



**SEM Monitoring Report: Q4 2017**

**SEM-18-002**

**January 2018**

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## 2. INTRODUCTION

The Single Electricity Market (SEM) is the term that is used to describe the electricity market for the island of Ireland.

This report provides an overview of the SEM and sets out recent trends in the market in relation to pricing, demand, scheduling and contract prices. It focuses in particular on the wholesale element of electricity prices, which makes up roughly 60% of customers' bills.

The report was prepared by the Market Monitoring Unit (MMU); the MMU resides within the Utility Regulator Northern Ireland, the main monitoring function of the Regulatory Authorities in joint collaboration with the Commission for Energy Regulation (CER). The unit's role is to investigate market power within the SEM and to monitor compliance of market participants with regards to the Bidding Code of Practice (BCoP) and other market rules. Another aspect of the roles and responsibilities of the MMU is to review market prices. This report covers this particular area of the SEM, along with some others; the key areas are:

- An overview of how the market works and key trends observed over the lifetime of the SEM
- Detailed market information on price (System Marginal Price) and quantity (Market Scheduled Quantity and Dispatch Quantity)
- Information on trends in directed contracts which are imposed by the Regulatory Authorities on the incumbent generators with market power in the SEM.

The information in this report is based on data that was provided by the Single Electricity Market Operator (SEMO), except where otherwise indicated.

Any feedback or comments that stakeholders may have should be emailed to:

- Kevin Baron at [kevin.baron@uregni.gov.uk](mailto:kevin.baron@uregni.gov.uk).

### 3. OVERVIEW

- **Wholesale costs:** Energy costs during the fourth quarter of 2017 increased by €156m on those in the third quarter of 2017. Capacity Payments increased 50% in this quarter to €153m. Constraints costs also increased from €45m in Q3 2017 to €65m in Q4 2017.
- **SEM Price (System Marginal Price “SMP”):** SMP increased to €53/MWh on average for the quarter compared to €43/MWh in Q3 2017.
- **Fuel Price:** Gas prices increased on average to 51 p/therm in Q4 2017, up from 41 p/therm in Q3 2017.
- **SEM demand (Market Schedule Quantity “MSQ”):** The average demand for the quarter was 4122 MW. By comparison, the demand in Q3 2017 was 3654 MW.
- **Directed Contracts:** This was the first round of Directed Contracts for I-SEM. In this context, “Q2 2018” extends only from the introduction of I-SEM on 23rd May 2018. The first part, or the “SEM” part, of Q2 2018 was sold in the final two round of Directed Contracts for SEM, Rounds 21 and 22.

On average, the prices of Directed Contract Baseload and Mid Merit products for the first year of I-SEM were 15% higher than those sold for the last year of SEM. The full volume has not yet been sold for a standard quarter in I-SEM, but the volumes so far are similar to those offered in the final two rounds of Directed Contracts for SEM, which saw an increase in DC volumes, due to reduced imports on the interconnectors leading to increased concentration within the SEM market.

## 4. SUMMARY

This section provides a high-level analysis of trends that are observed across the main elements of the SEM. The topics are various:

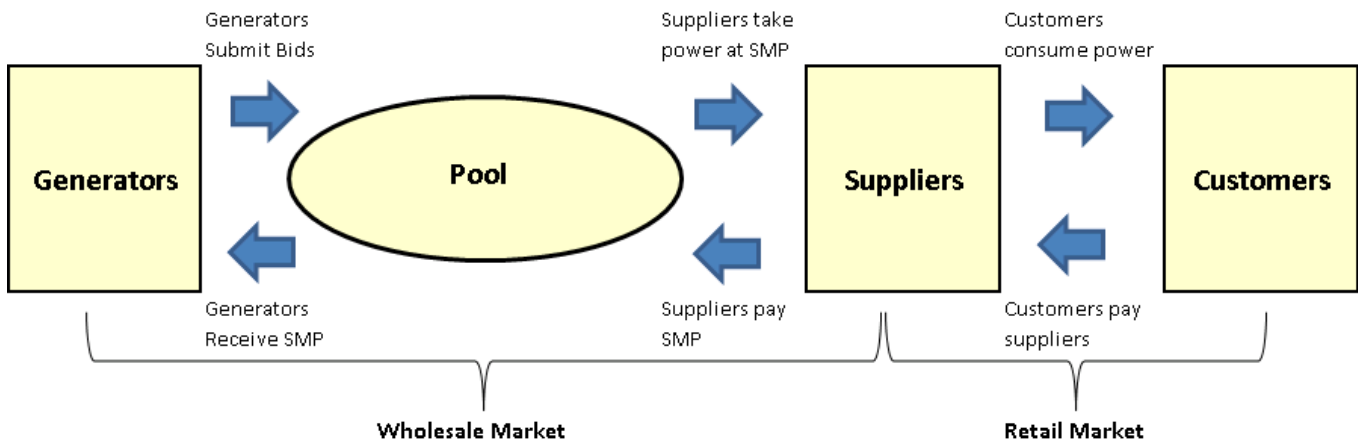
- **Background to the SEM:** This section explains how the market works, and in particular the way in which generators bid to provide the required electricity.
- **Electricity prices:** This section provides a high level breakdown of wholesale energy costs for the previous nine quarters.
- **System Marginal Price (SMP) and Demand:** This section provides information on the SMP and Demand levels since 2015.
- **Within day Energy Prices:** This section shows the average price and demand for each trading period in the previous nine quarters.
- **SMP Shadow Price & Uplift:** SMP can be broken down into two components - the Shadow Price and Uplift. This section looks at the impact of changes on SMP for Q4 2017.
- **Fuel mix:** This section outlines the changes in the type and proportion of fuels that were used for generation over the previous nine quarters.

## How the Single Electricity Market works

This section provides a brief overview of how the SEM operates. The SEM is the electricity market for the island of Ireland. It was introduced in November 2007. The SEM is jointly regulated by the Utility Regulator and the Commission for Regulation (referred to in this report as the Regulatory Authorities).

The SEM is a pool market through which all suppliers and generators above a minimum threshold must trade electricity. A market overview is shown below.

