



2016 LTSA Update

August 16, 2016
RPG Meeting

Agenda

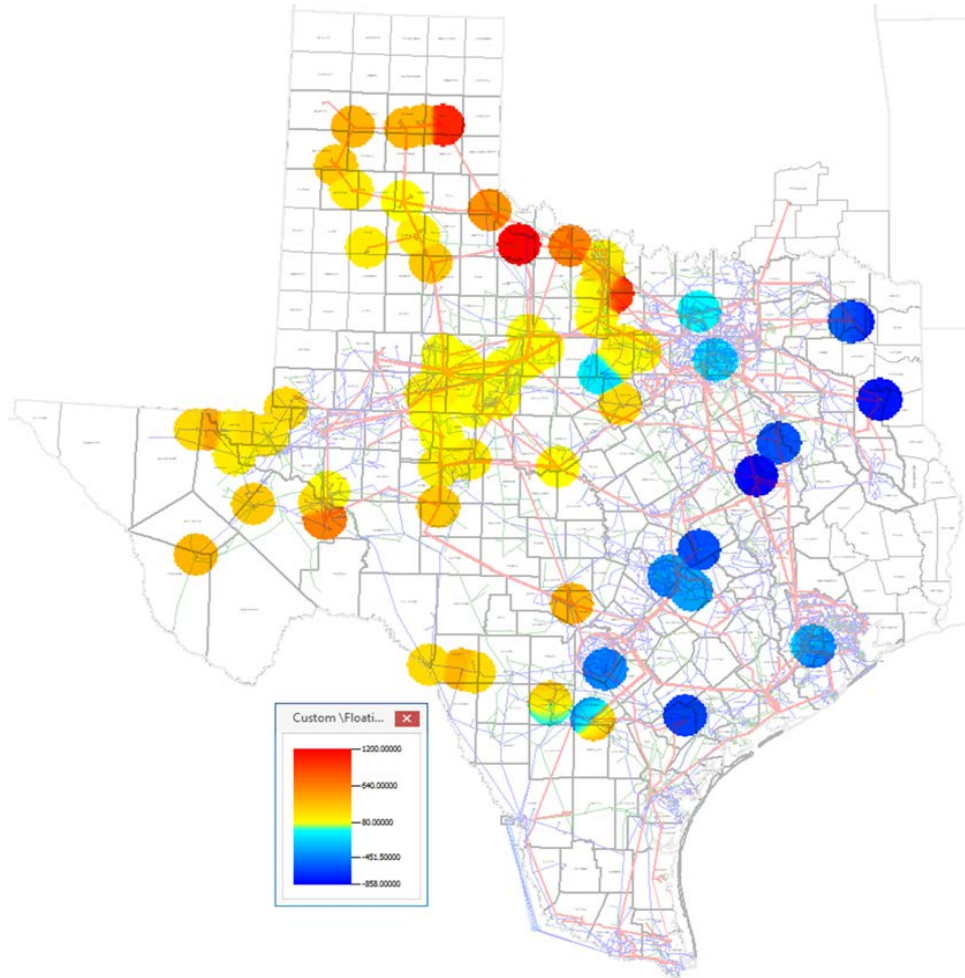
- Status of LTSA
- Generation addition/retirement of Current Trends
- Preliminary reliability issues of Current Trends
- Additional scenarios selected for transmission study
- Next steps

Status of LTSA

- ❑ As presented in the June RPG meeting, ERCOT completed the generation expansion analyses for all eight scenarios
- ❑ New generation and retirement were modeled in the reliability cases for the 2026 and 2031 Current Trends scenario. Reliability analysis is in progress and economic case is being prepared.
- ❑ The following two scenarios will be studied further for transmission analysis:
 - Environmental Mandate scenario
 - High Energy Efficiency (EE)/ Distributed Generation (DG) scenario

