Single Electricity Market Committee

Directed Contracts 2008/09 Quantification and Pricing Decision Paper

15 April 2008

SEM-08-051

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I. INTRODUCTION

An integral part of the development of the Single Electricity Market (SEM) has been the development of a Market Power Mitigation Strategy to ensure that the benefits associated with the SEM are not undermined by the abuse of market power. To that end the Commission for Energy Regulation and the Northern Ireland Authority for Utility Regulation ("the Regulatory Authorities" or "RAs") have jointly developed a strategy to mitigate market power in the SEM.

A fundamental part of this strategy is the implementation of a suite of Directed Contracts ("DCs"), the purpose of which is to remove the incentives on the incumbent generators to attempt to profit from the exertion of market power. These contracts will mitigate market power by reducing the incentive for the market participants to submit bids above competitive levels, or otherwise withhold capacity, to influence current spot prices or future contract prices. The contracts are a cornerstone of the market power mitigation plan and provide the opportunity and ability to place greater reliance on competitive forces.

This Decision Paper from the SEM Committee[1] reports on the results of the RAs' implementation of the quantification and pricing methodologies for DCs. The quantities and pricing formulae will apply to the DCs with a term from 1st October 2008 to 30th September 2009.

The methodologies that the RAs have adopted were consulted on at length and in detail with the industry throughout the All Island Project (AIP). Of particular relevance to the detailed methodologies underpinning the pricing, quantification and allocation of DCs are the following papers which were published on the AIP website (www.allislandproject.org):

- Market Power Mitigation in the SEM - Directed Contracts: Price, Form and Allocation, 21st June 2006, AIP/SEM/66/06

[1] The SEM Committee is established in Ireland and Northern Ireland by virtue of section 8A of the Electricity Regulation Act 1999 as inserted by section 4 of the Electricity Regulation (Amendment) Act 2007, and Article 6 (1) of the Electricity (Single Wholesale Market) (Northern Ireland) Order 2007 respectively. The SEM Committee is a Committee of both CER and NIAUR (together the Regulatory Authorities) that, on behalf of the Regulatory Authorities, takes any decision as to the exercise of a relevant function of CER or NIAUR in relation to a SEM matter.

- Market Power Mitigation in the SEM - Directed Contracts: Price, Form and Allocation: Decision Paper, 8th September 2006, AIP/SEM/115/06

- Market Power Mitigation in the SEM - Directed Contracts: Price, Form and Allocation: Supplemental Decision Paper, 3rd November 2006, AIP/SEM/165/06

- Market Power Mitigation in the SEM: Directed Contract Quantification Methodology Consultation Paper, 22nd September 2006, AIP/SEM/244/06

- Market Power Mitigation in the SEM: Directed Contract Quantification Methodology Decision Paper, 8th December 2006, AIP/SEM/208/06

The RAs have also consulted with the industry on the implementation of the 2008/09 DC process with a view to improving and building on the process pursued in 2007. A number of amendments were made to the subscriptions process, the details of which can be found in the following papers:

- Market Power Mitigation in the SEM: Directed Contract Implementation Report (Consultation Paper), 5th February 2008, SEM-08-02

- Directed Contract Implementation Report: A Response and Decision Paper, 13th March 2008, SEM-08-020

- Master Contract for Differences Agreement, 4th April 2008, SEM-08-048

- ESB Power Generation Directed Contract Subscription Rules, 3rd April 2008, SEM-02-047

II. SUMMARY OF DIRECTED CONTRACT IMPLEMENTATION RESULTS

There are three elements to the RAs' work on the implementation of Directed Contracts (DCs). These are the quantification of the DCs required to mitigate market power in the SEM; the pricing of DCs; and the eligibility of suppliers in the SEM to subscribe to DCs.

– **Quantity of Directed Contracts**

For the purpose of determining DC quantities a HHI (Herfindahl-Hirschman Index) level of 1,150 was considered appropriate for the first year of the SEM. The SEM Committee has again decided to set this year's threshold at 1,150. At this HHI level both ESB Power Generation (ESB PG) and NIE Power Procurement Business (NIE PPB) will be required to sell DCs. The quantities of DCs which ESB PG and NIE PPB will be required to make available to eligible suppliers during the subscription windows are shown below. It is important to note that the definitions of mid-merit and peak have changed since the equivalent exercise last year. The mid-merit product now applies during the hours beginning at 07:00 and ending at 23:00; and the peak product now applies during the hours beginning at 17:00 and ending at 21:00 in the fourth and first quarters of the year.

