# Single Electricity Market Committee

## Directed Contracts 2009/2010 Quantification and Pricing Supplemental Decision Paper

**20 May 2009**

**SEM-09-053**

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# I. INTRODUCTION AND BACKGROUND

On the 24th April 2009 the Regulatory Authorities (RAs) published an SEM Committee[1] Decision Paper on the Quantification and Pricing of Directed Contracts (DCs) for the 2009/10 contracting year (SEM-09-043). This paper followed the completion of the SEM Plexos validation project and DC implementation workstream. The results of the SEM Plexos validation project were presented at an industry workshop on Friday 17th April 2009.

As per the SEM Committee timetable (SEM-09-041), the DC primary subscription window commenced on Tuesday 5th May 2009 and was due to close on the 3rd June 2009, and the supplemental subscription window was scheduled to open on the 8th June 2009 and close on the 19th June 2009.

On 6th May 2009, the Regulatory Authorities suspended the DC subscription windows (SEM-09-045), following the discovery of a number of material errors in the backcast component of SEM Plexos validation project, which was confirmed by our independent consultants, KEMA (SEM-09-047). KEMA have advised that these errors called into question the accuracy of the forecast prices advised to the RAs and contained in SEM-09-043.

Following a thorough re-examination by KEMA of the SEM Plexos validation project, in consultation with the developers and owners of the Plexos Software, Energy Exemplar, KEMA have advised a new set of forecast prices to the RAs, which formed the basis of this SEM Committee supplemental decision.

On 19th May 2009, the SEM Committee published an indicative detailed timetable for the overall 2009 contracting process, covering directed contracts, non directed contracts, and Ireland PSO contract auctions (SEM-09-051). In relation to directed contracts, the paper stated that the volumes contained in SEM-09-043 and the individual eligibilities communicated to each supplier will stand.

The paper (SEM-09-051) also outlined an indicative date for the resumption of the directed contract subscription window. It provided for the primary subscription

[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 RAs) that, on behalf of the RAs, takes any decision as to the exercise of a relevant function of CER or NIAUR in relation to an SEM matter.

window to resume on Friday 22nd May and to run through to Friday 12thJune. The supplemental window would commence on Tuesday 16th June and end on Friday19th June. The SEM Committee can now confirm these dates.

# 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**

The entire volume of DC quantities remains unchanged from SEM-09-043, as shown in the table below. ESB PG will be required to make these volumes available to eligible suppliers during the revised subscription windows, less any valid volumes sold during the initial subscription window.

| | **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 revised 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.

| Contract (p) | Quarter (q) | Constant ($a_{p,q}$) | 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. | | | | |
|---|---|---|---|---|---|---|---|
| | | | Gas ($\beta_{p,q}$) | LSFO ($\gamma_{p,q}$) | Gas * LSFO ($\delta_{p,q}$) | Gasoil ($\varepsilon_{p,q}$) | CO2 ($\zeta_{p,q}$) |
| Baseload | Q4 '09 | 11.92 | 63.30 | 0.00000 | 0.00000 | 0.00204 | 0.6426 |
| Mid-Merit | Q4 '09 | 13.08 | 73.44 | 0.00000 | 0.00000 | 0.00305 | 0.7134 |
| Peak | Q4 '09 | 15.90 | 92.04 | 0.02839 | 0.00000 | 0.01053 | 0.8510 |
| Baseload | Q1 '10 | 8.56 | 67.57 | 0.00000 | 0.00000 | 0.00000 | 0.4594 |
| Mid-Merit | Q1 '10 | 8.01 | 79.65 | 0.00000 | 0.00000 | 0.00000 | 0.4453 |
| Peak | Q1 '10 | 12.70 | 99.68 | 0.00000 | 0.00000 | 0.00715 | 0.6297 |
| Baseload | Q2 '10 | 11.28 | 58.72 | 0.01878 | 0.00000 | 0.00000 | 0.5254 |
| Mid-Merit | Q2 '10 | 15.50 | 65.25 | 0.03050 | -0.02392 | 0.00000 | 0.5580 |
| Baseload | Q3 '10 | 25.94 | 33.81 | 0.02527 | 0.00000 | -0.00665 | 0.5469 |
| Mid-Merit | Q3 '10 | 32.94 | 30.61 | 0.04321 | 0.00000 | -0.01069 | 0.5821 |

- **Supplier Eligibility**

The total DC eligibilities communicated to each supplier on 24th April 2009 will remain unchanged.

