

► **Forward hedging under I-SEM**

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Executive summary

Energy markets are inherently volatile and participants need access to a range of risk management tools in order to manage their earnings risk. There are essentially three forms of risk hedging: clean hedging, asset backed hedging and proxy hedging. As well as standard forward contracts, traded over-the-counter or on-line exchanges, which help participants to lock in earnings from the wholesale market, there are a range of bespoke contracts that can provide participants with secure revenue streams outside of the wholesale market. In the Integrated Single Electricity Market (I-SEM) context these include Reliability Options and DS3 ancillary services contracts.

Market participants, ranging from large integrated utilities to small independent players, will adopt a range of different strategies for managing their exposures. With the introduction of I-SEM, the Irish market becomes part of the wider European Internal Energy Market (IEM), and we expect that participants will increasingly look to the more liquid trading hubs to manage their forward exposures. This is a pattern we have observed elsewhere following the introduction of market coupling.

With the greater price convergence associated with market coupling, I-SEM participants are able to hedge their positions in interconnected markets, either 'cleanly' where they are holders of transmission rights on interconnectors, or relying on the high degree of market correlation for proxy hedging. The correlation of monthly average prices between the current Single Electricity Market (SEM) System Marginal Price (SMP) and the GB electricity market (which is almost 100 times deeper in terms of trading volumes than the SEM) is already very strong at 91%, and this is despite flows frequently in the "wrong" direction to price differentials, an effect that will be eliminated with market coupling. Likewise, the highly liquid and strongly correlated GB gas market (monthly average price correlation of 92% to the SMP, with carbon included, and 2000 times deeper than the SEM) allows for proxy hedging, as well as asset-backed hedged for companies with gas-fired generation. These strong correlations are due to gas-fired generation being the most common marginal price setting plant type in both markets.

In this wider definition of the forward market, ESB is not a dominant player, and in fact by European standards it is a small company. The continuation of the vertical ring-fence would seem unusual, and a disproportionate intervention, in this context with several much larger vertically integrated players, including those active in the Irish market, not subject to the same restrictions.

However, whilst forward liquidity in the I-SEM is not a means to an end in itself and the market is unlikely to be that deep under any circumstance, as observed by the Competition and Markets Authority (CMA) in GB, it is important that participants have access to reliable forward price signals and the risk management products they need at a reasonable cost. These are features of a well-functioning forward market and are in the interest of all market participants. In I-SEM this is especially important for independent suppliers and generators, who do not have sophisticated trading capabilities, and are more reliant on clean hedges available directly in the I-SEM. This is unlikely to be as challenging for vertically integrated players.

1 Background

1.1 Introduction

In this paper we explore the geographic definition of the forward market for I-SEM participants. We examine the different forms of forward hedging, and the risk management strategies that different market participants may adopt. We discuss the likely evolution of the market once it becomes coupled with the IEM, and assess the scope for proxy hedging forward I-SEM exposures in more liquid interconnected markets, and correlated fuel markets.

1.2 Types of hedging

Energy markets are inherently volatile and participants need access to a range of risk management tools in order to manage their earnings risk.

There are essentially three different forms of hedging:

- ▶ **Clean hedging.** Clean hedging involves trading in the commodity where the underlying exposure exists, for example trading forward electricity contracts in I-SEM to hedge a supply portfolio in the Irish market.
- ▶ **Asset backed hedging.** Asset backed hedging involves using assets to convert exposure in one commodity into another, for example using a generation asset to hedge an electricity exposure and then hedging the resulting fuel and carbon exposure.
- ▶ **Proxy hedging.** Proxy hedging involves using a hedging instrument in one market which is closely correlated to an exposure in another market. Proxy hedging may be deployed where there is limited liquidity in the market with the underlying exposure. Examples of proxy hedging might include using GB electricity forward contracts to hedge forward I-SEM exposure, or using gas and carbon hedges to manage exposure to electricity prices in markets where gas plant is typically price-setting such as SEM/I-SEM. Since proxy hedges are not perfect, there is a residual 'basis risk'. In some circumstances there may be products available for managing this basis risk, such as Financial or Physical Transmission Rights on interconnectors, although the availability of these is limited by the capacity of interconnection.

Hedges can be either physical or financial. Physical trades result in the delivery of the commodity, which in electricity markets means a nominated physical position which has to be balanced, unless the position is closed before delivery. Financial trades are cash settled against an established reference price and do not result in a physical position, even if not closed out before settlement. The current SEM and proposed I-SEM forward market are financial.

Proxy hedges will typically be closed out prior to delivery, since the participant's underlying physical exposure is in a different market. If the price in the adjacent market has moved similarly to the main market when the hedge is closed (and hence the profit or loss of the proxy hedge has moved in the same way that a clean hedge would have done), the proxy hedge has been effective.

There is a wide range of hedging product types in electricity including:

- ▶ **Baseload.** A fixed price product with equal volume in all periods for a defined tenor e.g. month, season or year. In financial markets, such as the SEM, the baseload contract will typically take the form of a two-way Contract for Difference (CfD) with a fixed strike price.
- ▶ **Offpeak/peak/mid-merit.** A fixed price product with volume applicable only in certain defined time periods.
- ▶ **Options.** A contract that gives the holder the right to buy (call) or sell (put) the commodity at a pre-agreed strike price within a specified time period. There is an upfront fee associated with holding the option. Options can be physical or financial. One-way CfDs are examples of financial option contracts.
- ▶ **Shaping/balancing.** Bespoke contracts that cover the volume exposure between forward hedged position using standard products and underlying physical position.
- ▶ **Capacity contracts.** Contracts or agreements that provide hedges against the capacity value of generation plant (and demand side response), through an organised Capacity Remuneration Mechanism such as the proposed Reliability Options in I-SEM, which is effectively a centralised market in financial call options.
- ▶ **Bespoke contracts.** Contracts tailored to providing specific services such as DS3.
- ▶ **Derivatives in related products.** Financial contracts settled against related indices, such as temperature or wind conditions. For example, weather derivatives can be used to manage volume and price risk.
- ▶ **Insurance products.** Risk management products that cover the financial exposure to certain outcomes, for a premium, without directly offsetting the underlying finance exposure. Some companies may elect to self-insure by provisioning against adverse outcomes. This may be cheaper in some cases than trying to hedge the underlying insurance or buying insurance externally.

There are a number of mechanisms for trading including exchanges, on-line brokers and over-the-counter trading. Typically only the more standard products would be exchange or on-line broker traded, with the more bespoke contracts being negotiated bilaterally.

Credit plays an important role in forwards trading, given the potential exposures for participants if counterparties default on 'in-the-money' hedges. Some exchanges, and on-line brokers, offer clearing services for members with sufficient credit rating. Parties with lower credit ratings need to contract with clearing members in order to access the exchange. For over-the-counter trading credit arrangements are agreed bilaterally between the counterparties. Depending on the participant type, acceptable forms of credit include cash, letters of credit and parental guarantees.

1.3 What is liquidity?

The GB regulator, Ofgem, has defined liquidity in wholesale energy markets as 'the ability to quickly buy or sell a desired commodity or financial instrument without causing a significant change in its price and without incurring significant transaction costs'. This then raises the question of what levels of trading volume constitute a liquid market.

What is clear when assessing different European forward electricity markets, and other energy markets such as gas, is that there is a very wide range of levels of churn, the volume of trade relative

to the underlying physical demand. Such variations are not surprising given the differences in the physical characteristics, degrees of interconnectivity and the different requirements of market participants depending on their size and asset portfolios. Furthermore, liquidity tends to attract further liquidity (including from non-physically backed players) with some locations emerging as trading hubs.

Comparisons of churn in the SEM forward market with other European markets whilst useful, are not necessarily instructive, since SEM/I-SEM will never compete with the more active hubs. Levels of forward liquidity in I-SEM will always be low compared to some other European electricity markets due to its small market size and the high penetration of wind. The SEM has around 36 TWh of demand and less than 7 GW of demand at peak times in 2014. In 2014 there was 2.8 GW of wind capacity on the system which is equivalent to 22 per cent of installed capacity. This capacity has little incentive to sell forward given the renewable support arrangements and variability of output. This creates a structural limit on the volume of asset backed forward contracts generators can offer to the market.

The focus of the CMA when considering the liquidity question is more on product availability rather than churn. In assessing liquidity in the GB electricity market it considered whether the market offers products that parties want to trade, whether these products are available in 'reasonable' quantity, and whether prices are well defined. In other words, in a liquid market for a particular product, parties will have a reasonable expectation that they could buy (or sell) a 'reasonable' quantity without affecting the price.

