2020 RTP Sensitivity Analysis

September 2020
RPG Meeting

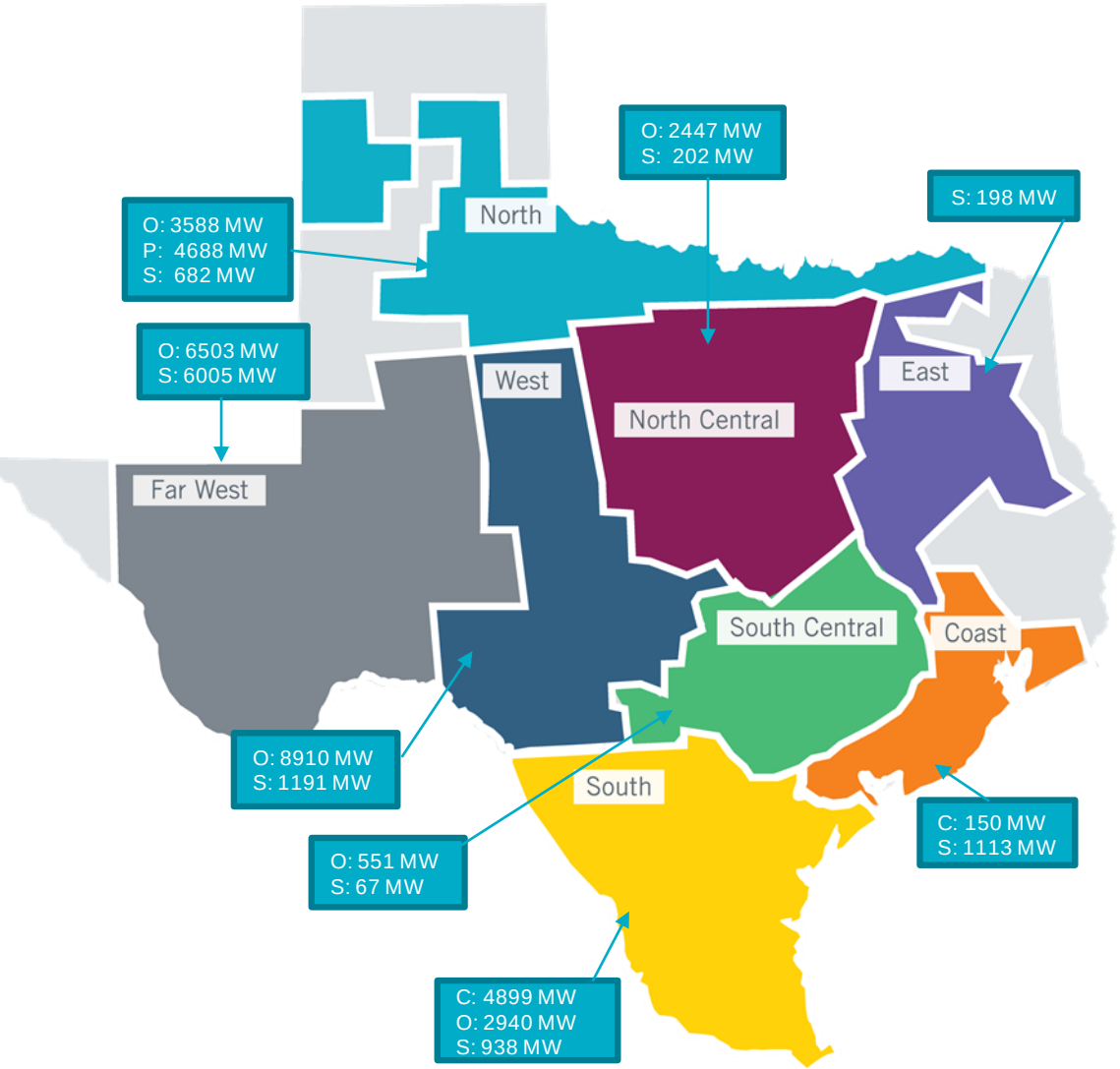
Agenda

- Introduction
- Overview of the 2020 RTP sensitivity analysis
- Study approach
- 2020 RTP on peak sensitivity analysis assumptions
- 2020 RTP off peak sensitivity analysis assumptions