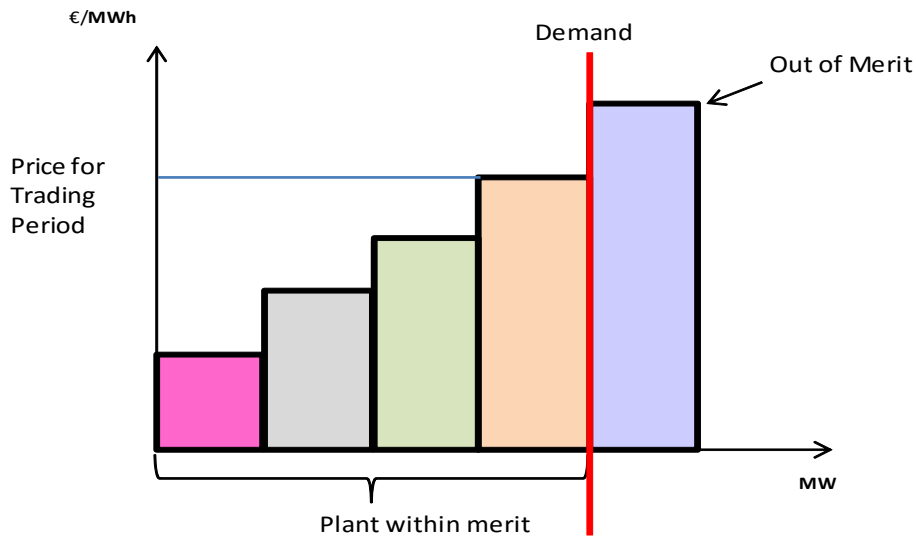
**Figure 1: Market Overview**



Generators submit bids to the market based on their short run marginal costs (as required by their licences and by the Bidding Code of Practice). These bids are mostly made up of fuel-related costs.

The SMP is determined for each half hour period, based on bids received from generators and customer demand. The SMP and schedule of generation is calculated by SEMO using optimisation software. Broadly speaking, bids that are submitted by the generators are stacked in order, starting with the least expensive, until demand is met. This process is illustrated in Figure 2:

**Figure 2: Market Schedule**



All generators that are scheduled (run in the market) are paid the same SMP for the energy they produce. Supply companies, which sell electricity to customers, pay the SMP for the electricity their customers consume.

Generators also receive Capacity Payments for any periods that they are available to generate. This contributes towards their fixed, long-term costs.

If there are constraints, a generator may be dispatched in a way that is different from the market schedule in order to balance supply and demand. These generators are said to be either 'constrained on' or 'constrained off'. Generators that are constrained off will pay back a payment and those that are constrained on will receive a payment. This ensures that generators are financially neutral for any differences between the market schedule and actual dispatch.

Settlement of the market is carried out by SEMO. This includes payment to generators and the invoicing of suppliers. The cost of operating SEMO is recovered from suppliers. This is a relatively small contributor to costs and is not covered in this report.

## Electricity prices

Electricity prices are made up of a number of different charges, broadly, they are:

- Wholesale costs (around 60%)
- Network costs (around 30%)
- Supplier costs (around 10%)

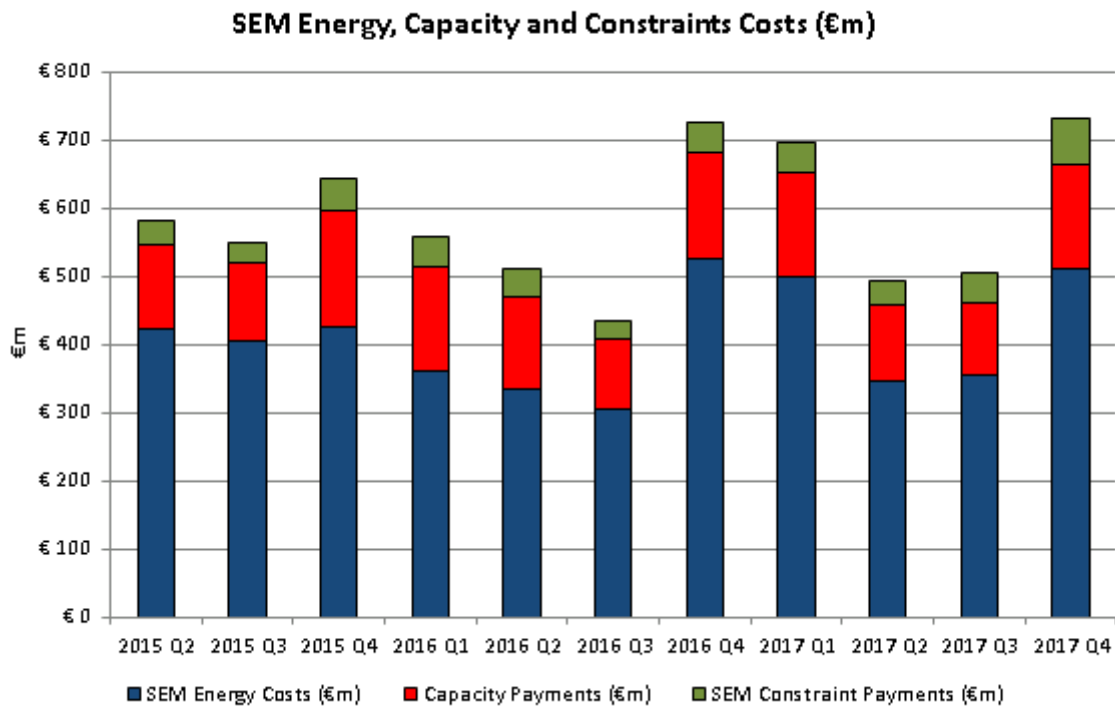
This report focuses on the wholesale element of electricity prices.

The main elements of the SEM wholesale costs are:

- Energy costs – Costs paid to generators for producing electricity
- Capacity costs – Costs paid to generators based on their availability to generate electricity
- Imperfections costs - Costs largely associated with network and system constraints.

The graph below gives a breakdown of these costs. The period covered is from Q2 2015 through Q4 2017.

