SEM Monthly Monitoring Report

1 May 2022 – 31 May 2022

SEM-022-031

CONTENTS

INTRODUCTION

The Single Electricity Market (SEM) is the wholesale electricity market for the island of Ireland. This report, carried out by the SEM Market Monitoring Unit (MMU), provides an overview of the performance of the SEM for the period May 2022. It covers the Day Ahead Market, Intra-Day Markets and the Balancing Market.

The MMU is a joint regulatory unit that is the main monitoring function of the two Regulatory Authorities (RAs), The Commission for Regulation of Utilities (CRU) and The Utility Regulator. The monitoring function of the MMU is carried out alongside that of the Agency for the Cooperation of Energy Regulators (ACER) and is provided for by Regulation (EU) No 1227/2011 of 25 October 2011 on wholesale energy market integrity and transparency (REMIT).

The SEM is composed of separate electricity trading arrangements in a number of different timeframes. This is shown graphically in Figure 1 below.

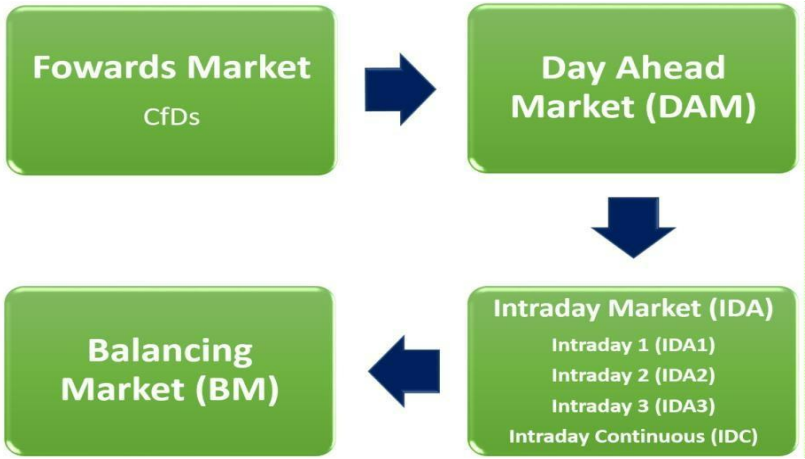


Figure 1 - SEM Energy Market

Trading in the forwards market is financial only and does not entail physical delivery of power. It does however provide market participants with the opportunity to hedge their positions in the Day Ahead Market (DAM) through forward contracts.

The DAM is a daily auction that takes place at 11:00 each day. Participation in the DAM is not mandatory. Following the DAM, the Intraday Auctions (IDA) enable participants to adjust their physical positions closer to real time. IDA1 and IDA2 are coupled with the GB market. IDA3 is a local market to the SEM. The Intraday Continuous Market (IDC) also provides market participants with the opportunity to refine their market position and minimise their exposure in the Balancing Market (BM). Through the Balancing Market (BM), the Transmission System Operators (TSOs) buy and sell power from market participants to ensure that the demand and supply of power is exactly matched at all times

SUMMARY DASHBOARD

The below dashboard outlines the key monthly averages for the period May 2021 to May 2022:

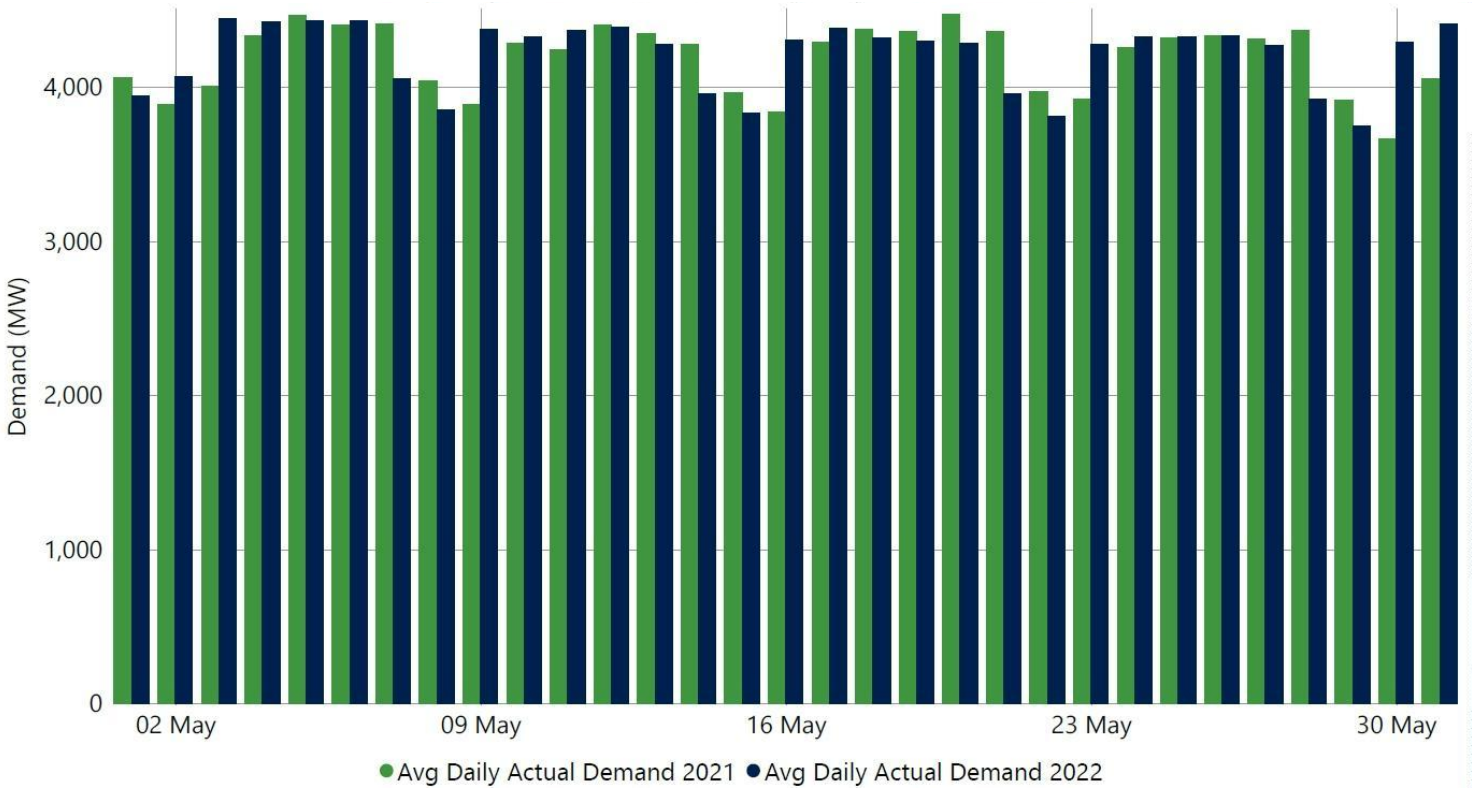
Monthly Averages	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22
DAM (€/MWh)	**96.73**	**95.00**	**143.41**	**131.47**	**195.54**	**214.77**	**204.72**	**250.40**	**201.46**	**175.11**	**293.25**	**218.26**	**143.27**
% Change from previous month	13%	-2%	51%	-8%	49%	10%	-5%	22%	-20%	-13%	67%	-26%	-34%
% Change from previous year	310%	266%	377%	256%	341%	346%	347%	326%	157%	204%	302%	155%	48%
Actual System Demand (MW)	**4188**	**4081**	**4111**	**4098**	**4274**	**4387**	**4735**	**4789**	**4834**	**4833**	**4675**	**4408**	**4208**
% Change from previous month	-2%	-3%	1%	0%	4%	3%	8%	1%	1%	0%	-3%	-6%	-5%
% Change from previous year	14%	8%	6%	5%	5%	2%	5%	2%	2%	3%	4%	3%	0%
Actual Wind Generation (MW)	**1069**	**998**	**449**	**846**	**873**	**1541**	**1542**	**1971**	**1682**	**2777**	**1559**	**1426**	**1428**
% Change from previous month	-2%	-7%	-55%	88%	3%	77%	0%	28%	-15%	65%	-44%	-9%	0%
% Change from previous year	-9%	-14%	-62%	-13%	-31%	-16%	-13%	-1%	11%	13%	-3%	31%	34%
Gas Price (€/MWh)	**26.12**	**28.59**	**36.20**	**43.80**	**61.80**	**80.46**	**80.34**	**109.16**	**81.61**	**76.55**	**124.91**	**66.21**	**38.25**
% Change from previous month	21%	9%	27%	21%	41%	30%	0%	36%	-25%	-6%	63%	-47%	-42%
% Change from previous year	477%	468%	622%	464%	450%	459%	463%	532%	262%	328%	594%	208%	46%
Carbon Price (€/Tonne)	**52.26**	**52.67**	**53.43**	**56.37**	**61.79**	**59.44**	**66.22**	**78.99**	**84.16**	**90.96**	**74.69**	**81.09**	**85.41**
% Change from previous month	14%	1%	1%	6%	10%	-4%	11%	19%	7%	8%	-18%	9%	5%
% Change from previous year	162%	124%	94%	111%	123%	135%	150%	155%	149%	138%	81%	77%	63%
Coal Price (€/MWh)	**9.65**	**12.47**	**15.35**	**17.43**	**20.70**	**28.56**	**17.63**	**16.94**	**18.89**	**23.26**	**44.28**	**39.91**	**42.55**
% Change from previous month	17%	29%	23%	14%	19%	38%	-38%	-4%	12%	23%	90%	-10%	7%
% Change from previous year	92%	120%	153%	196%	233%	322%	184%	125%	142%	204%	460%	384%	341%
EWIC % Periods Import	64.25%	37.00%	81.18%	38.06%	39.20%	39.58%	30.97%	25.77%	17.61%	18.15%	68.75%	0.00%	12.33%
EWIC % Periods Export	23.66%	14.00%	0.42%	15.42%	13.92%	30.07%	31.18%	47.14%	48.19%	59.19%	17.04%	0.00%	23.49%
EWIC % Not Flowing	12.10%	49.00%	18.40%	46.52%	46.88%	30.01%	37.85%	27.08%	34.21%	33.37%	14.21%	100.00%	64.18%
Moyle % Periods Import	73.12%	72.00%	97.53%	69.30%	70.52%	57.00%	50.63%	24.29%	35.65%	27.31%	55.04%	56.33%	38.54%
Moyle % Periods Export	26.88%	28.00%	2.47%	30.70%	29.48%	42.67%	49.38%	75.71%	64.35%	72.69%	44.83%	43.63%	61.46%
Moyle % Not Flowing	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	7.14%	0.13%	0.00%	0.00%

Dashboard 1 – Year Period Key Metrics

1. SYSTEM

1.1 SYSTEM DEMAND

The system demand graph below represents the electricity production required to meet electricity consumption on a daily average basis.

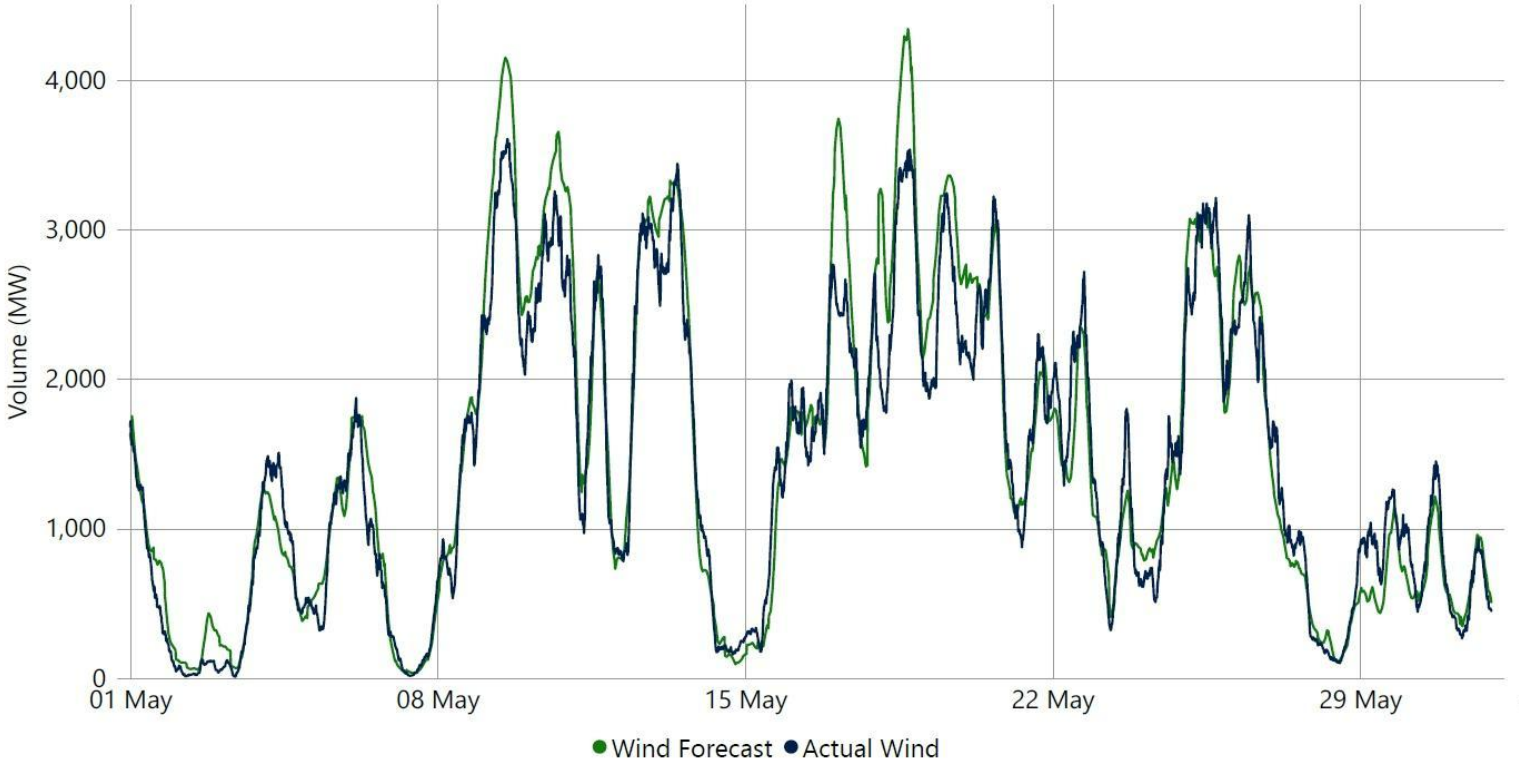


Graph 1 – Actual System Demand Daily Average 2021 against 2022

- Actual system demand in May 2022 averaged 4208 MW compared to 4188 MW in May 2021
- These two periods are on par

1.2 WIND GENERATION

Actual wind generation displayed below is the total electricity production of all wind farms on the system against forecast.