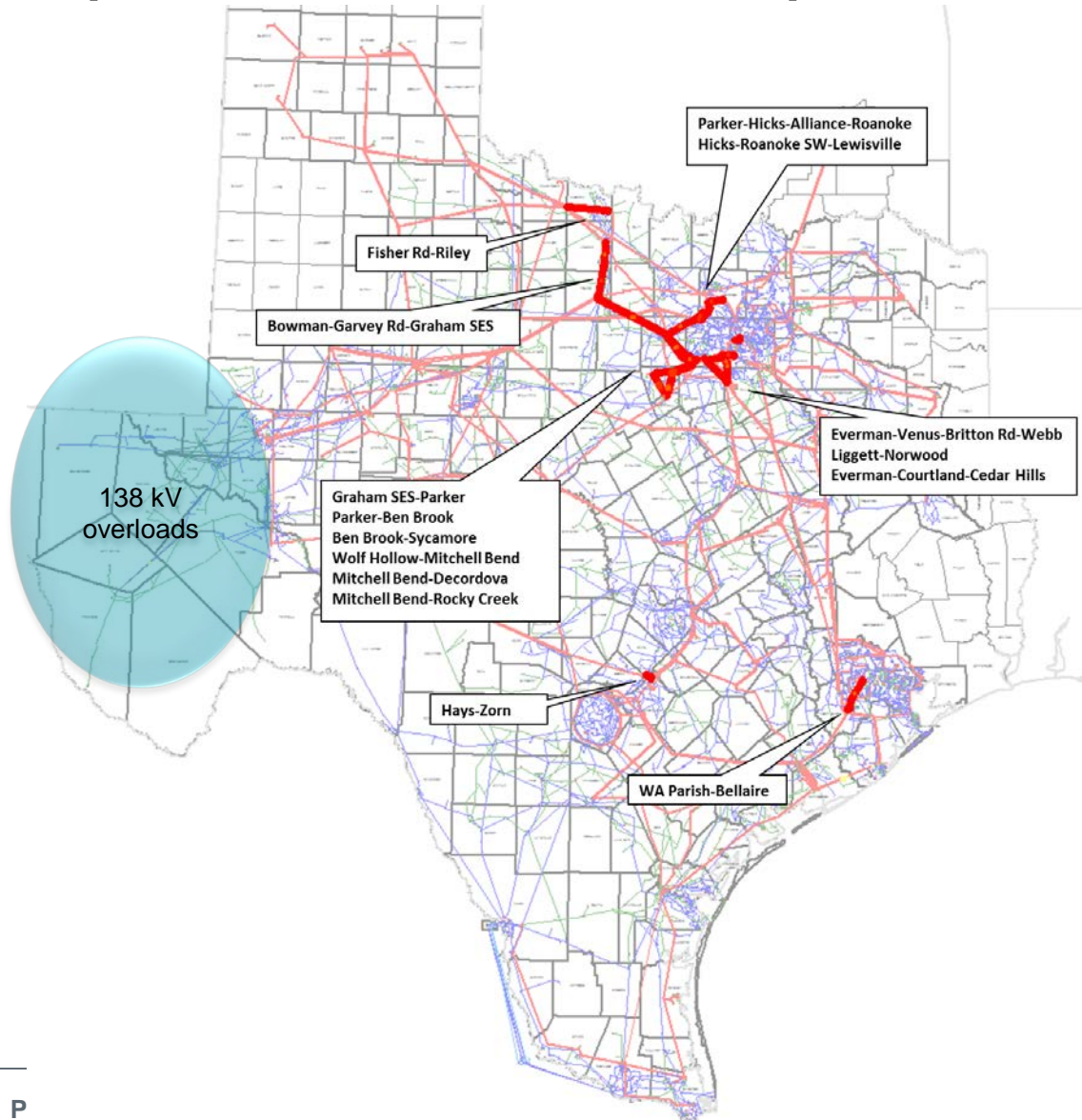
2031 Generation Addition and Retirement (Current Trends)

- ❑ Solar Additions:
20 GW by 2031
- ❑ Unit Retirement:
13.5 GW by 2031



2031 Additions (MW)	Coast	East	North	North Central	West	Far West	South Central	South	Total
Solar	0	0	9700	1200	3400	4500	500	900	20200
Retirements	(979)	(5618)	0	(2454)	0	0	(3378)	(1076)	(13505)
TOTAL	(979)	(5618)	9700	(1254)	3400	4500	(2878)	(176)	6695

Preliminary Result of Major N-1 Reliability Issues (2031 Current Trends)



- ❑ Approximately more than 550 miles of 345 kV lines were found overload in 2031 Current Trends
- ❑ 138 kV line overloads were also found. Many of them are located in the Far West weather zone
- ❑ Approximately total 1GVar of reactive power support were modeled at various locations inside DFW to maintain reasonable voltage in the start case

