Permian Basin Reliability Plan Study

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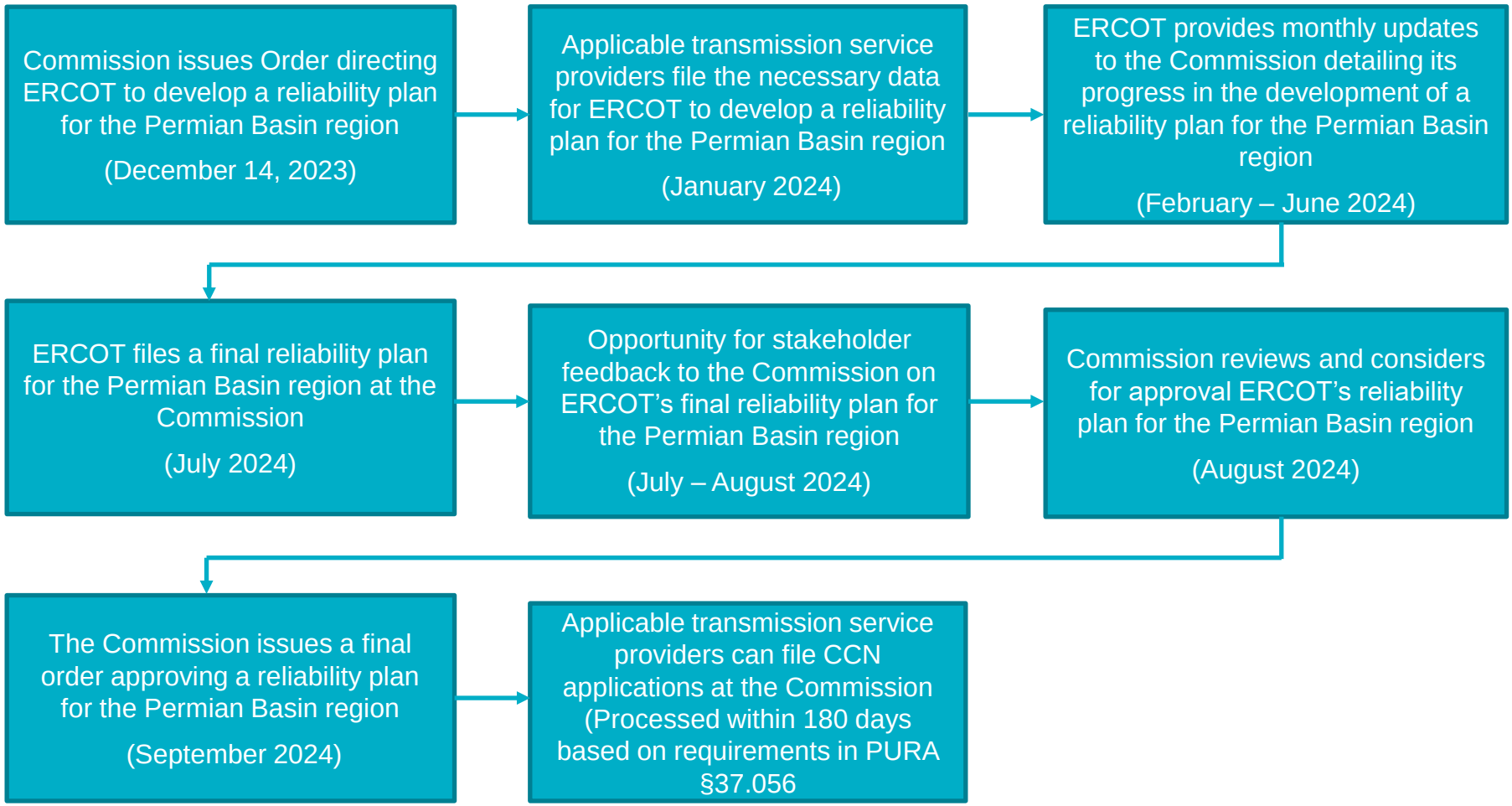
Workshop
June 28, 2024

Introduction

- H.B. 5066 (May 2023) requires the PUCT to direct ERCOT to develop a Reliability Plan for the Permian Basin region and that the plan must:
  - Address extending transmission service to areas where mineral resources have been found
  - Address increasing available capacity to meet forecasted load for the next decade
  - Provide available infrastructure to reduce interconnection times in areas without access to transmission service
- PUCT Order Project No. 55718 (December 2023)
  - Procedural Process and Timeline
  - Not later than July 2024, ERCOT must file a final reliability plan at the Commission in this project, and after opportunity for stakeholder feedback, and Commission will review and approve a reliability plan for the Permian Basin region
  - The applicable transmission service providers (TSPs) responsible for constructing the transmission infrastructure in the Commission-approved reliability plan can then move forward with filing the necessary applications for certificate of convenience and necessity (CCN) at the Commission
- Significant progress has been made to address the high demand growth in the Permian Basin area
  - Delaware Basin Load Integration Study in 2019
  - Permian Basin Load Interconnection Study in 2021

Procedural Process and Timeline per PUCT Order Project No. 55718



ERCOT Status Update Notifications

- ERCOT presented the draft study scope at January RPG meeting
  - https://www.ercot.com/calendar/01172024-RPG-Meeting
- ERCOT presented the updated study scope at February RPG meeting
  - https://www.ercot.com/calendar/02122024-RPG-Meeting
- ERCOT presented the status update at March, April, May, and June RPG meetings
  - https://www.ercot.com/calendar/03182024-RPG-Meeting-_-Webex
  - https://www.ercot.com/calendar/04092024-RPG-Meeting
  - https://www.ercot.com/calendar/05142024-RPG-Meeting
  - https://www.ercot.com/calendar/06112024-RPG-Meeting
- ERCOT provided PUCT the monthly status report regarding its development of the reliability plan for the Permian Basin in February, March, April, May and June
- ERCOT has held regularly scheduled meetings with the TSPs

Study Assumptions and Methodology

- Steady-state reliability analysis to identify
  - Transmission upgrades necessary to connect and reliably serve all the loads in the Permian Basin region
  - Transmission import paths necessary to meet the forecasted loads in the Permian Basin region
- Limited dynamic stability analysis utilizing the case where all identified transmission upgrades were modelled
- Study region
  - The Permian Basin region within the ERCOT system, including the Far West Weather Zone plus ten counties in West Weather Zone and two counties in North Weather Zone
- Study cases
  - 2030 and 2038 cases were created based on 2023 RTP 2029 West/Far West (WFW) summer peak preliminary case
- Load forecast
  - The bus level load from TSPs based on the 2022 S&P Global study (presented in March 2023 RPG meeting) was used for this study
  - Additional non-oil & gas load provided by TSPs
- Generation
- Transmission
- Reserve

Study Assumptions – Base Case

- Study Region
  - The Permian Basin region within ERCOT system, which include most the counties in Far West Weather Zone plus ten counties in West Weather Zone and two county in North Weather Zone
- Steady-State Base Case
  - The 2029 West/Far West (WFW) summer peak preliminary final case from the 2023 Regional Transmission Planning (RTP), posted Market Information System (MIS) in October 2023, was used as the starting base case in order to develop study cases for year 2030 and 2038
    - Case: 22SSWG_2029_SUM_WFW_10252023
    - Link: https://mis.ercot.com/secure/data-products/group-reports/transmission-service-providers?id=PG7-148-M

Study Assumptions – Load Forecast & Reserve

- Load in study area
  - The bus level load for year 2030 and 2038 was provided by TSPs serving loads in the Permian Basin area which includes
    a. Load levels forecasted in the 2023 S&P Global Permian Basin study
    b. Load currently served by temporary on-site generation not already accounted for in the S&P Global Permian Basin Study
    c. Additional load currently seeking interconnection that is not otherwise included in a or b, as determined by the electric utility with the responsibility for serving the load. This should expressly include demand yet to sign a full interconnection agreement
  - The reactive consumption of the projected load will be based on
    - Historical power factors for the load connecting to existing load serving stations
    - Power factor of 0.97, historical recorded performance of existing oil and gas load in the Permian Basin area, for load connecting to existing non-load serving stations or new stations
    - Power factors based on the load specific information for the additional load seeking interconnections
- Reserve
  - No load adjustment outside WFW weather zones was needed to maintain the reserve consistent with the RTP study

Study Assumptions – Load Forecast

Permian Basin Region Load Comparison (MW)

	2019 Delaware Basin Study	2021 Permian Basin Study 2030 Case	2023 RTP Study 2029 Case	Permian Basin Reliability Plan 2030 Case	Permian Basin Reliability Plan 2038 Case
Permian Basin Total Load	9,771	10,527	16,577	23,659	26,400
Permian Basin Oil & Gas Load*	9,771	10,527	12,341	11,964	14,705
Additional Non-Oil & Gas Load	0	0	4,236	11,695	11,695

