2020 LTSA Review

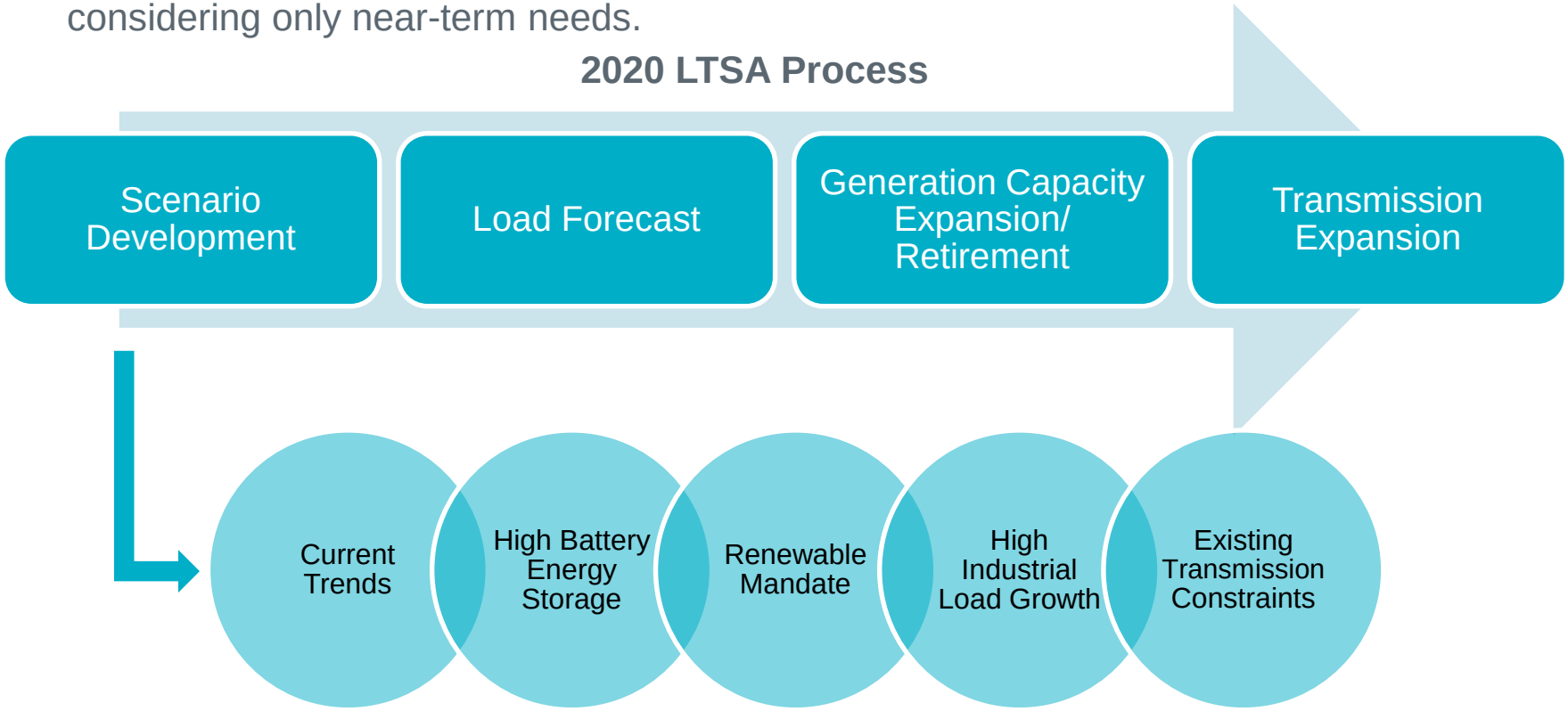
John Bernecker
Manager, Transmission Planning Assessment

December 15, 2020

2020 Long-Term System Assessment (LTSA)

- ERCOT's 2020 LTSA analyzed potential system needs through 2035.
- ERCOT analyzes different future scenarios in its long-term planning process to account for the inherent uncertainty of planning the transmission system beyond six years. The goal of using scenarios in the LTSA is to identify upgrades that are advantageous across a range of scenarios, or more economical than upgrades that are determined when considering only near-term needs.