Graph 2 – Forecasted against Actual Wind Generation

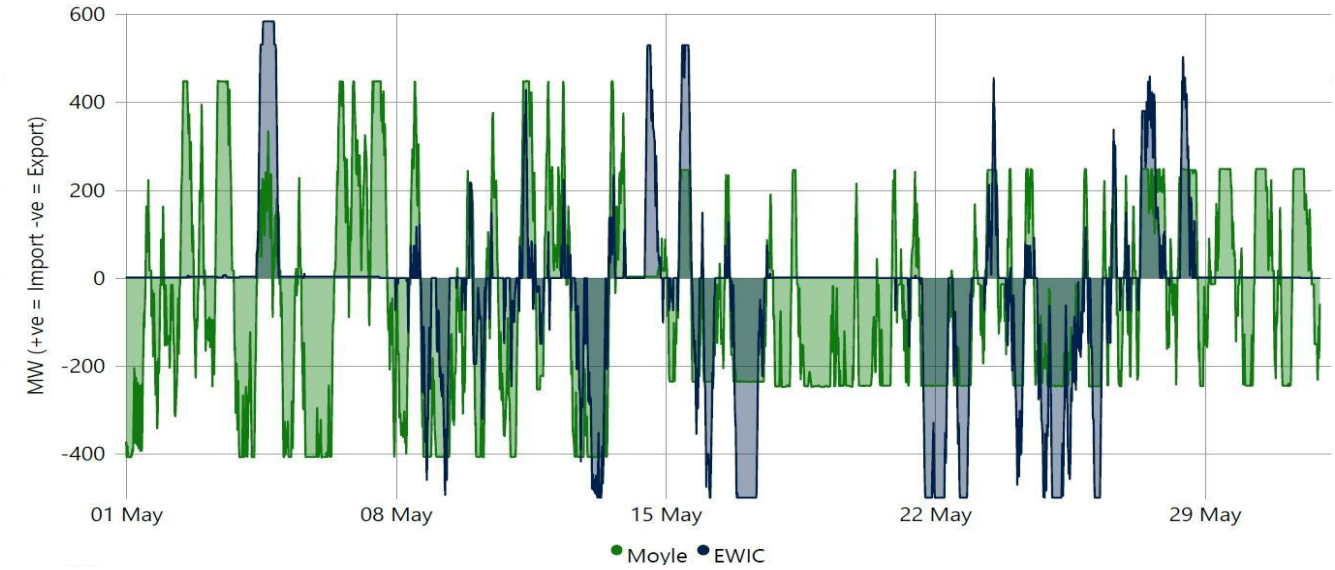
- Actual wind generation across the month averaged 1428 MW compared to 1069 MW in the same month last year
- Actual wind generation was on par with April 2022

1.3 INTERCONNECTION

Interconnection between the SEM and the wholesale electricity markets in Great Britain takes place over two interconnectors: 1) between Northern Ireland and Scotland via the Moyle Interconnector; and 2) between Ireland and Wales via the East West Interconnector (EWIC).

1.3.1 MOYLE & EWIC

In the graphs below actual flows of each interconnector are shown across the month on a quarter hourly basis. A positive flow (i.e. on the top half of the graph) shows the interconnectors importing from GB, indicating that the intraday SEM prices (IDA1/2) are likely to be higher than the intraday GB prices (IDA1/2). A negative flow (i.e. in the bottom half of the graph) shows that the SEM is exporting, indicating that the SEM price is likely to be lower than GB's. The below also shows EWIC continuing to be unavailable for some periods and Moyle being reduced to one pole (limited to approx. 250 MW).

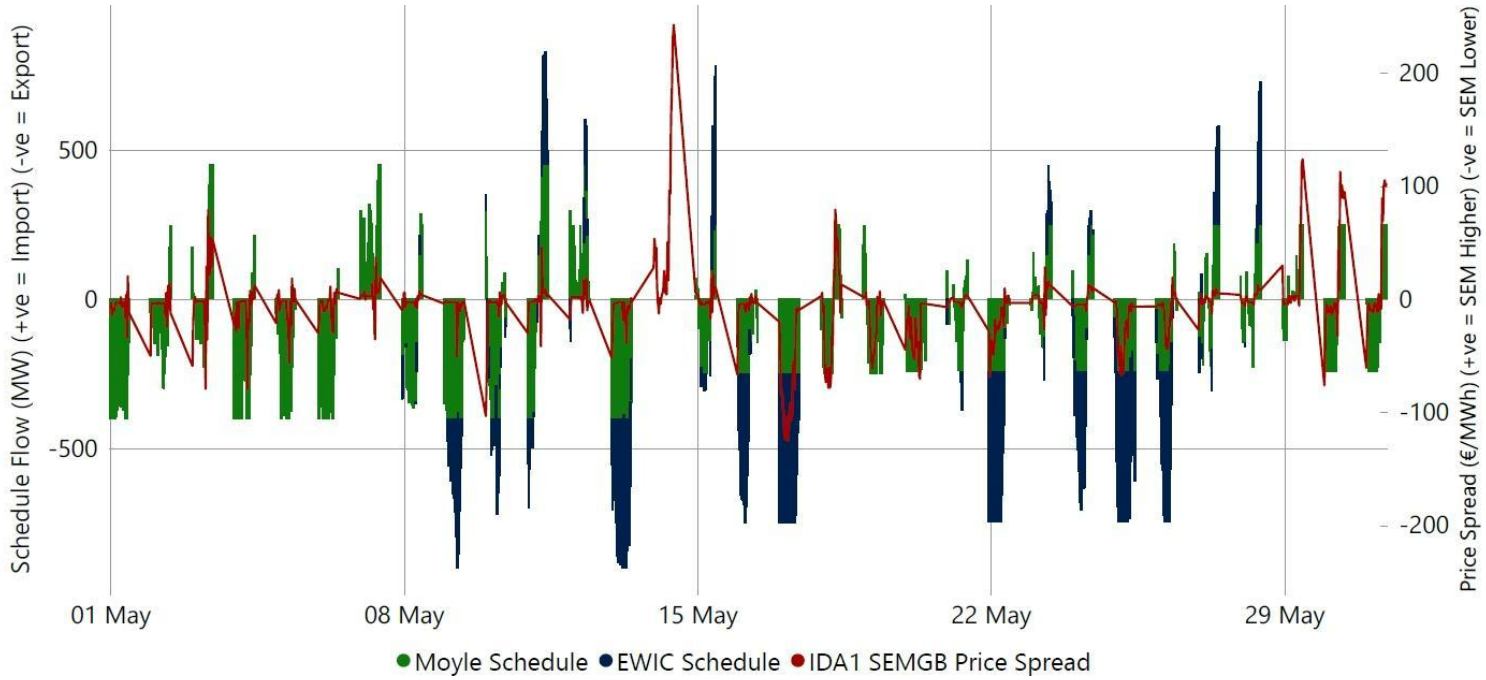


Graph 3 – Actual Interconnector Flows (15 Minute Intervals)

Scheduling of the direction and volume on each of the interconnectors is determined by the positive or negative state of the price spread between SEM and GB in the first two intraday auctions. Where the SEM is priced higher than GB the interconnectors should import and where the SEM is priced lower than GB the interconnectors should be exporting.

In the below two graphs the scheduled volumes of the two interconnectors are shown against the SEM and GB intraday price spreads. Flows are shown using the auction schedule of each interconnector at each 30 minute period throughout the day against the SEM GB price spread.

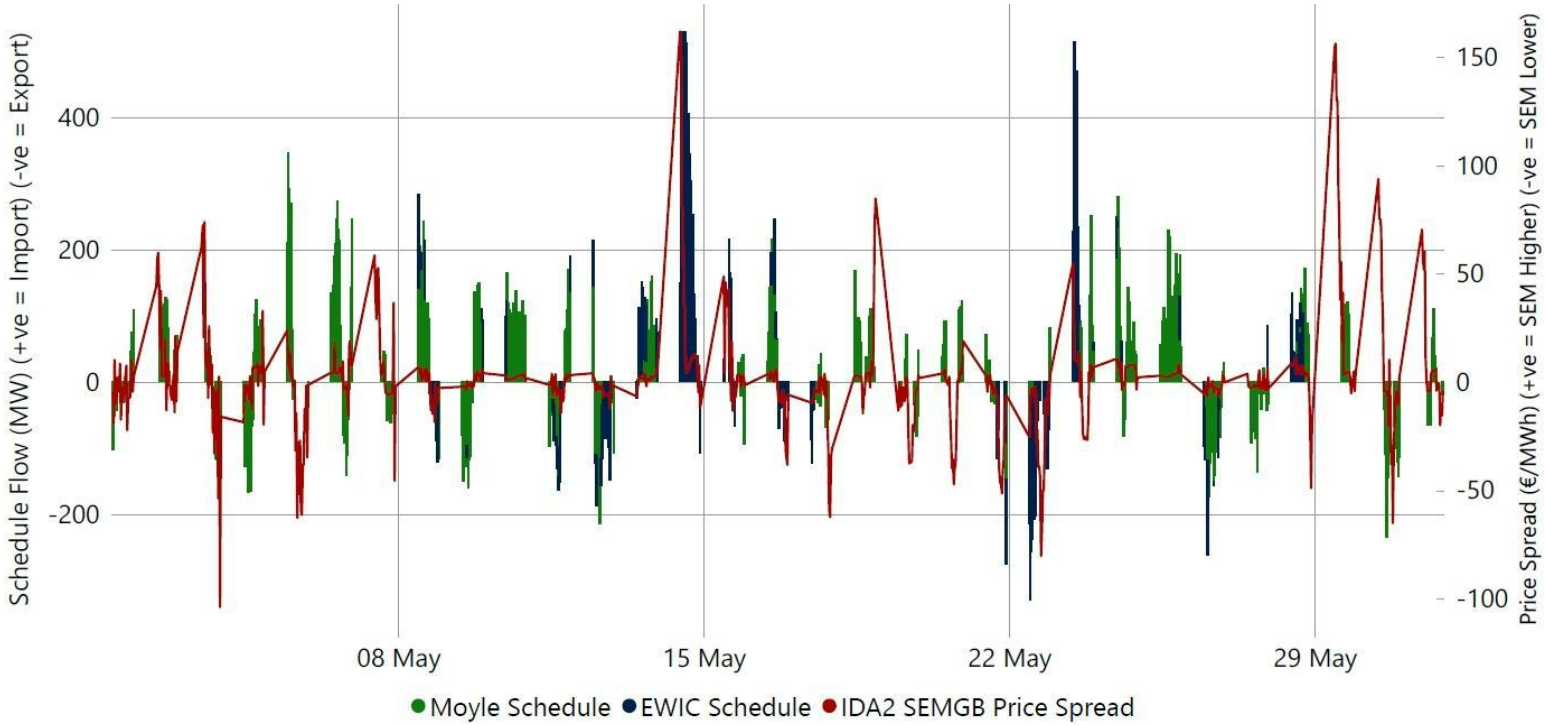
In the below graph, the IDA1 schedule is used for the first 24 half hour trading periods in the day. Here the schedule volume and direction is determined by the SEM GB price spread as a result of this auction (IDA1).



Graph 4 – IDA1 Interconnector Schedule against Price Spread (Periods 1-24)

- The monthly average price spread during these auction periods was (-)€4.91/MWh indicating that SEM is priced lower than GB
- Monthly net average of 180 MW export
- EWIC was unavailable at times and Moyle was only available on one pole

In the below graph, the IDA2 schedule is used for the second 24 half hour trading periods in the day. Here the auction volume (IDA1 volumes refined with IDA2 volumes) direction is determined by the SEM GB price spread as a result of this auction (IDA2). IDA2 adds to the liquidity in these periods which cover the trading day evening peaks.



Graph 5 – IDA2 Interconnector Schedule against Price (Periods 25-48)

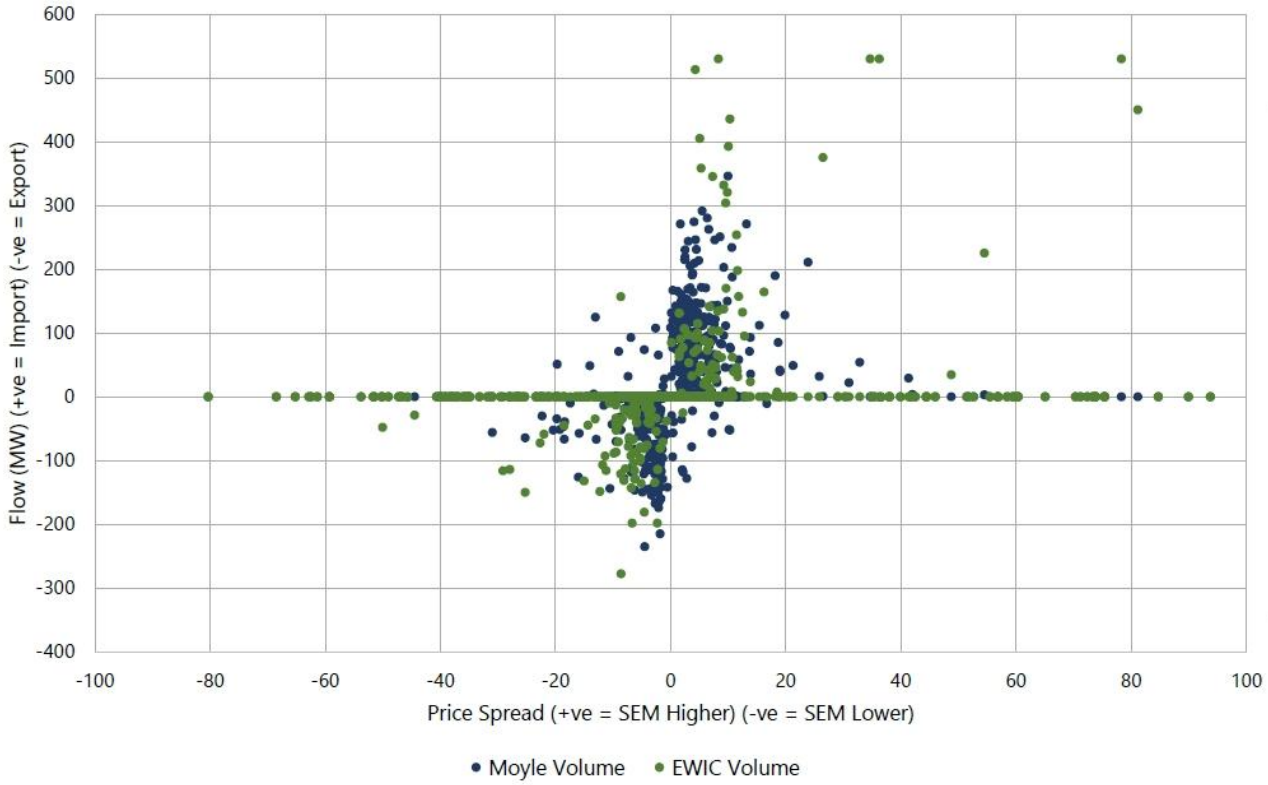
- The monthly average price spread during these auction periods was €1.28/MWh indicating that SEM is priced higher than GB
- Monthly net average was 26 MW import
- EWIC was unavailable at times and Moyle was only available on one pole

The below graphs chart the relationship between the two interconnectors and prices in each intraday auction.

