



SEM Monitoring Report: Q1 2017

SEM-17-035

May 2017

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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.

3. OVERVIEW

- **Wholesale costs:** Wholesale electricity costs during the first quarter of this year decreased on those in the fourth quarter of 2016. Capacity Payments decreased by €3m in this quarter to €151m from €154m in Q4 2016.
- **SEM Price (System Marginal Price “SMP”):** SMP decreased to €52/MWh on average for the quarter compared to €54/MWh in Q4 2016.
- **Fuel Price:** Gas prices increased to just under 49 p/therm in Q1 2017, up from 46 p/therm in Q4 2016. The historically low 2016 gas prices were a key contributor to low wholesale prices during most of 2016. This increase in gas price over the quarter has material impact on the SMP.
- **SEM demand (Market Schedule Quantity “MSQ”):** The average demand for Q1 2017 was 4177MW and is broadly what is expected for that time of year. The demand in Q4 2016 was roughly 4% lower, by comparison.
- **Directed Contracts:** On average, the prices of Directed Contract baseload, mid-merit and peak products for 2017 sold to date are 9-12% lower than those sold for 2016, and 26-33% lower than those sold for 2015. The volumes for 2016 were 10% higher than 2015 and 7% above 2014.

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:

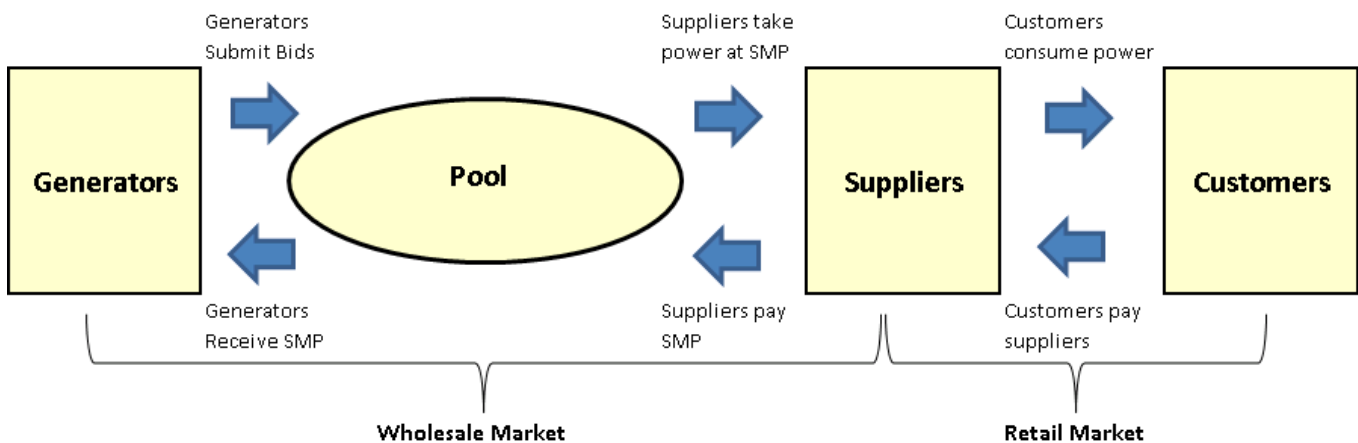
- **Background to the SEM:** This section explains how the market works, and in particular the way in which generators bid to provide the required electricity.
- **Electricity prices:** This section provides a high level breakdown of wholesale energy costs for the previous nine quarters.
- **System Marginal Price (SMP) and Demand:** This section provides information on the SMP and Demand levels since 2010.
- **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 Q1 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.

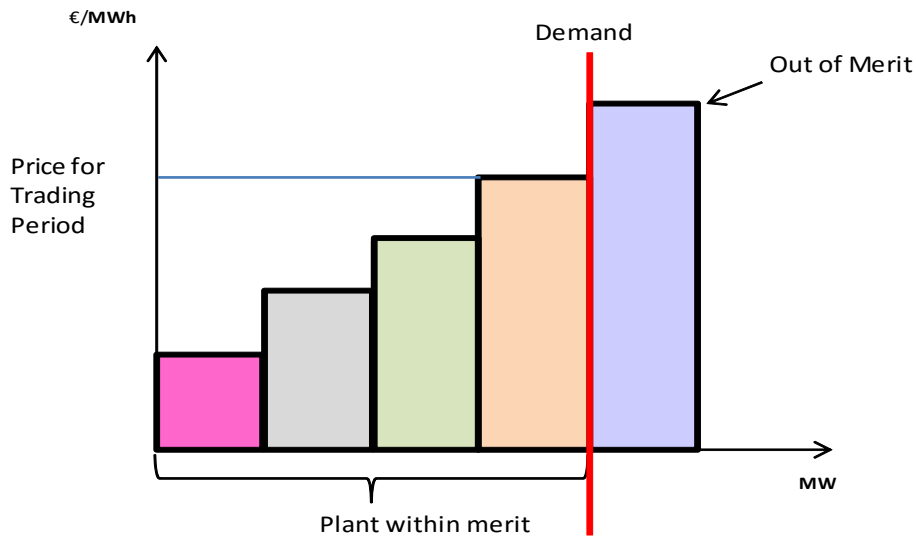
Figure 1: Market Overview



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%)