2020 LTSA Process

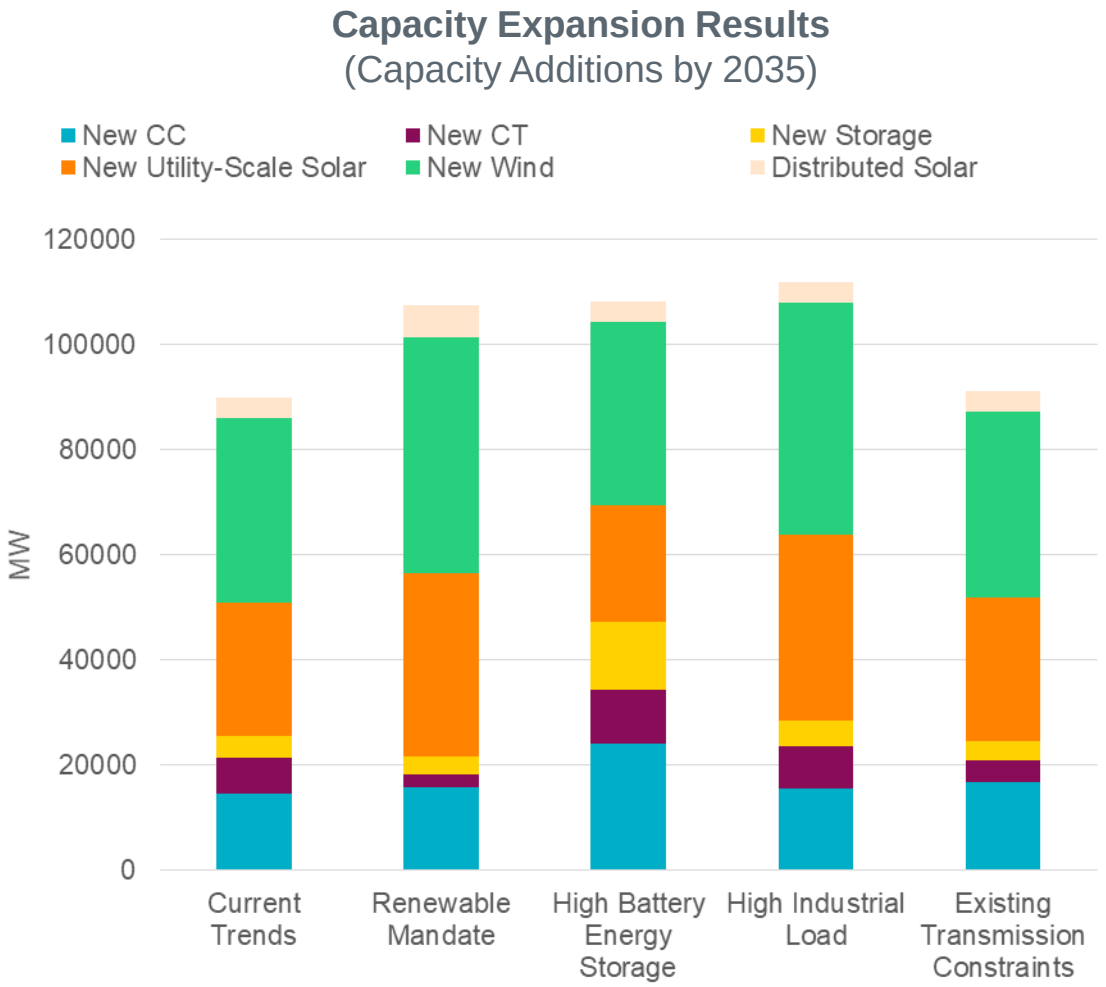


Key Findings

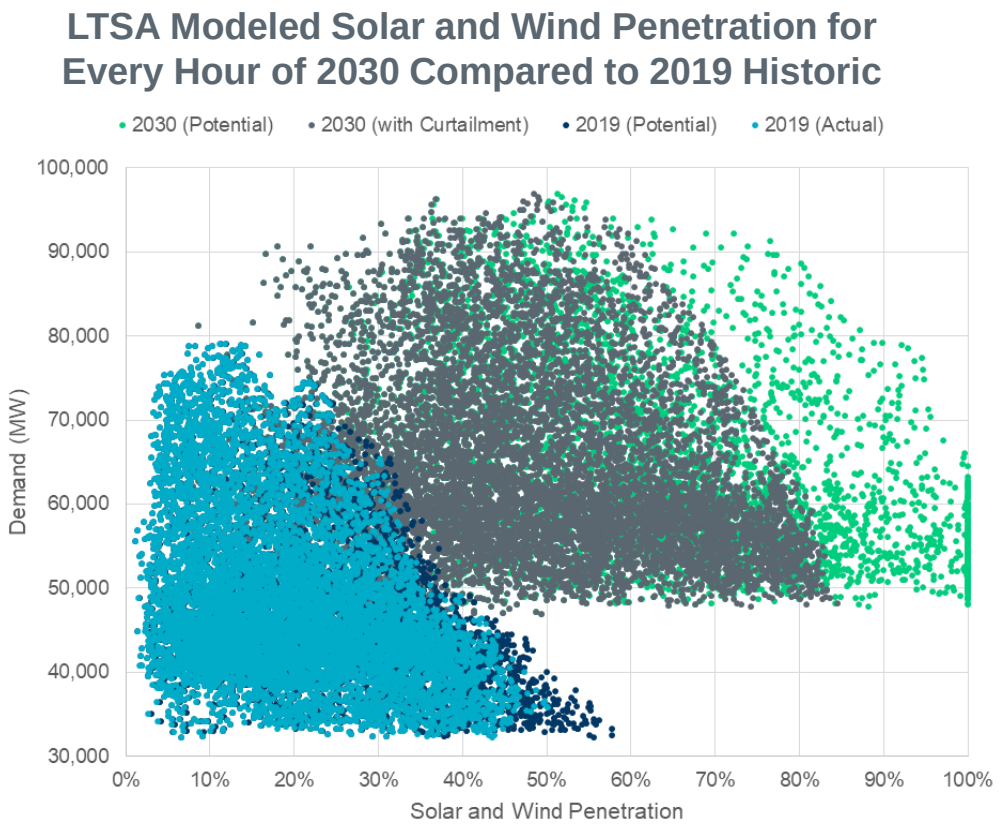
1. Significant growth in solar and wind resources was found across all five scenarios.
2. Growth in renewable resources and electric vehicle adoption lead to a shift in scarcity hours to later in the day in both summer and winter months.
3. The scale and location of wind and solar generation additions are dependent upon sufficient transmission capacity between resource-rich regions and demand centers.
4. Holistic solutions addressing both regional transfer limits and local constraints closer to urban demand centers are required to accommodate large-scale renewable generation transfers.

Capacity Expansion and Retirement Results

- Approximately 21 GW of thermal capacity was retired by 2035 across all five scenarios.
- Significant growth was seen for combined-cycle, solar, and wind resources for all five scenarios.
- Higher electric vehicle assumptions led to higher combined-cycle builds to accommodate charging at night.



2020 LTSA Renewable Generation Penetration

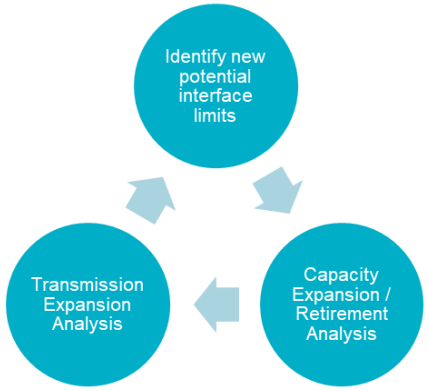


Renewable penetration is defined as the total amount of demand at any given time that is being served by solar and wind generation. The "potential" penetration is based on the available wind and solar irradiance while the "actual" and "with curtailment" values include transmission constraints and other reliability limitations.