This definition of liquidity suggests that in the I-SEM the forward market can be deemed to be sufficiently liquid if there is sufficient product availability to meet the hedging requirements of different market participants, given the breadth of options available in the context of an increasingly integrated European market, even if this means trading volumes are relatively small and trading activity infrequent.

1.4 The relationship between vertical integration and liquidity

One of the key concerns regarding vertical integration is that it can reduce liquidity in the market, since vertically integrated players can hedge internally and avoid participating in the forward and prompt markets. However, in reality few players are fully balanced and the net length of different players is only one of the drivers of total liquidity. For example, full separation of generation and supply would generate at a maximum trading volume equivalent to annual demand, and yet trading volumes in the German forward market are currently around 9 times underlying demand.¹ Furthermore, vertically integrated players regardless of their internally hedged position may elect to trade all their physical volumes through the day-ahead market². Certainly vertical integration has not presented a barrier to liquidity in the European day-ahead markets.

Forward liquidity has been one of the foremost concerns in the GB electricity market. This has resulted in Ofgem implementing the Secure and Promote provisions, requiring certain players to

¹ ACER, Report on the influence of existing bidding zones on electricity market, 7 March 2014, p 13.

² For example, SSE trades 100% of its generation and demand position, and EON 50%, through the day-ahead market in GB.

provide liquidity to the market through a market making facility. In its ongoing Energy Market Investigation, the CMA has investigated this issue further and has provisionally concluded that liquidity is not a significant issue. Rather than focusing on churn metrics, it has used the term liquidity to mean good availability of products that market participants wish to trade. The CMA uses figures of 30% of generation and 12% of supply being in the hands of non-vertically integrated firms as evidence that low forward liquidity is not insuperable and does not prevent operation of a competitively sustainable stand-alone generation or supply business. It concludes that vertical integration does not appear to affect liquidity in a way that would prevent an efficient independent supplier or generator from being able to trade basic products that are necessary to participate in upstream or downstream electricity markets.

Furthermore, the CMA concluded that it was unlikely that vertically integrated firms have the ability and incentive to foreclose the market to independent firms, i.e. deliberately withholding liquidity from the market to harm competitors.

1.5 The impact of the European Internal Energy Market

The goal of the European IEM is to drive greater integration between neighbouring markets promoting cross-border trading, security of supply and competition. The IEM is a legally binding set of common technical and commercial rules and obligations that govern access to and use of the European energy networks. In the common electricity wholesale market rules, there are a number of phases to the project starting with day-ahead market coupling, and then continuous intraday trading and ultimately common balancing arrangements.

Market coupling uses so-called implicit auctions in which players do not actually receive allocations of cross-border capacity themselves but just bid for energy on their local market exchange. The exchanges then use the available cross-border transmission capacity to minimise the price difference between two or more areas. In so doing, market coupling maximises the social welfare, avoids any artificial splitting of the markets, and sends the most relevant price signal for investment in cross-border transmission capacities. The efficiency of the mechanism is furthermore revealed by an increasing price convergence between market areas.

Day-ahead market coupling began in 2006 with the Tri-Lateral Market Coupling (TLC) area integrating France, Belgium and the Netherlands. In 2010, Germany was added to create the Central West Europe (CWE), which was volume coupled with NordPool at the same time.

Box 1 Nord Pool

Nord Pool is a common electricity market spanning the Nordic and Baltic countries and is often regarded as a model electricity market. A number of Nord Pool's market design features have been adopted in the IEM, notably implicit a day-ahead auctions and continuous intraday trading. Nord Pool began in the early 1990's and has progressively expanded to include the Norwegian, Swedish, Finnish, Danish, Estonian, Latvian and Lithuanian markets. The Nord Pool market is currently made up of 16 interconnected price zones as well having various points of interconnection with continental markets via direct current subsea cables.

The Nord Pool markets were part of the NWE day-ahead price coupling project that launched on 4 February 2014. The NWE region now operates under a common Multi-Regional Coupling (MRC) solution. Appendix 1 sets out further detail about market coupling in the Nord Pool market.

In 2014, price coupling in North Western Europe (NWE) went live creating a coupled region, stretching from France to Finland and from Great Britain to German/Austria, covering the region of CWE, Great Britain, the Nordics and the Baltics. Since the launch of NWE, two extensions of the Price Coupling of Regions (PCR) coupled area have taken place: in May 2014, Spain and Portugal joined; in February 2015, Italy coupled with France, Austria and Slovenia. As a result, the now-coupled area is called Multi-Regional Coupling (MRC) and covers now 19 countries, standing for about 85% of European power consumption³.

With the launch of I-SEM in 2017, Ireland will be integrated into the NWE region and be part of a market spanning 19 countries. The SEM currently imposes vertical ring-fencing on some but not all vertically integrated players. This appears inconsistent with the future vision of pro-competitive integrated markets under the IEM. We observe that other Member States who are already part of the IEM, namely Italy and Portugal, have comparable market share of the largest incumbent and levels of interconnection but these firms are not subject to such restrictions.⁴

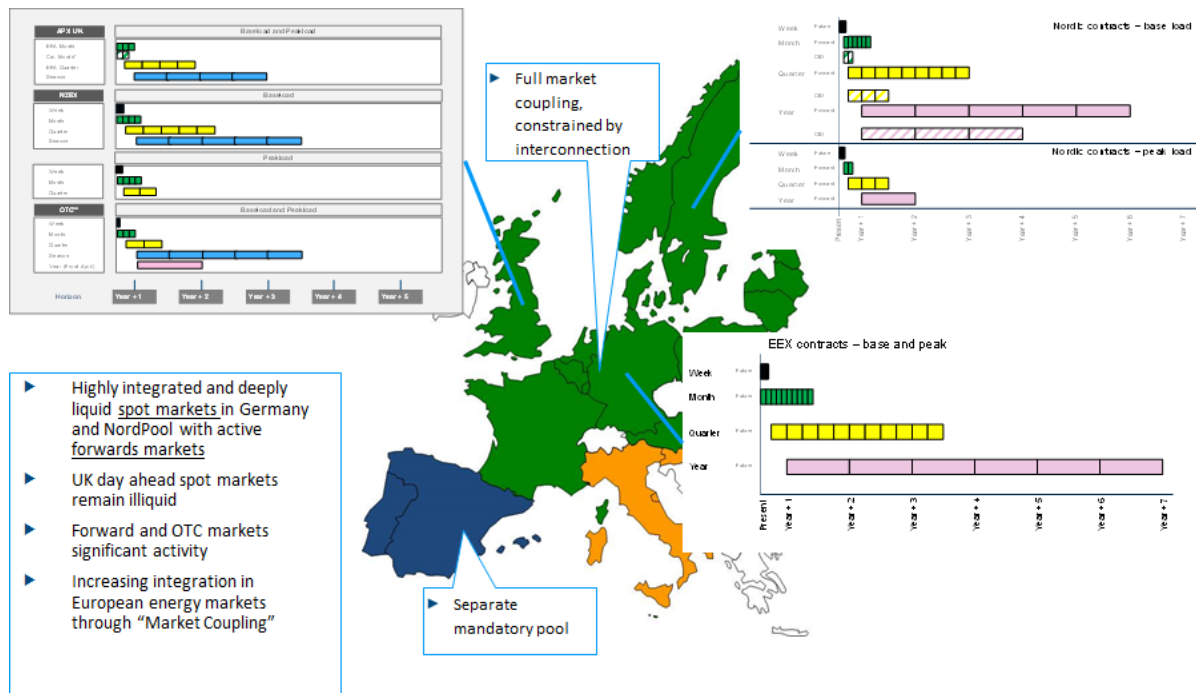
Around the time of the I-SEM launch it is expected that a common solution for integrated intraday trading will go live the so-called Cross-Border Intraday Initiative (XBID). The single intraday market will enable continuous cross-border trading across Europe, promoting further price convergence between interconnected markets.

Also by the end of the decade (3 years after I-SEM go-live at the latest) it is expected that the Energy Balancing Network Code will be operational, promoting sharing of balancing resources between markets.

³ The countries that operate MRC as of September 2015 are: Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Great Britain, Italy, Latvia, Lithuania, Luxembourg, The Netherlands, Norway, Poland (via the SwePol Link), Portugal, Slovenia, Spain and Sweden.

