

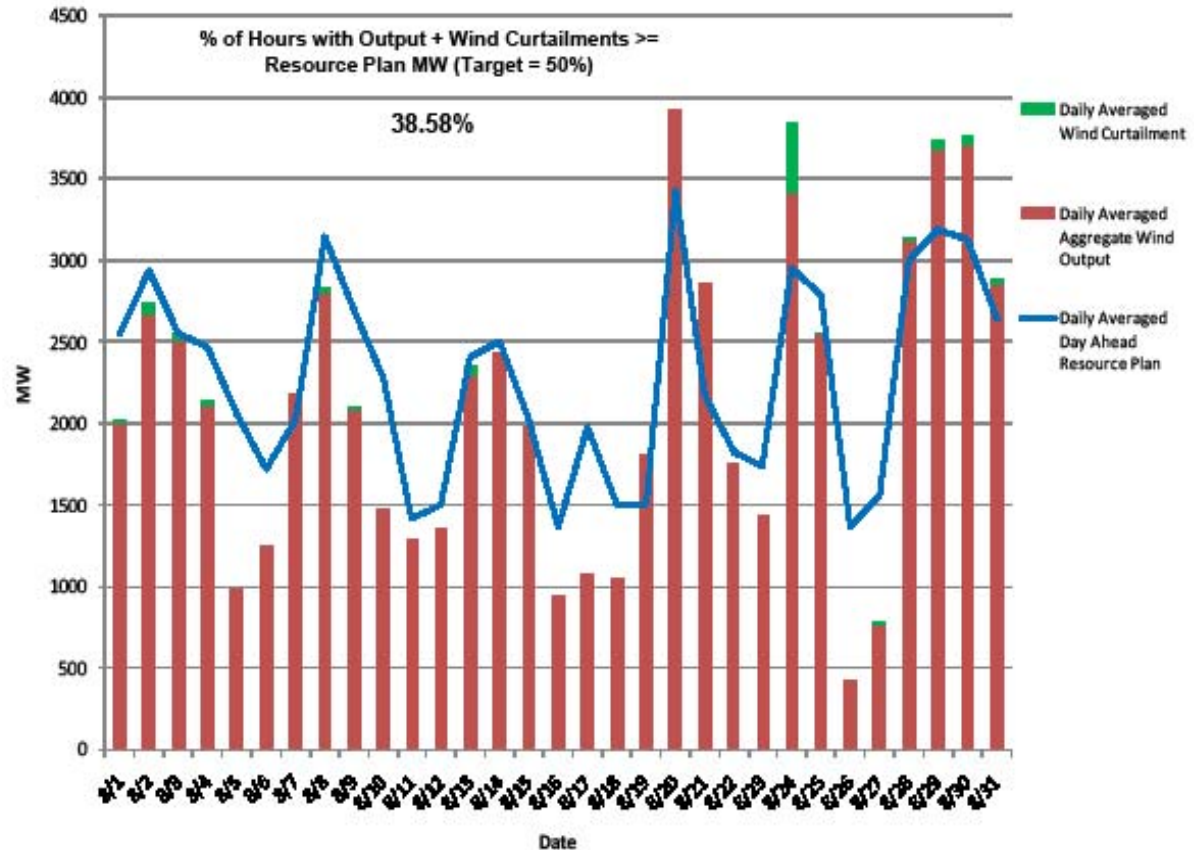


Research Partnership to Secure Energy for America

Wind Energy and Grid Reliability

Dan Wilkerson
Bryan Texas Utilities
November 18, 2010

August 2010: Actual Wind Output w/ Curtailment Added Back vs. Wind Day-Ahead Resource Plan Based on AWS Forecast for All Hours



Note: QEs must use AWST 50% probability of exceedance forecast for Day-Ahead Resource Plans

21 September 2010

Day	Hour Ending	Total Wind Output	Total Day-Ahead Resource Plan MWs for WGRs
20100901	1	1694.3	2314.0
20100901	2	1648.6	2240.0
20100901	3	2464.1	2366.0
20100901	4	3108.6	2587.0
20100901	5	3653.7	2833.0
20100901	6	3827.4	2796.0
20100901	7	3754.5	2598.0
20100901	8	3113.2	2501.0
20100901	9	2428.9	2319.0
20100901	10	2704.0	2141.0
20100901	11	2604.6	1898.0
20100901	12	2106.3	1606.0
20100901	13	1348.7	1397.0
20100901	14	1128.7	1225.0
20100901	15	1284.7	1145.0
20100901	16	1376.6	1132.0
20100901	17	1451.4	1171.0
20100901	18	1621.6	1181.0
20100901	19	2261.2	1231.0
20100901	20	2623.9	1401.0
20100901	21	2930.1	1866.0
20100901	22	2980.9	2439.0
20100901	23	4734.8	2857.0
20100901	24	4835.1	3231.0
20100902	1	3462.3	3808.0
20100902	2	2640.3	3658.0
20100902	3	2308.7	3530.0
20100902	4	2076.2	3613.0
20100902	5	2027.8	3663.0

Ancillary Services

- Regulation Service (Up & Down)
 - Capacity reserved by the grid operator and under automatic generation control that provides second by second load following capability (usually 800 – 1000 MW)
- Responsive Reserve Service
 - Capacity reserved by the grid operator to arrest frequency decay and/or provide a short term replacement for capacity lost due to unit trips and other unforeseen events. (Usually 2500 MW)
- Non-Spinning Reserve Service
 - Capacity reserved by the grid operator to provide short term capacity and energy, usually due to missed load forecast or unforeseen generation unavailability (Usually 500 – 700 MW)

Resources To Follow Load

- On Line Units Not Fully Loaded Mixture of Coal and Gas
- Gas Turbines
- Diesels, Other Internal Combustion
- Loads Acting as Resources (LARS)

Strong Cold Front & Heavy Rains

- January 28, 2010
- A strong cold front moved southward from the Texas Panhandle into the Sweetwater region.
- The cold front became temporarily stationary in the Sweetwater region from just after 3:00 am until 12:00 pm.
- A low pressure developed along the front in the McCamey region during this period.

Variability Affecting Reliability

- 9:00 a.m. – 10:00 a.m. 2,600 MW drop
 - Wind generation dropped from ~5200 MW to ~2600 MW
 - Reg Up maxed out and RRS had to be deployed
- 10:00 a.m. – 12:00 p.m. 1,400 MW rise
 - Wind generation increased from ~2,600 MW to ~4,000 MW
 - Reg Down maxed out and RRS recalled
- 12:00 p.m. – 12:20 p.m. 1,400 MW drop
 - Wind generation decreased from ~4,000 MW to ~2,600 MW
 - Reg Up close to max
- 12:20 p.m. – 13:30 p.m. 2,100 MW rise
 - Wind generation increased from ~2,600 MW to ~4,700 MW
 - Reg Down maxed out
- 13:30 p.m. – 14:20 p.m. 1,500 MW drop
 - Wind generation decreased from ~4,700 MW to ~3,200 MW
 - Reg Up close to max and RRS deployed

Wind, Regulation, and RRS

Wind Output, Regulation and RRS for 1/28/10

