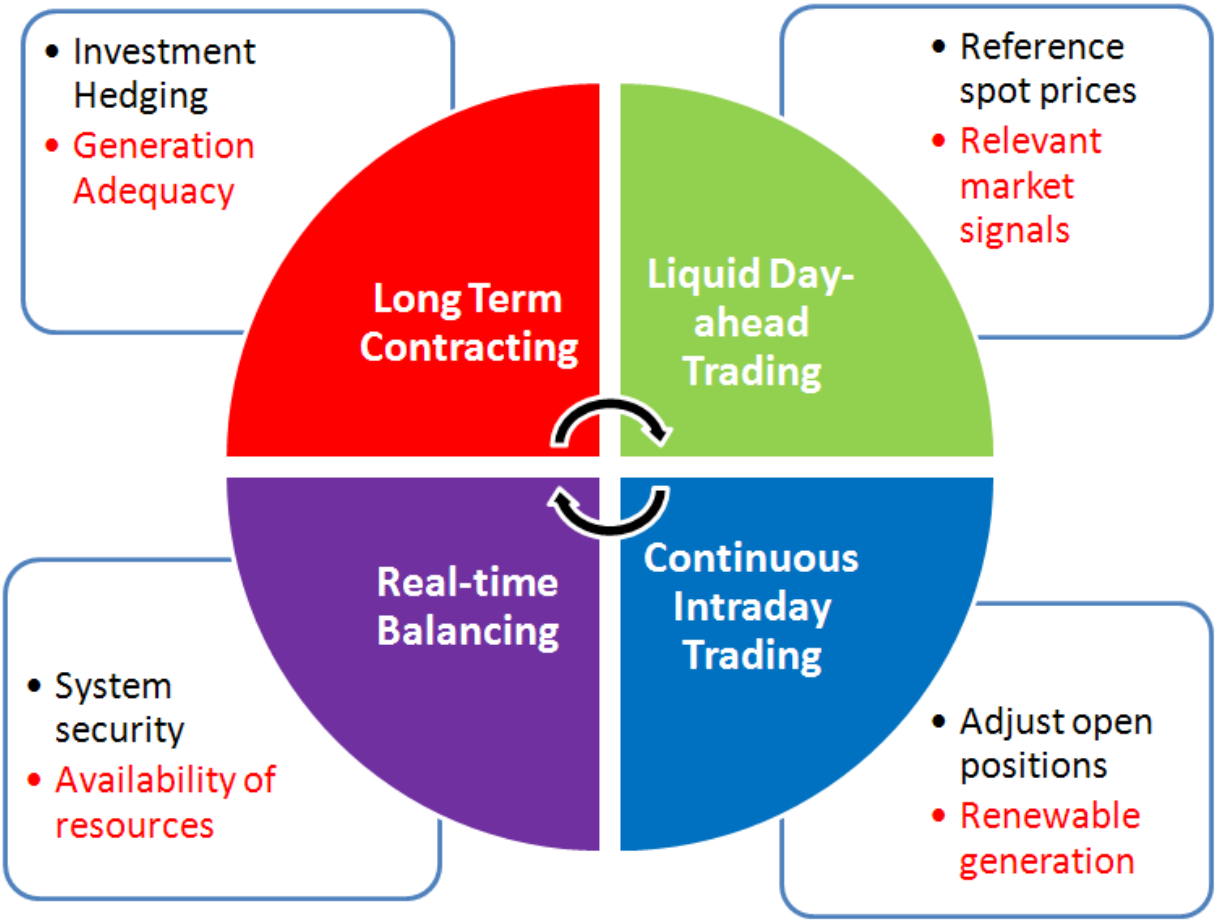
Process for Network Code Development



10.4 **Timeframes**

The Target Model is based on four distinct timeframes. They are:

- Long Term or Forward
- Day-ahead
- Intraday
- Balancing/Ex-post



10.5 **FG CACM**

The Agency for the Cooperation of Energy Regulators (ACER) published a draft of the Framework Guidelines on Capacity Allocation and Congestion Management for consultation in April 2011. The Evaluation of Responses to this consultation was then published on 28 July, a day prior to publication of the final Framework Guideline on 29 July 2011. The Framework Guideline is intended to set out clear and objective principles for capacity allocation and congestion management in Europe, which will be included in a legally binding[16] network code being developed by ENTSO-E. It deals with the forward, day-ahead and intraday markets and how capacity is both calculated and allocated within these timeframes.

[16] The Network Code, when adopted, will take the form of a binding EC Regulation

To be clear, it does not cover the balancing timeframe, which will be covered in a separate Framework Guideline. The Network Code on CACM also only deals with day-ahead and intraday, not the forward timeframe, which is likely to dealt with in a separate code.

The Framework Guideline provides for transitional arrangements for the day-ahead and the intraday markets of island systems with central dispatch, as long as these transitional arrangements:

- are justified on the basis of a cost-benefit analysis;
- do not unduly affect other jurisdictions;
- guarantee a reasonable degree of integration with the markets in adjacent jurisdictions;
- do not extend beyond 2016.

The key requirements set out in the Framework Guidelines are as follows:

The Capacity Calculation method shall use either a Flow-Based (FB) method or an Available Transfer Capacity (ATC) method for capacity calculation at each zone border for a given timeframe, based on a Common Grid Model. In cases where transmission networks are highly meshed and interdependencies between the interconnections are high, the flow-based method is preferred.

The Framework Guideline includes the definition of zones, where a zone is defined as a bidding area, i.e. a network area within which market participants submit their energy bids day-ahead, in intraday and in the longer term timeframe.

In the forward timeframe, Financial Transmission Rights (FTR) or Physical Transmission Rights (PTR) with Use-It-Or-Sell-It (UIOSI) can be used. The Framework Guideline also requires that there be a harmonised set of rules for borders and a single platform for the allocation of long-term transmission rights (PTR and FTR) at European level.

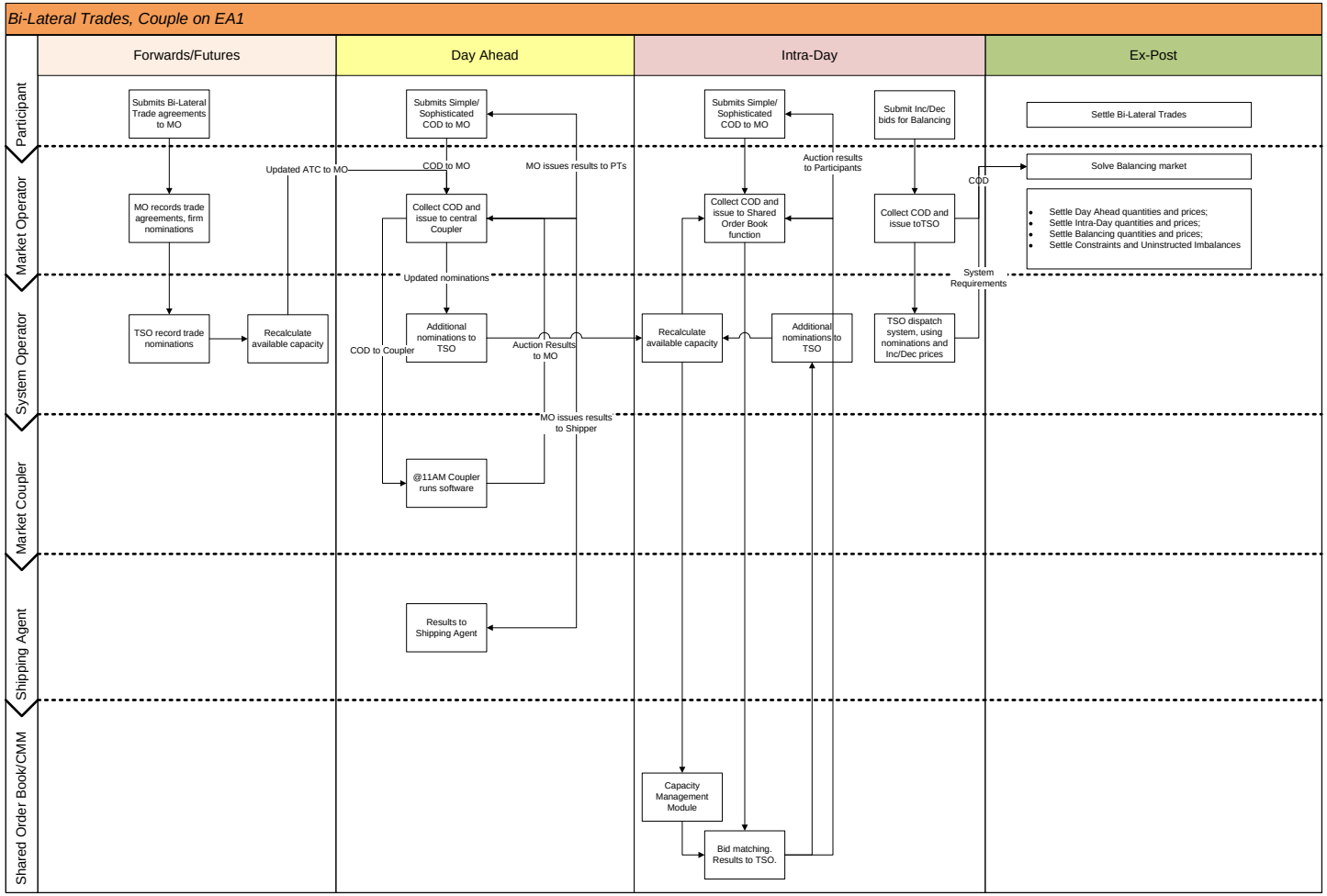
Allocation of day-ahead capacity is based on implicit auctions via a single price coupling algorithm which simultaneously determines volumes and prices in all relevant zones, based on the marginal pricing principle.

Curtailment of allocated capacity may only be used in emergency situations and *force majeure*, and when all other means are exhausted. Market participants shall not be affected and PXs shall not bear additional costs deriving from a reduction in allocated capacity.

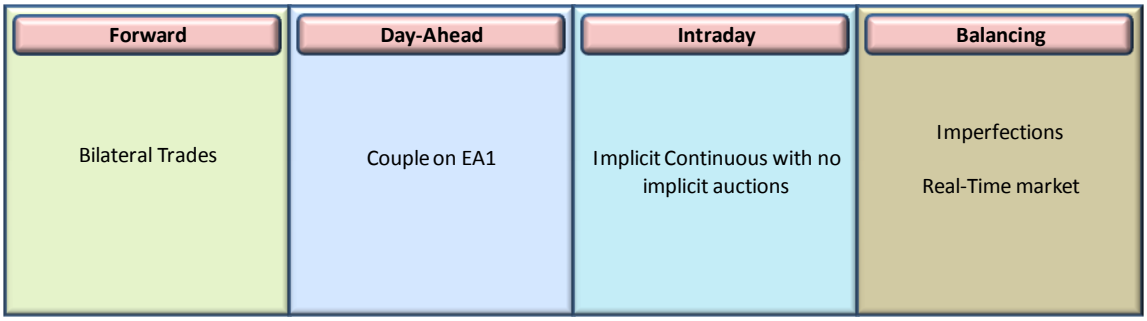
The intraday timeframe is based on continuous implicit trading that may be complemented by regional auctions where there is sufficient liquidity. To implement the European Target Model, the Framework Guideline requires the development of a pan-European Shared Order Book Function (SOBF) and Capacity Management Module (CMM). All cross-zonal intraday capacity is to be allocated via the pan-European platform, with a one-to-one relationship between the SOBF and the CMM. The SOBF will be provided with all bids from the power exchanges and available transmission capacities from the CMM. Explicit access is possible in the transitional phase.

11 Appendix C: The Pathways Models

11.1 Pathway 1: Bilateral Trades, Couple on EA1



11.1.1 Introduction



This pathway is made up of a limited bilateral trading market in the forward timeframe, with a price coupled market in the day-ahead timeframe occurring at the EA1 stage, continuous trading in the intraday timeframe and real-time pricing of imbalances. It can work with either of the proposed imbalance pricing mechanisms, ex-post or real-time but real-time may be more suitable.

11.1.2 High Level Description of the Pathway

11.1.2.1 *Forward Timeframe*

The design of the forward market will be a limited bilateral contract market with Physical Transmission Rights (PTRs) on the interconnectors or a forward CfD market with Financial Transmission Rights (FTRs). This will be a voluntary market (remembering however that generator must make data and themselves available to the TSO's such that they can make a decision to dispatch the generators if so required). Participants will be able to enter into bilateral contracts for the purchase and sale of electricity and to submit these contracted quantities to the Market Operator in advance of a defined gate closure. This would be expected to be in line with the current EA1 gate timings. The market timeframe will be the existing Trading Day of 06:00 for 24 hours.

These contracted quantities will be considered as "price taker" nominations from a market and System Operator point of view. This option will allow interconnector users, as well as other generators and suppliers, with explicit capacity holdings to nominate their traded quantities in advance of the coupled markets.

As this paper is concerned with evolutionary pathways for SEM, the inclusion of bilateral trading in the forward timeframe is not intended to replace the SEM with something more akin to BETTA. On the contrary, this option is intended to provide some opportunity to utilise the explicit capacity rights purchased in the forward timeframe. As such, some form of incentive to trade in the day-ahead stage or the intraday timeframes or some form of restriction of the volume of bilateral trades may be required. In this manner, we would envisage that this option would be more akin to the arrangements in Nordpool or MIBEL, where most trade goes through the day-ahead market; however, there is opportunity to trade

outside of these arrangements. This is in contrast to GB, France, Germany, where exchange traded volumes are low compared to OTC trades.

This market could see a limited amount of bilateral trades in advance of 11:00 gate closure of the day-ahead market, followed by the majority of trade taking place in the day-ahead market, followed by a smaller volume of trades to give 'shape' in intraday timeframe. An extreme case of this option would see the bilateral trades limited to 0% of trade, forcing all trade into the day-ahead and subsequent stages. There would be questions here in relation to the value of explicit capacity rights if there is no complimentary energy trading mechanism in the forward timeframe; however, PTRs with UIOSI or FTRs provide a hedge against the capacity price in the day-ahead stage. Forward could be solely financial i.e. CfDs for energy and capacity (FTRs), leaving all physical trades to occur in the day-ahead and intraday timeframes.

The diagram below (Figure 1) shows the contractual relationships between the various parties. As parties are trading bilaterally, they are entering into physical contracts with each other. In order to carry out cross border trades, they need to register an interconnector unit and purchase capacity in the explicit auctions. Once they have this they can purchase trade with other parties in GB (two Power Exchanges are shown here; however, it would be possible to trade directly with generators and suppliers directly). This diagram is not intended to be a definitive means of trading bilaterally but rather to highlight the role of the interconnector units. This role in subsequent timeframes will be carried out by a central agent known as the shipping agent.

