Brattle

Representative Drew Darby
Texas House of Representatives
P.O. Box 2910
Austin, Texas 78768

April 21, 2023

Dear Representative Darby,

Thank you for reaching out to us about how to improve transmission planning in Texas. We have been deeply involved in developing and improving transmission planning processes in Texas and the rest of the country over the past 20 years. Over that time, we have worked closely with stakeholders across the electric power industry on these issues, including ERCOT and other system operators, as well as the Midcontinent ISO and Southwest Power Pool, state agencies, electric utilities, transmission developers, and generation developers.

We provide responses to each of your questions in the remainder of this letter.

1. ***Please briefly summarize the key findings of the 2013 ERCOT report and discuss what recommendations were adopted by ERCOT or the Public Utility Commission of Texas (PUCT).***

We were engaged by ERCOT in 2013 to review its processes for evaluating long-term economic transmission projects and prepare recommendations on how to better estimate the economic value that transmission projects provide to the system. Based on interviews with ERCOT stakeholders and staff, review of the existing planning processes, and comparison to industry best practices, we recommended five improvements to ERCOT's planning process:[1]

- **Recommendation 1: Link near-term and long-term planning processes**: ERCOT should more systematically link its long-term (LTSA) transmission planning process to its near-term Regional Transmission Plan (RTP) process. Specifically, ERCOT should use the results of its long-term studies to identify and evaluate economic projects within the

[1] The Brattle Group, Recommendations for Enhancing ERCOT's Long-Term Transmission Planning Process, prepared for ERCOT, October 2013.

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RTP process for possible approval. Estimating both the costs and benefits (i.e., cost savings) of economic projects over a significant portion of their operating life will improve the evaluation of project's value.

- **Recommendation 2: Evaluate economic projects based on their net present value (NPV) or a comparison of "levelized" annual benefits and costs:** For evaluating transmission projects, ERCOT should estimate both benefits and costs over a 20 to 40 year period and compare either (a) the present value of a project's benefits (i.e., cost savings) to the present value of its cost or (b) the "levelized" annual benefits and costs. These approaches are successfully used by all other system operators for evaluating the cost effectiveness of transmission projects over their operating life.
- **Recommendation 3: Expand the scope of transmission-related cost savings and other benefits considered and quantified:** ERCOT should more comprehensively estimate the economic value offered by transmission projects by expanding the cost savings and other economic benefits of transmission projects considered in its planning studies. Specifically, ERCOT should improve its approach to estimating "production cost savings" and incorporate several additional benefit metrics associated with more holistically-planned transmission projects, such as the ability of some (larger) transmission projects to defer or avoid having to build (smaller) reliability projects in the future.
- **Recommendation 4: Improve the use of scenarios and sensitivities:** Recognizing that the future is uncertain, ERCOT should improve its use of scenarios and sensitivities in its long-term planning process. Well-specified scenarios will help ERCOT evaluate the need for and benefits of transmission projects under a range of plausible futures in order to improve the robustness of its transmission plans. The scenario development process should be a stakeholder-driven process that incorporates a wide range of views on the future of the state's economy and energy industry and produces several plausible future outcomes in terms of load growth, generation resources, and fuel prices.
- **Recommendation 5: Enhance the process for identifying projects and the benefits/costs associated with specific projects:** ERCOT should establish a structured process that allows market participants to propose candidate economic projects. Market participants would identify the proposed projects' likely benefits and costs and why the project is expected to offer the identified cost savings and other benefits. ERCOT could then prioritize the proposed projects with stakeholder input and undertake benefit-cost analysis to determine whether a proposed project meets its economic planning requirements.

Following our report, ERCOT engaged our team to implement Recommendation 4. We assisted ERCOT in facilitating a series of workshops with ERCOT staff and its stakeholders to identify future uncertainties, evaluate key drivers of transmission needs, and define several plausible scenarios.[2] The process resulted in the development of 10 scenarios for the 2014 LTSA and ERCOT has continued to update the scenarios during subsequent LTSA studies.

In line with Recommendation 3, ERCOT developed an approach in 2017 to estimate the benefits of potentially cost effective transmission projects under several historical weather conditions and accounting for transmission outages.[3] However, we are not aware of this approach has actually being implemented in ERCOT planning studies since it was developed.