The X-axis shows the spread in intraday prices between the SEM and GB so that the positive price difference on the right of the half graph is when the SEM price is higher than the GB price and the interconnector should be importing. The negative values on the left half of the graph is when the SEM price is lower and the interconnectors should be exporting.

The Y-axis shows the auction schedule volume and its direction so that in the upper half of the graph, in which values are positive, the interconnectors are importing into the SEM from GB. In the lower half the negative values indicate an export, which should occur when the difference between the intraday prices is negative and the SEM price is lower. These points are due to the interconnectors either exporting or importing across a number of periods in the expected direction based on the SEM/GB price spread. The large number of EWIC data points along the 0 MW value are mainly due to the interconnector being unavailable.

Graph 6 – IDA1 Interconnector Schedule against Price Spread (Cropped +/- €100/MWh)

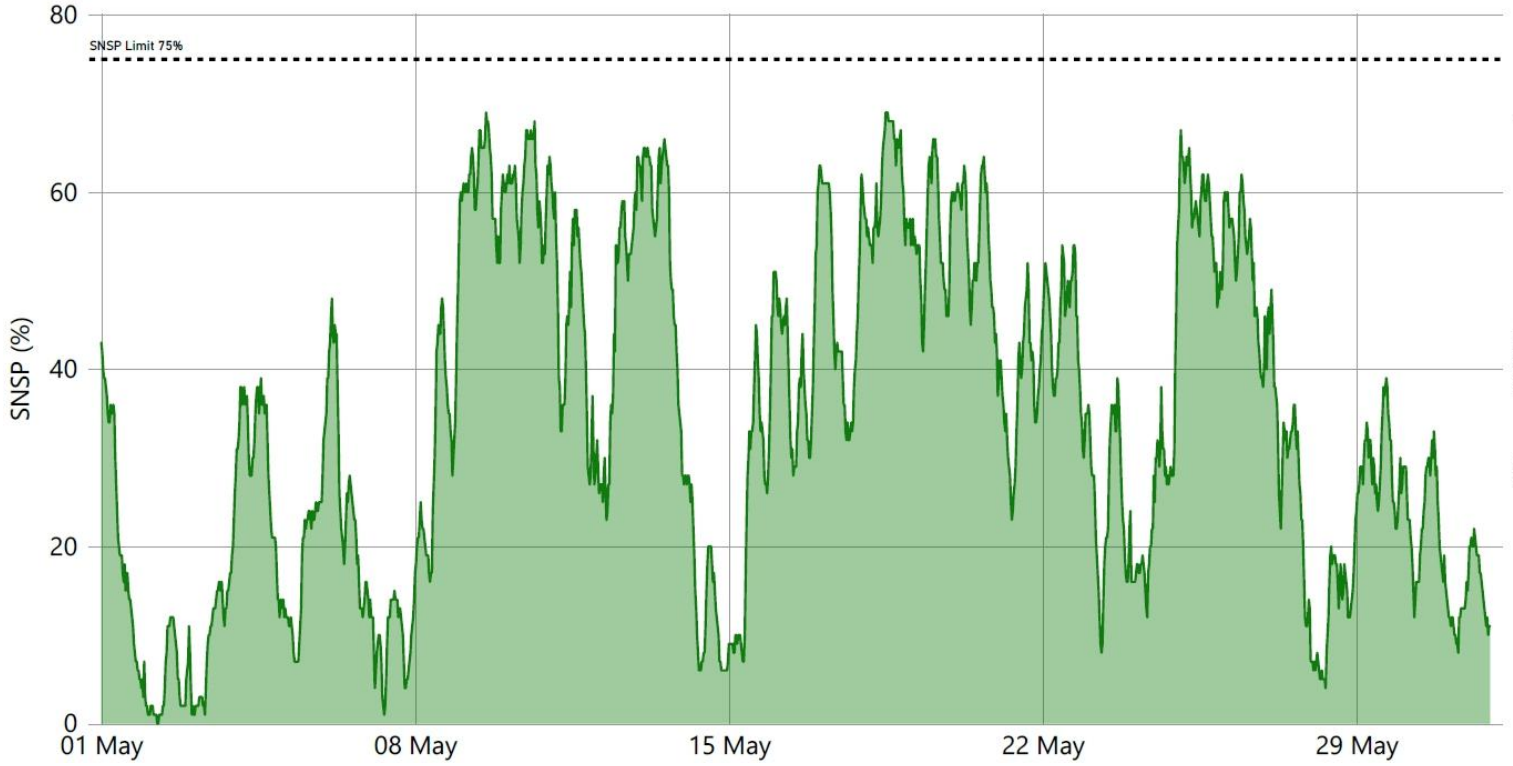


Graph 7 – IDA2 Interconnector Schedule against Price Spread (Cropped +/- €100/MWh)

In both graphs above there are points in the top left and bottom right quadrants that appear to show flows in the counter intuitive direction based upon the SEM/GB price spread. Then the price spread inverts for one period before reverting back to the previous positive or negative spread or the interconnector has been exporting towards full capacity and a price inverts for a longer periods over which it will take the interconnector a number of periods to change its flow direction to that expected based on the new price differential. The large number of EWIC data points along the 0 MW value are mainly due to the interconnector being unavailable.

1.4 SYSTEM NON-SYNCHRONOUS PENETRATION

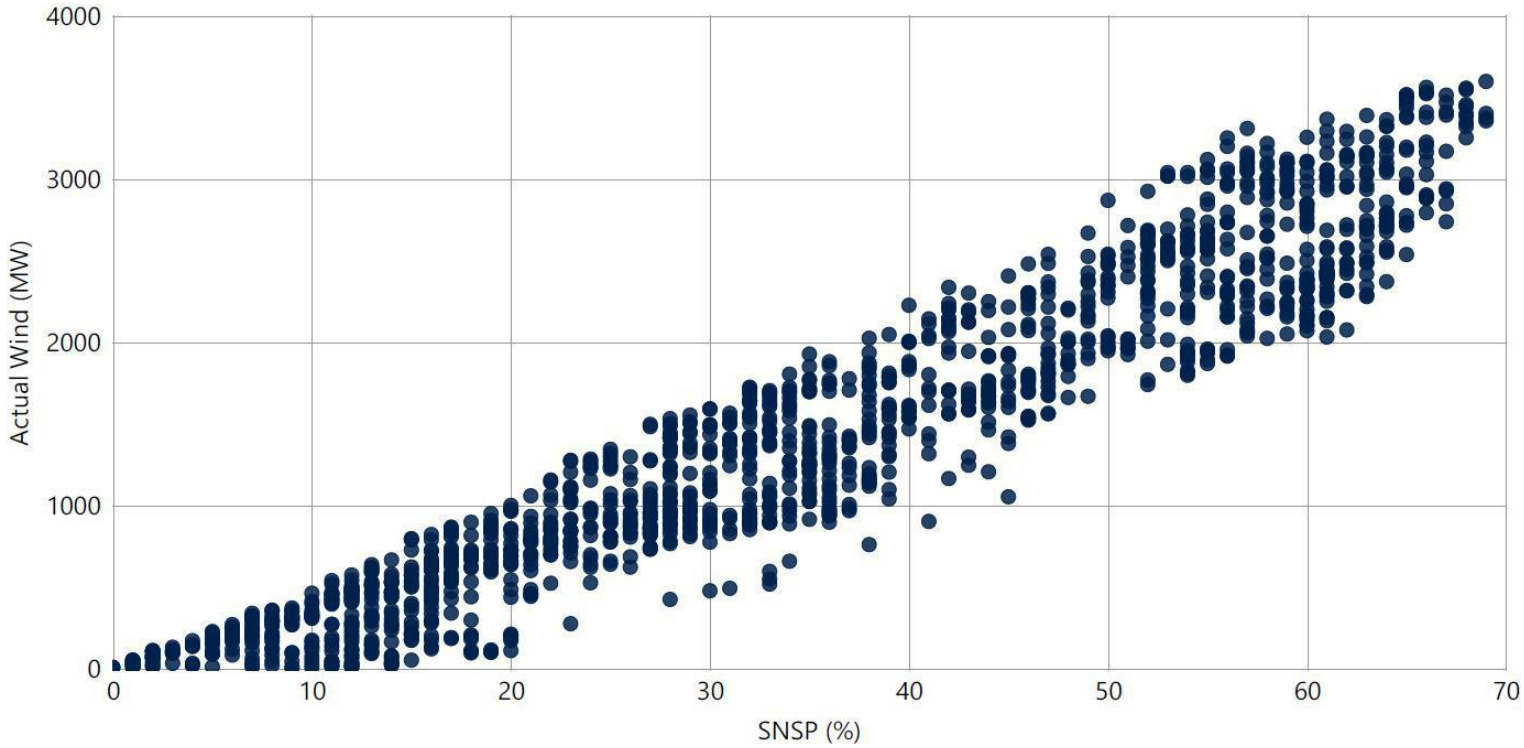
System non-synchronous penetration (SNSP) is a key measure of how much renewable generation is being used at a particular period in the day. The system is not currently capable of utilising 100% of renewable generation on the system and so must have some conventional synchronous generation running at all times. The current SNSP limit is 75%.



Graph 9 – SNSP (Half Hourly Intervals)

- Highest SNSP value of 69.18% was observed at 14:00 on 9 May
- The lowest value of 0.34% seen at 06:00 on 2 May

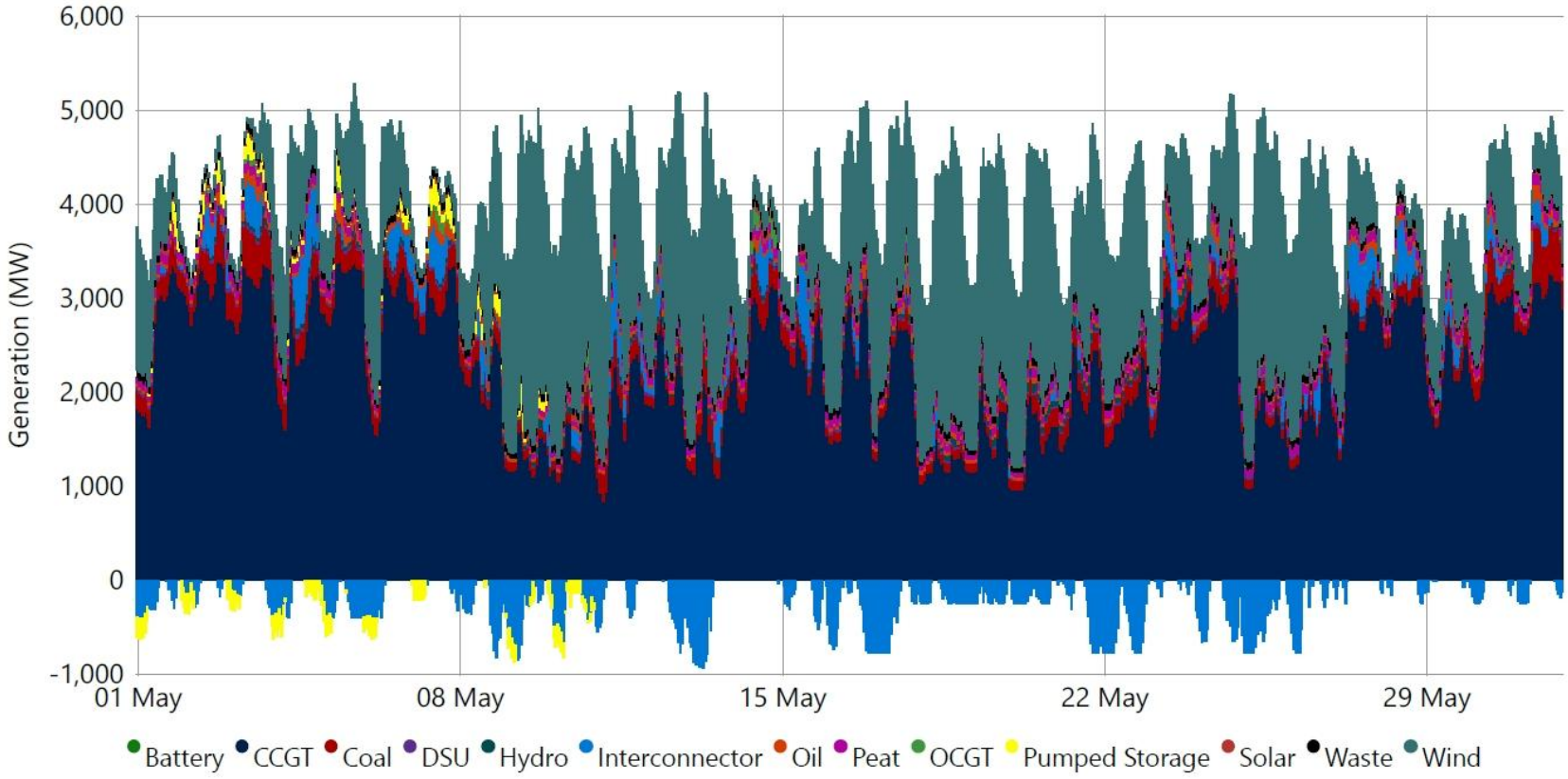
A major contributing factor to high or low SNSP levels is the volume of wind on the system at any given point. Higher wind volumes generally indicate higher levels of SNSP. This correlation is illustrated below.