⁴ Using 2014 information from the European Commission and ENTSO-E, The Republic of Ireland has 9% interconnected capacity and ESB, its largest incumbent, has a market share of 55% of generation. This does not include Northern Ireland that makes up the SEM. In comparison, Portugal has 7% interconnected capacity and its largest incumbent Energias de Portugal has a market share of around 45%. Italy's has about 7% of interconnected capacity and its largest incumbent, ENEL has a market share of around 25%. Greece also has similar traits but is not yet part of the IEM. Source: ENTSO-E Scenario Outlook & Adequacy Forecast 2014 and http://ec.europa.eu/energy/sites/ener/files/documents/2014_iem_communication_annex2.pdf.

Figure 1 MRC price coupled area



Through greater integration of the markets, it is expected that the IEM will lead to greater price convergence, and promote liquidity along the forward curve. It is expected that the trend towards liquid trading hubs will continue, with participants in smaller markets using the liquid hubs for the bulk of their forward risk management, and separately managing any residual basis risk.

In its 2014 market report on bidding zones the Agency for the Cooperation of Energy Regulators’ (ACER) observed that the liquidity of hedging products in small bidding zones tends not to be satisfactory, while in larger bidding zones liquidity tends to be satisfactory⁵. It noted that market participants from small bidding zones need to use a combination of contracts from larger bidding zones and transmission rights to hedge themselves. Since liquidity attracts greater liquidity, there is the potential for divergent liquidity between timeframes under the IEM, with liquid spot markets in smaller bidding zones delivered via market coupling, while forward markets in the smaller bidding zones are less liquid as forward hedging gravitates towards larger bidding zones. ACER concluded that multi-market transmission products could benefit smaller bidding zones. This seems to imply potential for a SEM-France or SEM-Germany transmission rights which would have the benefit of not requiring the holder to purchase each individual transmission right or an evolved version of the ‘multi-zone hub’ approach employed in Nord Pool and Italian markets. This indicates that once I-SEM becomes part of the IEM, the forward market for participants will likely become much broader. Larger integrated players who have sophisticated trading capabilities will be best placed to take advantage of this while small and independent players will likely continue to rely on clean hedges available in I-SEM.

Box 2 Impact of Netherlands market of market coupling

⁵ ACER, Report on the influence of existing bidding zones on electricity market, 7 March 2014, p 14.

The Netherlands and Germany are part of the CWE region along with France and Belgium. Market coupling was introduced in CWE in 2010. The CWE markets are also part of the NWE day-ahead price coupling project and now operate the PCR solution.

The introduction of market coupling initially led to a significant increase in price convergence across the NWE region. Full price convergence between the Dutch and German day-ahead markets was observed in 68% of hours in 2011. The increase in the day-ahead price convergence with Germany coincided with a marked decline in Dutch forward market liquidity. In late 2012, some observers attributed this trend to an increase in cross-border proxy hedging by Dutch participants. With market coupling improving the correlation between Dutch and German spot prices, Dutch stakeholders were apparently more willing to place forward hedges in the much larger and more liquid German market, taking advantage of lower transaction costs. For example, Frontier/Consentec report that average bid/offer spreads in 2012 of 0.45% in Germany compared to 0.69% in the Netherlands⁶.

However, the trends in both Dutch-German spot convergence and Dutch forward liquidity have reversed since 2011, as illustrated in Table 3. Full price convergence between the Netherlands and Germany was only witnessed in 19% of hours in 2013, while ICE ENDEX trading volumes have recovered strongly, exceeding the levels before day-ahead market coupling.

Table 1 Dutch-German spot price convergence and Dutch forward liquidity

	2009	2010	2011	2012	2013
NL-DE day-ahead price convergence (% hours)⁷	(<15%)	(<22%)	68%	52%	19%
ICE ENDEX year contract volumes (TWh)⁸	25.7	20.2	11.2	25.7	52.4

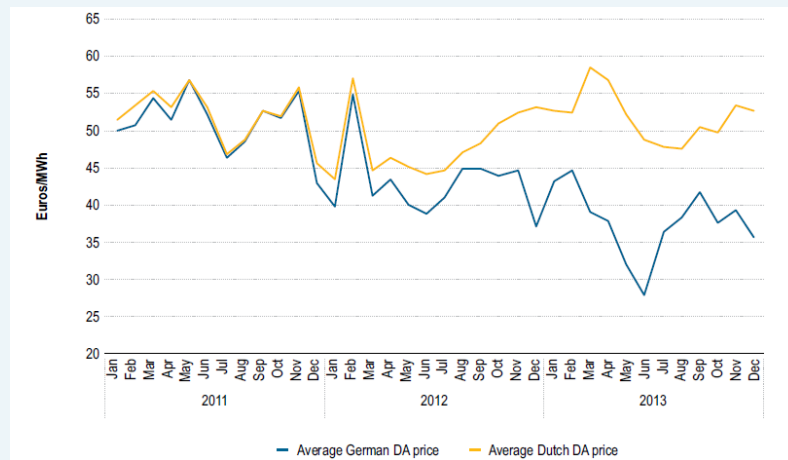
Figure 2 illustrates the increasing divergence between the Dutch and German power prices. This can be explained by movements in gas and coal prices (the Dutch generation fleet being predominantly gas-fired while Germany's is coal-based), together with significant increases in German renewable output (wind and solar).

⁶ <http://www.frontier-economics.com/documents/2014/03/frontier-report-bidding-zone-configuration.pdf>

⁷ ACER, Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2013, October 2014, p 112.

⁸ ACM Autoriteit Consument & Markt, 2014 Liquidity Report 2014, p 30.

Figure 2 German and Dutch power prices (day-ahead average)⁹



The experience in CWE suggests that the introduction of price coupling in I-SEM will lead to greater convergence between I-SEM and GB prices. The subsequent divergence between the Netherlands and Germany is less relevant since the marginal price setting plant in the Island of Ireland and GB has largely been, gas-fired generation, although the different proportions of wind on each system will also be a factor.

The IEM will lead to greater price convergence between bidding zones and promote liquidity along the forward curve. This presents participants, especially those in smaller bidding zones, with new opportunities for forward hedging in more liquid trading hubs. Participants with sophisticated trading capabilities will be best placed to take advantage of this.

⁹ ACER, Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2013, October 2014, p 112

2 How different market participants hedge?

2.1 Introduction

In this section we describe the hedging requirements and strategies of different types of market participants. It demonstrates that there is a wide range of instruments that can be used to manage forward price risk, with few participants relying solely on forward wholesale electricity markets contracts in their local markets.

2.2 Summary of hedging requirements of different market participants

Table 2 below summarises the hedging requirements of different market participants. We describe the requirements of each participant type in more detail below. However, what is evident at a summary level is that there are a wide range of options for forward hedging, and these vary by participant type. In the table, we have highlighted the I-SEM forward market products (in bold italics), and these only form a sub-set of the overall options available for forward hedging.

Table 2 Summary of risk management products available to different market participants

Player type	Hedging options
Independent generators	
Baseload gas generator	<i>Clean I-SEM baseload hedges</i> Electricity baseload hedges in GB/Continental Europe + transmission rights Proxy baseload hedges in GB/Continental Europe Reliability Options
Mid-merit gas generator	<i>Clean I-SEM mid-merit/peak hedges</i> Electricity mid-merit/peak hedges in GB/Europe + transmission rights Proxy mid-merit/peak hedges in GB/Continental Europe DS3 contracts Reliability Options
Coal generator	<i>Clean I-SEM baseload hedges</i> Electricity baseload hedges in GB/Continental Europe + transmission rights Proxy electricity baseload hedges in GB/Continental Europe Proxy gas/carbon hedges Reliability Options
Peaking generator	DS3 contracts Reliability Options
Wind generator	<i>REFIT/PPA to manage balancing risk</i> <i>Renewables Obligation/PPA to manage balancing risk with price floor</i> <i>FIT CfD/PPA to manage balancing risk</i>

Small suppliers	<i>Clean I-SEM baseload and mid merit/peak hedges I-SEM shaping products</i>
Vertically integrated utilities	<i>Clean I-SEM baseload and peak hedges</i> Generation asset backed fuel and carbon hedges (with internal electricity hedging) Proxy gas/carbon hedges Electricity hedges in GB/Continental Europe + transmission rights Proxy electricity GB/Continental Europe

2.3 Independent generators

2.3.1 Baseload gas generators

For a baseload gas generator, its most effective hedge would be I-SEM forward baseload contracts, allowing it to lock in a margin by simultaneously hedging its fuel and carbon requirement. Another effective clean hedge would be using GB forward contracts combined with Financial Transmission Rights (FTRs) on the EWIC or Moyle interconnectors¹⁰. A proxy hedge could potentially also be achieved in the GB (or other Continental Europe) forward electricity market without FTRs. However, the generator would be effectively swapping I-SEM spark spread risk for I-SEM/GB electricity price spread risk. The effectiveness of this as a hedge would depend on greater correlation between I-SEM and GB electricity prices than between I-SEM electricity and gas prices.