Introduction

- NERC Reliability Standard TPL-001-4 requires sensitivity analysis to be performed
- The focus of developing the 2020 RTP sensitivity analysis is on the impacts of renewables on the ERCOT grid given the rapid development of renewable resources and the increased penetration level
- Both historical data and 2020 RTP economic analysis are used to aid the development of the sensitivity analysis
- Historical data from more recent years (2019, 2020) are used to reflect the technology advancement and the increased solar installation

2020 RTP Wind and Solar Capacity



Label	Description	Capacity (MW)
C	Coastal Wind	5,049
O	Other Wind	24,939
P	Panhandle Wind	4,688
S	Solar	10,395

Overview of the 2020 RTP Sensitivity Analysis

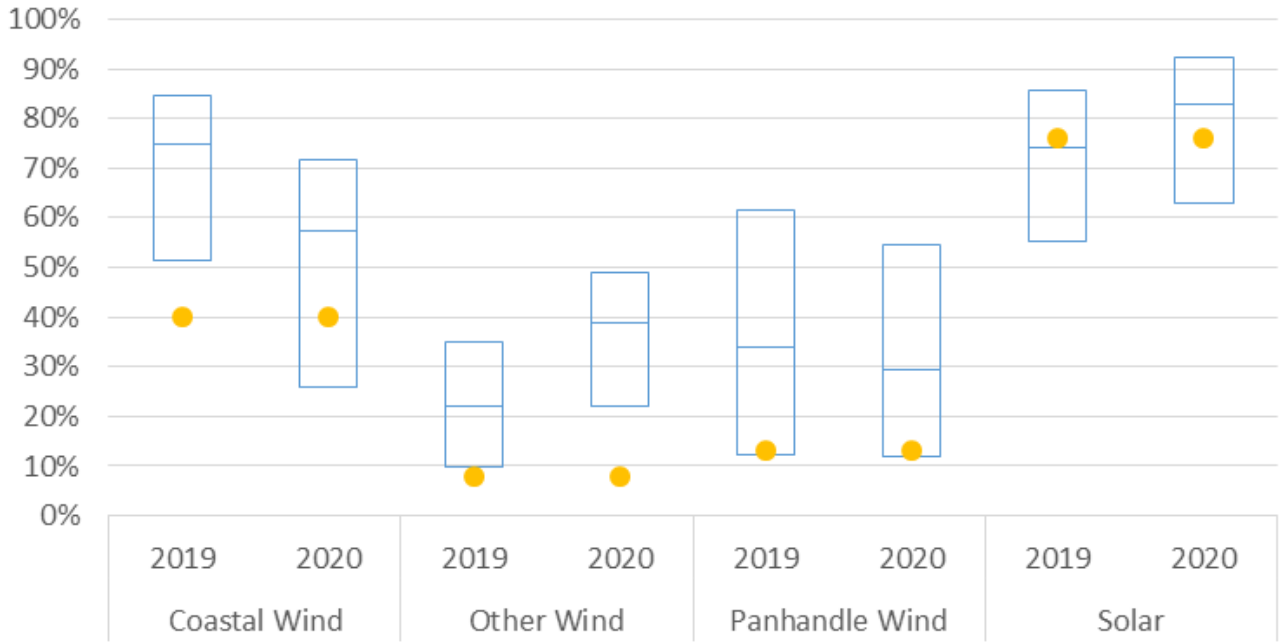
- High renewable output summer peak sensitivity
  - Years 2022 and 2025
- High renewable penetration off peak sensitivity
  - Year 2023
- No wind and no solar summer peak sensitivity for the West Far West (WFW) study region
  - Years 2022 and 2025
  - Only NERC P1, P2.1, P7, P3, and P6.2 contingencies will be studied

Study Approach

- All sensitivity analyses will respect the stability limits used in 2020 RTP
- All sensitivity analyses will maintain the ERCOT critical inertia level
- Both the high renewable output summer peak and high renewable penetration off peak sensitivity analyses will be studied using both approaches below:
  - Renewable curtailment allowed to alleviate reliability criteria violations
  - No renewable curtailment allowed to identify potential needs to accommodate the assumed level of penetration

On Peak Sensitivity Analysis

Renewable Hourly Capacity Output % Comparison



On each box, the central mark is the average hourly capacity output % for the top 20 load hours; the edges of the box are the minimum and maximum hourly capacity output % for the top 20 load hours

High Renewable Output Summer Peak Sensitivity

- Increase the dispatch level of the renewables to facilitate increased transfer of renewable energy from the resource rich West, Far West, North and South weather zones to the load centers, which are located in the North Central, Coast and South Central weather zones
  - Possible voltage and transfer issues due to high reactive power losses caused by increased long distance power transfer