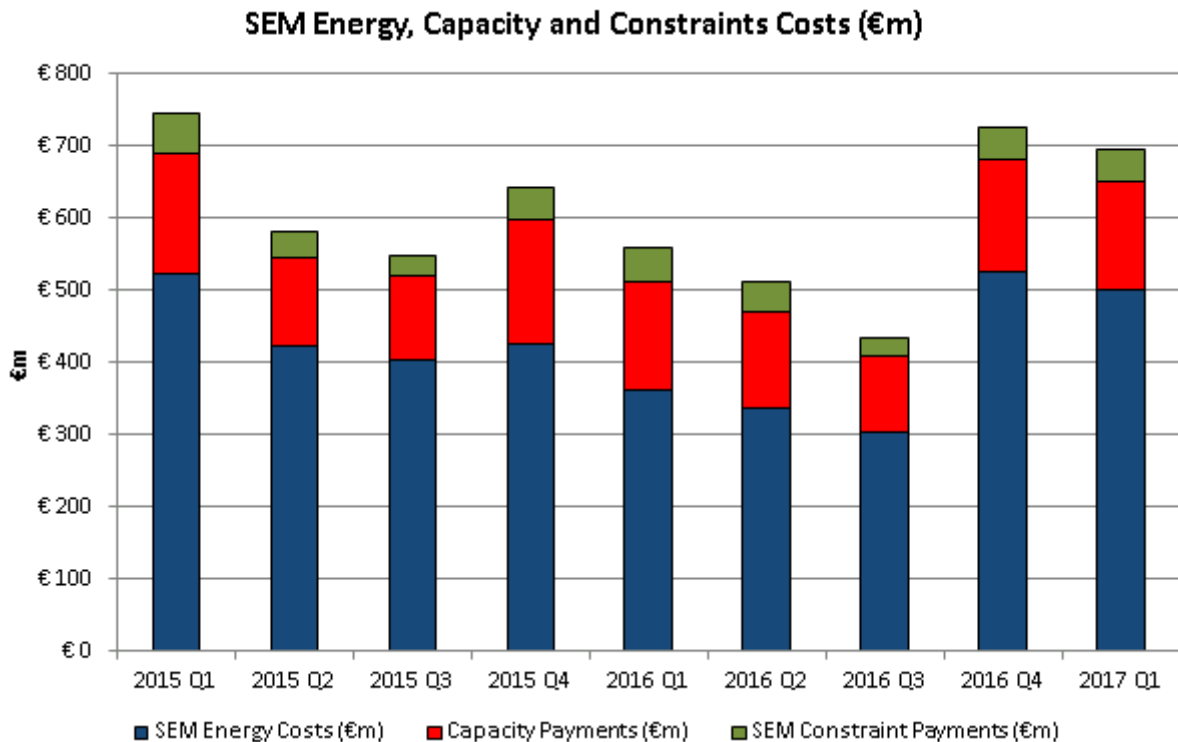
This report focuses on the wholesale element of electricity prices.

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 Q1 2015 through Q1 2017.

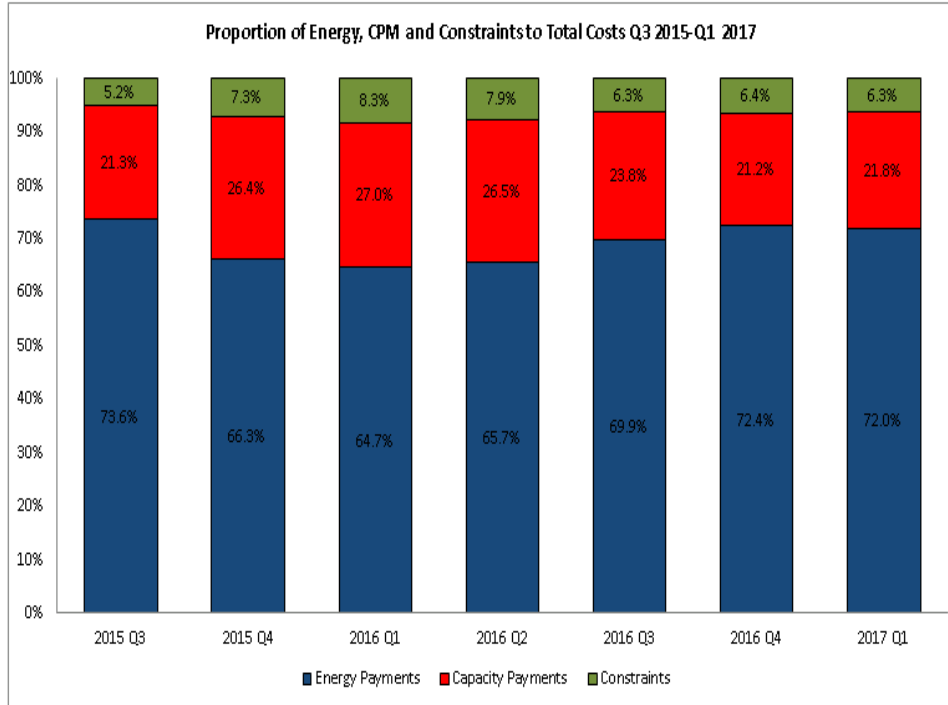
Figure 3: SEM Costs



As the following chart shows, energy costs are the largest element of the overall wholesale cost. In the first quarter of 2017, 72% of total wholesale costs were attributable to energy. Constraints costs are roughly 6% of total energy costs for Q1 2017, broadly similar to the last quarter.

The bar chart below shows the proportion of costs to the total for each quarter costs since Q3 2015.

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



System Marginal Price and Demand trends

Average SMP for Q1 2017 decreased to €52/MWh, which is roughly €2/MWh lower than Q4 2016.

Levels of demand increased from an average of 4092 MW in Q4 2016 to 4177 MW in Q1 2017.