**Figure 3: SEM Costs**

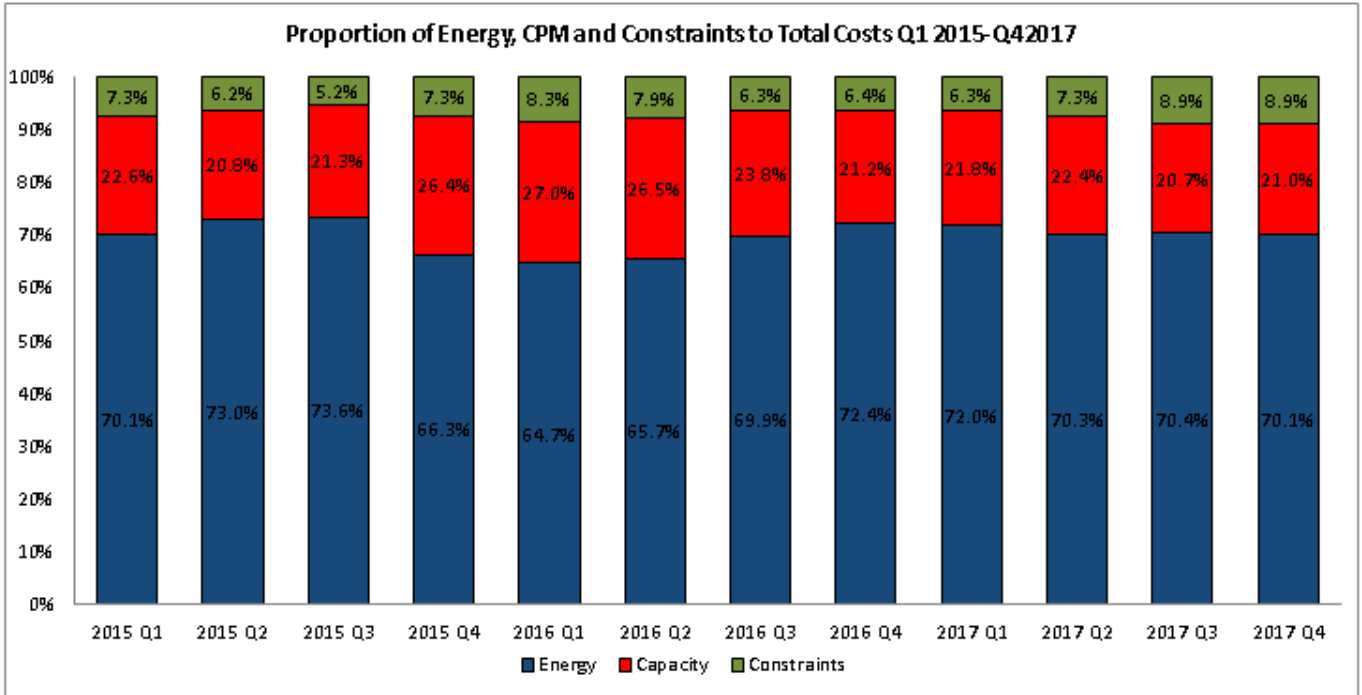


As the following chart shows, energy costs are the largest element of the overall wholesale cost. In the fourth quarter of 2017, 70% of total wholesale costs were attributable to energy. Constraints costs are roughly 9% of total energy costs for Q4 2017, the same proportion as Q3 2017.



## Energy Costs as a Percentage of Total Wholesale Costs

**Figure 4: Total percentage of Energy, Constraints and Capacity Payments.**



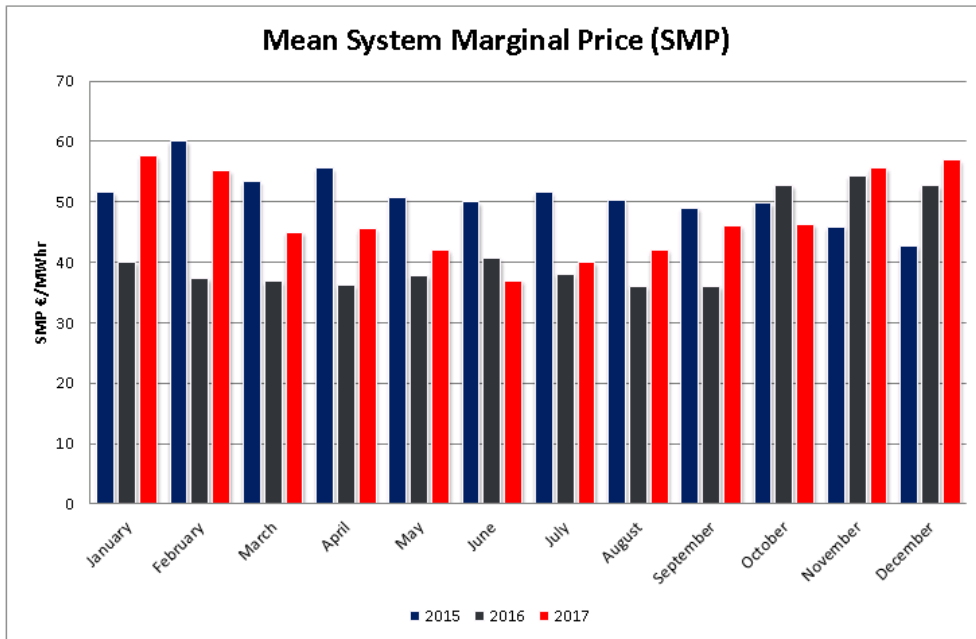
### System Marginal Price and Demand trends

Average SMP for Q4 2017 increased to €53/MWh, which is €10/MWh higher than Q3 2017.

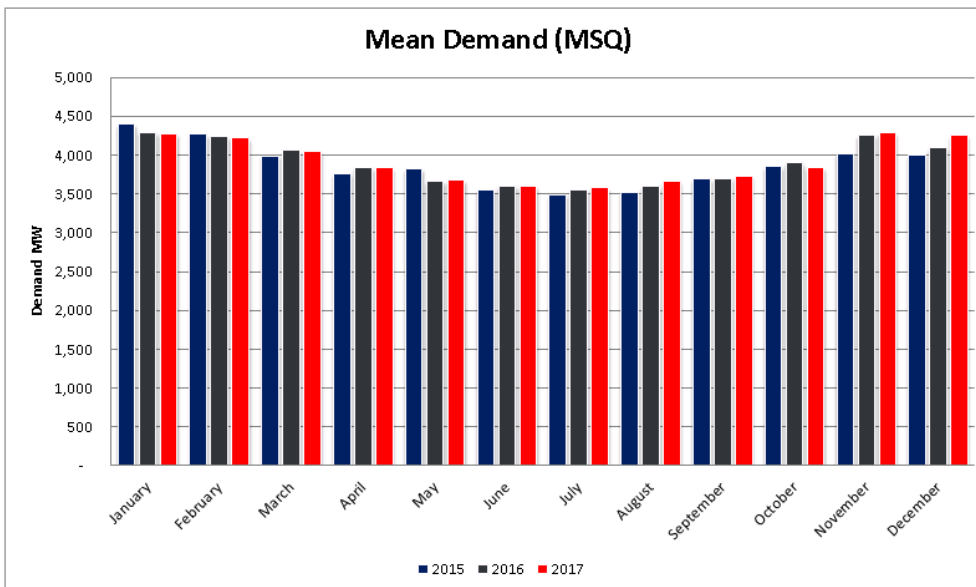
Levels of demand increased from an average of 3654 MW in Q3 2017 to 4122 MW in Q4 2017.

The following figures show the average monthly SMP and the demand recorded in the SEM since 2015.

