SCOTTISHPOWER

For RFG working Group

Analysis of Current UK Frequency Response

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Current GB Frequency Response Requirements

- Mandatory Frequency Response for all new Units above 50MW
- All new unit must provide a minimum response of 10% of rated capacity
- As 50MW is the level at which frequency response is currently required this can be considered to be equivalent to RFG B-C transition level (in terms of frequency response)

Current GB Frequency Response Volumes

- Analysis of Frequency response volumes over the year from December 2013 until November 2014
- Data was taken from the NGT Mandatory response volumes spreadsheet & the Firm Frequency response volumes spreadsheet
- This was carried by dividing the monthly scheduled volumes by the number of hours in the month to give an average hourly MW value

Current GB Frequency Response Volumes

Primary Response scheduled average MW per hour												
	Nov-14	Oct-14	Sep-14	Aug-14	Jul-14	Jun-14	May-14	Apr-14	Mar-14	Feb-14	Jan-14	Dec-13
Mandatory	384	349	403	506	396	387	399	462	366	299	294	381
FFR	216	290	268	267	307	307	306	267	216	265	281	273
Total	600	640	672	773	704	694	705	729	581	564	575	654

- Over the year the average scheduled Primary response was 657MW per hour

Current GB Frequency Response Volumes

Secondary Response scheduled average MW per hour												
	Nov-14	Oct-14	Sep-14	Aug-14	Jul-14	Jun-14	May-14	Apr-14	Mar-14	Feb-14	Jan-14	Dec-13
Mandatory	202	195	238	314	256	247	259	294	230	194	192	238
FFR	158	200	237	236	260	248	248	224	149	184	189	182
Total	361	395	475	550	516	495	507	518	379	378	381	420

- Over the year the average scheduled Secondary response was 448MW per hour

Current GB Frequency Response Volumes

High Response scheduled average MW per hour	Nov-14	Oct-14	Sep-14	Aug-14	Jul-14	Jun-14	May-14	Apr-14	Mar-14	Feb-14	Jan-14	Dec-13
Mandatory	686	619	556	656	512	422	532	725	617	434	459	582
FFR	0	90	190	190	280	280	280	190	0	100	72	24
Total	686	709	746	846	792	702	812	915	617	533	531	606

- Over the year the average scheduled High response was 708 MW per hour

Current GB Frequency Response Volumes

- Primary response was an average 657 MW per hour

% of primary volume supplied by units providing			
Primary only	Primary & Secondary	Primary & High	Primary, Secondary & High
0	33	1	66

- Secondary response was an average 448 MW per hour

% of secondary volume supplied by units providing			
Secondary only	Primary & Secondary	Secondary & High	Primary, Secondary & High
4	29	0	67

- High response was an average 708 MW per hour

% of high volume supplied by units providing			
High only	Primary & High	Secondary & High	Primary, Secondary & High
5	6	0	89

Current GB Frequency Response Capacity

- Using the data in the NGT mandatory Frequency Response Capability spreadsheet and the FFR Post Tender Reports

- Using the 0.5Hz entries

- Adding the Mandatory total to the additional FFR components gives

- Maximum available Primary Response 10,512 MW
- Maximum available Secondary Response 12,625 MW
- Maximum available High Response 9,446 MW

Current GB Frequency Response Overall Usage

Primary Response

- Scheduled 657 MW Capacity 10,512 MW
- Usage 6.3%

Secondary Response

- Scheduled 448 MW Capacity 12,625 MW
- Usage 3.5%

High Response

- Scheduled 708 MW Capacity 9,446 MW
- Usage 7.5%

Current GB Frequency Response Capacity per Fuel Type

- Using the data in the NGT mandatory Frequency Response Capability spreadsheet , the FFR Post Tender Reports and the current capacity values in the 10 year statement year for 2014

- Adding the Mandatory total to the additional FFR components and splitting it into fuel types to gives the following tables

Current GB Frequency Response Capacity per Fuel Type

Primary Response MW available capacity per fuel type												
	Gas	Coal	Pump storage	Oil	Onshore wind	Offshore wind	Nuclear	Hydro	Biomass	Marine	Inter connector	Unknown
Available Response	4310	3369	1234	784	384	310	90	31	0	0	0	0
Percentage of available response	41	32	12	7	4	3	1	0.3	0	0	0	0
Total Generating Capacity	29906	18598	2744	1123	4320	4266	9471	1122	2040	25	4000	0
Percentage of Fuel Type capacity	14	18	45	70	9	7	1	3	0	0	0	0