Scenarios Selected for Study

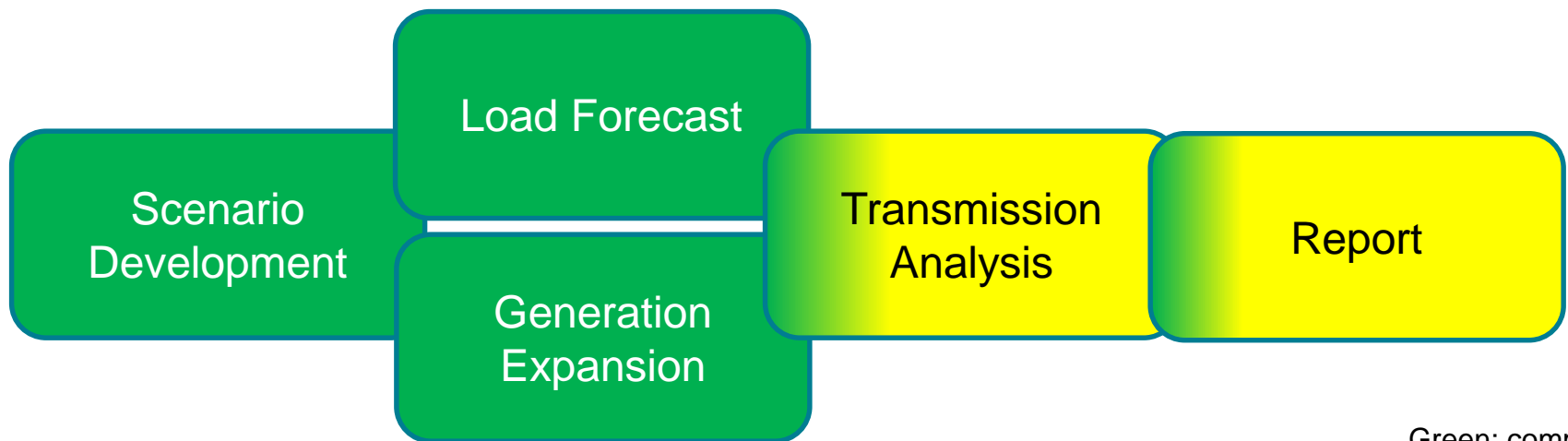
- ❑ ERCOT considered similarity of generation mix, load levels, and potential impact on transmission system
- ❑ Additional scenarios for transmission study
 - Environmental Mandate and High EE/DG scenarios

Description	Units	2017	2022	2026	2031
CC Adds	MW	-	-	1,117	2,234
CT Adds	MW	-	-	-	950
Coal Adds	MW	-	-	-	-
Nuclear Adds	MW	-	-	-	-
Storage Adds	MW	-	-	-	-
Geothermal Adds	MW	-	-	-	-
Solar Adds	MW	1,900	-	4,000	8,800
Wind Adds	MW	1,800	-	3,530	1,539
Annual Capacity Additions	MW	3,700	-	12,237	13,523
Cumulative Capacity Additions	MW	-	7,550	25,992	39,515
Economic Retirements	MW	-	8,218	13,313	17,984
Retirements due to Regional Haze	MW	-	6,278	-	-
Other Retirements	MW	-	850	-	-
Residential Demand Response	MW	293	328	356	391
Industrial Demand Response	MW	1,172	1,312	1,425	1,565
Reserve Margin	MW	15.7	11.6	15.9	12.9
Coincident Peak	MW	74,549	76,933	78,077	78,650
Average LMP	\$/MWh	31.17	69.77	104.80	120.61
Natural Gas Price	\$/mmbtu	3.74	4.69	5.45	6.28
Average Market Clearing Price	\$/MWh	8.33	14.88	19.23	19.21
Natural Gas %	%	46.8	53.7	51.4	47.1
Coal %	%	1.3	4.2	0.1	-
Wind %	%	18.2	17.6	19.9	20.4
Solar %	%	2.1	7.9	11.9	16.7
Scarcity	HRS	-	10.0	31.0	38.0
Unserviced Energy	GWhs	-	8.4	60.0	95.1
SO2	Tons	192,131	30,801	3,319	1,030
CO2	(k) Tons	178,218	143,605	125,067	111,377
NOx	Tons	74,798	51,308	44,300	39,845

