

Single Electricity Market Committee

Market Power Mitigation in the SEM Directed Contract Implementation Report

SEM-08-xx

14 February 2008

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1 Introduction

An integral part of the development of the SEM has been the implementation of a market power mitigation strategy to ensure that the benefits associated with the SEM are not undermined by the abuse of market power. As part of that strategy the Commission for Energy Regulation and the Northern Ireland Authority for Utility Regulation (jointly the “Regulatory Authorities”) put in place for the first eleven months of the SEM a suite of Directed Contracts (“DCs”), the purpose of which was to remove the incentives on ESB Power Generation (“ESB PG”) to attempt to profit from the use of market power.

In implementing its Directed Contracts policy in 2007, the Regulatory Authorities engaged in an extensive consultation process with the industry on the design, pricing and allocation of the Directed Contracts. The consultation process included industry forums and bilateral meetings. The Regulatory Authorities also published a series of consultation and decision papers during the process of developing its policies. These various papers can be found on the All Island Project website at <http://www.allislandproject.org/en/market-power-consultation.aspx>.

The Regulatory Authorities have reviewed the Directed Contract implementation process pursued in 2007 and are of the opinion that it was broadly successful, in the sense that:

- The subscription process went smoothly;
- The quantities of Directed Contracts on offer were fully subscribed for;
- Not all the quantities on offer were allocated to ESB CS and NIE Supply;
- The method for determining the daily prices over the six week subscription period was robust to variations in fuel and carbon prices, though it is noted that there were no significant variations in these prices over the period.

The Regulatory Authorities therefore propose to follow the same process and procedures in implementing their Directed Contracts policy in 2008, with only minor changes to that followed in 2007.

This Draft Implementation Report is designed to serve as a guide for the implementation of the policies of the Regulatory Authorities with respect to Directed Contracts in 2008. It follows the format used in the equivalent Implementation Report last year (AIP-SEM-07-92, published on

2nd April 2007) and describes the rules for quantification, allocation, and pricing of Directed Contracts, and the timing of the process. The Draft Report describes:

- the various tasks that will be performed by the Regulatory Authorities, as well as by the parties to the Directed Contracts, at each step in the process; and
- the models that will be used to define, allocate and price Directed Contracts.

The Draft Report incorporates a few relatively minor modifications to the Directed Contract process which the Regulatory Authorities believe are warranted given the experience gained in 2007. These modifications are summarised in Section 3 of the Report.

The Regulatory Authorities invite interested parties to submit comments on this Draft Implementation Report by **5pm on 22nd February 2008**, preferably in electronic form, to:

Stephen Powell
Commission for Energy Regulation
The Exchange
Belgard Square North
Tallaght
Dublin 24

spowell@cer.ie

The SEM Committee intends to publish all comments received. Those respondents who would like certain sections of their responses to remain confidential should submit the relevant sections in an appendix marked confidential.

2 Structure of this Report

Section 3 of the Report gives a brief description of the way in which the process to be followed this year differs from that followed last year (as described in AIP-SEM-07-92).

Section 4 provides an overview of the Directed Contract policy, enabling documents and implementation timescale. It outlines the specific tasks that will be performed by the Regulatory Authorities and the parties to the Directed Contracts.

Section 5 describes the specific models that will be used to quantify, allocate and price Directed Contracts.

3 Modifications to the 2007 Implementation Timetable, Products and Process

The Regulatory Authorities have reviewed the timetable, products, processes and procedures followed last year in determining the quantities and prices of the Directed Contracts that the Regulatory Authorities required ESB PG to offer suppliers for the eleven months from 1st November 2007.

The Regulatory Authorities are broadly satisfied that the process was satisfactory and resulted in a successful subscription process. They also understand that suppliers were generally content with the process in 2007. However there are a small number of minor changes that the Regulatory Authorities consider worthwhile making to ensure that this year's implementation goes as smoothly. These include:

- condensing the subscription window into a four week period, compared to last year's six-week period, with the initial Subscription Window lasting for three weeks (instead of four) and the secondary window for one week (instead of two);
- starting the subscription period a month or more earlier than the generic timetable set out in AIP-SEM-07-92, with the result that:
 - the initial Subscription Window would open on 28th April 2008 and end on 16th May 2008;
 - the Supplemental Window would open on 20th May and end on 26th May;
- increasing the daily subscription limit from 10% of a suppliers eligibility or 10MW, whichever is the higher, to 15% or 15MW, in the light of the condensed subscription timescales;
- allowing suppliers to subscribe for Directed Contracts on a quarterly rather than an annual basis;
- to align the DC products with electricity forward agreement (EFA) product blocks available in the BETTA market, changing:
 - the definition of the peak period from the trading periods arising during the hours beginning at 16:30 and ending at 20:00 to one beginning at

17.00 and ending at 21.00 on all days during the fourth and first quarters of the year;

- the definition of the mid-merit period from one which begins at 07.30 to one that begins at 07.00;
- changing minor elements of the Master Contract for Differences Agreement, to include:
 - adopting the same format of the monthly invoice that ESB PG and NIE PPB must send to suppliers as was used in the non-directed contracts last year;
 - changing the deadline for the issuing by ESB PG or NIE PPB of the monthly invoice from the 5th Business Day of the month to one of the 7th Business Day of the month; and
 - clarifying the calculation of forward exposure during delivery of the contract for the purpose of credit margining when quarterly fuel prices are no longer visible when a given quarter has begun.

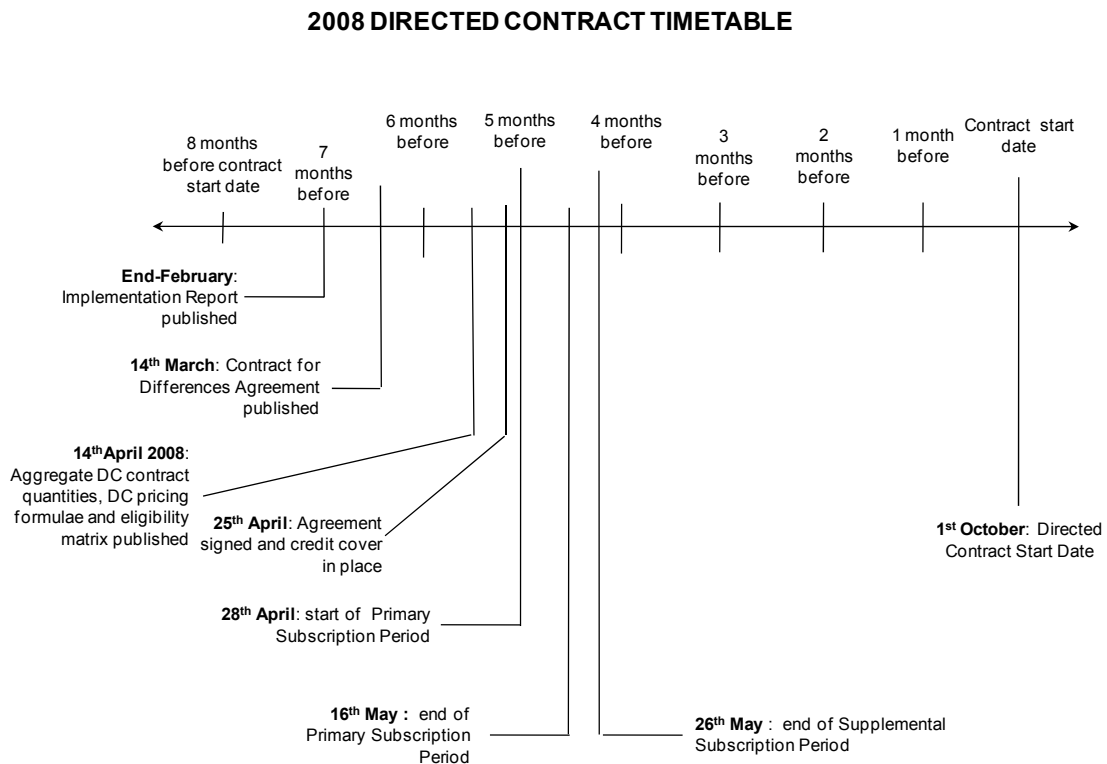
These proposed changes in the Master Contract for Differences Agreement will be published by the Regulatory Authorities in due course.