Graph 10 – SNSP against Actual Wind Generation

1.5 FUEL MIX

Demand across the Island is continuing to be met by a wide portfolio of generation types using a variety of fuels. The below graph provides an hourly summary across the month of the system generation per generator type.



Graph 11 – Hourly Metered Generation

The below chart shows how each of the main fuel types contributed to the overall share of generation mix across the month.

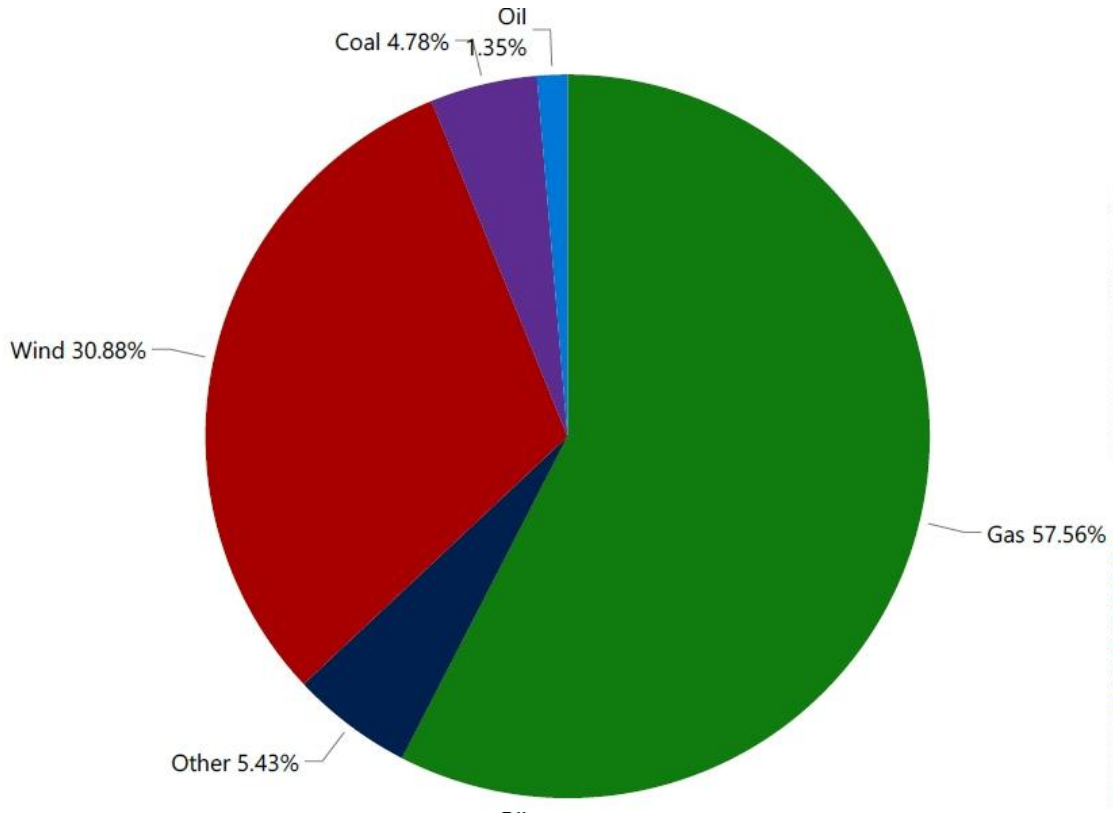


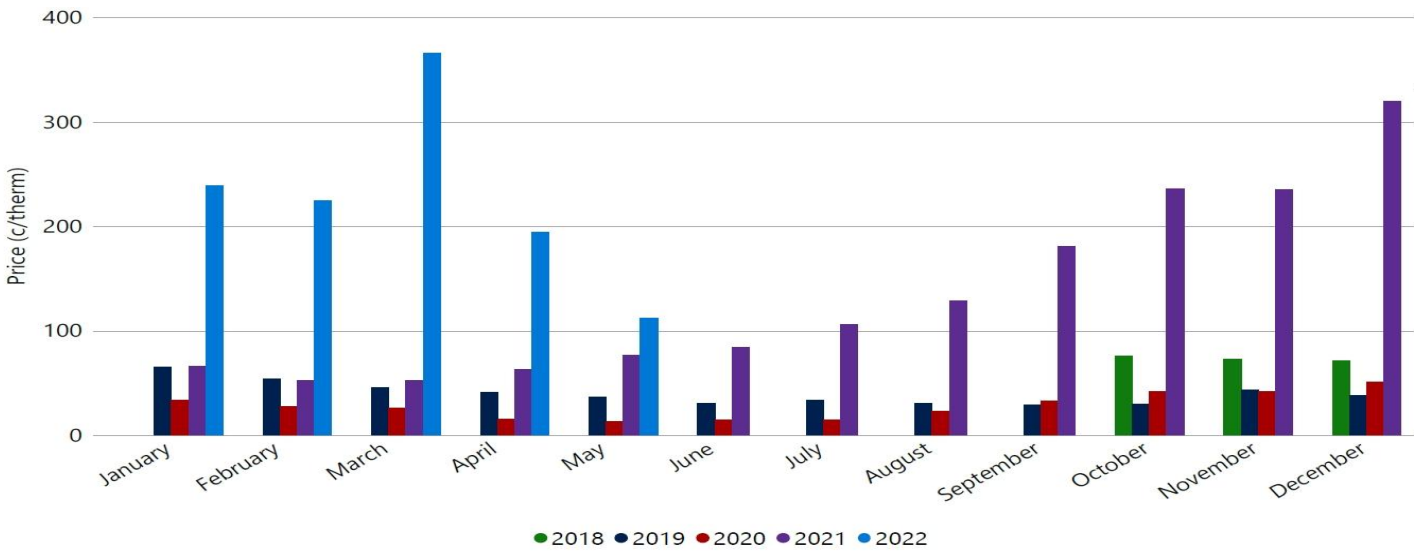
Chart 1 – Metered Generation Mix % Share

2. INPUT COSTS

A key driver for electricity prices in SEM continues to be the wholesale price of fuel and carbon emissions. In this section, the main input costs for generators in the SEM are analysed from 01 October 2018 (the beginning of the new SEM arrangements) until present. These are Gas, Carbon Emissions, Heavy Fuel Oil (HFO), Coal and Gasoil (Distillate).

2.1 GAS

Gas fired units continue to provide the largest portion of generation in the thermal fleet and in doing so will have a large effect of price formation in the majority of trading periods. The price of gas remains extremely volatile with prices continuing to trade significantly above historic price trends.

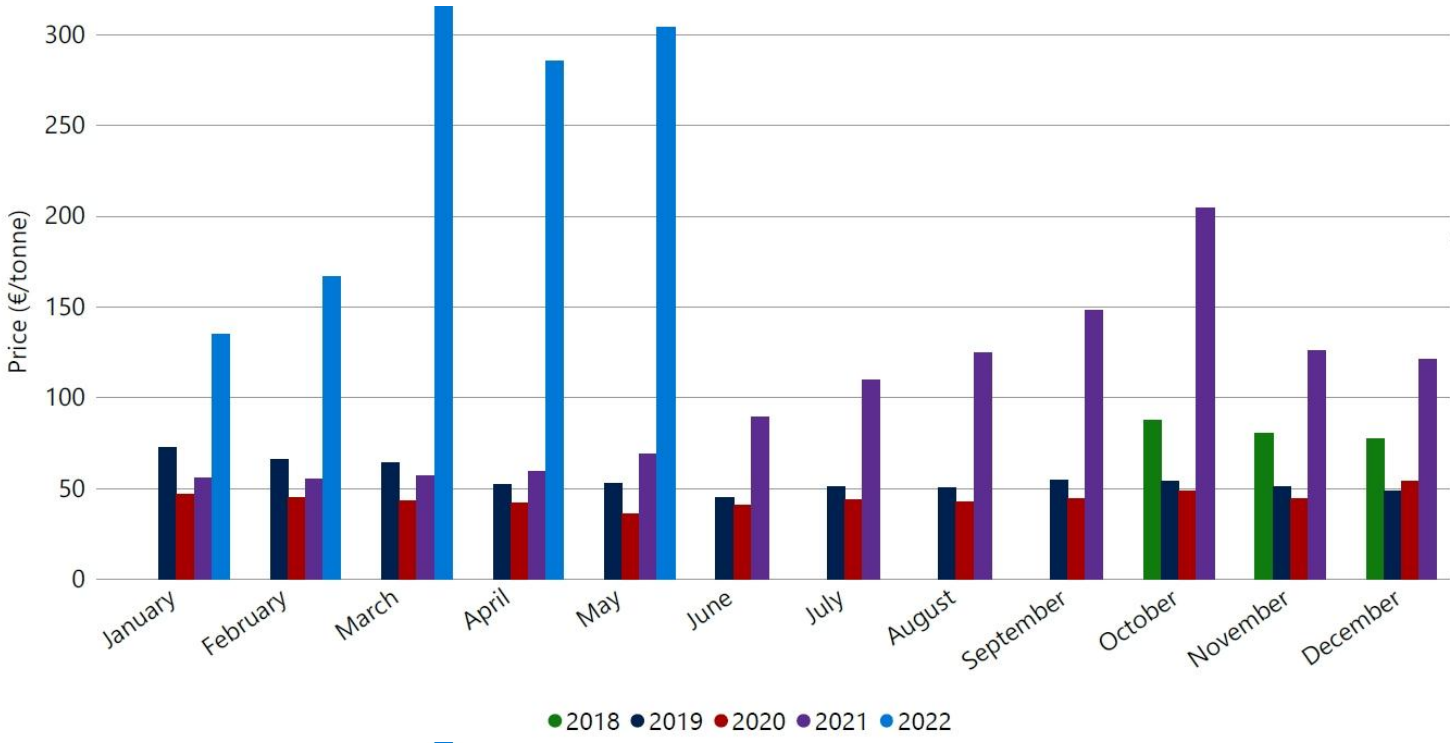


Graph 12 – Average Monthly Gas Price

- An average monthly price in May 2022 was 112.11c/therm.
- The monthly high for May 2022 was 174.19c/therm
- The monthly low for May 2022 was 35.23c/therm
- A drop in gas prices has been observed across the month however they remain consistently higher than the same period in previous years as illustrated in graph 12.

2.2 COAL

Whilst Coal usually provides a smaller percentage of metered generation than gas it is still a key fuel within the generation fleet.

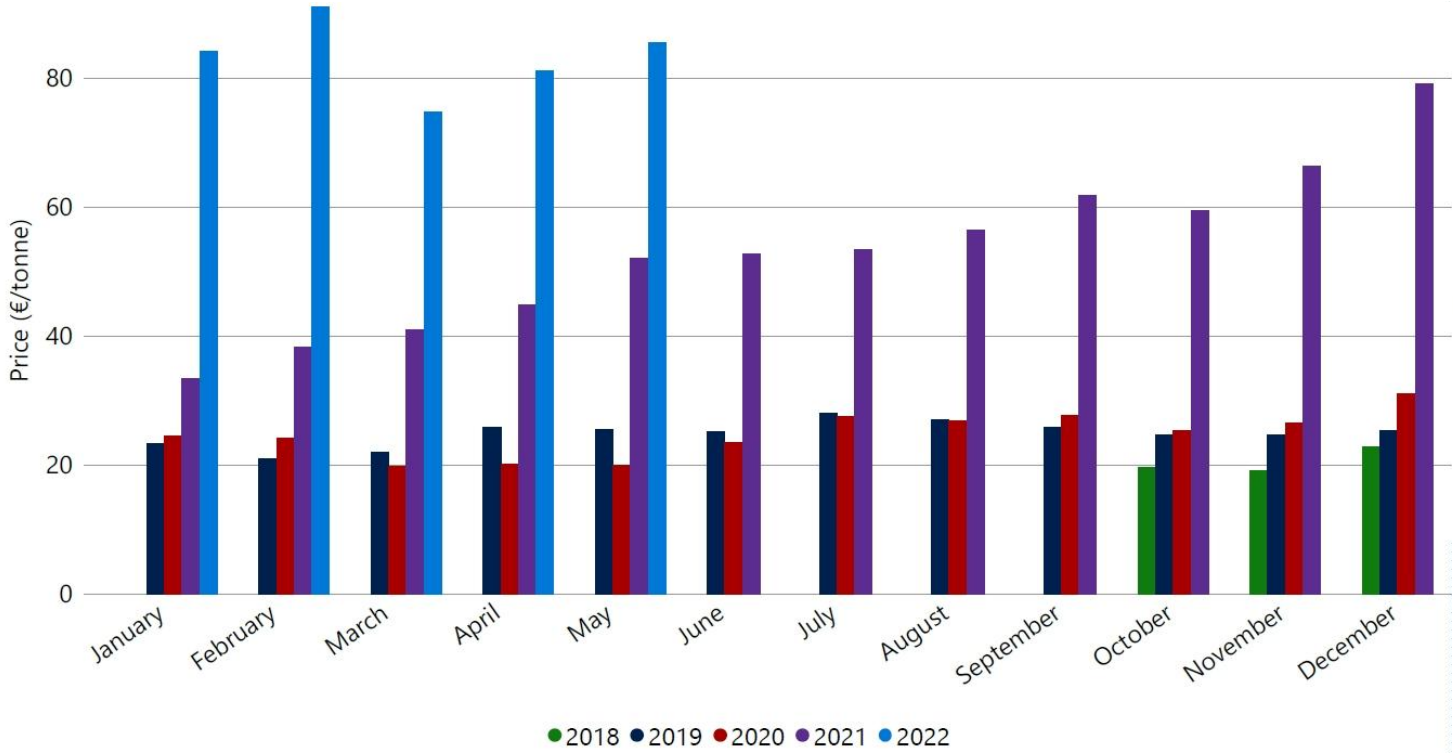


Graph 13 – Average Monthly Coal Price

- An average monthly price in May 2022 was €303.91/tonne
- The monthly high for May 2022 was €318/tonne
- The monthly low for May 2022 was €246.86/tonne

2.3 CARBON

Carbon (CO2) emission costs are a key input into the price formation for thermal units.

