Response Energy Payment Analysis

Background

The Response Energy Payment (REP) compensates Frequency Response (FR) providers for the costs incurred associated with changes in generation output. The principle is that the Market Index Price (MIP) represents the marginal cost of the marginal generator, the party most likely to be providing FR. When the REP was introduced power prices and consequently the MIP were predominantly set by either coal or gas fired plant due to these types of plant dominating the system. The Short Run Marginal Costs (SRMCs) of each technology were often similar and looking forward one month the MIP had a degree of predictability. The use of MIP for this purpose was imperfect, but the risk was manageable.

Changing Generation Mix

We are now faced with a very different generation background. For example, in 2004 coal and gas plant accounted for almost three quarters of generation output with wind plant accounting for only a very small proportion of generation output. By 2013 coal and gas plant accounted for approximately 60% of generation output, with wind's share of generation output rising to over 7%. Scenarios out to 2020 suggest that coal and gas will contribute somewhere between 35%-45% of generation output, with wind contributing between 15%-20%.

The range of technologies and, with it the range of SRMCs, is much wider and this will become more pronounced over the next few years. For illustration, a rough estimate of the SRMCs of different generation technologies is provided below:

- Coal 36% efficient = £30/MWh
- Gas 49% efficient = £40/MWh
- Onshore Wind = -£50/MWh
- Offshore Wind = -£100/MWh
- Solar = -£40/MWh
- Nuclear = £6/MWh (or ~-£10,000/MWh if neglecting start-up costs)

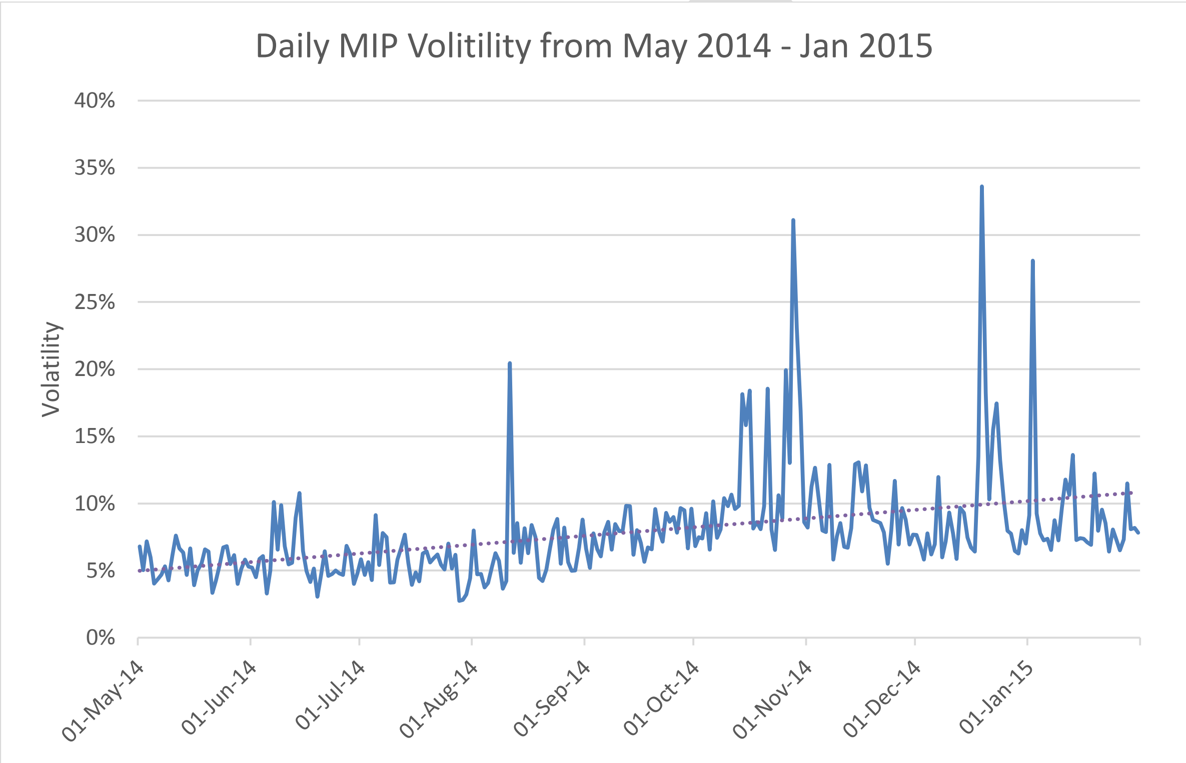
Even within the coal and gas generation technologies the range of SRMCs is increasing. This is due to increasing efficiency variations across the generation fleets, rising carbon costs and the need to comply with the Industrial Emissions Directive (IED).