4 Directed Contracts Policy and Implementation Overview Purpose

The Directed Contracts will mitigate market power by reducing the incentive for those incumbent generators (ESB PG and NIE PPB) who are subject to DC contracts to submit commercial bids into the SEM above competitive levels, or otherwise withhold capacity, in order to influence spot prices or future contract prices. These contracts are a cornerstone of the market power mitigation plan and provide the opportunity and ability to place greater reliance on competitive forces.

4.1 Timeline for Implementation

The timeline for implementation of the Directed Contracts in 2008 is shown in the diagram below. Each step on the timeline is described in turn below.



4.1.1 Publication of the Directed Contract for Differences Agreement

Only minor changes to the 2007 version of the Master Directed Contract for Differences Agreement will be made this year. The start date this year is **1st October 2008**,¹ and the term of the Agreement will be a full twelve months. The final form of the 2008 Agreement will be published by **mid-March 2008**.

Once the final form of the Agreement has been set, certain items will remain to be completed upon execution. When the Agreements are executed, the parties to the contracts will need to complete certain items. These items include:

- Names of the buyer and seller (cover sheet);
- Date of execution (page 1);
- Jurisdiction of corporate organisation (page 1, recitals);
- Currency of transaction, (throughout the Agreement, i.e., euros for ESB PG as the Republic of Ireland (ROI) seller and sterling for NIE PPB as the Northern Ireland (NI) seller);
- Applicable regulatory authority of transaction, (throughout the Agreement, i.e., the Commission for Energy Regulation in the case of ESB PG as the seller and NIAUR in the case of NIE PPB as seller);
- Bank name for interest calculation (Section 7.4);
- Signatories (pages 24 and 25);
- Addresses and contact information (Schedule 2).

In addition, when eligible suppliers elect to subscribe to Directed Contract quantities during either the initial or the Supplemental Subscription Periods, their elections will be recorded and confirmation letters (in the form of Schedule 6) will be made part of the Directed Contract for Differences Agreement.

¹ The contract start date refers to the date upon which the difference payment obligations begin. The Contract for Differences Agreement will be executed in advance of the contract start date.

4.1.2 Publication of the Aggregate Directed Contract Quantities

The Regulatory Authorities will publish in the form of the table below the final Directed Contract quantities, by quarter and product, and separately for ESB PG and NIE PPB, by **14th April 2008**.

Quarter	<i>ESB PG Directed Contract Quantities</i>			<i>NIE PPB Directed Contract Quantities</i>		
	Baseload Quantity (MW)	Mid-Merit Quantity (MW)	Peak Quantity (MW)	Baseload Quantity (MW)	Mid-Merit Quantity (MW)	Peak Quantity (MW)
Q4 2008						
Q1 2009						
Q2 2009						
Q3 2009						

The Market Concentration Model will be used to determine the final Directed Contract quantities, using a target Herfindahl-Hirschman Index (HHI) set by the Regulatory Authorities. The mechanics of the Market Concentration Model are described in detail in the modelling section below.

4.1.3 Publication of the eligibility matrix for suppliers

The Meter Data Providers (in NIE and ESB Networks) will provide the Regulatory Authorities by **28th March 2008** with the Maximum Import Capacity (MIC) data that will, along with historical “deemed” average load by customer types, determine the final Directed Contract supplier eligibilities. The MIC data will be by supplier by customer type and will reflect a snapshot of maximum import capacity at a given date. The MIC data may be adjusted for any known pending customer supplier changes.

The Meter Data Providers will also provide half-hourly (or quarter-hourly) load data, aggregated by customer type (not by supplier) for 12 months. For non-half-hourly and non-quarterly-hourly metered customer classes, the Meter Data Providers will provide a load profile shape and total consumption for 12 months. The Regulatory Authorities will calculate “deemed” average load for each customer class from this load data—“deemed” average load is discussed further in the “Eligibility Model” section. The load shape data

may be obtained by the Regulatory Authorities well in advance of the receipt of MIC data.

Using MIC data and the historical load shape for each customer type, the Regulatory Authorities will create a matrix that specifies how the MW eligibility for each type of Directed Contract is derived for each supplier, given that supplier's MVA of MIC for each customer class.

Once the MIC data is adjusted as necessary, it will be input into the Eligibility Model that has a matrix of MW eligibility for each Contract for Difference type by customer class and the resulting final eligibilities by product and by quarter will be communicated by the Regulatory Authorities to the suppliers. The Regulatory Authorities will communicate to suppliers the final Directed Contract eligibilities in the form of the table below by **14th April 2008**.

As explained in the description of the Eligibility Model below, a supplier's eligibility for Directed Contracts with a given seller will simply be that supplier's total eligibility for Directed Contracts multiplied by that seller's share of Directed Contract quantities for a given product and quarter.

	<i>[Supplier Name] Eligibilities for Directed Contracts with ESB PG</i>			<i>[Supplier Name] Eligibilities for Directed Contracts with NIE PPB</i>		
Quarter	Baseload Quantity (MW)	Mid-Merit Quantity (MW)	Peak Quantity (MW)	Baseload Quantity (MW)	Mid-Merit Quantity (MW)	Peak Quantity (MW)
Q4 2008						
Q1 2009						
Q2 2009			n/a			n/a
Q3 2009			n/a			n/a

4.1.4 Publication of the Directed Contract pricing formula and indicative prices

The Regulatory Authorities will also publish the final pricing formula for Directed Contract transactions, along with indicative Directed Contract prices by **14th April 2008**.