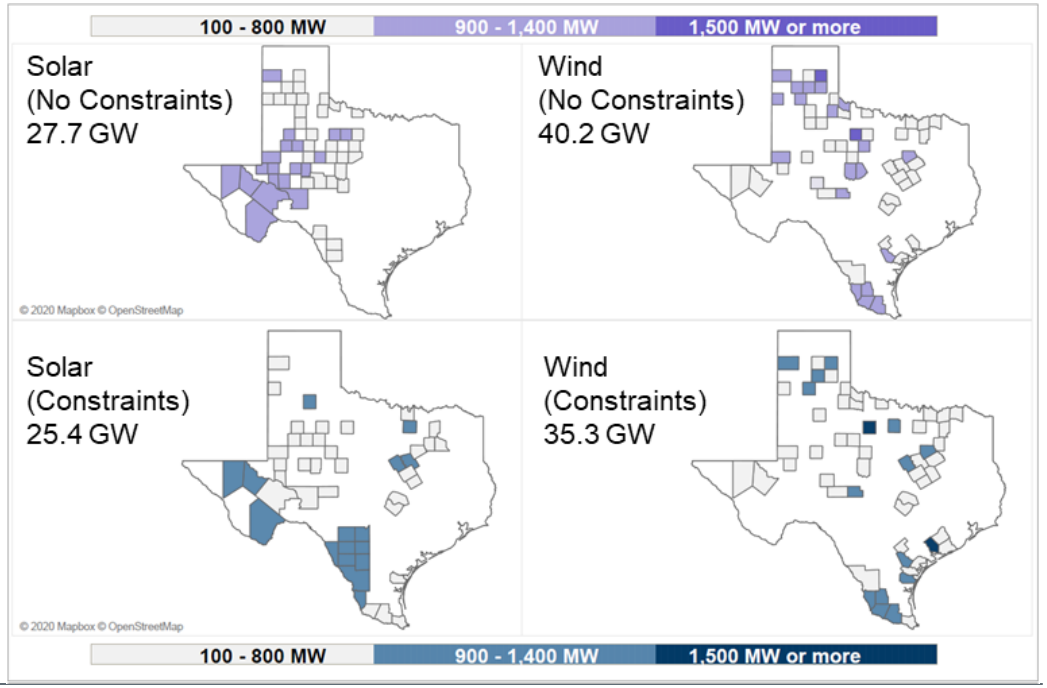
- The results for the LTSA capacity expansion and retirement analysis showed ~21 GW of thermal generation retired and significant growth of solar, wind, and combined cycle generation in all five scenarios.
- The growth in solar and wind caused significantly higher penetrations of renewable generation compared to recent years.
- Historically, the most stressed system conditions – from both resource scarcity and transmission security standpoints – have been during summer afternoons. In all five scenarios studied, stressed system conditions were observed at other times of the day and on days throughout the year due to the changed resource mix.

Transmission Limit Impacts on Generation

- For the Current Trends Scenario, ERCOT conducted two iterations of capacity expansion/ retirement analysis considering transmission constraints.
- The results showed that transmission constraints could lead to:
  - Less wind and solar generation capacity being constructed
  - New wind and solar generation being located closer to load centers and, as a result, farther from the most resource-rich regions
  - Increased utilization of natural gas generation and battery energy storage
  - Fewer capacity additions overall