Under the Renewables Obligation scheme the SRMC of wind generation is negative, the SRMC of biomass is considerably lower than coal or gas. The introduction of Contract for Difference Feed in Tariff (CfD FiT) support for biomass and wind will create another class of marginal cost. All renewables, gas, coal and hydro are capable of providing FR, all are capable of being the marginal generator and setting the market price. It is entirely feasible that within a 24 hour period all classes of technology may provide FR and all may, at some point, set the market price.

Increasing MIP Volatility

Due to the changing generation mix noted above, we expect the MIP will become increasingly volatile in future years. To illustrate, a report from Brattle Group suggested that in markets with high levels of wind penetration, the "management of wind power has become a major issue in all three of the markets [Spain, Germany and Denmark] studied…" The report then goes on to say "All three markets provide a preview of the increased price volatility that GB can expect with increased levels of wind power."[1]

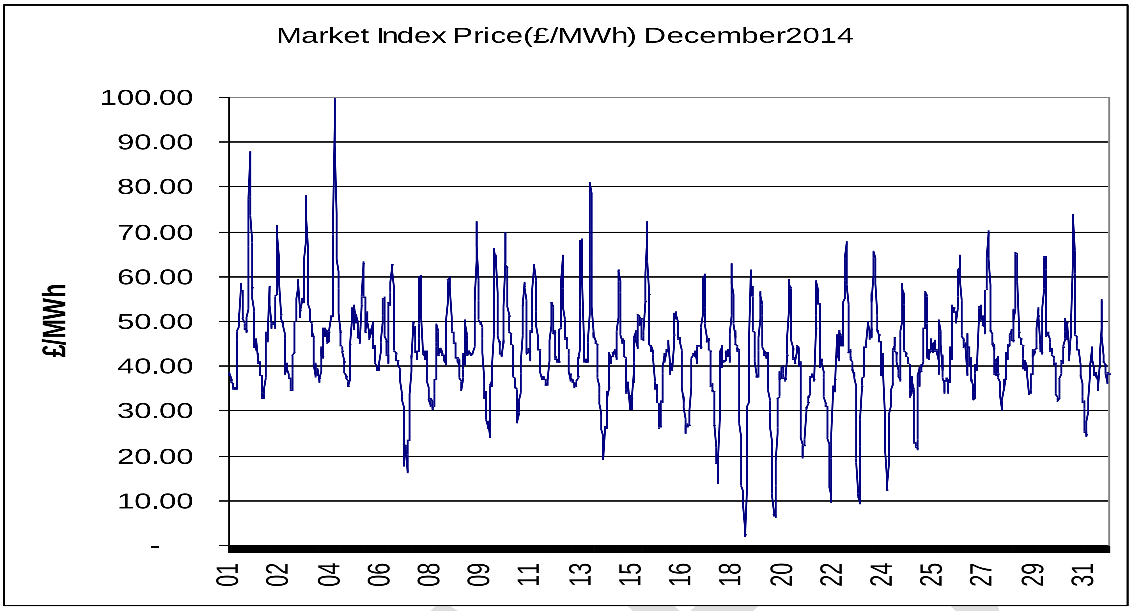
Analysis of the MIP also shows an increase in its volatility as displayed in the graph below. The graph presents the within day volatility of the period from early 2014 up to the end of January 2015. The within day volatility is represented by the standard deviation of the MIP over 48 half hour prices. The line of best fit shows the gradual increase in volatility.