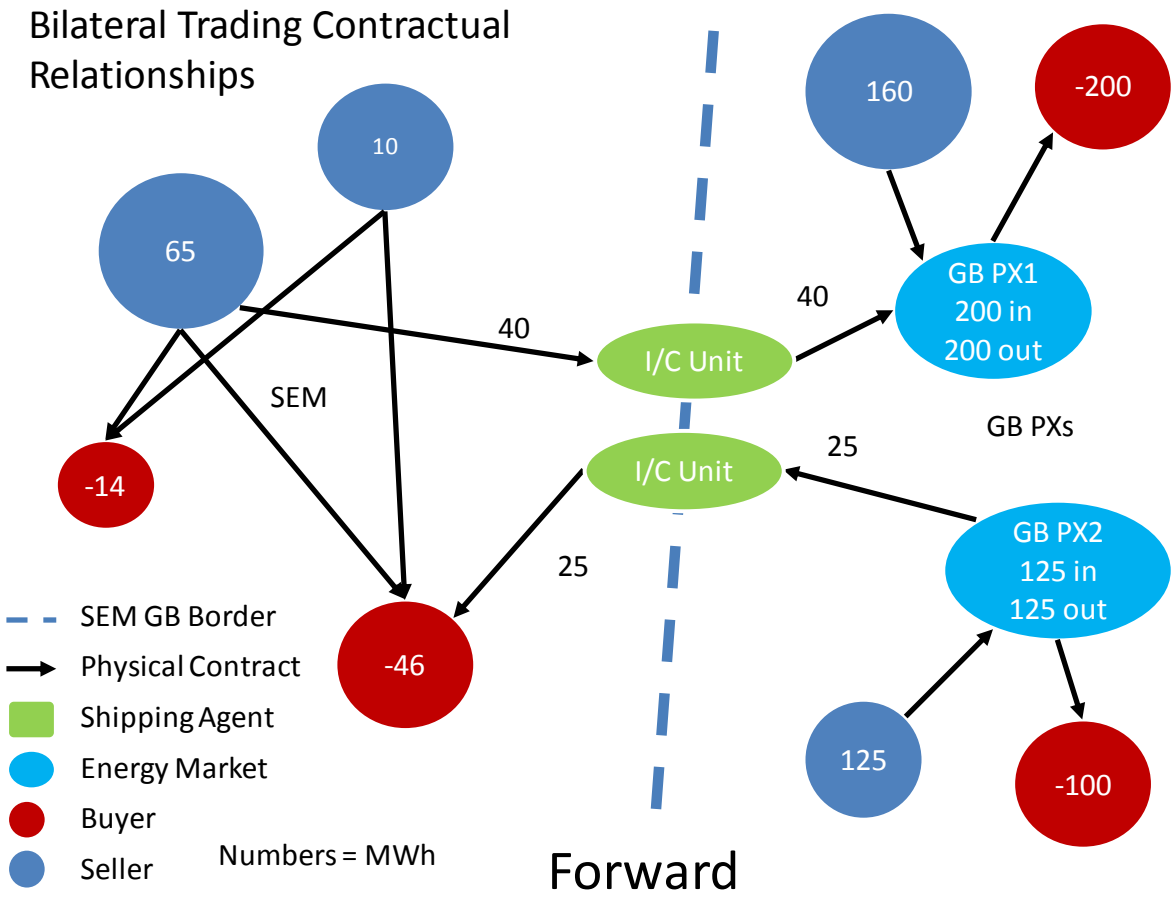


Figure 1 - Contractual relationships for bilateral cross border trades (MWh)

11.1.2.2 *Day-Ahead Timeframe*

While this is called "Couple on EA1", the timing will be line with the current proposals for European day-ahead markets (Gate Closure at 11:00). This is considered to be coupled on the EA1 because there is be no explicit running of the SEM before the coupled market. Simple and sophisticated orders will be submitted to the Market Operator in advance of day-ahead gate closure. Bids that are feasible[17] will be transferred to the central European market coupler for inclusion[18]. The results will be issued back to the Market Operator. Results will then be published from the Market Operator to the System Operators and all Participants who have participated.

[17] Further information on the nature of feasible bids is covered in Appendix 12.2.3

[18] Further detail on market coupling is provided in Appendix 12.2

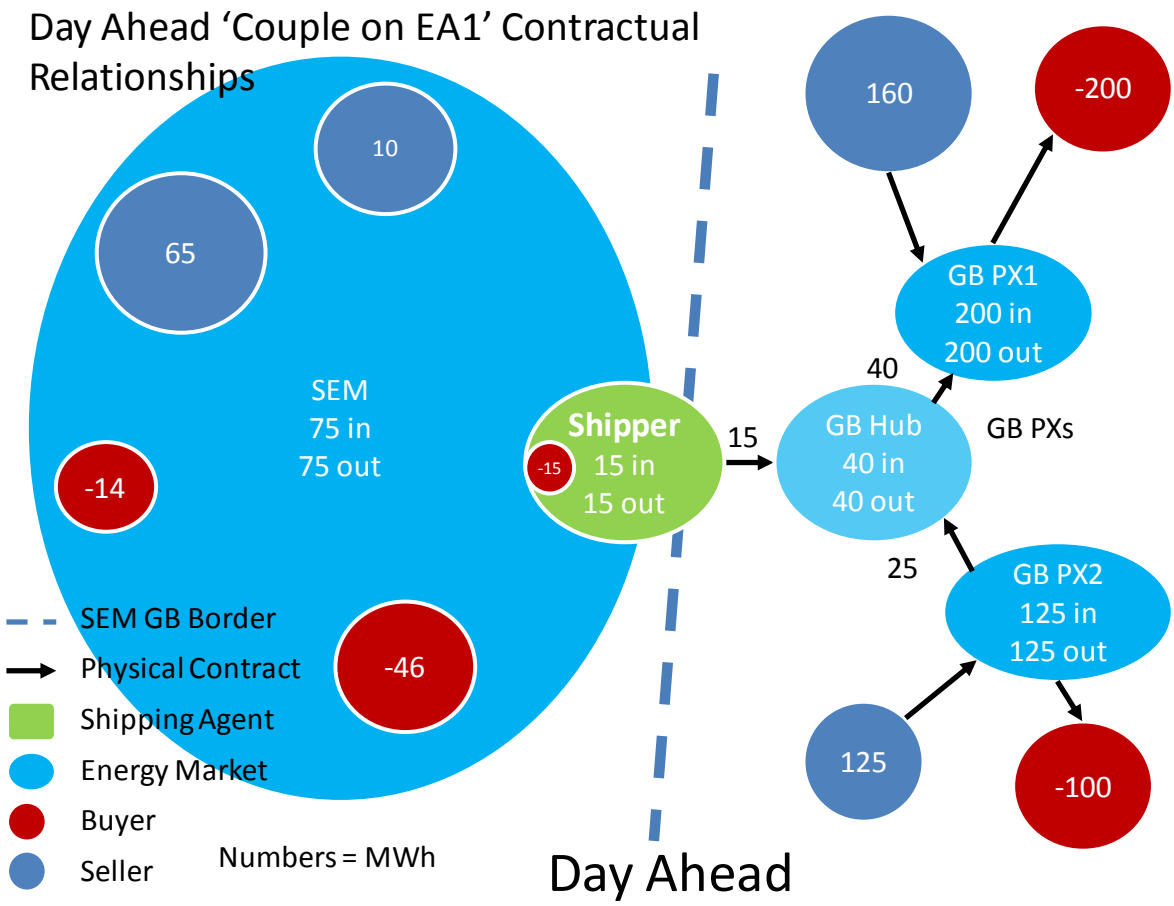


Figure 2 - Contractual relationships for cross border trades in MWh through European day-ahead price coupled auction

The relationships between various parties at the day-ahead stage are illustrated in Figure 2. The quantities (shown in the diagram) and the relevant prices are determined by a single price coupling algorithm for all of Europe. The shipping agent (see inset below) takes the place of the interconnector units and settles the imports and exports in the different markets. Also, added at this stage is the Virtual Hub in GB to coordinate the coupling of both power exchanges. This virtual hub is similar to the National Balancing Point in GB for gas trading.

The Shipping Agent

It is expected that a shipping agent will also be required in this process to ensure correct financial settlement of trades across different markets. Currently, interconnector units are shipping agents for individual trades between the SEM and GB. In the day-ahead and intraday timeframes, all trades will be coordinated via local Market Operators and therefore there is a need for a single shipping agent between markets to settle imports and exports to and from each market.

An export will be seen as a purchase of electricity from the SEM and will be settled by the Market Operator as a payment to a generator and a charge on the Shipping Agent. The

Shipping Agent will equally be paid by the importing Market Operator in another market where the consumer of the electricity is charged.

An import will be seen as a purchase of electricity by the SEM and will be settled by the Market Operator as a payment to a generator and a charge on the Shipping Agent. The Shipping Agent will equally be paid by the importing Market Operator in another market where the consumer of the electricity is charged. It is common for TSO's or PX's to fulfil this role.

A variation on this pathway would be to couple on EA2 and retain EA1 in its existing design, allowing Participants to submit complex commercial and technical data into the SEM. This will allow Participants with firm interconnector capacity two opportunities to trade: either in the bilateral market or by competing in the EA1 market run. This EA1 would need to be a mandatory submission for all generators while non-participatory for suppliers as it will not be providing firm quantities to Participants other than those with interconnector capacity holdings. As with the existing design, a schedule will be created around a load forecast from the System Operators.

This would impact on the gate closure timing of the bilateral market as it would now have to be earlier than the existing gate closure for EA1. No other outputs of the EA1 MSP run would be considered firm.

The added value of retaining this gate must be measured considering -

- Ability for interconnector units to trade in the Bilateral arrangements;
- Practicality of retention of elements of the SEM design;
- Costs/Benefits of retaining this mandatory arrangement solely to provide an additional trading opportunity for interconnector capacity holders;

11.1.2.3 *Intraday Timeframe*

Once past the day-ahead timeframe, intraday trading opens. Again, this will be through submission of simple/sophisticated bids to the Market Operator. Feasible orders will be collected and submitted to the Shared Order Book function where, in conjunction with the Capacity Management Module, purchases and sales will be matched[19]. It is assumed that the Shipping Agent responsible for the cross border elements of trade will be a Participant in the SEM and will be included at this point. See inset on Shipping Agent.

Because this design lacks a Forward Pool, the addition of within day auctions does not complement the design strongly. The Bilateral design pushes the responsibility on the

[19] Further detail on the intraday arrangements is provided in Appendix 12.3

trading Participants to ensure their needs are accurately represented in the initial contracted positions to avoid being exposed to balancing prices. The additional opportunities for trade in the coupled market and in the Shared Order Book appear to be adequate for this design.

11.1.2.4 *Balancing Timeframe*

Contracted quantities would be considered market firm. In other words, all purchases by suppliers will be met by their own ex-post demand. The physical delivery of quantities is provided by the System Operator who will dispatch the system in real-time, taking note of the contracted quantities of generators but also of their own obligations with respect to managing the system.

As such, the inclusion of an Imperfections mechanism in the ex-post settlement will compensate generators when they are dispatched away from their contracted positions. To ensure quality information is available for the System Operators in terms of formulating a good economic dispatch of the system, generators will be required to submit complex commercial offer sets into the balancing market. These should include both incremental and decremental prices.

The Gate Closure for the balancing market could align with the Gate Closure for the Bilateral trading arrangements. This will ensure that enough financial data is available to the System Operator with enough notification that they can determine a feasible operations schedule, taking account of the firm contract positions as well as deviations in terms of actual system load and wind generation. However, it may be possible that gates for balancing offers can be closer to real-time allowing for multiple sets of balancing offers.

After their use by the System Operators for real time dispatch, these offers will be used in the determination of the prices in the balancing market. Generators unable to meet their contracted positions due to other circumstances, such as a station trip, will be charged in the balancing market on the difference between their market positions and their actual delivery. The balancing price will be determined via a real-time market where the actual dispatch quantities are used to set balancing prices.

Final settlement in the SEM will be based on the results of the day-ahead, intraday and balancing markets. Bilateral trade arrangements will be settled between the counter parties to the trade. Depending on the volume of trade settled in the bilateral market, this could see a marked reduction in the collateral requirements of the SEM.

