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PUC DOCKET NO. 53758

APPLICATION OF GRID UNITED TEXAS LLC FOR PARTIAL CERTIFICATE OF CONVENIENCE AND NECESSITY RIGHTS PURSUANT TO PURA §§ 37.051(C-1) AND 37.056(B)(2) TO INTERCONNECT AN HVDC FACILITY TO THE ERCOT TRANSMISSION GRID	**§**	**BEFORE THE PUBLIC UTILITY COMMISSION OF TEXAS**

DIRECT TESTIMONY AND EXHIBITS

OF

KRIS ZADLO

ON BEHALF OF

APPLICANT
GRID UNITED TEXAS LLC

July 5, 2022

PUC DOCKET NO. 53758
DIRECT TESTIMONY AND EXHIBITS OF KRIS ZADLO

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EXHIBITS

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME, OCCUPATION, AND BUSINESS ADDRESS.

A. My name is Kris Zadlo. I am the Chief Development Officer of Grid United LLC (Grid United), which wholly owns Grid United Texas LLC (Grid United Texas), the applicant in this proceeding. My business address is 1717 West Loop South, Suite 1800, Houston, Texas 77027.

Q. WHAT IS YOUR EDUCATIONAL AND PROFESSIONAL BACKGROUND?

A. I have over 32 years of experience in the electric power industry and have been responsible for interconnecting over 20,000 megawatts (MW) of utility-scale energy projects throughout my career. I received a Master of Science in Electrical Engineering from Purdue University in 1990 and a Bachelor of Science from Rose-Hulman Institute of Technology in 1989. I am a licensed professional engineer in the State of Illinois (license number 062-049149). My resume is attached as **Exhibit KZ-1** and my Testimony History is attached as **Exhibit KZ-2.**

Q. PLEASE DISCUSS YOUR WORK EXPERIENCE?

A. At Grid United, I am the Chief Development Officer responsible for overseeing development, planning, engineering, design, and other technical activities pertaining to Grid United transmission projects. I am part of the senior management team responsible for developing Grid United's corporate policies. Prior to Grid United, I worked for Invenergy for 13 years, where I was responsible for managing services to all Invenergy projects with respect to their commercial activities pertaining to transmission assets. These responsibilities included managing technical and regulatory issues, as well as supporting filings before the Federal Energy Regulatory Commission (FERC) and state commissions. Previously, I was employed with Calpine Corporation (Calpine) as Vice President of Transmission. I worked for Calpine for 8 years. Prior to Calpine I worked for Commonwealth Edison Company of Chicago (Commonwealth Edison or ComEd) as Technical Studies Director. I worked for 10 years at Commonwealth Edison, holding

various positions in transmission planning, generation planning, operations, and strategic analysis. As stated above, my resume is attached as **Exhibit KZ-1.**

Q. PLEASE DESCRIBE YOUR UTILITY EXPERIENCE?

A. I started my career at Commonwealth Edison in Chicago where I worked for 10 years in various positions in Transmission Planning and Strategic Analysis. As Technical Studies Director, I was responsible for transmission engineers who performed stability and voltage studies and maintained the equipment rating database for the entire transmission system. I personally wrote Commonwealth Edison's "Guidelines for Interconnection of Generation" and "Guidelines for Dynamic Scheduling." I also wrote ComEd's first "Interconnection for Photovoltaic Power System." Over my career, I have overseen the interconnection of over 20,000 MW of utility-scale generation of various technologies and 700 miles of high voltage transmission lines. In 2001-2002, I was part of a small group of industry experts that crafted FERC's Large Generator Interconnection Procedures, which were issued in 2003.

Q. PLEASE DESCRIBE YOUR EXPERIENCE IN IMPLEMENTING NEW TECHNOLOGIES.

A. I founded Invenergy's energy storage business in 2012. In 2015, Invenergy's Grand Ridge Energy Center received two prestigious industry awards: Power Engineering's Renewable Energy Project of the Year and Energy Storage North America's Innovation Award. Earlier in my career, I worked with General Electric (GE) to develop a Trailer Mounted Combustion Turbine (TM2500) to help meet a critical energy need in the City of Chicago in 2000. This project was developed in 10 months, was the first deployment of its kind, and was the beginning of a new product line for GE. In both cases, I was able to create or implement new utility-scale technologies for safe and useful deployment.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE PUBLIC UTILITY COMMISSION OF TEXAS (PUC OR COMMISSION)?

A. No.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE FERC OR ANOTHER STATE REGULATORY COMMISSION?

A. Yes. I have previously testified before the FERC, the Missouri Public Service Commission, the Wisconsin Public Service Commission, and the Kansas Corporation Commission. A complete list of proceedings in which I have testified is attached as **Exhibit KZ-2.**

Q WERE YOUR TESTIMONY AND THE PORTIONS OF THE APPLICATION YOU SPONSOR PREPARED BY YOU OR BY KNOWLEDGEABLE PERSONS UPON WHOSE EXPERTISE, JUDGMENT, AND OPINIONS YOU RELY IN PERFORMING YOUR DUTIES?

A. Yes, they were.

Q. IS THE INFORMATION CONTAINED IN YOUR TESTIMONY AND IN THE PORTIONS OF THE APPLICATION YOU SPONSOR TRUE AND CORRECT TO THE BEST OF YOUR KNOWLEDGE AND BELIEF?

A. Yes, it is.

II. PURPOSE OF TESTIMONY

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to describe and support the project proposed in this proceeding, the estimated schedule for the proposed project, the technology proposed, and the benefits and feasibility of the proposed project. I sponsor certain portions of Grid United Texas' Application for Partial Certificate of Convenience and Necessity Rights Pursuant to PURA §§ 37.051(c-1) and 37.056(b)(2) to Interconnect an HVDC Facility to the ERCOT Transmission Grid, filed in this docket on July 5, 2022 (Application).

Q. WHAT PORTIONS OF GRID UNITED TEXAS' APPLICATION DO YOU SPONSOR?

A. I sponsor or co-sponsor the responses to Questions 3, 5, 6, 7, 11, 14, and 15 of the Application. I also sponsor Attachment 7 to the Application.

III. PROJECT DESCRIPTION AND SCHEDULE

Q. PLEASE DESCRIBE THE PROJECT PROPOSED IN THIS PROCEEDING.

A. The Pecos West Intertie Project (Proposed Project) is a proposed 1,500 MW high voltage direct current (HVDC) interconnection between the Electric Reliability Council of Texas (ERCOT) and the Western Electricity Coordinating Council (WECC). The Proposed Project is proposed to connect at the LCRA Transmission Services Corporation (LCRA TSC) Bakersfield Switching Station in Pecos County, Texas, and at an El Paso Electric Company (EPE) Station in El Paso County, Texas. Grid United Texas has evaluated interconnection at EPE's Caliente Station and Newman Station, but could interconnect at whichever station is deemed most appropriate after further consultation with EPE. As applicable, the specific station alternatives and routes will be addressed in a subsequent application by Grid United Texas for the Proposed Project. An approximately 250 to 300 mile ±525 kilovolt (kV) overhead HVDC tie line (Tie Line) will connect the HVDC converter stations at each end of the Proposed Project. The Proposed Project's HVDC technology allows ERCOT to maintain electrical isolation from the WECC system.

Q. PLEASE DESCRIBE THE ESTIMATED SCHEDULE FOR THE PROPOSED PROJECT.

A. The Application associated with this testimony is the beginning of the regulatory process associated with the Proposed Project. Grid United Texas is pursuing a multi-step regulatory strategy, which involves (1) this filing seeking partial authorization of rights or privileges under a certificate, namely a finding by the PUC that the public convenience and necessity require, or will require, the interconnection of HVDC converter facilities to LCRA TSC's Bakersfield Station with an appropriate end-point station in EPE's system that will allow the import of power into, and the export of power out of, the ERCOT transmission grid pursuant to the requirements of PURA § 37.051(c-1) (this Application); (2) a filing with the FERC, seeking approval of the HVDC interconnection into ERCOT under Sections 210, 211, and 212 of the Federal Power Act, and (3) a subsequent CCN filing with the PUC identifying all of the proposed facilities and routes for the Proposed Project, and seeking authorization from the PUC to exercise all rights and authority under the CCN to allow the construction and operation of the DC Tie Line facilities between the LCRA TSC

Bakersfield Switching Station in ERCOT and the identified EPE endpoint station in WECC. If successful in obtaining all of the necessary regulatory approvals from the PUC and the FERC, Grid United Texas anticipates beginning right-of-way acquisition in 2024 followed by engineering in 2025. An approximately three-year construction period is expected to commence at the beginning of 2026 and be completed by the end of 2028.

Q. WHY IS GRID UNITED TEXAS PROPOSING A MULTI-STEP REGULATORY PROCESS?

A. Under PURA § 37.051(c-1), a person seeking to interconnect a facility to the ERCOT transmission grid that enables additional power to be imported into or exported out of the ERCOT power grid must apply to the PUC for a certificate of convenience and necessity for such interconnection not later than the 180th day before the date the person seeks any order from the FERC related to the interconnection. Because the Proposed Project needs the FERC approval to ensure the independence of the ERCOT grid is not compromised by the interconnection, it is first required to apply to the PUC before seeking such FERC approval. However, determining routing, conducting an environmental assessment, and preparing all of the other necessary materials for a standard certificate of convenience and necessity (CCN) application is a costly and time-intensive process, all of which would be unnecessary if the PUC determines the Proposed Project is not in the public interest or the FERC ultimately declines to grant the requested interconnection order.

Thus, in order to allow the necessary PUC and FERC public interest assessments prior to expenditure of significant time and resources for a complete routing assessment, Grid United Texas is seeking in this Application partial authorization from the Commission regarding the propriety and necessity of the interconnection itself, preliminary to Grid United Texas requesting the necessary interconnection order from the FERC. Then, if the PUC has determined the Proposed Project is in the public interest and the FERC has issued the necessary interconnection order, Grid United Texas will proceed to prepare the studies necessary for evaluation of the Tie Line by the PUC prior to construction and operation of the Proposed Project. Thus, the regulatory process proposed by Grid United Texas not only provides efficiency, but also allows the PUC input into this critical project at an early stage that can shape its development in a way that best serves the state's needs and policy goals.

Q. PLEASE DESCRIBE THE PROPOSED TECHNOLOGY THAT WILL BE UTILIZED FOR THE CONSTRUCTION AND OPERATION OF THE PROPOSED PROJECT.

A. The HVDC converter stations at each end of the Proposed Project will convert electricity between Alternating Current (AC) and Direct Current (DC). When operating, HVDC converter stations can operate in one of two modes: rectifier mode (converting AC power to DC power) or inverter mode (converting DC power back to AC power). In other words, each converter station will be capable of converting AC power into DC power or vice versa (i.e., the converters will be bi-directional in nature).