Last year's final Directed Contract pricing formula was published in AIP-SEM-07-157. It expressed the forward electricity price (i.e., the strike price in the Contract for Differences Agreement) as a non-linear function of the forward fuel and carbon prices. The formula is reproduced below:

$$DCStrike_{q,p} = \alpha_{q,p} + \beta_{q,p} * NG_q + \gamma_{q,p} * LSFO_q + \delta_{q,p} * (NG_q * LSFO_q) + \epsilon_{q,p} * GO_q + \zeta_{q,p} * C_q + \eta_{q,p} * (NG_q * C_q)$$

The regression constants and coefficients are shown in the table below.

Contract (p)	Quarter (q)	Constant ($\alpha_{q,p}$)	Coefficients					
			Gas (NG) ($\beta_{q,p}$)	LSFO ($\gamma_{q,p}$)	Gas * LSFO ($\delta_{q,p}$)	Gasoil ($\epsilon_{q,p}$)	CO2 ($\zeta_{q,p}$)	Gas*CO2 ($\eta_{q,p}$)
Baseload	Nov-Dec '07	26.59	36.41	-0.03038	0.08980	0.01167	0.5113	0.0000
Mid-Merit	Nov-Dec '07	36.92	26.68	-0.03197	0.12235	0.01911	0.5642	0.0000
Peak	Nov-Dec '07	71.01	2.52	-0.04106	0.21422	0.01671	0.6863	0.0000
Baseload	Q1 '08	22.62	39.89	-0.02098	0.07911	0.00534	0.6116	0.0000
Mid-Merit	Q1 '08	35.62	28.58	-0.04534	0.14238	0.00837	0.6759	0.0000
Peak	Q1 '08	57.63	6.07	-0.06377	0.22704	0.01042	0.8091	0.0000
Baseload	Q2 '08	-7.74	93.70	0.02916	0.00000	0.00491	1.8875	-2.5902
Mid-Merit	Q2 '08	-15.45	117.55	0.04178	0.00000	0.00710	2.5229	-3.8053
Baseload	Q3 '08	1.68	76.71	0.02614	0.00000	0.00426	1.8866	-2.5262
Mid-Merit	Q3 '08	-2.73	94.04	0.03781	0.00000	0.00652	2.6006	-3.8148

It is anticipated that a formula of this form will be used to price the Directed Contracts this year. However, if it becomes apparent that this form is not satisfactory as the Directed Contract Pricing formula is developed, then a different form may be chosen.

Along with the formula, the Regulatory Authorities will publish indicative Directed Contract prices by mid-April. These indicative Directed Contract prices will be obtained by inputting recent forward fuel and carbon prices into the final Directed Contract pricing formula. They will be published in the form of the table below, or in similar form.

	<i>ESB PG Indicative Directed Contract Prices as of April __ 2008 [date of forward fuel price]</i>			<i>NIE PPB Indicative Directed Contract Prices* as of April __ 2008 [date of forward fuel price]</i>		
Quarter	Baseload Price (€/MWh)	Mid-Merit Price (€/MWh)	Peak Price (€/MWh)	Baseload Price (£/MWh)	Mid-Merit Price (£/MWh)	Peak Price (£/MWh)
Q4 2008						
Q1 2009						
Q2 2009			n/a			n/a
Q3 2009			n/a			n/a
<i>*The Directed Contract pricing formula specified by the Regulatory Authorities will be used to determine a price for each product and quarter denominated in €/MWh. NIE PPB Directed Contracts will be denominated in £/MWh. To arrive at the price for NIE PPB Directed Contracts, the €/MWh price obtained from the Regulatory Authorities' formula will be converted to £/MWh based on the exchange rate published by the European Central Bank. The exchange rate used will be for the same business day on which forward fuel prices were obtained.</i>						

The formula and formula coefficients used to set Directed Contract prices will be determined as a result of econometric analysis that will be performed in the coming months. The mechanics of this econometric analysis (“Econometric Pricing Model”) are described in the modelling section below.

4.1.5 Execution of Master Directed Contract for Differences Agreements

The Directed Contracts have been designed as Master Agreements. This allows all Directed Contract transactions to be governed under the same set of commercial terms and conditions. Each transaction executed during the initial Subscription Period (or Supplemental Subscription Period) will be recorded in the form of Schedule 6 and will become part of the Master Agreement. Schedule 6 specifies for a given transaction the quarterly prices at which the transaction is struck, the quantities applicable during each quarter, and the product definition (i.e., whether the transaction is baseload, mid-merit or peak).

The Master Agreements are executed in advance of the initial Subscription Period so that the commercial arrangements that will govern any transactions that are, at the election of the supplier, executed during the Subscription Period are in place. The rights

and responsibilities associated with transactions under the Master Agreement will not be triggered until transactions have been executed during the initial Subscription Period.

The Master Agreements will be executed this year by the Directed Contract sellers (ESB PG and NIE PPB) and eligible suppliers shortly before **28th April 2008**.

4.1.6 Subscription Period

Quantity Elections

This year the initial Subscription Period will run for the three weeks from Monday **28th April 2008** to Friday **16th May 2008**. On each day during the Subscription Period, suppliers will be able to elect to purchase a percentage of their eligibility for each product, subject to a maximum of 15 per cent or 15 MW, whichever is the greater. Unlike last year, suppliers will be able to elect for different percentages of their eligibility in each of the four quarters.

Supplier elections will be specified in a form similar to the table below and should be communicated to the sellers (ESB PG and/or NIE PPB) between 8:30am and 10am on a given election day. On a given day, a supplier must submit the same election percentages to ESB PG and NIE PPB if both are selling Directed Contracts.

<i>[Supplier Name]</i>				
<i>Directed Contract Election</i>				
<i>[Date]</i>				
	Q4 2008	Q1 2009	Q2 2009	Q3 2009
Baseload Percent of Eligibility	__%	__%	__%	__%
Mid-Merit Percent of Eligibility	__%	__%	__%	__%
Peak Percent of Eligibility	__%	__%	n/a	n/a

The eligibility percentage will be applied to that supplier's eligibility matrix to arrive at the MW quantities for each quarter and product to be included in Schedule 6 transaction confirmations. For example, assume the supplier has the following eligibilities.