11.1.3 How it ties in with the Options in Appendix A

Option	Forward	Day-Ahead	Intraday	Balancing
Capacity Allocation &	Nomination of capacity	Implicit bidding	Implicit bid	N/A

Pricing	through Bilateral trade		matching	
Energy Scheduling & Pricing	Bilateral Trades	Determined by market coupler	Determined by SOBF	Price based on balancing COD, schedule as dispatch
Offer Structure	Contract based	Feasible, simple/sophisticated	Feasible, simple/sophisticated	Complex COD, BCOP applied
Gate Closure	09:00 (D-1)	11:00	Up to one hour	09:00 (D-1)
Trading Day	06:00 for 24 h	23:00 for 24 h	Min 1 hr	06:00 for 24 h

11.1.4 Open questions

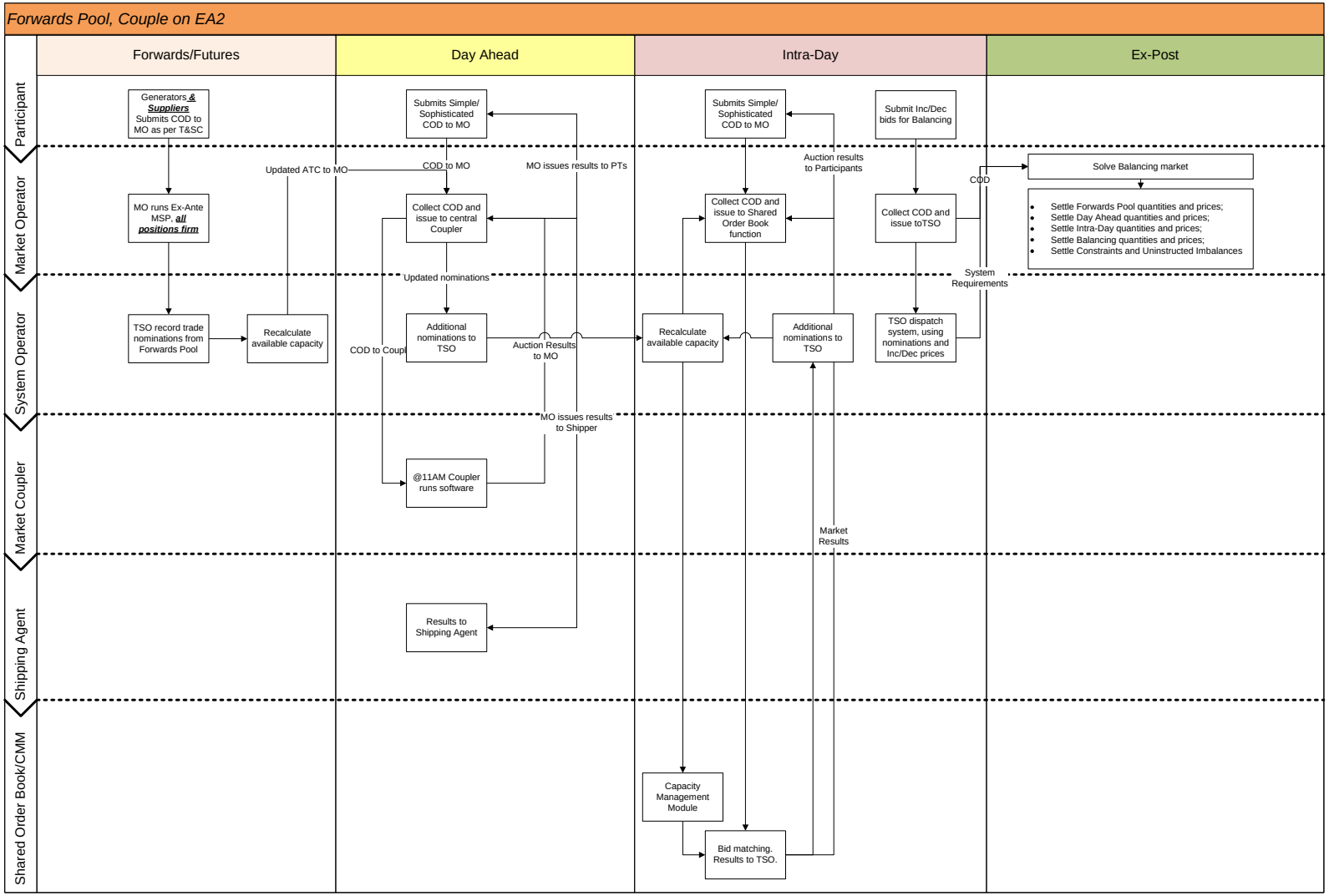
A significant issue in terms of final settlement across all the market timeframes is the different trading periods. It is as yet not clear how Constraints can be calculated where this is the difference between market positions and the dispatch position when the dispatch position is calculated on a half-hourly trading period, as is the balancing market while the day-ahead and intraday markets are resolved on an hourly basis. It will be necessary to at some point convert either the hourly values into half-hourly averages or aggregate the half-hourly values into hourly values. While the second option may seem easier at first look, it represents a more significant change from the current SEM trading arrangements for all marketplaces to settle at an hourly resolution rather than retaining the half-hour for internal trades. We must also take account of the issues that are being observed in Europe with respect to frequency issues around the transition from one hour to the next and the consideration that these may be the result of the firm trades at one hour resolution. This may lead to European standards changing to a shorter trading period and, in this light, it would be unwise to look at increasing the SEM trading period at this time.

SEM High Level Design	
Transparency	Low in the forward timeframe; Medium in the day-ahead and intraday timeframe (due to simplification of bids); Medium in the balancing. Decisions taken by the System Operator in real time will be published
Risk Management	Participants seeking long-term contracts will need a liquid spot market for reference prices. This will take time to evolve; the extent that bilateral trades are limited in the forward timeframe to prevent a wholesale move to bilateral trading would be required.
Price formation and liquidity	The bilateral component of this pathway would need to be limited to avoid a wholesale move to a bilateral market. If this occurs the bulk of the trade would move through the day-ahead timeframe. This price would be important as a reference price for financial risk management contracts.
Dispatch efficiency	Market forces should drive an efficient dispatch in that lower cost generators should be contracted before more expensive ones; however, because there is no transparency of pricing in the bilateral market and there is distinct possibility that much of the trade could move to this timeframe, the ability of this design to produce a least cost dispatch is debatable. The degree of competition is important here;

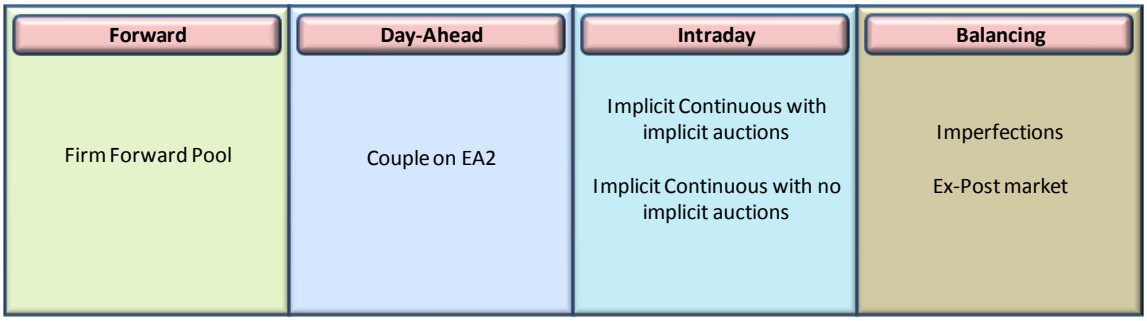
New entrants	While new entrants will have access to four marketplaces in which to trade, if most trade moves to the bilateral timeframe this will mean that new entrants will need long term contracts established before joining the market. Otherwise they will potentially be exposed to the Ex-Post market prices or dependent on being successfully able to trade on the day-ahead and intraday markets with counter-parties outside of the SEM. As such, this could be seen as a barrier to entry.
Renewables	Renewable generators in a Bilateral market are likely to be contracted by suppliers at prices that may be below the market average. This is because with no fuel costs they are reliant on market prices set by other generators but also because as their output is unpredictable, long term fixed contracts will be attractive in this market design rather than trading on the day-ahead or intraday markets. While the proximity to real time may provide the benefit of better forecasts, there is increased risk on generators with regards to the firmness of any volumes allocated in these markets.
Participant Impact	The introduction of bilateral trade arrangements could have impact on Participants. This is in terms of risk management as well as system development. With this model, Participants will not only have to develop interfaces for submitting nominations to the Market Operator but will also have to develop decentralised trading platforms to track their trades as well as manage their own settlement. However, as Participants currently manage out of market contracts through other mechanisms it is possible that the impact may not be significant.

Competitiveness	It is not considered that a bilateral trade model will demonstrate any benefits in terms of competition. The model will allow larger integrated utilities to move a large amount of their trade out of the transparent markets and into arrangements that are not clearly subject to scrutiny. While there is no reason to assume this will have negative impact on retail consumer competition, the possibility is there. Also, the impact on new entrants can limit the number of players in a market of this kind.

11.2 **Pathway 2: Forward Pool, Couple on EA2**



11.2.1 Introduction



This pathway is made up of a Forward Pool market in the forward timeframe with market coupling on EA2. This option can work with within day auctions without cross border capacity. It can work with either of the proposed balancing market designs but the pool model would make it more suitable to the ex-post balancing market with a pool price.

11.2.2 High Level Description of the Pathway

The design of the forward market will be a pool market which is referred to as the 'forward pool'. This will be a voluntary market (generators will remain available to the System Operators in all instances unless on outage regardless of which market they choose to participate in). Participants will submit complex commercial and technical offer sets for their generation (including interconnector units and demand side units) in the same manner as under the current T&SC. Participants will also be able to submit purchase bids in respect of their suppliers. In terms of suppliers, they can also act as Price Takers and submit nominations which would be in respect of their own demand forecasts. Submissions need to be made to the Market Operator in advance of a defined gate closure. This would be expected to be in line with the current EA1 gate timings; however, to align with the earlier timelines for market coupling on EA2, changing these gates to an earlier timeframe should be reviewed.

11.2.2.1 *Forward Timeframe*

The Forward Pool will have the following features -

- The Forward Pool will resolve a schedule based on the marginal pricing principal using submitted data from suppliers to determine the schedule demand.
- Quantities and prices that result from the EA1 run of the MSP software are firm for all generators and suppliers.
- The design of the market schedule will be consistent with the current design – marginal pricing based on economic merit order with no modelling of system constraints.
- Generators will be scheduled to meet a forecast system load.
- Instead of basing this on the TSO forecast as per the current design, the forecast system load will be determined from Supplier Unit nominations or Supplier side bidding.

In order to purchase energy in this timeframe, suppliers are required to participate in the Forward Pool. This can take the form of submission of Commercial Bid Data or Price Taker type nominations of their load profile. Commercial Bid Data for suppliers will be of the form of a simple purchase bid, made up of a single set of Price/Quantity pairs. While participation is voluntary, if suppliers don't actively participate – as in, they provide inefficient or incorrect forecasts of their consumption – then they will be exposed to prices in subsequent timeframes.

This may also result in inefficient flows on the interconnectors. This would happen as the interconnector would be scheduled into export based on nominated renewable generation forecasts. Even without these, once interconnector export bids have been submitted, in merit generation will be scheduled on to meet exports at a given shadow price. With supplier participation, the Forward Pool market will clear when nominated and bid-in supplier load is matched against the generation curve.

On completion of the EA1 run, the Market Operator will publish out $\boldsymbol{MSQ_{EA1}}$ for all generators, $\boldsymbol{MIUN_{EA1}}$ for interconnector units, $\boldsymbol{ND_{EA1}}$ for all suppliers (where $\boldsymbol{ND_{EA1}}$ is based on supplier forecasts which we will call $\boldsymbol{SL_{EA1}}$ or supplier load) and a $\boldsymbol{SMP_{EA1}}$ (based on the Shadow Price calculation).

The publication of firm forward prices should encourage more active demand side participation in the day-ahead and intraday markets as demand customers seek to amend their load profile to avail of better prices from the earlier markets rather than be exposed to balancing prices, which may be less beneficial. This results in generators and suppliers having firm market positions in advance of the first run of the European markets.

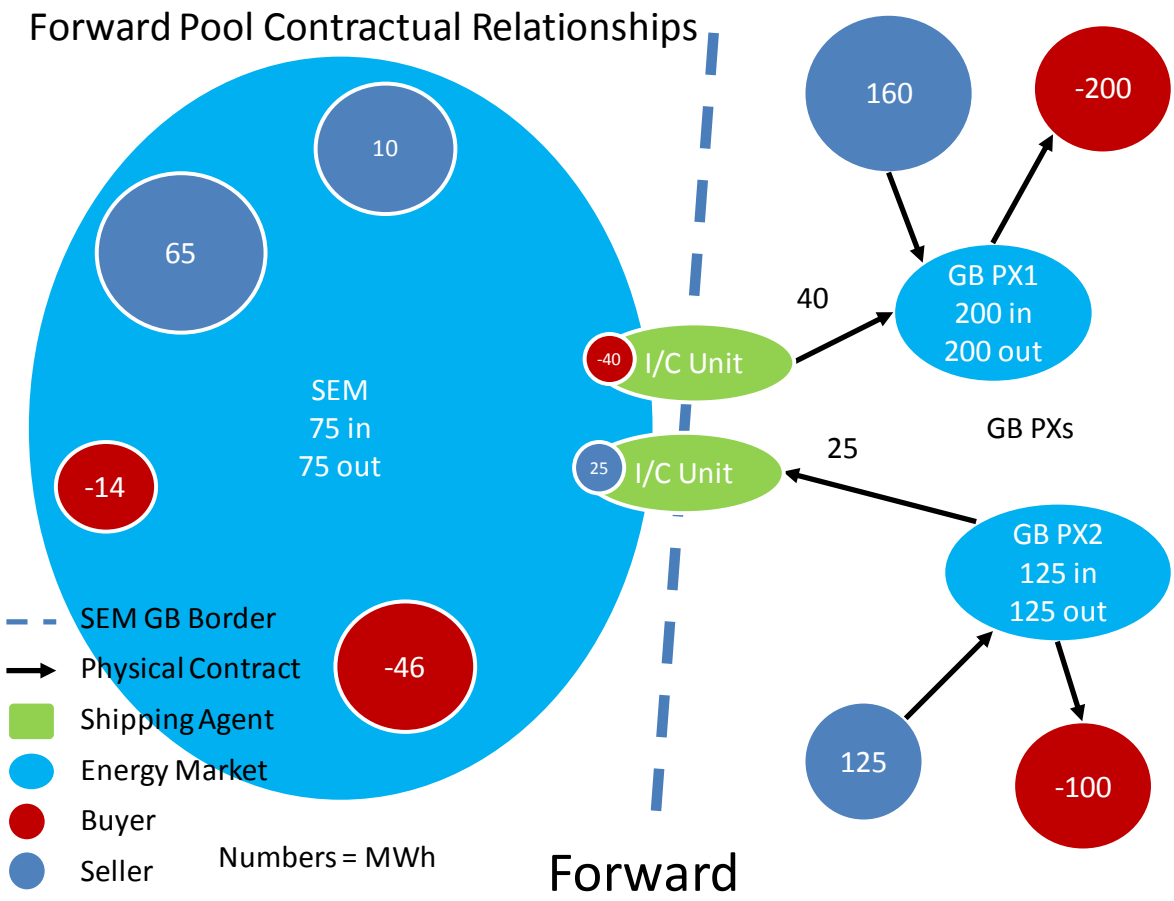


Figure 3 – Contractual relationships for cross border trades in MWh via the forward pool.

The contractual relationships for the forward pool are illustrated in Figure 3. In contrast to the relationships shown in the bilateral forward contractual arrangements, trades in the forward pool would be governed by the rules of the Trading and Settlement Code in similar manner to current trades in the SEM. This also differs from the central counterparty model of a power exchange whereby the exchange is counterparty to all physical trades via exchange traded contracts. Whereas the interconnector unit would be a participant of the pool, the interconnector unit would have a contract with the power exchange (or other party) in GB. In the SEM, all offers and bids are pooled including offers from interconnector units that have purchased capacity on the interconnector. The quantities traded in the forward pool are settled at the relevant prices in the SEM and via the interconnector units for cross-border quantities. Once again, Figure 3 is not intended to provide a definitive picture of cross border trades via the forward pool but more to illustrate the role of interconnector units in cross border trades from the forward pool.