Q. WHY IS GRID UNITED TEXAS PROPOSING HVDC TECHNOLOGY FOR THE PROPOSED PROJECT?

A. Grid United Texas is proposing HVDC technology for two reasons. First, transmission of power through AC lines is difficult to control. HVDC technology allows for precise power control allowing ERCOT to maintain electrical isolation from adjacent grids. Second, HVDC technology offers the most efficient means of transmitting large amounts of power over long distances with lower losses than AC transmission lines.

IV. PROJECT BENEFITS

Q. DOES THE PUBLIC CONVENIENCE AND NECESSITY REQUIRE, OR WILL REQUIRE, THE INTERCONNECTION OF HVDC FACILITIES TO THE LCRA TSC BAKERSFIELD STATION IN ERCOT WITH AN APPROPRIATE EPE STATION IN WECC?

A. Yes, the public convenience and necessity supports the interconnection of a DC tie between ERCOT (at the LCRA TSC Bakersfield Station) and WECC (at either the EPE Caliente or Newman Substation).

Q. PLEASE EXPLAIN THE BASIS OF YOUR OPINION.

A. While there are many benefits the Proposed Project provides, there are four primary categories of benefits that will benefit the public convenience and necessity.

- The Proposed Project will relieve constrained generation resources in ERCOT's West Texas region by allowing power that would otherwise contribute to congestion in ERCOT's West Texas region to be shifted to serve load in El Paso and further west.
- The Proposed Project will provide a connection to WECC for situations when additional power is needed in ERCOT but such power is not available from generation resources within ERCOT due to outages or transmission constraints.
- The Proposed Project will provide a grid interconnection for EPE from the east, thus diversifying EPE's interconnections that are currently limited from the west and north.
- The Proposed Project will provide enhanced resiliency and reliability to both ERCOT and EPE, because the Proposed Project will have the ability to provide black start capability, voltage regulation capability, and the ability to address inertia and frequency response issues on both sides of the HVDC facilities.

Q. PLEASE EXPLAIN HOW THE PROPOSED PROJECT WILL HELP WITH TRANSMISSION CONSTRAINTS.

A. High congestion rent is an indication of areas of the ERCOT grid where generation resources are unable to economically operate. ERCOT is projecting West Texas congestion rent for 2023 to be more than $380 million, increasing to more than $410 million per year in 2026. When a region of the Texas grid is severely constrained, it results in high prices for customers in the form of "congestion costs" and broad market inefficiency where supply is not able to freely flow to meet demand. This congestion reflects a real cost to consumers and occurs when lower-cost generators are prevented from serving load due to limitations on the transmission system. The Proposed Project will provide an additional outlet for the significant amount of generation resources currently curtailed in West Texas, allowing such power to flow to consumers served by EPE (or elsewhere in WECC) when it is economical to do so. While this may not technically "reduce congestion" in ERCOT because it does not provide another transmission pathway *within* ERCOT, it does reduce the constraints placed upon those generation resources and allows their low cost power to economically flow to other Texas electric consumers in El Paso.

Q. PLEASE EXPLAIN HOW THE PROPOSED PROJECT WILL PROVIDE AN ADDITIONAL POWER SOURCE BENEFIT TO ERCOT.

A. During extreme events, the ability to import power into ERCOT from WECC would provide significant benefits to Texas consumers. For example, during Winter Storm Uri in 2021, both ERCOT and the Southwest Power Pool (SPP) experienced rolling blackouts. However, WECC did not experience shortages to the same degree. During that storm event, if the Proposed Project had been in place, power could have been imported into ERCOT to assist with the significant demand that was not able to be met by the available generation within ERCOT.

Presently, ERCOT has no interconnection with WECC. Recently, the Texas legislature responded to Winter Storm Uri with a number of measures to incentivize the build-out and hardening of the ERCOT transmission system to avoid future grid-wide blackouts that threaten the competitiveness of the Texas economy and the safety of its citizens. The Proposed Project is such a project, because it can be operated to bring in generation resources outside of ERCOT when the ERCOT market is stressed.

Q. PLEASE EXPLAIN HOW THE PROPOSED PROJECT WILL BENEFIT TEXAS ELECTRIC CONSUMERS SERVED BY EPE.

A. EPE is currently interconnected to the WECC system by only three transmission corridors from the north and west. These transmission corridors are potentially threatened when wildfires occur in New Mexico. The Proposed Project provides a geographically diverse interconnection for EPE from the east. Such an interconnection not only provides significantly greater reliability and resiliency for EPE customers, but also allows access to significant existing and planned renewable generation in West Texas.

Q. PLEASE EXPLAIN HOW THE PROPOSED PROJECT WILL PROVIDE ADDITIONAL ENHANCED RESILIENCY AND RELIABILITY BENEFITS TO BOTH EPE AND ERCOT.

A. The proposed HVDC converter technology currently planned for use by Grid United Texas has numerous features that will potentially provide significant reliability and resiliency benefits to both ERCOT and EPE. Such benefits include: (1) black start capability that

would allow a blackstart from WECC to restore service in ERCOT, and vice versa, thus serving as a grid-forming asset; (2) the ability to provide dynamic stability in both markets, by mitigating voltage oscillation and deficiency issues by pulling or pushing power from either side to balance and mitigate imbalances and disturbances; (3) the ability to address inertia and frequency response issues that arise on both grids; and (4) the ability to provide or take energy as needed, thus reducing congestion, which also affects reliability. Of course, all of these would be subject to ERCOT direction and coordination, thus providing additional tools to ERCOT to enhance resiliency and reliability.

Q. WHAT DO YOU MEAN WHEN YOU SAY THESE "WOULD BE SUBJECT TO ERCOT DIRECTION AND COORDINATION?"

A. LCRA TSC's Bakersfield Station is within ERCOT and part of the ERCOT grid, subject to ERCOT oversight. The HVDC converter that would connect to the Bakersfield Station would similarly be interconnected with ERCOT and, thus, subject to ERCOT oversight and direction. ERCOT would have the ability and authority to direct the use of the HVDC converter facilities in the same manner as it would be able to direct LCRA TSC to operate the Bakersfield Station and would be able to direct Grid United Texas to operate the HVDC converter facilities to assist the ERCOT grid in all of the ways described above in circumstances when such benefits are needed. Grid Untied Texas anticipates involvement with ERCOT staff and ERCOT market participants in the coming months and years to fully establish and finalize all necessary protocols necessary for the HVDC converter facilities to fully operate in a manner that best benefits the ERCOT grid.

Q. DOES THE PROPOSED PROJECT PROVIDE ECONOMIC BENEFITS TO TEXAS MARKET PARTICIPANTS, INCLUDING CONSUMERS?

A. Yes.

Q. WHAT ARE SOME OF THE ECONOMIC BENEFITS FROM THE PROPOSED PROJECT?

A. Analysis by Grid United Texas and its external consultants shows that the Proposed Project delivers economic benefits across three broad categories: (1) annual production cost

savings, (2) reduction in congestion, and (3) new markets for all generators. Each of these is discussed below.

(1) Significant annual production cost savings on both sides of the line. Annual production cost savings represent avoided fuel costs to serve load on either end of the line. These reflect true "grid" savings and market efficiency that accrues to market participants. While Grid United Texas' simulations show the Proposed Project exporting more power to EPE than importing to ERCOT, annual production cost savings is actually greater on the ERCOT side of the line. Modeling shows that power on the line will generally flow to EPE customers, allowing them to benefit from low-cost (and often curtailed) power in West Texas. While imports to ERCOT are modeled at lower volumes than exports to EPE, the cost savings of that imported power to ERCOT is higher than exports to EPE, reflecting the Proposed Project's production cost benefits to ERCOT in times of high demand and high power prices in ERCOT.

(2) Alleviation of curtailed power, providing increased power flows and market efficiency in West Texas. The ERCOT grid is experiencing a rapid shift in the type and location of generation to meet demand; massive growth in inverter-based resources, mostly wind and solar, continues while traditional thermal generation is retired. More than 45 gigawatts (GW) of wind, solar and battery energy storage was expected to be installed in ERCOT by the end of 2021 while 6 GW of coal and gas generation was retired from 2018 to 2021. Renewable generation connected to West Texas alone could exceed 38 GW by 2023. This shift has brought the issue of congestion to the forefront at ERCOT in general, and in West Texas specifically, as the change in the generation mix results in increased distance between generation supply and load. Grid United Texas' studies clearly show that in a "business as usual" scenario (i.e., no extreme weather events), the Proposed Project is utilized 44 percent of the hours in the simulation year, transporting ~1,800 gigawatt hours (GWh) of lower-cost energy from predominantly congested localities in West Texas to El Paso (with approximately 80 percent of power flows out of ERCOT to El Paso, and approximately 20 percent of power flows into ERCOT). It is important to note that while the Proposed Project provides cost benefits to ERCOT (enabling the import of power in

times of high prices and scarcity in ERCOT), most of the time it is helping to reduce constraints on generation resources in West Texas by matching lower-cost, stranded supply in West Texas with demand in El Paso.

(3) Increasing market efficiency for all generators and decreasing curtailment by opening new markets for West Texas Power producers. The massive build-out of renewables in West Texas continues, leading to market instability and congestion, negative pricing (approaching 30 percent of all hours in off-peak months at West Texas Hub), and curtailments of ~5,000 GWh in 2020 (representing approximately 5 percent of total wind/solar generation in the state). By providing a new pathway for constrained generation resources in a highly congested region, the Proposed Project opens new markets for generators of all types, decreasing curtailment and increasing thermal and renewable generation. Specifically, simulations performed by Grid United Texas and our consultants show that the Proposed Project would result in an increase of more than 400,000 megawatt hours (MWh) per year in thermal generation and the reduction in curtailment of upwards of 700,000 MWh per year in renewable generation. The inability to reach new markets represents a true cost and missed opportunity for producers; power remains the only major commodity that Texas producers are unable to trade in meaningful quantities across state borders.

Q. HOW DID GRID UNITED TEXAS STUDY OR EVALUATE THE ECONOMIC IMPACTS OF A 1,500 MW HVDC INTERCONNECTION BETWEEN ERCOT AND EPE (WECC)?