In the absence of any forward hedging, the Capacity Remuneration Mechanism (CRM), in the form of Reliability Options, affords a degree of hedge against the spark spread downside risk, since a proportion of the generator's earnings is secured through the capacity payment. The proportion of earnings covered by the CRM is relatively less for baseload generators who rely more on infra-marginal rents, relative to mid-merit or peak generators.

2.3.2 Mid-merit gas generators

Hedging for mid-merit generators is relatively more difficult than for baseload generators, particularly in markets with high proportions of wind since outturn generation patterns cannot be accurately predicted in advance. Forward I-SEM mid-merit/peak contracts may provide a reasonable hedge, absent the wind issue. Mid-merit/peak hedges in neighbouring markets with associated FTRs would also be an option, and potentially proxy hedges. As noted above, the revenue stability provided by Reliability Options are relatively more important for mid-merit generators. Mid-merit generators may also be able to participate in providing DS3 services, and therefore further less reliant on earnings in the wholesale market that need hedging. Given the high degree of correlation between gas/carbon and electricity prices in the SEM (and expected in the I-SEM), some generators may consider they do not need to forward hedge fully with the Reliability Options and DS3 contracts providing sufficient earnings stability.

¹⁰ The SEM Committee has decided that Financial Transmission Rights (FTRs) will apply under I-SEM. A final decision has yet to be made on the type of FTRs between options or obligations.

2.3.3 Coal generators

Coal generators have the same range of electricity market hedges as gas generators. Given the high degree of correlation between gas and carbon and electricity prices, coal generators are able to hedge the dark spread using proxy gas and carbon hedges. Such a proxy hedge is commonly used by baseload coal generators in markets where gas fired generation is marginal, but is less effective for mid-merit coal generators.

2.3.4 Peaking generators

Peaking generators are unlikely to offer or use standard forward products for hedging. Earning stability for these generators will principally be provided through a combination of Reliability Options and DS3 contracts.

2.3.5 Wind generators

The current REFIT arrangements in the Republic of Ireland require suppliers to contract with wind generators to provide a revenue floor. Hence, there is not a requirement for wind generators to forward hedge. There is also a payment to suppliers to cover balancing costs. For wind generators in Northern Ireland operating under the Renewables Obligation, who are exposed to market prices, there may be a requirement to enter into a long term Power Purchase Agreement (PPA) to provide a price floor.

Under I-SEM, all participants will be balance responsible and this will likely require wind generators to enter into PPAs in order to manage their balancing risk. Hence, this is a new market requirement and it may be expected that portfolio players offer these services to wind generators directly or their REFIT suppliers. The Aggregator of Last Resort (AoLR) arrangements will ensure that there are always backstop provisions in place.¹¹

2.4 Small suppliers

In markets which are sufficiently liquid for them to do so, suppliers to mass market customers typically 'ladder hedge' over a period of 12-24 months in order to average out their electricity purchase costs, and then price their tariffs based off this average cost. They will typically involve a combination of standard baseload and peak products to match their expected shape as best they can, and may then supplement this with shaped and balancing products. Where the latter are not available, independent suppliers are exposed to volume and basis risk in the near term markets.

In the business to business market, suppliers will typically hedge at the point that customers price fix. Again there is residual shape and balancing risk to be managed, although loads tend to be flatter and less weather dependent making this easier than for mass market customers.

Smaller suppliers would not typically have the capability to trade in adjacent markets or enter into proxy hedges and trade more widely, and so would be more reliant on the availability of pure I-SEM based hedges to support their positions.

¹¹ The SEM Committees' decision paper set out that demand participants would not be eligible for the AoLR. All generators equal to or below 10MW will be eligible to participate as well as all renewable technologies.

The hedging strategies of independent suppliers would be best supported through the frequent availability of hedging products provided by large integrated players.

2.5 Vertically integrated players

Vertically integrated players will use the full range of hedging products described above, and will normally employ an integrated trading strategy to optimise their trading books and asset portfolios. Some also engage in proprietary trading. Many of the pan-European players, such as SSE and Centrica, have consolidated their trading activities in a single location. Their diversified portfolios, wider geographic reach and more sophisticated trading capabilities will allow them to focus on trading hubs and deploy basis risk management and proxy hedging techniques, and hence they are less reliant on pure hedges in every market that they trade.

A good example of proxy hedging is the use of the TTF hub in the Netherlands for management of gas price risk, and also electricity price risk in markets with a prevalence of gas-fired generation. TTF is providing significant European liquidity and forward price discovery, whilst all other surrounding continental hubs have relatively low churn and are used more for physical balancing by the participants. Hence, risk management in gas is primarily done on the liquid TTF and then physical positions/balancing closer to delivery is done on the local market hub. As a result the markets surrounding TTF (with the possible exception of the French hub) are highly correlated – even prior to the implementation of gas market coupling. This level of correlation extends out to the NBP in Great Britain, and since gas pipelines to Ireland are uncongested the NBP price is accessible to physical players in Ireland. Proxy-hedging with gas is common place and hence pan-European players with sophisticated trading capabilities benefit from deeply liquid gas hubs across NBP and TTF.

By having generation assets, integrated players have the ability to engage in asset backed trading and hedge electricity exposures in the more liquid fuel markets directly. This is in addition to any proxy cross-commodity hedging that they may employ. Exposures in their electricity supply businesses can be managed through internal trades, and then hedged through the fuel and carbon risk to lock in the margin across the value chain¹². The generation and trading arms are also able to offer shaping and balancing products to their supply businesses.

Box 3 Different hedging strategies of integrated players

The following are typical trading strategies that integrated players may adopt:

1. **Drip feed.** This is the process of buying cover for a long or short volume profile over a period of time with cover limits imposed once the delivery point approaches. On occasion, energy companies will add triggers to the strategy to enable buying and selling linked to time or commodity spreads to be accelerated or decelerated to ensure a fair market price is achieved.
2. **Rolling intrinsic.** This involves buying, back-to-back, the entire profile against the current market price. Volumes can be bought and sold on the basis of time spreads to ensure that a 100 per cent cover position is maintained. This is especially important when balancing shape as market products cascade down when approaching delivery. This strategy can generate significant additional value through time-spread optimisation.
3. **Short term optimisation.** Used to optimise assets on an intrinsic basis to ensure optimal dispatch at point of delivery and minimise imbalance costs. The hedging would be triggered by e.g. price

¹² Note that this is a clean hedge rather than a proxy hedge.

moves, new demand forecasts and physical changes in supply (e.g. station outage). Speed to market becomes ever more critical in the day ahead and intraday timeframes.

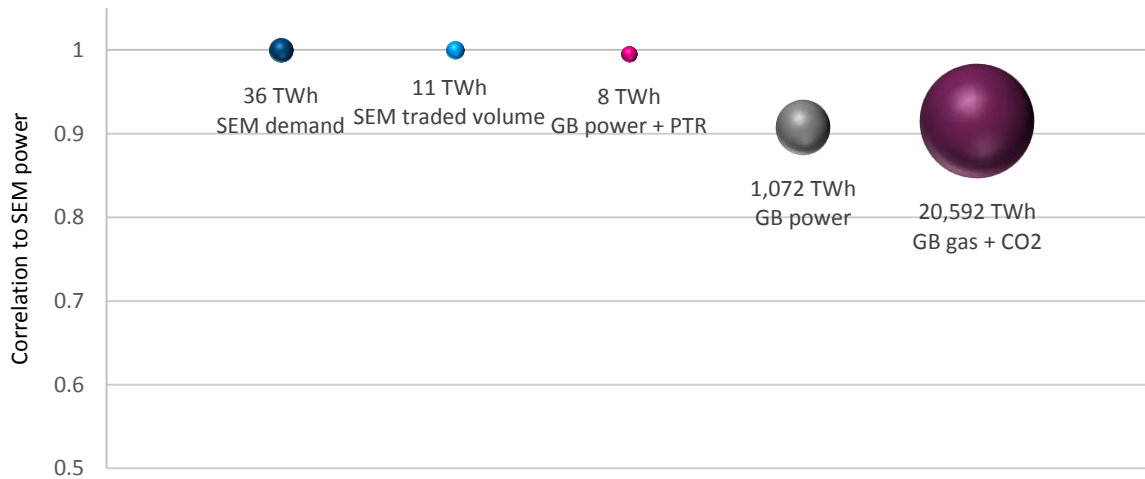
4. **Long-term optimisation and delta hedging.** Commonly deployed by energy companies to maximise the value from their generation units and gas fields, these strategies rely on the running of an optimisation model to value the asset and calculate the delta with speed to market of less importance.