	ESB PG			**NIE PPB**		
	Directed Contract Quantities			**Directed Contract Quantities**		
Quarter	**Baseload Quantity (MW)**	**Mid-Merit Quantity (MW)**	**Peak Quantity (MW)**	**Baseload Quantity (MW)**	**Mid-Merit Quantity (MW)**	**Peak Quantity (MW)**
Q4 2008	244	135	460	0	0	0
Q1 2009	280	36	489	0	0	0
Q2 2009	237	110	n/a	0	107	n/a
Q3 2009	132	223	n/a	0	233	n/a

– **Pricing of Directed Contracts**

The prices of directed contracts will be determined each day during the subscription period using the regression formulae as determined by the RAs through econometric analysis. The constants and coefficients of the pricing formulae are presented in the table below.

The regression formulae for the calculation of the DC strike prices take the following form:

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

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

			Coefficients				
			Multiply Gas Coefficient by Euros/therm Gas Price and all other coefficients by Euros/tonne fuel or Euros/tonne C02 Price. The Gas * LSFO coefficient should be multiplied by the product of the gas price and LSFO price.				
Contract (p)	**Quarter (q)**	**Constant ($\alpha_{q,p}$)**	**Gas (NG) ($\beta_{q,p}$)**	**LSFO ($\gamma_{q,p}$)**	**Gas * LSFO ($\delta_{q,p}$)**	**Gasoil ($\varepsilon_{q,p}$)**	**CO2 ($\zeta_{q,p}$)**
Baseload	Q 4 '08	7.54	66.14	0.00768	0.00000	0.00435	0.5037
Mid-Merit	Q 4 '08	7.47	71.08	0.02085	0.00000	0.00613	0.5449
Peak	Q 4 '08	106.01	-15.01	-0.20394	0.30136	0.01694	0.7040
Baseload	Q1 '09	9.27	65.82	0.00627	0.00000	0.00311	0.4843
Mid-Merit	Q1 '09	9.42	71.32	0.01787	0.00000	0.00484	0.5209
Peak	Q1 '09	78.11	11.25	-0.13103	0.20820	0.02128	0.6699
Baseload	Q2 '09	13.27	55.67	0.00391	0.00000	0.00066	0.7047
Mid-Merit	Q2 '09	16.71	58.16	0.00715	0.00000	0.00112	0.7897
Baseload	Q3 '09	15.64	56.08	0.00254	0.00000	0.00115	0.6836
Mid-Merit	Q3 '09	19.76	57.95	0.00832	0.00000	0.00193	0.7802

Again, the details of how the daily calculation of the strike price for that day's DC subscription can be found in SEM-08-02.

- **Supplier Eligibility**

Using supplier MIC data and historical energy and load shape for each customer type the RAs have calculated the MW eligibility for each type of DC for each supplier for each of the DCs being offered by ESB PG and NIE PPB, given that particular supplier's MVA of MIC for each customer class. Suppliers' MICs will be monitored on a monthly basis by the RAs to ensure that suppliers are not opportunistically putting load back onto the incumbent suppliers, NIE Energy and ESB Customer Supply, on a seasonal basis to profit from DCs.

Supplier eligibility will be communicated to each supplier and to the DC sellers (ESB

PG and NIE PPB) separately.

III. DIRECTED CONTRACT QUANTITIES

Directed Contracts will be offered in quarterly segments for the period 1st October 2008 to 30th September 2009. There are three DC products in the market: Baseload, Mid-Merit and Peak. Suppliers can elect to subscribe for any given product in any particular quarter (unlike last year when a supplier had to elect to subscribe for a given product across the whole eleven months) from either ESB PG or NIE PPB or both. The definitions of the products are set out in the Master Agreement. These are as follows:

- Baseload Product: For Trading Periods at the Contract Quantity arising in all hours.
- Mid-merit Product: For Trading Periods at the Contract Quantity during the hours beginning at 07:00 and ending at 23:00 on Business Days and for Trading Periods on days that are not Business Days at 80% of the Contract Quantity.
- Peak: For Trading Periods arising during the hours beginning at 17:00 and ending at 21:00 on all days during, October, November, December, January, February and March at the Contract Quantity.