ERCOT has not implemented the recommendations to link the near-term and long-term planning processes (Recommendation 1), quantify the benefits and costs over a 20 to 40 year period (Recommendation 2), improve estimates of "production cost savings" and expand the scope of other cost savings and benefits considered and quantified beyond the proposed changes noted above (Recommendation 3), or enhance its process for identifying potential economic projects (Recommendation 5).

In 2022, ERCOT completed a study of the longer-term cost savings of transmission projects that would resolve the West Texas export limit, which currently is the largest source of congestion on the ERCOT system. The study incorporated assumptions from the LTSA "Current Trends" Scenario to estimate 2030 production cost savings of several transmission projects designed to resolve congestion and reliability issues caused by growth in exports from West Texas. The study provides an example of what ERCOT could do in its RTP to leverage the LTSA scenarios to improve the linkage between the near-term and long-term (Recommendation 1). However, the study stopped short of calculating the cost effectiveness of the proposed upgrades over a longer-term timeframe using either the present value or levelized approach to quantifying long-term costs and benefits (Recommendation 2), nor did it improve ERCOT's process of estimating production cost savings or quantify other cost savings and benefits (Recommendation 3).[4]

[2] The Brattle Group, Stakeholder-Driven Scenario Development for the ERCOT 2014 Long-Term System Assessment, prepared for ERCOT, September 2014.

[3] ERCOT, Impact of Weather Uncertainty and Transmission Outages on Economic Project Evaluations, Version 3.0, June 2018.

[4] ERCOT, Long-Term West Texas Export Study, January 2022.

2. ***ERCOT has two types of transmission projects—reliability-driven and economic-driven. Texas has only seen two economic projects built since 2012, which indicates a failure in the process. Please describe how reliance only on reliability projects increases costs for Texas consumers. Please communicate why economic transmission planning is used in all markets and how we might specifically improve the ERCOT process, while still ensuring reliability?***

Maintaining the reliability of the power system has been and will continue to be the primary role of transmission planners at ERCOT. However, relying solely on the near-term reliability planning process and the generation interconnection process to upgrade the transmission system will result in higher costs to consumer compared to a planning process that incorporates a comprehensive view of the cost savings and other economic benefits of transmission projects.

The purpose of the economic planning process is to identify transmission projects that, in addition to addressing reliability needs, will also reduce the overall costs for serving customers. Reliability-focused planning does not consider similar opportunities to reduce overall costs. Therefore, relying solely on reliability planning will not result in the most cost effective buildout of the transmission system. For this reason, ERCOT and other markets across the U.S. have supplemented reliability-focused planning with economic planning processes.

However, ERCOT's economic planning process does not identify all the potential cost effective transmission projects because it: (a) only identifies a subset of the potential cost savings that transmission projects can provide and (b) compares only the first-year cost savings (which tend to increase over time) to the first-year costs of transmission projects (which decline over time) despite the fact that these projects will be in service for 40 or more years.

As outlined in the 2013 report, ERCOT can improve its economic planning process by (1) estimating more comprehensively the production cost savings of transmission, especially by simulating high-stress market conditions when the cost of inadequate transmission is particularly high, such as a heat wave or a cold snap, (2) recognizing and quantifying additional cost savings and other economic benefits of transmission projects, such as reduced energy losses, avoided reliability transmission projects, and reduced generation investment costs, (3) estimating the long-term cost savings of transmission projects over 20 to 40 years, and (4) comparing the long-term cost savings to the long-term project costs for identifying and approving cost effective projects.

3. ***Please explain the value of production cost savings analysis and briefly discuss its use in other markets across the country. Concerns have been raised in discussions in the Texas Legislature that production cost savings are difficult to quantify more than a few years out and are somehow "subjective." In your response, please address whether production cost savings can be readily quantified and how other markets have addressed quantifying these benefits over longer time horizons. Are there any studies or analyses in other markets that have quantified at the time that the transmission project or projects were approved?***

The term "production cost savings" refers to the fuel and other variable operating costs of generators in ERCOT. Production cost savings occur when new transmission projects reduce system congestion and allow generation resources with lower production costs to displace generation resources with higher production costs. Production cost savings are a standard cost savings metric evaluated in economic transmission planning processes in ERCOT and other markets. In ERCOT and in many other regions it is the only type of cost savings routinely quantified for new transmission projects.