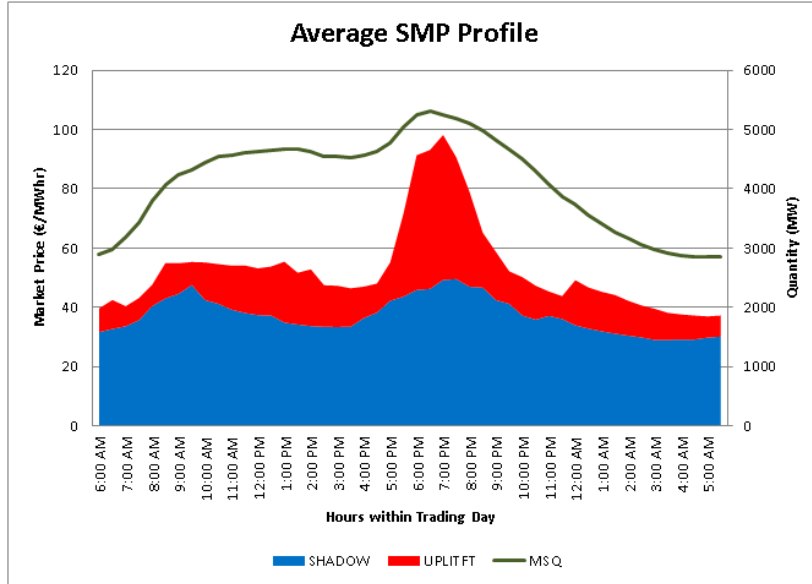
**Figure 5: Mean System Marginal Price 2015 - 2017**



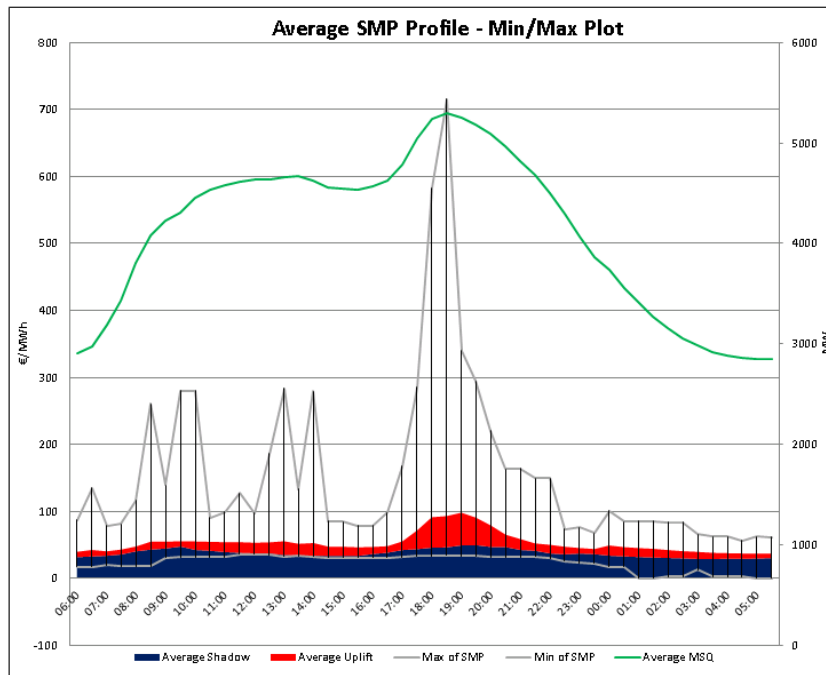
**Figure 6: Demand in the Single Electricity Market 2015 - 2017**



**Figure 7: Average SMP Profile during Q4 2017**

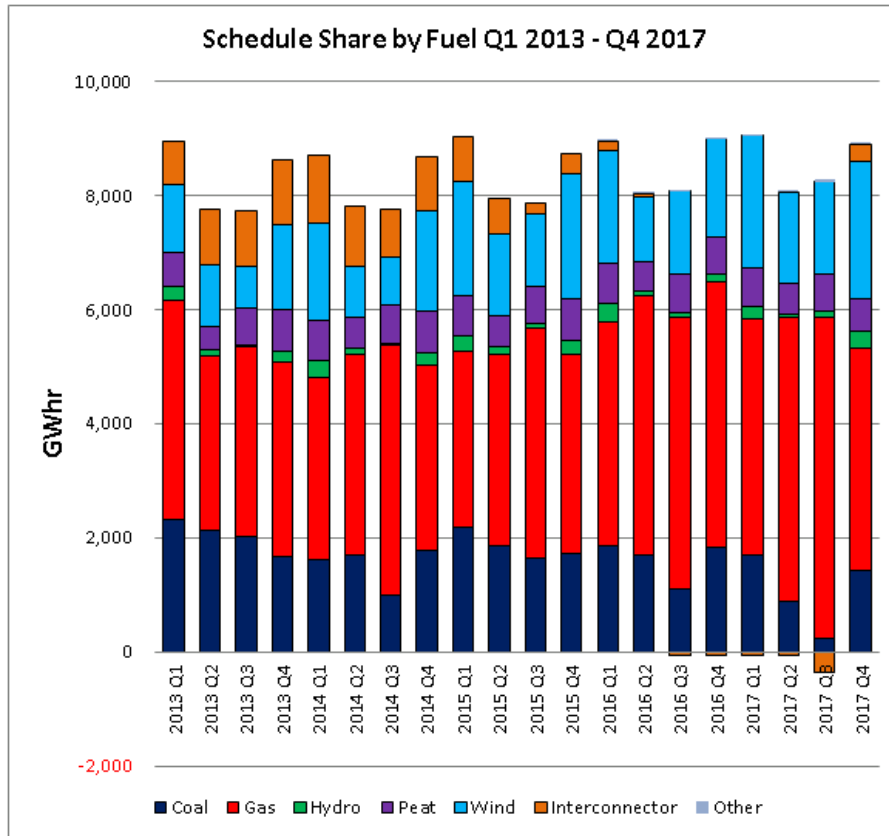


**Figure 8: Average SMP Profile during Q4 2017**



## Share of generation by fuel type (fuel mix)

Figure 9: Fuel Mix in the Single Electricity Market (100% Share)



Gas is the most common fuel that is used for electricity production in the SEM. The figure above shows the share of generation by each fuel type in each quarter since 2013.

A number of trends were observed:

- Solar generation and Waste continued to receive scheduled volumes in Q4 2017, although this share suffered a drop of 75% on the last quarter.
- Gas share decreased by 27% to 44% in Q4 2017
- Coal increased in shared volume, up 13% to 16% of total share in Q4 2017.
- Wind share increased to 27% in Q4 2017. This is an increase of 7% on Q3 2017
- Interconnector share increased, with net export of +311 MW on average in Q4.

## 5. DETAILED MARKET INFORMATION

### Summary

The following section provides more in-depth information on trends observed across the SEM:

1. **Dashboard.** This section builds on the previous chapter and explores quarterly trends that have been observed.
2. **Energy prices.** This section is presented in two main parts. The first covers the relationship between the SMP and prices in Great Britain (BETTA). The second covers the relationship between SMP and fuel/capacity prices.
3. **Market share.** This section looks at both the Market Schedule Quantity (MSQ<sup>1</sup>) and Dispatch Quantity (DQ<sup>2</sup>) by company.
4. **Constraints.** Levels of constraints in the SEM have increased considerably over the past nine months. This section analyses the cost to the consumer of constraint payments.
5. **Infra-marginal rent (IMR).** IMR is the difference between the price paid for generation and the cost to produce that generation. Levels of IMR are analysed and trends explained in this section.
6. **Interconnector Flows:** This section analyses the percentage of interconnector flows in the expected profitable direction.