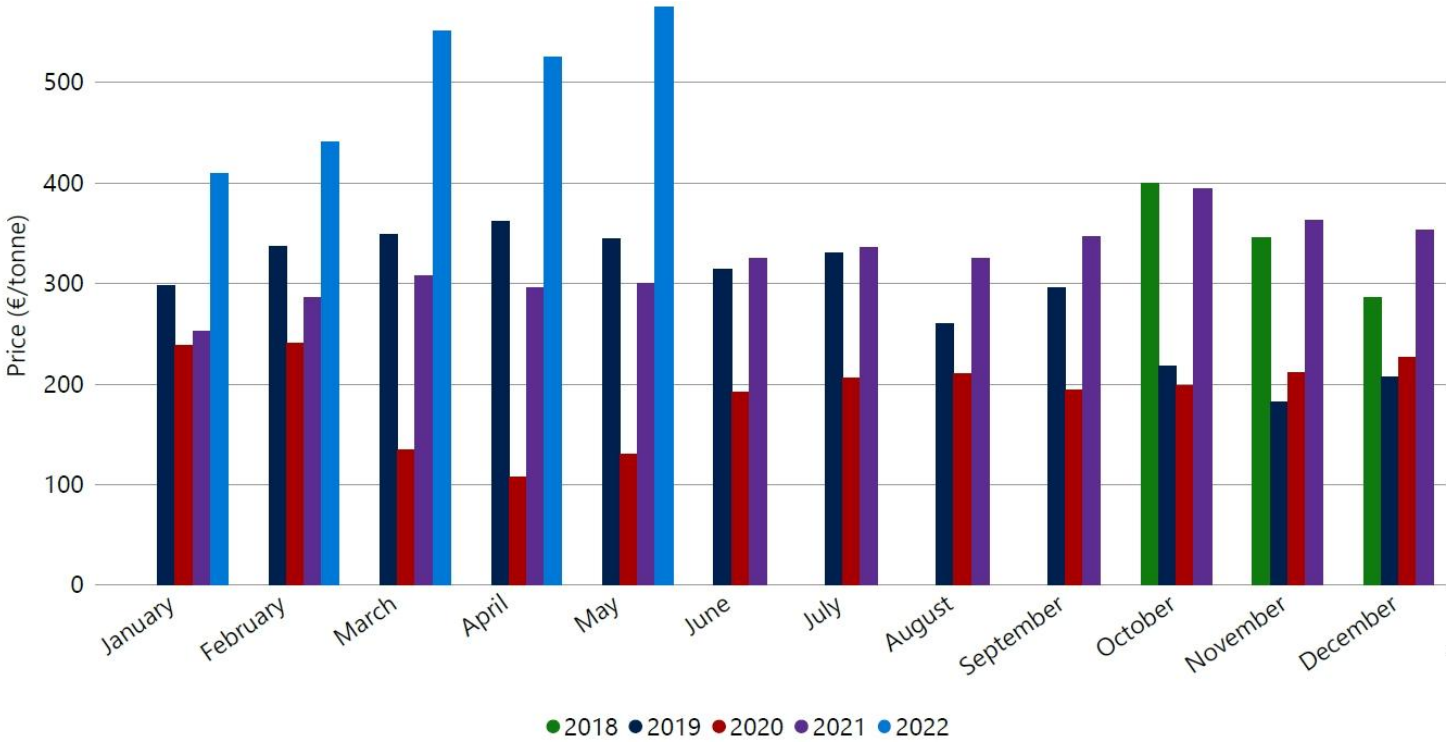


Graph 14 – Average Monthly Carbon Emissions Price

- An average monthly price in May 2022 was €85.41/tonne
- The monthly high for May 2022 was €91.69/tonne
- The monthly low for May 2022 was €77.55/tonne

2.4 HEAVY FUEL OIL

Heavy Fuel Oil (HFO) provides fuel for a number of units within the generation fleet.

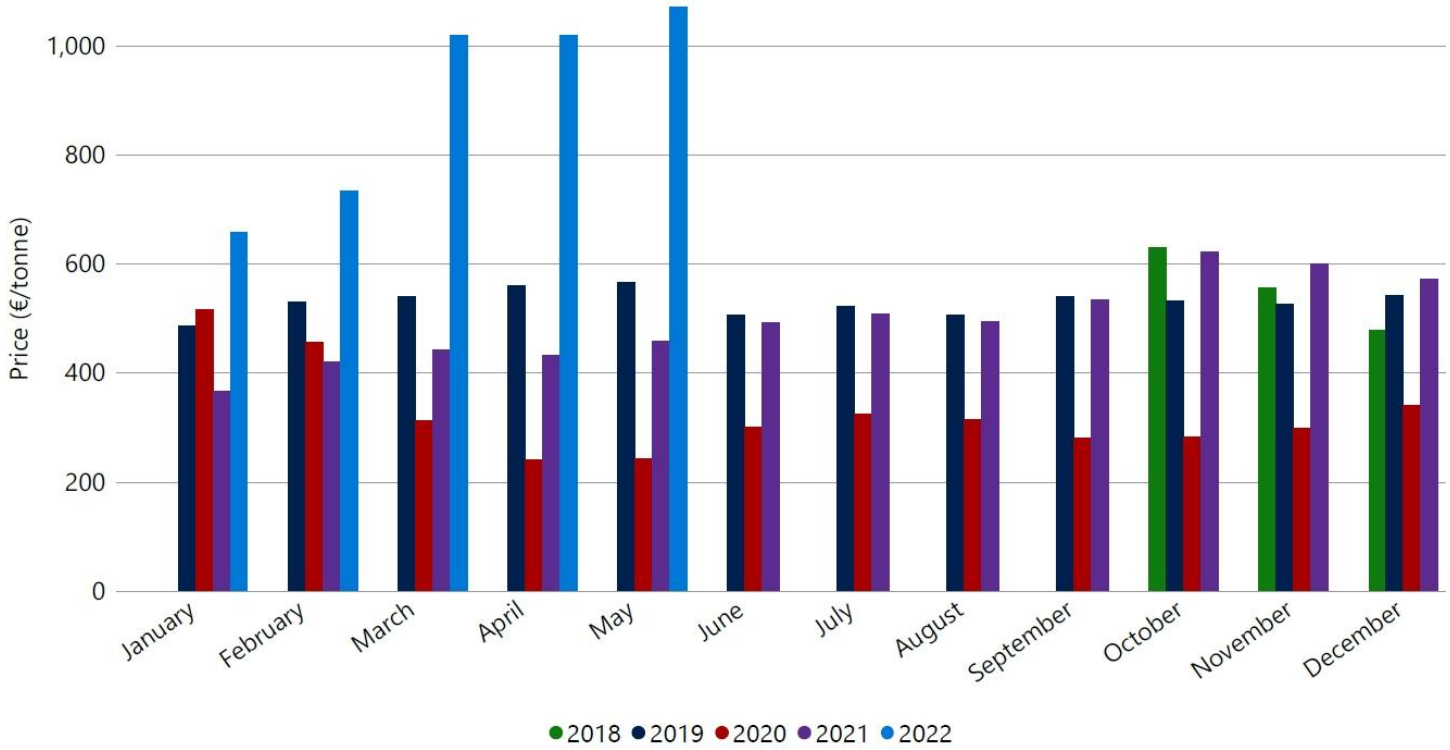


Graph 15 – Average Monthly HFO Price

- An average monthly price in May 2022 was €574.39/tonne
- The monthly high for May 2022 was €600.89/tonne
- The monthly low for May 2022 was €535.77/tonne

2.5 GASOIL

Gasoil provides fuel for a small number of units within the generation fleet.



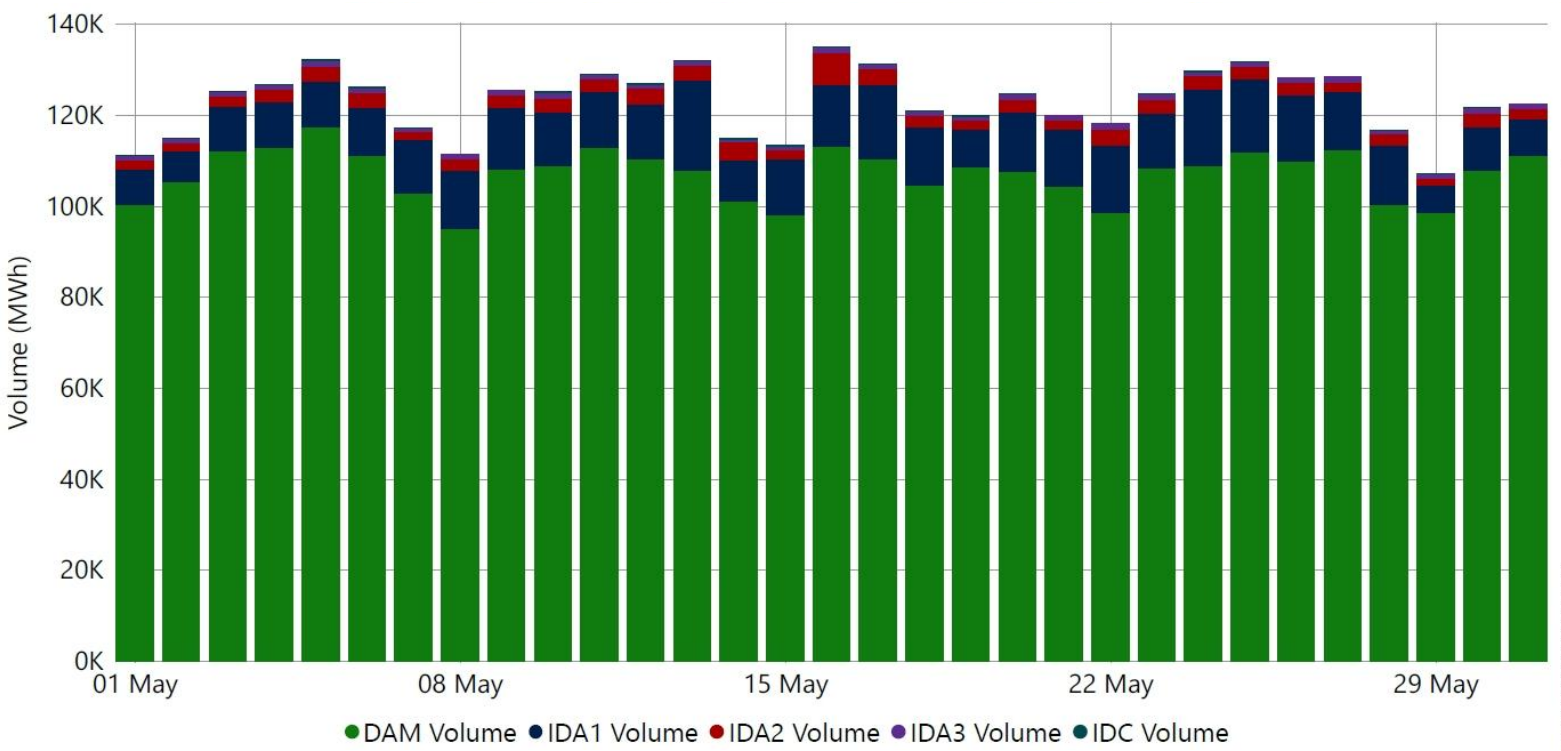
Graph 16 – Average Monthly Gasoil Price

- An average monthly price in May 2022 was €1070.03/tonne
- The monthly high in May 2022 was €1185.62/tonne
- The monthly low for May 2022 was €992.88/tonne

3. MARKET PERFORMANCE

3.1 PRICES & VOLUMES

The graph below shows the daily volumes in each ex-ante market in the SEM during May.

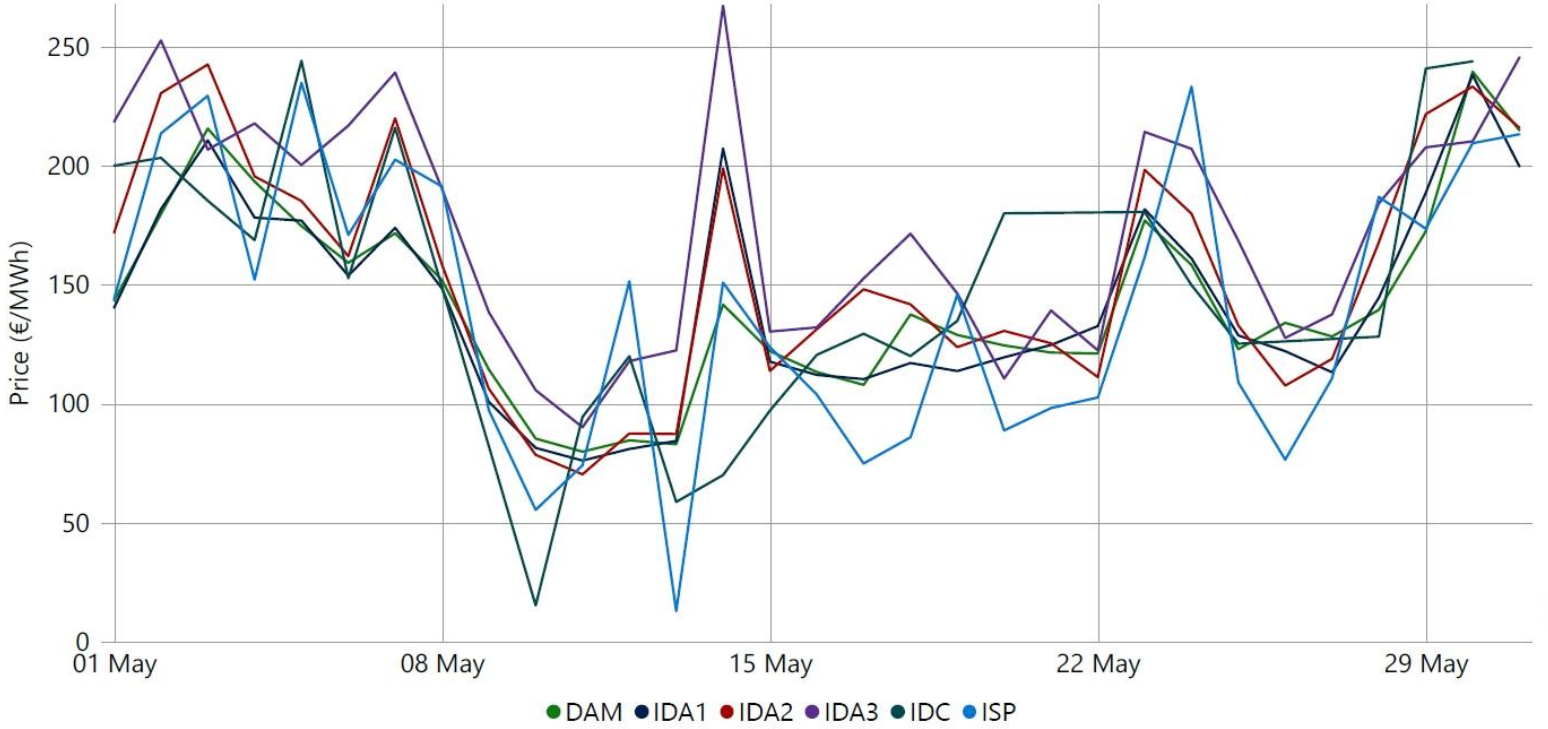


Graph 17 – Daily Ex-Ante Volumes

Daily Average Volume

- DAM 107,055 MWhs
- IDA1 11,948 MWhs
- IDA2 2,823 MWhs
- IDA3 992 MWhs
- IDC 80 MWhs

The below graph shows the daily average ex-ante and balancing market prices across May.