11.2.2.2 *Day-ahead Timeframe*

Because EA1 is used as the Forward Pool, this option couples on EA2. Simple and sophisticated orders will be submitted to the Market Operator in advance of gate closure.

Bids that are feasible[20] will be transferred to the central market coupler for inclusion. The results will be issued back to the Market Operator. Results will then be published from the Market Operator to the System Operators and all Participants who have competed. The interactions with the market coupler and the Shipping Agent will be the same here as with the previous Pathways.

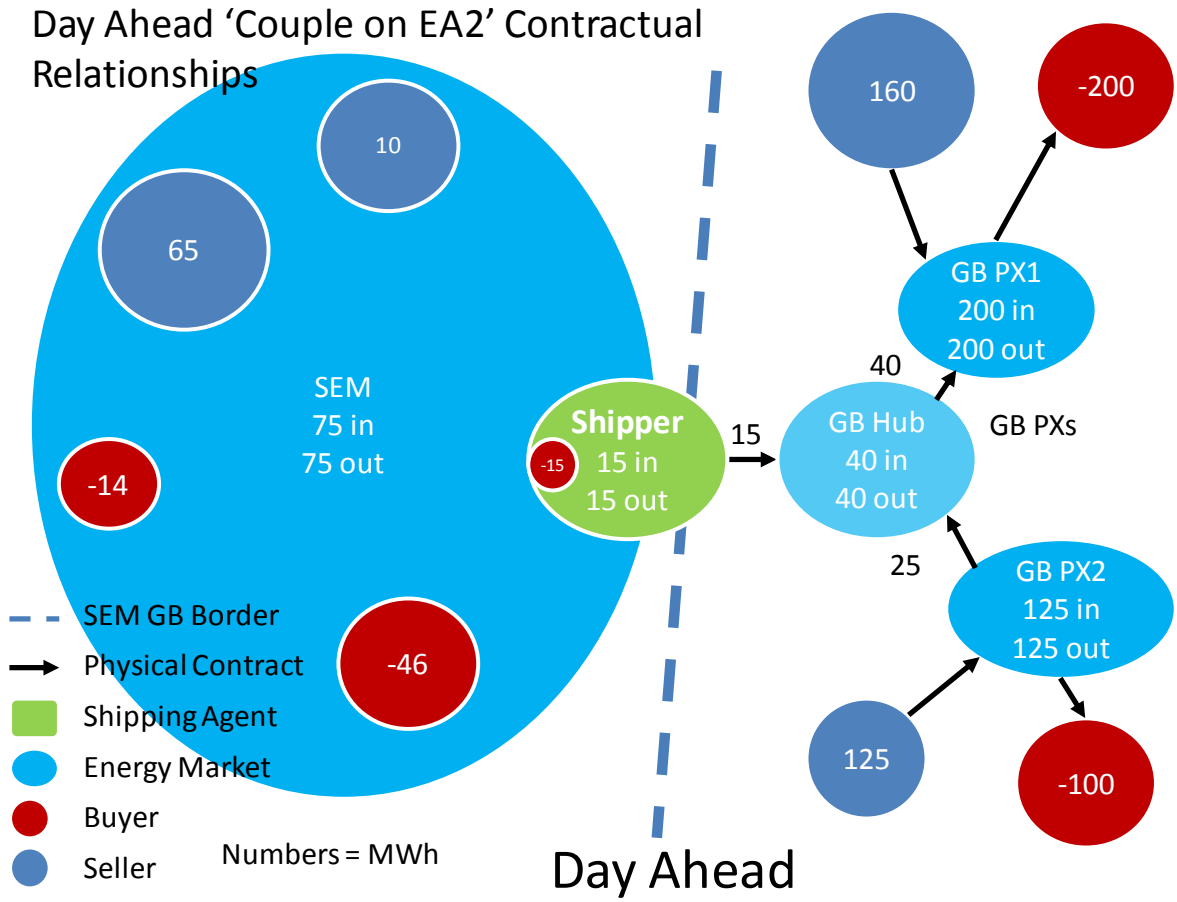


Figure 4 - Contractual relationships for cross border trades in MWh via the European single price coupled auction

The relationships between various parties at the day-ahead stage are illustrated in Figure 4. The quantities (shown in the diagram) and the relevant prices are determined by a single price coupling algorithm for all of Europe. The shipping agent takes the place of the interconnector units and settles the imports and exports in the different markets. Also, added at this stage is the Virtual Hub in GB to coordinate the coupling of both power exchanges. This virtual hub is similar to the National Balancing Point in GB for gas trading.

It is understood that suppliers can bid in as both additional demand, looking to make incremental purchases or as "generation" looking to sell some of their purchases from the earlier markets.

[20] Further information on the nature of feasible bids is covered in Appendix 12.2.3

11.2.2.3 *Intraday Timeframe*

Once past the day-ahead timeframe, trading opportunities are open via the intraday bidding. Again, this will be through submission of simple/sophisticated bids to the Market Operator. Feasible bids will be collected and submitted to the Shared Order Book function where, in conjunction with the Capacity Management Module, purchases and sales will be matched. It is expected that a Shipping Agent (Figure 5) will be required in this process also to ensure correct financial settlement of trades across different markets as discussed in Pathway 1.

Because this design allows for a voluntary Forward Pool, this can potentially work more easily with intraday auctions than the bilateral model. These intraday auctions could take the form of an incremental net pool providing an opportunity to suppliers and generators to refine their positions between the Forward Pool and day-ahead markets and the balancing market without interfacing with the central coupler or the Shared Order Book functions on a European level. This provides levels of stability with respect to the design for participants in that –

- they can refine their trade in a pool mechanism, retaining some of the core SEM design approaches;
- trading days in the intraday auctions can still align with the existing SEM trading day;
- Participants will not be required to convert their complex bids into simple/sophisticated orders;
- retains existing design elements of the SEM;

However, it must be noted that once the day-ahead coupling is complete the Capacity Management Module coordinates available cross border energy flows in conjunction with the Shared Order Book Function. As a result, this means that there is no cross border capacity available to these intraday auctions.

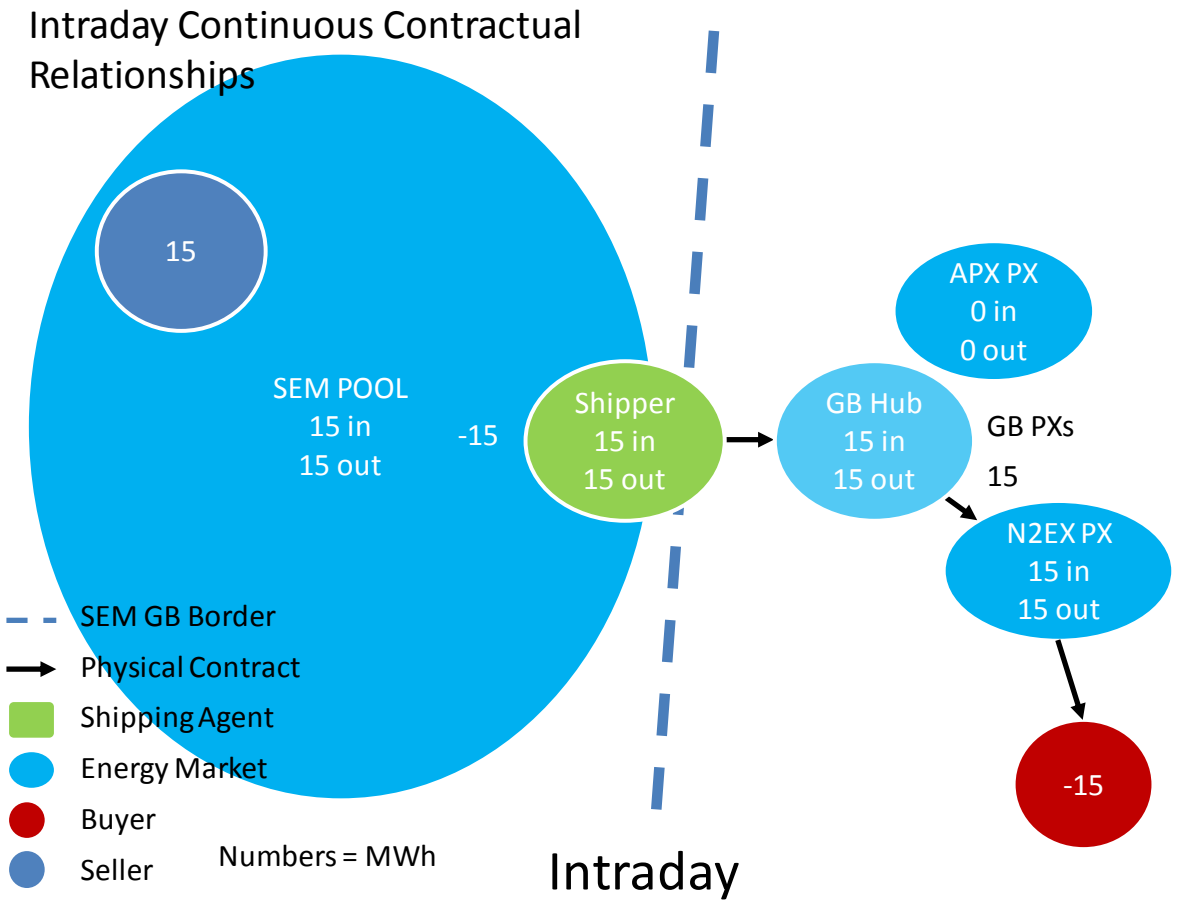


Figure 5 - Contractual relationships for cross border trades via the European continuous trading arrangements

11.2.2.4 *Balancing Timeframe*

As with the other options, a set of commercial and technical offer data is required by a specified gate closure for the balancing market (to be determined). The TSOs will make use of these additional incremental and decremental prices to balance the power system in real time.

As with the previous pathway, Generators unable to meet their contracted positions due to other circumstances, such as a station trip, will be charged in the balancing market on the difference between their market positions and their actual delivery. The method by which this can be achieved is the same as in the pathway for the bilateral option.

Because this design option retains a number of elements of the pool approach, this offers the option to use ex-post pricing to determine the balancing price. This would be calculated with perfect hindsight rather than based on the Real Time dispatch costs.

Ex-Post balancing Market

This can be achieved by retaining the existing ex-post MSP run with some alterations –

MSP Demand calculation –

- The first pass of the MSP Demand calculation sets the demand to be met equal to contracted demand from all the pre-real time markets;
- Residual MSP Demand is then calculated based on delivered quantities calculated according to the rules set out in the current design;

Treatment of Price Maker generators –

- Price Makers with Contracted Quantities from the earlier markets will have their Availability values set to their summed Contracted Quantities;
- This will mean the ex-post MSQ will at least equal their Contracted Quantities while allowing these generators to be scheduled to a higher output if available and in merit;
- Equally, generators who have tripped or re-declared availability at short notice will have an ex-post MSQ of zero or their lower delivered output. Each scenario will mean that this generator is exposed to the balancing prices for their imbalance quantities.
- Generators who are available will have their output increased/decreased based on their position in the merit order subject to the incremental and decremental bids as well as the load balance requirement in any given trading period.
- This will be separate from settlement of Constraints and Uninstructed imbalances.

All markets will be settled ex-post as part of the SEM. This will mean that collateral requirements will continue to be on the gross quantities of the combined markets that make up the SEM.

11.2.3 How it ties in with the Options in Appendix A

Option	Forward	day-ahead	intraday	Ex-Post
Capacity Allocation & Pricing	Bid into EA1	Implicit bidding	Implicit bid matching	N/A
Energy Scheduling & Pricing	Optimisation using marginal	Determined by market coupler	Determined by SOBF	Price based on balancing COD, optimisation of remaining

	principal			generation
Offer Structure	Complex COD, BCOP applied	Feasible, simple/sophisticated	Feasible, simple/sophisticated	Complex COD, BCOP applied
Gate Closure	09:00 (D-1)	11:00	Up to one hour	09:00 (D-1)
Trading Day	06:00 for 24 h	23:00 for 24 h	Min 1 hr	06:00 for 24 h

11.2.4 Open questions

SEM High Level Design	
Transparency	The Forward Pool mechanism will provide greater transparency of pricing in the SEM over the Bilateral option but again, the practicality of this is dependant on the volume of trade that passes through this market; Limited in day-ahead (due to simplification of bids); Low in intraday; Visibility of inputs to ex-post pricing; however, transparency really depends on the volume of trade in this timeframe;
Risk Management	As this is closer to the centralised model, participants are open to greater risk due to volatility of market price; however, as with current arrangements, a CfD market will allow participants to hedge positions against these price issues.
Price formation and liquidity	SEM price formation exists in the forward and ex-post timeframes but liquidity depends on participation.
Dispatch efficiency	Basing the Forward Pool on complex commercial and technical data should

	provide greater efficiency in dispatch with generators being brought on in the forward and Ex-Post markets according to their position in the merit order. As with any design option, the offer structures for the day-ahead and intraday markets carry a risk of increasing inefficiency in dispatch; however, the ability of the dispatch to reflect the simplified trades within the short timeframes allowed in intraday may mean dispatch will have to occur based on complex bids into the balancing market. This should be reflected in an economically efficient dispatch but will likely result in divergence from the market contracted quantities.
New entrants	Access to pool markets such as the forward design will increase opportunities for new entrants to join the market without the need of pre-existing contracts with buyers/sellers. As such, this would minimise potential barriers to new entrants.
Renewables	The pool option means that market prices are fully available to renewable generators and they can access these without being limited in Bilateral contracts. This design affords four trading opportunities for generators which are open to renewable and non-renewable generators alike. Therefore, a renewable generator can opt to trade in the Forward pool through submission of a nomination and be scheduled at that price. Any variance between forecasts and actual delivery must be settled in the balancing market. Alternatively, a generator without capability of forecasting efficiently can simply allow their entire output be settled in the balancing market at the balancing price. Support scheme payments should ensure sufficient compensation where the balancing

	price has been detrimental.
Participant Impact	The introduction of new arrangements will impact on participants trading arrangements but by retaining key aspects of the current design such as form of offers, Trading Day duration, this will allow for reusability of a number of existing interfaces. This is also true in respect of the retention of ex-post settlement by a centralised Market Operator, meaning participants can retain key systems and interfaces around invoice management and funds transfer.
Competitiveness	Retaining as much of the gross pool design should support increased competition as it does not create barriers for new entrants. In this pathway, the ability for participants to trade openly and transparently in three timeframes will mean better overall liquidity over the other pathways. An issue with this option could arise around the determination of a reference price for the contract market.

