



WECC

Enforcing Frequency Response Requirements in PCM

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Frequency response obligation

- Frequency Response Obligation (FRO) (MW/0.1HZ) of the entire Western Interconnection is derived to cover severe system disturbances
- WECC system FRO is 858 MW/0.1Hz, according to the NERC 2018 Frequency Response Annual Analysis
- Maximum frequency decrease for the Western Interconnection for 2019 was calculated by NERC as 0.248 Hz



FRO allocation and Frequency response requirement

- Each BAA obligates to provide frequency response. FRO of a BAA is calculated as in the equation below

$$FRO_{BA} = FRO_{Int} \frac{P_{gen_{BA}} + P_{load_{BA}}}{P_{gen_{Int}} + P_{load_{Int}}}$$

- Frequency Response Requirement (FRR) (MW) is derived from FRO
 - Maximum frequency decrease for the Western Interconnection for 2019 was calculated by NERC as 0.248 Hz
 - Under Frequency Load Shedding (UFLS) setting (e.g. 59.7 Hz) is used to derive FRR from FRO
 - Total FRR can be estimated as $FRO * 0.3 = 858 * 3 = 2574$ MW



Considerations of enforcing FRR in ADS PCM

- The purpose of enforcing FRR in PCM
 - Commit enough synchronous generators with governor response capability for reliability reason
 - This becomes more important as renewable penetration increases
- Questions for enforcing FRR
 - FRR allocation – BAL-003 suggests allocating FRR in proportion of load and generation of BAAs. So, the allocation may change every hour
 - Whether enforcing at region (or BAA) level or at region group level?
 - What type of generators can provide FRR – Hydro, CC, Storage



Testing

- Purpose is to demonstrate the impact of enforcing FRR on the simulation results, and initiate the discussion
- For testing purpose, a simplified approach for FRR allocation is used for testing purpose
 - Allocate FRR in proportion of region's annual energy of load
 - ADS PCM has enforced FRR for the CAISO region using the CAISO's assumption (770 MW), then the rest regions share the rest 1804 MW
 - BC Hydro and NW regions and TIDC are not enforced with FRR since they are hydro dominated. BANC are enforced with half of its share similarly to the CAISO's assumption
 - Enforce FRR for other regions on Combined cycle (8% of capacity,) and storage (100% of capacity), the same as in the CAISO's assumption
- Further discussion would be needed in coordination with PCDS for refining the setup



WECC FRR	2574	CAISO ass	770	Rest regio	1804
Row Labels	Sum of Sum (Energy)	Load ratio	Load Ratio excluding CAISO	FRR calcul	Actual enforced FRR
AB_AESO	96,334,990	9.50%	12.57%	227	227
BC_BCHA	65,680,680	6.47%	8.57%	155	0
BS_IPCO	19,557,205	1.93%	2.55%	47	47
BS_PACE	53,126,920	5.24%	6.93%	126	126
CA_BANC	18,552,430	1.83%	2.42%	44	22
CA_CFE	22,031,280	2.17%	2.87%	52	52
CA_IID	4,257,471	0.42%	0.56%	11	11
CA_LDWP	34,156,140	3.37%	4.46%	81	81
CA_TIDC	2,861,704	0.28%	0.37%	7	0
NW_AVA	13,700,840	1.35%	1.79%	33	0
NW_BPAT	69,348,320	6.84%	9.05%	164	0
NW_CHPD	1,971,675	0.19%	0.26%	5	0
NW_DOPD	2,186,102	0.22%	0.29%	6	0
NW_GCPD	10,598,970	1.04%	1.38%	25	0
NW_NWMT	13,233,980	1.30%	1.73%	32	0
NW_PACW	22,468,990	2.22%	2.93%	53	0
NW_PGE	22,572,620	2.23%	2.94%	54	0
NW_PSEI	25,807,330	2.54%	3.37%	61	0
NW_SCL	8,976,500	0.88%	1.17%	22	0
NW_TH_Malin	0	0.00%	0.00%	0	0
NW_TPWR	4,889,470	0.48%	0.64%	12	0
NW_WAUW	841,191	0.08%	0.11%	2	0
RM_PSCO	53,300,760	5.25%	6.95%	126	126
RM_WACM	28,129,700	2.77%	3.67%	67	67
SW_AZPS	43,196,860	4.26%	5.64%	102	102
SW_EPE	10,962,210	1.08%	1.43%	26	26
SW_NVE	34,694,160	3.42%	4.53%	82	82
SW_PNM	15,050,870	1.48%	1.96%	36	36
SW_SRP	40,099,720	3.95%	5.23%	95	95
SW_TEPC	18,272,900	1.80%	2.38%	44	44
SW_TH_Mead	0	0.00%	0.00%	0	0
SW_TH_PV	0	0.00%	0.00%	0	0
SW_WALC	9,656,130	0.95%	1.26%	23	23
WECC total exc	766,518,118		100.00%	1804	





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