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<sup>1</sup> MSQ is the market scheduled quantity of output of all generators in each trading period.

<sup>2</sup> DQ is the Dispatch Quantity defined as the level of active power dispatched by the relevant transmission system operator in each trading period.

Figure 10: Single Electricity Market dashboard

Quarterly Averages	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Change From last Quarter
SMP €/MWh	58	55	53	50	46	38	38	37	54	52	42	43	53	↑
% Change from previous Quarter	12%	-4%	-4%	-4%	-8%	-17%	0%	0%	47%	-4%	-19%	2%	23%	↑
% Change from Quarter, previous year	-11%	-15%	-1%	-2%	-20%	-31%	-27%	-27%	17%	37%	10%	17%	-2%	
Margin MW	5785	6278	5125	5456	5233	6526	5764	5486	5401	6378	6050	5523	5930	↑
% Change from previous Quarter	15%	9%	-18%	6%	-4%	25%	-12%	-5%	-2%	18%	-5%	-9%	7%	↑
% Change from Quarter, previous year	4%	15%	1%	8%	-10%	4%	12%	1%	3%	-2%	5%	1%	10%	
Demand MW	3934	4137	3586	3564	3954	4155	3701	3608	4092	4177	3700	3654	4122	↑
% Change from previous Quarter	12%	5%	-13%	-1%	11%	5%	-11%	-3%	13%	2%	-11%	-1%	13%	↑
% Change from Quarter, previous year	1%	3%	1%	2%	1%	0%	3%	1%	3%	1%	0%	1%	1%	
Actual Availability MW	9719	10415	8770	9020	9187	10681	9465	9094	9487	10555	9750	9176	10052	↑
% Change from previous Quarter	14%	7%	-16%	3%	2%	16%	-11%	-4%	4%	11%	-8%	-6%	10%	↑
% Change from Quarter, previous year	3%	10%	2%	6%	-5%	3%	8%	1%	3%	-1%	3%	1%	6%	
Shadow €/MWh	43	41	40	42	38	32	33	27	47	44	35	37	43	↑
% Change from previous Quarter	18%	-4%	-1%	3%	-11%	-23%	-18%	-35%	74%	-6%	-20%	6%	16%	↑
% Change from Quarter, previous year	-7%	-13%	9%	16%	-11%	-23%	-18%	-35%	24%	39%	6%	37%	-9%	
Uplift €/MWh	15	14	12	8	8	6	5	10	7	8	7	5	10	↑
% Change from previous Quarter	-4%	-5%	-13%	-30%	0%	-20%	-20%	94%	-30%	14%	-13%	-29%	100%	↑
% Change from Quarter, previous year	-22%	-21%	-23%	-44%	-45%	-54%	-57%	18%	-13%	24%	36%	-50%	43%	
Interconnector (Total)	443	366	233	182	152	80	30	-70	-28	-46	-46	-162	311	↑
Moyle	294	253	202	139	26	35	-6	-20	-17	30	-18	-70	198	↑
EWIC	149	113	31	43	126	45	36	-50	-11	-76	-16	-92	113	↑
% Change from previous Quarter	28%	-17%	-36%	-65%	-16%	-47%	-62%	-330%	-60%	64%	0%	-252%	292%	↑
% Change from Quarter, previous year	-53%	-34%	-47%	-76%	-66%	-78%	-87%	-139%	-118%	-157%	-251%	-131%	1211%	
Wind MW (produced)	801	919	644	583	998	910	525	658	787	1076	738	745	1082	↑
% Change from previous Quarter	116%	15%	-30%	-9%	71%	-9%	-42%	25%	20%	37%	-31%	1%	45%	↑
% Change from Quarter, previous year	20%	17%	57%	57%	25%	-1%	-18%	13%	-21%	18%	41%	13%	37%	

Note: The wind figures presented in this table do not cover production from wind farms which are not part of the SEM.

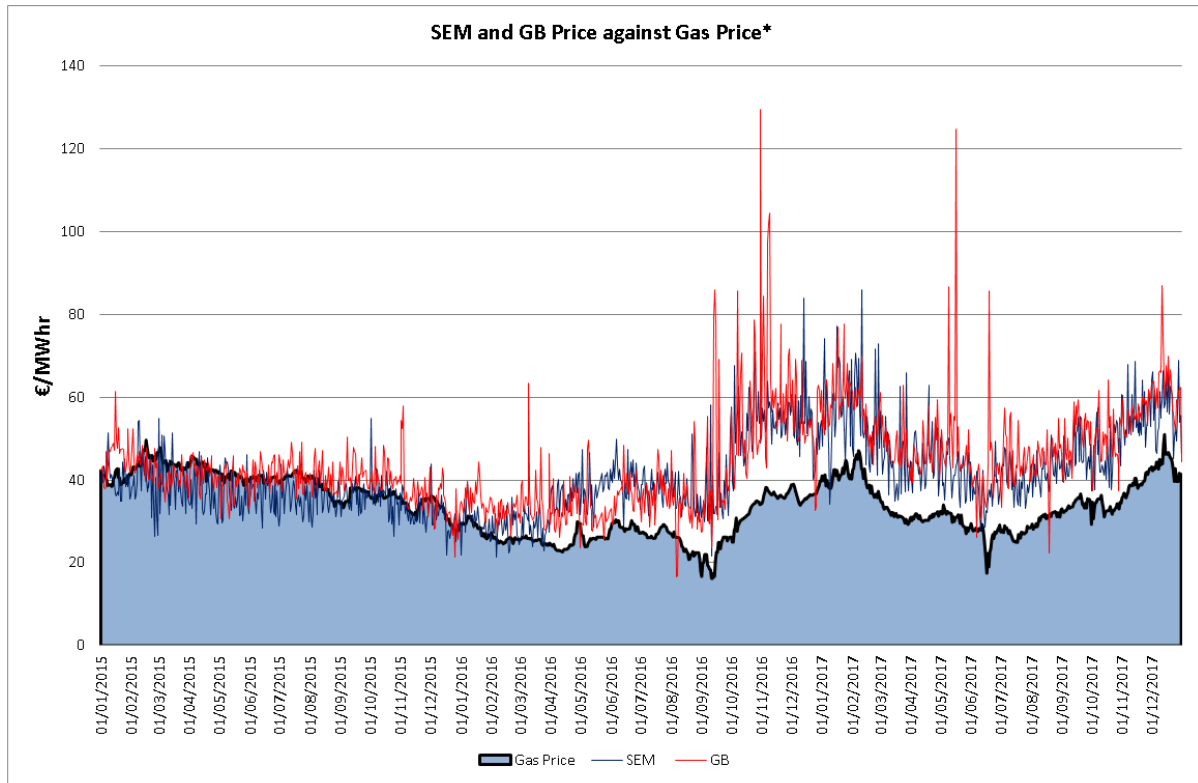
## Summary highlights based on the dashboard