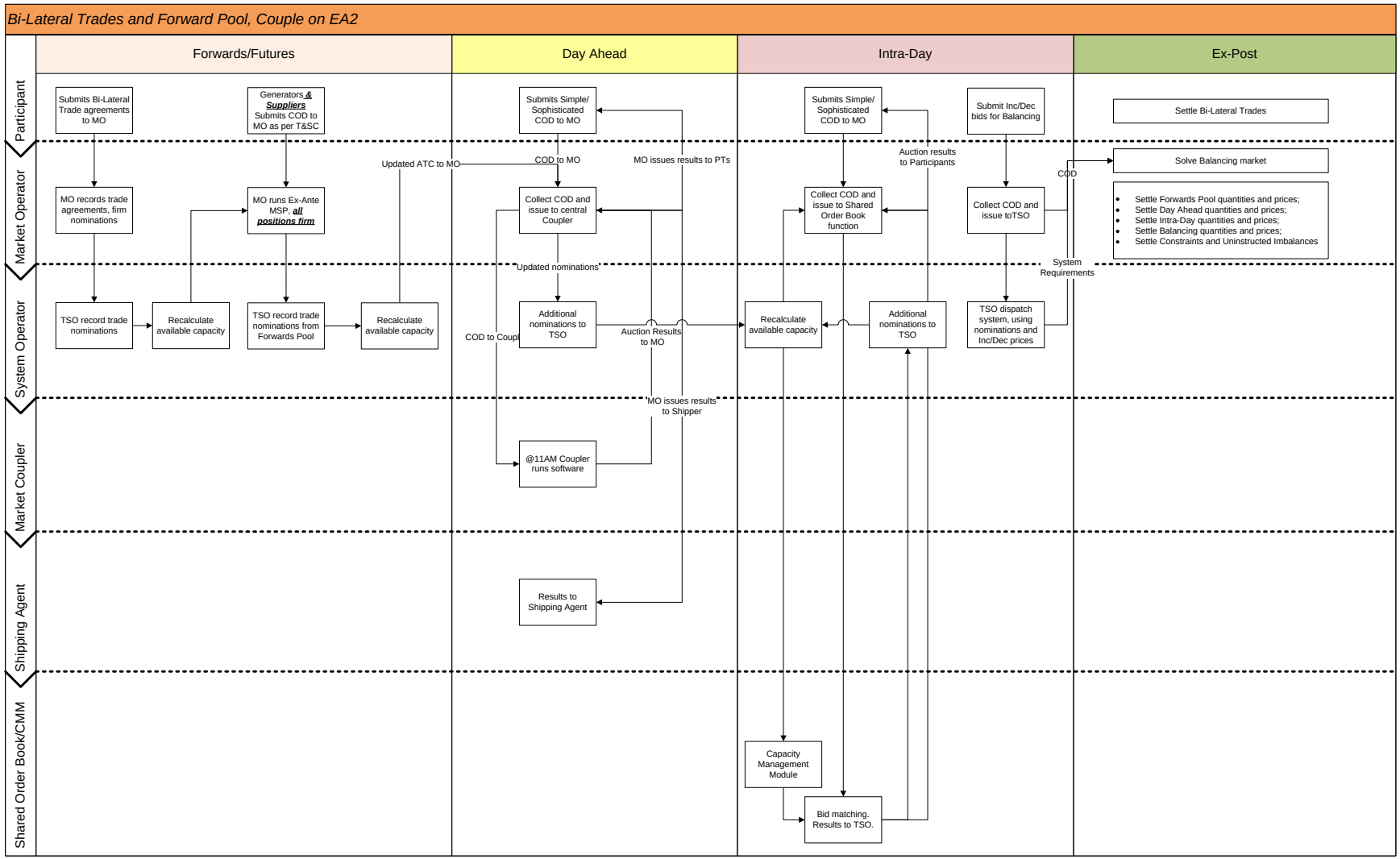
A consideration here is that this may lead to increased divergence between the market schedule and dispatch. We would consider that for TSOs to meet obligations with respect to security of supply, it would not be prudent to base dispatch decisions on the forecasts from suppliers. We would consider that the current practices of producing indicative schedules from RCUC based on TSO forecasts should continue.

However, once both the dispatch and market are scheduled on the principal of least cost production, it would be very likely that the final Ex-Post schedule in the market will follow the same pattern of unit commitment as the dispatch schedule. Therefore, divergence between the two may be no worse than in the current design.

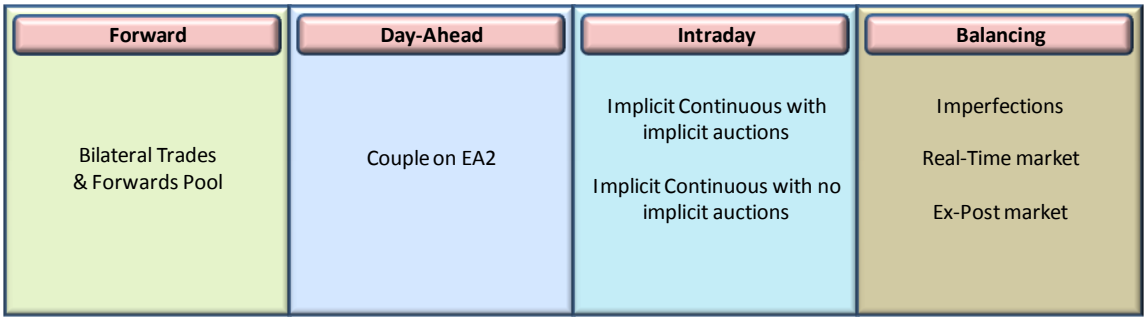
The EA1 only determines a Shadow Price with no calculation of Uplift at this time

As Uplift is required to ensure that all generators running recover their entire running costs, it is not appropriate to calculate Uplift until a full picture is available of all generators who are in fact running (meaning, generators that may not be committed in the EA1 MSP run but may come on in a later timeframe).

11.3 Pathway 3: Bilateral & Forward Pool, Couple on EA2



11.3.1 Introduction



This pathway is made up of a bilateral trade market in the forward timeframe, along with a forward pool with market coupling on EA2. This option can work with or without within day auctions and either of the proposed balancing market designs.

11.3.2 High Level Description of the Pathway

11.3.2.1 *Forward Timeframe*

This pathway combines elements of the first two options to provide Participants with two opportunities to trade in advance of the day-ahead coupled market.

This is achieved by first having a set of bilateral trading arrangements suitably in advance of the day-ahead market. The Gate Closure for submission of bilateral contract volumes would need to be at D-2 to allow sufficient time for the calculation of a Forward Pool and coupling on EA2.

In this pathway, Participants can submit complex commercial and technical offer data into the Forward Pool even while entering into bilateral agreements. When the Gate Closure for the bilateral market is complete, submitted firm contracted quantities will be imported into the Forward Pool. In resolving the Forward Pool, the market will exclude offered quantities from generators where these have already been met by bilateral contracts. In this way, if a generator is available for 200MW and has a firm bilateral contract of 100MW then the Forward Pool will only consider its commercial offers for the range of 100MW to 200MW. This is to ensure that least cost principals are observed. The Forward Pool makes the assumption that if an amount of energy from a submitted bid stack is already contracted that it will be the cheapest quantities that were contracted first.

Supplier values will be treated differently. Whereas the market will have visibility of the total availability of a generator from its technical data, it will have no visibility of the proposed off take of a supplier. Therefore, it will be assumed that when a Supplier submits commercial offer data and/or nominations into the Forward Pool that this is in addition to any firm contracted quantities from the bilateral market.

The Gate Closure for the Forward Pool will be at D-1 in advance of the day-ahead market at 11:00. As with pathway 2, the initial view is that this can be aligned with the current EA1 timings; however, because the day-ahead market is 30 minutes earlier than the current EA2, it should be investigated if different timelines can be accommodated.

11.3.2.2 *Day-Ahead Timeframe*

Once the Forward Pool is completed and results published, submissions to the day-ahead market can be reviewed in terms of feasibility with quantities already contracted being excluded from the day-ahead.

As with the other pathways, simple and sophisticated orders are collected by the Market Operator and, if feasible, passed to the central market coupler. Firm quantities and prices are returned and published to Participants, including the Shipping Agent, and the System Operators.

Complex commercial offer data will be received for the Ex-Post market and will be used by the System Operators to adjust the dispatch from the firm quantities resolved in the different marketplaces.

11.3.2.3 *Intraday timeframe*

After the completion of the day-ahead market, Participants can submit purchase and sell orders into the intraday market. These are again assessed for feasibility in the same manner as in the other pathways. The ability to integrate within day auctions into this option is dependent on the liquidity in the earlier pool. If more trade moves to the bilateral phase, then there is little benefit to additional within-day auctions. As such, they are not considered appropriate with this pathway.

11.3.2.4 *Balancing Timeframe*

In the balancing timeframe, incremental and decremental quantities will be calculated as already set out in the other pathways.

Final settlement in the SEM will be based on the results of the day-ahead, intraday and balancing markets. Bilateral trade arrangements will be settled between the counter parties to the trade.

Depending on the volume of trade settled in the Bilateral market, this could see a marked reduction in the collateral requirements of the SEM.

Because this pathway is made of up market options in the forward timeframe that seem incompatible at first review, this design will probably need more tweaking in terms of the Ex-Post market and the ability to make use of the existing within-day auctions.

11.3.3 How it ties in with the Options in Appendix A

Option	Forward	day-ahead	intraday	Ex-Post
Capacity Allocation & Pricing	Nomination of capacity through Bilateral trade Bid into EA1	Implicit bidding	Implicit bid matching	N/A
Energy Scheduling & Pricing	Bilateral Trades; Optimisation using marginal principal	Determined by market coupler	Determined by SOBF	Price based on balancing COD, schedule as dispatch
Offer Structure	Contract based Complex COD, BCOP applied	Feasible, simple/sophisticated	Feasible, simple/sophisticated	Complex COD, BCOP applied
Gate Closure	09:00 (D-1)	11:00	Up to one hour	09:00 (D-1)
Trading Day	06:00 for 24 h	23:00 for 24 h	Min 1 hr	06:00 for 24 h

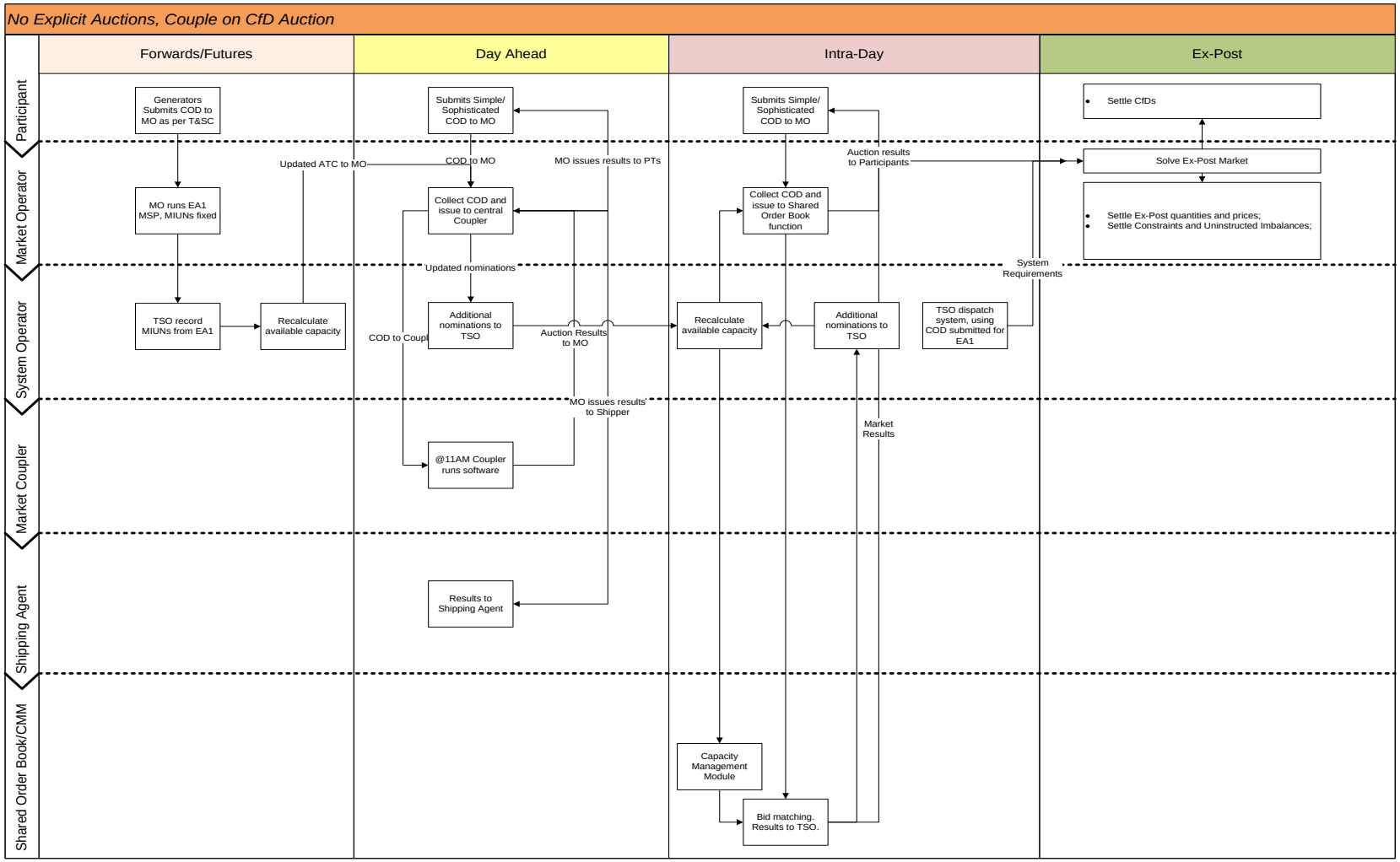
11.3.4 Open questions

SEM High Level Design	
Transparency	While transparency of pricing is low in the Bilateral part of this design, the Forward Pool mechanism will provide greater transparency of pricing in the SEM. Again, the practicality of this is dependant on the volume of trade that passes through this market; Limited in day-ahead (due to simplification of