Delaware Basin Area Load Comparison (MW)**

	2019 Delaware Basin Study	2021 Permian Basin Study 2030 Case	2023 RTP Study 2029 Case	Permian Basin Reliability Plan 2030 Case	Permian Basin Reliability Plan 2038 Case
Delaware Basin Total Load	5,260	4,960	7,933	10,930	13,183
Delaware Basin Oil & Gas Load*	5,260	4,960	4,884	6,439	8,692
Additional Non-Oil & Gas Load	0	0	3,049	4,491	4,491

*Including residential/commercial load

**The Delaware Basin load is a subset of the Permian Basin load and is included as part of the Permian Basin Reliability Plan Study

Load Forecast – Observations and Challenges

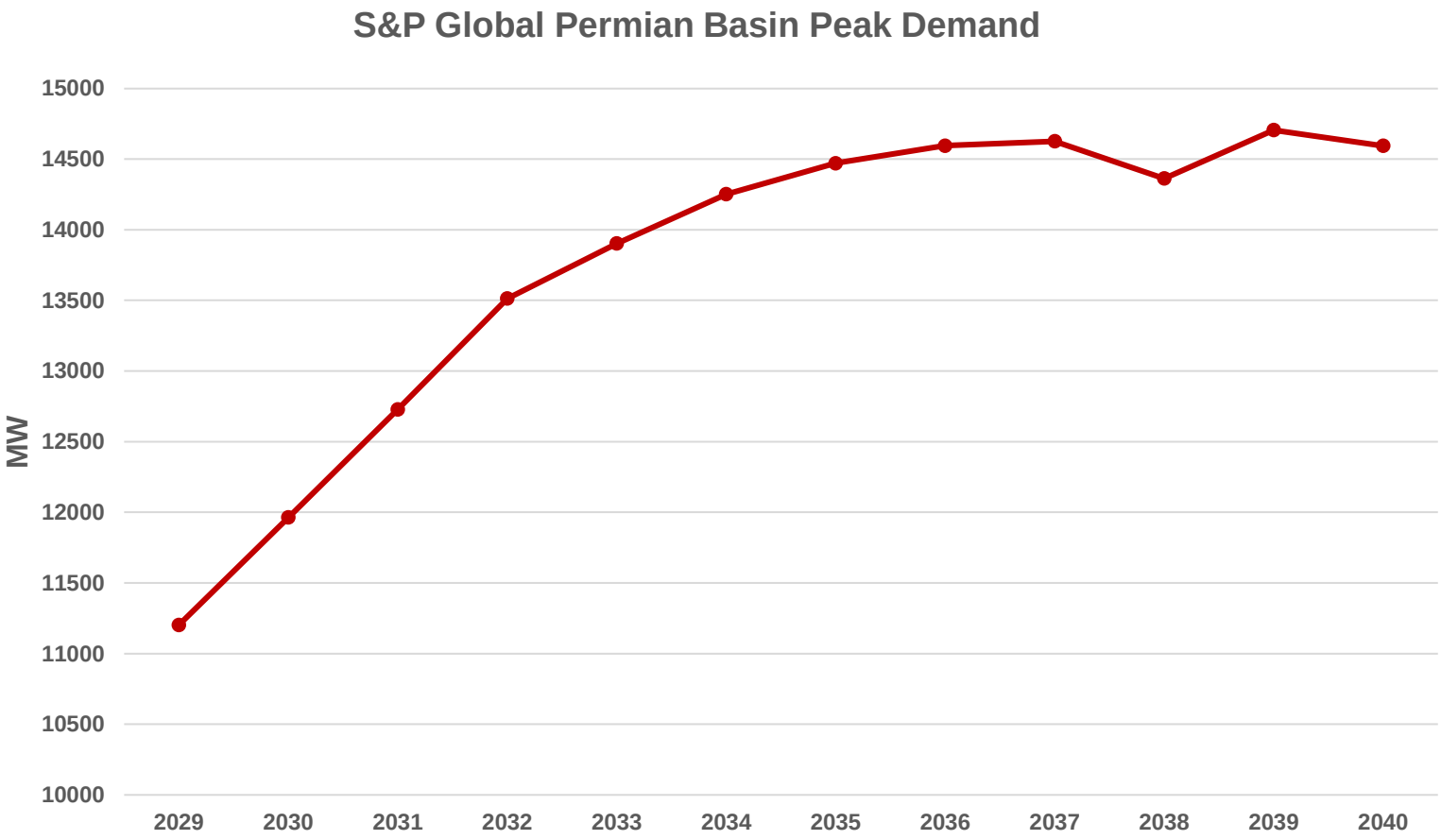
- The total load in the Permian Basin region is extremely high, even for 2030. The total load level is comparable to that of ERCOT Coast Weather Zone and North Central Weather Zone

	2023 RTP 2029 Non-Coincident Peak Load (MW)	Load in the 2038 Starting Case of This Permian Basin Reliability Plan Study (MW)	Conventional Gen Capacity (MW)
North Central WZ	32,458	28,173	~ 28,400*
Coast WZ	29,848	26,967	`~ 25,900
Permian Basin Region	16,577	26,400	~ 2,800

* This includes the conventional generation in the East Weather Zone

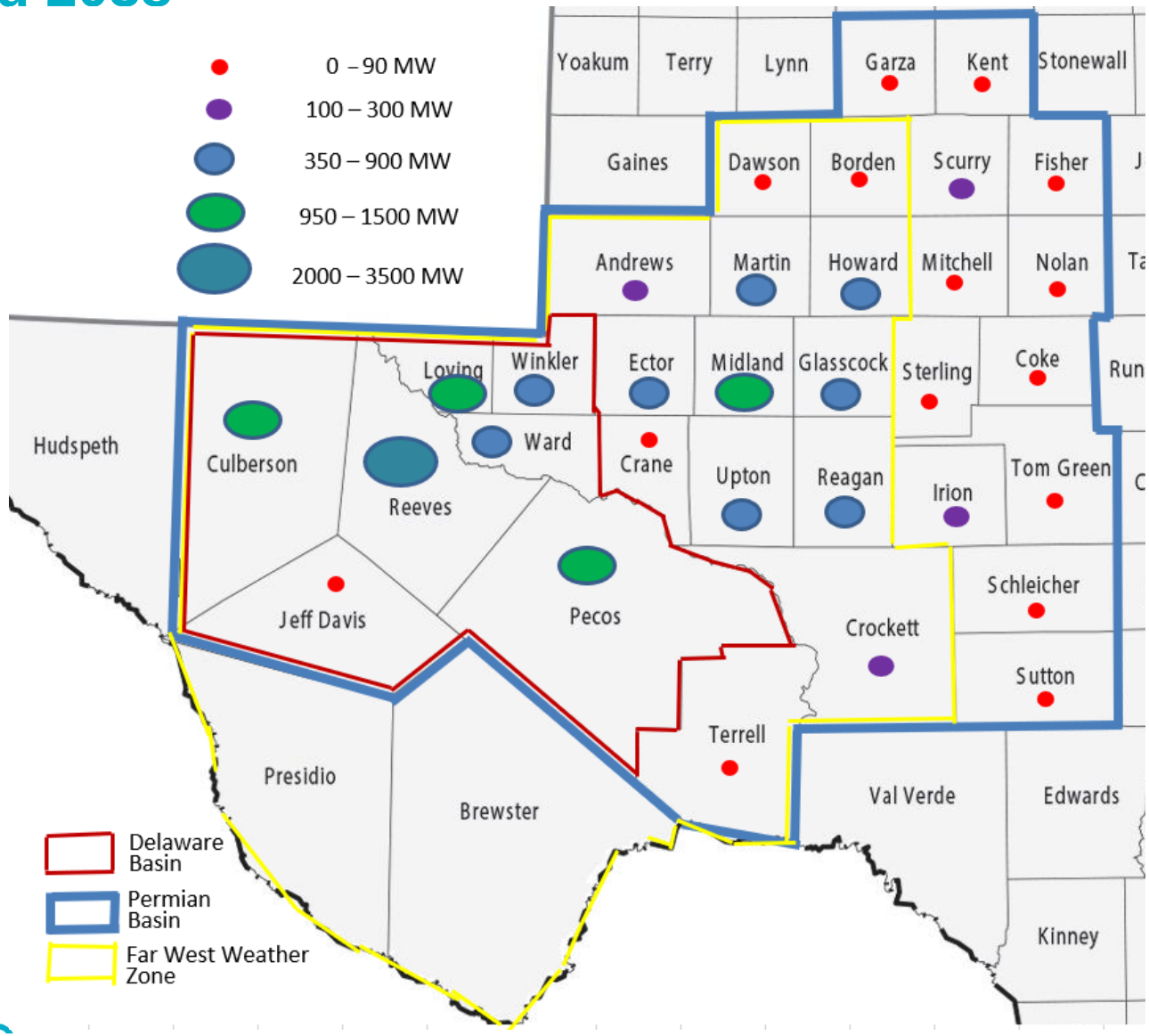
- The total Load in West & Far West Weather Zones in this Permian Basin Reliability Plan Study is 28,669 in 2038 case which is even higher than the load in North Central Weather Zone
- The total amount of additional non-oil & gas load is almost the same as the oil & gas load
- Within the Permian Basin, oil & gas load is shifting to the Delaware Basin area where transmission is relatively sparse. Especially for 2038, the load in the Delaware Basin area (8,692 MW) is significantly higher than what we have previously studied (5,260 MW)
- Permian Basin lacks local conventional generation compared to the North Central and Coast Weather Zones
- Considering the high level of load growth to be evaluated, identifying a reliability plan to meet this extremely high load level required extraordinary effort to complete on the directed timeline and was much more complex compared to previous special studies ERCOT has conducted