Graph 18 – Daily Ex-Ante and Balancing Market Volumes

Daily Average Prices

- DAM €143.27/MWh
- IDA1 €142.58/MWh
- IDA2 €157.72/MWh
- IDA3 €173.91/MWh
- IDC €153.13/MWh
- Imbalance Settlement Price €141.54/MWh

3.2 MARKET SHARE

The below charts show the market share for each ex-ante market by volume and value.

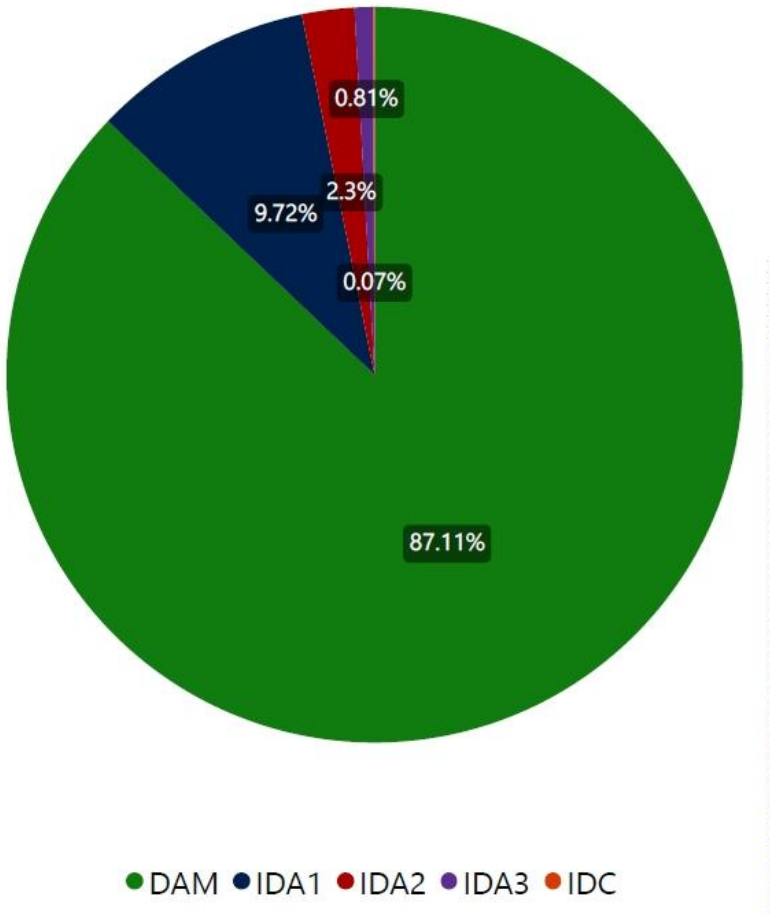


Chart 2 – Ex-Ante Volume Market Share (MWh)

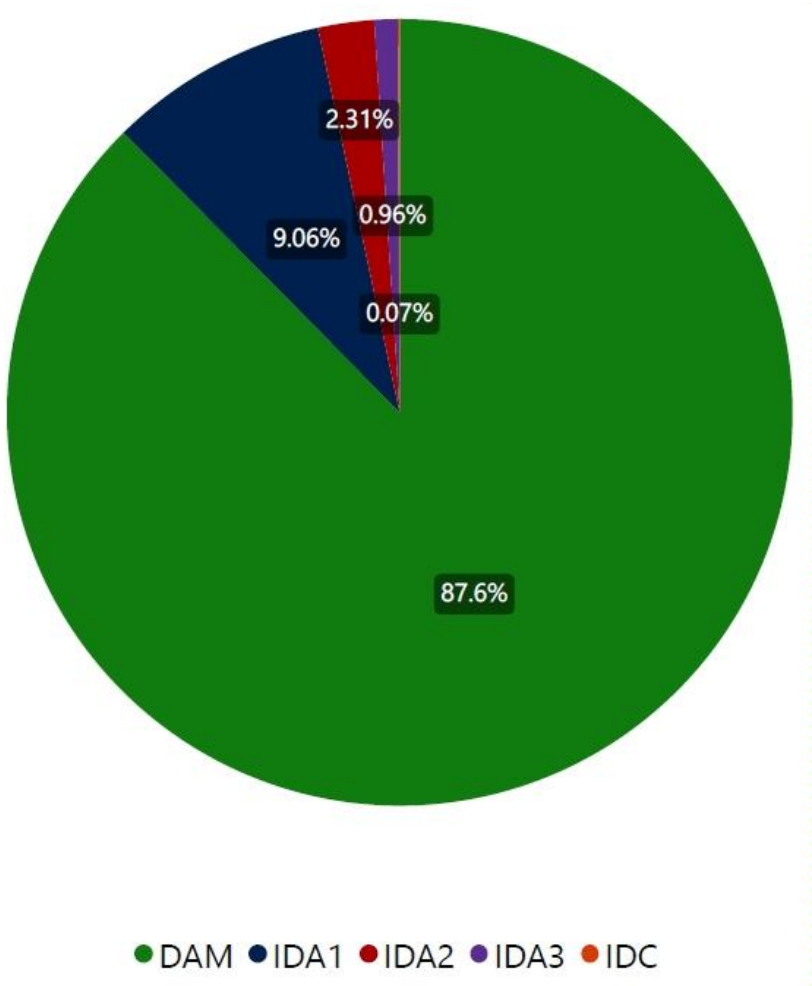
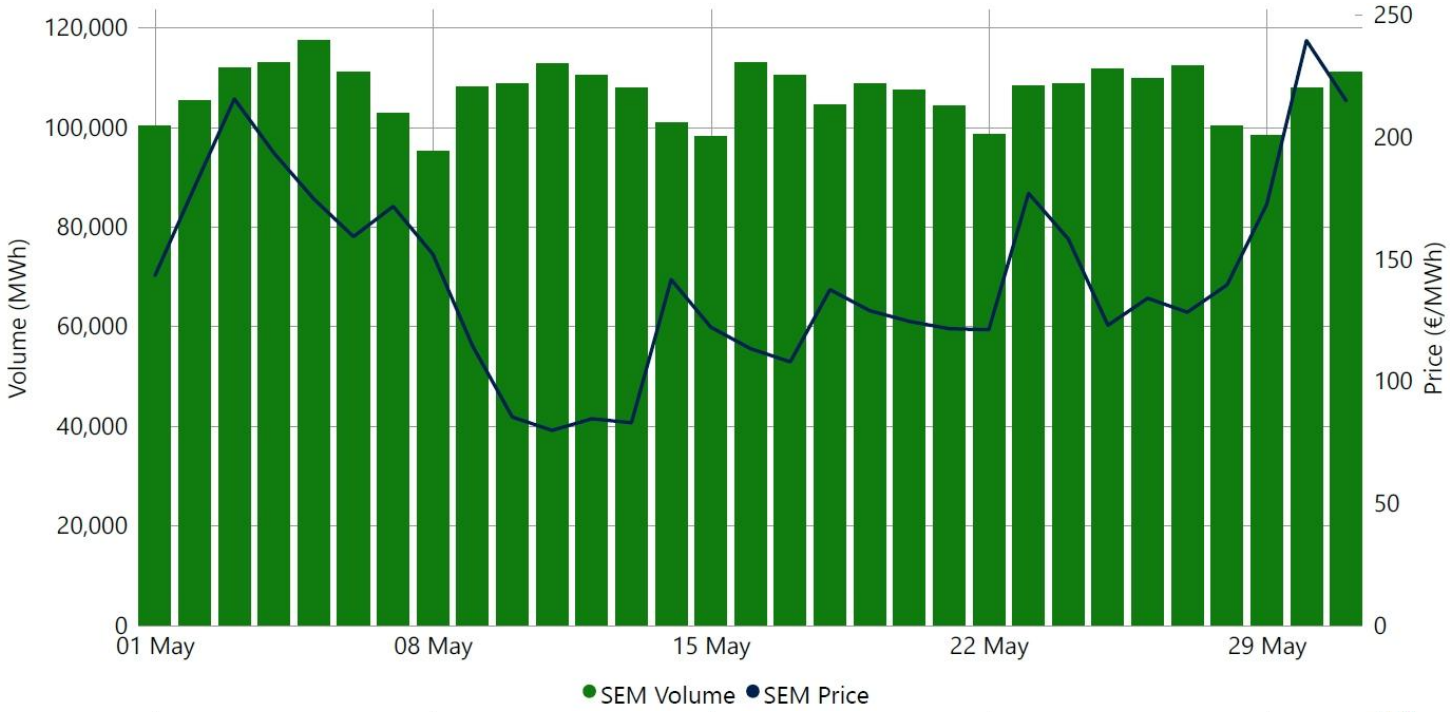


Chart 3 – Ex-Ante Value Market Share (€)

4. DAY AHEAD MARKET

4.1 PRICES & VOLUMES

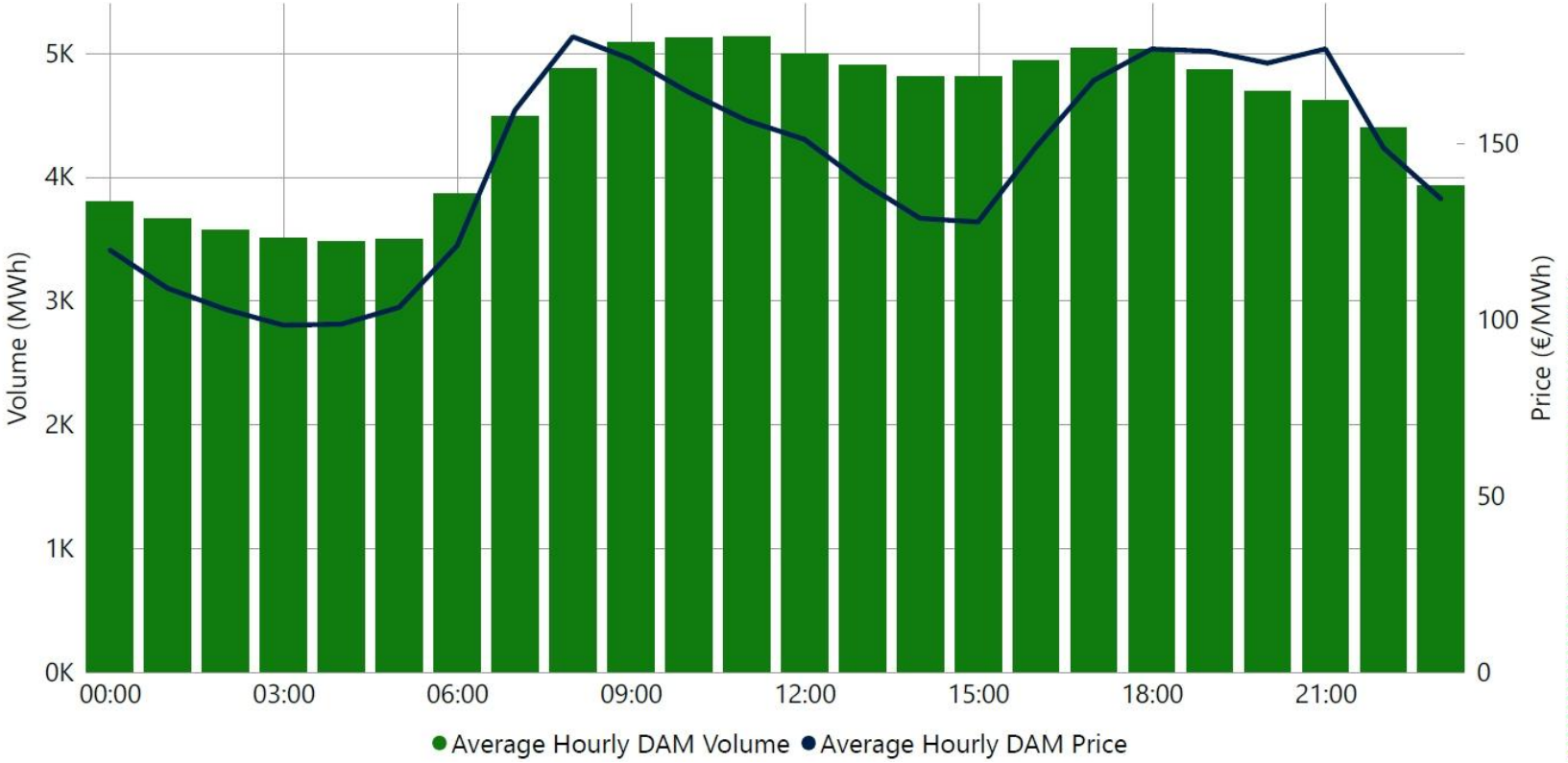
The graph below shows the daily volumes daily and average prices in the Day Ahead Market during May.