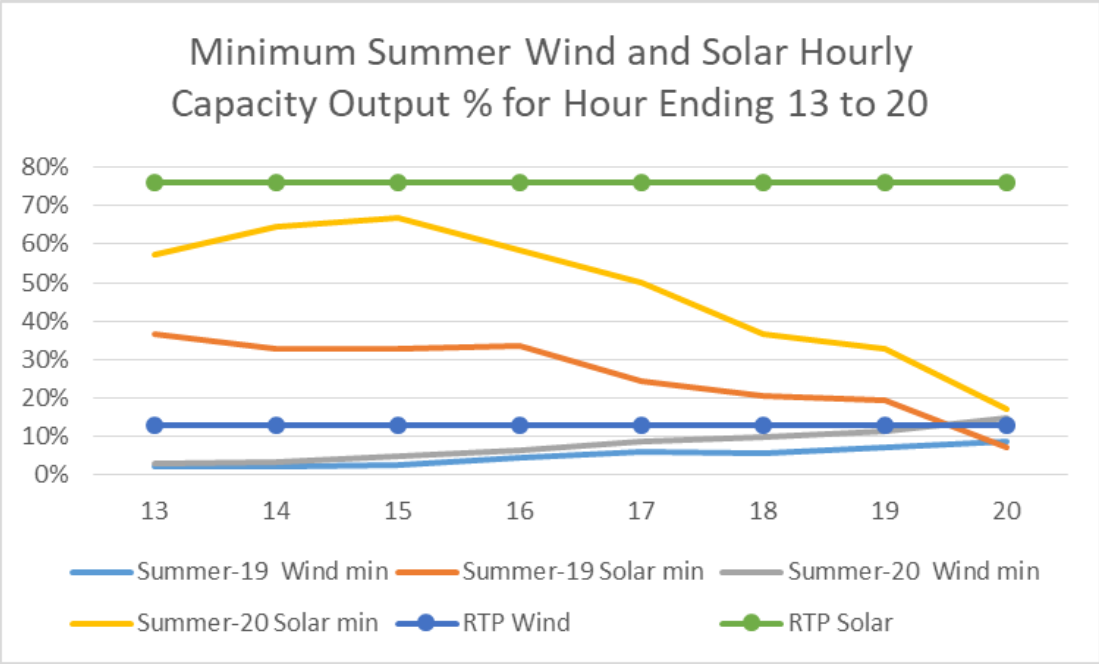
High Renewable Output Summer Peak Sensitivity Assumptions

- One study case instead of four study region based cases
- ERCOT 50/50 load forecast
- Maximum renewable penetration level before curtailment

		2019 Average		2019 Max		2020 Average		2020 Max	
Year	ERCOT Load (MW)	Total Renewable output (MW)	Penetration Level	Total Renewable output (MW)	Penetration Level	Total Renewable output (MW)	Penetration Level	Total Renewable output (MW)	Penetration Level
2022	83,580	18,614	22%	24,797	30%	22,551	27%	27,957	33%
2025	87,855	18,614	21%	24,797	28%	22,551	26%	27,957	32%

- The penetration level with 2020 summer top 20 load hours average hourly capacity output % are close to the 2020 RTP economic study top 20 load hours' penetration level, and is selected for this analysis

Minimum Renewable Hourly Capacity Output %



- Both the 2019 and 2020 summer data demonstrated the possibility of having both very low wind and very low solar hourly capacity output % in the late afternoon and early evening hours
- This may create higher net load that could stress the system especially for regions with less conventional generators available and high industrial load, which typically do not vary with hours of the day
- The WFW study region is selected to study the impact of higher net load

