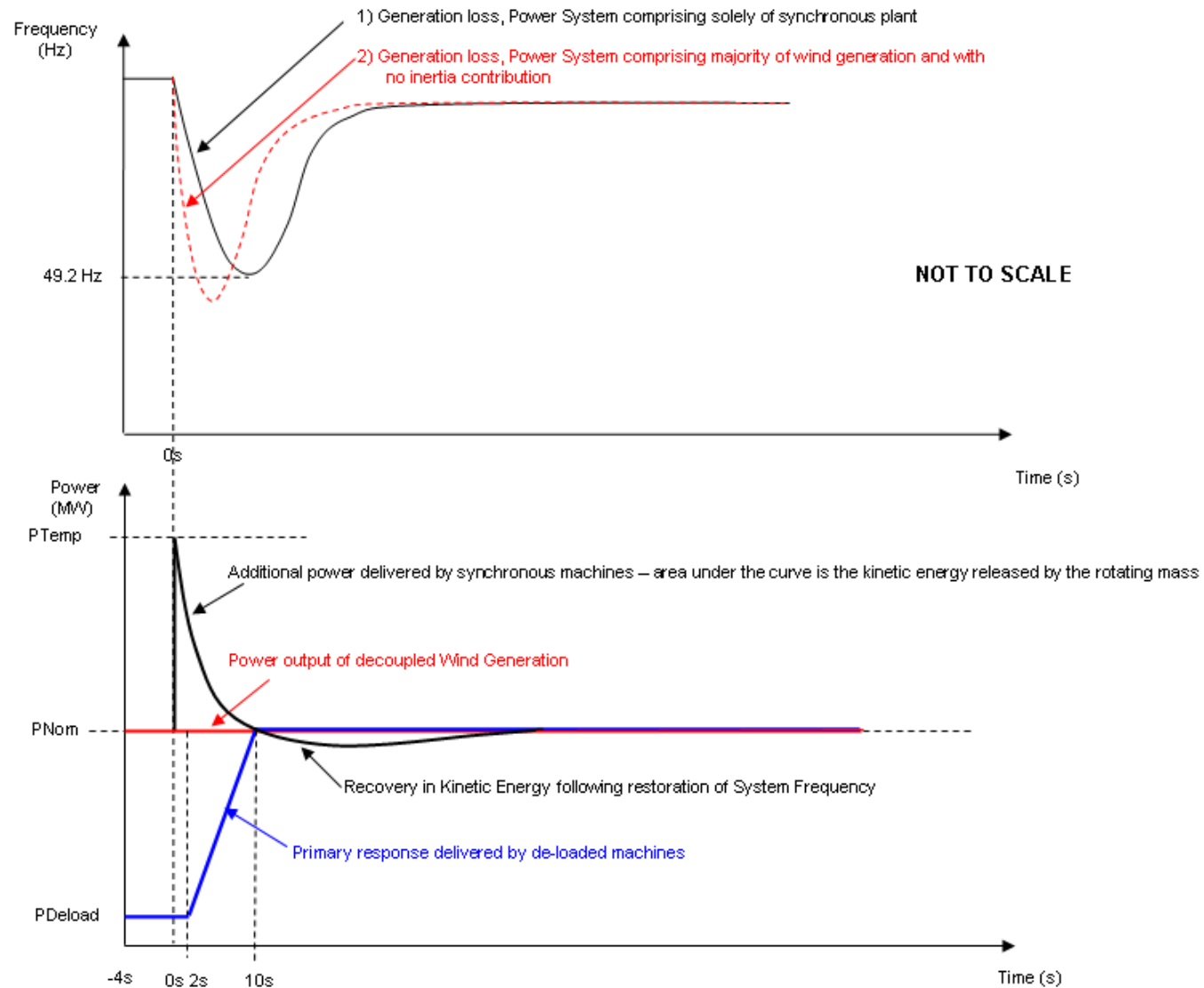


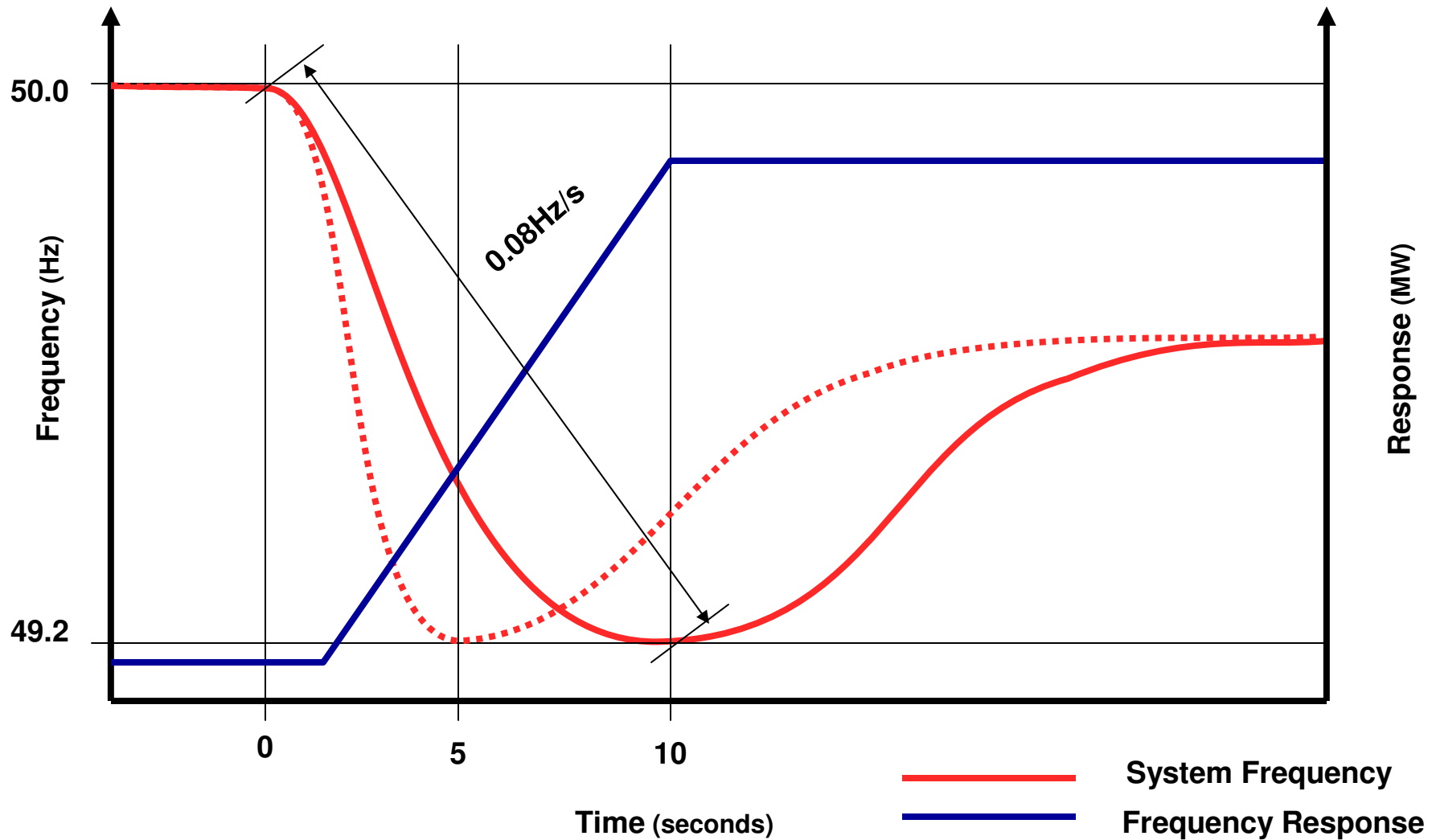
Rapid Frequency Response

BSSG Update 30th October 2013

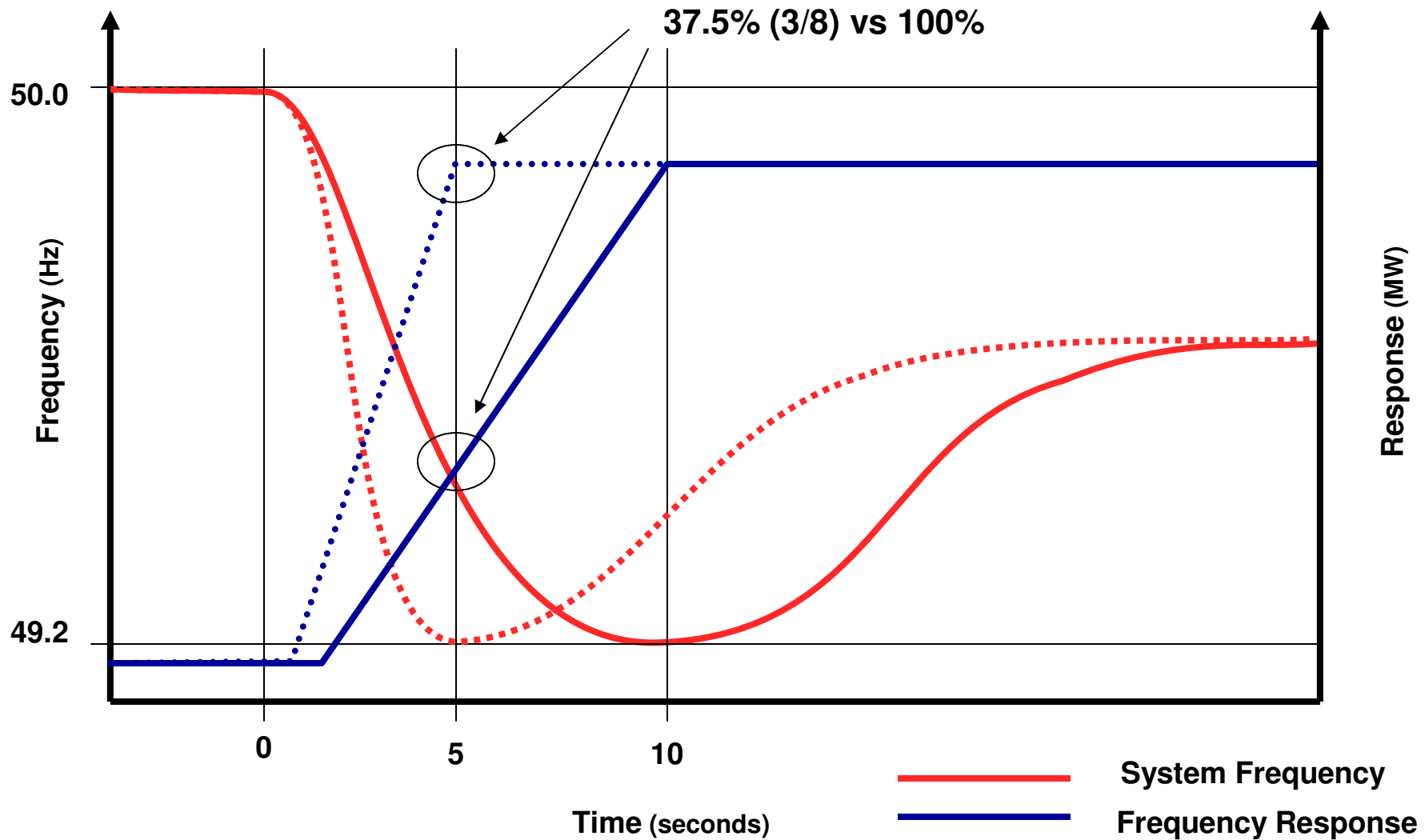
Recap



Fast Frequency Response - Benefit



Fast Frequency Response - Benefit



Fast Frequency Response – Quantifying Benefit

Demand = 25 GW

10s Response

INTW*	1260	1600	1800
-4	1103	1737	2123
-2	1135	1779	2190
0	1170	1824	2315
2	1208	1870	2449
4	1250	1953	2593
6	1297	2082	2748

5s Response

INTW	1260	1600	1800
-4	1010	1487	1768
-2	1021	1487	1808
0	1031	1511	1855
2	1042	1557	1908
4	1052	1608	1965
6	1063	1664	2025

Difference

INTW	1260	1600	1800
-4	93	250	355
-2	114	292	382
0	139	313	459
2	166	313	540
4	198	345	628
6	234	418	722

Demand = 30 GW

10s Response

INTW	1260	1600	1800