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

Figure 5: Mean System Marginal Price

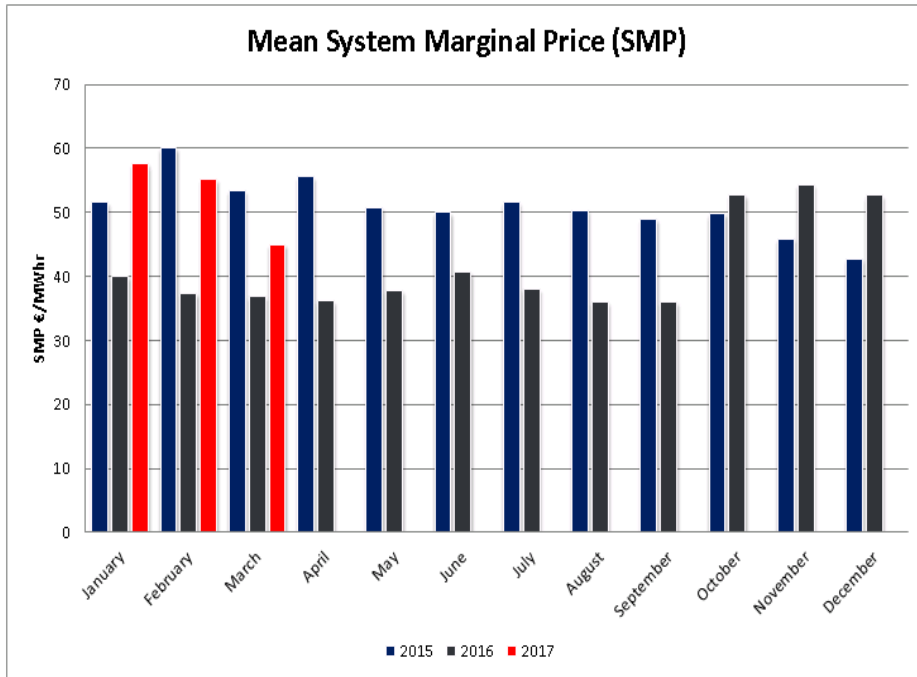


Figure 6: Demand in the Single Electricity Market 2012 - 2017

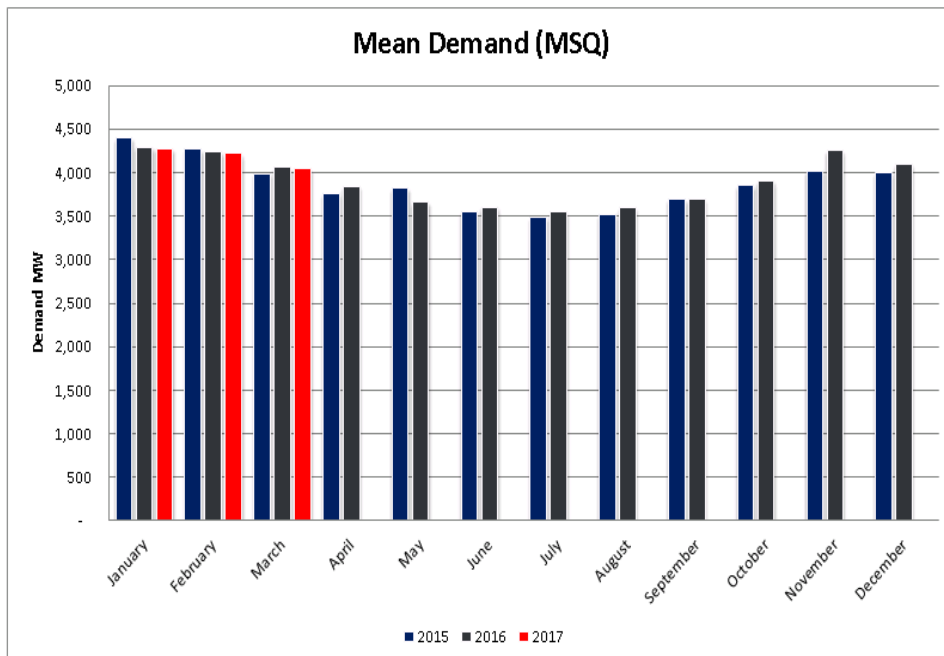


Figure 7: Average SMP Profile during Q4 2016

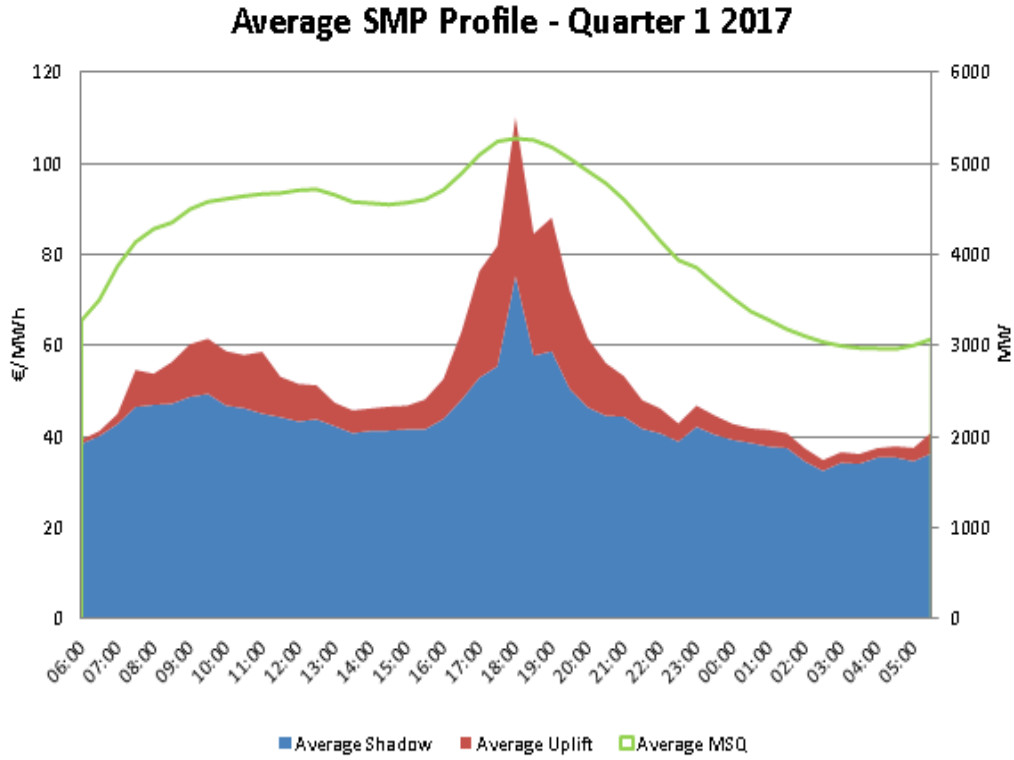
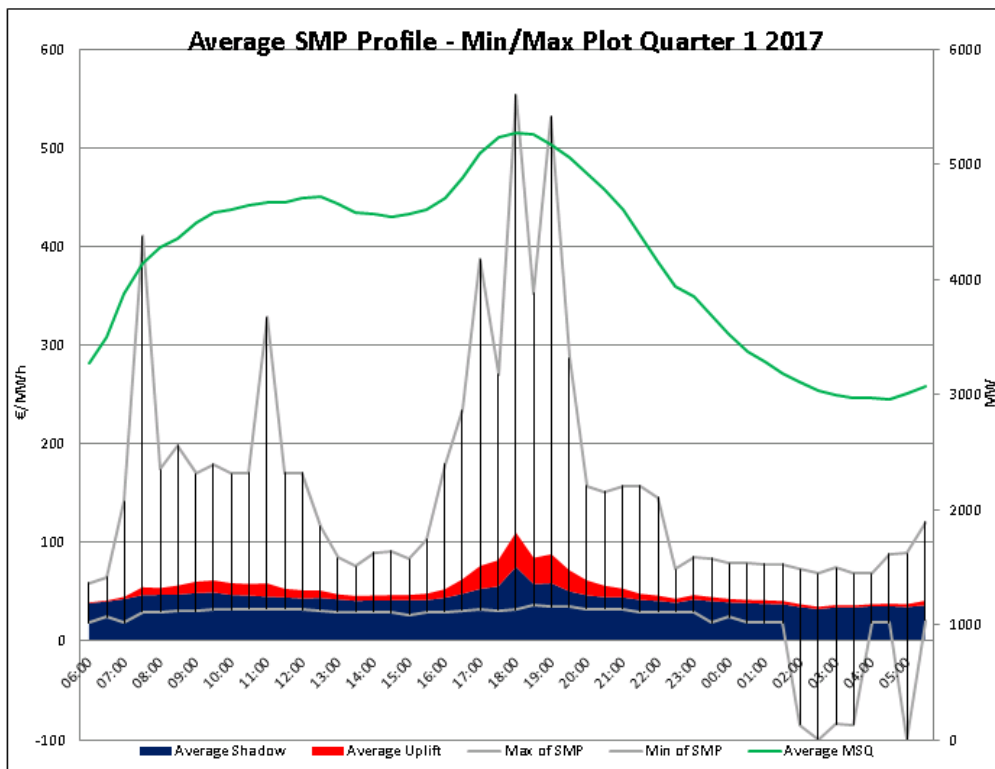