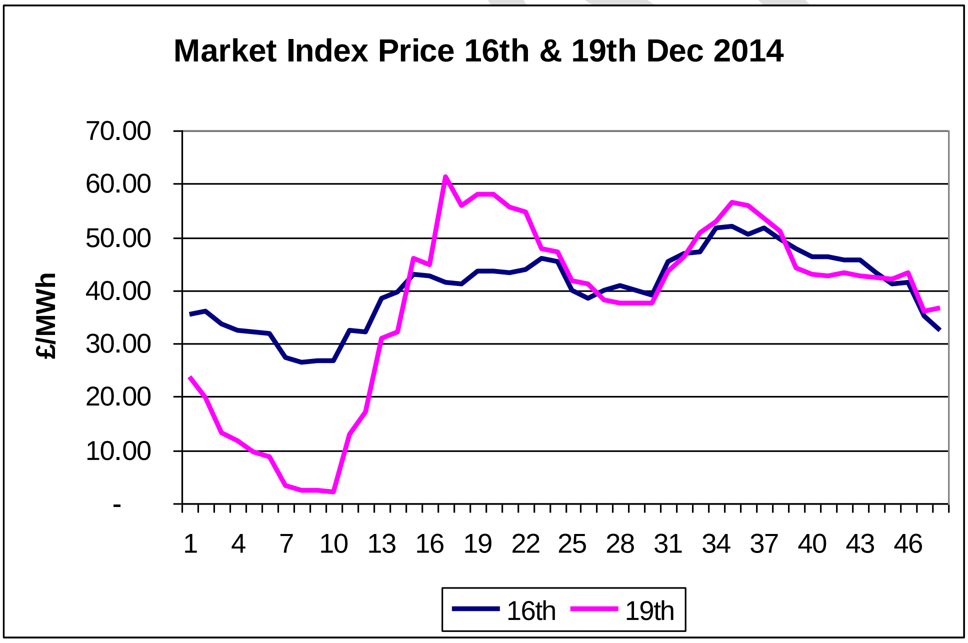
MIP December 2014 Example

[1] ALTERNATIVE TRADING ARRANGEMENTS FOR INTERMITTENT RENEWABLE POWER: A CENTRALISED RENEWABLES MARKET AND OTHER CONCEPTS (April 2010). Hesmondhalgh, S; Et al. *Brattle Group p16.* https://www.ofgem.gov.uk/ofgem-publications/40208/brattle-report-alternative-trading-arrangements-intermittent-renewable-power-pdf.pdf

Below is a chart of the MIP for December. The average price was £43.25/MWh, the maximum price was £99.61/MWh and the minimum price was £2.20/MWh. The REP would have been settled on these half hour prices.



If we consider two days (16 and 19 December), we can see the following variation in the MIP:



Day ahead power prices £/MWh		
	16th	19th
Overnight	34.00	29.50
Peak	52.80	47.30

Both coal and gas generators were providing FR during all periods on 16 & 19 December. The SRMC of coal and gas units did not change significantly over the two days. Depending upon which period the units were utilised for FR, a generator could be cashed out at a range of prices between £2.20/MWh and £61.38/MWh.

By way of illustration appendix 1 identifies when Drax Units 1 and 6 were utilised for frequency response. The Units had the same utilisation price i.e. the cost of despatch to the SO was the same. However, the Units pattern of utilisation was very different, consequently the average MIP at which the response energy was cashed out at was different for each Unit and each day even though their utilisation prices were identical. The spread of prices that Drax Units 1 and 6 was exposed to was around £15/MWh as shown in the table below:

Response Energy MIP Exposure £/MWh			
T_DRAXX-1 16TH	**T_DRAXX-1 19TH**	**T_DRAXX-6 16TH**	**T_DRAXX-6 19TH**
40.09	29.15	36.30	25.36

This shows that units called to deliver FR are likely to experience a material difference in the REP they receive/pay back relative to the cost incurred/saved. The only circumstance where a unit's REPs would match its costs incurred/saved is where:

- It is used continuously for FR every day, on every period; and
- It is part loaded such that it will provide high and low FR; and
- It's high and low FR capability at that part load point are equal

It is unclear whether this scenario will occur particularly often. In summary, the wider the spread of potential MIP the greater the risk to the FR generator. As the analysis above shows, the volatility of the MIP is only likely to increase.