Graph 19 – DAM Daily Volume and Price

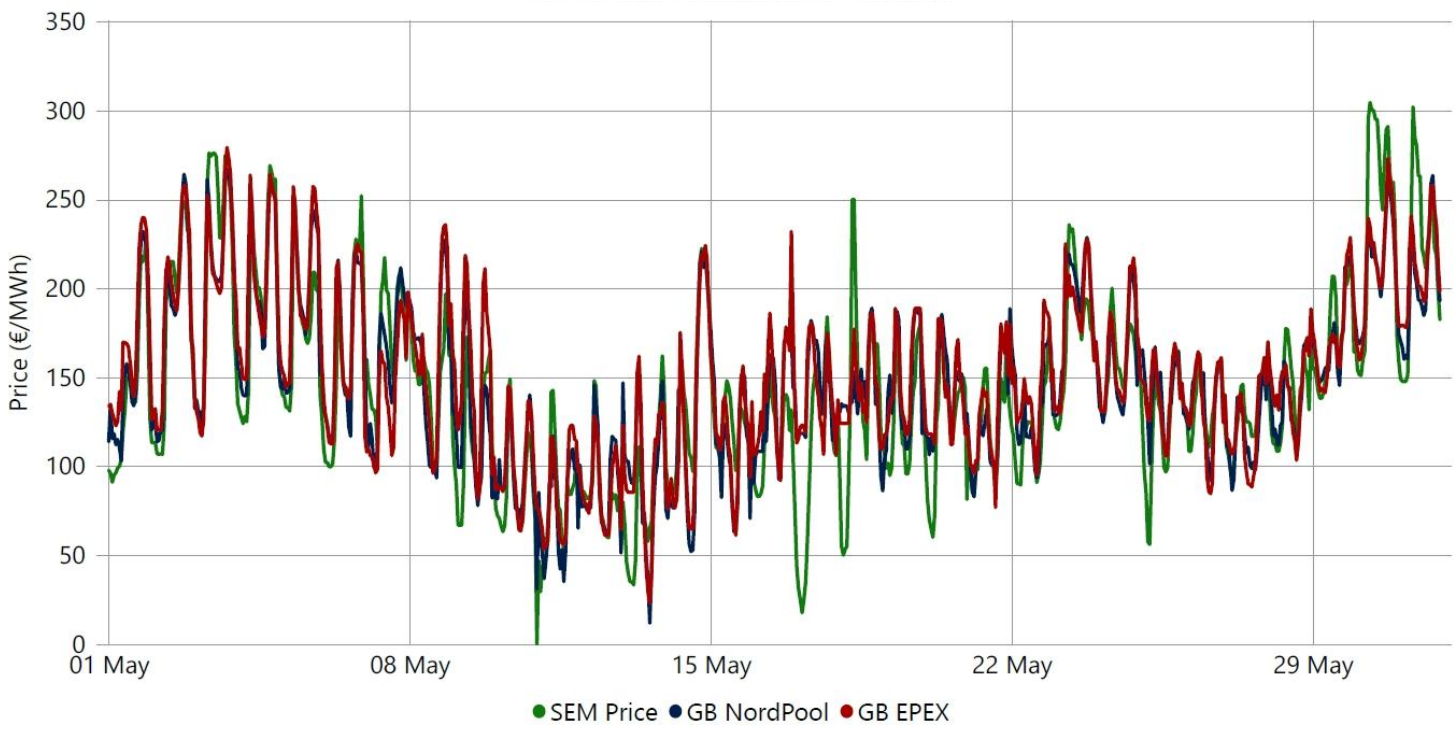
- The average DAM price across May was €143.27/MWh
- The highest daily price observed was €239.53/MWh seen on 30 May
- Lowest daily price was observed on 11 May of €79.82/MWh

The highest average volumes generally continue to be traded across peak morning and evening periods where the highest prices are seen.



Graph 20 – Average Volume and Price per Hourly Period

The graph below shows how the SEM DAM prices compare with those in GB.

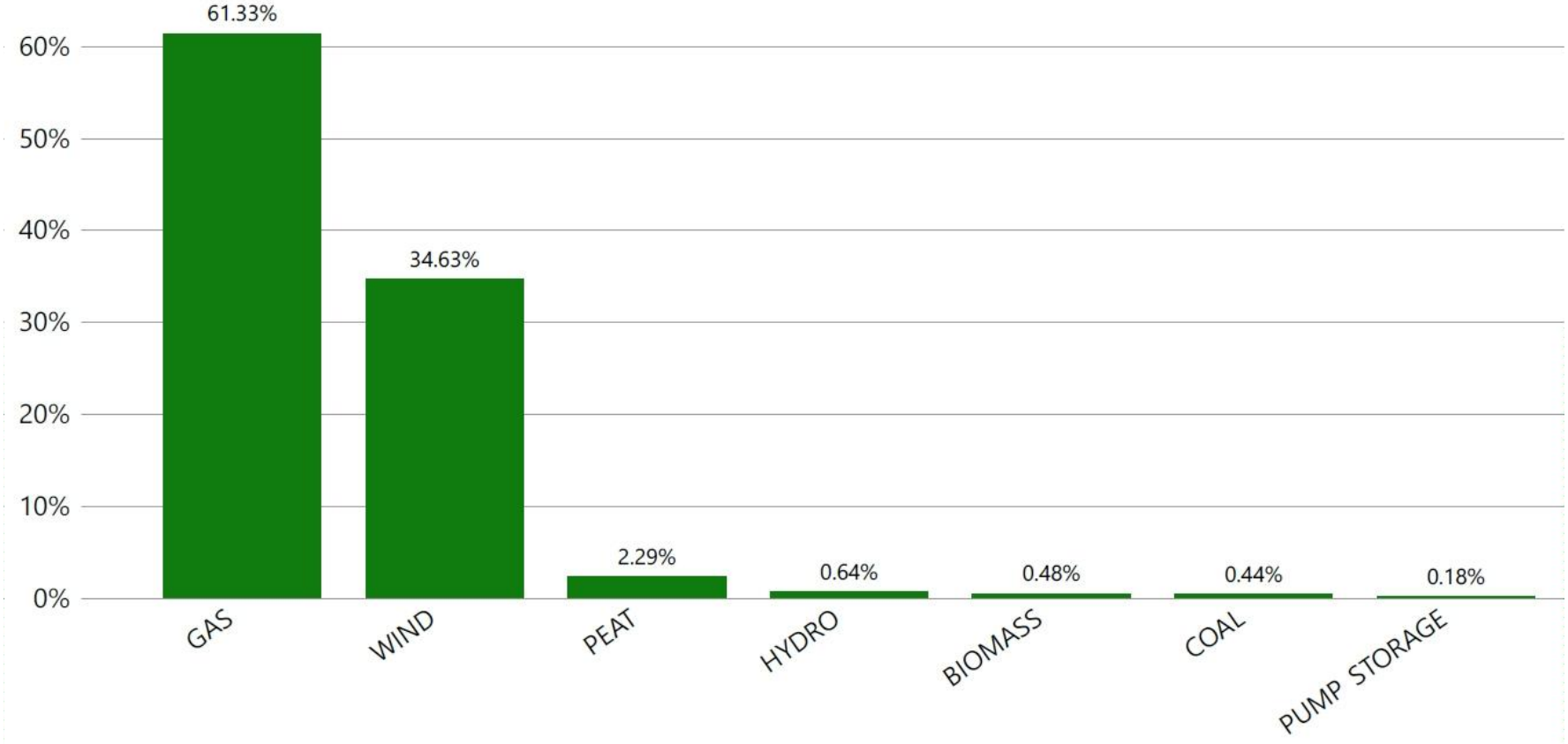


Graph 21 – DAM Hourly Prices SEM, GB EPEX & GB NordPool

- GB EPEX has an average price of €150.51/MWh
- GB NordPool has an average price of €147.13/MWh.
- SEM average price was €143.27MWh

4.2 FUEL MIX

The below graph shows the breakdown of cleared DAM generator sell orders by fuel type.

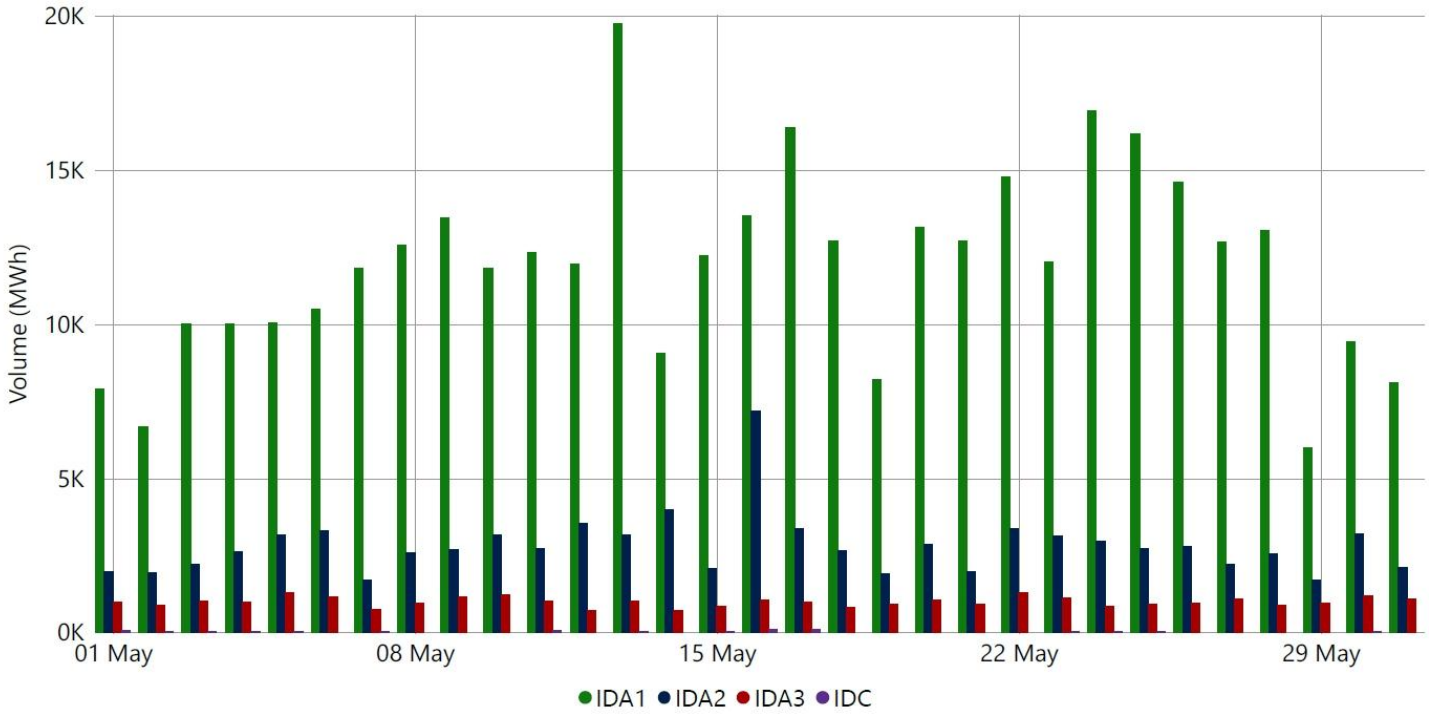


Graph 22 – DAM Generator Sell Order by Fuel Type

5. INTRADAY MARKET

5.1 PRICES & VOLUMES

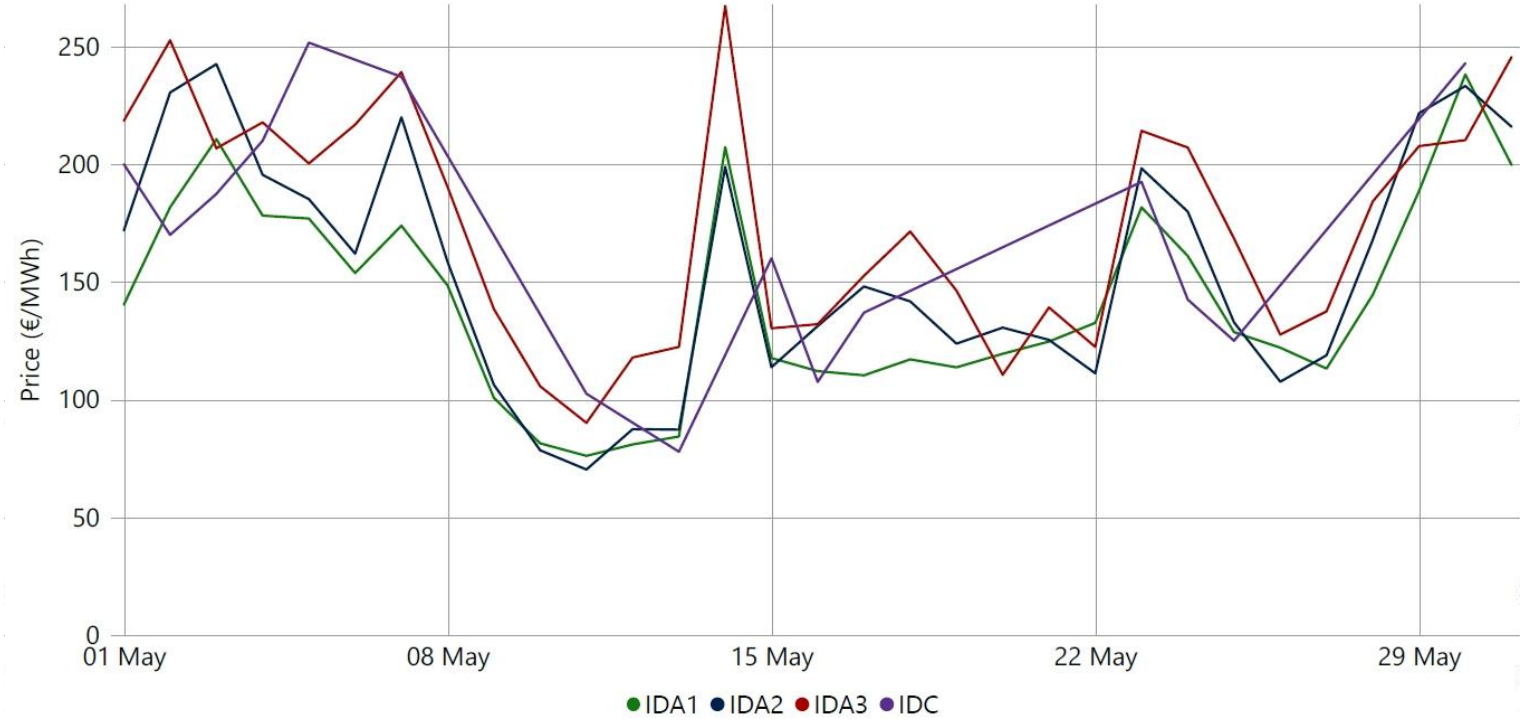
The graph below shows the daily volumes in each intraday auction during May.



Graph 23 – Daily Total Intraday Volumes

- IDA1 in accounted for 9.72% of ex-ante traded volumes
- IDA2 accounted for 2.3%
- IDA3 accounted for 0.81%
- IDC accounted for 0.07%.

The graphs below shows the daily average prices each intraday auction during May.