Figure 8: Average SMP Profile during Q1 2017



Share of generation by fuel type (fuel mix)

Figure 9: Fuel Mix in the Single Electricity Market Q4 2012 – Q1 2017

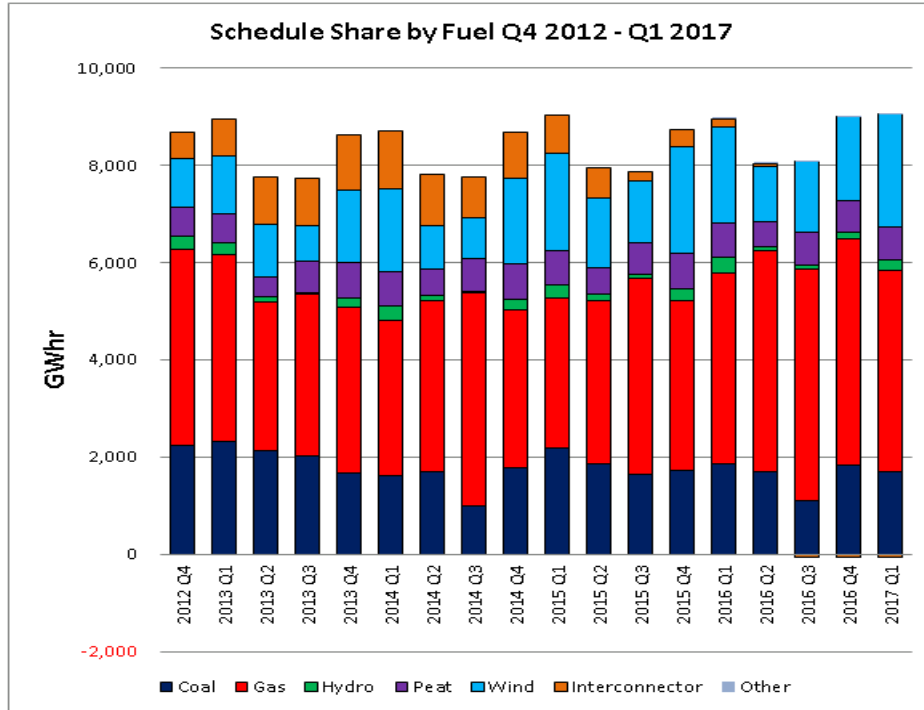
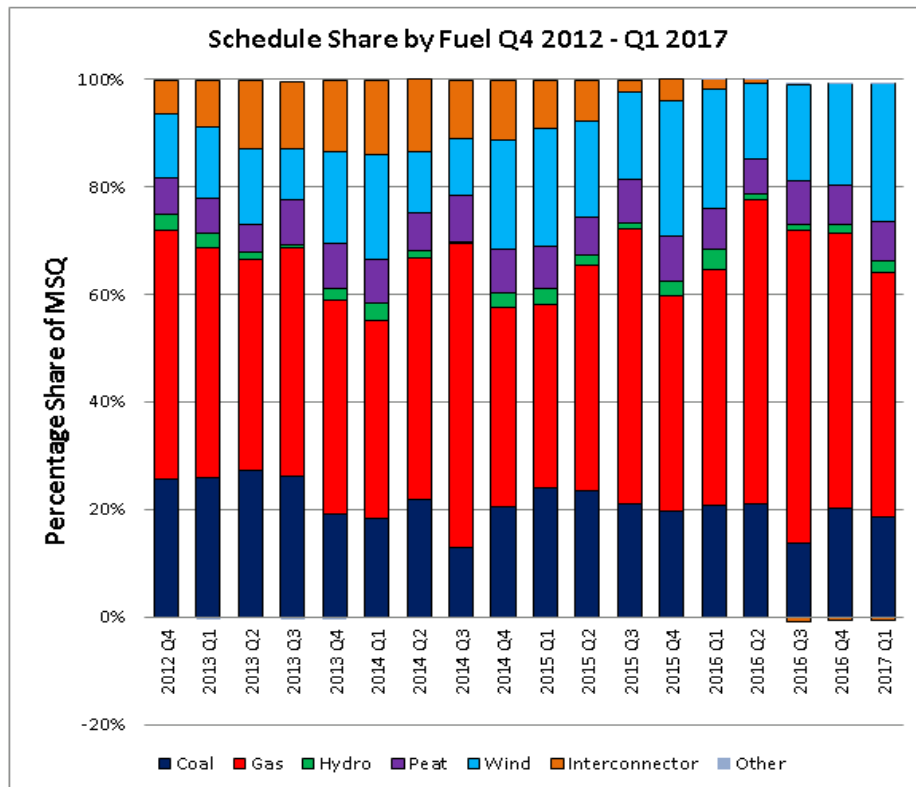


Figure 10: Fuel Mix in the Single Electricity Market Q4 2012 – Q1 2017



Gas is the most common fuel that is used for electricity production in the SEM. The figure above shows the average percentage of generation by each fuel type and the total demand by fuel type in each quarter since the second quarter of 2012.

A number of trends can be observed:

- Gas share has slightly decreased to 50% in Q1 2017.
- Wind share was 19% in Q4 2016. This is roughly the same figure in Q1 2017.
- Interconnector share remained the same as in the previous quarter. In Q1 2017 it was roughly -1% of the share.

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 (MSQ³) and Dispatch Quantity (DQ⁴) 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.