	<i>[Supplier Name] Directed Contract Eligibilities</i>		
Quarter	Baseload Quantity (MW)	Mid-Merit Quantity (MW)	Peak Quantity (MW)
Q4 2008	200	100	100
Q1 2009	200	100	100
Q2 2009	100	50	50
Q3 2009	200	100	50

Assume also that the supplier makes the following election:

<i>[Supplier Name] Directed Contract Election [Date]</i>	Q4 2008	Q1 2009	Q2 2009	Q3 2009
Baseload Percent of Eligibility	15%	15%	5%	5%
Mid-Merit Percent of Eligibility	8%	5%	15%	15%
Peak Percent of Eligibility	5%	10%	-	-
<i>Note that suppliers need not elect the same percentage for each product. Different percentages for different products in different quarters may be elected.</i>				

The corresponding quantities to be included in the Schedule 6 transaction confirmations would be as follows:

	<i>[Supplier Name] Directed Contract Transaction Quantities for [date]</i>		
Quarter	Baseload Quantity (MW)	Mid-Merit Quantity (MW)	Peak Quantity (MW)
Q4 2008	30	8	5
Q1 2009	30	5	10
Q2 2009	5	7.5	-
Q3 2009	10	15	-

For the above example, a separate Schedule 6 transaction confirmation will be used for election for a given product for a given quarter. Since the supplier in this example elects to subscribe a percentage share of all three products (peak, mid-merit, and baseload)

across all four quarters, the supplier would need to execute ten Schedule 6 transaction confirmations, one for each product and each quarter.²

If both ESB PG and NIE PPB offer Directed Contracts, the election percentages will be applied to the supplier's eligibilities for both sellers. For example, assume the supplier has the following eligibilities:

	<i>[Supplier Name] Eligibilities for Directed Contracts with ESB PG</i>			<i>[Supplier Name] Eligibilities for Directed Contracts with NIE PPB</i>		
Quarter	Baseload Quantity (MW)	Mid-Merit Quantity (MW)	Peak Quantity (MW)	Baseload Quantity (MW)	Mid-Merit Quantity (MW)	Peak Quantity (MW)
Q4 2008	200	100	100	50	20	20
Q1 2009	200	100	100	50	20	20
Q2 2009	100	50	-	10	10	-
Q3 2009	200	100	-	50	20	-

And it makes the following election:

<i>[Supplier Name] Directed Contract Election [Date]</i>	Q4 2008	Q1 2009	Q2 2009	Q3 2009
Baseload Percent of Eligibility	15%	15%	5%	5%
Mid-Merit Percent of Eligibility	8%	5%	15%	15%
Peak Percent of Eligibility	5%	10%	-	-

If a supplier elects to purchase a percentage of its Directed Contract eligibility in a particular quarter, then it must elect to purchase the same percentage of its eligibility with ESB PG and NIE PPB in that quarter. The corresponding quantities to be included in the Schedule 6 transaction confirmations would be as follows:

² Note that peak products will not be available in the second and third quarters of 2009.

	[Supplier Name] Directed Contract Transaction Quantities with ESB PG for [date]			<i>[Supplier Name]</i> <i>Directed Contract Transaction</i> <i>Quantities with NIE PPB for [date]</i>		
Quarter	Baseload Quantity (MW)	Mid-Merit Quantity (MW)	Peak Quantity (MW)	Baseload Quantity (MW)	Mid-Merit Quantity (MW)	Peak Quantity (MW)
Q4 2008	30	8	5	7.5	1.6	1
Q1 2009	30	5	10	7.5	1	2
Q2 2009	5	7.5	-	0.5	1.5	-
Q3 2009	10	15	-	2.5	3	-

In this case, the supplier elects to subscribe a percentage share of the peak product, the mid-merit product and the baseload product with both sellers. Hence, the supplier will need to execute twenty Schedule 6 transaction confirmations, one for each product for each quarter for each seller.

The Regulatory Authorities will continue to set a cap on the quantities elected by a supplier *on any given day* during the Subscription Period. This cap is equal to the maximum of 15% or 15 MW, whichever is the greater.

The Directed Contract sellers will apply the cap as follows:

1. For each product type and each quarter, the Directed Contract sellers will calculate what percent 15MW is of the supplier's total eligibility – eligibility with ESB PG plus that with NIE PBB — in that quarter and for that product type. If eligibility is zero for a particular quarter and product type, then this percentage is not applicable for that quarter and product type. Each figure will be rounded to the nearest whole percentage point. An example is provided in the table below.

	<i>[Supplier Name] Directed Contract Eligibilities</i>			<i>[Supplier Name] 15 MW is this percent of Directed Contract Eligibilities (Rounded)</i>		
Quarter	Baseload Quantity (MW)	Mid-Merit Quantity (MW)	Peak Quantity (MW)	Baseload	Mid- Merit	Peak
Q4 2008	30	120	120	50%	13%	13%
Q1 2009	40	100	130	38%	15%	12%
Q2 2009	20	90	n/a	75%	17%	n/a
Q3 2009	20	50	n/a	75%	30%	n/a

2. Separately for each product type, the Directed Contract sellers will determine the lowest percentage of the quarterly percentages calculated in Step 1 above.
3. For each product type, the tentative maximum percentage the supplier can elect on any given day is the maximum of 15% and the percentage calculated in Step 2 above. Steps 2 and 3 are illustrated in the table below.

Product	<i>Minimum Percentage from Step 2</i>	<i>Applicable Maximum Percent Election (from Step 3)</i>
Baseload	38% (from Q1 2009)	Max of 15% and 38% is: 38%
Mid-Merit	13% (from Q4 2008)	Max of 15% and 13% is: 15%
Peak	12% (from Q1 2009)	Max of 15% and 12% is: 15%

Note that during the Subscription Period, suppliers cannot enter into transactions that exceed 100% of their eligibility in any product. Hence, the maximum daily election for a product is also constrained by previous elections for that product. For example, if a supplier has already subscribed 96% of its baseload eligibility, any additional elections of baseload transactions may not exceed 4% of eligibility during the Subscription Period.

Finally, the Regulatory Authorities specified last year that the elections will be subject to a minimum. The minimum quantity will be set equal to 1%. The same minimum will apply this year.

The Regulatory Authorities will also continue to require that all elections be made as whole number percentages. Elections seeking to transact for a fractions of a percentage point of eligibility will not be accepted.

Subscription Guidelines

The Directed Contract seller(s) will submit Subscription Guidelines to the Regulatory Authorities for approval each year not later than six weeks before the start of the subscription window (i.e., by **17th March 2008**). This document, when approved, will be issued to eligible suppliers a fortnight in advance of their notification of eligibility (i.e., on **31st March 2008**). The Subscription Guidelines will inform the eligible supplier of the subscription process and set out in detail its exact mechanics.

Strike Prices

The strike prices that apply to a given election are determined in accordance with the final Directed Contracts pricing formulae that will be published by the Regulatory Authorities by **14th April 2008**. These formulae convert forward fuel and carbon prices into forward electricity prices for each product and each calendar quarter. When a supplier elects to purchase a share of its Directed Contract eligibility, the strike prices for that purchase are the estimated electricity prices for the relevant product and quarters on the day that election is made, as determined by the Directed Contracts pricing formulae. In other words, the forward fuel and carbon price indices that are used to determine strike prices for a given transaction are those that are quoted on the day that the transaction is entered into.

Any supplier seeking to make an election during the Subscription Period will need to notify the seller between 8:30am and 10:00am on the day upon it wishes to enter into Directed Contract transactions for a percentage of its eligibility. The forward fuel prices used to price all transactions entered into on a given day will be the end-of-day forward fuel prices for that trading day. Hence, while the quantities transacted will be known by 10:00am, the corresponding prices will not be known until later that day or early the following day.