System operators estimate production cost savings by simulating the generation dispatch of the market for future years with simulation models that are a detailed representation of the power grid, with highly realistic representations of all of the region's generation resources and transmission lines. The ability of the production cost models to capture the full production cost savings of proposed transmission projects depends on the extent to which the models reflect the real-world market conditions that create congestion and increase costs to customers. For example, the simulation models used by ERCOT and many other grid operations only consider "normal" weather conditions in the presence of a fully available transmission grid, without reflecting the more stressed conditions that the power grid has to handle during heat waves, cold snaps, or during planned and unplanned transmission outages. A recent national laboratory report found that 50% of congestion-related cost occurred during only 5% of all hours in a year when the system is the most stressed.[5] Because ERCOT's production cost simulations do not incorporate such stress conditions when most of the cost savings of transmission would occur, the simulation results therefore do not fully capture the potential cost savings of transmission.

More realistic production cost simulations also require developing assumptions about future market conditions. While the exact future market conditions are not known today, system

[5] Millstein, et al., Empirical Estimates of Transmission Value using Locational Marginal Prices, Lawrence Berkeley National Laboratory, August 2022.

operators across the country have developed stakeholder-approved approaches for creating more realistic scenarios of future market conditions.

Both SPP and MISO have approved significant portfolios of cost effective transmission upgrades based on their evaluation of forecasted cost savings over 20 or more years using these scenarios. For example, MISO approved $10 billion of projects in its 2022 Long Range Transmission Plan (LRTP) Tranche 1 process based on cost savings over 20 years,[6] and SPP approved $1 billion of projects in its 2021 planning study that quantified cost savings for 40 years.[7]

SPP has undertaken additional efforts to ensure that the forecasted cost savings identified in their planning studies actually are realized for their customers. In 2015 and 2021, SPP performed studies of recently-approved projects to estimate the costs savings they provide under actual market conditions, including heat waves, cold snaps, and transmission outages. In their 2021 study, SPP found that transmission projects installed from 2015 to 2019 provide over $27 billion of cost savings and other benefits over 40 years compared to $5 billion in transmission costs.[8] SPP concluded that their planning-level forecast of these cost savings significantly underestimated the realized benefits of the projects.

The use of scenarios that cover the range of plausible future outcomes is an effective tool to address the fact that the future is uncertain. For example, MISO develops three future scenarios with varying demand and renewable energy penetration that it uses in its annual transmission planning studies.[9] SPP develops two future scenarios for its planning studies.[10] The system planners then run forward-looking market simulations based on the scenarios. Simulating the system based on one or more future scenario allows the system planners to forecast longer-term cost savings of transmission projects and test how those cost savings change under alternative future market conditions.

ERCOT already develops long-term scenarios of future market conditions through a stakeholder-driven process. For example, the 2022 LTSA included three scenarios (Current Trends, Expanded System Outlook, and Demand Side Evolution) that accounted for differences

6 MISO, LRTP Tranche 1 Portfolio Detailed Business Case, June 2022.

7 SPP Engineering, 2021 Integrated Transmission Planning: Assessment Report & Addendum, Version 2.0, December 2022, p. 1.

8 SPP Transmission Planning, The Value of Transmission: A 2021 Study and Report by the Southwest Power Pool, March 2022.

9 MISO, MISO Futures Report, December 2021.

10 SPP Engineering, 2021 Integrated Transmission Planning: Assessment Report & Addendum, Version 2.0, December 2022, pp. 13 – 14.

in forecasted demand and generation resource investments. Based on the assumptions in each scenario, ERCOT developed forecasts of the future generation mix and resources in the interconnection queue. This approach allows ERCOT to evaluate how the transmission system will need to evolve with expected (but uncertain) changes to the system. For example, in 2014, the LTSA forecasted 5 to 17 GW of solar would be built in the ERCOT system by 2029, despite less than 200 MW of solar capacity on its system at the time.[11] As of the end of 2022, there were 15 GW of solar operating on the ERCOT system.[12]

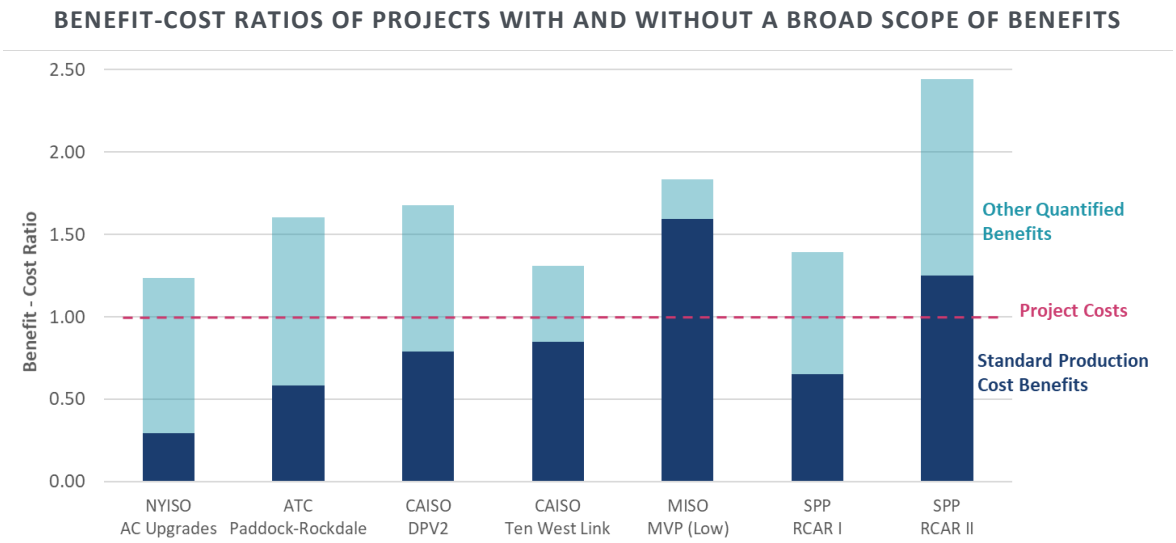
Unfortunately, the ERCOT Regional Transmission Plan (RTP) process does not consider the long-term benefits of transmission projects identified in the forward-looking LTSA scenarios and, therefore, misses the opportunity to evaluate and approve transmission projects that would reduce the overall system costs for serving customer demand and mitigate increases in customer costs. More proactive planning of the ERCOT system based on LTSA scenarios, if it had been implemented and was in place during the past nine years, likely would have identified transmission upgrades that cost-effectively resolve the largest source of congestion on the ERCOT system today and reduced overall costs to customers.

We recently summarized in a report titled *Transmission Planning for the 21st Century: Proven Practices that Increase Value and Reduce Costs* the experience gained by other system operators across the country to improve estimates of production cost savings and other cost savings.[13] In that report, we included the figure below that shows the total economic benefits that system planners quantified for several economic transmission projects, with the benefits broken out between standard production cost savings (dark blue bars) and other quantified benefits (light blue bars). The figure shows that the type of production cost savings estimated by ERCOT approximately understates by 50% the total costs savings offered by well-planned transmission projects.

[11] ERCOT, 2014 Long-Term System Assessment, December 2014.

[12] ERCOT, Fact Sheet: March 2023, March 2023.

[13] The Brattle Group and Grid Strategies, Transmission Planning for the 21st Century: Proven Practices that Increase Value and Reduce Costs, October 2021.



Source: The Brattle Group and Grid Strategies, Transmission Planning for the 21st Century: Proven Practices that Increase Value and Reduce Costs, October 2021

4. ***It is my understanding that the value of transmission benefits (or cost savings) grows over time while costs decrease. Please discuss your view on an appropriate time horizon over which to evaluate transmission costs and benefits. Describe the time horizon over which such costs and benefits are evaluated in other markets.***

Yes, the cost savings of cost-effective transmission projects tend to increase over time due to load growth, increasing fuel prices, and changing generation mix. For example, the cost savings for upgrades evaluated in the West Texas Export study increased by almost fivefold from $135 million in 2023 to $642 million in 2030 for Option 1.[14] However, that may not always be the case and, consequently, should be confirmed with forward-looking market simulations.

In contrast to benefits that increase over time, the regulated annual costs of transmission decrease over the life of the projects as their book value depreciates over time.

Given these trends in benefits and costs over time, relying solely on first-year costs and benefits will greatly understate the cost effectiveness of transmission projects. This is because doing so compares cost savings and other economic benefits when they are the lowest with annual project costs when they are the highest.