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

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

Figure 11: Single Electricity Market dashboard

Quarterly Averages	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Change From last Quarter
SMP €/MWh	72	63	63	65	65	53	51	58	55	53	50	46	38	38	37	54	52	↘
% Change from previous Quarter	8%	-12%	0%	3%	0%	-18%	-3%	12%	-4%	-4%	-4%	-8%	-17%	0%	0%	47%	-4%	
% Change from Quarter, previous year	16%	1%	1%	-2%	-10%	-16%	-18%	-11%	-15%	-1%	-2%	-20%	-31%	-27%	-27%	17%	37%	
Margin MW	5245	5421	5337	5536	5479	5073	5031	5785	6278	5125	5456	5233	6526	5764	5486	5401	6378	↑
% Change from previous Quarter	-6%	3%	-2%	4%	-1%	-7%	-1%	15%	9%	-18%	6%	-4%	25%	-12%	-5%	-2%	18%	
% Change from Quarter, previous year	12%	16%	5%	0%	4%	-6%	-6%	4%	15%	1%	8%	-10%	4%	12%	1%	3%	-2%	
Demand MW	4132	3547	3492	3884	4021	3567	3506	3934	4137	3586	3564	3954	4155	3701	3608	4092	4177	↘
% Change from previous Quarter	4%	-14%	-2%	11%	4%	-11%	-2%	12%	5%	-13%	-1%	11%	5%	-11%	-3%	13%	2%	
% Change from Quarter, previous year	2%	-2%	1%	-2%	-3%	1%	0%	1%	3%	1%	2%	1%	0%	3%	1%	3%	1%	
Actual Availability MW	9377	8968	8829	9421	9500	8640	8537	9719	10415	8770	9020	9187	10681	9465	9094	9487	10555	↑
% Change from previous Quarter	-1%	-4%	-2%	7%	1%	-9%	-1%	14%	7%	-16%	3%	2%	16%	-11%	-4%	4%	11%	
% Change from Quarter, previous year	7%	8%	3%	-1%	1%	-4%	-3%	3%	10%	2%	6%	-5%	3%	8%	1%	3%	-1%	
Shadow €/MWh	53	44	44	46	47	37	36	43	41	40	42	38	32	33	27	47	44	↓
% Change from previous Quarter	6%	-18%	2%	4%	2%	-21%	-3%	18%	-4%	-1%	3%	-11%	-23%	-18%	-35%	74%	-6%	
% Change from Quarter, previous year	14%	-5%	-4%	-8%	-11%	-15%	-18%	-7%	-13%	9%	16%	-11%	-23%	-18%	-35%	24%	39%	
Uplift €/MWh	19	20	19	19	18	16	15	15	14	12	8	8	6	5	10	7	8	↑
% Change from previous Quarter	13%	5%	-3%	-1%	-6%	-11%	-3%	-4%	-5%	-13%	-30%	0%	-20%	-20%	94%	-30%	14%	
% Change from Quarter, previous year	22%	18%	19%	14%	-5%	-20%	-20%	-22%	-21%	-23%	-44%	-45%	-54%	-57%	18%	-13%	24%	
Interconnector (Total)	355	449	443	513	552	439	346	443	366	233	182	152	80	30	-70	-28	-46	
Moyle	205	190	111	197	244	128	65	294	253	202	139	26	35	-6	-20	-17	30	
EWIC	150	259	331	315	307	311	281	149	113	31	43	126	45	36	-50	-11	-76	↑
% Change from previous Quarter	45%	27%	-1%	16%	8%	-20%	-21%	28%	-17%	-36%	-65%	-16%	-47%	-62%	-330%	-60%	64%	
% Change from Quarter, previous year	71%	39%	102%	109%	55%	20%	-15%	-53%	-34%	-47%	-76%	-66%	-78%	-87%	-139%	-118%	-157%	
Wind MW (produced)	555	502	330	666	783	410	371	801	919	644	583	998	910	525	658	787	1076	↑
% Change from previous Quarter	19%	-10%	-34%	102%	18%	-48%	-9%	116%	15%	-30%	-9%	71%	-9%	-42%	25%	20%	37%	
% Change from Quarter, previous year	-4%	32%	-10%	42%	41%	-18%	12%	20%	17%	57%	57%	25%	-1%	-18%	13%	-21%	18%	

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

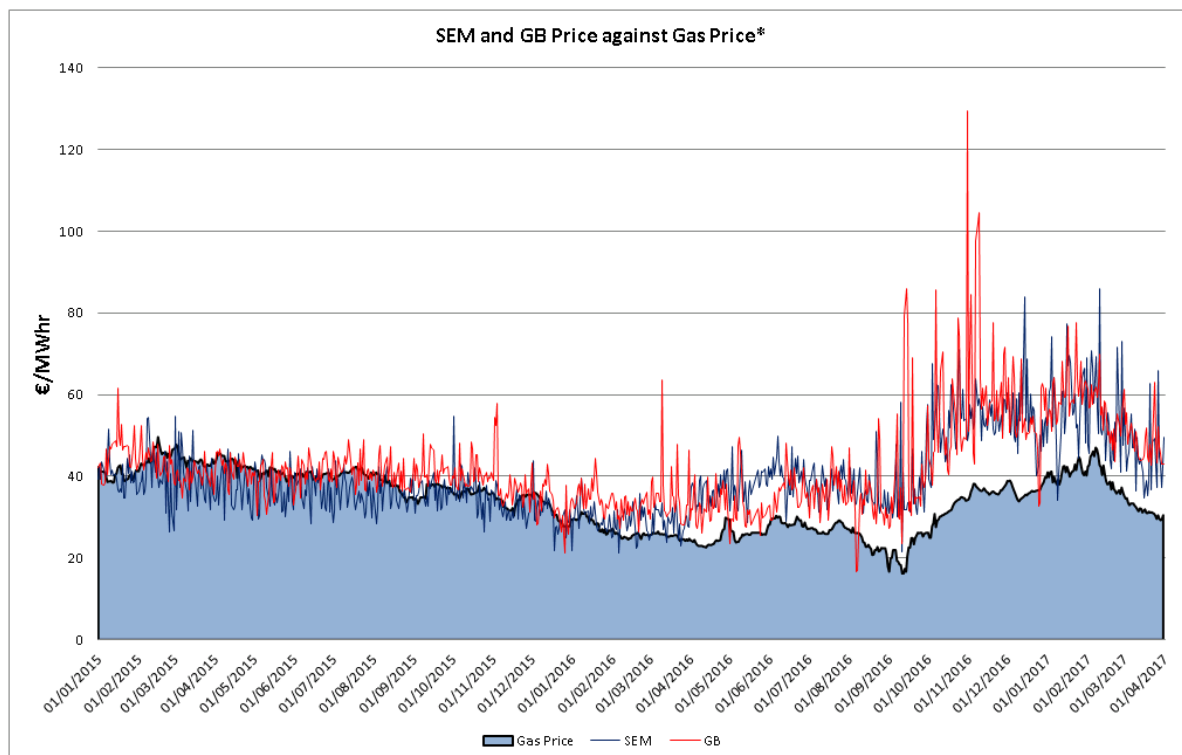
Summary highlights based on the dashboard