A. On January 18, 2022, Grid United Texas engaged nFront Consulting LLC (nFront) to evaluate the potential economic impact of the Proposed Project on both ERCOT and EPE (WECC). nFront performed a Security Constrained Economic Dispatch (SCED) analysis to evaluate the potential benefits of the Proposed Project between the ERCOT Balancing Authority (BA), at Bakersfield 345 kV, and the EPE BA, at Caliente 345 kV. For modeling purposes, the Proposed Project was connected to ERCOT at Bakersfield and to EPE at Caliente, and then energy transactions were modeled to occur, from higher price to lower price, when the EPE marginal energy cost was $5/MWh greater than or less than the

Bakersfield 345 kV LMP cost. nFront utilized an iterative process to maximize the MW transfer between EPE and ERCOT. Finally, nFront calculated the annual production cost of the "without HVDC tie" scenario compared to the "with HVDC tie" scenario to show the annual production cost savings while taking into account the transactional costs of buying/selling power between markets. A summary of the nFront study is attached as **Exhibit KZ-4**.

Q. SINCE THE nFRONT STUDY USED EPE'S CALIENTE STATION IN ITS CALCULATIONS, ARE THE PROPOSED PROJECT'S ECONOMIC BENEFITS TIED TO THE USE OF THAT PARTICULAR STATION?

A. No. Although the Caliente Station was used for the nFront study, the results of the study would be similar for any electrically comparable EPE station deemed appropriate and used for the Proposed Project, including the Newman Station. Any differences in the calculations and resulting numbers would be negligible. It is the connection to EPE's system that is the most significant factor, not the particular station used in the analysis.

Q. WHAT TOOL WAS USED FOR THE NFRONT ASSESSMENT?

A. nFront utilizes the PROMOD IV™ production-cost simulation (dispatch) model and its complementary Transmission Analysis Module (or PROMOD™/TAM).

Q. WHAT ARE SOME OF THE KEY ASSUMPTIONS?

A. The WECC model includes all WECC members, and the following assumptions were utilized:

- WECC Assumptions
  - Reviewed WECC Paths 47 (Arizona) & 48 (New Mexico) as the only paths that would likely impact import/export for EPE
  - Reviewed and utilized WECC open access transmission tariffs (OATT) for tariffs between each balancing authority
  - Reviewed and used EPE 2021 Integrated Resource Plan (IRP) Resources and Demand
- ERCOT Assumptions

- Renewable Additions all have executed Interconnection Agreements and have met Planning Guide Section 6.9
- Utilized December 2021 Capacity, Demand Reserves Report loads
- Utilized S&P 3Q-2021 fuel forecast
- Utilized preferred reliability transmission upgrades identified by ERCOT
- Utilized the Generic Transmission Constraints identified by ERCOT.

Q. BASED ON THE RESULTS OF THE nFRONT STUDY, WHAT IS THE FORECASTED ANNUAL PRODUCTION COST SAVINGS AND AVOIDED CURTAILMENT OF THE PROPOSED PROJECT ON ERCOT?

A. The annual production cost savings for ERCOT, inclusive of revenue from exported energy to EPE and the cost of imported energy from EPE, is approximately $51.7 million. This is a conservative amount that does not include savings that would occur when ERCOT pricing is high during ERCOT Energy Emergency Alert conditions (including Level 3 Rotating Outages). For example, during an EEA 3 event, the ability to import 1,500 MW could prevent the outage of ~1.2 million customers, based on an annual average residential power usage of 11 MWh in 2020.

Q. HAVE YOU ESTIMATED THE POTENTIAL VALUE OF IMPORTS INTO ERCOT DURING AN EEA LEVEL 3 EVENT (ROTATING OUTAGES)?

A. Yes, I have. There are a variety of factors that could be considered in such an analysis, including system wide offer caps, the availability of resources from the EPE side of the interconnection, the ability of the ERCOT system to accept imports and the duration of the event. For discussion purposes for this simple calculation, I made the assumption of a system wide offer cap of $5,000/MWh and sufficient availability of generation resources from the EPE side of the interconnection to flow 1,500 MW of power. Under such assumptions, if an EEA Level 3 event lasted one day, the potential value of the Proposed Project to ERCOT would be approximately $180 million.

1,500 MW (capacity) x $5,000/MWh (offer cap) x 24 hours = $180 million

There are a variety of ways the assumptions could be modified under various scenarios, but this simple calculation helps demonstrate the significant value the Proposed Project could provide during times of scarcity in ERCOT.

Q. IS IT REASONABLE TO ASSUME EPE WILL HAVE 1,500 MW OF GENERATION CAPACITY TO EXPORT TO ERCOT DURING TIMES OF SCARCITY IN ERCOT?

A. I agree that during times of scarcity in ERCOT, EPE may or may not have available generation capacity. During Winter Storm URI, EPE's system was significantly less impacted than ERCOT and had excess generation resources that could have been imported to ERCOT. During the ERCOT EEA Level 3 event in 2011 and looking back into the some of the other ERCOT winter storm outages (e.g., 1989), EPE may not have had available generation capacity however it could have drawn upon other resources in the WECC and wheeled energy across its system to ERCOT. It is not Grid United Texas' position that the Proposed Project is the complete solution to every instance of stress on either the ERCOT or EPE system. The Proposed Project is, however, a valuable tool that may have the capability of significantly benefiting either system at critical times of scarcity.

Q. BASED ON THE RESULTS OF THE nFRONT STUDY, WHAT IS THE FORECASTED ANNUAL PRODUCTION COST SAVINGS OF THE PROPOSED PROJECT ON EPE?

A. The annual production cost savings for EPE, inclusive of revenue from exported energy to ERCOT and the cost of imported energy from ERCOT, is approximately $26.2 million based on Henry Hub natural gas prices predominately below $3 MMBTU. Natural gas prices are presently significantly higher, with the average Henry Hub spot price in May 2022 above $8/MMBtu. While these savings are smaller than in ERCOT, it's important to put them in context. These cost savings represent approximately 12 percent of EPE's total, system-wide annual fuel cost of approximately $225 million calculated in the nFront simulation. The Proposed Project will provide EPE the ability to import lower-cost (predominantly) renewable energy from West Texas that would be otherwise curtailed and provide a valuable hedge against higher natural gas prices.

Q. WHAT DOES THE nFRONT STUDY SHOW REGARDING THE PROPOSED INTERCONNECTION'S FORECASTED UTILIZATION AND IMPACT ON CURTAILMENT?

A. The study shows the proposed Tie Line utilized 3,931 hours of the year, or 44.9 percent of the time, transporting over 1,800 GWhs of energy (approximately 1,500,000 MWh/year exported to EPE and approximately 300,000 MWh/year imported to ERCOT) while avoiding more than 700,000 MWh of renewable curtailment and increasing thermal generation by approximately 400,000 MWh.

Q. HOW DOES THE FORECASTED UTILIZATION OF THE PROPOSED INTERCONNECTION COMPARE TO EXISTING HVDC INTERCONNECTIONS IN ERCOT?

A. The forecasted utilization is similar to (and in some cases exceeds) recent utilization of the other existing HVDC ties in ERCOT, although the Proposed Project is expected to export the majority of the time while the HVDC ties currently existing in ERCOT are predominantly importers (see Exhibit KZ-3 for further details on nFront's simulated Proposed Project operations vs 2021 actual and historical operations of ERCOT's existing HVDC ties).

Q. WHAT DOES THE nFRONT STUDY SHOW REGARDING THE PRIMARY FORECASTED FLOW DIRECTION ON THE PROPOSED INTERCONNECTION BETWEEN ERCOT AND EPE?

A. While the nFront study shows a bi-directional movement of power (~45% utilization of the line by hour), roughly approximately 80 percent in a given year is moving to El Paso (1,500,000 MWh/year) and the remaining approximately 20 percent (300,000 MWh/year) of the power flows to ERCOT. As a result, EPE will benefit from lower-cost, stranded (predominantly) renewable generation, while ERCOT is able import lower-cost (predominantly) thermal power from EPE's system in times of high demand on the ERCOT system. As discussed above, the Proposed Project will broadly increase market efficiency, helping to remove constraints to generation resources in West Texas by opening new markets for curtailed and constrained renewable and thermal generation.

Q. DOES THE nFRONT ANALYSIS CONSTITUTE AN ECONOMIC COST-BENEFIT STUDY THAT SHOWS THE ERCOT-WIDE ANNUAL PRODUCTION COST SAVINGS ATTRIBUTABLE TO THE PROPOSED PROJECT EQUAL TO OR GREATER THAN THE FIRST-YEAR ANNUAL REVENUE REQUIREMENT OF THE PROPOSED PROJECT?

A: It is unclear what constitutes an economic cost benefit study, as the Texas state legislature, the PUC, and ERCOT continue to work to determine the precise test and tools they will use to evaluate economic transmission projects in ERCOT moving forward. However, nFront's analysis of the Proposed Project shows significant annual production cost savings in both ERCOT and in EPE, which represent greater market efficiency and lower costs for market participants.

The Proposed Project would add 1,500 MW of transfer capacity (with expansion capability up to 3,000 MW) to this critically constrained region, allowing the efficient movement of power, resulting in higher market efficiency and lower costs across the system. Thus, there is significant evidence that the Proposed Project benefits the public interest of electric consumers in both ERCOT and EPE.

Q. IS THERE A PROBABLE IMPROVEMENT OF SERVICE OR LOWERING OF COST TO CONSUMERS IN ERCOT IF THE PROPOSED PROJECT IS APPROVED?

A. Yes. By enabling power to flow into ERCOT at times of high demand (and, thus, higher costs), the Proposed Project would provide additional capacity to meet demand, thus increasing market efficiency while lowering costs across all market participants.

Q. IS THERE A PROBABLE IMPROVEMENT OF SERVICE OR LOWERING OF COST TO CONSUMERS SERVED BY EPE IF THE PROPOSED PROJECT IS APPROVED?

A. Yes. The Proposed Project provides reliability and resiliency to El Paso electric consumers, as well as significant reduction in annual production costs for EPE customers. By providing additional capacity to EPE customers when needed, the Proposed Project will improve service and lower costs for the same reasons discussed in response to the prior question.

Q. ARE THERE OTHER ECONOMIC BENEFITS NOT CAPTURED BY THE nFRONT ANALYSIS?

A: Yes. The analysis performed by nFront was a business-as-usual analysis utilizing typical load and generation profiles and low gas prices which do not fully capture the effect of ERCOT scarcity pricing, weather volatility, or fuel supply shocks. For example, nFront utilized Henry Hub natural gas prices predominately below $3 MMBTU. Natural gas prices are presently significantly higher, with the average Henry Hub spot price in May 2022 above $8/MMBtu. The nFront analysis contained very little scarcity pricing. There were only 119 hours where the price at the Proposed Project's ERCOT interconnection point was above $100/MWh. Additionally, the analysis did not value the reliability attributes such as the dynamic voltage support, frequency response or black start capability. Grid United Texas is continuing to evaluate the manner in which the Proposed Project's converter stations could be used to increase the West Texas Export, McCamey, and Bearcat GTC limit. In other words, the analysis is a conservative base case and if one were to include all these additional benefits the customer value would be considerably greater.

V. PROPOSED PROJECT FACILITY DESCRIPTIONS

Q. HOW IS AN HVDC CONVERTER STATION DIFFERENT THAN A TYPICAL AC SUBSTATION?

A. AC substations typically convert power from one voltage to another or serve as a switching station between multiple transmission lines. An HVDC converter station converts AC power to DC power utilizing sophisticated power electronic equipment such as thyristors or insulated-gate bipolar transistors. The equipment is housed in a building called the valve hall.

Q. HOW WILL THE TIE LINE STRUCTURES ASSOCIATED WITH THE PROPOSED PROJECT DIFFER FROM TYPICAL TRANSMISSION LINE STRUCTURES WITHIN TEXAS?

A. The proposed Tie Line will have similarities and differences to typical transmission facilities in Texas. Generally, the Tie Line will be similar in height, span length and right-of-way width to a typical 345 kV AC transmission line. Unlike an AC transmission line,

however, which contains three primary conductors, the Tie Line will have two primary high voltage conductors that will be operated at approximately 525 kV and, depending on the ultimate design, may have 1-2 lower voltage conductors that would serve as a dedicated metallic return. Grid United Texas will provide further details to the Commission regarding the proposed manner of construction (e.g., pole or lattice steel) of the necessary structures in the subsequent CCN amendment request associated with the routing of the Tie Line facilities. So, although the exact facilities are not being specified in this Application, all necessary information will be supplied to the PUC and additional full approval of the CCN by the PUC will be necessary before the facilities may be constructed and operated.

VI. CONSTRUCTION, OPERATION, AND MAINTENANCE OF THE PROPOSED PROJECT

Q. WHAT EXPERIENCE DOES GRID UNITED TEXAS HAVE IN ENGINEERING, CONSTRUCTION AND PROJECT MANAGEMENT OF HIGH VOLTAGE ELECTRIC TRANSMISSION FACILITIES?

A. Grid United Texas has a team of experienced professionals, including myself, with well over 100 years of collective experience managing and overseeing the design, construction, and operation of transmission projects similar to that proposed in this proceeding. Our team members have particular experience working with the largest contractors designing and constructing high voltage transmission facilities throughout North America, including Patsy Baynard, Vice President of Project Development; Gimod Olapurayil, Vice President of Transmission Strategy; Bryant Coon, Project Development Director; and Allie Wahrenberger, PE, Director of Engineering. Grid United Texas team members have decades of experience in engineering, construction and project management of high voltage electric transmission facilities, including thousands of miles of greenfield development.

Q. HOW WILL GRID UNITED TEXAS MANAGE CONSTRUCTION OF THE PROPOSED PROJECT?

A. Similar to existing transmission utilities operating in Texas, Grid United Texas will engage experienced contractors to engineer, procure, and construct the Proposed Project. Grid United Texas's experienced team of engineers and project managers will carefully oversee

every stage of the Proposed Project. The Proposed Project will be constructed to meet or exceed all applicable operation and maintenance standards for transmission facilities in the location of the Proposed Project. More specific information regarding the construction and operation of the Proposed Project will be provided to the PUC in the required subsequent CCN Application filing by Grid United Texas.

Q. PLEASE DESCRIBE HOW GRID UNITED TEXAS PROPOSES TO OPERATE AND MAINTAIN THE PROPOSED PROJECT?

A. Grid United Texas will operate and maintain the Proposed Project in accordance with all applicable North American Electric Reliability Corporation (NERC) reliability standards applicable to such facilities. In addition, Grid United Texas will operate and maintain the Proposed Project in accordance with all applicable statutes, protocols, regulations, and rules of the Commission, ERCOT, and WECC. Grid United Texas will meet or exceed all generally accepted standards of a reasonable and prudent transmission facility operator. More specific information regarding the construction and operation of the Proposed Project will be provided to the PUC in the required subsequent CCN Application filing by Grid United Texas.

Q. PLEASE DESCRIBE GRID UNITED TEXAS' ABILITY TO PROVIDE MAINTENANCE ON THE PROPOSED PROJECT.

A. Maintenance activities for the Proposed Project will be broken into two major categories: HVDC converter maintenance and high voltage intertie maintenance. Maintenance on HVDC converter stations is typically performed by the original equipment manufacturer (OEM). As the manufacturer, the OEM is in a unique position to monitor the operational performance and perform both routine and emergency maintenance for the HVDC converter station, as needed, while ensuring that lessons learned on similar equipment throughout the world is shared to the benefit of the owner. For example, it is my understanding that the OEM is providing such services for ERCOT's Welsh HVDC converter station. The second set of maintenance activities is on the high voltage intertie. Although this is a DC tie line, maintenance activities are very similar to those undertaken on AC transmission lines. Grid United Texas's intention is to hire a qualified local

contractor or utility to provide those services to the Proposed Project. More specific information regarding the maintenance of the Proposed Project will be provided to the PUC in the required subsequent CCN Application filing by Grid United Texas.

Q PLEASE DESCRIBE GRID UNITED TEXAS'S EXPERIENCE PERFORMING EMERGENCY RESPONSE AND RESTORATION WORK ON HIGH-VOLTAGE TRANSMISSION LINES?

A. It is Grid United Texas' intention to hire a qualified local contractor or utility to provide emergency response and restoration services to the Proposed Project. A local contractor or utility will be in the best position to provide and manage such services because they will have personnel and equipment locally.

Q. PLEASE DESCRIBE GRID UNITED TEXAS'S CAPABILITY OF PROVIDING CONTINUOUS AND ADEQUATE SERVICE WITH THE PROPOSED PROJECT.

A. Pursuant to PURA § 37.151(2), a certificate holder shall provide continuous and adequate service to its certificated area. Grid United Texas will hire a highly qualified operations and maintenance (O&M) team to provide O&M services for the facility once it is placed in operation. Grid United Texas has the resources to fully staff all positions necessary to ensure continuous and adequate service and is committed to doing so upon approval of the Proposed Project.

VII. THE SOUTHERN CROSS PROJECT

Q. ARE YOU FAMILIAR WITH THE SOUTHERN CROSS HVDC PROJECT?

A. Yes.

Q. IS THE PROPOSED PROJECT SIMILAR TO THE SOUTHERN CROSS PROJECT AND INVOLVE SIMILAR INTERCONNECTION AND ENERGIZATION ISSUES LIKE THOSE ASSOCIATED WITH THAT PROJECT?

A. Except for the fact that the Proposed Project utilizes the same HVDC technology as Southern Cross, there are very little, if any, similarities. The Proposed Project is located in West Texas, while Southern Cross is located in East Texas. The Proposed Project is an intrastate line, entirely within the State of Texas, while Southern Cross is an interstate line

that traverses the states of Texas, Louisiana and Mississippi. The Proposed Project would be ERCOT's first WECC interconnection. This first of its kind interconnection would provide Texas a host of new resiliency and reliability benefits, as well as economic benefits.

VIII. REGULATORY STANDARDS

Q. IN YOUR OPINION, ARE THE PROPOSED FACILITIES NECESSARY FOR THE SERVICE, ACCOMMODATION, CONVENIENCE, OR SAFETY OF THE PUBLIC?

A. Yes. As noted above, the Proposed Project provides many such benefits to the public, by alleviating congestion in ERCOT's West Texas region, providing a connection to an outside grid for situations when additional power is needed in ERCOT, providing an additional transmission source for customers served by EPE, and providing enhanced resiliency and reliability to both EPE and ERCOT. These systemic benefits will also result in significant cost savings to ERCOT market participants, including consumers, as noted in my testimony further above.

Q. HOW DOES THE PROPOSED PROJECT SUPPORT THE RELIABILITY AND ADEQUACY OF THE INTERCONNECTED TRANSMISSION SYSTEM?

A. As noted above, among other things it provides additional sources of power for both EPE and ERCOT, it provides an additional transmission corridor for EPE, it provides additional resiliency features, such as black start capability, dynamic stabilizing capabilities, and additional tools to address inertia and frequency issues.

Q. DOES THE PROPOSED FACILITY FACILITATE ROBUST WHOLESALE COMPETITION?

A. Yes. The Proposed Project would open new markets for generators of all types, decreasing curtailment and increasing thermal and renewable generation. As noted above, simulations demonstrate that the Proposed Project would result in greater than 400,000 MWh per year increase in thermal generation and the reduction in curtailment of upwards of 700,000 MWh per year in renewable generation. The inability to reach new markets represents a

true cost and missed opportunity for producers; power remains the only major commodity that Texas producers are unable to trade in meaningful quantities across state borders. As just one example, with new markets provided by the Proposed Project, Texas wind producers would likely capture an incremental $8 million per year alone, just from an estimated average of approximately $15 / MWh production tax credit that they are currently foregoing due to curtailment.

Q. WHAT RECOMMENDATION, IF ANY, HAS AN INDEPENDENT ORGANIZATION, AS DEFINED IN PURA § 39.151, MADE REGARDING THE PROPOSED PROJECT?

A. The Proposed Project will be submitted to ERCOT for analysis shortly after the filing of the Application. As of the date of this testimony, no recommendation regarding the Proposed Project has been made by any independent organization as defined in PURA § 39.151.

Q. IS THE PROPOSED FACILITY NEEDED TO INTERCONNECT A NEW TRANSMISSION SERVICE CUSTOMER?

A. While the Proposed Project is not needed to interconnect a specific new transmission service customer, it will result in additional transmission service customers, as it will open up a completely new pathway and connection between generators and consumers that does not currently exist, providing a direct connection between WECC and ERCOT.

Q. IS THE APPLICATION FILED BY GRID UNITED TEXAS IN THE PUBLIC INTEREST?

A. Absolutely. The Proposed Project provides a variety of significant benefits directly designed to address concerns raised by the Texas Legislature in response to Winter Storm Uri, and will provide additional capacity benefits, reliability enhancement, greater resiliency, and open up new markets for Texas generators. It provides these significant benefits with no harm to consumers or other market participants. This is exactly the type

of project that the Commission should be encouraging now to strengthen the ERCOT grid and better protect Texas citizens in the future.

IX. CONCLUSION

Q. IS THERE ANYTHING ELSE SPECIFIC TO THE PROPOSED PROJECT YOU WOULD LIKE TO ADD?

A. Not at this time.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes, it does.

KRIS ZADLO, PE

1717 West Loop South, Suite 1800, Houston, TX 77027

Energy Executive with extensive Business Development, Strategic Planning and Regulatory Affairs expertise. Versed in the development and design of both large-scale transmission projects and renewable generation projects. Experienced in all phases of project development, from initial feasibility analysis and conceptual design, through execution, financing, and construction. Effective at building new teams that generate excellent business results within both large corporate environments and small entrepreneurial fast-growing companies.

Core qualifications include:

- Strategic Analysis and Development
- Joint Venture Partnerships
- Energy Sales and Marketing
- Business Development
- Market Analytics
- Energy Storage Development
- Transmission Analysis and Planning
- Project Financing
- Regulatory Affairs
- Written & Oral Testimony

Master of Science • Electrical Engineering • Purdue University • West Lafayette, IN
Bachelor of Science (Cum Laude) • Electrical Engineering • Rose-Hulman • Terre Haute, IN

Professional Experience

Grid United, Houston, TX (2021 to Present)

Chief Development Officer

The scope of my responsibilities includes creating new transmission projects and managing all aspects of Grid United's development activities including overseeing commercial studies, environmental permitting, engineering, design, and other technical studies pertaining to Grid United transmission projects.

Invenergy, Chicago, IL (2008 to 2021)

Senior Vice-President responsible for **Commercial Analytics, Regulatory and Government Affairs, Strategy and Transmission Analysis**

Managed over 500 interconnection requests totaling ~ 100 GW and over $500 million in security. Successfully interconnected over 10 GW of utility scale projects (7.6 GW of wind and solar generation, 2.4 GW of natural gas generation) throughout the U.S. Created a Transmission development group that is responsible for developing and permitting 800 miles HVDC transmission project. Created an Energy Storage Department that was responsible for the development and construction of award-winning battery projects. Responsible for creating a Commercial Analytics and Strategy Department that performs market assessments and strategic plans. Created and responsible for Regulatory and Government Affairs.

Kris Zadlo

- Responsible for:
  - Regulatory and technical aspects of transmission development
  - Market analytics and strategy functions
  - Market assessments and assisting in the sales, marketing, financing, and construction of new projects.
  - Regulatory and Government Affairs
  - Transmission Analysis
- Founded Invenergy's energy storage development program in 2012
- Won 2015 Energy Storage Project of the Year for Grand Ridge Energy Center
- Formed a strategic joint venture partnership with key battery vendors
- Created a technical process to review and assess the interconnection capability for new development opportunities. Provide strategic direction on where to develop and site new projects.
- Responsible for Invenergy joining both national and regional trade associations and maximized and leveraged the membership to company's benefit.
- Recruited and hired high quality personnel to Invenergy.
- Offer advocacy and regulatory testimony on behalf of the company.
- Voting Member of the Health & Welfare Committee, Risk Committee, and nonvoting member of the Investment Committee.
- Advisory board member of the Invenergy's Women Network

Calpine Corporation and SkyGen, Houston, TX & Chicago, IL (2000-2008)

Vice-President, Transmission Operations (2006-2008)

Promoted as a part of a new management team charged with brining Calpine out of bankruptcy. Responsible for creating a new transmission department that successfully supported over 21,000MWs of operating assets as well as the trading organization.

- Directly responsible for creating $60M in realized and planned revenue.
- Responsible for developing company's post-bankruptcy strategic electrical transport plan.
- Provided oversight of the company's pre-petition electrical firm transport contracts.
- Provided testimony & appeared as a witness in Bankruptcy Court.

Director, Transmission Management (2000-2006)

Responsible for the interconnection of 4,550MW of natural gas generating facilities while creating new revenue streams and eliminating transmission constraints.

- Directly responsible for creating over $112M in realized and planned revenue (2002-2011).
- Actively involved in development, marketing and divestiture of over thirty generation assets.
- Directed technical and commercial assessments of new & existing generation assets.
- Directed filings of required tariffs and protests at state commissions & FERC.
- Provided testimony & appeared as witness in both, state commissions & FERC proceedings.
- Developed procurement strategies for transmission service & rights in all major US markets.

Kris Zadlo

- Negotiated and financially optimized new electrical interconnection agreements.
- Acted as IPP sector representative on MISO Advisory Committee for 2003-2006.

Commonwealth Edison, Chicago, IL (1990 to 2000)

Technical Studies Director (2000)

Responsible for leading or directing various technical assessments.

- Responsible for developing company's voltage & stability procedures and compliance for its 80 connected generating units.
- Responsible for evaluating all new technologies promoted for system enhancement.
- Responsible for the equipment-rating database.

IPP Interconnection Manager (1998-2000)

Developed and interconnection process and standards and was responsible for interconnecting new generators to the electrical grid.

- Developed and directed the construction of 100MW peaking generation facility in Illinois.
- Coordinated all interconnection activities of new generators within Northern Illinois region.
- Produced new & updated regulations for generator interconnection to the system.

Early Positions Included:

Principal Engineer – Transmission Studies (1996-1998)
General Engineer – Integrated Resource Planning (1994-1996)
Engineer - System Planning Department (1990-1994)

Foreign Language - Fluent in Polish - Served as a technical translator for partnership with Polish Power Grid Company sponsored by the United States Energy Association.

List of industry speaking engagements, court testifying and published works upon request

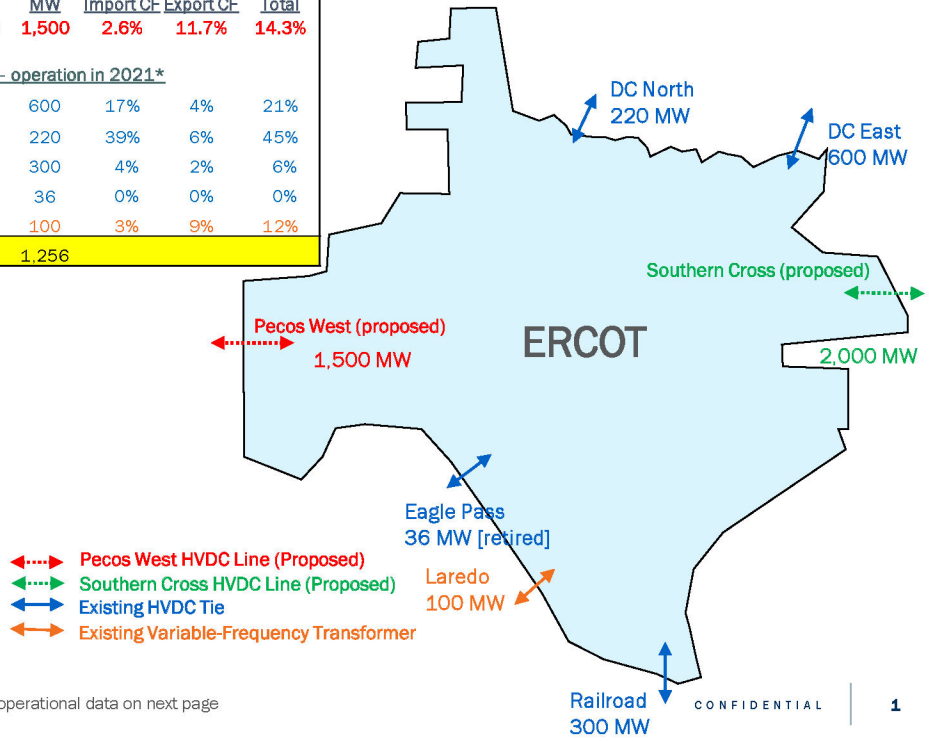
#	Jurisdiction	Case or Docket Number	Entity Initiating Proceeding	Subject Matter
1	FERC	ER01-176	Broad River Energy Center	Generator Interconnection
2	FERC	ER03-624	Ontelaunee Energy Center	Ancillary Service Rate
3	FERC	ER03-1015	Pine Bluff Energy Center	Ancillary Service Rate
4	FERC	ER03-1114	Carville Energy Center	Ancillary Service Rate
5	Wisconsin Public Utility Commission	05-AE-118	Wisconsin Electric Power Corporation	Generation Construction Certification
6	FERC	ER04-889	Parlin Energy Center	Ancillary Service Rate
7	FERC	ER04-978	Newark Energy Center	Ancillary Service Rate
8	FERC	ER04-1055	Riverside Energy Center	Ancillary Service Rate
9	FERC	ER04-1059	RockGen Energy Center	Ancillary Service Rate
10	FERC	ER05-677	Osprey Energy Center	Ancillary Service Rate
11	FERC	ER05-912	Sutter Energy Center	Ancillary Service Rate
12	FERC	ER05-1093	Hermiston Energy Center	Ancillary Service Rate
13	FERC	ER05-1102	Goldendale Energy Center	Ancillary Service Rate
14	FERC	ER05-1361	Fox Energy Center	Ancillary Service Rate
15	FERC	ER03-765	Oneta Energy Center	Ancillary Service Rate
16	FERC	ER06-1128	Mankato Energy Center	Ancillary Service Rate
17	NY Bankruptcy Court	05-60200 (BRL) 06-01683 (BRL)	Nevada Power	Law Suit
18	Missouri Public Service Commission	EA-2016-0358	Grain Belt Express Clean Line LLC	Certificate of Convenience and Necessity
19	Missouri Public Service Commission	EM-2019-0150	Grain Belt Express Clean Line LLC	Application for Approval of Acquisition
20	Kansas Corporation Commission	19-GBEE-253-ACQ	Grain Belt Express Clean Line LLC	Application for Approval of Acquisition

Existing and Proposed HVDC Ties

Expected Operations of Pecos West

- Bidirectional transfer between ERCOT and El Paso
- Primarily utilized to export power from ERCOT to El Paso
- Initial studies indicate >1.5M MWh/year exported and >300k MWh/year imported
- Low capacity factor utilization belies that the line is being used in ~44% of hours in the year

New ties	MW	Import CF	Export CF	Total
Pecos West	1,500	2.6%	11.7%	14.3%
Existing ties – operation in 2021*				
DC East	600	17%	4%	21%
DC North	220	39%	6%	45%
Railroad	300	4%	2%	6%
Eagle Pass	36	0%	0%	0%
Laredo	100	3%	9%	12%
	1,256			



* Existing tie utilization based on 2021 operating data from ERCOT; historical tie operational data on next page

Existing HVDC Ties Operational History

Import Capacity Factor to ERCOT

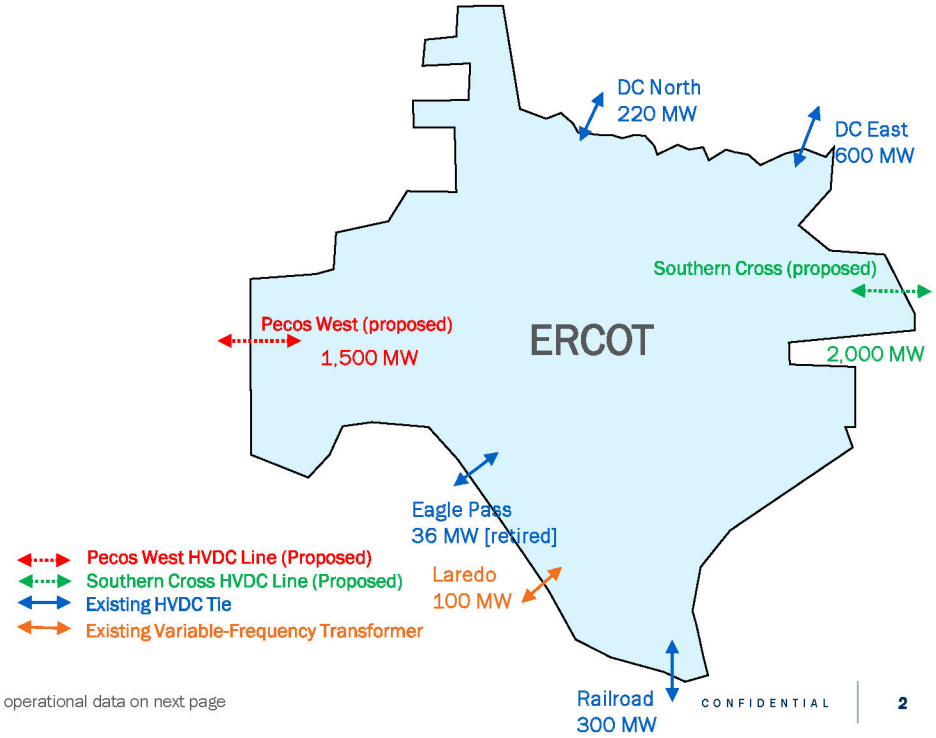
	Eagle Pass	East	North	Railroad	Laredo
2017	14%	5%	18%	29%	25%
2018	12%	4%	12%	27%	51%
2019	8%	4%	10%	27%	36%
2020	1%	2%	7%	2%	11%
2021	0%	4%	6%	2%	9%

Export Capacity Factor from ERCOT

	Eagle Pass	East	North	Railroad	Laredo
2017	0%	6%	21%	0%	0%
2018	0%	25%	35%	1%	1%
2019	1%	22%	44%	2%	2%
2020	1%	18%	29%	5%	3%
2021	0%	17%	39%	4%	3%

Total Capacity Factor

	Eagle Pass	East	North	Railroad	Laredo
2017	14%	11%	39%	29%	26%
2018	12%	29%	47%	28%	52%
2019	9%	26%	54%	29%	38%
2020	1%	20%	36%	7%	14%
2021	0%	21%	45%	6%	12%



* Existing tie utilization based on 2021 operating data from ERCOT; historical tie operational data on next page

HVDC Bi-Pole El Paso Electric - ERCOT

Grid United LLC

May 3, 2022

Agenda

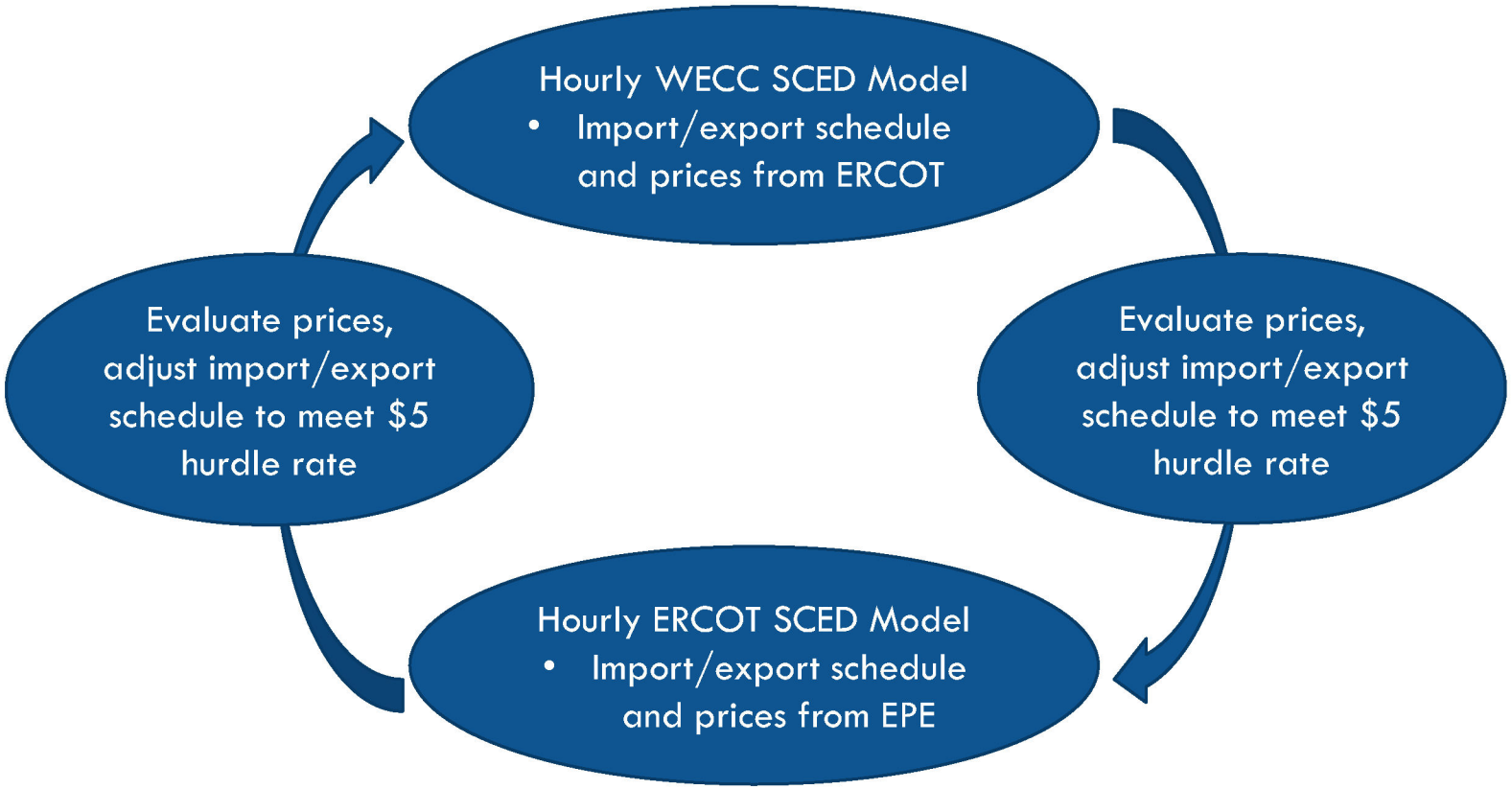
- Methodology
- Results
  - Binding constraints
  - Capacity Factors
  - Annual Production Cost Summary
- ERCOT Assumptions
  - Queue
  - Demand
- EPE Assumptions
  - Queue
  - Demand

Methodology

- nFront performed Security Constrained Economic Dispatch ("SCED") on the ERCOT system and EPE-WECC system.
- Grid United's HVDC tie was modeled for up to 1,500 MW bidirectional transfer between Bakersfield 345 kV (ERCOT) and Caliente 345 kV (EPE), performed for a single 2027 Case year.
- The Transfer required price differential greater than $5 from ERCOT and EPE to allow Import/Export.
- Iterative analysis to determine Import and Export without violating required minimum price limit.

Methodology

- WECC and ERCOT modeled independently with import/export schedules on the tie passed back and forth between them
- Modeled in a "status quo" world: WECC balancing authorities schedule and coordinate subject to OATT hurdle rates. Limited zero-cost inter-BA transfer capability available during dispatch to simulate CAISO-EIM participation
- Objective: maximize total benefit of the tie subject to $5 hurdle rate out of both ERCOT and EPE



Limitations

- Modeled the HVDC tie as a transactional wheel (a hurdle), not as a fixed/sunk cost
  - If modeled as a fixed sunk cost, results would improve, e.g. more production cost savings
- No losses were assumed across the HVDC tie
- Not an evaluation of interconnection/transmission service availability
  - No AC power flow evaluating voltage, credible double continencies, etc. (only DC power flow for N-0 and N-1)
  - No stability, short circuit, harmonics, EMTP, etc.
- Did not seek to optimize the size or interconnection location of the tie
- Additional benefits to reliability not considered, e.g., reduced LOLE to both ERCOT and EPE, ability to transact operating reserves, etc.
- Changes to large scale transmission, Carbon costs in either market that would impact MEC or ERCOT West GTC increases would have material impact on results presented.

Results

nFRONT CONSULTING LLC
Power Industry Planners • Analysts • Advisors

Annual Production Cost

- Both ERCOT and El Paso Electric see reductions in annual production cost (APC)
- Majority of flows are out of ERCOT and into EPE

Direction	MWh
EPE to ERCOT	344,920
ERCOT to EPE	1,539,419

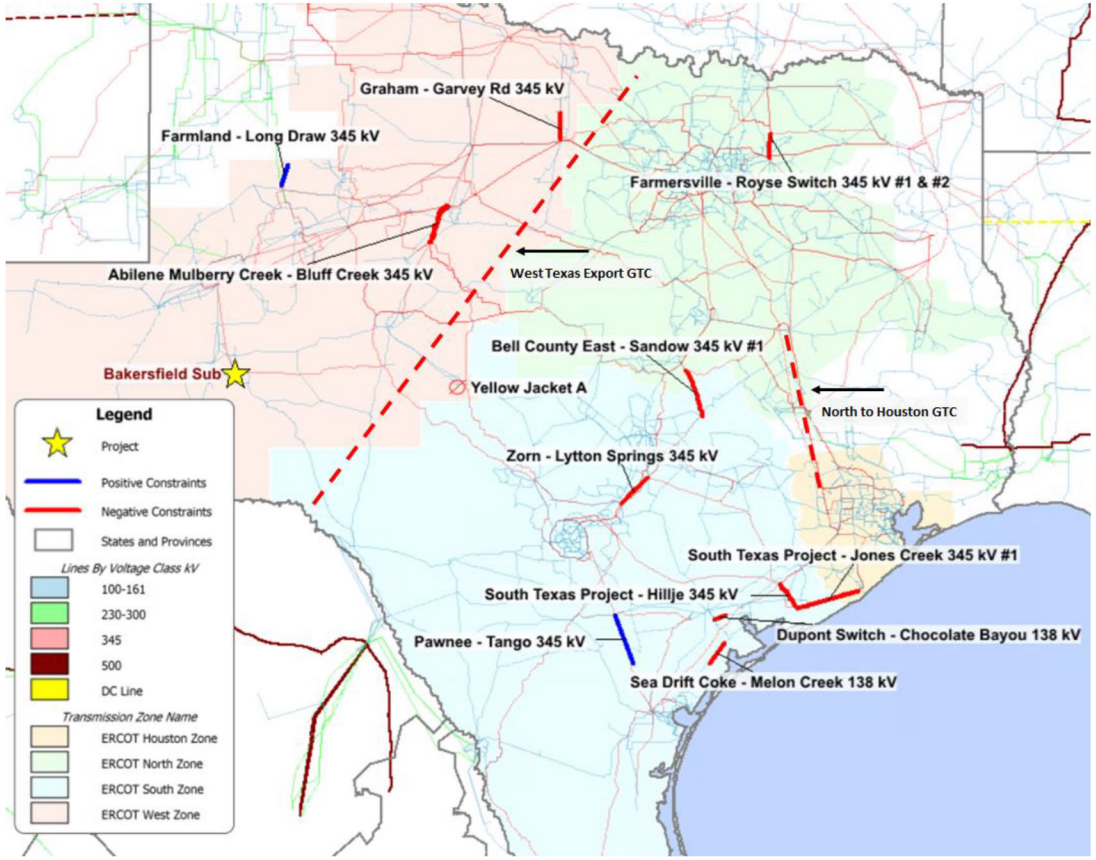
El Paso Electric	
Base Case Annual Production Cost (no HVDC)	$225,426,878
Change Case Annual Production Cost (with HVDC)	$180,575,521
Gross APC Savings	**$44,851,357**
Revenue from Exported Energy	$3,639,936
Cost of Imported Energy	($16,263,212)
ERCOT Export Charge (Imported Energy)	($7,697,097)
EPE Through & Out Charge (Exported Energy)	$1,724,600
Net Savings	**$26,255,584**

ERCOT	
Base Case Annual Production Cost (no HVDC)	$5,187,796,311
Change Case Annual Production Cost (with HVDC)	$5,154,597,118
Gross APC Savings	**$33,199,193**
Cost of Imported Energy	($3,639,936)
Revenue from Exported Energy (to generators)	$16,263,212
EPE Through & Out Charge (Imported Energy)	($1,724,600)
ERCOT Export Charge (Exported Energy)	$7,697,097
Net Savings	**$51,794,966**

ERCOT – Constraints

- HVDC exports from ERCOT reduce congestion on the West Export Generic Transmission Constraint.

Top Constraints Impacting Node LMP ($/MWh)					
Positive: Increase in LMP					
Negative: Decrease in LMP					
Rank	**Constraint**	**Pool From**	**Pool To**	**Base**	**Change**
1	West Texas Export	N/A	N/A	($3.26)	($2.85)
2	North to Houston GTC	N/A	N/A	($0.40)	($0.40)
3	South Texas Project - Hillje 345 kV	ERCOT-S	ERCOT-S	($0.05)	($0.05)
4	Zorn - Lytton Springs 345 kV	ERCOT-S	ERCOT-S	($0.04)	($0.03)
5	Farmland - Long Draw 345 kV	ERCOT-W	ERCOT-N	$0.07	$0.08
6	Pawnee - Tango 345 kV	ERCOT-S	ERCOT-S	$0.06	$0.06
7	Sea Drift Coke - Melon Creek 138 kV	ERCOT-S	ERCOT-S	($0.03)	($0.03)
8	South Texas Project - Jones Creek 345 kV #1	ERCOT-H	ERCOT-S	($0.02)	($0.02)
9	Yellow Jacket Phase Shifter	ERCOT-W	ERCOT-W	($0.02)	($0.01)
10	Farmersville - Royse Switch 345 kV #2	ERCOT-N	ERCOT-N	($0.01)	($0.01)
11	Farmersville - Royse Switch 345 kV #1	ERCOT-N	ERCOT-N	($0.01)	($0.01)
12	Dupont Switch - Chocolate Bayou 138 kV	ERCOT-S	ERCOT-S	($0.01)	($0.01)
13	Graham - Garvey Rd 345 kV	ERCOT-W	ERCOT-W	($0.00)	($0.00)
14	Abilene Mulberry Creek - Bluff Creek 345 kV	ERCOT-W	ERCOT-W	($0.01)	($0.01)
15	Bell County East - Sandow 345 kV #1	ERCOT-S	ERCOT-N	($0.00)	($0.00)



ERCOT – Thermal/Renewable, Prices

- New HVDC exports from ERCOT reduce ERCOT renewable curtailment by over 700,000 MWh, increase thermal output by over 400,000 MWh, and have a minimal impact on hub-level LMP

Technology	Base Curtailment (MWh)	Change Curtailment (MWh)	Reduction (MWh)
Wind	3,518,215	2,966,480	551,735
Solar	2,168,789	2,001,369	167,420

Simple Average LMP Changes			
Hub	Base Case	Change Case	Increase/(Decrease)
HB_WEST	$24.84	$25.10	$0.26
HB_NORTH	$28.45	$28.35	($0.10)
HB_HOUSTON	$30.58	$30.51	($0.07)
HB_SOUTH	$29.02	$28.95	($0.07)

Region	Base Thermal Generation (MWh)	Change Thermal Generation (MWh)	Increase/(Decrease)
Total ERCOT	276,074,963	276,507,341	432,378
West Zone	11,230,761	11,413,074	182,313

EPE – Constraints

- Addition and utilization of the HVDC tie has a minimal impact on transmission constraints affecting the EPE system

Top Constraints Impacting Node LMP ($/MWh)					
Positive: Increase in LMP					
Negative: Decrease in LMP					
Rank	**Constraint**	**Pool From**	**Pool To**	**Base**	**Change**
1	Newman 345/115kV Xfmr	EPE BA	EPEBA	$0.12	$0.13
2	Path 47 Interface	PNMBA	EPEBA	$0.00	$0.00
3	Hidalgo - Greenlee 345kV	EPE BA	TEPCBA	$0.00	$0.00
4	Bernardo - Belen 115kV	WACMBA	PNMBA	$0.00	$0.00
5	Four Corners - Arroyo 345kV	APSBA	PNMBA	$0.00	$0.00
6	TOT 4A	PACEBA	WACMBA	$0.00	$0.00

EPE Thermal fleet

- Minimal changes to EPE's thermal generation fleet utilization thermal fleet between the base and change cases
- Montana Power Station does not show a historical per-unit breakdown
- Must Run units included in model for system reliability

Generator	Historical CF	Base Case CF	Change Case CF	Increase/(Decrease)	Retirement Date
Copper Unit 1	5.94%	2.07%	1.25%	(0.8%)	
Luna Combined Cycle	61.56%	62.31%	61.02%	(1.3%)	
Milagro Cogen A	0.00%	0.00%	0.00%	0.0%	3/1/2016
Milagro Cogen B	0.00%	0.00%	0.00%	0.0%	3/1/2016
Montana GT1	26.21%	10.31%	8.42%	(1.9%)	
Montana GT2	26.21%	9.84%	8.15%	(1.7%)	
Montana GT3	26.21%	8.41%	6.84%	(1.6%)	
* Montana GT4	26.21%	28.43%	26.94%	(1.5%)	
Newman Unit 1	37.97%	0.00%	0.00%	0.0%	1/1/2023
Newman Unit 2	37.97%	0.00%	0.00%	0.0%	1/1/2023
Newman Unit 3	37.97%	0.00%	0.00%	0.0%	1/1/2023
Newman GT6		8.93%	8.74%	(0.2%)	
Newman CC1	46.31%	0.00%	0.00%	0.0%	12/1/2026
* Newman CC5	46.31%	54.65%	53.33%	(1.3%)	
Rio Grande Unit 7	28.36%	0.00%	0.00%	0.0%	12/1/2023
* Rio Grande Unit 8	28.36%	24.75%	24.74%	(0.0%)	
* Rio Grande Unit 9	34.54%	31.63%	30.15%	(1.5%)	
*** Must Run**					

Assumptions

nFRONT CONSULTING LLC
Power Industry Planners • Analysts • Advisors

ERCOT Demand – Peak – Natural Gas

	2022	2023	2024	2025	2026	2027	2028
Summer Peak Demand (based on normal weather)	78,084	79,857	81,239	82,408	83,574	84,506	85,391
plus: Energy Efficiency Program Savings Forecast	2,801	3,221	3,643	4,063	4,483	4,904	5,324
Total Summer Peak Demand (before Reductions from Energy Efficiency Programs)	80,884	83,079	84,882	86,471	88,057	88,520	89,686
less: Rooftop solar PV Forecast	-351	-529	-686	-827	-968	-1,108	-1,245
less: Load Resources providing Responsive Reserves	-1,591	-1,591	-1,591	-1,591	-1,591	-1,591	-1,591
less: Load Resources providing Non-Spinning Reserves	0	0	0	0	0	0	0
less: Emergency Response Service (10- and 30-min ramp products)	-895	-925	-925	-925	-925	-925	-925
less: TDSP Standard Offer Load Management Programs	-270	-270	-270	-270	-270	-270	-270
less: Energy Efficiency Program Savings Forecast	-2,801	-3,221	-3,643	-4,063	-4,483	-4,904	-5,324
Firm Peak Load, MW	74,977	76,542	77,767	78,795	79,819	79,722	80,331
Source: Dec 2021 CDR							

Year	Henry Hub	HSC	Carthage	TETCO STX	Waha
2021	3.32	3.69	3.25	3.27	3.20
2022	4.41	4.40	4.36	4.40	4.18
2023	3.47	3.44	3.39	3.45	3.09
2024	3.17	3.12	3.08	3.12	2.77
2025	3.02	2.98	2.93	2.98	2.62
2026	2.99	2.94	2.89	2.95	2.60
2027	3.01	2.96	2.92	2.97	2.62
2028	3.08	3.04	3.00	3.04	2.69

Source: ERCOT – S&P Global

ERCOT Renewable Generation

- nFront includes wind that has an executed Interconnection Agreement (IA) and posted Sufficient Financial Security (SFS).
- nFront's Solar buildout from 2022-2025 all have an executed IA and SFS and 2026-2028 there are several with executed IA and completed Full Interconnection Study.