No other market in the U.S. uses a similar approach to evaluating the benefits and costs of transmission project. Across the country, system planners estimate the cost effectiveness of

[14] ERCOT, Long-Term West Texas Export Study, January 2022, p. v.

transmission projects over 15 to 50 years, with MISO and SPP using 20 years to 40 years.[15] As we recommended in the 2013 report referenced above, ERCOT should consider estimating benefits and costs over a 20 to 40 year period, consistent with the time horizon already used in SPP and MISO.

5. ***As I understand it, using a levelized approach to measuring costs and benefits is common practice in other markets. Levelized costs and benefits are currently required under rule in Texas. Please explain the importance of a levelized cost analysis of the costs and benefits of a proposed transmission project.***

As noted in earlier responses, identifying cost-effective transmission requires evaluating the long-term costs and benefits of transmission. To estimate the long-term benefits and costs over 20 or 40 years, system planners either calculate the discounted "present value" of the costs and benefits or calculate the "levelized" annual costs and benefits, which is required in Texas. The present value of benefits and costs are estimated as the sum of annual benefits and annual costs, both increasingly discounted over time to reflect the fact that a dollar spent or saved 10 or 20 years from now is significantly less valuable than a dollar saved or spent today. Levelized annual costs and benefits are calculated such that the present value of the levelized costs over time is equal to the present value of non-levelized costs over time. These levelized annual costs thus are similar to the "levelized" annual payments on home mortgages.

Because of how levelized annual costs are determined, comparing the benefits and costs using levelized annual values is equivalent to comparing the present values of benefits and costs. As long as benefits and costs are considered over a sufficient timeframe, either approach will consequently be able to correctly estimate the cost effectiveness of new transmission projects and be a significant improvement over the current approach in ERCOT of estimating and comparing only the first-year costs and first-year benefits.

But again, the crucial aspect of either a present value or a levelized approach is the timeframe over which the costs and benefits are estimated. If costs and benefits are estimated only over a short timeframe, such as only the first six years, then levelizing these costs accomplishes very little.

[15] System planner use the following timeframes for their long-term benefits analysis: MISO uses 20 years; SPP uses 40 years; PJM uses 15 years; NYISO uses 20 years; and CAISO uses 50 years.

6. ***Would proper, long-term economic planning benefit large, industrial consumers, oil and gas operators, and residential consumers across Texas? If so, why?***

Yes, long-term economic planning, when done well, identifies cost-effective transmission projects that will reduce overall costs for serving all customers, including large, industrial consumers, oil & gas operators, and residential customers. Economic projects reduce overall costs by reducing other system costs (e.g., generation-related costs, avoided reliability-only transmission investments) more than the costs of building and operating the transmission project.

Having a long-term perspective of system costs and transmission needs is important for selecting the transmission investments that address not only near-term needs but that also provide the lowest-cost solutions in the long term. For example, while a lower-capacity transmission upgrade may be more cost effective to address near-term reliability needs, a second or third lower-capacity upgrade may be necessary in the longer-term. The long-term planning analysis may show that building a higher-capacity transmission line may be by far the more cost-effective solution than addressing emerging reliability needs through several incremental solutions.

7. ***Can you identify any other reforms in the transmission planning process that would benefit Texas consumers?***

Yes, we have two additional recommendations that would benefit Texas consumers.

While the Texas Legislature and the PUCT can identify the framework for evaluating cost effective transmission, implementation of the framework by ERCOT requires significant effort and expertise. It is essential that ERCOT have the available resources, including staff and analytical tools, to complete the many requirements placed on it and plan for a reliable and cost effective system.

One aspect of transmission planning that requires particular expertise is the development and operation of improved production cost models that more accurately reflect real-world market conditions, especially those time periods (such as heat waves and cold snaps) when transmission is most valuable. ERCOT should complete ongoing studies to assess how well their production cost models are capturing such high-stress market conditions when transmission is most valuable and then identify improvements to its model and demonstrate to the PUCT and stakeholders that they are capturing the full economic value of transmission. Back-cast analyses

similar to SPP's Value of Transmission study are an option to do so. An alternative and more focused approach to model validation would be for ERCOT to attempt to replicate the market conditions of a recent historical year in the production cost models it uses for transmission planning.

Thank you for letting us provide our perspective and please feel free to reach out to us if you have any questions.

Sincerely,

Johannes P. Pfeifenberger

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