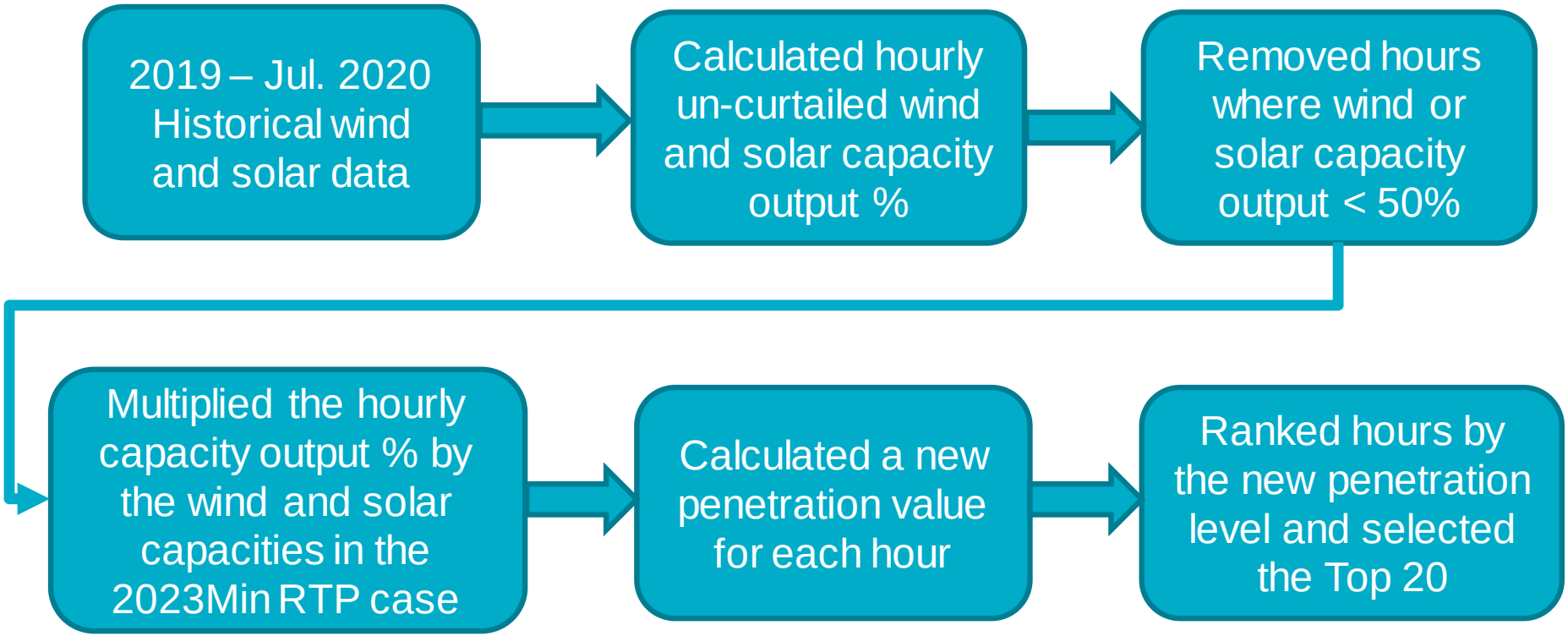
WFW Study Region No Wind and No Solar Sensitivity

- To further stress the system, the no wind and no solar condition will be studied for the WFW region with the unavailability of reactive power support from wind and solar resources
  - Total WFW dispatchable renewable generation is 6,699 MW in the RTP base cases
  - Total WFW maximum reactive power capacity from renewables is 7,888 MVar in the RTP base cases
- The load level will be kept at the 2020 RTP summer peak level

Off Peak Sensitivity Analysis

High Renewable Off Peak Sensitivity Case

❑Top 20 Hour Selection



Solar and Wind Dispatch Levels

- Solar and Wind Dispatch:
  - Utilized the average hourly capacity output % of the Top 20 hours
    - Wind evaluated by region: Coastal, Panhandle, Other
  - Results in 7,876 MW of solar generation
  - Results in 26,626 MW of wind generation
  - Output may be scaled lower to maintain 2020 RTP stability limits

Label	Resource - Region	Capacity Output %
C	Coastal Wind	60.45%
P	Panhandle Wind	86.27%
O	Other Wind	78.31%
S	Solar	75.74%

Hydro Dispatch and DC Tie Import/Export

- Hydro Dispatch:
  - Reviewed past output during the top 20 hours
  - Results in 114 MW of Hydro generation

- DC Tie Import/Export:
  - Reviewed past output during the top 20 hours
  - DC East: 0 MW
  - DC North: 0 MW
  - DC Laredo: 0 MW
  - DC Railroad: 0 MW

Load Level

- Based on 2020 RTP economic case data
  - Ranked each hour by un-curtailed renewable penetration
    - Used the 2022 RTP economic case
  - Found the 99th percentile of un-curtailed penetration
  - Calculated the average load of the hours within the 99th percentile
  - Results in 43,083 MW of load

Questions?

Ping.Yan@ercot.com

Craig.Wolf@ercot.com