The Directed Contract sellers will provide the Regulatory Authorities with a close-of-day status report on transactions entered into on each day during the Subscription Period.

The status report will include the names of the suppliers entering into Directed Contracts, their eligibility and the details of each transaction (e.g., product type, quarterly quantities, strike prices). Furthermore, at the end of each business day within the Subscription Period, the Directed Contract sellers will notify suppliers by e-mail of the total cumulative MW quantity (by product and by quarter) subscribed for up to and including that date.

Sellers and buyers of Directed Contracts should note that if, between the time at which the pricing formulae were published and a time at which it is applied during the Subscription Period, forward fuel or carbon markets move to a point outside the range of values for which there is sufficient confidence in a particular pricing formula (e.g., if the performance of the formula was never tested at those relative index levels, or if it is known that the formula does not produce reasonable prices at those index levels), then the Regulatory Authorities reserve the right to suspend the subscription process and rerun the Econometric Pricing Model at that time, using the prevailing forward fuel and carbon prices as inputs. In this case, the resulting formula(e) would replace the original formula(e) and would be used to establish strike prices. The formulae may also be rerun if there is significant change to plant availability. The subscription window would reopen once the formula has been revised.

Notice of Unsubscribed Quantities

At the end of the initial Subscription Period, notice will be sent to suppliers who have taken 100% of their allocation of all Directed Contracts specifying the extent to which there are unsubscribed quantities for each type of product (baseload, mid-merit and peak) and each quarter.

4.1.7 Supplemental Subscription Period

The Supplemental Subscription Period will begin during the third week of May 2008 (i.e., on Tuesday **20th May 2008**) and end on **26th May 2008**.

The Supplemental Subscription Period is designed to give suppliers who have fully subscribed their eligibility during the initial Subscription Period an opportunity to enter into additional Directed Contract transactions. To be eligible to enter into Directed Contract transactions during the Supplemental Subscription Period, suppliers must have

subscribed 100% of their eligibility in all types of products (baseload, mid-merit and peak) and in all quarters. A supplier who is fully subscribed for baseload in three out of four quarters (say), but not fully subscribed for peak will not be permitted to make additional elections during the Supplemental Subscription Period. Each supplier who is eligible to make elections in the Supplemental Subscription Period will have an eligibility equal to the entire quantity of remaining contracts in each quarter. This ensures that if only one supplier wishes to subscribe to Directed Contracts in the Supplemental Subscription Period, then all remaining Directed Contracts may be subscribed to. When all the directed contracts assigned to ESB PG and NIE PPB are subscribed to, then no further subscriptions can be made – even if suppliers may notionally have eligibility remaining in the Supplemental Subscription Period.

New entrant suppliers who are granted a supply licence in the period to mid-May 2008 and who are not affiliated with any existing market participant will also be allowed to participate in the Supplemental Subscription Period. Such suppliers will have a maximum entitlement based on their MIC as measured one week prior to the start of the Supplemental Subscription Period. Their eligibility will be calculated using the Eligibility Model and their elections will take the form of existing supplier elections. New entrants will need to execute the Directed Contracts prior to the first day of the Supplemental Subscription Period. New entrants will only be entitled to subscribe for Directed Contracts if the contracts are not fully subscribed during the initial Subscription Period.

Quantity Elections

Suppliers making quantity elections during the Supplemental Subscription Period will be required to do so in the same manner in which the elections were made during the initial Subscription Period. Specifically, the elections must contain the data that is presented in the table below and must be communicated to the seller(s) between 8:30am and 10:00am on the transaction day.

[Supplier Name] Directed Contract Election during Supplemental Subscription Period [Date]	Q4 2008	Q1 2009	Q2 2009	Q3 2009
Baseload Percent of Eligibility	__%	__%	__%	__%
Mid-Merit Percent of Eligibility	__%	__%	__%	__%
Peak Percent of Eligibility	__%	__%	n/a	n/a

Further, as was the case during the initial Subscription Period:

- Supplier elections will be subject to a minimum of 1%.
- Supplier elections will be subject to a maximum of 15% or 15MW.
- Supplier elections must be specified as whole number percentages.

If the available Directed Contract quantities for a given product are oversubscribed as a result of multiple suppliers' electing the same transaction on the same day during the Subscription Period, those suppliers' elections will be scaled down on a *pro rata* basis until 100% of the available Directed Contract quantities are subscribed.

The Directed Contract sellers will provide the Regulatory Authorities with a close-of-day status report on transactions entered into on each day during the Supplemental Subscription Period. In addition, at the end of each business day within the Supplemental Subscription Period, Directed Contract sellers will notify suppliers by e-mail of the total cumulative MW quantity (by product and by quarter) of Directed Contract subscribed for up to and including that date.

4.2 Monthly Review of Supplier Eligibility

The Regulatory Authorities will monitor supplier MICs on a monthly basis to ensure that suppliers are not opportunistically putting load back on the PES on a seasonal basis to take advantage of seasonal differences in the cost of serving load; or taking advantage of a fixed PES tariff that does not change with market conditions and arranging to return customers to the PES and profiting from the Directed Contract.

If the Regulatory Authorities so elect, they may reduce the MW quantities that that supplier has under Directed Contracts to the extent there has been a material reduction in customer load served by the supplier. The intent of the Regulatory Authorities is that the quantity reduction is strictly an anti-gaming measure. It will therefore only be triggered if there is evidence of gaming, and not in other circumstances. To clarify, a reduction in contract volumes is subject to the following conditions:

- A 20% MIC reduction;
- All the 20% MIC reduction must go to the PES(s);
- ESBPG and/or NIE PPB will be advised of the potential reduction and their opinion will be sought on whether to reduce volumes (based on their exposure under the contract);
- Where a seller consents to a reduction the PES(s) will be offered the volume taken from the gaming supplier.

The first assessment of quantity reduction will be conducted before the contract start date to be effective with the contract start date, where the meter data day and the contract start date are more than a month apart.

5 Directed Contract Implementation Models

As noted, several models were developed as part of the market power work stream and continue to be available to the implementation team. The models are as follows:

- (1) **Production Simulation Model (PLEXOS).** Directed Contracts will be priced based upon a forecast of SMPs. This will be performed with a production simulation model. The Regulatory Authorities intend to continue to use PLEXOS. A validated PLEXOS model is a key input to other models used to determine the quantities and prices of Directed Contracts. The Market Concentration Model and Econometric Pricing Model In particular will require input data developed from the validated production simulation model. The Regulatory Authorities have now initiated a project to validate PLEXOS against the outputs of the MSP software and against historical technical and commercial offer data to ensure that PLEXOS can adequately replicate the half hourly market schedule quantities and SMPs that have been produced since the SEM began on 1st November 2007.
- (2) **Market Concentration Model.** This model determines the quantity of Directed Contracts that will be required to mitigate the market power of ESB PG and NIE PPB.
- (3) **An Eligibility Model.** This model takes Maximum Import Capacity (MIC) data and historical load and energy data from the Meter Data Providers and output from the market concentration model, and produces tables of directed contract eligibility by supplier. The model takes as an input half-hourly and/or quarter-hourly load data aggregated by customer type in order to determine MW eligibilities for each type of Directed Contract (baseload, mid-merit, peak) for each load group.
- (4) **Econometric Pricing Model.** This model creates the Directed Contract Pricing Formulae that specify the strike prices for Directed Contract transactions as a function of forward fuel and carbon prices. The Directed Contract Pricing Formulae are designed to determine for each quarter a unique price for baseload transactions, mid-merit transactions and peak transactions. The

Econometric Pricing Model uses PLEXOS outputs, from a variety of bounding fuel price scenarios as an input.