REP Risk for FR Providers

There are two types of risk that FR providers face; price risk due to the volatility of the MIP and volume risk due to the uncertainty associated with FR utilisation. Currently, with a method based on MIP*1.25/0.75, FR providers face both price risk and volume risk. It should also be noted that until now the MIP has not dropped below £0/MWh because the APX exchange would not accept negative prices. From January 2015 this was no longer the case. Given the growth of wind and solar, both of which have negative SRMCs, a prudent generator would anticipate negative prices in the near future. Therefore MIP volatility is likely to increase further in future.

Under the proposed REP method, having a fixed price of £0/MWh (although the principle is the same for any other value) eliminates the price risk caused by the volatility of the MIP. This is likely to be beneficial for all FR providers so if it were to be introduced this option should be available to all FR providers. However this option does not help manage the volume risk. It is also worth noting that for wind, a £0/MWh REP price is unlikely to be greatly beneficial considering its negative marginal cost.

Ultimately, regardless of whether a FR provider operates under the current or proposed REP method, the only way to protect against running at a loss (due to REP costs being greater than REP revenue) is to increase holding prices.

This increase in holding fee will have a detrimental impact on National Grid’s ability to carry out efficient FR. Further, If the risk cannot be quantified the generator may price itself out of the market. This reduction in competition cannot be of benefit to end consumers. If a generator could nominate a specific REP, both the price and volume risk could be more efficiently managed and would result in lower holding prices. This is likely to better facilitate competition and assist National Grid’s procurement of FR, thus resulting in better outcomes for the end consumer.

Appendix 1

Periods	MIP £/MWh		T_DRAXX-1 16TH	T_DRAXX-1 19TH	T_DRAXX-6 16TH	T_DRAXX-6 19TH
	16TH	19TH	Utilised for FR 1= yes 0 = no			
1	35.44	23.80	1	1	1	1
2	35.96	19.76	1	1	1	1
3	33.65	13.13	1	1	1	1
4	32.53	11.74	1	1	1	1
5	32.00	9.72	1	1	1	1
6	31.72	8.70	1	1	0	1
7	27.33	3.30	0	1	0	1
8	26.35	2.36	0	1	0	1
9	26.62	2.47	0	1	0	1
10	26.61	2.20	0	1	0	1
11	32.31	13.03	0	1	0	1
12	32.03	17.19	0	0	0	1
13	38.53	31.00	0	0	0	1
14	39.77	32.22	0	0	0	1
15	42.92	45.93	0	0	0	1
16	42.73	44.78	0	0	0	0
17	41.48	61.38	0	0	0	0
18	41.02	55.73	0	0	0	0
19	43.48	58.07	1	0	0	0
20	43.71	57.98	1	0	0	0
21	43.41	55.50	1	0	0	0
22	43.84	54.68	1	0	0	0
23	45.93	47.83	1	0	0	0
24	45.26	47.20	1	0	0	0
25	39.87	41.63	1	0	0	0
26	38.33	41.05	1	0	0	0
27	39.89	38.03	1	0	0	0
28	40.78	37.61	0	0	0	0
29	40.09	37.68	0	0	0	0
30	39.10	37.54	0	1	0	0
31	45.32	43.71	0	1	0	0
32	47.00	46.37	0	1	0	0
33	47.19	50.87	0	1	0	0
34	51.81	52.75	0	1	0	0
35	52.09	56.54	0	0	0	0
36	50.46	55.83	0	0	0	0
37	51.55	53.58	0	0	0	0
38	49.68	51.13	0	0	0	0
39	47.88	44.31	0	1	0	0
40	46.14	42.97	1	1	0	1
41	46.36	42.61	1	1	0	1
42	45.56	43.31	1	1	0	1
43	45.53	42.74	1	1	0	1
44	43.23	42.50	1	1	1	1
45	41.21	41.92	1	1	1	1
46	41.39	43.22	1	1	1	1
47	35.25	36.16	1	1	1	1
48	32.35	36.67	1	1	1	1