Many vertically integrated companies that employ internal hedging, liquidate their forward positions in the day ahead markets. This can facilitate optimisation of the portfolio, particularly across interconnected markets, and adds liquidity to the day-ahead market. Therefore, the presence of vertically integrated players need not be deleterious to near term market liquidity. Furthermore, in markets with financial forward hedging, such as the I-SEM, players must participate in the near term markets to match their physical positions.

Pan-European players are likely to focus much of their forward electricity trading on hubs with greatest liquidity. Closer to real-time, players may close forward positions and become more active in the local markets using day-ahead (and in the future within-day) market coupling to manage cross-border positions. The basis risk between its forward hedges in liquid hubs and near term prices in local markets can be managed through forward Financial or Physical Transmission Rights on interconnectors. A decision of whether to hedge this basis risk will depend on the strength of correlation between the markets, and the company's appetite for holding risk.

The chart in Figure 2 below illustrates the depth and correlation between forward markets that a pan-European vertically integrated energy player with interests in Ireland might use. The bubbles represent the approximate size of each market based on volumes traded and we have indicated the correlation between markets, based on analysis set out in the next section. The chart shows around 11 TWh of contracts trading through Directed Contracts, Non-Directed Contracts and Public Service Obligations. This is small relative to total annual demand in the SEM of 36 TWh. However, participants have access to the GB forward market where approximately 1,000 TWh of electricity is traded annually. With a correlation to the I-SEM market of 0.91 the GB power price represents an attractive proxy hedge for I-SEM. Furthermore, the basis risk on around 8 TWh could be managed through FTRs on interconnectors, converting it into a clean hedge. Even greater liquidity can be accessed in the GB gas market, the National Balancing Point (NBP), which itself is highly correlated to the even more liquid TTF market. With a correlation of around 0.92 it is an even more effective proxy hedge for the I-SEM than the GB electricity forward market.

Figure 3 Comparison of the market size and correlations between markets where a vertical integrated firm can hedge



Liquidity in markets where proxy hedges are possible far exceeds current liquidity, and expected future liquidity, in the SEM/I-SEM. Hence, proxy hedging is a very important consideration when assessing whether any liquidity solutions specific to the I-SEM forward electricity market are necessary. Whilst the increase in wind in the I-SEM may weaken correlations with the GB gas market (with gas plant less frequently setting the electricity price), the implementation of IEM (and potentially greater interconnection in the future) is likely to lead to greater price convergence in electricity markets, making proxy hedging in other European electricity market an increasingly viable risk management strategy for I-SEM participants. We discuss proxy hedging in further detail in the next section.

3 Proxy hedging

3.1 Introduction

In this section we examine opportunities for proxy hedging in the I-SEM, analysing the effectiveness of proxy hedging the SEM System Marginal Price (SMP) against the GB power price, and against the GB NBP gas price and European Union Emissions Trading Scheme carbon prices. The high correlations observed suggest that there is a range of proxy hedging options available to SEM participants. Proxy hedging is also commonly deployed in European markets. We provide an example of proxy hedging in Nord Pool in Appendix A.

3.2 What is a proxy hedge?

Proxy hedges are an alternative to clean hedge or an asset backed hedge. A proxy hedge involves using a hedging instrument based on a commodity in one market with a price which is closely correlated to a commodity in another market.

Proxy hedges may be deployed by market participants primarily where there is limited liquidity in the market with the underlying exposure. Similarly, if opportunities for clean hedging or asset backed hedging either do not exist or are prohibitively expensive, and the participant's applicable risk tolerances do not allow them to remain unhedged, a proxy hedge can provide an alternative risk management approach. As proxy hedges are not perfect, there is a residual basis risk. Furthermore, high transaction costs or onerous credit and collateral requirements may limit the attractiveness of proxy hedges.

Proxy hedges will typically be closed out prior to delivery, since the participant's underlying exposure is in a different market. The proxy hedge has been effective if the price in the adjacent market has moved similarly to the main market when the hedge is closed.

3.3 Effectiveness of GB electricity market as proxy hedge

The SEM is connected directly to the GB electricity market through the Moyle and East-West interconnectors, totalling 950 MW of capacity¹³. For participants with transmission rights on the interconnectors, forward I-SEM exposures can be hedged directly in the GB market¹⁴. In addition, due to the price convergence between coupled markets, the GB forward electricity market should also offer an effective proxy hedge for I-SEM.

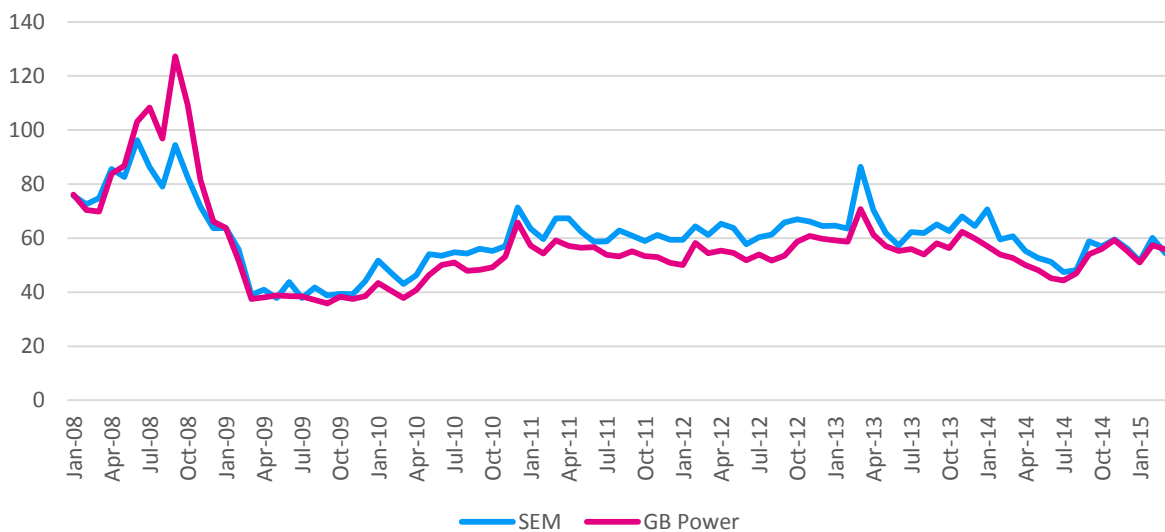
Historically prices between the SEM and GB power market have been highly correlated, with gas-fired generation playing an important role in price setting in both markets. This correlation can break

¹³ The Moyle interconnector has been operating at half its name plate capacity (250MW) since June 2012 due to a series of faults. The Moyle interconnector expects to return to full operation in 2016.

¹⁴ Physical Transmission Rights are currently sold across the SEM GB bidding zone border. The emerging I-SEM will see a transition to Financial Transmission Rights (FTRs). A final decision has yet to be made on the type of FTRs between options or obligations.

down in the near term¹⁵, due to varying near term conditions, but in the forward trading horizons of monthly or greater, which is most relevant for hedging, the correlation is strong and is unlikely to break down. This is illustrated in Figure 4, which plots the monthly average SMP price against the monthly average GB power price from 2008-2014.¹⁶ We have used monthly average spot prices rather than forward prices for this analysis due to the lack of a reliable forward price currently in SEM.