### High Level Summary

- Average SMP was €53/MWh in Q4 2017. This was an increase of €10/MWh on the third quarter of 2017. In Q4 2016, mean SMP was €54/MWh
- Levels of demand have remained generally stable over the past nine quarters, with the usual seasonal fluctuations being observed. Comparing Q4 2017 with the same quarter in 2016 we see that average levels of demand have increased from 4092 MW to 4122 MW
- Actual Availability increased by 10% on Q3 2017 and average Margin levels in Q4 2017 were 7% higher than Q3 2017
- The Shadow Price has increased in the quarter, from €37/MWh in Q3 2017 to €43/MWh in Q4 2017

## Energy price trends

Figure 11: Price comparison between the Single Electricity Market and BETTA



*\*The Gas Price units have been transformed from GBP p/therm to €/MWh under a notional burn efficiency of 50%, for ease of comparison to the electricity price.*

The SEM prices shown in Fig.12 do not include Capacity Payments made to generators. The units of both the SEM price and the BETTA price are in €/MWh for ease of comparison.

Gas has been dominant in the generation fuel mix since the SEM was established. As a result the profile of electricity prices has tended to follow that of the price of gas. While this continues to be the case today, in general the proportion of gas in the fuel mix has started to decrease.

Quarterly average gas price increased from 41 p/therm in Q3 2017, to 51 p/therm in Q4 2017. This increase impacts on the SMP as the fuel mix is gas dominant within the SEM, however, as figure 9 (page 12) shows, this may be offset by the decrease in gas dominance on Q3 2017.

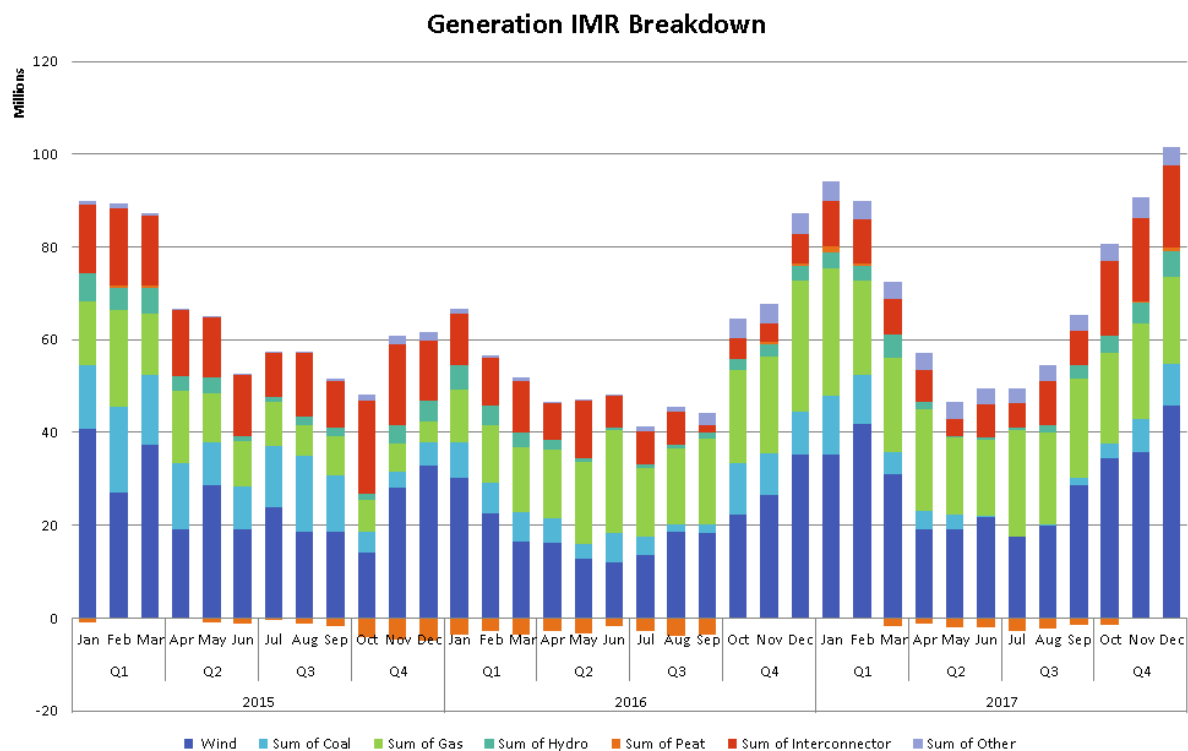


## Infra-marginal rent (IMR) trends

IMR is the difference between the price paid for generation and the cost to produce that generation. All scheduled generators whose bids are less than the SMP for the period will earn varying levels of IMR, depending on their bid price.

The following chart shows the levels of IMR received by fuel type.

**Figure 12: Quarterly breakdown of Infra Marginal Rent by Fuel Type**

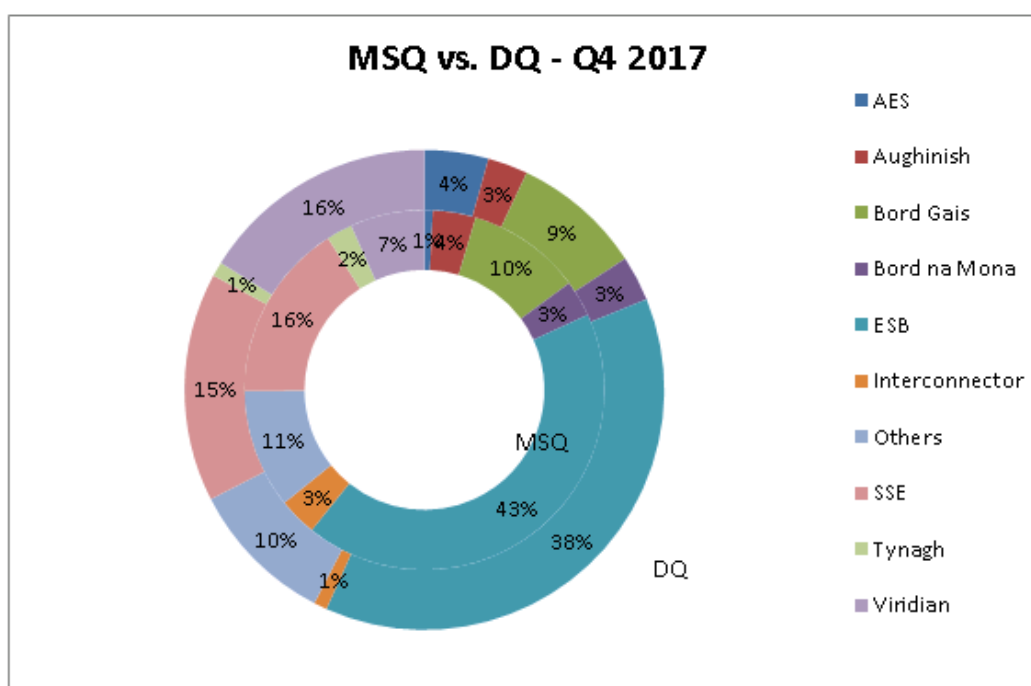


Wind generation makes up a large share of IMR when compared with its percentage of the fuel mix. In the latest quarter (Q4 2017), wind accounted for €116m of IMR revenues.

## Market and Dispatch Share by Owner

Figure 13: Quarterly breakdown MSQ/DQ by Owner

Owner	MSQ - Current Quarter	MSQ %	DQ - Current Quarter	DQ %
AES	135660	1%	746601	4%
Aughinish	703924	4%	469264	3%
Bord Gais	1872222	10%	1521622	9%
Bord na Mona	591744	3%	528600	3%
ESB	7760529	43%	6563016	38%
Interconnector	625392	3%	154206	1%
Others	1947555	11%	1714850	10%
SSE	2928545	16%	2674926	15%
Tynagh	425127	2%	168525	1%
Viridian	1215637	7%	2794736	16%
<b>Total</b>	<b>18206336</b>	<b>100%</b>	<b>17336347</b>	<b>100%</b>



The SEM operates on an unconstrained basis and is settled by the SEMO on an ex post basis. This can lead to differences between the market schedule and the real time dispatch of generating units. This is due to the System Operator dispatching generating units in real time under additional constraints that are not included in the market engine.

The pie chart above compares the share of MSQ and DQ by generation owner, for the latest quarter.

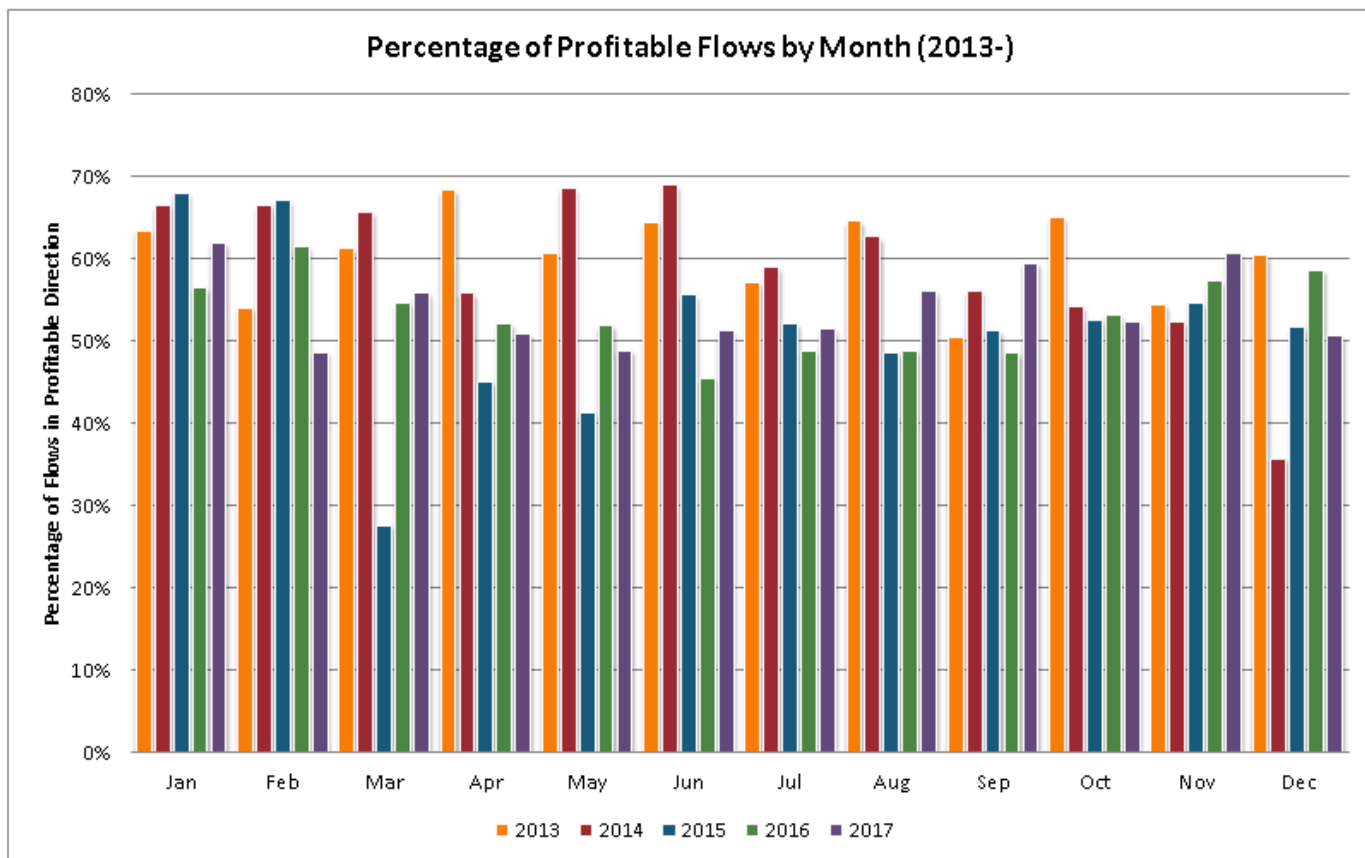
If there is a difference between the market schedule and the real-time dispatch the System Operators must dispatch generator units in real time under additional constraints not considered by the market engine. Transmission constraints and the need to provide reserve on the network are some of causes. Constraint payments keep generators financially neutral against these differences.

To balance supply and demand, constraining off will always result in generators being constrained on, and vice versa. Units constrained off will pay back a constraint payment and the corresponding units that are constrained on will receive a payment.

## Interconnectors Flows

The graph in Figure 15 illustrates the percentage of times in a month that the Interconnector flows in the expected profitable direction i.e. from GB to SEM if SEM Price is higher and vice versa.

Figure 14 – IC Profitable Flows



Interconnector flows do not always flow in the profitable direction and at times when these flows *are* in the profitable direction, the available capacity is not always fully utilised.

The 2017 flows are slightly higher than in previous years, in the early portion of the year the percentage of profitable flows returned to near 2013 levels when average profitable flows neared 55%.

## 6. DIRECTED CONTRACTS Q4 2017

### Overview

In November 2012 the regulatory authorities published an information note on contracting in the SEM from 2007 to 2013. The note provided details about the different contract products offered as well as the volume of contracts sold each year. The note also showed the trends in prices over the past number of years, both in terms of fuels and contracts. This included information on the price and volume of directed contracts sold.

In April 2012 the regulatory authorities published the decision on the format of directed contracts for 2012/13 and beyond. The decision was to move away from holding directed contract subscriptions on an annual basis and instead to have rolling quarterly subscriptions. With the move to quarterly subscriptions, it is appropriate that information on the price and volumes of directed contracts should be provided on a more regular basis than the annual contracting report.

The tables and figures below provide information on the price and volume of directed contracts subscriptions, using the same format as the contracting report. The information includes the latest subscription round, Round 1 (I-SEM), which was held in December 2017. Each subsequent quarterly price report will include the latest subscription results.

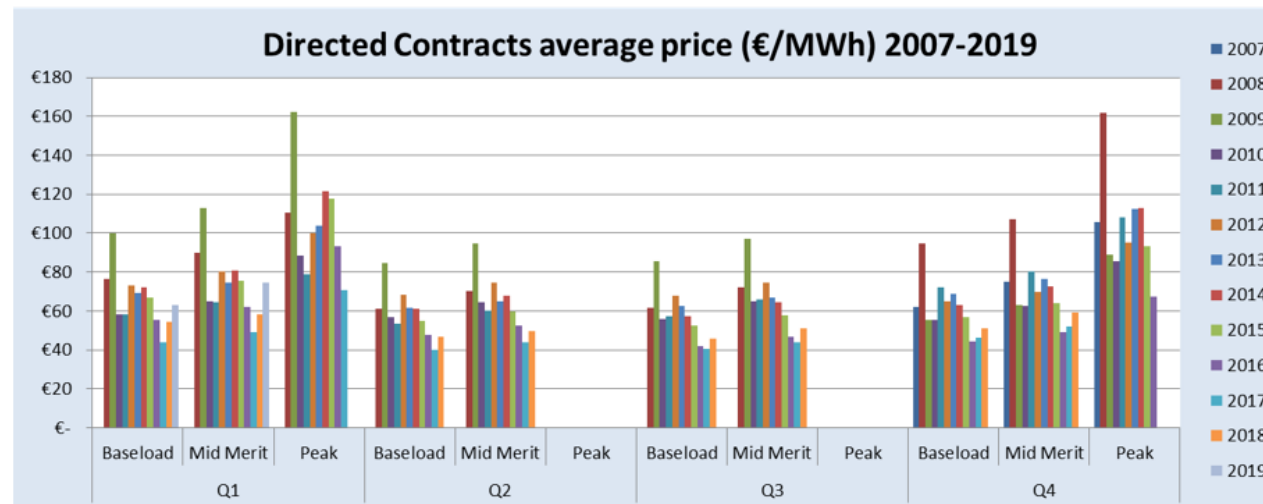
This was the first round of Directed Contracts for I-SEM. In this context, “Q2 2018” extends only from the introduction of I-SEM on 23rd May 2018. The first part, or the “SEM” part, of Q2 2018 was sold in the final two round of Directed Contracts for SEM, Rounds 21 and 22.

On average, the prices of Directed Contract Baseload and Mid Merit products for the first year of I-SEM were 15% higher than those sold for the last year of SEM. The full volume has not yet been sold for a standard quarter in I-SEM, but the volumes so far are similar to those offered in the final two rounds of Directed Contracts for SEM, which saw an increase in DC volumes, due to reduced imports on the interconnectors leading to increased concentration within the SEM market.

Directed Contracts average price (€/MWh), 2007-2019. The figures shown in red for Q2 2018 are the average of the “SEM” Q2 2018 and the “I-SEM” Q2 2018 prices.

DC Average Price (€/MWh), 2007-2019												
Year	Q1			Q2			Q3			Q4		
	Baseload	Mid Merit	Peak	Baseload	Mid Merit	Peak	Baseload	Mid Merit	Peak	Baseload	Mid Merit	Peak
2007										€ 62	€ 75	€ 106
2008	€ 76	€ 90	€ 111	€ 61	€ 70		€ 61	€ 72		€ 95	€ 107	€ 162
2009	€ 100	€ 113	€ 163	€ 85	€ 95		€ 86	€ 97		€ 55	€ 63	€ 89
2010	€ 58	€ 65	€ 88	€ 57	€ 64		€ 56	€ 65		€ 55	€ 62	€ 86
2011	€ 58	€ 65	€ 79	€ 54	€ 60		€ 58	€ 66		€ 72	€ 80	€ 108
2012	€ 73	€ 80	€ 100	€ 68	€ 74		€ 68	€ 74		€ 65	€ 70	€ 95
2013	€ 69	€ 75	€ 104	€ 62	€ 65		€ 63	€ 67		€ 69	€ 76	€ 113
2014	€ 72	€ 81	€ 121	€ 61	€ 68		€ 57	€ 64		€ 63	€ 73	€ 113
2015	€ 67	€ 76	€ 118	€ 55	€ 60		€ 52	€ 58		€ 57	€ 64	€ 93
2016	€ 56	€ 62	€ 93	€ 48	€ 53		€ 42	€ 47		€ 44	€ 49	€ 67
2017	€ 44	€ 49	€ 71	€ 40	€ 44		€ 41	€ 44		€ 46	€ 52	€ -
2018	€ 55	€ 58	€ -	€ 47	€ 50		€ 46	€ 51		€ 51	€ 59	€ -
2019	€ 63	€ 74	€ -									

Directed Contracts average price (€/MWh)



Directed Contracts volumes (GWh), 2007-2019. The figures shown in red for Q2 2018 are the sum of the "SEM" Q2 2018 and the "I-SEM" Q2 2018 volumes.

DC Volumes (GWh), 2007-2019													
Year	Q1			Q2			Q3			Q4			Total TWh
	Baseload	Mid Merit	Peak	Baseload	Mid Merit	Peak	Baseload	Mid Merit	Peak	Baseload	Mid Merit	Peak	
2007										352	122	90	0.56
2008	587	194	76	157	604		-	769		539	199	163	3.29
2009	605	52	169	518	316		291	671		492	312	74	3.50
2010	557	235	62	524	453		581	135		-	259	113	2.92
2011	-	209	73	-	423		-	291		462	143	13	1.61
2012	336	100	-	260	134		-	212		546	-	61	1.65
2013	643	-	-	788	19		795	153		868	142	51	3.46
2014	680	350	90	815	126		1,009	21		870	19	33	4.01
2015	887	47	74	885	62		945	7		990	15	11	3.92
2016	871	10	47	1,135	7		1,259	3		967	7	-	4.31
2017	843	27	9	1,149	160		693	190		1,023	172	-	4.27
2018	1,304	-	-	451	214		404	269		347	285	-	3.27
2019	175	12	-	-	-		-	-		-	-	-	0.19

Directed Contracts volumes (GWh)