- (5) **A PLEXOS interface model.** This model is used to interface between PLEXOS and the Market Concentration and the Econometric Pricing Models to ensure smooth transfer of data and accuracy of results.

Each model, with the exception of the PLEXOS production simulation model, is described in turn below.

5.1 Market Concentration Model

The Market Concentration Model ("Concentration Model") calculates the quantity of Directed Contracts that ESB PG and NIE PPB will be required to make available to eligible suppliers. The Directed Contract quantities are set such that market concentration in the SEM (as calculated by the model) is below a certain Herfindahl-Hirschman Index (HHI) threshold. HHI is a tool used by economists to measure concentration. The HHI index is equal to the sum of the squares of the market shares of firms in the industry. The maximum value for HHI in an industry in which a single firm has 100 percent of the market is therefore 10,000. The HHI threshold used in 2007 in setting the Directed Contract was 1,150. The Regulatory Authorities reserve the right to choose a different threshold HHI in 2008.

The market share calculations that underlie the HHI analysis in the Concentration Model are based on potentially competitive capacity. The "market" in the model is defined as the total amount of capacity that is relevant to competition in any given hour. Potentially competitive capacity – that capacity that is relevant to competition – is calculated half hourly for the various generation owners based on the cost of each generation owner's units. In a given half hour, a unit's capacity is considered potentially competitive so long as its cost is less than or equal to $SMP * (1.05)$. Further, wind and hydro units, as well as imports over the Moyle interconnector, have custom criteria in the Concentration Model to determine their quantity of potentially competitive capacity. Units that have no incentive to raise the market price are treated as fully competitive supply in the HHI calculation.

In the Concentration Model, capacity under Directed Contract is treated as fully competitive supply since this capacity would not benefit directly from increases in market price. In effect, the capacity under Directed Contract is treated like a large number of very small competitors, and this is how Directed Contracts lower the HHI of the SEM. Directed Contracts are allocated in gradual steps to ESB PG and NIE PPB, with each marginal allocation given to the company with the largest residual market share – that is, the largest market share after allocated Directed Contract volumes have been subtracted. Directed Contracts are allocated until the HHI is reduced below its target level.

As a first step, the Concentration Model determines Directed Contract quantities for ESB PG and NIE PPB by product type (baseload, mid-merit, and peak) for each month. Quarterly Directed Contract quantities are determined in the Concentration Model to be the maximum monthly Directed Contract quantity occurring in that quarter.

5.1.1 How the Model Works

The Concentration Model calculates Directed Contract quantities for ESB PG and NIE PPB, using an HHI approach. Market share is calculated based on each generation owner's potentially competitive capacity.

The Concentration Model relies on PLEXOS inputs and outputs. Hence, a validated PLEXOS model is required before the Concentration Model can be used.

Baseload, Mid-Merit and Peak Products

Directed Contract allocations to ESB PG and NIE PPB are determined separately for peak, mid-merit, and baseload products, and are initially determined separately for each month.

Note that there are two uses for the terms “peak”, “mid-merit” and “baseload” with respect to the Directed Contracts themselves and with respect to the Concentration Model:

- The terms “peak”, “mid-merit”, and “baseload” are defined terms in the Directed Contracts. In this context, they describe the hours in which a given transaction will

apply. For example, if the transaction is a peak transaction, it will only apply in those hours that are defined to be peak hours in the Directed Contract.

- For purposes of calculating Directed Contract quantities, the Concentration Model designates each hour of the year as being one (and only one) of baseload, mid-merit, and peak. The hours that are exclusively baseload are designated as such in the Concentration Model. Hours that would be considered both baseload and mid-merit, but not peak, in the Directed Contract are considered for modelling purposes as exclusively mid-merit. Hours that would be considered baseload, mid-merit and peak in the Directed Contract are considered for modelling purposes as exclusively peak. The practical result of this is that each load period is treated independently – concentration in mid-merit and peak hours does not affect the calculation of baseload Directed Contract quantities.

The definitions of baseload, mid-merit, and peak for purposes of calculating Directed Contract quantities will be consistent with the 2008 definitions set out in Section 3 above, namely:

- **Peak.** In the Winter months (October to March, inclusive) there will be four peak hours per day in the Concentration Model: the hours that fall between 17.00 and 21.00. In the Spring, Summer and Autumn months (April to September, inclusive) there are zero peak hours per day. The peak Directed Contract product applies in these same peak time periods.
- **Mid-Merit.** In the winter months (October to March, inclusive) there are twelve mid-merit hours per day in the Concentration Model: the ten hours that fall between 07.00 and 17.00 plus the two hours that fall between 21.00 and 23.00. In the summer months (April to September, inclusive) there are sixteen mid-merit hours per day: the hours that fall between 07.00 and 23.00. In contrast, the mid-merit Directed Contract product applies in both peak and mid-merit hours, with mid-merit Directed Contract product set to 100% of the mid-merit Directed Contract MW on business days and 80% on non-business days.

- **Baseload.** There are eight baseload hours every day in the Concentration Model: the seven hours that fall between midnight and 07.00 plus the one hour between 23.00 and midnight. In contrast, the baseload Directed Contract product applies in all hours – peak, mid-merit, and baseload.

Step-By-Step Procedure to Determine Directed Contract Quantities

The initial monthly Directed Contract quantities are calculated for ESB PG and NIE PPB as follows:

- 1) The aggregate market share of each of each generation owner is calculated in each baseload half-hour.³ Aggregate market share for generation owners is based on their total potentially competitive capacity. .
- 2) The HHI is calculated in each baseload half-hour for the generation ownership market shares calculated in the step above. An average baseload HHI is then calculated for the month as the simple average of all the baseload half-hour HHIs in the month. Any Directed Contract quantity a company has already been allocated is excluded from the numerator in the calculation to determine that company's HHI contribution – that is, Directed Contracts are “atomised”.⁴
- 3) If the monthly average baseload HHI calculated in the previous step exceeds a threshold level, Y, ESB PG or NIE PPB – whichever has the highest baseload market share in that month – is allocated 1% of that company's monthly average baseload market share, as calculated in Step 1, as a Directed Contract quantity. In determining the company with the largest baseload market share in that month, Directed Contract quantities already allocated to ESB PG and NIE PPB are first subtracted from their monthly average baseload market share.
- 4) Steps 2 & 3 are repeated, until the monthly average HHI first falls to Y or less. The baseload Directed Contract quantities determined at this point are the final baseload Directed Contract quantities for that month. The baseload Directed

³ In this context, baseload, mid-merit, and peak hours are mutually exclusive.