Description	Units	2017	2022	2026	2031
CC Adds	MW	-	-	-	-
CT Adds	MW	-	-	-	-
Coal Adds	MW	-	-	-	-
Nuclear Adds	MW	-	-	-	-
Storage Adds	MW	-	-	-	-
Geothermal Adds	MW	-	-	-	-
Solar Adds	MW	1,900	-	4,600	5,100
Wind Adds	MW	1,800	-	-	-
Annual Capacity Additions	MW	3,700	-	4,600	5,100
Cumulative Capacity Additions	MW	-	-	8,200	12,800
Economic Retirements	MW	-	3,010	6,194	14,526
Retirements due to Regional Haze	MW	-	6,278	-	-
Other Retirements	MW	-	850	-	-
Residential Demand Response	MW	322	361	392	430
Industrial Demand Response	MW	1,289	1,443	1,566	1,720
Reserve Margin	MW	23.0	16.9	17.6	11.6
Coincident Peak	MW	74,549	76,463	76,361	72,111
Average LMP	\$/MWh	31.23	40.51	49.76	77.41
Natural Gas Price	\$/mmbtu	3.74	4.69	5.45	6.28
Average Market Clearing Price	\$/MWh	8.35	8.64	9.13	12.33
Natural Gas %	%	39.4	46.8	44.2	38.6
Coal %	%	28.1	16.9	17.2	17.4
Wind %	%	17.7	17.3	17.1	17.8
Solar %	%	1.6	6.1	8.9	10.5
Scarcity	HRS	-	-	2.0	22.0
Unserviced Energy	GWhs	-	-	0.8	37.7
SO2	Tons	297,845	88,613	87,571	84,766
CO2	(k) Tons	202,028	176,583	173,835	155,494
NOx	Tons	100,593	73,655	72,763	66,864

Next Step

- ❑ Continue to study both reliability and economic analyses for the Current Trends scenario
- ❑ Build start cases for the two additional scenarios and perform reliability and economic analysis
- ❑ Identify longer-term transmission projects to address economic and reliability needs
- ❑ Publish LTSA report in December 2016



Green: complete
Yellow: in progress

Question



Appendix: 2016 LTSA Study Scope

The 2016 LTSA Study Scope can be found at

- <https://mis.ercot.com/pps/tibco/mis/Pages/Grid+Information/Long+Term+Planning> >> Long-Term Planning Studies

Appendix: Generation Siting

- ❑ The information from the generation expansion results were used such as the capacity additions by generation type, the expected in-service dates, and the retirement of existing generation.

- ❑ The generation siting methodology consistent with the previous LTSA was used to identify the individual buses where such generation can be modeled.
 - Siting of new Solar/Wind generation considered in this LTSA will be dictated by the wind and solar profiles used in the generation expansion analysis

 - New CCs and CTs will be sited by considering various information such as the generation interconnection queue, brownfield sites and counties proposed for non-attainment

Appendix: Result of Generation Expansion

	Current Trends	High Economic Growth	Environmental Mandate	Texas Recession	Low Natural Gas	High EE and DG	Extreme Weather	High EV and Storage Adoption
Cumulative - MW	2031	2031	2031	2031	2031	2031	2031	2031
CC Adds	-	-	3,351	0	0	0	3,900	0
CT Adds	-	-	1,140	0	0	0	6,088	0
Coal Adds	-	-	0	0	0	0	0	0
Nuclear Adds	-	-	0	0	0	0	0	0
Storage Adds	-	-	0	0	0	0	0	0
Battery Adds	-	-	0	0	0	0	0	40
Solar Adds	20,200	21,700	28,100	17,800	14,500	17,900	27,200	15,600
Wind Adds	-	221	6,924	0	0	0	3,344	0
Additions	20,200	21,921	39,515	17,800	14,500	17,900	40,532	15,640
Retirements	13,505	13,071	25,112	15,675	9,417	21,654	20,873	11,571
Net Generation Change	6,695	8,850	14,403	2,125	5,083	-3,754	19,659	4,069
Coincident Peak	81,787	83,258	78,650	78,145	82,367	72,111	81,825	81,187
Unserved Energy (GWhs)	51.9	77.6	95.1	24.2	9.5	37.7	23.7	16.5