Ancillary Services and Large Loads in ERCOT

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Large Load Integration

May 6, 2024

ERCOT Ancillary Services Overview

Services procured by ERCOT in the Day-Ahead-Market to balance next day's supply and demand of electricity.

Real Time Issues that might cause imbalance:

- Daily load patterns
- Instantaneous load variation
- Changes in variable generation output
- Generators tripping offline

What type of resources can provide AS?

- Generation resources
- Non-Controllable load resources
- Controllable load resources
- Aggregate load resources
- Energy storage resources

Ancillary Service Types

- **Regulation Service (Reg Up/Dn):**
  - Reserved capacity that is deployed every 4 seconds to balance supply and demand.
- **Responsive Reserve Service (RRS):**
  - Reserve capacity that can balance supply and demand if a generator trips offline.
- **Non-Spin Reserve Service (NSRS):**
  - Capacity that can respond within 30 minutes to address forecasting errors or to replaced deployed reserves.
- **ERCOT Contingency Reserve Service (ECRS):**
  - Capacity that can be available within 10 minutes to cover errors in forecasts, replace deployed reserves, and recover frequency.

Large Loads Providing Ancillary Services

- Qualifying Large Loads can participate in the Ancillary Service market as either a Non-Controllable Load Resource (NCLR) or a Controllable Load Resource (CLR).

- ERCOT has observed Large Load (Interim LLI) participation in…
  - Responsive Reserve Service (RRS)
  - Non-Spin Reserve Service (NSRS)
  - ERCOT Contingency Reserve Service (ECRS)

- Less than 20% of Large Load (Interim LLI) capacity provides AS on average.

Large Load Behavioral Impacts

- Most Large Loads have been observed to independently respond to…
  - Price Signals
  - 4CP
  - Extreme Weather Events
- An independent response refers to load behavior that is not coordinated with ERCOT through a direct dispatch instruction.
- This independent response often causes an increase in…
  - Load and Net-Load Variability
  - Load and Net-Load Uncertainty (Forecast Error)

Large Load Impacts on Ancillary Services

- **Regulation Service:**
  - Higher net-load variability due to Large Load increases total procurement.
- **Non-Spin Reserve Service:**
  - Higher net-load uncertainty due to Large Load increases total procurement.
- **ERCOT Contingency Reserve Service:**
  - Higher net-load uncertainty due to Large Load increases total procurement.
  - Significant net-load forecast error can distort the effectiveness of the ECRS manual release triggers.
    - See next slide for example.

ECRS Manual Release Trigger w/ Large Load Ramp Example

- Manual release triggers are currently based on the following two assessments of available dispatchable capacity to serve forecasted 10 minute ahead net load:
  - ❑ 10-min Net Load Ramp Capability
    - 10-min Remaining Ramping Capability minus 10-min Net Load Ramp Forecast
  - ❑ PRC Trigger
    - PRC – 3200 – (10-min Net Load Ramp Forecast) + QSGR
- Both triggers are more likely to occur during intervals of elevated system prices, which ERCOT has observed is also when many Large Loads independently curtail (totaling over 2 GW).
  - For example, during the evening solar down ramp.
- This independent price response is not well accounted for in 10-min Net Load Forecasts and can result in the forecasted 10-min Net Load Ramp to be larger than is observed in real-time.
  - As a result, ECRS my be manually triggered when it otherwise would not have if Large Load ramps could be better incorporated into the 10-min forecasts.

Ancillary Service Procurement Lag

- Most AS products are procured based on historical data.
- Current AS procurement methodologies do not account for rapid year-to-year changes in demand.
- For example, Regulation Services are procured at the 95th percentile of 5-min net-load ramps (HE 1 – 24 for every month) during the previous year.
  - Manual adjustments to procurement totals are made for Wind & Solar generation growth projections.
  - Currently, no manual adjustments are made for flexible load growth projections.
- Large Loads independently responding to market signals that energized less than a year ago are not currently accounted for in regulation procurement.