High Level Summary

- Average SMP was €52/MWhr in Q1 2017. This was a decrease of €2/MWh on the fourth quarter of 2016. In Q1 2016, mean SMP was €38/MWhr. This was primarily driven by a low Gas price.
- Levels of demand have remained generally stable over the past nine quarters, with the usual seasonal fluctuations being observed. Comparing Q1 2017 with the same quarter in 2016 shows a 0.5% increase.
- Margin levels have largely fluctuated over the last nine quarters; Q1 2017 is an 18% increase on Q4 2016.
- Actual Availability increased by 11% on Q4 2016.
- The Shadow Price has decreased in the quarter, from €47/MWh in Q4 2016 to €44/MWh in Q1 2017.
- Average Uplift has increased over the past quarter from €7/MWh in Q4 2016 to €8/MWh in Q1 2017.

Energy price trends

Figure 12: 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.

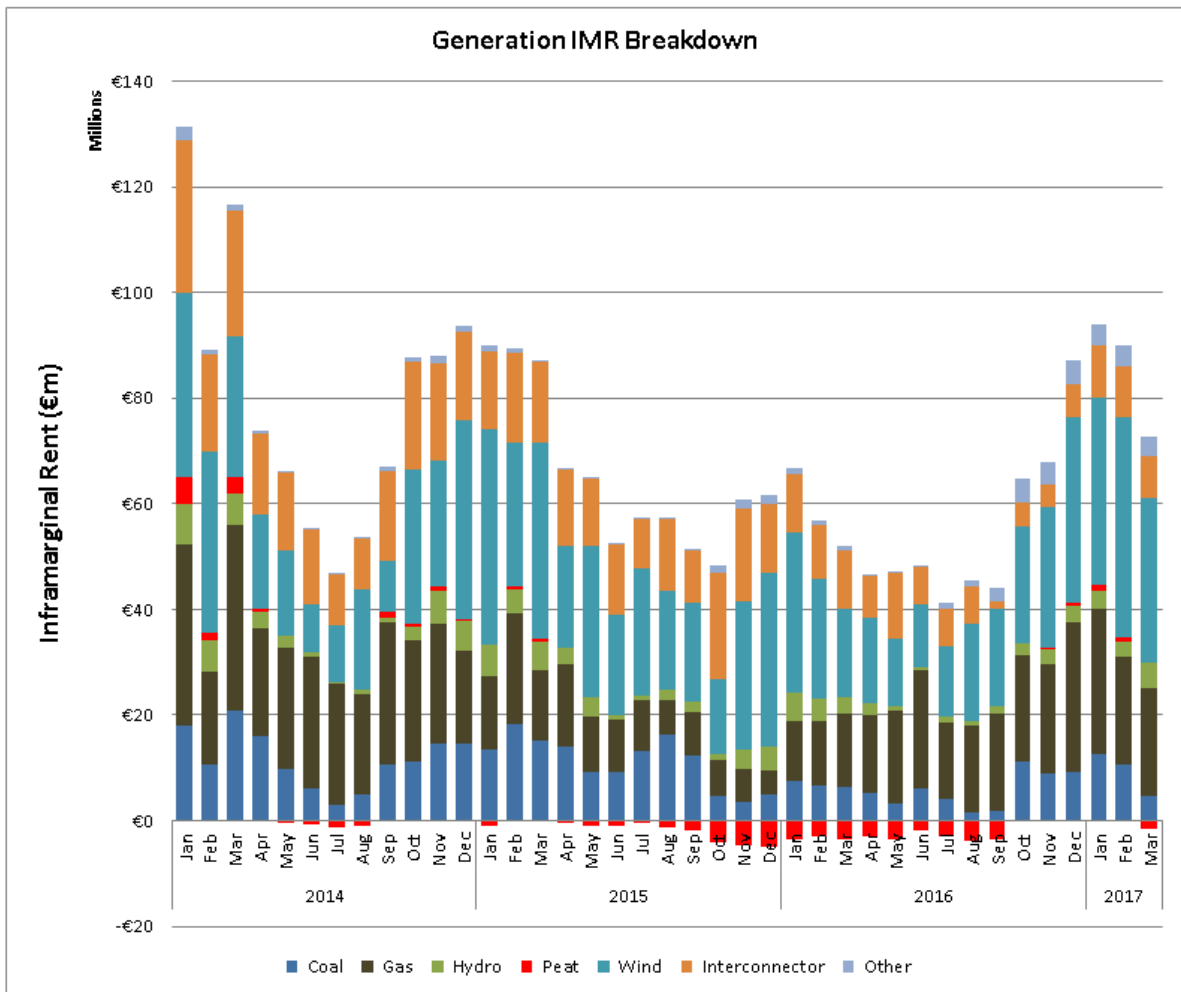
Quarterly average gas price increased from 46 p/therm in Q4 2016, to 49 p/therm in Q1 2017. This increase impacts on the SMP as the fuel mix is gas dominant within the SEM.

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 13: Quarterly breakdown of Infra Marginal Rent by Fuel Type