⁴ In this context, “atomised” means that this capacity is in effect split up into many very small pieces to be owned by a very large number of companies. In practice, atomized capacity only appears in the denominator of the HHI calculation.

Contract apply in all hours – baseload, mid-merit, and peak – though they are determined based on baseload-hour HHIs alone.

- 5) Steps 1 to 4 are repeated, this time for mid-merit hours. Note that mid-merit contracts are applied at reduced MW amounts on non-business days, compared to business days, currently an 80% reduction in the Model. For every 1% Directed Contract allocation on business days, allocation for non-business days is 0.8%. Baseload Directed Contract quantities calculated in Step 4, as well as any already determined mid-merit Directed Contract quantities, are allocated before making the mid-merit HHI calculation in Step 2. The mid-merit Directed Contracts apply in mid-merit and peak hours, though they are determined based on mid-merit-hour HHIs alone.
- 6) Steps 1 to 4 are again repeated, this time for peaking hours. Baseload and mid-merit Directed Contract quantities calculated in step 4 & 5, as well as any already determined peak Directed Contract quantities, are allocated before calculating the peak HHIs in Step 2.
- 7) The directed contract quantities (in MW) allocated to ESB PG and NIE PPB for each of the three product types and in each month are reported in a summary table.

How the Concentration Model Measures the Contribution of Capacity Resources to Market Share

As discussed above, a generation owner's market share is based on each generation owner's potentially competitive capacity. The calculation is as follows. For thermal units, a unit's capacity is considered "potentially competitive capacity" in a particular hour so long as that unit's cost/MWh is less than or equal to $(1.05) * SMP$.

- The SMP used will be SMP inclusive of uplift.
- Consider an SMP (with uplift) of €50.00/MWh. Then the threshold for units is €52.50/MWh.

- A unit's cost/MWh is its average cost. Average cost is calculated quarterly based on cost and generation outputs from PLEXOS. The costs considered are generation costs and start-up costs, inclusive of the opportunity costs of carbon emissions.

The Regulatory Authorities decided in December 2006 that “energy limited resources such as hydro, pumped hydro and wind will be recognised considering their energy limits and maximum production.”⁵ This rule is applied in practice in the Market Concentration Model as follows:

- Hydro, including Pumped Storage. In a given half-hour, the amount of hydro capacity that is considered available is simply the amount of half-hydro that actually generated in the PLEXOS run associated with the Market Concentration Model run.
- Wind. Wind capacity is treated the same as traditional hydro, i.e., actual PLEXOS generation.

Additionally, the potentially competitive capacity due to the Moyle interconnector is in every half-hour set equal to the maximum level of purchases into the SEM over the Moyle.

Exclusion of Units that do not Benefit from Execution of Market Power

As decided in *Directed Contract Quantification Methodology Decision Paper* (AIP/SEM/208/06) published on 8th December 2006, units that because of regulation do not benefit from the execution of Market Power are excluded from the HHI calculation (see pp. 16-19). The units excluded from the HHI calculation are the three peat units: West Offaly, Lough Ree, and Edenderry. These units will be atomised – meaning they will be included in the denominator but not the numerator of the HHI calculation. Tynagh, Aughinish and NIE PPB will be included in the HHI calculation.

Ownership Groups for the HHI Calculation

The following ownership groupings are considered in the Concentration Model:

- ESB PG – separate from affiliates, as decided in AIP/SEM/208/06 (p. 16);

⁵ *Market Power Mitigation in the SEM: Directed Contract Quantification Methodology: Decision Paper* [AIP/SEM/208/06], page 20.

- NIE PPB – separate from affiliates, as decided in AIP/SEM/208/06 (p. 16);
- ESBI units and Hibernian – as decided in AIP/SEM/208/06 (p. 16). In practice this means that Synergen’s Dublin Bay plant and ESBI’s Coolkeeragh CCGT units as well as Hibernian Wind units are treated as one generation grouping;
- Huntstown and Huntstown II as one grouping;
- Aughinish (an ownership group of one unit);
- Tynagh (an ownership group of one unit);
- Wind units not owned by Hibernian. It is assumed in the Concentration Model that the output from these units is divided equally between five different generation owners. While this is an approximation, it is reasonable for the purposes of calculating market concentration;⁶
- The Moyle interconnector – Moyle is atomised, as decided in AIP/SEM/208/06 (p. 19);
- The three peat PSO units are also atomised, as stated above.

Calculation of Quarterly Volumes

The Directed Contract volumes that will ultimately be required are set quarterly. The Concentration Model calculates quarterly volumes by taking the maximum of the monthly volumes. The Concentration Model calculates the quarterly maximum volumes for each quarter and product type.

Where Input Data Comes From

All input data for the Concentration Model come from the PLEXOS input and output databases. In general terms,

- The price series that determines whether a unit is “potentially competitive capacity” is half hourly SMP inclusive of uplift, from PLEXOS output data;

⁶ The model takes in total wind generation as an input and divides that generation between Hibernian and non-Hibernian wind units in proportion to the total capacities of the Hibernian and non-Hibernian wind units.

- The unit costs are average costs, inclusive of generation, start-up, and emissions cost, as calculated from PLEXOS output data;
- Unit capacities are from PLEXOS input data;
- Wind and hydro half hourly generation patterns are from PLEXOS output data.

5.2 Eligibility Model

Each supplier with Directed Contract eligibility has an eligibility calculated separately for each quarter and each product-type – peak, mid-merit, and baseload. The calculations are performed in a simple MS Excel model.

5.2.1 Eligibility Matrix

The first step is to fill in the Eligibility Matrix. This Matrix establishes, by customer class, Directed Contract eligibility per MW of MIC, calculated separately by quarter and Directed Contract product. For example, one MW of MIC serving the Industrial Customer Class might translate into eligibility in Q1 2009 of 0.05 MW of baseload Directed Contract, 0.04 MW of mid-merit Directed Contract and 0.06 MW of peak Directed Contract. The Eligibility Matrix is calculated as follows.

- Step 1: Start with the total MW of Directed Contract, by quarter and product type, that ESB PG and NIE PPB are required to make available, as calculated by the Concentration Model.
- Step 2: Across all suppliers, the total MW of Directed Contract eligibility due to a customer class is calculated separately for each quarter and product type. For example, the calculation for the Q1 2009 peak Directed Contract eligibility due to the domestic customer class is calculated as follows. Start with the Q1 SEM Peak Directed Contract MW from Step 1; multiply by the Q1 “deemed” average peak-hour load for the domestic customer class; divide by the Q1 “deemed” average peak-hour load for all customer classes.^{7 8}

⁷ Deemed average load for a customer class is the average of a year of historical load data for that class, constructed as follows. For classes that are not metered in quarter-hourly or half-hourly

- Step 3: Start with the total Directed Contract MW eligibility by quarter and product due to a particular customer class, as calculated in Step 2. Divide by the total MW MIC for that class.