Regulation Service Procurement Lag Example

- ERCOT performed an analysis in November 2023 that evaluated what the change in Regulation (Up & Dn) procurement would be for 2024 if past Large Load (Interim LLI) ramping behavior was scaled up to a future projected load total.
  - Large Load (Interim LLI) ramping behavior was scaled to correspond to 4,479 MW of approved to energize Large Load.
  - A new 95th percentile for net-load ramps was then calculated and the deltas were recorded.
- The deltas indicate how much more (or less) regulation would need to be procured to account for year-to-year Large Load growth while still achieving a 95th percentile net load ramp target.
  - *Assumes 4,479 MW build out that behaves similar to already existing Large Loads.
- In total, the increase in regulation procurement for Jan – Oct 2024 would be…
  - Regulation Up: **88,207 MWh**
  - Regulation Dn: **110,739 MWh**

Regulation Procurement by Hour Ending (MW)			
HE	Up	Down	Total
1	1	10	11
2	6	2	8
3	8	10	18
4	11	15	26
5	9	18	26
6	7	6	13
7	5	11	16
8	6	15	22
9	10	4	14
10	6	8	14
11	2	10	12
12	-1	16	15
13	-4	17	13
14	-1	24	23
15	4	51	55
16	2	24	27
17	1	26	27
18	5	21	25
19	23	42	65
20	5	26	31
21	51	4	55
22	79	-4	75
23	22	6	28
24	31	1	32

Average Change from Current Regulation Procurement by Month (MW)										
Reg	1	2	3	4	5	6	7	8	9	10
Up	15	12	15	6	0	6	16	33	11	6
Down	14	26	12	10	2	6	14	43	10	15
Total	29	39	27	16	2	12	30	76	21	22

Questions?

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Appendix – Regulation Procurement Deltas

Regulation Up Procurement Differences Due to LFL Growth Projection (MW)

HE	Month									
	1	2	3	4	5	6	7	8	9	10
1	-20	-1	20	48	-1	0	4	2	-23	-21
2	0	19	27	9	-5	8	5	1	1	-8
3	4	24	-1	2	-6	3	11	-1	24	22
4	9	36	21	-4	-1	-4	10	30	16	0
5	1	5	24	-5	23	1	0	13	5	18
6	16	12	18	5	-8	7	6	9	9	0
7	10	20	-5	7	-3	-3	-12	2	11	25
8	17	17	2	7	2	-4	0	14	3	5
9	73	-1	26	-5	8	-4	-1	13	-7	0
10	26	-9	38	4	5	-3	2	7	-5	-2
11	-9	1	17	2	-2	3	11	5	1	-7
12	2	22	-6	-3	-4	-6	-6	-17	-1	12
13	-13	2	0	-1	0	-18	-3	-8	-3	1
14	-4	4	-8	-14	1	-1	-4	18	-4	0
15	12	-9	18	7	5	-15	16	-15	8	16
16	2	-5	2	14	4	-7	4	2	12	-4
17	17	-5	-5	3	7	-11	5	-1	0	-3
18	0	-1	10	-19	9	19	0	23	4	1
19	21	-2	8	-4	-4	72	68	78	-13	4
20	109	11	-12	-33	-16	-6	49	13	-50	-10
21	12	45	92	23	9	59	52	61	85	68
22	29	44	58	55	48	52	28	194	149	133
23	64	41	27	40	-94	-5	135	123	-14	-97
24	-19	19	-2	-4	16	9	-2	230	53	5

Regulation Down Procurement Differences Due to LFL Growth Projection (MW)

HE	Month									
	1	2	3	4	5	6	7	8	9	10
1	-6	36	24	11	0	2	-2	7	2	24
2	4	45	-20	-1	-15	1	3	3	-1	3
3	6	18	32	7	-3	4	0	5	25	6
4	43	23	32	13	4	-1	2	4	34	-6
5	-2	69	21	34	2	-1	7	3	30	13
6	-14	45	36	-9	-11	3	-5	6	-5	8
7	27	114	-1	1	0	3	1	5	-27	-10
8	42	20	22	15	-3	8	3	2	7	38
9	-1	-3	19	-2	-2	15	8	0	-4	10
10	18	16	1	9	6	1	-1	18	11	2
11	2	31	0	0	17	2	18	25	4	2
12	-19	12	-4	-2	-2	-6	0	190	-2	-8
13	-2	1	-6	-6	15	-3	5	193	-2	-22
14	-2	9	5	9	14	-25	35	193	13	-10
15	-6	-5	-1	5	3	168	133	157	58	-6
16	0	-2	-30	16	3	8	61	131	47	11
17	99	15	14	12	12	6	23	90	2	-11
18	94	43	29	0	5	2	-17	30	10	10
19	-16	85	57	4	1	6	6	15	1	260
20	9	15	10	116	-4	-10	36	61	15	8
21	20	24	23	0	8	-10	25	-49	-13	11
22	16	0	9	0	-5	-13	-6	-53	7	9
23	22	21	18	2	1	-23	-6	-13	17	23
24	4	2	-10	4	7	7	1	-1	1	-3

These tables indicate the difference in regulation procurement schedules if Large Load (Interim LLI) was scaled up to the total approved to energize amount for 2024 (4,479 MW) as described in the methodology on slide 9.