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REGIONAL TRANSMISSION RELIABILITY PLANS	§ § §	**PUBLIC UTILITY COMMISSION OF TEXAS**

AEP COMPANIES' COMMENTS ABOUT EXTRA HIGH VOLTAGE TRANSMISSION LINES TO THE ERCOT REGION

I. Introduction

AEP Texas Inc. (a wholly owned subsidiary of American Electric Power Inc. (AEP)) and Electric Transmission Texas, LLC (a joint venture between AEP and Berkshire Hathaway) (collectively "the AEP Companies") appreciate the opportunity to respond to these questions related to extra high voltage (EHV) lines in the Electric Reliability Council of Texas (ERCOT) region. Across its system, AEP has extensive experience operating and maintaining EHV transmission with over 8,000 miles of our 40,000-mile system operating above 300-kV. AEP currently operates 2,200 miles of 765-kV transmission lines and 115 miles of 500-kV transmission lines within the AEP footprint.

II. Comments

1. Please explain if your company has actual experience with planning, building and maintaining 500-kV or 765-kV lines and if so in what regions and projects?

a) In detail describe the specific projects including the voltage level, the total cost of the project including cost for underlying equipment and facilities to accommodate the new voltage level, year of construction, total time to complete the project from start to energize, length in miles, total cost by mile, if they were multi-State projects, location (specific routes) and ongoing expenses associated with these projects including but not limited to O&M.

AEP's transmission network consists of approximately 40,000 miles of transmission lines across 13 states, with over 8,000 miles of the system operated above 300-kV. AEP has extensive experience operating and maintaining EHV transmission.

- Approximately 2,200 miles of 765-kV transmission lines and 30 substations across six states in the Pennsylvania-New Jersey-Maryland Interconnection (PJM) and Midcontinent Independent System Operator (MISO) regions.

- Approximately 115 miles of 500-kV transmission lines and six substations across two states in PJM and one state in Southwest Power Pool (SPP).
- The following is a list of AEP's 765-kV and 500-kV transmission lines and their respective original in-service dates.

Transmission Line Name	In-Service Year	Voltage	State(s)
Kammer - Fort Martin (AEP Portion)	1965	500	WV
Cloverdale - Dooms (AEP Portion)	1965	500	VA
Big Sandy - Broadford	1967	765	KY/WV
Broadford - Sullivan (AEP Portion)	1968	500	VA
Baker - Broadford	1970	765	KY/WV
Jefferson - Dumont	1970	765	IN
Baker - Amos	1970	765	KY/WV
Jacksons Ferry - Cowans Ford (AEP Portion)	1970	500	VA
Baker - Don Marquis	1971	765	KY/OH
Amos - Kammer	1971	765	WV
Broadford - Jacksons Ferry	1971	765	VA
Dumont - Wilton Center (AEP portion)	1971	765	IN
Kammer - Dumont	1971	765	IN/OH/WV
Jacksons Ferry - Cloverdale	1973	765	VA
Dumont - Cook	1973	765	IN/MI
Gavin-Marysville	1973	765	OH
Culloden - Gavin	1973	765	OH/WV
Gavin - Mountaineer	1973	765	OH/WV
Amos - Gavin	1973	765	OH/WV
Gavin-Kammer	1973	765	OH/WV
Hanging Rock - Jefferson	1975	765	KY/IN/OH
North Proctorville - Hanging Rock	1975	765	OH
Rockport - Sullivan	1978	765	IN
Kammer - Mountaineer	1979	765	WV
Rockport - Jefferson	1980	765	IN
Kammer - South Canton	1980	765	OH/WV
Culloden - Wyoming	1980	765	WV
Axton - Jacksons Ferry	1984	765	VA
Jacksons Ferry - Wyoming	2006	765	VA/WV
Sorenson Extension	2016	765	IN
Greentown-Reynolds (AEP portion)	2018	765	IN