# 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.

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 remain unchanged from SEM-09-043 and are set out below.

| | **ESB PG** | | |
|---|---|---|---|
| | **Directed Contract Quantities** | | |
| **Quarter** | **Baseload Quantity (MW)** | **Mid-Merit Quantity (MW)** | **Peak Quantity (MW)** |
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# 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.

The regression analysis was rerun using a revised and updated validated Plexos model, again 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 validated model will be published on the all-island project website (www.allislandproject.org)

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:

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

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.

| Contract (p) | Quarter (q) | Constant ($a_{p,q}$) | 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. | | | | |
|---|---|---|---|---|---|---|---|
| | | | Gas ($\beta_{p,q}$) | LSFO ($\gamma_{p,q}$) | Gas * LSFO ($\delta_{p,q}$) | Gasoil ($\varepsilon_{p,q}$) | CO2 ($\zeta_{p,q}$) |
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| Peak | Q4 '09 | 15.90 | 92.04 | 0.02839 | 0.00000 | 0.01053 | 0.8510 |
| Baseload | Q1 '10 | 8.56 | 67.57 | 0.00000 | 0.00000 | 0.00000 | 0.4594 |
| Mid-Merit | Q1 '10 | 8.01 | 79.65 | 0.00000 | 0.00000 | 0.00000 | 0.4453 |
| Peak | Q1 '10 | 12.70 | 99.68 | 0.00000 | 0.00000 | 0.00715 | 0.6297 |
| Baseload | Q2 '10 | 11.28 | 58.72 | 0.01878 | 0.00000 | 0.00000 | 0.5254 |
| Mid-Merit | Q2 '10 | 15.50 | 65.25 | 0.03050 | -0.02392 | 0.00000 | 0.5580 |
| Baseload | Q3 '10 | 25.94 | 33.81 | 0.02527 | 0.00000 | -0.00665 | 0.5469 |
| Mid-Merit | Q3 '10 | 32.94 | 30.61 | 0.04321 | 0.00000 | -0.01069 | 0.5821 |

**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 = 8.56 + (67.57 * 0.64363) + (0.00000 * 253.86) + (0.00000 * 0.64363 * 253.86) + (0.00000 * 409.21) + (0.4594 * 15.00)
  = €58.94 per MWhr

- Mid-Merit Q1 ’10 Strike Price = 8.01 + (79.65 * 0.64363) + (0.00000 * 253.86) + (0.00000 * 0.64363 * 253.86) + (0.00000 * 409.21) + (0.4453 * 15.00)
  = €65.96 per MWhr

- Peak Q1 ’10 Strike Price = 12.70 + (99.68 * 0.64363) + (0.00000 * 253.86) + (0.00000 * 0.64363 * 253.86) + (0.00715 * 409.21) + (0.6297 * 15.00)
  = €89.24 per MWhr

The following tables show Directed Contract prices using actual fuel, carbon and exchange rate inputs as reported for Monday 18th May 2009 in euro.

| **Sample ESB PG Directed Contract Prices** | | | |
|---|---|---|---|
| Quarter | Baseload Price (€/MWh) | Mid-Merit Price (€/MWh) | Peak Price (€/MWh) |
| Q4 2009 | 54.94 | 62.80 | 87.46 |
| Q1 2010 | 57.06 | 63.74 | 86.45 |
| Q2 2010 | 56.19 | 64.10 | n/a |
| Q3 2010 | 56.04 | 65.09 | n/a |