The Eligibility Matrix is made from the ratios calculated in Step 3.

5.2.2 Directed Contract Eligibility by Supplier

The Eligibility Matrix is used to calculate a supplier's Directed Contract eligibility. Directed Contract eligibility for the supplier is calculated for each customer class to which a supplier supplies power. This quantity is a simple multiplication:

[Directed Contract MW / MW of MIC, from the Eligibility Matrix, for that customer class, quarter, and Directed Contract Product] * [The customer class's MIC from the supplier]

The supplier's Directed Contract eligibility is the sum of its eligibilities due to the various customer classes it serves. The sum is performed separately by quarter and product type.

5.2.3 MVA vs. MW

MIC is measured in MVA. The Regulatory Authorities have previously decided to convert MVA to MW for the purposes of allocation. The preceding description assumes that MIC numbers were converted.

5.2.4 If Both ESB PG and NIE PPB Are Allocated Directed Contract

A supplier's total eligibility is calculated based on the sum of ESB PG and NIE PPB's Directed Contract quantities – summed by quarter and product type. A supplier's eligibility is split between ESB PG and NIE PBB based on their relative proportion of the total Directed Contract Quantities by quarter and product type.

increments, a year of load data is built by multiplying that class's load profile shape for the year by its total consumption for the year. For customer classes that are metered quarter-hourly or half-hourly, their actual consumption by period is used.

8 For the calculation of "deemed" average load by load-period type, each hour is designated as one (and only one) of baseload, mid-merit, and peak. The designations should be the same ones used to calculate Directed Contract Quantities in the Market Concentration Model (see discussion in the section on that model).

5.2.5 Data Sources

- The total Directed Contract Quantities for the entire SEM are the sum of the Directed Contract quantities for ESB PG and NIE PPB as determined in the Concentration Model
- A year of half-hourly load by customer class comes from the Meter Data Provider.
- MIC data for each customer class for each supplier comes from the Meter Data Providers.

5.3 Econometric Pricing Model

The pricing formulae that the Regulatory Authorities have chosen for Directed Contracts recognises that forward market prices for electricity are dependent on forward market prices for fuel and emissions (specifically, CO₂). This Directed Contract pricing formula expresses the forward market price for electricity in a given calendar quarter and for a given product (baseload, mid-merit or peak) as a function of the forward fuel and emissions prices. This approach to pricing ensures that the strike prices for Directed Contract transactions entered into during the initial and Supplemental Subscription Period will appropriately reflect the contemporaneous market prices of fuel and emissions markets.

The Econometric Pricing Model is used to estimate the relationship between fuel and carbon prices and electricity prices and hence to derive the Directed Contract pricing formula. The Econometric Pricing Model is complementary to PLEXOS, which also analyses the relationship between fuels and carbon prices and electricity prices.

The Directed Contract pricing formula enables participants to understand how Directed Contract strike prices will change within the Subscription Period as a result of changes in underlying fuel and carbon prices. The Directed Contract pricing formulae will represent a view of price formation that is appropriate for establishing forward contract prices.

5.3.1 Derivation of the Directed Contract pricing formula from the Econometric Pricing Model

The derivation of the Directed Contract pricing formulae comes from a set of regressions. The dependent variable in these regressions is mean SMP; the relevant independent variables are fuel and emission cost inputs. The regression will be run on pseudo data, i.e., a number of runs of the model at a variety of conditions will be run to give the regression the necessary variation to yield, after linear regression, proper conditional prices which reflect the mean SMP under different input price conditions. Mean SMPs are calculated by quarter and product type – with the means being weighted averages with weights to match the delivery requirements for each product type.

The results of the regression will allow the Regulatory Authorities to publish the regression formulae coefficients, as shown in the table in Section 4.1.4 above. To the extent that analysis of the relevant data implies that a different formula is appropriate, then the parameters specified will change.

5.4 PLEXOS Interface Model

Both the Market Concentration Model and the Econometric Pricing Model require input data from PLEXOS runs in order to produce their results.

5.4.1 PLEXOS Interface with Market Concentration Model

The Market Concentration Model (or simply Concentration Model) requires the following inputs from PLEXOS:

- 1) Half hourly SMP Prices
- 2) Half hourly aggregate generation for Wind and Hydro
- 3) Average Costs/MWh for each unit
- 4) Unit capacities. If a unit is to come on-line or will retire mid-contract year, that should be noted as well.

The last item, unit capacities and any changes in on-line status, come from PLEXOS input data. All the other items come from PLEXOS output data. SMP prices and hydro & wind generation are simply copied and pasted into the Concentration Model. The calculation of average costs/MWh for each unit requires manipulation of PLEXOS outputs. Average costs include start-up and “generation costs”, the latter of which include no-load costs. All costs include emissions taxes. Average costs are calculated as a unit’s total generation and start-up costs in a quarter divided by its total generation in that quarter. These quarterly averages are inputted into the Concentration Model.

5.4.2 PLEXOS Interface with Econometric Pricing Model

The Econometric Pricing Model is a regression model, where the dependent variable is average SMP in the SEM. The SMP data come from PLEXOS. There are ten regressions to forecast average SMP prices by quarter for each Directed Contract (Directed Contract) product type (bearing in mind that there are no peak products in Q2 and Q3 2009). The interface works as follows.

- 1) Start with a series of indicative price combinations of: Natural Gas, Coal, Gasoil, LSFO, and Carbon. These indicative prices are hypothetical combinations of the index prices that will ultimately set the strike prices of the Directed Contract.
- 2) Each combination of index prices must be translated into PLEXOS input fuel and carbon prices for the units in the SEM.
- 3) PLEXOS is run for each combination of hypothetical prices. The hourly SMPs are the relevant outputs.
- 4) For each series of SMP outputs, calculate ten relevant average SMP prices. The ten prices are the weighted average SMPs for each quarter and Directed Contract product. The weights match how Directed Contract products are applied.
 - a. Baseload products have an equal weight in all hours.
 - b. Mid-Merit products have an equal weight in all mid-merit & peak hours on business days, but have a uniformly reduced weight in those same

periods on non-business days. The non-business day weight is 80% of the business day weight. Mid-merit products have no weight in hours that are not mid-merit or peak hours.

- c. Peak products have an equal weight in all peak hours, and zero weight in all other hours.

The ten regressions are run with the following data. The independent variables are the hypothetical index-fuel-price combinations from Step 1). Note that, within a quarter, the same index values are used in each of the baseload, mid-merit, and peak regressions. The dependent variables are the associate average SMPs calculated in Step 4). The regressions may be expanded if it is found that reflecting fuel price relationships as independent variables significantly reduces that standard error and its variance.