AEP's most recent major line construction project at 765-kV was the Greentown-Reynolds project, a 64-mile 765-kV line connecting the existing 765/230/138-kV Greentown substation near Kokomo, Indiana with a new 765/345-kV Reynolds substation in Reynolds, Indiana. The project was approved as part of MISO's Multi-Value Project (MVP) portfolio. AEP completed the project through partnerships with Northern Indiana Public Service Company (NIPSCo) and Duke Energy. The siting and routing process began in Q1 2014, and all routing and right-of-way acquisition was completed by Q4 of 2015. The project was then approved for construction by the Indiana Utility Regulatory Commission in 2016. Construction was completed in two years and the project energized in June of 2018. The total cost was $347M, of which approximately $240M was 765-kV transmission line cost ($3.75M per mile) and approximately $107M was substation cost at Reynolds and Greentown. Note that since Greentown was an existing substation, no transformers were required at that terminal.

The MISO 2024 Transmission Cost Estimation Guide has been referenced by ERCOT for evaluation of EHV options (500-kV or 765-kV) in recent studies. The guide differs from AEP's assumptions in certain ways, for example it assumes 225-feet for right-of-way width for 765-kV versus AEP's 200-foot standard, but it is a useful reference point for conceptual cost information. 500-kV, single-circuit transmission line costs are estimated in the range of $4.1M-$5.1M per mile. 765-kV single-circuit transmission line costs are estimated in the range of $5.2M-$6.3M per mile. Costs can vary widely depending on project-specific characteristics such as terrain, route, property values, environmental conditions, etc. However, in AEP's estimation the relative costs comparison across different voltage classes in the MISO guide is accurate.

2. Compared to the use of 345-kV transmission lines, what are the differences in procurement costs, engineering, life expectancy, and lead times for constructing 500-kV and 765-kV transmission lines. In addition, please explain in detail:

The same basic principles that apply to 345-kV line and component design apply to the higher voltages, but there are some differences that must be addressed. While the total cost of an individual EHV transmission asset may be higher than a 345-kV asset, the increased capability of the EHV system should also be considered since it will make it more economical than its 345-kV equivalent. As the voltage and conductor bundle sizes increase, larger clearances must be maintained which increases the size of the right-of-way, structures, and insulator assemblies per line. The effects of corona (electrical discharge) and audible noise must also be addressed through careful selection and laboratory testing of conductor, bundle spacing, and corona-free hardware. Properly designed and tested 765-kV and 500-kV insulator assemblies will have the same performance and service life as those of 345-kV and lower voltages. Structures, conductors, hardware, and foundations will also have the same service life regardless of operational voltage.

Material costs will increase relative to the amount of material required as the voltage increases. Similar conductors are used at each voltage class. 345-kV transmission lines usually have two conductors per phase. 500-kV may have two, three, or four conductors per phase, and 765-kV may have four or six conductors per phase. The increase in conductor cost is directly proportional to the number of conductors in the bundle. This increase in cost is partially offset by the accompanying benefits of lower impedance and energy losses, and higher load carrying capability of the line (Note that the more conductors per phase, the lower the impedance and the higher the capacity for the line). AEP currently has four approved conductor suppliers covering all voltage levels. Assuming manufacturing capacity is available, lead time from receipt of purchase order to start of delivery will be the same regardless of voltage.

Insulator assemblies are larger for higher voltage lines and the costs are proportional to the voltage level. AEP has three approved suppliers for insulators at 500-kV and 765-kV and four approved suppliers for the associated hardware. Assuming manufacturing capacity is available, lead time from receipt of purchase order to start of delivery will be the same for 500-kV insulator assemblies as 345-kV. The lead time from receipt of order to start of delivery for 765-kV insulator assemblies may be greater than 345-kV due to the additional corona mitigation requirements, but are generally not a critical path item.

The unit cost of steel ($/pound) will be the same regardless of voltage, but total cost will be larger for higher voltages or double-circuit structures because of the extra material required. AEP currently has three approved tubular steel suppliers and five approved latticed steel suppliers. Generally, AEP expects the lead time from receipt of purchase order to start of delivery will be the same regardless of voltage.

a) Are there different average Right of Way width requirements?