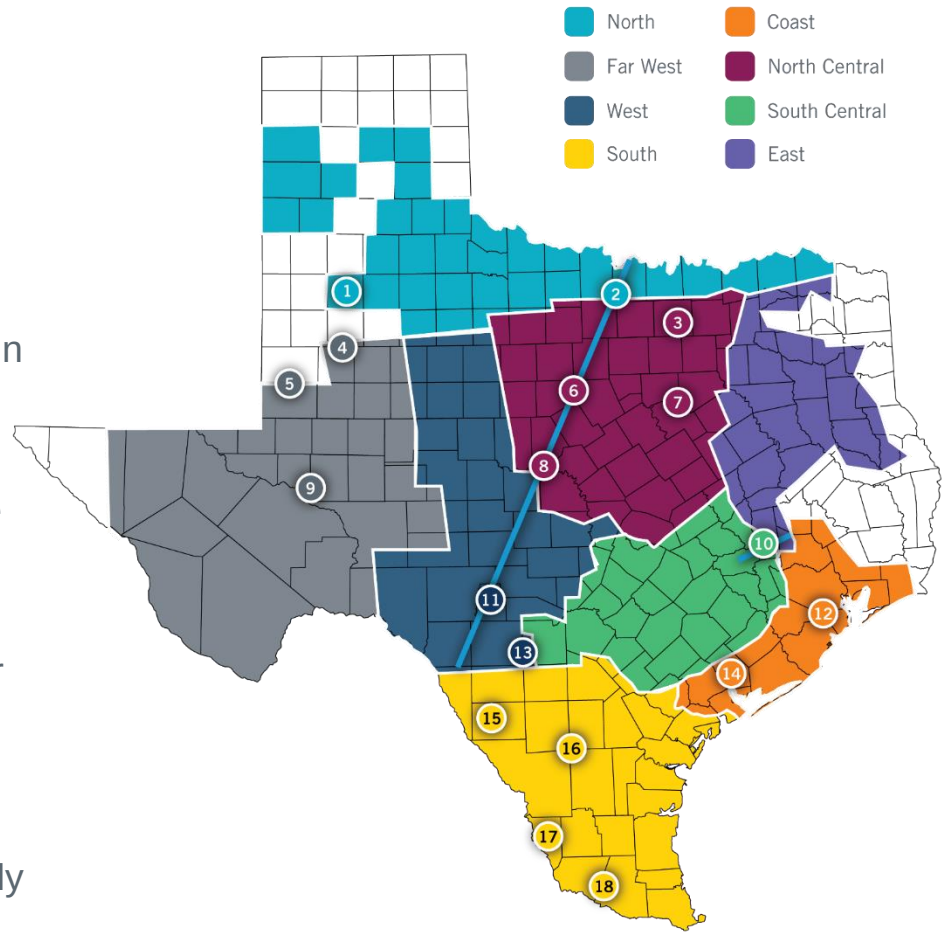
Comparison of Wind and Solar Generation Expansion
(Current Trends, 2035)



Transmission Expansion

- Holistic solutions addressing both regional limits on the long-distance transfer of power and local constraints closer to near urban demand centers are required to accommodate high transfers of generation from West Texas.
- The need for transmission improvements is driven both by the location of new generation and trends in customer demand growth.
- Large industrial load additions in both rural and urban areas can increase the need for major transmission improvements.
- Times of use and flexibility of customer demand are shifting as new technologies are adopted.
- Evaluation of system conditions other than peak load is becoming increasingly important.

Locations of Transmission Improvements Identified for Current Trends, 2035



Transmission Expansion

Map Index	Description	Map Index	Description
1	Lubbock Loop	10	North Houston Import
2	Panhandle to Dallas-Fort Worth	11	Bakersfield to Big Hill to Uvalde
3	Dallas-Fort Worth Area Improvements	12	Houston / Freeport Area Improvements
4	Lamesa Area Improvements	13	San Antonio Import
5	Lamesa to Andrews County	14	South Houston / Freeport Import
6	West Shackelford to Comanche Peak	15	Southwest Improvements
7	Sam Switch to Venus Switch	16	Fowlerton to Del Sol
8	Brown Switch to Bell County East	17	Del Sol to Lobo Second Circuit
9	Rio Pecos to Crane	18	Frontera Import

Questions / Comments

- Please send questions and/or comments to John.Bernecker@ercot.com