Figure 4 SMP Power (SMP) versus GB power (2008-2014) (€/MWh)



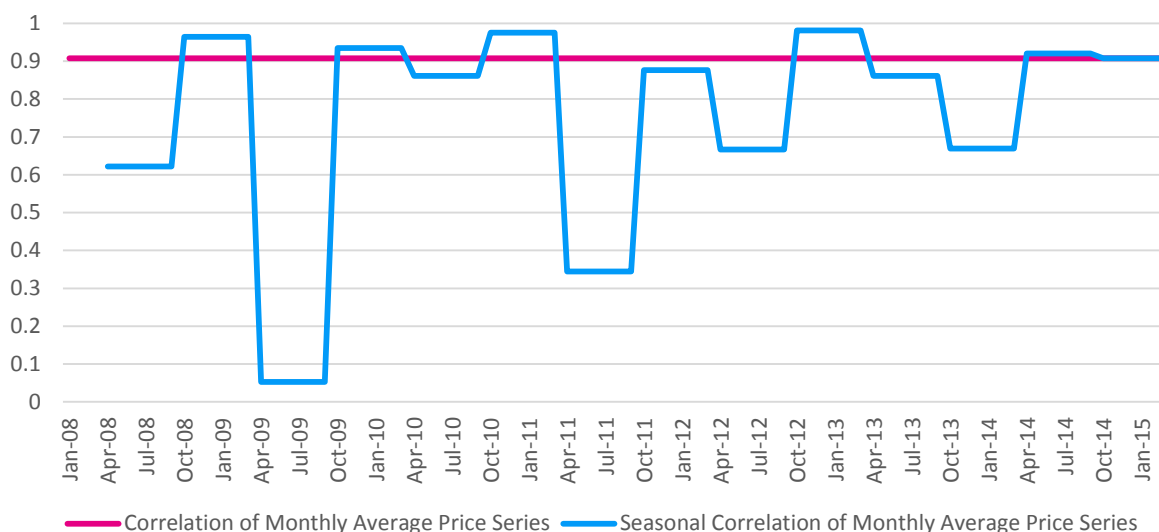
To test the effectiveness of the GB electricity market as a proxy hedge, we have calculated the correlation between the monthly SMP and the GB power price over the same period, 2008-2014. The analysis set out in Figure 5 shows the correlation of monthly average prices and the seasonal correlation of monthly average prices. This suggests a correlation of 91%, while the average seasonal correlation was 76% throughout the same period. The winter seasonal correlation averaged 90% while the summer seasonal correlation averaged 62%. The SEM Committee has also previously noted the high correlation of this relationship¹⁷.

¹⁵ The daily average price correlation between SEM power and GB power was 77% over the same 2008-2014 period.

¹⁶ The GB power price is converted in Euros at the prevailing foreign exchange rate on each trading day.

¹⁷ The Single Electricity Market: Market Update (April – June 2015), SEM-15-072, September 2015.

Figure 5 SEM power (SMP) versus GB power correlation (2008-2014)

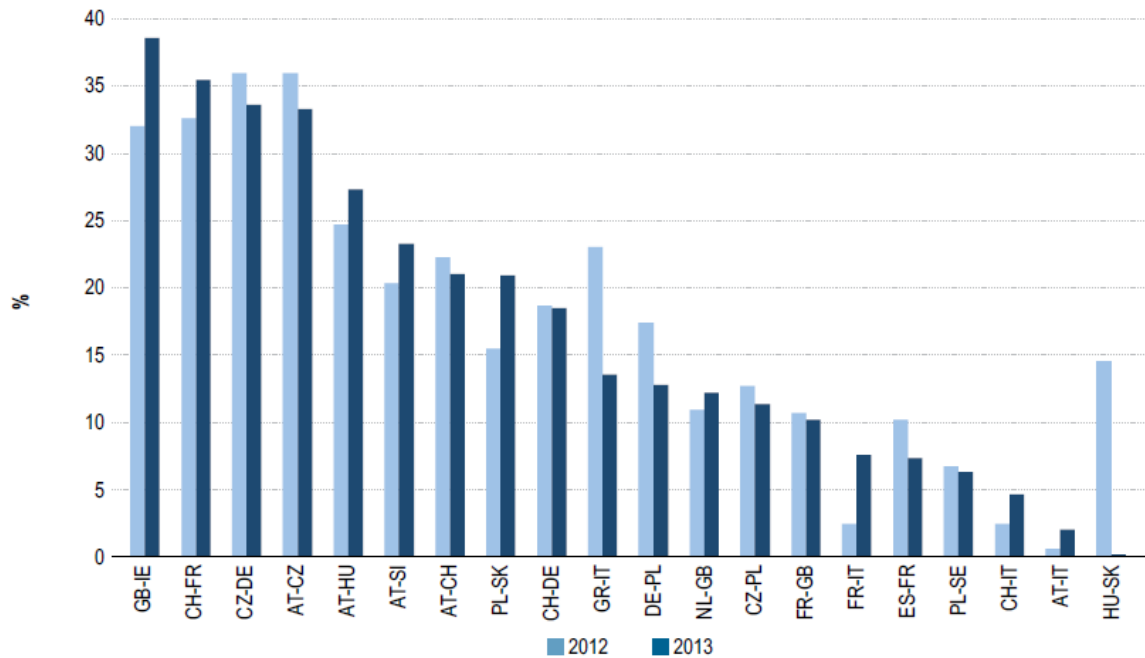


With the introduction of market coupling under I-SEM, there is significant scope to improve the efficiency of interconnector flows between SEM and GB, and in turn the price convergence between the two markets could increase. ACER’s 2014 market monitoring report shows that the SEM-GB border has the highest proportion of hours with day-ahead nominations flowing the “wrong” way given price differentials as set out in Figure 6.¹⁸ This is in part due to the current SEM Capacity Payment Mechanism which rewards import flows in all periods. Under the proposed design for the I-SEM CRM there will be no additional incentive to import to the Irish market outside of the energy price signal. The same ACER report also estimates that the SEM-GB border (EWIC, Moyle combined) has the highest social welfare loss in Europe due to the absence of market coupling.¹⁹

¹⁸ Power is said to be flowing the “wrong” way across an interconnector when it flows from the higher priced bidding zone to the lower priced bidding zone.

¹⁹ ACER, Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2013, October 2014, p 122-123.

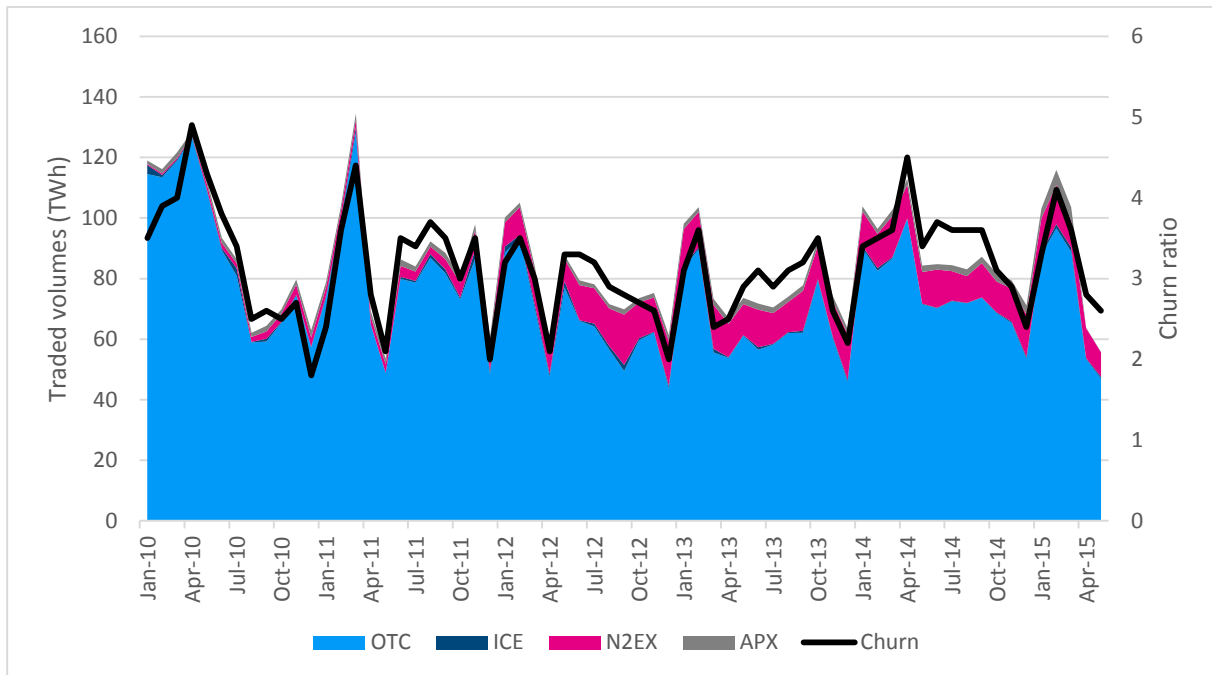
Figure 6 Hours with net day-ahead nominations against price differentials²⁰



The GB forward electricity market is a relatively liquid market as shown by the volume of trades and churn ratio shown in Figure 7. This depth and anticipated price convergence makes it an effective proxy hedge for the I-SEM.

²⁰ ACER, Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2013, October 2014, p 118-119.

Figure 7 Monthly GB power traded volumes and churn ratio²¹



3.4 Effectiveness of gas and carbon markets as proxy hedge

Gas-fired generation is the most common marginal price setting plant in the SEM. As a consequence, the price of gas, which is largely determined by the GB gas market, plays a significant role in determining the SMP. Gas interconnection between Ireland and GB is not constrained, and hence there is effectively full price convergence.