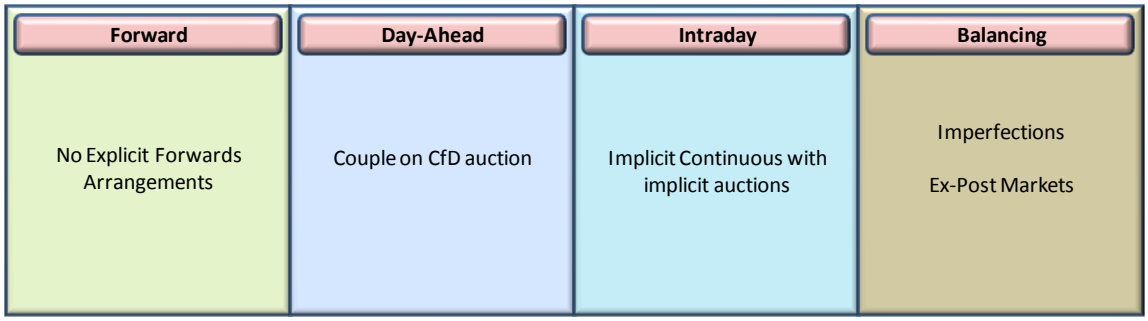
	bids); Low in intraday; Visibility of inputs to ex-post pricing; however, transparency really depends on the volume of trade in this timeframe;
Risk Management	The inclusion of both options in the forward timeframe gives greater opportunity to participants to manage the risk of price volatility in the Ex-Post market. A CfD market will still be needed to allow participants to hedge positions against these price issues if the Forward Pool is selected as the trading platform.
Price formation and liquidity	SEM price formation exists in the Forward and ex-post timeframes but liquidity depends on participation.
Dispatch efficiency	Basing the Forward Pool on complex commercial and technical data should provide greater efficiency in dispatch with generators being brought on in the Forward and Ex-Post markets according to their position in the merit order. As with any design option, the offer structures for the day-ahead and intraday markets carry a risk of increasing inefficiency in dispatch; however, the ability of the dispatch to reflect the simplified trades within the short timeframes allowed in intraday may mean dispatch will have to occur based on complex bids into the balancing market. This should be reflected in an economically efficient dispatch but will likely result in divergence from the market contracted quantities.
New entrants	Access to pool markets such as the Forward design will increase opportunities for new

	entrants to join the market without the need of pre-existing contracts with buyers/sellers. As such, this would minimise potential barriers to new entrants.
Renewables	The pool option means that market prices are fully available to renewable generators and they can access these without being limited in Bilateral contracts. This design affords four trading opportunities for generators which are open to renewable and non-renewable generators alike. Therefore, a renewable generator can opt to trade in the Forward pool through submission of a nomination and be scheduled at that price. Any variance between forecasts and actual delivery must be settled in the balancing market. Alternatively, a generator without capability of forecasting efficiently can simply allow their entire output be settled in the balancing market at the balancing price. Support scheme payments should ensure sufficient compensation where the balancing price has been detrimental.
Participant Impact	The introduction of bilateral trade arrangements could have significant impact on Participants as discussed with reference to Pathway 1. The addition of an extra pool option could mean for participant impact this pathway will be the highest.
Competitiveness	The impact on competition in this model is largely dependent on where the liquidity moves to. If more trade moves to the bilateral arrangements, then this pathway may not see benefits in terms of competition.

11.4 Pathway 4: No Explicit Forward, Couple on CfD auction



11.4.1 Introduction



This option uses an arrangement similar to the current Contracts for Difference trading to interface with the pan European systems. The intention here is retain SEM arrangements and overlay a financial cross border coupling arrangement at the day-ahead and intraday stages.

11.4.2 High Level Description of the Pathway

If we consider the requirement for firm day-ahead prices and quantities from the coupling algorithm, we need some mechanism to handle imbalances i.e. deviations from the forecasts used at the day-ahead stage. This could be achieved in the SEM via some of the previous options if ex-post pricing is retained and differences between the forecast quantities of the day-ahead and the quantities of the ex-post run are settled at the price from the ex-post run, as follows:

where CQ_{DA} is the day-ahead Coupled Firm Quantity, CP_{DA} is day-ahead Coupled Firm Price, MSQ_{EP} is the current ex-post Firm Quantity and SMP_{EP} is the current ex-post Firm Price.

If we rearrange, grouping the CQ_{DA} products we get:

The first part of this is a compensation payment and the second part is the current energy payment based on ex-post MSQs and SMPs. Therefore, putting in place an arrangement that can deliver the first part of the above equation would achieve the equivalent to a firm physical day-ahead price with imbalance settlement on the ex-post price. If we examine the first product in the above equation, we can see that it is similar to CfD financial product currently used to manage SMP risk in the SEM. A further requirement would be to fix the quantity of the cross border trade in the SEM to ensure that both prices and cross border quantities are firm.

11.4.2.1 *Forward Timeframe*

This option adds no explicit forward arrangements except for the current ones that exist in the SEM (trading for capacity across the interconnectors). As is currently the case in the SEM, Generators would submit offers into EA1. This would remain an indicative schedule with the exception that interconnector trades would be fixed at this stage.

11.4.2.2 *Day-ahead Timeframe*

Generator Units and Supplier Units would submit orders before 11:00 for the coupled auction. These would be sent to and matched by the central coupler. This coupler would determine CQ_{DA} and CP_{DA} for all the Generator Units and Supplier Units that submitted orders. These would represent the prices and quantities of a set of physical contracts. As can be seen below, this would take the form of traded CfD contracts through some form of Multilateral Trading Facility. The CfDs would have the ex-post SMP as the reference price.

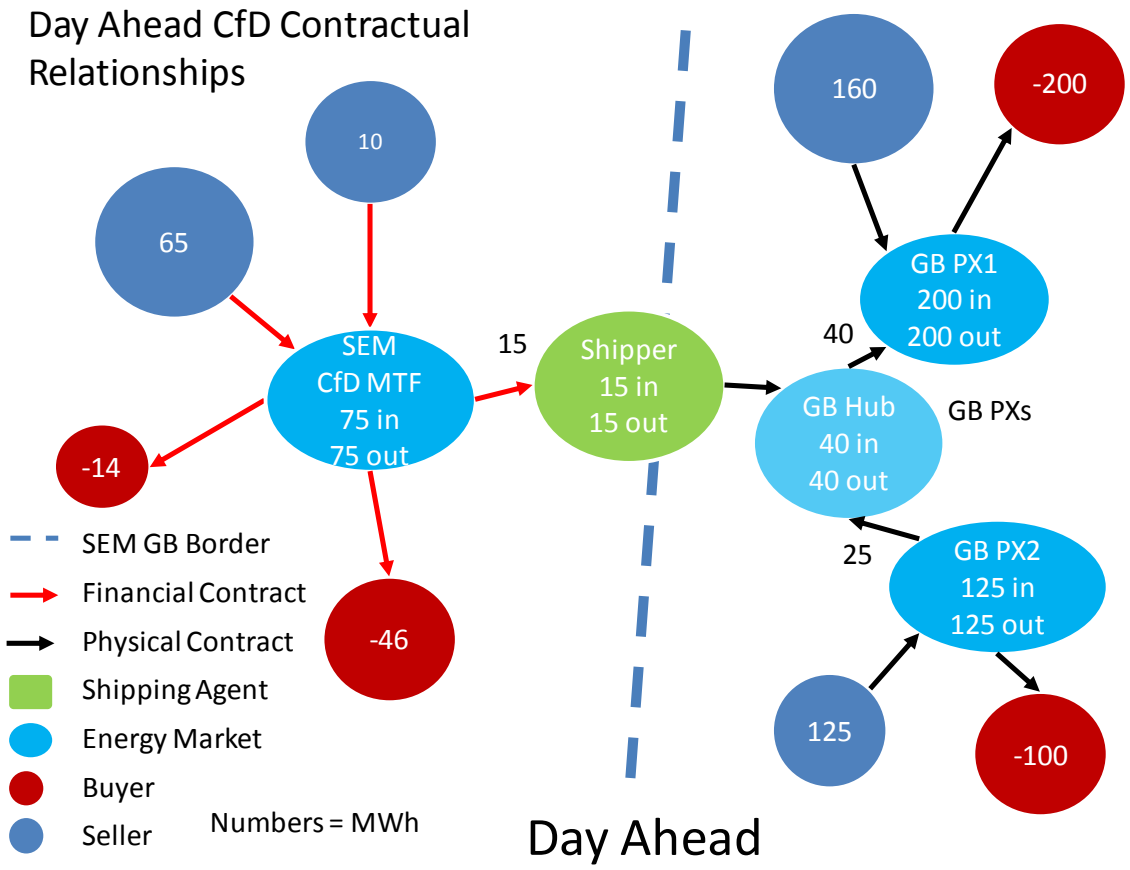


Figure 6 - Contractual relationships for cross border trades via the coupled CfD auction

The parties to these contracts would be on one side the Generator Unit or Supplier Unit that submitted an order and on the other, the central counter party. In addition

where cross border trade is involved, the Shipping Agent would take the place of the Generator or Supplier Unit party to the contract (Figure 6).

As the quantities and prices are being determined via an auction it would difficult to match bids and offers bilaterally and some form of central party would be required. A key consideration here is whether these arrangements would take the form of:

1. The current arrangements in SEM (see other options where EA1 or EA2 is made firm)
2. An exchange traded contracts model with central counterparty in the SEM (i.e. in the T&SC)
3. An exchange traded contracts model with central counterparty outside the SEM (i.e. via another set of rules and contracts).

11.4.2.3 *Intraday Timeframe*

In the intraday timeframe, continuous trading would occur via the same central counterparty. Orders would be submitted by Generators and Suppliers on a continuous basis and these would be submitted by the central counterparty to the pan-European Shared Order Book Function. This would continuously match offers and bids and matched trades would be sent back to the central counterparties in each zone to settle accordingly. These prices and quantities would be the strike prices of CfDs in a similar manner to those traded at the day-ahead stage.

The parties to these contracts would be on one side the Generator Unit or Supplier Unit that submitted an order and on the other, the central counter party. In addition where cross border trade is involved, the Shipping Agent would take the place of the Generator or Supplier Unit party to the contract (Figure 7).

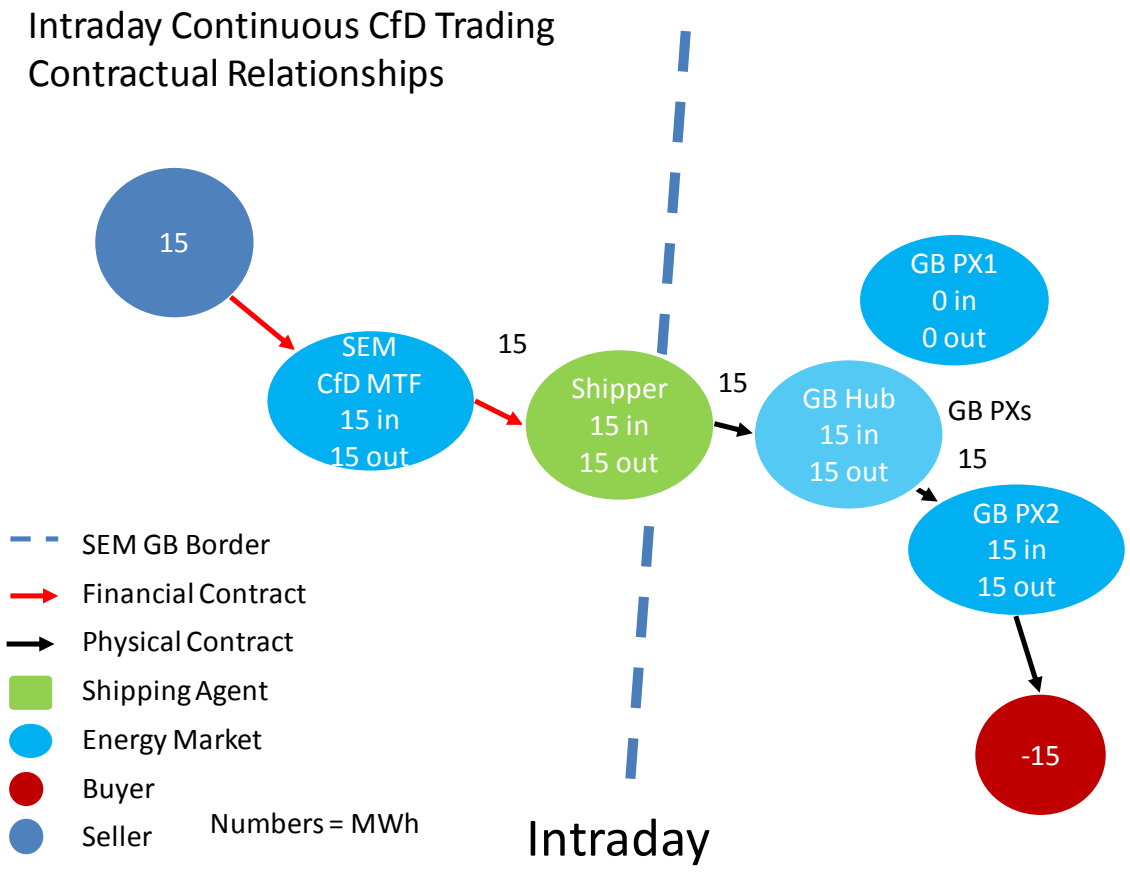


Figure 7 - Contractual relationships for cross border trades via price coupled CfD auction.

11.4.2.4 *Balancing Timeframe*

In the balancing timeframe, ex-post pricing would take place as it currently does in the SEM and the CfDs would be settled as they currently are outside of the SEM.