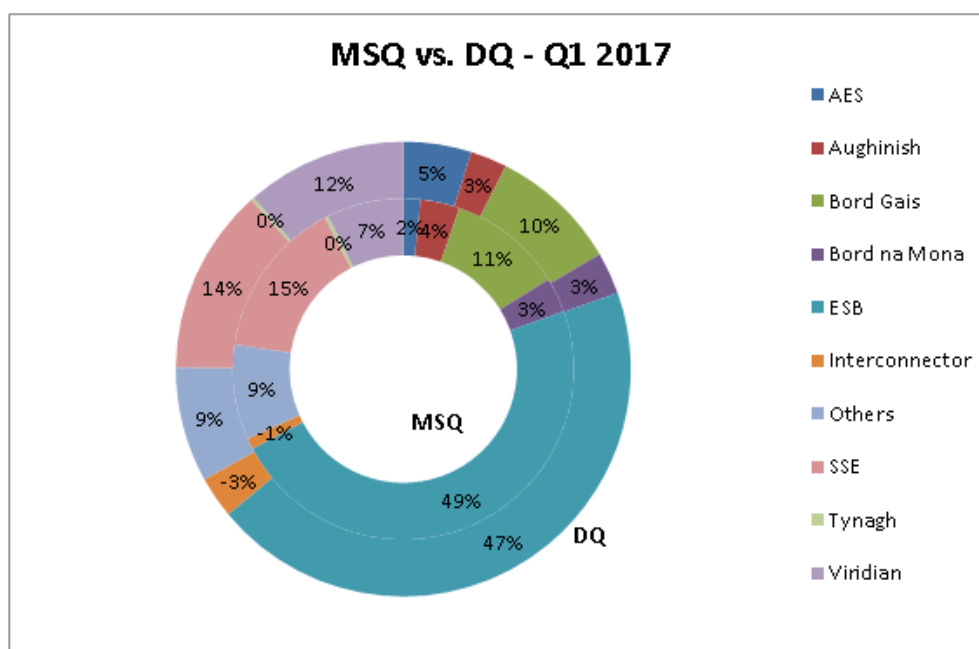
Wind generation makes up a large share of IMR when compared with its percentage of the fuel mix. In the latest quarter (Q1 2017), wind accounted for €35m of IMR revenues.

Gas continued to dominate in IMR earnings; this is unsurprising given the fuel mix seen in figures 9 and 10.

Market and Dispatch Share by Owner

Figure 14: Quarterly breakdown MSQ/DQ by Owner

Owner	MSQ - Current Quarter	MSQ %	DQ - Current Quarter	DQ %
AES	302360.092	2%	899284.299	5%
Aughinish	693089.501	4%	482558.919	3%
Bord Gais	2024202.888	11%	1698878.428	10%
Bord na Mona	612548.093	3%	553165.956	3%
ESB	8895422.745	49%	8248036.418	47%
Interconnector	-196827.203	-1%	-548826.597	-3%
Others	1670485.304	9%	1517354.709	9%
SSE	2811857.782	15%	2460388.689	14%
Tynagh	64557.091	0%	42514.288	0%
Viridian	1352699.011	7%	2120147.256	12%
Total	18230395.3	100%	17473502.37	100%



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 between the previous eight quarters and 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.

6. DIRECTED CONTRACTS Q1 2017

Overview

In November 2012 the regulatory authorities published an information note **Error! Bookmark not defined.** 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 **Error! Bookmark not defined.** 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 **Error! Bookmark not defined.** 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 20, which was held in Mar 2017. Each subsequent quarterly price report will include the latest subscription results.

The contract volumes for Q4 2017 show the volume of contracts sold to date and do not represent the full volume of contracts that are likely to be sold for the period. As a result of the DC subscriptions moving to a rolling quarterly schedule, the full volume for each quarterly product (e.g. Baseload Q1 2016) will be sold over a year. The table below shows the proportion of the expected total Directed Contracts volumes that have been sold to date for the given quarters.

Note that since the I-SEM go live date has been extended to May 2018, the additional 3 quarters in the SEM – Q4 17, Q1 18 and Q2 18 – are being offered in additional rounds of Directed Contracts scheduled in 2017.

Figure 15: Expected Volumes in Q1 2017

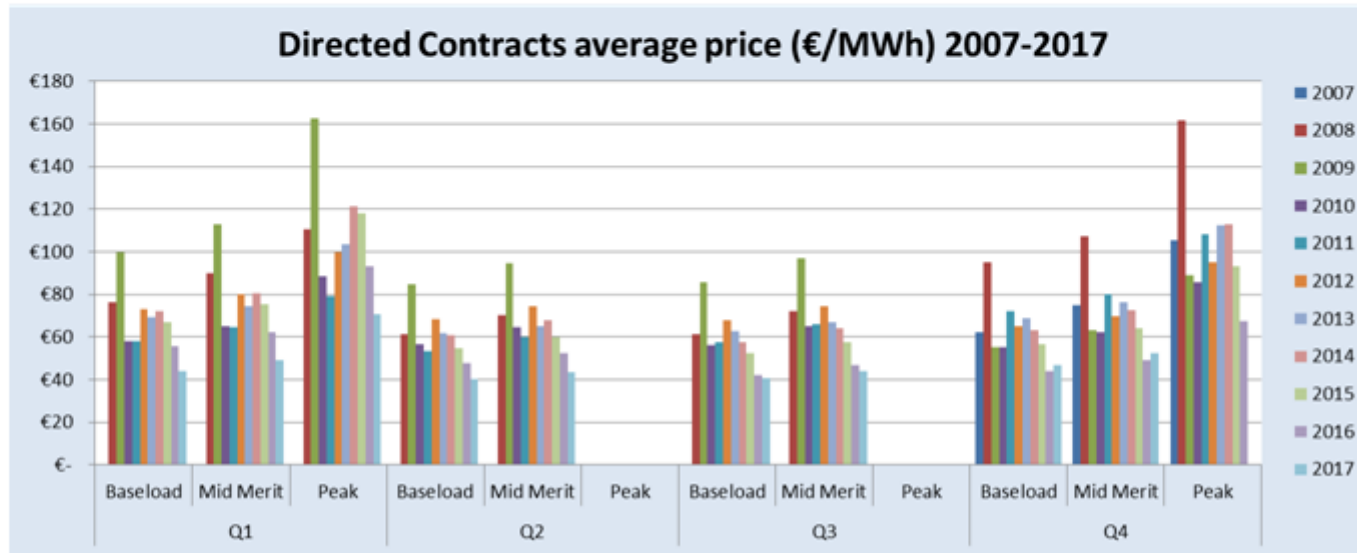
Expected Volumes of DCs Offered to Date			
Q1 2017	Q2 2017	Q3 2017	Q4 2017
100%	100%	100%	50%

On average, the prices of Directed Contract baseload, mid-merit and peak products for 2017 sold to date are 9-12% lower than those sold for 2016, and 26-33% lower than those sold for 2015. The volumes for 2016 were 10% higher than 2015 and 7% above 2014.