The other main determinant of the price of gas-fired generation in the SEM is the price of carbon, which is determined by the price of European Union Allowances (EUA), carbon credits used in the European Union Emissions Trading Scheme.

As a result using gas and carbon to proxy hedge SEM electricity is effective, and it is a risk management strategy currently used by a number of SEM participants.

Northern Ireland (NI) and the Republic of Ireland (RoI) have renewable targets of 40% of electricity generation from renewable sources by 2020. Onshore wind is the main renewable technology expected to be commissioned over this timeframe. Total installed onshore wind capacity stood at just over 2.8 GW at the end of 2014. Although it is uncertain whether or not the 2020 renewable targets will be met, there is a significant pipeline of new onshore wind projects in both NI and the RoI, and further significant build-out of onshore wind is expected over the coming years. Wind generation will represent an increasingly significant component of the overall generation mix in the SEM/I-SEM over time.

²¹ Ofgem, Wholesale Energy Markets in 2015, p 56.

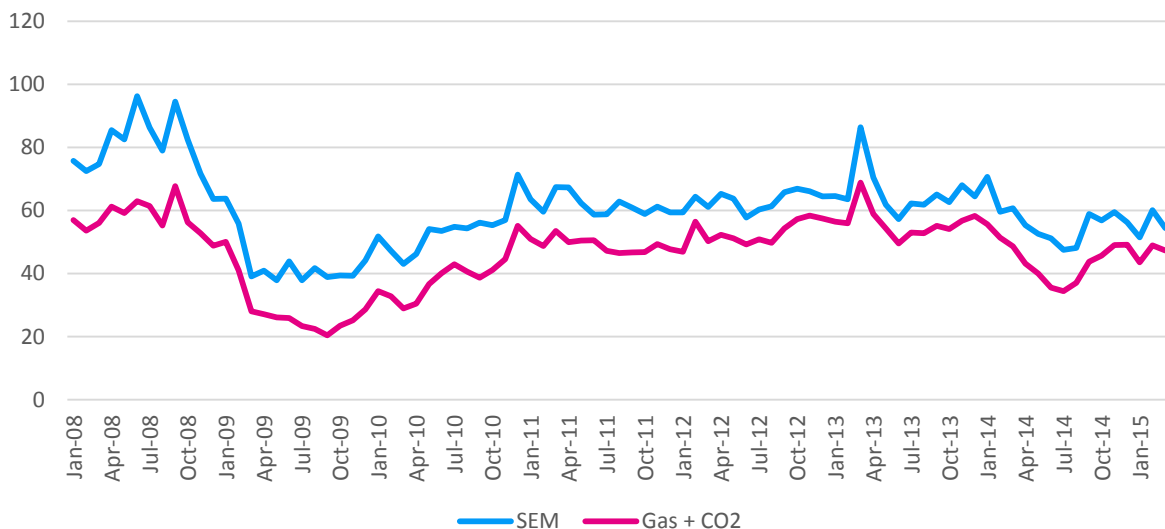
The SEM has sufficient firm generation plant on the island to meet agreed generation adequacy requirements, with a new 460 MW CCGT commissioned at Great Island at the beginning of 2015, and a healthy pipeline of up to 460 MW of connection agreements for additional thermal plant, primarily in the RoI.

In the SEM generators are currently required to bid their short run marginal cost (SRMC) into the gross mandatory pool. For that reason the SMP is primarily driven by the SRMC of the marginal plant that is required to meet demand. Gas-fired generation is the most common marginal plant type in the SEM. The SMP is made up of three major components, gas, carbon and an ex-post ‘uplift’. Together the gas and carbon components form the ‘shadow price’ while the ‘uplift’ component is driven by generator technical bid parameters associated with start-up costs and is priced using the ex-post uplift reconciliation algorithm.

The composition of the SMP, particularly the shadow price component, presents market participants an opportunity to proxy hedge. This proxy hedge involves buying gas and carbon that fixes the price of gas and carbon components of the SMP managing the exposure to the typical marginal price setting plant. The resulting hedge will be imperfect due to the uncertainty over the amount of the ‘uplift’ component which is not explicitly correlated to gas prices. Figure 8 plots the monthly average SMP against the monthly average GB NBP gas and the EUA carbon prices from 2008-2014 and shows a consistently close relationship.

Whilst the implementation of I-SEM represents a significant change in market design, the principal prices drivers are unlikely to change materially. We would therefore expect gas-fired generation to remain the most common price setting plant.

Figure 8 SMP Power versus NBP gas and EUA carbon (2008-2014) (€/MWh)

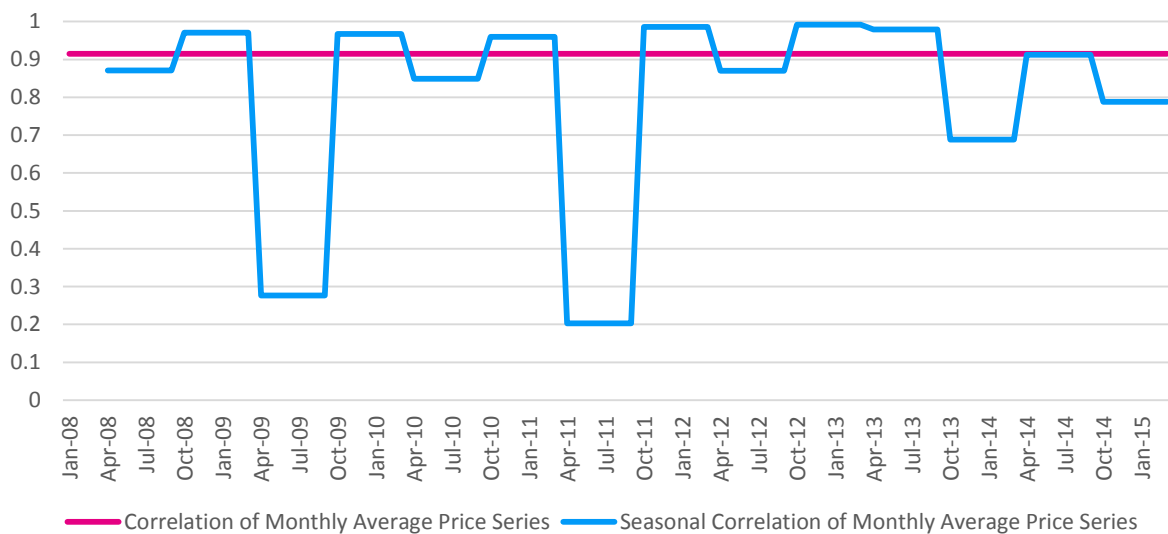


To test the effectiveness of this proxy hedge we have calculated the correlation between the monthly average SMP and the monthly average NBP gas and the EUA carbon price over the same period 2008-2014.²² Figure 9 sets out the correlation of monthly average prices and the seasonal

²² The GB power price is converted in Euros at the prevailing foreign exchange rate on each trading day.

correlation of monthly average prices. The analysis indicates a correlation of around 92% while the seasonal correlation averaged 81% throughout the same period. The winter seasonal correlation averaged 91% while the summer seasonal correlation averaged 71%. The correlation and winter seasonal correlation represent a high degree of correlation between the variables. The SEM Committee has also previously noted this high correlation²³. So whilst the supply and demand conditions in the short term markets may lead to correlations breaking down²⁴, the strong correlation of SMP to GB gas and EUA carbon over a monthly horizon allows market participants to proxy hedge their risk through the more liquid markets for gas and carbon contracts.