11.4.3 How it ties in with the Options in Appendix A

Option	Forward	day-ahead	intraday	Ex-Post
Capacity Allocation & Pricing	Explicit Auctions	Implicit allocation via Single Price Coupling Algorithm.	Implicit allocation of remaining capacity in CMM via continuous energy trades	N/A
Energy Scheduling	XB flows =	CfD quantities and prices determined	Matched trades from SOBF and	EP2 as

& Pricing	MIUNs	by Single Price Coupling Algorithm. Current ID Auctions redundant. MIUNs=XB CfD Quantities	CMM. Current ID Auctions redundant. MIUNs=XB CfD Quantities	current. CfDs settled against SMP.
Offer Structure	Complex COD, BCOP applied	Feasible, simple/sophisticated	Feasible, simple/sophisticated	Complex COD, BCOP applied
Gate Closure	09:00 (D-1)	11:00	Up to one hour	09:00 (D-1)
Trading Day	06:00 for 24 h	23:00 for 24 h	Min 1 hr	06:00 for 24 h

11.4.4 Open questions

SEM High Level Design	
Transparency	Medium. Retains mandatory nature of gross pool; Depends on how much information from CfD process is visible to other Market Participants.
Risk Management	Medium. Availability of day-ahead and intraday CfDs will enhance the ability of participants to manage price risk associated with ex-post pricing. On the other hand, participants will be exposed to volume risk to the extent that their ex-post quantity is different to their CfD quantity. The liquidity of the day-ahead and intraday CfD markets is important here.
Price formation and liquidity	Low. As all physical trading will be concentrated in EP2, the price would be reflective of the marginal cost of producing energy on the day *with perfect*

	hindsight. It is likely however that the CfD price may be considerably different than the SMP for the following reason. Any generator that has variable or unreliable output will not want to play in the CfD markets. This is because they cannot guarantee their output to back their financial contracts. In addition, the large and increasing amount of priority dispatch is guaranteed (insofar as is possible) their quantity in EP2 as prices takers. So they will not be likely to trade in the earlier stages as it is of no value to them (except if they were going to be curtailed). As such the day-ahead schedule may look very different than the ex-post schedule. So long as the ex-post schedule exists, priority dispatch units will not be inclined to take volume risk ex-ante. It may be possible to force them into the schedules by socialising their volume risk through constraints.
Dispatch efficiency	Low. Interconnector flows may not be reflective of actual prices as the wind and other priority dispatch generators will only want to play in EP2. All technical and most commercial offer data will be available to the SOs by 9:00am to enable them to carry out operational scheduling; however, MIUNs will be governed by incomplete market information. These will need to be updated based MIUNs arising from the day-ahead and intraday CfD quantities.
New entrants	High. Pool mechanism is attractive to new entrants. Transparency of CfD trading will be important here.

SEM High Level Design	
Renewables	Good. As priority dispatch will guarantee the available renewables their full quantity in the ex-post schedule, they would not be subject volume risk and their price risk is likely to be mitigated by long term contracts such as ReFIT or through ROCs.
Participant Impact	While this option sees minimal change to the SEM central market systems, it may entail significant change for participants. The development of trading across a CfD platform will require the development of a new trading platform with which Participants will have to interface. The management of this trading will be beyond the SEM and may therefore result in a second Market Operator to manage. Participants will be required to develop secondary invoicing and settlement systems to manage their cash flows both in the SEM and outside of the SEM. This option also requires that the Trading Day in the SEM aligns with the European Trading Day, running from 23:00 for 24 hours, which is not required in the other pathways.
Competitiveness	In terms of competition, this option should not adversely affect the market seeing as most of the original aspects of the SEM are retained. However, access to the actual market price for energy may be limited only to those participants trading across borders. As such, consumers in the Irish market will have limited access to the true price of wholesale cross border energy across Europe.

12 The Pathway Components described

This section sets out the gaps between the SEM design and the Target Model under a number of specific detailed headings.

12.1 Forward

12.1.1 Capacity Allocation and Pricing

Market Model	Feature	Source
Target Model	1. Explicit Auctions of Financial Transmission Rights (FTR) or Physical Transmission Rights (PTR) with Use-It-Or-Sell-It (UIOSI). 2. a. TSOs provide a single platform (single point of contact) for the allocation of long-term transmission rights (PTR and FTR) at European level. b. As a transitional arrangement, regional platforms may operate, as long as this does not hamper the improvement and harmonisation of allocation rules. The CACM Network Code(s) shall also foresee greater harmonisation of the nomination rules, deadlines and processes. 3. PTR are subject to the UIOSI requirement at the time of nomination (or equivalent market allocation process), which means, as a default, the resale of non-nominated capacity rights. 4. TSOs shall give the total financial resale value of capacity (in the case of an explicit auction this is equal to the clearing price of the auction in which the capacity is resold; in the case of an implicit auction this is equal to the day-ahead price differential between the two zones) back to the	FG CACM

	market participants who owned the PTR.	
SEM	1. Explicit auctions of Physical Transmission Rights (PTR) with Use-It-Or-Sell-It (UIOSI) unless Long Term Nomination (LTN) submitted. LTN not firm. Only prevents UIOSI from applying to Interconnector Capacity Entitlements (ICE) from Long Term Auctions in the Daily Capacity Auction. IUs Active Capacity Holdings=LTN+ICE from Daily Capacity Auctions. This ACH is used in EA1. 2. a. No Regional FUI Platform. b. AMP Platform shared with Moyle. Same vendor as IFA and BritNed? 3. PTRs are subject to UIOSI at the time of nomination (currently prior to the Daily Capacity Auction); however, nomination is not firm. It only allows the IU to offer this capacity into EA1.	EWIC Access Rules v1.0, Moyle Access Rules v3.0
Gap	1. No gap. 2. a. No single EU platform as yet. b. No regional platform though same vendor? 3. Nominations need to be made firm as current rules allow participants to hoard capacity from Daily Auction.	

12.1.1.1 *Option: Establish a European Auction Platform*

Market Model	Feature	Difficulty
Target Model	TSOs provide a single platform (single point of contact) for the allocation of long-term transmission rights (PTR and FTR) at European level.	
SEM	TSOs provide a single platform (single point of	Hard

	contact) for the allocation of long-term transmission rights (PTR and FTR) at European level.	

12.1.1.2 *Option: Establish a FUI Auction Platform*

Market Model	Feature	Difficulty
Target Model	As a transitional arrangement, regional platforms may operate, as long as this does not hamper the improvement and harmonisation of allocation rules. The CACM Network Code(s) shall also foresee greater harmonisation of the nomination rules, deadlines and processes.	
SEM	TSOs provide a single platform (single point of contact) for the allocation of long-term transmission rights (PTR and FTR) at FUI level.	Medium

12.1.2 Energy Scheduling & Pricing

The design of the Energy Scheduling & Pricing rules is essential to a successful design. While the CACM does not provide for any explicit scheduling and pricing in the forward timeframe, the value of firm capacity rights is only truly realised where some options for forward trading on energy is considered.

Market Model	Feature	Source
Target Model	Not explicitly stated but forward transmission rights imply some form of forward	FG CACM

	energy trading.	
SEM	No physical forward trading	High Level Design
Gap	FTRs and PTRs are only useful if there is a means of trading energy physically in advance of the day-ahead. Most European zones allow bilateral trading in advance of DA; however, the SEM does not. Therefore, some kind of physical trading mechanism is required in SEM in advance of day-ahead.	

12.1.2.1 *Option: Use EA1 as Forward Auction and EA2 as DA Coupled Auction*

Market Model	Feature	Difficulty
Target Model	FTRs or PTRs with UIOSI (and some mechanism to physically trade energy before DA stage).	
SEM	PTR with UIOSI (use EA1 to trade energy forward using PTRs, auctioned energy quantities firm (automatic nomination), otherwise UIOSI for EA2, day-ahead)	Medium

12.1.2.2 *Option: Allow bilateral forward trading of energy and EA2 as DA Coupled Auction*

Market Model	Feature	Difficulty
Target Model	FTRs or PTRs with UIOSI (and some mechanism to physically trade energy before DA stage).	

SEM	PTR with UIOSI (bilateral physical energy trades outside the pool nominated at DA, nominations firm, otherwise UIOSI for DA (EA1))	Hard

12.1.2.3 *Option: Allow bilateral forward trading of energy, use EA1 as Forward Auction and EA2 as DA Coupled Auction*

Market Model	Feature	Difficulty
Target Model	FTRs or PTRs with UIOSI (and some mechanism to physically trade energy before DA stage).	
SEM	PTR with UIOSI (bilateral physical energy trades outside the pool nominated before DA, nominations firm, use EA1 to trade energy forward using PTRs, auctioned energy quantities firm (automatic nomination), otherwise UIOSI for DA [EA2 – coupled market])	Hard

12.1.3 Offer Structure

Market Model	Feature	Source
Target Model	Not specified.	?
SEM	Complex commercial offer data sets, made up of price/quantity pairs with start up costs and technical data.	SEM High Level Design
Gap	None	

12.1.3.1 *Option: If using EA1 as forward auction/allocation, retain current SEM Offer Structure in EA1*

Market Model	Feature	Difficulty
Target Model	Not specified.	
SEM	Commercial and Technical Offer Data as set out in	Easy

As the Forward Pool is in essence a firm version of the existing EA1, the commercial and technical offer submissions do not need to align with the form of offer for the coupled and intraday markets. Retaining the existing format will retain much of the original market design.

12.1.4 Gate Closure

Market Model	Feature	Source
Target Model	Not specified	?
SEM	EA1 09:30 (TD-20.5) EA2 11:30 (TD-18.5) WD1 08:00 (TD+2) WDn 20:00 (TD+14)?	IDT High Level Design
Gap	None	

Gate Closures for the different arrangements will need to be considered. Because the day-ahead has a Gate Closure is at 11:00, thirty minutes earlier than the current EA2 design, this will mean earlier gates will also need to be adjusted.

- The Forward Pool auction can have Gate Closure at 09:00;
- The Bilateral contract market can have Gate Closure at 09:00;
- For the combined option, the bilateral contract market will have Gate Closure at 23:00 with the Forward Pool auction at 09:00.

12.1.5 Trading Day

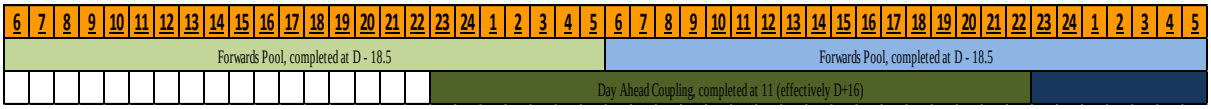
Market Model	Feature	Source
Target Model	Not specified	?
SEM	06:00 – 06:00	IDT High Level Design
Gap	None	

12.1.5.1 *Option: If using EA1 as forward auction/allocation, retain current SEM Trading Day in EA1*

This option considers the Target Model Trading Day as set out in the day-ahead timeframe being applicable to the Forward timeframe also.

Market Model	Feature	Difficulty
Target Model	23:00 – 23:00	
SEM	06:00 – 06:00	Easy

Retaining the existing 06:00 for 24 hours design will not cause any issue here as there will be an overlap between the design of the Forward and the day-ahead that will see that all Trading Periods are covered as shown below.



12.1.5.2 *Option: If using EA1 as forward auction/allocation, change to EU Trading Day in EA1*

Market Model	Feature	Difficulty
Target Model	23:00 – 23:00	
SEM	23:00 – 23:00	Medium

While this may see some alignment with the day-ahead timeframe, the misalignment with the gas markets may have a more material impact on participants. This may also reduce efficiency in the SEM as fuel prices may have to be locked down at an earlier time to meet this.

Moving to the day-ahead trading day will also limit the ability of the Forward Pool in terms of scheduling. This will mean that with gate closure of 09:00 the Forward Pool will be determining firm schedules for a day that is less than 14 hours away

12.1.6 Settlement

Settlement of the Forward arrangements will take place in the Ex-Post timeframe. Current SEM design of initial settlement at D+5 can persist for the Forward Pool arrangements. This will see financial settlement based on the firm quantities calculated, paid and charged at the single System Marginal Price.

Using this approach raises the issue of the Uplift calculation in the SEM. True cost of running across the pools can only be determined in the Ex-Post timeframe and it would therefore not be appropriate to include Uplift in the System Marginal Price calculation for the Forward Pool. If Uplift is calculated particular to the Forward Pool, it will mean that suppliers who contract significant portions of their demand in this timeframe will carry the full cost of starts for generators who are committed on. These generators will be serving load also in the Ex-Post timeframe and therefore, if their starts are being passed to the participants in the Forward Pool only, suppliers in the Ex-Post timeframe will benefit from reduced prices. This is not consistent with the intended design which should incentivise suppliers to contract more energy in the Forward Pool over the Ex-Post mechanisms.

12.1.7 Credit Risk

The addition of a Forward Pool option will not adversely increase the Credit Risk requirements or rules of the SEM. In fact, as more values are set in advance of the

Trading Day, it will reduce uncertainty in the collateral forecasts. In terms of total volumes, as all volumes will still be financially settled in the SEM, there will no be no significant change in the volumes being considered.

A move to a bilateral contracts market would see more significant change; however, the existing rules would still be fit for purpose in this space as the calculations would focus on the risk that exists within the market settlement. Participants would see a reduction in their collateral requirements depending on how much trade moves to the contract market. With respect to the credit risk on the contracts themselves, these are outside of the SEM and a matter for the counter-parties to the contracts to resolve.

12.2 Day-ahead Timeframe

In the day-ahead timeframe, the SEM will be coupled to other European markets on the basis of implicit auctions via a single price coupling algorithm which will simultaneously determine prices and quantities across all coupled markets.

The price coupling algorithm for the day-ahead market is currently being developed through the Price Coupling of Regions (PCR) initiative. This group has six core members and is working under Europex (the Association of European Energy Exchanges). The algorithm is being designed around the principal of maximisation of social welfare across all coupled markets. Currently, the process supports simple and sophisticated bidding but not the full range of complex commercial and technical offer data used in the SEM.

It is envisaged that market coupling of the SEM will be done through the implementation of a solution which collects simple and sophisticated commercial orders from Participants. Each order will be based upon hourly trading. Orders will be validated by the Market Operator on receipt and infeasible orders will not be processed. This means that Participants cannot offer trade which they are not able to physically deliver.

An alternative to the feasibility check on Participant submissions is to allow all orders, including those known to be physically infeasible, to be passed to the coupler. In this approach, the Participant is now potentially exposed to balancing prices if they are unable to find matching physical power in the intraday market. This will increase risk on Participants, though an appropriately structured balancing price calculation should ensure that a Participant would only take the approach of offering physical trades on which they can't deliver in the day-ahead market, when they are sure of being able to unwind this position or of their ability to purchase replacement power in the intraday market.

The responsibility for calculating the simple commercial orders will rest with Participants alone. In this model, we do not consider it appropriate that Participants continue to submit complex commercial offer data with a central agency carrying the risk of converting the bids into a PCR compatible format. In this type of approach, errors by this central agency could result in generators/suppliers being out of merit commercially as a result. Compensation mechanisms would need to ensure that the central agency is suitably insured or is able to socialise the costs of these potential errors.

Accepted submissions will be processed to the market coupling solution after gate closure at 11:00. The software will be run by the central market coupler and this will determine, on the basis of the merit of purchases and sales of power across all coupled market as well as the available interconnector capacity between these markets, the market quantities for all bidding parties and the price(s). Where no

congestion exists on interconnectors across the coupled markets, this process will determine a single price. In the event of congestion between zones, this will lead to separation of prices and discrete prices for each of the congested zones.