Right-of-way widths can vary depending on conductor span length. Minimum widths must maintain National Electric Safety Code (NESC) clearances to structures or objects located outside of the right-of-way under certain ambient temperature and wind speed conditions. AEP typically uses 150-feet for 345-kV single- and double-circuit transmission lines, 175-feet for 500-kV single-circuit transmission lines, and 200-feet for 765-kV single-circuit transmission lines.

However, it is critical to consider the exceptionally large load carrying needs faced by the ERCOT Region and, compare the right-of-way requirements in terms units of capability provided, such as a least cost megawatt (MW)-per-mile basis. For example, a single 100-mile 765-kV circuit would require a right-of-way corridor of approximately 2,424 acres. An equivalent load carrying capability at 500-kV would require three such circuits, totaling approximately 6,364 acres, and at 345-kV would require the equivalent of six circuits and approximately 10,909 acres of right-of-way. This equates to overall cost savings in material and construction costs, right-of-way acquisition, etc.

b) Are there any ancillary devices such as additional dynamic reactive devices that would be required? Please provide the estimated costs for these devices.

No dynamic reactive devices would be required. In fact, higher-voltage transmission could eliminate the need for series compensation, which has been shown to have problematic interactions with generating units. We are not aware of an instance where series compensation has ever been needed at 765-kV in the U.S.; however, it has been applied at 500-kV and 345-kV.

3. Compared to the use of 345-kV transmission lines, what are the differences in procurement costs, engineering, life expectancy, and lead times for constructing 500-kV and 765-kV transmission substations?

AEP has existing standard 500-kV and 765-kV substation designs in place. Similar to transmission lines, for both 500-kV and 765-kV, there will be slightly higher procurement costs due to the physical size of the structures (e.g., slightly taller structure height, wider phase spacings, etc.). However, there is no difference between 345-kV, 500-kV, or 765-kV in terms of engineering complexity or life expectancy. Lead times for constructing 500-kV and 765-kV transmission substation structures are similar, primarily because both voltage levels utilize tapered tubular structural shapes.

AEP has long-standing relationships with equipment vendors and is able to leverage those relationships to provide competitive pricing and delivery time for EHV projects. AEP currently has multiple manufacturers under contract capable of producing 765-kV structures and equipment.

AEP's blanket contracts with each vendor provides benefits such as: negotiated terms and conditions, established progress payments, and production slot allocation. The production slot allocation with manufacturers puts most 765-kV substation equipment at the same or better lead time as lower-voltage equipment. Transformer lead times can vary, as discussed below in Question 5.

4. Compared to the use of 345-kV transmission lines, what are the differences in operations & maintenance costs for 500-kV and 765-kV? In addition, please explain in detail:
a) What are the impacts on lead times for towers, replacement transformers and other replacement parts for 500-kV and 765-kV?

There is not a significant difference between the operation costs of 500/765-kV and 345-kV lines. Maintenance costs are also similar with one exception, which is right-of-way upkeep (e.g., forestry). Since 345-kV lines utilize 150-feet of right-of-way while 500-kV and 765-kV lines require 175-feet and 200-feet respectively, there is additional clearing that must be accounted for. However, with fewer lines required for the same capacity, the overall amount of right-of-way to maintain for higher voltage lines should be less.

Substation equipment at 765-kV, 500-kV, and 345-kV is also maintained at the same time intervals and thus operation and maintenance costs are comparable. Single-phase equipment utilized at 765-kV and 500-kV requires testing and maintenance of individual units, therefore some additional time is required, but it is not a major cost driver.

AEP has a robust capitalized spare program that stocks and manages both line, station, and protection and control equipment to enable timely outage response regardless of voltage. 765-kV transformers are engineered and designed with a dedicated, switchable spare. Spare transmission towers are also maintained to allow for rapid response in the event of a catastrophic event.