S&P Global Permian Basin Load Forecast by Year



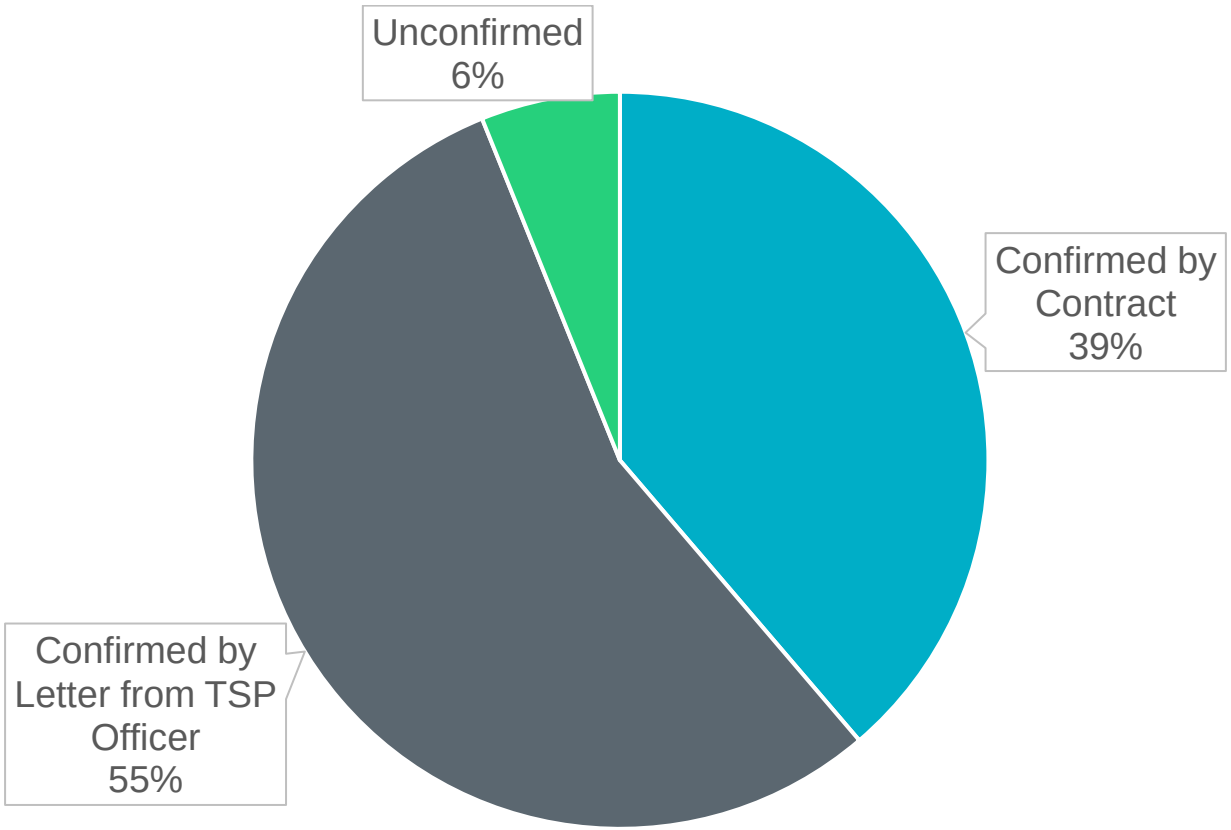
The S&P Global Permian Basin load is peaked in 2039 with 14,705 MW. The 2030 (11,964 MW) and 2039 (14,705 MW) load level was studied in this Permian Basin Evaluation

County-Level S&P Global Permian Basin Load Forecast in 2030 and 2038



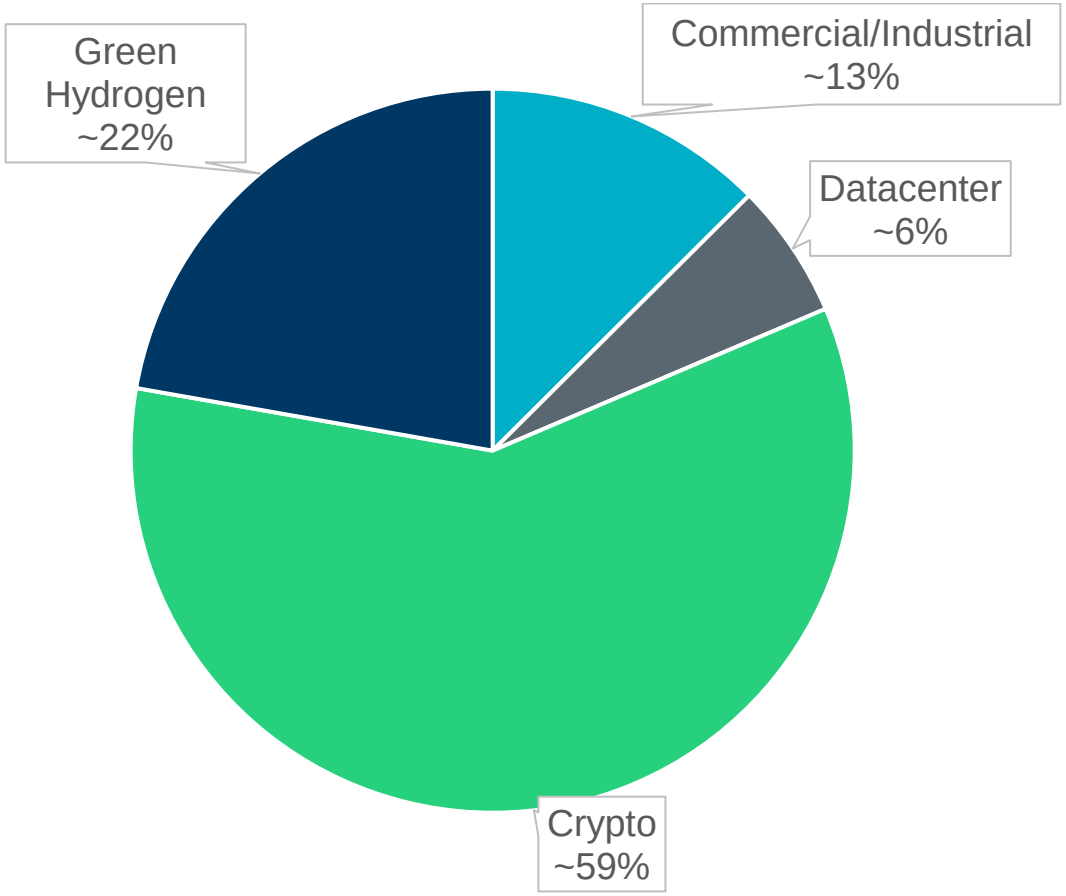
Additional Non-Oil & Gas Load Breakdown

This chart shows the confirmed/unconfirmed percentage breakdown for the total 11,695 MW of additional non-oil & gas load.



Additional Non-Oil & Gas Load Type Breakdown

This chart shows the approximate load type breakdown for the total 11,695 MW of additional non-oil & gas load.