Current GB Frequency Response Capacity per Fuel Type

Secondary Response MW available capacity per fuel type												
	Gas	Coal	Pump storage	Oil	Onshore wind	Offshore wind	Nuclear	Hydro	Biomass	Marine	Inter connector	Unknown
Available Response	5957	3681	1270	784	492	335	90	66	0	0	0	56
Percentage of available response	47	29	10	5	4	3	1	0.5	0	0	0	0.5
Total Generating Capacity	29906	18598	2744	1123	4320	4266	9471	1122	2040	25	4000	0
Percentage of Fuel Type capacity	20	20	46	60	11	8	1	6	0	0	0	?

Current GB Frequency Response Capacity per Fuel Type

High Response MW available capacity per fuel type												
	Gas	Coal	Pump storage	Oil	Onshore wind	Offshore wind	Nuclear	Hydro	Biomass	Marine	Inter connector	Unknown
Available Response	4551	2931	338	812	398	287	92	37	0	0	0	0
Percentage of available response	48	31	4	8	4	3	1	0.5	0	0	0	0
Total Generating Capacity	29906	18598	2744	1123	4320	4266	9471	1122	2040	25	4000	0
Percentage of Fuel Type capacity	15	16	12	72	9	7	1	3	0	0	0	0

Current GB Frequency Response Capacity per Fuel Type

Gas, Coal & Oil have largest frequency response capabilities and exceed the target 10% of installed capacity.

On & Offshore wind frequency response capacities are slightly below the 10% target of installed capability but this might be due to commissioning timings. Also the current total capacities are above the dispatched levels for primary & secondary and just below that of high.

Other technologies do not seem to be providing any significant response .

Current GB Frequency Response Volumes by Fuel Type

- Analysis of Frequency response volumes over the year from December 2013 until November 2014
- Data was taken from the NGT Mandatory response volumes spreadsheet & the Firm Frequency response volumes spreadsheet
- This was carried by dividing the monthly scheduled volumes by the number of hours in the month to give an average hourly MW value
- This the has been calculated per fuel type

Current GB Frequency Response Volume by Fuel Type

Primary Response MW scheduled MW per fuel type

	Gas	Coal	Pump storage	Oil	Onshore wind	Offshore wind	Nuclear	Hydro	Biomass	Marine	Inter connector	Unknown
Response	260	182	216	0	0.06	0	0	0.01	0	0	0	0
% response	40	27	33	0	0	0	0	0	0	0	0	0

Secondary Response MW scheduled MW per fuel type

	Gas	Coal	Pump storage	Oil	Onshore wind	Offshore wind	Nuclear	Hydro	Biomass	Marine	Inter connector	Unknown
Response	185	118	135	0	0.03	0	0	0.01	0	0	0	18
% response	40	26	30	0	0	0	0	0	0	0	0	4

High Response MW scheduled MW per fuel type

	Gas	Coal	Pump storage	Oil	Onshore wind	Offshore wind	Nuclear	Hydro	Biomass	Marine	Inter connector	Unknown
Response	386	326	0.01	0.03	0.07	0	0	0.01	0	0	0	0
% response	54	46	0	0	0	0	0	0	0	0	0	0

Comments on Frequency Response Volumes on Fuel Type

- Coal was only 3rd in primary and secondary response volumes
- Of the approximately 700MW of frequency response available from wind only 6 units were dispatched on 2 days during the year long period, with the maximum potential usage on one day being 150MW, but the exact split during day unknown
- Therefor in principal there was sufficient reserve response capacity if all coal and gas were displaced by wind

Suggested RFG B-C Transition Level

- On the bases that the current 50MW frequency response requirements appear to be providing sufficient capacity there appears to be no reason to reduce this level

- Also given that the current 50MW limit has been in place for 8 years and plants are still being build above this level and this does appear not causing a volume issue

- Any reduction from 50MW is just lightly to produce additional unused capacity at cost to generators