Directed contracts average price (€/MWh), 2007-2017

DC Average Price (€/MWh), 2007-2017												
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		€ 47	€ 53	-

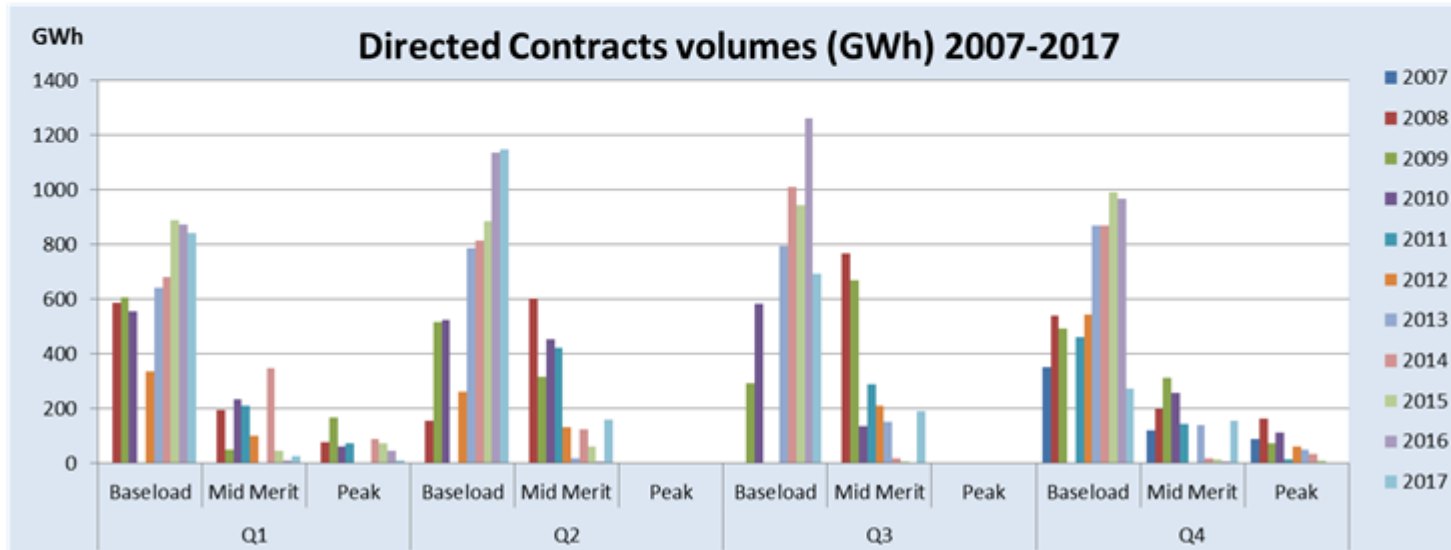
Directed contracts average price (€/MWh)



Directed contracts volumes (GWh), 2007-2017

DC Volumes (GWh), 2007-2017													
Year	Q1			Q2			Q3			Q4			Total
	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		274	157	-	3.50

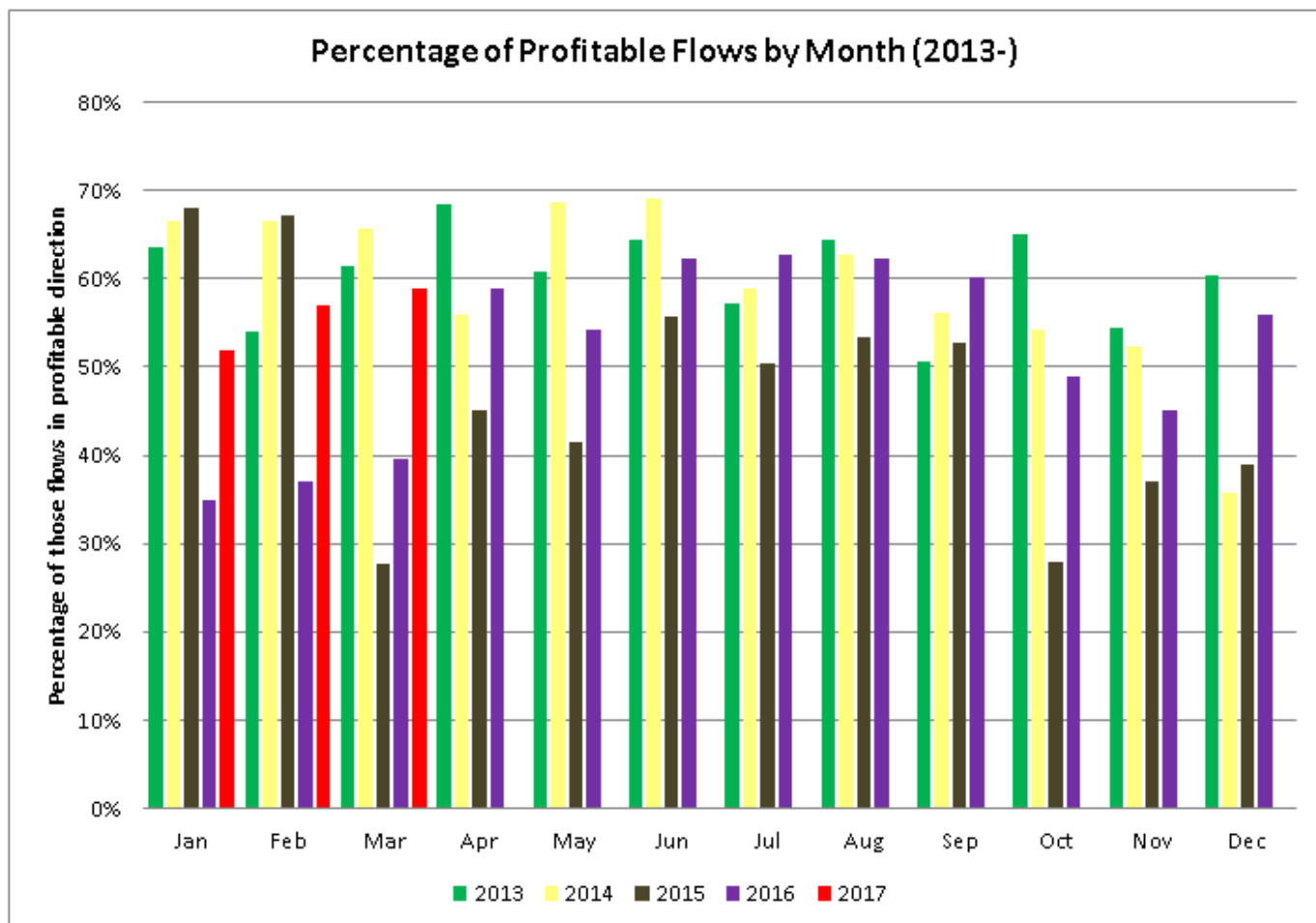
Directed contracts volumes (GWh)



Interconnectors Flows - Profitability

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 15 – 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.

Early 2016 flows were much lower than in previous years, in the latter portion of the year the percentage of profitable flows returned to near 2013 levels, with the last quarter surpassing those in the same quarter of 2015