Study Assumptions – Generation

- New generation that met Planning Guide Section 6.9(1) condition with Commercial Operation Date (COD) before June 2030 and 2038 at the time of the study, but not already modeled in the starting case, was added to the study base cases based on the February 2024 Generator Interconnection Status (GIS) report posted on March 1, 2024
  - GIS Link: https://www.ercot.com/gridinfo/resource
- Renewable generation dispatch was consistent with the 2024 RTP methodology
  - All solar units were online and dispatched up to 76% of their installed capacity
  - All battery units including the distribution connected batteries were dispatched up to 20.3% of their installed capacity
  - Wind generation in Coastal area was dispatched up to 60% of their installed capacity
  - Wind generation in Panhandle area was dispatched up to 29% of their installed capacity
  - Wind generation in other areas was dispatched up to 22% of their installed capacity

Study Assumption - Transmission

- Based on the October 2023 Transmission Project and Information Tracking (TPIT) posted on ERCOT website, RPG approved Tier 1, Tier 2, and Tier 3 projects as well as Tier 4 projects with in-service dates on or before summer 2030 and 2038 within the study area were added to the study base case if not already modeled in the starting case
  - TPIT Link: https://www.ercot.com/gridinfo/planning
- Additional projects identified in the previous special studies will be added
  - Oncor West Texas 345-kV Infrastructure Rebuild Project (endorsed by the ERCOT Board of Directors in June 2024)
  - Stage 3, Stage 4, and Stage 5 upgrades (currently under EIR review) in the Delaware Basin Load Integration Study (Stage 1 and Stage 2 upgrades were already approved and modelled in the study)
  - New 138-kV lines to connect the future new loads into the system as proposed by the Permian Basin Load Interconnection Study

Contingencies and Criteria – Steady State

- Contingencies
  - NERC TPL-001-5.1 and ERCOT Planning Criteria
  - Link: https://www.ercot.com/mktrules/guides/planning/current
    - P0 (System Intact)
    - P1, P2-1, P7 (N-1 condition)
    - P2-2, P2-3, P4, and P5 (EHV only)
    - P3 (G-1+N-1: G-1 of Permian Basin all five units, Odessa combined cycle train 1)
    - P6-2 (X-1+N-1: X-1 of Riverton, Sand Lake, and Solstice 345/138-kV transformers)
- Criteria
  - Monitor all 60-kV and above buses, transmission lines, and transformers in the study area (excluding generator step-up transformers)
  - Thermal
    - Use Rate A for pre-contingency conditions
    - Use Rate B for post-contingency conditions
  - Voltage
    - Voltages exceeding their pre-contingency and post-contingency limits
    - Voltage deviations exceeding 8% on non-radial load busses

Study Scope

- ERCOT focused on the 138-kV and above transmission upgrades and TSPs worked on the 69-kV transmission upgrades
  - ERCOT reviewed the 69-kV transmission upgrades provided by TSPs and included the projects which were needed in this study
- Capacitor banks were added in the case to address the voltage issues. The capacitor banks can be proposed and added by TSPs when the load is materialized, and are not included in the project list of this study
- For the planned maintenance outage scenarios, ERCOT only considered the major 345-kV maintenance outages in the Delaware Basin area since
  - The oil & gas loads are concentrated in the Delaware Basin area
  - The transmission in the Delaware Basin area is relatively sparse
  - Other planned maintenance outage scenarios may be evaluated in following RTP studies or RPG reviews

Study Methodology

- Due to the high load level, significant amount of local transmission upgrades, especially in the Delaware Basin area, are needed to served the load. Two steps are taken to address the reliability need:
  - First, identify and evaluate the local transmission upgrades to serve the load
  - Second, evaluate the import paths into the Permian Basin region and re-evaluate the need for local transmission upgrades
- Due to the high load level in local areas, both 2030 and 2038 study base cases were not solvable. The reliability need analysis and project evaluation were performed step by step by adding loads in areas gradually:
  - Add load in one area, and identify the transmission upgrades to resolve the local reliability violations (sometimes need to propose transmission upgrades first and then add load)
  - Move to another area to add load and identify transmission upgrades
  - After all the loads were included in the study cases, the identified transmission upgrades were re-evaluated to make sure the proposed transmission upgrades are optimal
- Started with the 2038 case to identify the reliability needs and evaluate transmission upgrades
  - The transmission upgrades for 2030 would be a subset of the transmission upgrades for 2038

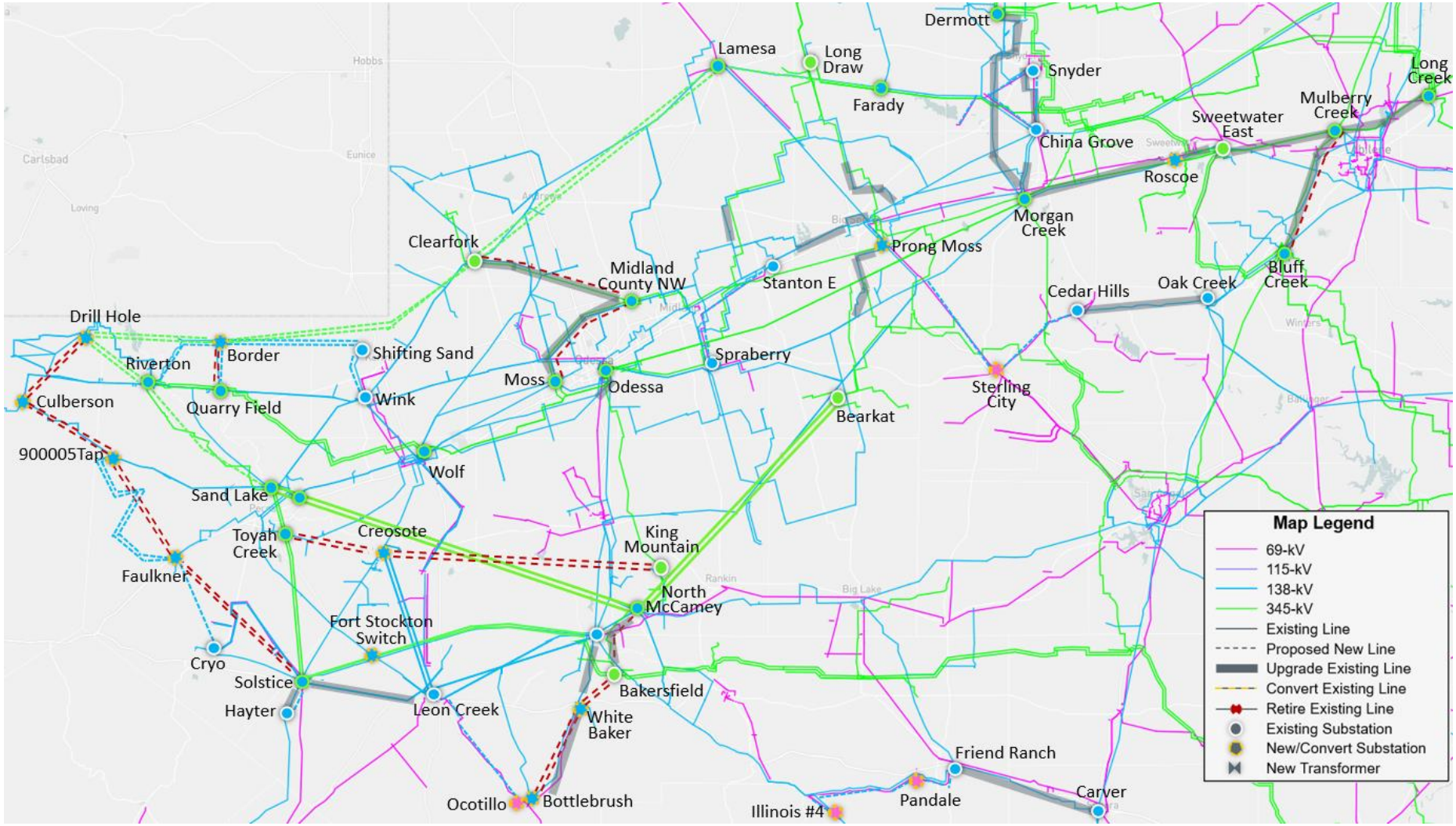
Reliability Need Analysis

- ERCOT conducted the reliability need analysis for the S&P Global Permian Basin load plus all the additional non-oil & gas load for 2030 and 2038
  - The reliability need analysis was taken step by step starting with the Delaware Basin area as the S&P Global Permian Basin load is concentrated in this area
    - The additional non-oil & gas load in the Midland Basin area is not included here
    - Add the S&P Global load in the Delaware Basin area gradually
    - Propose potential local transmission projects to serve the load
    - Include placeholder import paths
    - Add the additional non-oil & gas load in the Delaware Basin area gradually
  - The reliability need analysis in the Midland Basin area
    - Add the additional non-oil & gas load in the Midland Basin area gradually
    - Propose potential local transmission projects to serve the load

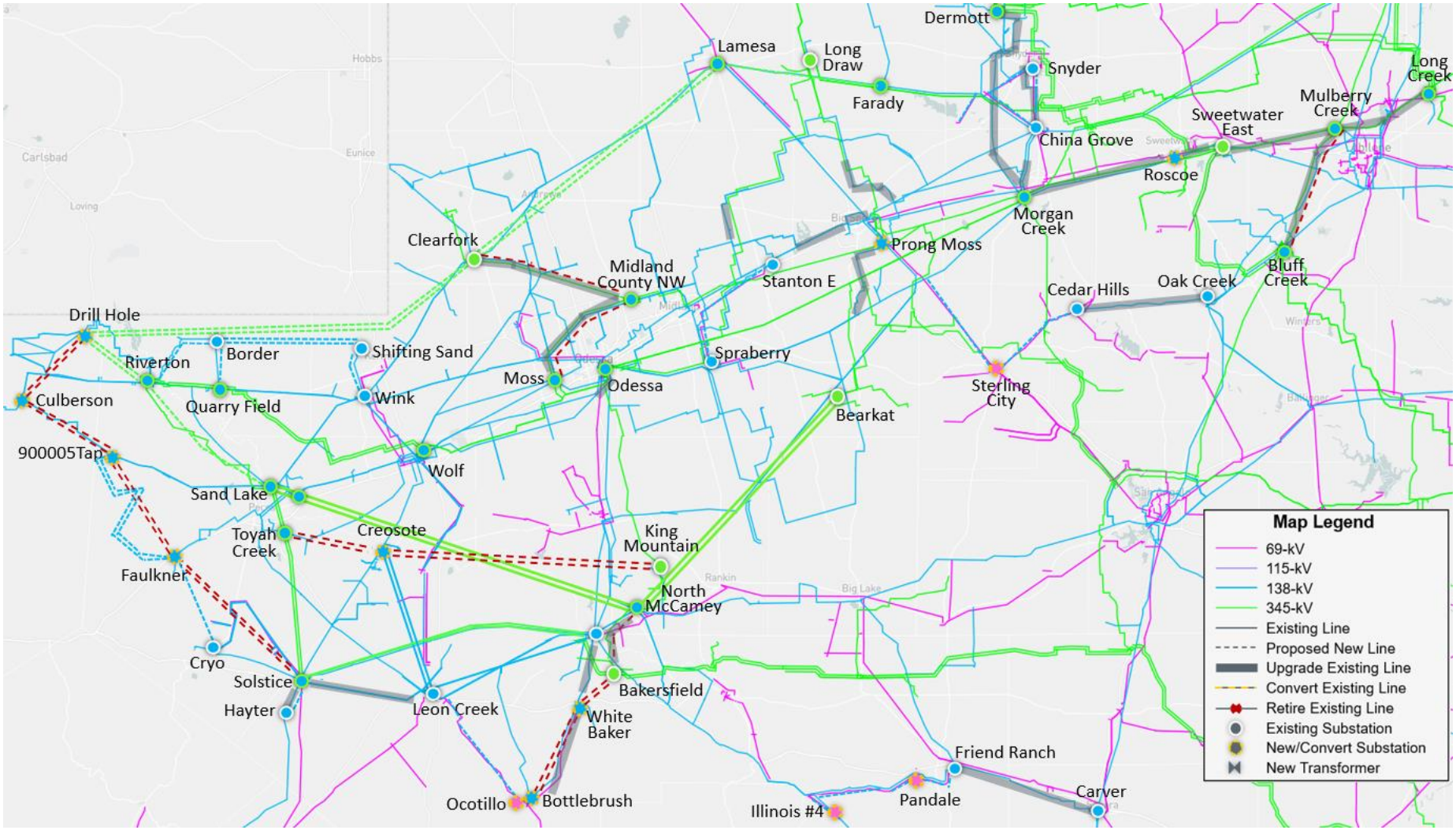
Reliability Need Analysis – 2038 and 2030

- The steady-state reliability study results showed that both local transmission upgrades and additional import paths to the Permian Basin region are needed
- Local transmission upgrades include
  - Add new 345-kV substations with 345/138-kV transformers
  - Add new 345-kV double-circuit transmission lines
  - Form a new 345-kV double-circuit loop in the Delaware Basin area
  - Add new 138-kV transmission lines
  - Rebuild the existing 345-kV and 138-kV transmission lines
  - Convert the existing 69-kV transmission lines to 138-kV
  - Add new reactive support devices
- Import paths include
  - Add new 345-kV double-circuit transmission lines
  - Add new 500-kV and 765-kV extra high voltage (EHV) transmission lines

Local Transmission Projects for 2038 to Serve All Loads in Permian Basin Region



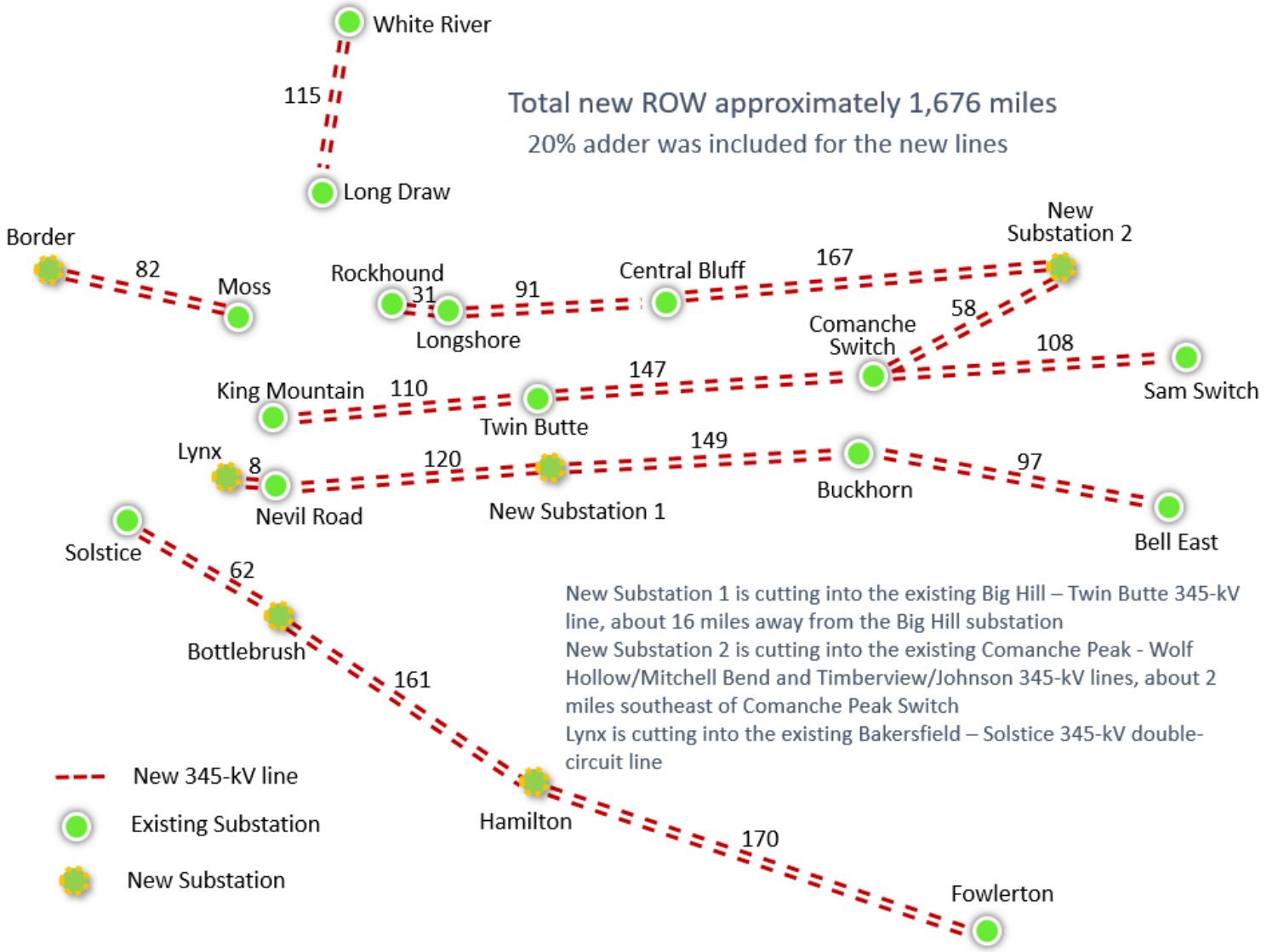
Local Transmission Projects for 2030 to Serve All Loads in Permian Basin Region