Implicit in the results of the day-ahead auction will be the cross border flows. This will be determined as the difference between generation scheduled and load served. Cross border flows will be allocated to the Shipping Agent. In the post coupling timeframe, the Shipping Agent will be responsible for the nomination of cross border flows, be a counter party to the settlement of exports and imports on relevant exchanges and markets. This means that the Shipping Agent will be a registered participant in the SEM and will take the place of interconnector units in the day-ahead market though it will not have an active bidding role. The Shipping Agent will be settled accordingly and will also be exposed to Credit Risk rules within the SEM.

From within the SEM, the market coupling will produce a single price for each hour in the Trading Day (now based on the standard European trading day starting at midnight CET) with quantities produced deemed as firm. While the System Operator can dispatch the generator away from this physical flow for reasons detailed in the Grid Code, the quantity of power is considered to have been delivered. Only if the participant becomes unavailable and cannot deliver the power regardless of system constraints will they become exposed to balancing prices. In normal cases, it is considered the contracted quantity flowed and the participant's cash flows will be adjusted using constraints to account for instructed deviations.

Prices and quantities from the market coupling run will be transferred to settlements and cash flows will be determined on that basis.

12.2.1 Capacity Allocation and Pricing

Market Model	Feature	Source
Target Model	Daily Implicit Auction via Single Price Coupling algorithm	FG CACM
SEM	Daily Explicit Auction	Access Rules
Gap	Implicit Auction via Single Price Coupling algorithm	

12.2.1.1 *Option: DA replaces EA2*

Market Model	Feature	Difficulty
Target Model	Daily Implicit Auction via Single Price Coupling algorithm	
SEM	Daily Implicit Auction (in place of EA2) via Single Price Coupling algorithm.	Medium

12.2.2 Energy Scheduling and Pricing

Market Model	Feature	Source
Target Model	Daily Explicit Auction via Single Price Coupling algorithm with firm prices and quantities	FG CACM
SEM	Daily Explicit Auction	Access Rules
Gap	Firm Prices and Quantities Single Price Coupling algorithm	

12.2.2.1 *Option: DA replaces EA2*

Market Model	Feature	Difficulty
Target Model	Daily Explicit Auction via Single Price Coupling algorithm	
SEM	Daily Explicit Auction (replaces EA2) via Single Price Coupling algorithm.	Medium

12.2.3 Offer Structure

A key point of the offers for the day-ahead and intraday options is that the bids from generators must be feasible. For example, this means that a generator with a notice time of 12 hours with an initial position of off cannot submit a bid to trade in any of the next eleven trading hours. This will prevent firm quantities being awarded to generators in the day-ahead and intraday timeframes where the generator is clearly unable to meet these trades with the result that the System Operators must find replacement energy with very short notice and with the generator being forced to unwind any infeasible positions or face being in imbalance in the Ex-Post timeframe.

Detailed rules will need to be set out to define explicitly when an offer is considered feasible.

Market Model	Feature	Source
Target Model	Simple Offers and Bids Block Offers and Bids Etc. Not generator unit specific.	? COSMOS Spec
SEM	Complex Offers, No Bids	SEM High Level Design
Gap	Target Model does not yet facilitate complex offers.	

12.2.3.1 *Option: Change SEM Offers*

Market Model	Feature	Difficulty
Target Model	Simple Offers and Bids	

	Block Offers and Bids Etc.	
SEM	Subset of Target Model	Medium

12.2.3.2 *Option: Change Target Model Offers*

Market Model	Feature	Difficulty
Target Model	Complex Offers Simple Offers and Bids Block Offers and Bids Etc.	Hard
SEM	Complex Offers, No Bids	

12.2.3.3 *Option: Align DA CfD Offers*

Market Model	Feature	Difficulty
Target Model	Simple Offers and Bids Block Offers and Bids Etc.	
SEM	Complex Offers, No Bids	
DA CfD Market	Subset of Target Model	Medium

12.2.4 Gate Closure

Market Model	Feature	Source
Target Model	DA 11:00 (TD-12)	?
SEM	EA1 09:30 (TD-20.5) EA2 11:30 (TD-18.5) WD1 08:00 (TD+2) WDn 20:00 (TD+14)?	IDT High Level Design
Gap	EA1 GC is 90mins before DA GC EA2 GC is 30mins after DA GC	

12.2.4.1 *Option: Change SEM GC*

Market Model	Feature	Difficulty
Target Model	DA GC 11:00	
SEM	DA GC 11:00	Medium

12.2.4.2 *Option: Change Target Model GC*

Market Model	Feature	Difficulty
Target Model	EA1 GC 09:30 or EA2 GC 11:30	Very difficult
SEM	EA1 GC 09:30, EA2 GC 11:30	

12.2.4.3 *Option: Align DA CfD market GC*

Market Model	Feature	Difficulty
Target Model	DA GC 11:00	
SEM	EA1 GC 09:30, EA2 GC 11:30	
DA CfD Market	DA GC 11:00	Easy

12.2.5 Trading Day

Market Model	Feature	Source
Target Model	23:00 for 24 hours	CACM/PCR/NWE?
SEM	06:00 for 24 hours	T&SC
Gap	Trading Days do not align.	

12.2.5.1 *Option: If using EA1 as forward auction, retain current SEM Trading Day in EA1*

Market Model	Feature	Difficulty
Target Model	23:00 – 23:00	
SEM	06:00 – 06:00 for EA1 23:00 – 23:00 for EA2?	Easy

12.2.5.2 *Option: If using EA1 as forward auction, change to EU Trading Day in EA1*

Market Model	Feature	Difficulty
Target Model	23:00 – 23:00	
SEM	23:00 – 23:00	Medium

12.2.6 Settlement

There is no additional complexity in the Settlement of the day-ahead.

Settlement of the day-ahead results will take place in the Ex-Post timeframe. Current SEM design of initial settlement at D+5 can persist for the Forward Pool arrangements. This will see financial settlement based on the firm quantities calculated, paid and charged at the single System Marginal Price. This will mean that Energy Payment in the SEM, currently calculated as a single quantity by a single price per Trading Period, will be calculated as a number of individual Energy Payments: firstly in respect of the Forward timeline (where the Forward Pool option is pursued – settlement of Bilateral agreements will be outside of the SEM), then in respect of the day-ahead timeline, then in respect of prices and quantities contracted on the intraday market and finally on the basis of any imbalances in the Ex-Post timeframe.

To facilitate the calculation of imbalance quantities and constraint quantities, the Trading Period across the timelines will need to be harmonised in the Settlement.

12.2.7 Credit Risk

The addition of a day-ahead trading option will not adversely increase the Credit Risk requirements or rules of the SEM.

Collateral values for offered quantities will be included in the undefined portion of the calculation and can still be assessed based on forward prediction. After the completion of the day-ahead run when trades are firm, they will be included in the as traded not settled part of the calculation.

As the markets come closer to real time, some changes will be required to the calculation to ensure accuracy of data. This will involve allocating energy quantities accurately from the undefined portion to the traded not settled portion on a more dynamic timescale than is currently the case.

12.3 Intraday Timeframe

In the intraday timeframe, the SEM will be linked to other European markets on the basis of continuous implicit trading

This will be implemented in the SEM by creating a platform for Participants to submit commercial orders in a format compatible with the European standard. This is assumed to follow the standard of the day-ahead market coupling orders (simple and sophisticated). It is assumed that feasibility checks will also be applied to these orders to ensure that offers of physical flow can be met.

Submissions will be passed through to the Shared Order Book Function managed at a European level. In conjunction with the Capacity Management Module, this function will match all submissions making use of a single pan-European algorithm. This will take the form of matching energy sales orders (generation bids) to energy purchase orders (supplier offers). This matching will be done against trading blocks of a minimum of one hour; however, block bids covering multiple hours will also be considered. When bids are matched in the Shared Order Book function and this results in an allocation of cross border capacity between zones, the Capacity Management Module will recalculate the remaining available cross border capacity for trade.

The outputs of the Shared Order Book function will be a Contracted Quantity for a Participant (either a sale or a purchase) and a Contracted Price at which this trade takes place. Firm quantities will be returned to the local Market Operator and advised to the Participant and System Operator.

The framework guidelines allow for the retention of implicit auctions to run alongside the intraday arrangements where there is sufficient liquidity in these auctions; however, as cross border capacity can only be allocated after the day-ahead timeframe through the Capacity Management Module, it is not clear how implicit auctions will be able to allocate firm capacity flows though the framework guidelines do allow for explicit access to cross border capacity as a transitional step.

It is assumed that additional energy flows assigned in the intraday timeframe will be managed by a Shipping Agent carrying out the same function as in the day-ahead timeframe. It should also be noted that the framework guidelines expect intraday trade and capacity allocation to be coordinated by the System Operators through re-dispatch of the system or through countertrade mechanisms to be defined in the balancing network code.

12.3.1 Capacity Allocation and Pricing

Market Model	Feature	Source
Target Model	…implementation of the	FG CACM

	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). … where there is sufficient liquidity, regional auctions may complement the implicit continuous allocation mechanism. Where implemented, implicit auctions should have adequate bidding deadlines to provide the necessary flexibility to the market and be coordinated with, and linked to, the pan-European Target Model.	
SEM	2 x Implicit Auctions EA2 and WD1.	Access Rules
Gap	No Continuous Implicit. More implicit auctions would be required.	

12.3.1.1 *Option: Continuous Trading with no auctions*

Market Model	Feature	Difficulty
Target Model	Implicit Continuous (Regional Auctions may complement)	
SEM	Implicit Continuous	Hard

This would mean that SEM Market Participants would be able to submit offers on a continuous basis to the Shared Order Book Function. These would be matched accordingly and would be firm.

12.3.2 Energy Scheduling and Pricing

See Capacity Allocation and Pricing.

12.3.3 Offer Structure

A key point of the offers for the day-ahead and intraday options is that the bids from generators must be feasible. For example, this means that a generator with a notice time of 12 hours with an initial position of off cannot submit a bid to trade in the next trading hour. This will prevent firm quantities being awarded to generators in the day-ahead and intraday timeframes where the generator is clearly unable to meet these trades with the result that the System Operators must find replacement energy with very short notice.

Market Model	Feature	Source
Target Model	Simple Offers and Bids Block Offers and Bids Etc. Not generator unit specific.	SOBF?
SEM	Complex Offers, No Bids	SEM High Level Design
Gap	Unlikely that SOBF will facilitate complex offers.	

12.3.3.1 *Option: Change SEM Offers*

Market Model	Feature	Difficulty
Target Model	Simple Offers and Bids Block Offers and Bids Etc.	
SEM	Subset of Target Model	Hard

12.3.3.2 *Option: Change Target Model Offers*

Market Model	Feature	Difficulty
Target Model	Complex Offers Simple Offers and Bids Block Offers and Bids Etc.	Hard
SEM	Complex Offers, No Bids	

12.3.3.3 *Option: Align DA CfD Offers*

Market Model	Feature	Difficulty
Target Model	Simple Offers and Bids Block Offers and Bids Etc.	
SEM	Complex Offers, No Bids	
DA CfD Market	Subset of Target Model	Medium

12.3.4 Gate Closure

12.3.5 Trading Day

Intraday trades will be on a product basis with a minimum trade of one hour. Block bids covering multiple hours can also apply. While there is no explicit Trading Day defined for the intraday timeframe, it is assumed that as the intraday begins after the completion of the day-ahead that it will be bound by the same Trading Day. This will mean that intraday products can only be offered after the publication of the day-ahead results covering hours up to 23:00 the following day. If trades were allowed past this time, then that would mean that intraday trades were open for a Trading Day for which day-ahead market coupling had not yet happened.

12.3.6 Settlement

Intraday traded quantities will be settled in the ex-post timeframe by the Market Operator. Contracted quantities that are matched in the intraday auction will be matched at a contracted price and financial settlement will be carried out on the basis of these values.

12.3.7 Credit Risk

The addition of an intraday trading option will not adversely increase the Credit Risk requirements or rules of the SEM; however, to ensure accuracy of collateral postings, the frequency of operation of the credit risk calculations will need to be addressed.

This can be done by having more frequent re-calculation to include additional intraday trades but completed on a time-bound basis such as hourly. An alternative approach would be to refine the credit monitoring such that any additional intraday trades by a Participant will trigger a re-calculation of the credit risk requirements. This will be a two step process as order submissions will trigger one additional calculation as the offered trades of the Participant will have increased. When an order is matched and confirmed by the Shared Order Book, this will mean that this is now a traded quantity. This will trigger a further re-calculation as the traded but not settled portion of the credit risk requirement will need to be adjusted up, the offered not traded portion will need to be adjusted down and any projected unknown quantities from the undefined exposure period will need to be amended to recognise the firm trades.

This will lead to a much more dynamic recalculation of credit risk requirements for Participants and more frequent publication of credit risk reports; however, if calculations of undefined exposure in the day-ahead timeframe are accurate, there will be minimal impact as these recalculations will just be a refining of the quantities that make up the total credit risk forecast. Considering this and that Participants will only be able to post additional collateral during banking hours (outside of Settlement

Reallocation Agreements), it is not clear that changes to the operation of the current credit risk requirements will deliver any benefit.

12.4 Ex-Post Markets and Settlement

Energy Settlement will be calculated on -

- $CQ_{EA} * CP_{EA}$
- $CQ_{DA} * CP_{DA}$
- $CQ_{ITDn} * CP_{IDTn}$

In the ex-post timeframe, we now have

- ***Sum (CQ)*** across all marketplaces
- ***DQ*** for each Trading Period
- ***MG*** for each Trading Period
- ***Avail*** for each Trading Period

In the run of the ex-post MSP software, calculate residual MSP demand in the same manner as in N.32 while the main values are calculated based on ***CQ*** for Supplier Units in the SEM

For each generator **where *Sum (CQ) > 0,***

If (DQ – AO) > TOLOG or (DQ – AO) < TOLUG

HOL/LOL = Min (Actual Output, Max Avail)

Else HOL = Max Avail

And LOL = Sum (CQ)

Therefore, in the output of the MSP run, the *MSQ* for each generator will be

- ***Sum (CQ)*** where generator is fully available;
- ***Actual Output*** where generator ran lower than Sum(CQ) without being constrained down;
- ***0*** where generator is unavailable.

Therefore, we can determine a balancing quantity or BalQ as

$$BalQ = MSQ_{EP} – Sum\ (CQ)$$

Balancing Settlement then becomes –

If BalQ > 0, BalQ * BalP (therefore, Generator did not deliver in real time, so replacement power required)

Else BalQ * MOP (therefore, Generator required to be brought on in the Ex-Post balancing)

Where ***BalP*** is the Balancing Price (determined by yet undecided mechanism).