In the Quantification Methodology Decision Paper (AIP/SEM/208/06) the RAs committed to using concentration measures as a means of assessing market power in the SEM, and specifically on the Herfindahl-Hirschman Index (HHI), to set DC quantities. The RAs also stated that they would select a HHI in the range of 1,000 to 1,500 and it was anticipated that a threshold of between 1,000 to 1,250 would be appropriate.

The SEM Committee have decided to continue to use a target HHI level of 1,150. This HHI level is an input into the concentration model which is used to determine the DC allocations to ESB Power Generation (ESB PG) and NIE Power Procurement Business (NIE PPB) for each product by reducing monthly HHI levels to the target of 1,150. The concentration model relies on the inputs and outputs of the validated market simulation model, PLEXOS. These include half-hourly System Marginal Prices (SMPs), generation average unit costs, unit capacities etc.. The concentration model is described in detail in the Directed Contract Implementation Report (SEM-08-02).

ESB PG and NIE PPB are required to have DCs imposed on them in order to reduce the market's HHI level to the target of 1,150. The DC quantities are set out below.

	ESB PG			NIE PPB		
	Directed Contract Quantities			Directed Contract Quantities		
Quarter	**Baseload Quantity (MW)**	**Mid-Merit Quantity (MW)**	**Peak Quantity (MW)**	**Baseload Quantity (MW)**	**Mid-Merit Quantity (MW)**	**Peak Quantity (MW)**
Q4 2008	244	135	460	0	0	0
Q1 2009	280	36	489	0	0	0
Q2 2009	237	110	n/a	0	107	n/a
Q3 2009	132	223	n/a	0	233	n/a

IV. DIRECTED CONTRACT PRICING

The prices of Directed Contracts are determined by regression formulae that express the DC strike price in a given quarter and for a given product (Baseload, Mid-Merit or Peak) as a function of forward fuel and carbon prices. The dependent variable in the regression formulae is the Directed Contract strike price; the independent variables are forward fuel and carbon prices.

Base prices of Directed Contracts were derived from the validated market simulation model, PLEXOS, by taking the average of 20 PLEXOS runs, each based on different forced outage schedules. Forward or future fuel and carbon prices on 8th April 2008 were used. PLEXOS was then run over 160 times using an historically realistic range of fuel and carbon price combinations to derive a range of prices for the three products (Baseload, Mid-Merit and Peak). These SMPs were then regressed on the range of input fuel and carbon prices to derive a regression equation for each product and each quarter using an econometric pricing model, which measures the effects of changes in fuel prices on SMP. The pricing formulae will consequently estimate the relationship between fuel and carbon prices on the one hand and electricity prices in the SEM on the other and essentially provide a derived estimate of the SMPs PLEXOS would produce if run each day throughout the subscription window.

The DC sellers in the SEM, ESB PG and NIE PPB, will apply the approved published fuel and carbon indices to the regression formulae each day throughout the subscription window and notify suppliers who have elected to subscribe for DC products on that day of the calculated strike price. ESB PG contracts will be priced in euro; those offered by NIE PPB in pounds sterling. In calculating the sterling price each day, NIE PPB will use the formulae set out below first to derive a price in euro. This will then be converted into pounds sterling at the euro/sterling exchange rate of the day (i.e., the same rate as is used in the formulae to covert the sterling gas price into euro).

It should be noted that if, between the publication date of the pricing formulae 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 the pricing formulae, the Regulatory Authorities reserve the right to suspend subscription and rerun the econometric pricing model or otherwise to amend the determination of the DC strike prices to correct any mispricing. The rerun would be done using the prevailing forward fuel and carbon prices as inputs. In this case,

the resulting formulae would replace the original formulae and would be used to establish DC strike prices thereafter. The formulae may also be rerun if there is significant change to plant availability. The subscription window would reopen once the formulae have been revised.

The Directed Contract regression formulae take the following form:

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

where:

$DCStrike_{q,p}$ = Directed Contract Strike Price (in €/MWh) for the relevant quarter (q) and product (p), i.e., baseload, mid-merit and peak.

$\alpha_{q,p}$ = formula constant, which may vary by quarter (q) and product (p).

$\beta_{q,p}$, $\gamma_{q,p}$, $\delta_{q,p}$, $\varepsilon_{q,p}$ and $\zeta_{q,p}$ = formula coefficients, which may vary by quarter (q) and product (p).

NG_q = the price (in pence sterling per therm) for quarterly Intercontinental Exchange Natural Gas Futures for the relevant quarter, as reported in *European Spot Gas Futures*, published by Heren Energy ÷ (GBP/EURO Exchange Rate) / 100.