Import Paths – Major Consideration Factors

- Import paths could serve as dual-purpose
  - Import generation to Permian Basin region to serve the forecasted Permian Basin load
  - Export rich renewable generation in West Texas to the load centers
- Generation
  - Import from generation rich area
- CIP-014
  - Avoid voltage instability under the major 345-kV substation outage
- ERCOT Long-Term West Texas Export Study
  - Considered the West Texas export paths if applicable
- Cost

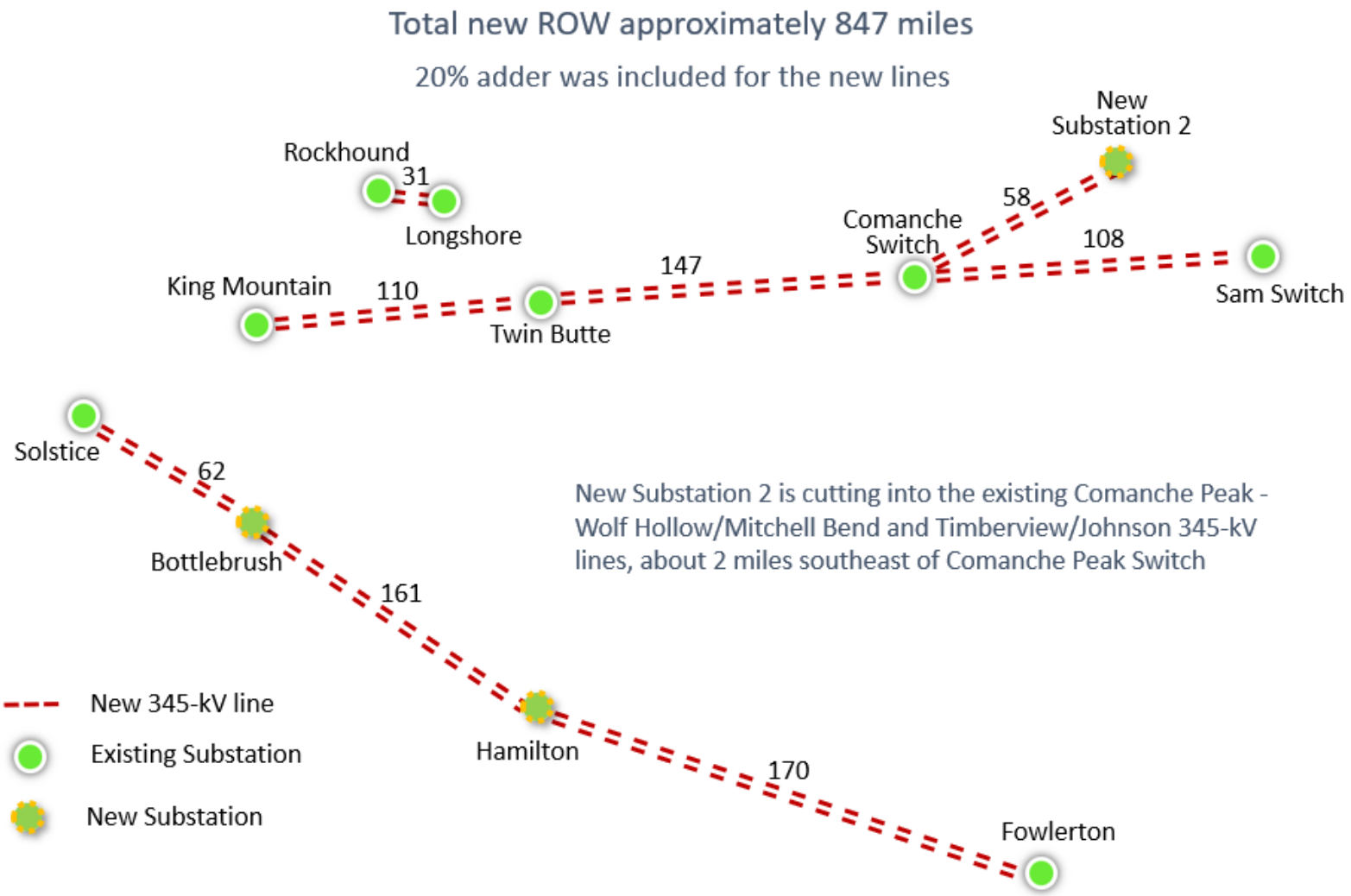
345-kV Import Paths to Permian Basin Region for 2038



345-kV Import Paths to Permian Basin Region for 2038 (cont.)

- Import Path 1
  - Construct a new 345-kV New Substation 2, about 2 miles southeast of the existing Comanche Peak Switch, cutting into the existing Comanche Peak – Wolf Hollow/Mitchell Bend 345-kV double-circuit line and Comanche Peak – Timberview/Johnson 345-kV double-circuit line
  - New New Substation 2 – Comanche Switch 345-kV double-circuit line
  - New New Substation 2 – Central Bluff – Longshore – Rockhound 345-kV double-circuit line
  - New Moss – Border 345-kV double-circuit line
- Import Path 2
  - New Sam Switch – Comanche Switch – Twin Butte – King Mountain 345-kV double-circuit line
- Import Path 3
  - New Bell East – Buckhorn – New Substation 1 – Nevil Road – Lynx 345-kV double-circuit line
  - New Substation 1 is cutting into the existing Big Hill – Twin Butte 345-kV line, about 16 miles away from the Big Hill substation
  - Lynx is cutting into the existing Bakersfield – Solstice 345-kV double-circuit line
- Import Path 4
  - New Fowlerton – Hamilton – Bottlebrush – Solstice 345-kV double-circuit line
  - No 345/138-kV transformers at Hamilton in this study
  - Add new dynamic reactive devices at Hamilton
- Additional Upgrades
  - New White River – Long Draw 345-kV double-circuit line
  - Bypass the series capacitors at Edison and add new dynamic reactive devices

345-kV Import Paths to Permian Basin Region for 2030



345-kV Import Paths to Permian Basin for 2030 (cont.)

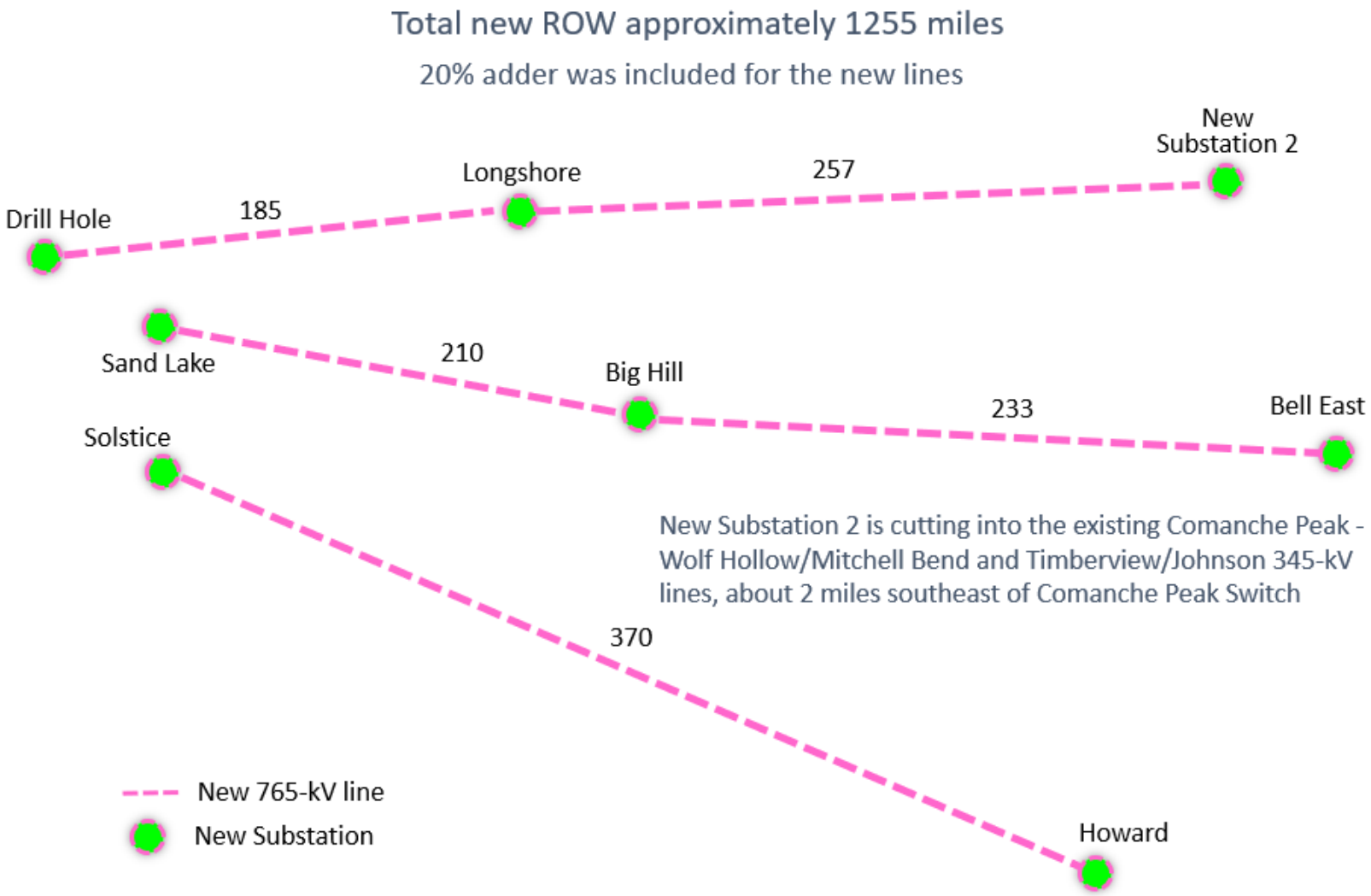
- Portion of Import Path 1
  - Construct a new 345-kV New Substation 2, about 2 miles southeast of the existing Comanche Peak Switch, cutting into the existing Comanche Peak – Wolf Hollow/Mitchell Bend 345-kV double-circuit line and Comanche Peak – Timberview/Johnson 345-kV double-circuit line
  - New New Substation 2 – Comanche Switch 345-kV double-circuit line
  - New Longshore – Rockhound 345-kV double-circuit line
- Import Path 2
  - New Sam Switch – Comanche Switch – Twin Butte – King Mountain 345-kV double-circuit line
- Import Path 4
  - New Fowlerton – Hamilton – Bottlebrush – Solstice 345-kV double-circuit line
  - No 345/138-kV transformers at Hamilton in this study
  - Add new dynamic reactive devices at Hamilton
- Additional Upgrade
  - Bypass the series capacitors at Edison and add new dynamic reactive devices