Figure 9 SEM power (SMP) versus NBP gas and EUA carbon correlation (2008-2014)



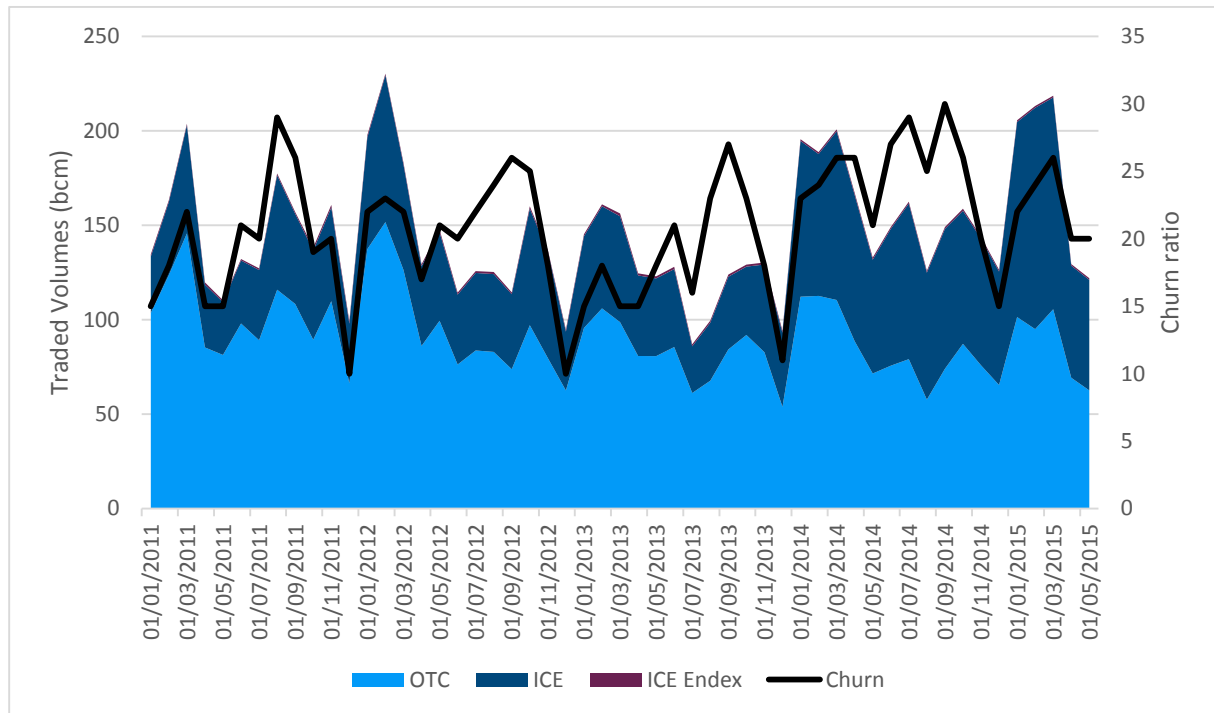
The primary attractiveness of a proxy hedge is the degree of correlation between the market with the underlying exposure and the proxy’s market as a higher correlation reduces a market participant’s basis risk. The depth of the chosen proxy market is another important dimension in the decision to proxy hedge as higher levels of liquidity provide participants greater confidence in the resulting prices of that market, allow them to transact when they want and may offer lower transaction costs²⁵. The NBP gas market is a highly liquid market as shown by the volume of trades and the churn ratio in Figure 10 compared to the equivalent levels in the SEM. A comparison of the market size of the NBP gas market to the SEM was shown above in Figure 2. This shows that the NBP gas market can provide an attractive proxy hedge.

²³ The Single Electricity Market: Market Update (October – December 2014), SEM-15-022, 22 April 2015.

²⁴ The daily average price correlation between SEM power and NBP gas and EUA carbon was 77% over the same 2008-2014 period.

²⁵ Transaction costs and the ability to transact when required are two other important features.

Figure 10 Monthly NBP gas traded volumes and churn ratio²⁶



3.5 Summary

Evidence within Europe suggests under market coupling liquidity is attracted to trading hubs, and proxy hedging using these markets is a viable hedging strategy for participants in smaller interconnected markets. Access to transmission rights also offers the ability to clean hedge in adjacent markets, although this is limited by the capacity available.

There is already a high degree of correlation between the SEM and the GB electricity market, particularly over monthly and longer time horizons, and market coupling may be expected to lead to increased price convergence making the GB electricity market an effective proxy hedge. Furthermore, the level of correlation with the GB gas market means that I-SEM participants have access to a further, very liquid, market in which to proxy hedge.

Through the combination of clean hedges, asset backed hedges and proxy hedges I-SEM market participants have a variety of options to manage their underlying exposures.

²⁶ Ofgem, Wholesale Energy Markets in 2015, p 35.

4 Conclusions

The analysis in this paper demonstrates that market participants adopt a range of strategies for managing their exposures, including clean hedges, asset backed hedges and proxy hedges.

With the introduction of I-SEM, the Irish market becomes part of the wider European IEM, and we expect that participants will increasingly look to the more liquid trading hubs to manage their forward exposures. This is a pattern we have observed elsewhere. In this wider forward market definition, ESB is not a dominant player, and in fact by European standards it is a small company. The continuation of the vertical ring-fence would seem unusual, and a disproportionate intervention, in this context with several much larger vertically integrated players, including those active in Ireland, not subject to the same restrictions.

However, whilst forward liquidity in the I-SEM is not a means to an end in itself and the market is unlikely to be that deep under any circumstance, as observed by the CMA it is important that participants have access to reliable forward price signals and the risk management products they need at a reasonable cost. These are features of a well-functioning forward market and are in the interest of all market participants. In I-SEM this is especially important for independent suppliers and generators, who do not have sophisticated trading capabilities, and are more reliant on clean hedges available directly in the I-SEM. This is unlikely to be as challenging for vertically integrated players.

Appendix A Nord Pool

Although Nord Pool has had market coupling in place for some time, we have chosen to analyse Nord Pool market data from the commencement of the NWE project and MRC, since this provides the best analogy for when I-SEM is coupled into NWE. The analysis period is from February 2014 to August 2015.

The Nord Pool forward market is a ‘multi-zone hub’ design where the majority of forward products are offered for a group of bidding zones and are referenced against the Nordic system price²⁷ that acts as a hub.²⁸ The analysis in Table 2 shows that the correlations between the daily Nord Pool bidding zone day-ahead prices with the daily Nordic system price are imperfect. Using a Nordic forward product may therefore expose the participant to basis risk in the form of a price spread between their bidding zone and the Nordic system price. There is also relatively thin trading of instruments needed to manage this basis risk.

This locational basis risk can be hedged using a financial derivative such as a Contract for Difference (CfD) or an Electricity Pricing Area Differentials (EPADs).²⁹ We observe that EPADs are not always available in all Nordic bidding zones. Taking an example where no CfD is offered in the SE3 bidding zone, but CfDs are available in the neighbouring SE2, SE4 and Oslo bidding zones, a SE3 market participant could use one of these CfDs as a proxy. The correlations in Table 2 show that the participant would face lower basis risk between the SE3 bidding zone price and the Nordic system price if it were to proxy hedge the SE2 or SE4 day ahead price.

²⁷ The Nordic System Price represents an unconstrained market clearing price for each hour and is calculated as the intersection of the aggregate supply and the aggregate demand curves from all bids and offers made into the Nord Pool day-ahead market.

²⁸ This is in contrast to a ‘single zone hub’ approach where bidding zone forward products are referenced against the day ahead price of that bidding zone.

²⁹ EPADs are Futures, DS Futures and Average rate Futures referencing the difference between an Area Price and an index such as the Nordic system price.

Table 3 Day-ahead daily price correlations between Nord Pool bidding zones (2014-2015)

	SYS	SE1	SE2	SE3	SE4	FI	DK1	DK2	Oslo	Kr.sand	Bergen	Molde	Tr.heim	Tromsø	EE	LV	LT
SYS	1																
SE1	0.93	1															
SE2	0.92	1	1														
SE3	0.91	0.98	0.98	1													
SE4	0.88	0.94	0.94	0.97	1												
FI	0.60	0.64	0.64	0.66	0.63	1											
DK1	0.70	0.75	0.75	0.79	0.81	0.57	1										
DK2	0.75	0.81	0.81	0.84	0.88	0.60	0.93	1									
Oslo	0.94	0.77	0.77	0.76	0.73	0.45	0.56	0.60	1								
Kr.sand	0.94	0.77	0.77	0.76	0.73	0.45	0.56	0.60	1	1							
Bergen	0.94	0.77	0.77	0.76	0.73	0.45	0.56	0.59	1	1	1						
Molde	0.94	0.98	0.98	0.95	0.91	0.60	0.70	0.76	0.80	0.79	0.80	1					
Tr.heim	0.94	0.98	0.98	0.95	0.91	0.60	0.70	0.76	0.80	0.79	0.80	1	1				
Tromsø	0.94	0.96	0.96	0.93	0.89	0.57	0.68	0.74	0.81	0.81	0.82	0.99	0.99	1			
EE	0.51	0.53	0.53	0.54	0.52	0.77	0.48	0.49	0.40	0.40	0.40	0.50	0.50	0.48	1		
LV	0.31	0.40	0.40	0.40	0.39	0.56	0.45	0.46	0.16	0.16	0.15	0.36	0.36	0.34	0.62	1	
LT	0.31	0.40	0.40	0.41	0.39	0.56	0.45	0.46	0.16	0.16	0.16	0.36	0.36	0.34	0.62	1	1