-4	864	1344	1626
-2	866	1345	1651
0	867	1346	1737
2	868	1346	1831
4	869	1383	1933
6	870	1468	2044

5s Response

INTW	1260	1600	1800
-4	860	1336	1617
-2	862	1338	1619
0	864	1340	1620
2	865	1342	1622
4	867	1343	1623
6	868	1344	1624

Difference

INTW	1260	1600	1800
-4	4	8	9
-2	4	7	32
0	3	6	117
2	3	4	209
4	2	40	310
6	2	124	420

Demand = 45 GW

10s Response

INTW	1260	1600	1800
-4	411	889	1171
-2	413	891	1172
0	415	893	1174
2	416	894	1175
4	418	895	1176
6	419	896	1177

5s Response

INTW	1260	1600	1800
-4	410	886	1166
-2	412	888	1168
0	414	889	1169
2	415	891	1171
4	417	893	1173
6	418	894	1174

Difference

INTW	1260	1600	1800
-4	1	3	5
-2	1	3	4
0	1	4	5
2	1	3	4
4	1	2	3
6	1	2	3

* "INTW" is the non-synchronous contribution to generation and import/export

Fast Frequency Response – Quantifying Benefit

- Proposed Next Steps
 - Combine requirement curves with
 - load duration curve for demand
 - Generation background (non-synchronous vs synchronous contribution)
 - Expected evolution of large loss risks
 - Deal with infeasibilities
 - Result provides a benefit in terms of volume
 - Multiple views required

Fast Frequency Response – Benefit vs Cost

- Proposed Next Steps
 - Balancing Service Cost Scenarios
 - View A (Baseline) – 10 second Response
 - View B – 5 second Response
 - View C – 10 second response with inertia constraint
 - View D – 10 second response with infeed loss risk curtailment
 - Implementation Cost
 - Assumed development cost per manufacturer
 - Conclusion Based on Balancing Services Cost vs Implementation Cost