EHV Import Paths to Permian Basin Region

- Size and locations of the load
- Multiple long 345-kV import paths will be needed to transfer power to Permian Basin region
- EHV import paths
  - Voltage level above 345-kV will make these needed transfers more efficient
  - More cost effective, and require less Right of Way, than 345-kV transmission lines of equal MW capacity
  - 500-kV and 765-kV transmission levels were evaluated for 2038
  - The design of the EHV paths considered the 2024 RTP needs

500-kV Import Paths Option for 2038

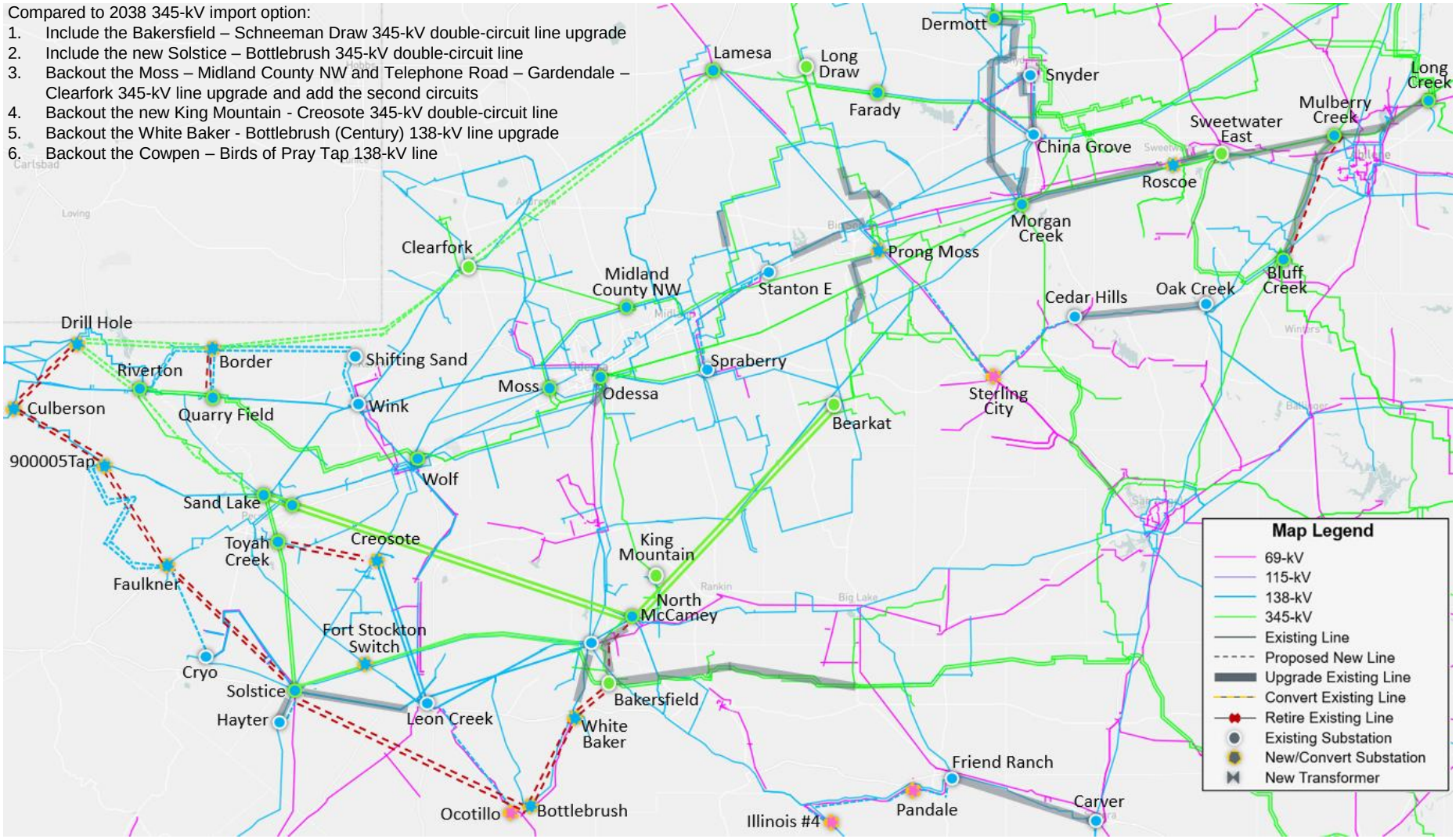
765-kV Import Paths Option for 2038



Local Transmission Upgrades for EHV Options in 2038 to Serve All Loads in Permian Basin Region

Compared to 2038 345-kV import option:

1. Include the Bakersfield – Schneeman Draw 345-kV double-circuit line upgrade
2. Include the new Solstice – Bottlebrush 345-kV double-circuit line
3. Backout the Moss – Midland County NW and Telephone Road – Gardendale – Clearfork 345-kV line upgrade and add the second circuits
4. Backout the new King Mountain - Creosote 345-kV double-circuit line
5. Backout the White Baker - Bottlebrush (Century) 138-kV line upgrade
6. Backout the Cowpen – Birds of Pray Tap 138-kV line



Study Assumption – Dynamic Studies

- As mentioned at the May 2024 RPG meeting, ERCOT conducted a limited dynamic stability analysis utilizing the case (year 2038) with all identified 345-kV import path project modeled
- Key Assumptions:
  - Modeled dynamic data of all generation, except certain units (e.g., unit with no dynamic model available)
  - Included representative dynamic load model of the potential large load based on the review of existing load models in the study region
  - Modeled all transmission upgrades identified in the study region, including all dynamic reactive power devices (e.g., synchronous condensers) assumed in the 2038 case
  - Tested all P1 and P7 345-kV and 138-kV contingencies in the study region based on the planning criteria in ERCOT Planning Guide Section 4 and NERC TPL-001-5.1

Preliminary Findings – Dynamic Studies

- The results of the dynamic stability analysis indicated no dynamic stability issue for the 2038 case with all transmission upgrades relevant to 345-kV import paths

- ERCOT is currently conducting dynamic stability analysis for the 2038 case with all transmission upgrades relevant to the 765-kV extra high voltage transmission option to identify any dynamic stability issue. For the EHV study, ERCOT plans to focus on P7 345-kV contingencies in the study region