Year	Fuel Type	Houston	North	South	West	Panhandle	Total
As of 1/1/2022	Wind	0	1,140	7,400	16,469	3,941	28,950
2021	Wind	0	1,140	7,400	16,469	3,941	28,950
2022	Wind	0	2,450	8,525	20,033	3,941	34,949
2023	Wind	0	2,750	9,095	21,475	3,941	37,261
2024	Wind	0	2,750	9,258	21,575	3,941	37,524
2025	Wind	0	2,950	9,258	21,830	3,941	37,979
2026	Wind	0	2,950	9,258	21,830	3,941	37,979
2027	Wind	0	2,950	9,258	21,830	3,941	37,979
2028	Wind	0	2,950	9,258	21,830	3,941	37,979

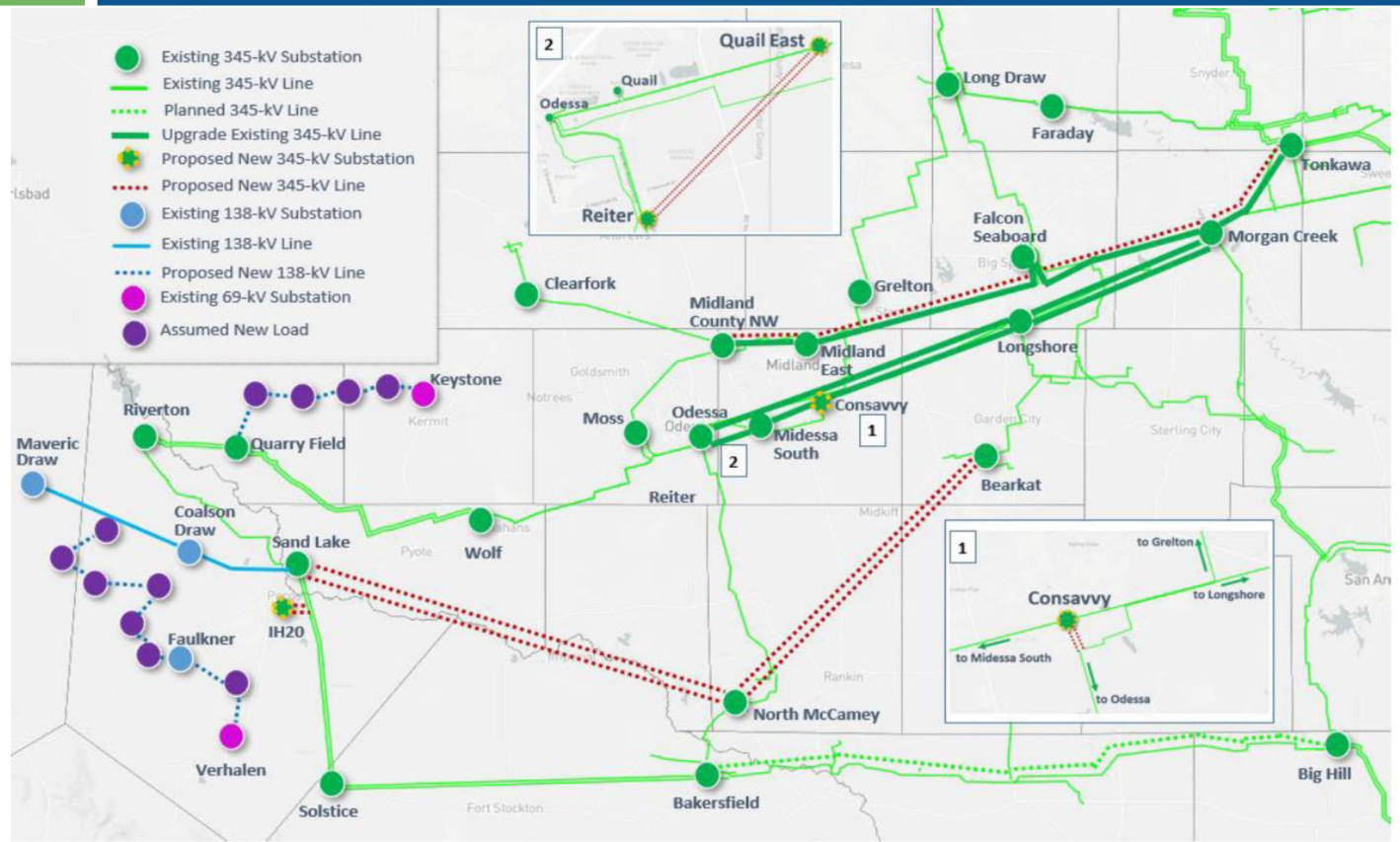
Year	Fuel Type	Houston	North	South	West	Panhandle	Total
As of 1/1/2022	Solar	122	679	463	6,753	240	8,257
2021	Solar	122	679	463	6,753	240	8,257
2022	Solar	561	1,443	1,249	7,065	240	10,557
2023	Solar	1,152	2,335	3,398	7,317	240	14,443
2024	Solar	1,473	4,185	6,142	8,032	490	20,322
2025	Solar	1,853	5,448	7,106	8,981	993	24,381
2026	Solar	1,853	6,312	7,889	9,779	993	26,827
2027	Solar	1,853	7,390	8,220	9,825	993	28,281
2028	Solar	1,853	7,390	8,220	9,825	993	28,281

- Wind as percentage with production tax credits as the roll off through the years.

Year	Houston	North	South	West	Panhandle	Total
2019	0%	73%	68%	42%	100%	58%
2021	0%	78%	79%	73%	100%	78%
2022	0%	95%	86%	80%	100%	85%
2023	0%	90%	84%	83%	100%	85%
2024	0%	90%	79%	84%	100%	85%
2025	0%	85%	79%	83%	73%	81%
2026	0%	81%	73%	77%	37%	72%
2027	0%	81%	66%	75%	25%	68%
2028	0%	72%	55%	69%	5%	60%

Source: nFront ERCOT

2021 Regional Transmission Plan (RTP)



Preferred Reliability Upgrades

- nFront assumed all proposed reliability upgrades are in-service for scenario performed in ERCOT.
- Upgrades are for load growth in ERCOT.
- ERCOT West GTC is being modeled at 12.45 GW transfer.

Source: ERCOT RTP

ERCOT Gas Forecast – S&P Global

- nFront utilizes the Gas forecast released quarterly from S&P Global.

Year	Henry Hub	HSC	Carthage	TETCO STX	Waha
2021	3.32	3.69	3.25	3.27	3.20
2022	4.41	4.40	4.36	4.40	4.18
2023	3.47	3.44	3.39	3.45	3.09
2024	3.17	3.12	3.08	3.12	2.77
2025	3.02	2.98	2.93	2.98	2.62
2026	2.99	2.94	2.89	2.95	2.60
2027	3.01	2.96	2.92	2.97	2.62
2028	3.08	3.04	3.00	3.04	2.69

Source: S&P Global

EPE Demand – Peak – Natural Gas

Table 5: El Paso Electric Company's amended 2021 Integrated Resource Plan Energy Demand Forecast								
	2021	2022	2023	2024	2025	2026	2027	2028
System Peak (MW)	2,121	2,155	2,177	2,190	2,216	2,240	2,269	2,292
Energy Demand (GWh)	8,772	8,905	8,989	9,058	9,131	9,221	9,325	9,435

Henry Hub	1	2	3	4	5	6	7	8	9	10	11	12	Annual Average
2022	6.07	5.95	5.52	4.00	3.82	3.86	3.90	3.90	3.88	3.91	3.99	4.14	4.41
2023	4.22	4.14	3.82	3.21	3.13	3.18	3.23	3.24	3.23	3.27	3.38	3.58	3.47
2024	3.69	3.63	3.39	2.95	2.91	2.95	2.99	3.00	2.99	3.02	3.13	3.35	3.17
2025	3.46	3.39	3.20	2.82	2.79	2.83	2.87	2.89	2.88	2.91	3.02	3.23	3.02
2026	3.34	3.30	3.13	2.78	2.76	2.81	2.86	2.87	2.87	2.91	3.02	3.24	2.99
2027	3.35	3.31	3.16	2.82	2.81	2.85	2.89	2.89	2.89	2.92	3.04	3.27	3.01
2028	3.40	3.36	3.22	2.88	2.87	2.91	2.96	2.96	2.97	3.00	3.12	3.35	3.08

GDel:New Mexico	1	2	3	4	5	6	7	8	9	10	11	12	Annual Average
2022	4.30	4.11	3.81	3.10	2.97	3.01	3.19	3.22	3.18	3.08	3.28	3.60	3.40
2023	3.75	3.63	3.31	2.72	2.66	2.71	2.91	2.91	2.81	2.78	3.09	3.33	3.05
2024	3.43	3.36	3.17	2.59	2.56	2.61	2.78	2.81	2.73	2.70	3.06	3.33	2.93
2025	3.42	3.35	3.18	2.60	2.58	2.61	2.82	2.82	2.74	2.70	3.05	3.30	2.93
2026	3.41	3.34	3.16	2.61	2.57	2.62	2.82	2.84	2.74	2.72	3.10	3.36	2.94
2027	3.47	3.40	3.23	2.65	2.62	2.66	2.85	2.85	2.78	2.74	3.11	3.38	2.98
2028	3.51	3.43	3.24	2.68	2.64	2.70	2.89	2.89	2.84	2.79	3.18	3.44	3.02

Source: EPE IRP – S&P Global

EPE Renewables

- EPE system includes growth from the EPE IRP for Solar and Wind.

Queue Number	County	State	Physical BA	Ownership BA	MW	ISD	Status	2027 Base
Hatch Solar Energy Center: PV1	Doña Ana	NM	EPE BA	EPE BA	5	IS	IS	5
Las Cruces Centennial Solar Farm: PV	Doña Ana	NM	EPE BA	EPE BA	12	IS	IS	12
Macho Springs Solar Facility	Luna	NM	EPE BA	EPE BA	50	IS	IS	50
Roadrunner Solar Electric Facility: PV1	Doña Ana	NM	EPE BA	EPE BA	20	IS	IS	20
SunE EPE1: PV1	Otero	NM	EPE BA	EPE BA	11	IS	IS	11
SunE EPE2: PV	Doña Ana	NM	EPE BA	EPE BA	13	IS	IS	13
EPE_LG-19-9 -1	Doña Ana	NM	EPE BA	EPE BA	100	1/2024	GIA	100
EPE_LG-19-9-2	Doña Ana	NM	EPE BA	EPE BA	50	1/2024	GIA	50
EPE_LG-21-9-3	Bernalillo	NM	EPE BA	EPE BA	150	1/2023	Early	100
EPE_LG-21-9-5	Bernalillo	NM	EPE BA	EPE BA	150	1/2025	Early	150
EPE_SG-19-11-1	Dona Ana	NM	EPE BA	EPE BA	20	1/2023	GIA	20

Queue Number	County	State	Physical BA	Ownership BA	MW	ISD	Status	2027 Base
Gen_Pinal2		NM	SRP BA	EPE BA	NA	1/2025	NA	203

Source: EPE IRP