$LSFO_q$ = the price (in US dollars per metric tonne) for quarterly swap transactions for 1% sulphur free on board (FOB) fuel oil cargoes in North West Europe (NWE) for the relevant quarter, as reported by Platts *Forward Oil Curve* ÷ USD/EURO Exchange Rate.

GO_q = the price (in US dollars per metric tonne) for swap transactions for 0.1% Gasoil cargoes in NWE including cost, insurance and freight (CIF), as reported by Platts *Forward Curve Oil* ÷ USD/EURO Exchange Rate.

C_q = the weighted-average price (in Euro per tonne of Carbon Dioxide) published by the London Energy Brokers Association on their website (www.leba.org.uk) for a given calendar year. The calendar price for a given year will apply to all quarters falling within that year.

The values of the constants and the independent variable coefficients are set out in the table below.

			Coefficients				
			Multiply Gas Coefficient by Euros/therm Gas Price and all other coefficients by Euros/tonne fuel or Euros/tonne C02 Price. The Gas * LSFO coefficient should be multiplied by the product of the gas price and LSFO price.				
Contract (p)	**Quarter (q)**	**Constant ($\alpha_{q,p}$)**	**Gas (NG) ($\beta_{q,p}$)**	**LSFO ($\gamma_{q,p}$)**	**Gas * LSFO ($\delta_{q,p}$)**	**Gasoil ($\varepsilon_{q,p}$)**	**CO2 ($\zeta_{q,p}$)**
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Mid-Merit	Q3 '09	19.76	57.95	0.00832	0.00000	0.00193	0.7802

Worked Example:

The following example uses hypothetical fuel and carbon prices to illustrate the calculation of DC strike prices given the relevant regression formulae.

Given the following spot exchange rates and Q1 2009 fuel and carbon prices:

Fuel and Carbon Prices		
Gas	78	GBP pence /therm
Low Sulphur Fuel Oil	540.00	USD per tonne
Gasoil	980.00	USD per tonne
CO_2	25.00	Euro/tonne
Exchange Rates		
USD/EURO	1.5875	
GBP/EURO	0.80110	

And converting the fuel to Euro using spot exchange rates (e.g. Gas: 78/100 ÷ 0.80110) results in the following Euro prices:

Conversion of Fuel Prices to Euro		
Gas	0.9737	Euro/therm
Low Sulphur Fuel Oil	340.16	Euro per tonne
Gasoil	617.32	Euro per tonne
CO_2	25.00	Euro/tonne

The contract strike prices for the Baseload, Mid-merit and Peak products in Quarter 1 2009 are calculated as follows:

- Baseload Q1 '09 Strike Price = 9.27 + (65.82 * 0.9737) + (0.00627 * 340.16) + (0.00000 * 0.9737 *340.16) + (0.00311 * 617.32) + (0.4843 * 25.00)
  = €89.52 per MWhr or £71.71 per MWhr (89.52 * 0.80110)

- Mid-Merit Q1 '09 Strike Price = 9.42 + (71.32 * 0.9737) + (0.01787 * 340.16) + (0.00000 * 0.9737 * 340.16) + (0.00484 * 617.32) + (0.5209 * 25.00)
  = €100.95 per MWhr or £80.87 (100.95 * 0.80110)

- Peak Q1 '09 Strike Price = 78.11 + (11.25 * 0.9737) + (-0.13103 * 340.16) + (0.20820 * 0.9737 * 340.16) + (0.02128 * 617.32) + (0.6699 * 25.00)
  = €143.34 per MWhr or £114.83 (143.34 * 0.80110)

The following tables show Directed Contract prices using actual fuel, carbon and exchange rate inputs as reported for Thursday 10th April 2008 in euro and sterling.

Sample ESB PG Directed Contract Prices			
Quarter	Baseload Price (€/MWh)	Mid-Merit Price (€/MWh)	Peak Price (€/MWh)
Q4 2008	85.45	96.45	144.00
Q1 2009	89.52	100.93	143.15
Q2 2009	76.32	85.19	n/a
Q3 2009	77.19	87.55	n/a

Sample NIE PPB Directed Contract Prices			
Quarter	Baseload Price (£/MWh)	Mid-Merit Price (£/MWh)	Peak Price (£/MWh)
Q4 2008	68.45	77.27	115.36
Q1 2009	71.71	80.86	114.68
Q2 2009	61.14	68.25	n/a
Q3 2009	61.84	70.14	n/a