Cost Estimates

- Capital costs estimates of each transmission upgrade at 345-kV level or lower were provided by the TSP relevant to each upgrade
  - ERCOT used the cost estimates provided by the TSPs to calculate total project cost estimates for various transmission upgrades
- For EHV (500-kV and 765-kV) options, ERCOT used a general cost estimate to calculate the total project cost estimates
  - Referenced the MISO 2024 Transmission Cost Estimation Guide
    - Link: 20240131_PSC_Item_05_Transmission_Cost_Estimation_Guide_for_MTEP24_-_Redline631529.pdf (misoenergy.org)
  - General cost estimates for EHV options

	T-Line $/mile	Substation	Transformer
500-kV double-circuit	$6.9M*	$94.8M	$15.9M
765-kV single-circuit	$6.1M	$97.3M	$27.2M

*A ratio of 1.4 was used to estimate the cost for 500-kV double-circuit line based on 500-kV single-circuit line

Cost Estimates Summary

- Cost estimates in $ Million

	2030	2038		
		345-kV	500-kV	765-kV
Local Upgrades	5,054	5,255	4,712	4,712
Import Paths	3,991	7,694	10,605	9,059
Total	9,045	12,949	15,317	13,771

- The cost estimates of the local upgrades include the 345-kV and 138-kV transmission upgrades, 69-kV transmission conversions, and placeholder reactive devices (capacitor banks)
- The difference of the cost estimates for the local upgrades between 345-kV and EHV import paths are due to certain transmission upgrades not needed in the EHV options
- The cost estimates of the import paths include the 345-kV and EHV transmission upgrades and dynamic reactive devices

Next Steps

- Complete the limited dynamic stability analysis utilizing the case where all identified projects are modeled
- Complete the report in July 2024
- Final Presentation in July RPG meeting
  - https://www.ercot.com/calendar/07162024-RPG-Meeting

Deliverables and Timeline

- The study is expected to be completed in June 2024 and the final report is ready in July 2024
- Status updates at RPG meetings
- Tentative Timelines

Deliverables	Tentative Timeline
Load Update by TSPs	January 2024
Review the Data Provided by TSPs	January 2024
Develop Study Base Case and Conduct Reliability Analysis	February 2024
Study Potential Transmission Solutions and Propose Final Reliability Plan	March – June 2024
Final Report	July 2024

Thank you!

Stakeholder comments also welcomed through:

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Appendix – Local Transmission Projects for 2030 and 2038 in Delaware Basin Area

- 345-kV
  - Update the Stage 3 upgrade: New 345-kV double-circuit transmission line from Riverton – Drill Hole (instead of new 345-kV single-circuit line from Riverton – Owl Hill)
  - Stage 4 upgrade: Convert the existing Sand Lake – Riverton 138-kV line into 345-kV and add a new 138-kV line from Sand Lake – Riverton
  - Update the Stage 5 upgrade: Faraday – Lamesa – Clearfork – Drill Hole (instead of Riverton)
  - Add a new Border 345/138-kV substation with two 345/138-kV transformers; Loop the Stage 5 upgrade of new Clearfork – Drill Hole 345-kV double-circuit transmission line into the new Border 345-kV station; Add a new Border – Quarry Field 345-kV double-circuit transmission line (2038)
  - Add new 345/138-kV substations with two 345/138-kV transformers each at Culberson, 900005Tap (between Culberson and Sand Lake), and Faulkner
  - Add new 345-kV double-circuit transmission lines to form a loop: Riverton – Drill Hole – Culberson – 900005Tap – Faulkner – Solstice
  - Add a new 345/138-kV Creosote substation with three 345/138-kV transformers and add new 345-kV double-circuit transmission lines from King Mountain to Creosote to Toyah Creek
  - Add a new Fort Stockton Switch 345/138-kV substation with three 345/138-kV transformers; Loop the existing Bakersfield – Solstice 345-kV double-circuit transmission lines into Fort Stockton Switch (2038)
  - Upgrade the existing Bakersfield – Nevil Road – North McCamey 345-kV transmission lines and add second circuits
  - Add new 345/138-kV substations with two 345/138-kV transformers each at White Baker and Century (Bottlebrush) and add new 345-kV double-circuit transmission lines from Bakersfield to White Baker to Bottlebrush

Appendix – Local Transmission Projects for 2030 and 2038 in Delaware Basin Area (cont.)

- 138-kV
  - Add Quarry Field to Border 138-kV second circuit and Shifting Sand – Wink 138-kV second circuit, and add new 138-kV double-circuit transmissions line from Border – Shifting Sand to connect and serve the new loads and form a loop
  - Add Border – Riverton 138-kV second circuit
  - Add new 138-kV double-circuit transmission lines from 900005Tap to Faulkner to connect and serve the new loads and form a loop
  - Add new 138-kV transmission lines from Faulkner to Cryo to connect and serve the new loads and form a loop
  - Upgrade the existing Bottlebrush (Century) – White Baker – Girvin 138-kV transmission line
  - Bypass the Solstice phase shifter transformer and upgrade the existing Solstice – FT Stockton Plant 138-kV transmission line
  - Upgrade the existing Cowpen – Birds of Pray Tap 138-kV transmission line (2038)
  - Upgrade the existing Creosote - Trans Pecos Tap 138-kV transmission line
  - Rebuild the existing Solstice – Hayter Tap 138-kV transmission line to double-circuit; Move the large load as well as LCRA load at Hayter Tap to Hayter; Radially serve the loads at Hayter from Solstice
  - Convert the existing 16th Street – Ft. Stockton – Pinion – Ocotillo 69-kV transmission line to 138kV; Build a 138-kV tie between Ocotillo and Bottlebrush 138-kV substations; and Expand Ocotillo substation and move the 16th Street 138/69-kV transformer to Ocotillo

Appendix – Local Transmission Projects for 2030 and 2038 in Midland Basin Area

- 345-kV
  - Add a new 345/138-kV Prong Moss substation with two new 345/138-kV transformers; Loop the existing Bulldog – Elbow 138-kV transmission line into Prong Moss; Loop the existing Hillcrest – McDonald 138-kV line into Prong Moss; Convert the existing Big Spring – Signal Mountain 69-kV line to 138-kV; and Connect Signal Mountain to Prong Moss
  - Add a new 345/138-kV Roscoe substation near the Sweetwater Tap with two new 345/138-kV transformers; Loop the existing Sweetwater East – Champion and Bitter Creek – Cattleman 345-kV double-circuit line into Roscoe; Convert the existing Plowboy – Escoka 69-kV line to 138-kV; Loop the converted Plowboy – Eskota 138-kV line into Roscoe near the Sweetwater; Move the Eskota 138/69-kV transformer #1 to Plowboy
  - Upgrade the existing 345-kV double-circuit transmission lines from Cattleman to Sweetwater East to Long Creek
  - Upgrade the existing Bluff Creek – Abilene Mulberry Creek 345-kV transmission line and add second circuit
  - Upgrade the existing Moss – Midland County NW and Telephone Road – Gardendale – Clearfork 345-kV transmission lines and add second circuits
  - Upgrade the existing Bakersfield – Cedar Caynon – Noelke – Schneeman Draw 345-kV double-circuit transmission lines (needed for EHV options)

Appendix – Local Transmission Projects for 2030 and 2038 in Midland Basin Area (cont.)

- 138-kV
  - Add a new Ranger (Morgan Creek) – Frontier 138-kV transmission line
  - Upgrade the existing Ranger – Sun – Demott and Ranger – China Groove – Snyder 138-kV transmission lines
  - Upgrade the existing Eiland – Elbow 138-kV transmission line
  - Upgrade the existing Luther – Bulldog 138-kV transmission line
  - Upgrade the existing Natural Dam – Beals Creek 138-kV transmission line
  - Upgrade the existing Big Springs – Steer 138-kV transmission line
  - Upgrade the existing Friend Ranch – Carver 138-kV transmission line
  - Connect the new load bus 900052 to Big Lake to form a 138-kV loop
  - Upgrade the existing Grady – Coronado Midstream Tap – Sales Ranch 138-kV transmission line
  - Upgrade the existing Odessa – Reiter 138-kV double-circuit transmission line
  - Convert the existing Snyder – Scurry – China Grove and Snyder – Amoco Tap – China Grove 69-kV transmission lines to 138-kV
  - Convert the Stanton East – Midland Basin – Spraberry 69-kV transmission line to 138-kV
  - Convert the Illinois #4 – Pandale – Ozona – Friend Ranch 69-kV transmission line to 138-kV, expand Ozona substation and move the Illinois #4 138/69-kV transformer to Ozona
  - Expand the Pandale substation and build a 138-kV tie between Pandale and Stockman substations
  - Convert the Cedar Hill – Sterling City – Chalk 69-kV transmission line to 138-kV
  - Upgrade the existing Oak Creek – Cedar Hills 138-kV transmission line