



Ramp-Rate Methodology

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Ramp-Rate Principles

- 4 ramp-rate segments can be modeled
- In addition to the ramp-rate segments up to 2-Forbidden Regions can be modeled
- An aggregate ramp-rate curve made up of the operational ramp-rate and Forbidden Operating Regions is created
- Aggregate ramp-rate curve will still be used even if Forbidden Region is not enforced

Ramp-Rate Issues

- For past 6 months ability to accommodate varying ramp-rates has improved
- In cases where large ramp-rates changes exist from one operating range to another we observe significant impact on performance
- Large Ramp-Rate changes appear to being used to model combined cycle

Ramp-Rate Proposed Solution

- Limit ramp-rate changes where ramp-rate change from one operating range to next operating range to a 10:1 change
- CAISO will internally adjust ramp-rate to achieve a 10:1 ratio if submitted ramp-rate is not achieved
- A Normal Card can be used to hold a resource at a required MW until resource is able to ramp at the adjusted ramp rate

Ramp-Rate Example

Resource has for ramp-rate segments

- 0-10 MW at 5 MW/min
- 10-20 MW at .4 Mw/min
- 20-100 MW at 5 Mw/min
- 100-150 Mw at 10 Mw/min
- Forbidden Region between 30-90 MW with Transit Time = 60 minutes

Operating Range (Mw)	Ramp-Rate (Mw/Min)	Forbidden Region Transit Time (min)	Aggregate Effective Ramp-Rate	Ramp-Rate Change (Upward Direction)	Maximum Change (10:1)x min ramp-rate	Ok/Not Ok	Corrected
0	5		5	-		Ok	5
10	.4		.4	4.6	4.0	Not-Ok	.5
20	5		5	4.6	4.0	Not-Ok	5
30	For.Reg.	60	1	4	10.0	Ok	1
90	For.Reg.		5	4	10.0	Ok	5
100	10		10	5	50.0	Ok	10
150	-	-	-				