5. Compared to the 345-kV auto transformers, what are the differences in procurement costs, engineering, life expectancy, and lead times for 345/500kV and 345/765kV auto transformers? What is availability of multiple vendors providing these transformers?

When comparing the costs of 345-kV auto transformers with 345/500-kV and 345/765-kV units, there is typically an increase for the higher voltage classes. This increase is primarily due to the need for single-phase units to handle the larger size and weight, impacting shipping and hauling logistics. For example, a 345/138-kV, 675 MVA three-phase unit weighs approximately 750,000 lbs. and costs around $4M. In contrast, a 765/345-kV, 750 MVA single-phase unit weighs approximately 800,000 lbs. and costs around $5M (these costs are approximate - specific figures are contingent on vendor quotes and design specifications). Again, it is important to note the cost per MW capacity remains lower. The standard 345-kV transformer bank noted above has a nameplate capacity of 675MVA, whereas a standard 765-kV transformer bank has a total nameplate capacity of 2,250MVA.

The engineering complexities and life expectancy between 345-kV, 345/500-kV, and 345/765-kV auto transformers are similar. The design and construction principles remain consistent across these voltage classes. Therefore, the life expectancy and associated engineering challenges do not vary significantly and can be considered inconsequential for this comparison.

Lead times for these transformers are also comparable, with the exception that higher voltage transformers (500-kV and 765-kV) may experience slightly longer lead times due to the limited number of manufacturers capable of producing them (which could increase with increased demand). AEP maintains a core group of suppliers for 500-kV and 765-kV transformers with dedicated production capacity to ensure timely delivery of orders.

The industry is witnessing an expansion in the 765-kV transformer market, with a major supplier expanding into the US footprint and expecting to have their first 765-kV units available within the next two years. This supply chain expansion could allow Texas utilities to leverage these developments for future growth and operational efficiency. While the engineering and life expectancy factors remain relatively consistent across these voltage classes, procurement costs, lead times, and vendor availability currently present minor differences.

6. Are there any environmental or community values issues related to the use of 500-kV and 765-kV regarding noise pollution or public health?

While Texas does not have statewide noise level ordinance, noise regulations in other states often specify 55 dBA or below for transmission lines near residential areas. By way of reference, the City of Corpus Christi's noise ordinance specifies a maximum decibel level of 70 dBA during daytime hours and 60 dBA during nighttime hours. AEP's design target for audible noise levels at the edge of right-of-way for all transmission lines, including 765-kV, is 55 dBA or less.

For power-frequency Electromagnetic Field (EMF), IEEE Standard C95.6TM-2002 recommends the following limits:

	General Public	Controlled Environment
Electric Field Limit (kV/m)	5.0	20.0*
Magnetic Field Limit (mG)	9,040	27,100

**10.0 kV/m within power line ROW.*

AEP designs all transmission lines with EMF levels well below the IEEE limits at the edge of right-of-way. EMF levels decline sharply with distance away from the centerline and further from the edge of right-of-way.

Additionally, single-circuit 765-kV structures are shorter than typical double-circuit 345-kV towers or double-circuit 500-kV structures while maintaining necessary NESC clearances. Lower height can reduce the visual impact and may alleviate some concerns related to airport proximity and other factors considered in the CCN process.

From an environmental integrity perspective, as fewer lines are required for the same capacity, the overall amount of right-of-way impact to migratory bird populations, protected species habitat, soil and water resources, recreational and park areas, and other ecological resources would also be less (see response to Question 2[a] above for acreage requirements).

7. Can 500-kV or 765-kV transmission lines be constructed and operated at 345-kV on an interim basis with 500-kV and 765-kV transmission substations being added later for EHV conversion?

Yes, a higher-voltage transmission line can be operated at a lower voltage. For example, a 765-kV transmission line could be operated at 345-kV and connected directly to a 345-kV substation (this configuration exists in upstate New York today). However, the opposite is not true. The design voltage of a transmission line represents the maximum potential operating voltage; therefore a 345-kV or 500-kV design cannot be operated 765-kV.

8. Compared to the use of 345-kV transmission lines, are there any additional operational or system improvement and reliability benefits associated with 500-kV or 765-kV transmission lines? Please explain in detail.

Yes, 765-kV and 500-kV have higher capacity and lower impedance per mile than 345-kV. The higher the voltage, the higher the capacity and lower the impedance. This allows a transmission line to:

- Deliver more power, reducing the number of new lines and new right-of-way need to serve the load.
- Increase transfer capability over longer distances without the need for series compensation.
- Transfer power more efficiently with lower transmission losses (for equivalent power flow over the same distance, line losses for 765-kV are less than 1/3 that of 345-kV).
- Improve grid stability by increasing the short circuit strength of the transmission grid, improving the ability of generators and the grid as a whole to withstand disturbances from faults.

The commitment to the development of a 765-kV backbone improves the reliability and efficiency of the entire transmission network by allowing larger more efficient transfers of power from generation sources to load centers over long distances. A backbone system can also unload the underlying transmission network so it can be operated at a more efficient and safe loading level to better serve local load centers.

Additional reliability benefits associated with 765-kV include reduced outages (sustained outages 2x less frequent and momentary 6x less frequent than 345-kV, based on outage data from the North American Transmission Forum [NATF]) and single-phase switching capability. Single-phase switching allows for momentary outage of one of the three phases of a transmission circuit to avoid the more severe interruption of the entire circuit.

Single-phase equipment used for 500-kV and 765-kV designs also offer reliability improvements in a switchable spare transformer design. One spare transformer can be used for an outage of any of the three phases and switched automatically. This differs from 345-kV as each spare transformer typically requires a full-size three phase unit. Additionally, these transformers are separated by firewalls and have dedicated, drainable oil containments, ensuring quick extinguishing of oil fires and minimizing downtime and operational risks.

a) Do EHV Transmission lines reduce or eliminate the need for large under builds on the 138-kV and 230-kV system?

Yes, physics dictates that the lower impedance of EHV lines means these will be utilized more for power transfers than lower-voltage lines (electricity follows the path of least resistance), leaving capacity on the lower-voltage lines available to better serve local needs. Use of higher voltage lines also reduces the overall number of new lines and new right-of-way needed to meet system demands. Generation and load can be connected directly to EHV lines up to 765-kV, however lower-voltage lines will remain necessary to serve smaller-scale generation and customers.

b) Would you expect an EHV system to eventually be upgraded to a higher voltage or will it remain the backbone of the bulk power system for decades?

No, it is expected that the build out of a full 765-kV backbone would improve the reliability, stability, and efficiency and serve the bulk power system for decades to come. The 765-kV network in PJM has reliably served the region for over 50 years. Despite the growth in demand within the PJM, as well as MISO, both regions are reaching the conclusion that expanding the use of 765-kV is the proper approach for their systems.

9. Compared to the use of 345 kV transmission lines, are there any additional considerations for 500-kV or 765-kV transmission lines regarding reliability, resiliency, and redundancy when facing events such as extreme weather conditions, hurricanes, tornadoes, wildfires, cybersecurity, or physical security threats?

From a design perspective, the same reliability, resiliency, and redundancy requirements that are applied to 345-kV are applied to 500-kV and 765-kV. AEP's current design standard for 500-kV and 765-kV structures does exceed NESC minimums for wind, which is an improvement over 345-kV. This is not a requirement; however, if utilized for new construction, it would provide a higher level of resilience versus current lower-voltage designs.

A higher-voltage backbone also provides added capacity to absorb power flows for both planned and unplanned outages of lower voltage facilities, helping to ensure reliability and mitigate congestion during abnormal events or extreme conditions. Both 500 kV and 765 kV stations would require additional risk assessments for cybersecurity or physical security threats. AEP has a substation physical security standard which has specific recommendations for highpriority 765-kV facilities. This is an added layer of protection that could be applied to any new EHV construction.

a) Would incorporation of 500-kV, or 765-kV transmission lines into the ERCOT system change the ERCOT transmission planning process and how?

No, NERC defines 345-kV, 500-kV, and 765-kV as EHV facilities, meaning all would be studied under the same performance criteria. Currently, ERCOT is studying the addition of 345-kV, 500-kV, and 765-kV as part of the 2024 Regional Transmission Plan and as an option for the bulk import paths in the Permian Basin Reliability Study.

b) What would be the impact of EHV on meeting NERC reliability standards, including contingency planning?

There would not be an impact in meeting NERC reliability stability standards, including contingency planning. NERC defines 345-kV, 500-kV, and 765-kV as EHV facilities, meaning-all would be studied under the same performance criteria. The 765-kV and 500-kV transmission network has been part of the North American Transmission grid for over 50 years and as such, have been subject to same reliability standards and enforcement as 345-kV.

Prior to any lines being built, planning studies will evaluate the impact of an outage of any EHV facility, or combination of EHV facilities, to ensure the grid meets the performance criteria set forth by NERC and ERCOT.

10. Are there any other aspects related to planning, building and operating 500-kV and 765-kV?

Given the substantial load and generation growth being experienced in Texas, we stand at the threshold of an opportunity to lay the foundation for the grid of the future for the ERCOT region. We must recognize that that future is not simply 10 or 15 years, we must consider these facilities will be in place to meet customers' needs for more than 50 years. AEP believes the best way to satisfy these needs is to begin the construction of a 765-kV based transmission backbone. We hope the information provided in this filing is helpful in guiding the Commission's decisions and would welcome the opportunity to share further details of our experience constructing, owning, and operating 765-kV facilities in a Commission Workshop at some future date.

III. Conclusion

The AEP Companies appreciate the opportunity to provide comments on Staff's questions and the Commission's consideration of these comments. An executive summary of the comments is provided at the end of this filing.

Respectfully submitted,

/s/ Melissa Gage

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ON BEHALF OF AEP TEXAS INC. AND ELECTRIC TRANSMISSION TEXAS, LLC

PROJECT NO. 55249

REGIONAL TRANSMISSION RELIABILITY PLANS	§ § §	**PUBLIC UTILITY COMMISSION** **OF TEXAS**

<u>AEP Companies' Executive Summary</u>

AEP has extensive experience operating and maintaining Extra-high Voltage (EHV) transmission with over 8,000 miles of our 40,000-mile system operating above 300-kV. AEP currently operates 2,200 miles of 765-kV transmission lines and 115 miles of 500-kV transmission lines within the AEP footprint. The following is a summary of AEP's responses to the PUC *Questions for Stakeholder Comment About Introduction of Extra High Voltage (EHV) Transmission Lines to the ERCOT Region* as filed in Docket No. 55249:

<u>Overall Benefits:</u>

- 765-kV and 500-kV have higher capacity and lower impedance per mile than 345-kV. The higher the voltage, the higher the capacity and lower the impedance. This allows an EHV transmission line to:
    - Deliver more power, reducing the number of new lines and new ROW needed to serve the load.
    - Increase transfer capability over longer distances without the need for series compensation.
    - Transfer power more efficiently with lower transmission losses.
    - Improve grid stability by increasing the short circuit strength of the transmission grid and improving the ability to withstand disturbances from faults.
    - Be utilized more for large power transfers than lower-voltage lines, leaving more capacity on the lower-voltage lines available to better serve local needs.

<u>Planning:</u>

- NERC defines 345-kV, 500-kV, and 765-kV as EHV facilities and as such, all would be studied by ERCOT and AEP under the same performance criteria.
- Prior to any lines being built, planning studies will evaluate the impact of an outage of any EHV facility, or combination of EHV facilities, to ensure the grid meets the performance criteria set forth by NERC and ERCOT.

<u>Design:</u>

- The same basic principles that apply to 345-kV line and component design also apply to higher voltages (500-kV and 765-kV), but with a few differences:
    - Higher voltages require wider rights-of-way and larger clearances, structures, and insulator assemblies per line.
    - