Single Electricity Market Committee

**Directed Contracts 2009/2010
Quantification and Pricing
Decision Paper**

Version 2

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SEM-09-043

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I. INTRODUCTION

An integral part 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 2009 to 30th September 2010.

The Commission hereby directs ESB Power Generation to implement this decision of the SEM Committee under Condition 3 of its licence to generate electricity. Specifically, this direction relates to paragraphs 1 to 3, which state that:

1. *Where, and to the extent, required by the Commission, the Licensee shall offer to enter into contracts with Suppliers and Northern Ireland Suppliers in relation to the output of the generation units at the generating stations identified in Schedule 1 to this licence ("Directed Contracts").*

2. *The form of any Directed Contracts; the price at which such Directed Contracts are offered to Suppliers and Northern Ireland Suppliers; the applicable*

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[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.

megawatt contract quantities and the method of allocation of such Directed Contracts among Suppliers and Northern Ireland Suppliers shall be determined by the Commission from time to time and notified to the Licensee.

3. *The Licensee shall comply with directions issued by the Commission for the purposes of this Condition including, without limitation, directions as to the matters referred to in paragraph 2 of this Condition.*

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

– 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 2009/10 DC process with a view to improving and building on the process pursued in the previous two years. 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), 11th February 2009, SEM-09-015

– Directed Contract Implementation Report: A Response and Decision Paper, 27th March 2009, SEM-09-030

- Master Contract for Differences Agreement, 9th April 2009, SEM-09-038

- Update to the 2009 Master Agreement Version 1 (Explanatory Note), 9th April 2009, SEM-09-037

- ESB Power Generation Directed Contract Subscription Rules, 9th April 2008, SEM-09-036

- Directed Contract Implementation Report A Supplemental Decision Paper: Revised Timeline, 17th April 2009, SEM-09-041

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 only ESB Power Generation (ESB PG) will be required to sell DCs. NIE Energy Power Procurement Business (NIEE PPB) is not required to offer DCs at this HHI level for the 2009/2010 contracting year. The quantities of DCs which ESB PG will be required to make available to eligible suppliers during the subscription windows are shown below.

| | ESB PG | | |
| | Directed Contract Quantities | | |
Quarter	Baseload Quantity (MW)	Mid-Merit Quantity (MW)	Peak Quantity (MW)
Q4 2009	223	226	200
Q1 2010	258	174	172
Q2 2010	240	334	n/a
Q3 2010	263	98	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:

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

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

Contract (p)	Quarter (q)	Constant ($a_{p,q}$)	Gas ($\beta_{p,q}$)	LSFO ($\gamma_{p,q}$)	Gas * LSFO ($\delta_{p,q}$)	Gasoil ($\varepsilon_{p,q}$)	CO2 ($\zeta_{p,q}$)	$DF_{p,q}$
			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.					
Baseload	Q4 '09	9.87	58.85	0.00000	0.04432	0.00523	0.5628	1.140
Mid-Merit	Q4 '09	11.99	69.40	0.00000	0.04408	0.00750	0.6095	1.165
Peak	Q4 '09	23.42	94.54	0.00000	0.05005	0.01737	0.7046	1.175
Baseload	Q1 '10	8.83	62.88	-0.01210	0.03344	0.00456	0.4988	1.140
Mid-Merit	Q1 '10	6.82	74.16	0.00000	0.03290	0.00624	0.5082	1.165
Peak	Q1 '10	18.62	98.70	0.00000	0.00453	0.01596	0.6439	1.175
Baseload	Q2 '10	16.04	64.36	0.00000	0.00000	0.00000	0.5250	1.140
Mid-Merit	Q2 '10	19.59	72.54	0.00000	0.00000	0.00000	0.5647	1.165
Baseload	Q3 '10	17.32	53.44	0.00000	0.00000	0.00000	0.5730	1.140
Mid-Merit	Q3 '10	22.75	55.65	0.00000	0.00000	0.00000	0.6537	1.165

– **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, 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 seller (ESB PG) separately.

III. DIRECTED CONTRACT QUANTITIES

Directed Contracts will be offered in quarterly segments for the period 1st October 2009 to 30th September 2010. 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 from ESB PG. 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. In that paper 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 for 2009/2010. The continuation of this HHI level for the 2010/2011 contracting year will be reviewed over the course of year in light of the operation of the market as more data becomes available.

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 NIEE 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 availabilities and capacities etc.. The concentration model is described in detail in the Directed Contract Implementation Report (SEM-09-015).

ESB PG 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.

Quarter	ESB PG		
	Directed Contract Quantities		
	Baseload Quantity (MW)	Mid-Merit Quantity (MW)	Peak Quantity (MW)
Q4 2009	223	226	200
Q1 2010	258	174	172
Q2 2010	240	334	n/a
Q3 2010	263	98	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. 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 seller, ESB PG, 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.

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 subscription window would reopen once the formulae have been revised.

The Directed Contract regression formulae take the following form:

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

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.

$DF_{p,q}$ = the KEMA-recommended discount factor by quarter (q) and product (p) to be applied to the regression formulae to account for the observed systematic over-estimation of SMP in the current year's validated SEM model.

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

Contract (p)	Quarter (q)	Constant $(a_{p,q})$	Gas $(\beta_{p,q})$	LSFO $(\gamma_{p,q})$	Gas * LSFO $(\delta_{p,q})$	Gasoil $(\varepsilon_{p,q})$	CO2 $(\zeta_{p,q})$	$DF_{p,q}$
					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.				
Baseload	Q4 '09	9.87	58.85	0.00000	0.04432	0.00523	0.5628	1.140
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Peak	Q1 '10	18.62	98.70	0.00000	0.00453	0.01596	0.6439	1.175
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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 2010 fuel and carbon prices:

Fuel and Carbon Prices		
Gas	57	GBP pence /therm
Low Sulphur Fuel Oil	335.00	USD per tonne
Gasoil	540.00	USD per tonne
CO_2	15.00	Euro/tonne
Exchange Rates		
USD/EURO	1.3196	
GBP/EURO	0.8856	

And converting the fuel to Euro using spot exchange rates (e.g. Gas: 57/100 ÷ 0.8856) results in the following Euro prices:

Conversion of Fuel Prices to Euro		
Gas	0.64363	Euro/therm
Low Sulphur Fuel Oil	253.86	Euro per tonne
Gasoil	409.21	Euro per tonne
CO_2	15.00	Euro/tonne

The contract strike prices for the Baseload, Mid-merit and Peak products in Quarter 1

2010 are calculated as follows:

- Baseload Q1 '10 Strike Price = [8.83 + (62.88 * 0.64363) + (-0.01210 * 253.86) + 0.03344 * 0.64363 *253.86) + (0.00456 * 409.21) + (0.4988 * 15.00)] ÷ 1.140
   = €53.54 per MWhr

- Mid-Merit Q1 '10 Strike Price = [6.82 + (74.16 * 0.64363) + (0.00000 * 253.86) + (0.03290 * 0.64363 *253.86) + (0.00624 * 409.21) + (0.5082 * 15.00)] ÷ 1.165
   = €60.17 per MWhr

- Peak Q1 '10 Strike Price = [18.62 + (98.70 * 0.64363) + (0.00000 * 253.86) + (0.00453 * 0.64363 *253.86) + (0.01596 * 409.21) + (0.6439 * 15.00)] ÷ 1.175
   = €84.32 per MWhr

The following table shows Directed Contract prices using actual fuel, carbon and exchange rate inputs as reported for Friday 17th April 2009 in euro.

Sample ESB PG Directed Contract Prices			
Quarter	Baseload Price (€/MWh)	Mid-Merit Price (€/MWh)	Peak Price (€/MWh)
Q4 2009	49.50	56.32	81.89
Q1 2010	53.44	60.08	84.17
Q2 2010	51.49	57.75	n/a
Q3 2010	47.09	52.76	n/a