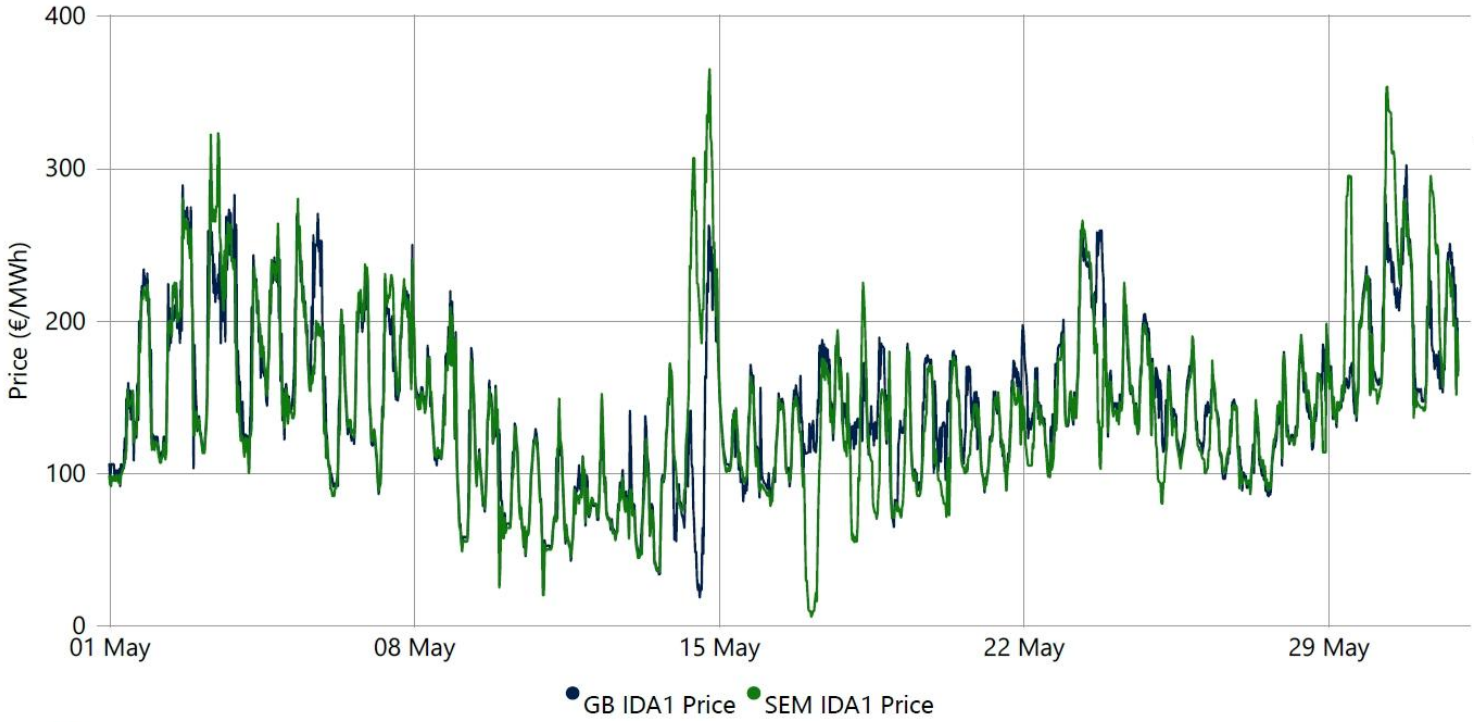


Graph 24 – Daily Average Intraday Prices

Average Intra-day prices

- IDA1 €142.58/MWh
- IDA2 €157.72/MWh
- IDA3 €173.91/MWh
- IDC €153.13/MWh

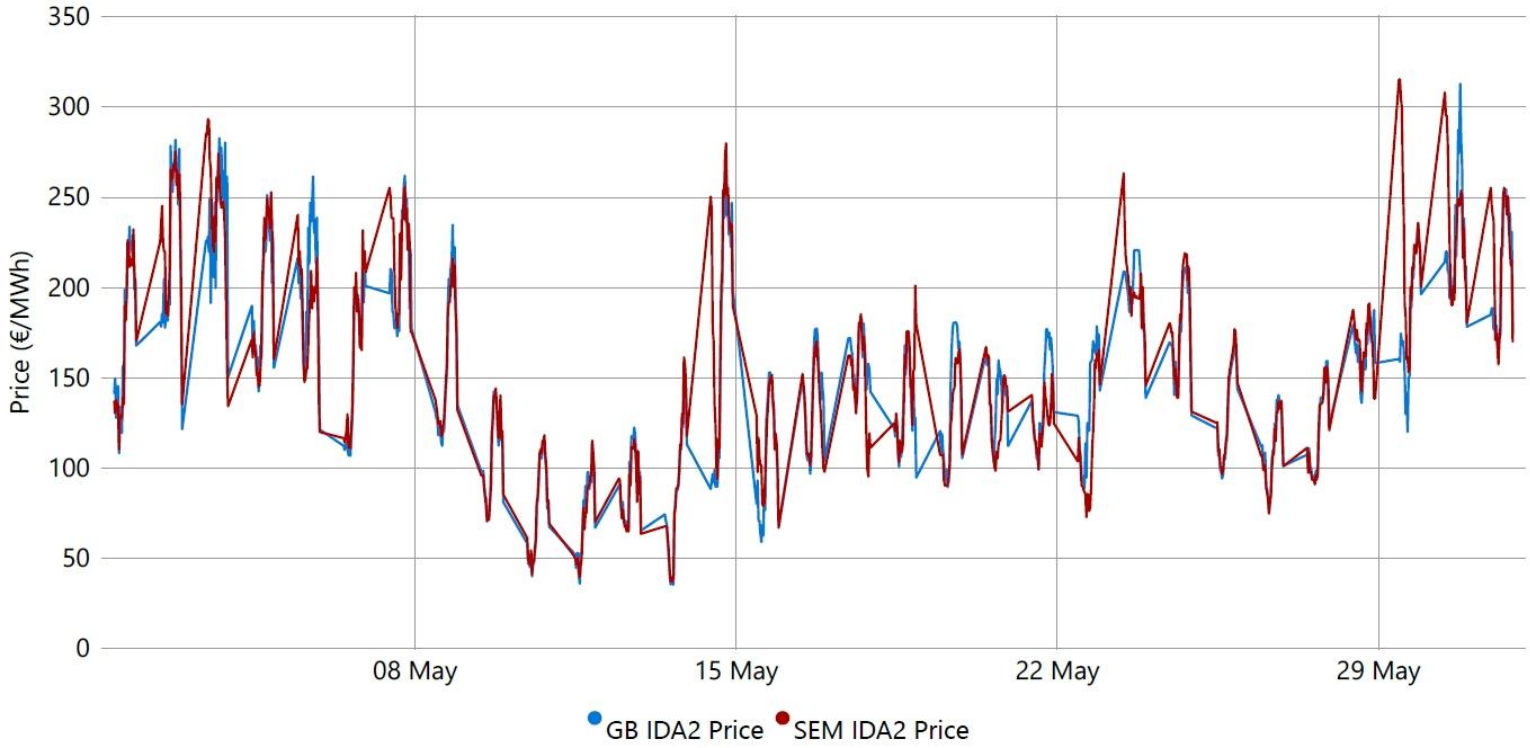
In the below two graphs the IDA1 and IDA2 prices in the SEM can be compared to those in GB across the month.



Graph 25 – SEM & GB Intraday 1 Prices

Average Intra-day prices

- SEM IDA1 €142.58/MWh
- GB IDA1 €144.38/MWh



Graph 26 – SEM & GB Intraday 2 Prices

Average Intra-day prices

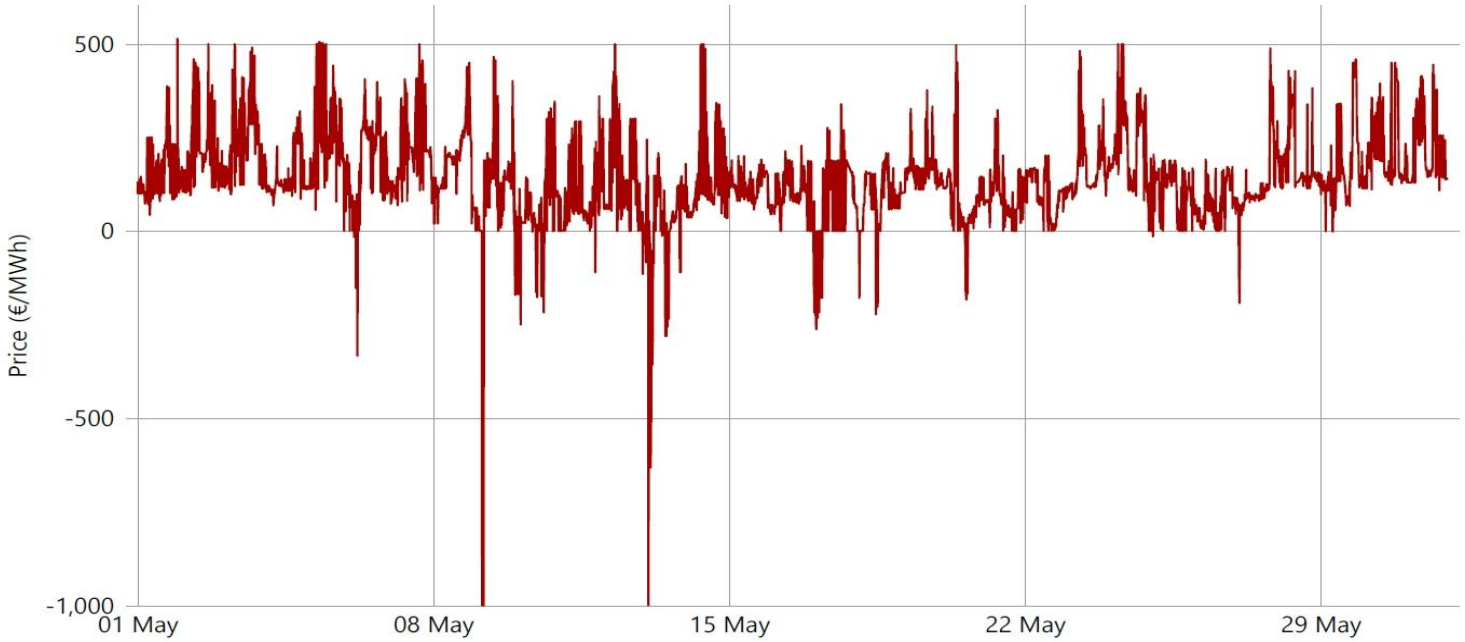
- SEM IDA2 €157.72/MWh
- GB IDA2 €153.44/MWh

6. BALANCING MARKET

The balancing market is a complex market that determines the imbalance settlement price for settlement of the TSO's balancing actions and any uninstructed deviations from a participant's notified ex ante position.

6.1 PRICES & VOLUMES

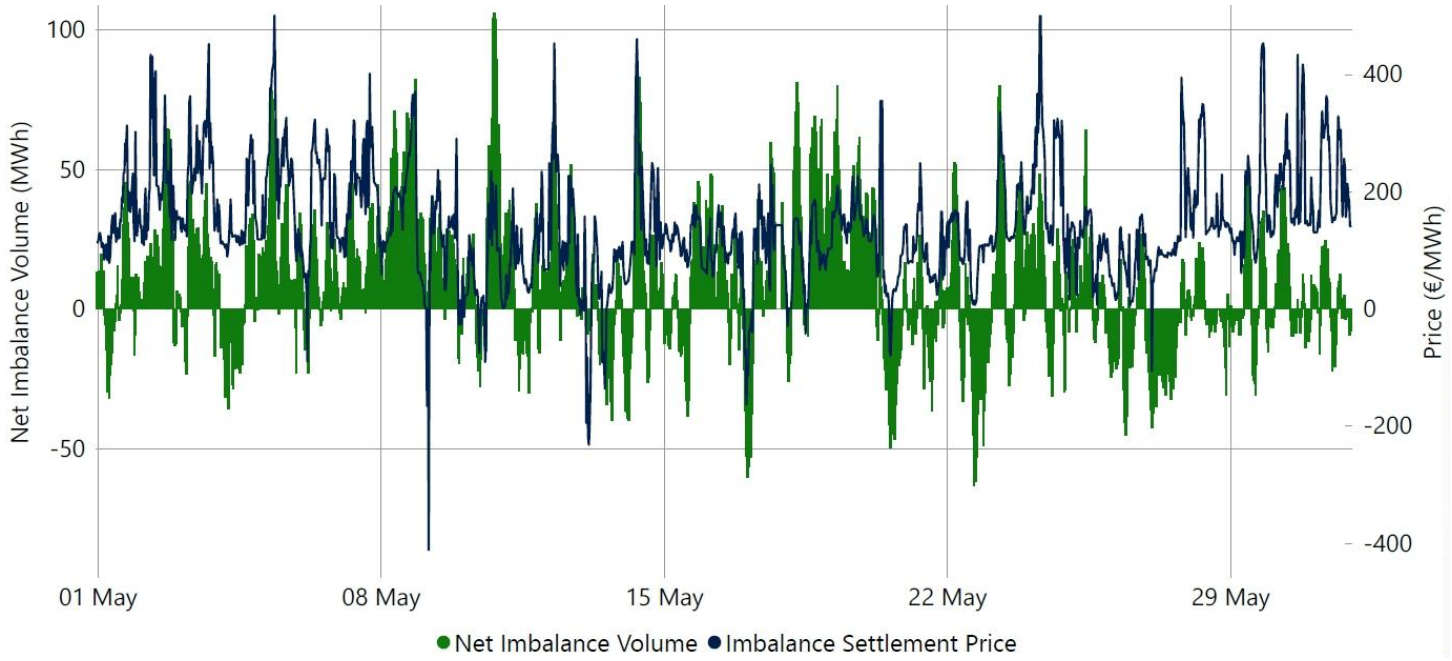
The graph below shows the price for each 5 minute Imbalance Price Period.



Graph 27 – 5 Minute Imbalance Pricing Period

- The average 5 minute price across the month was €141.85/MWh
- The highest 5 minute imbalance pricing period was at 22:35 & 22:40 on 1 May with a price of €513.63/MWh
- The lowest price seen was (-)€1000/MWh seen at 03:40 & 03:30 to 03:40 on 9 May then again at 02:10 on 13 May

The graph below shows the price for each 30 minute Imbalance Settlement Period.



Graph 28 – Imbalance Settlement Price against Net Imbalance Volume

- The average 30 minute price across the month was €141.54/MWh
- The highest 30 minute imbalance settlement price was at 09:00 on 5 May with a price of €499.97/MWh
- The lowest price seen was (-)€411.72/MWh seen at 04:30 on 9 May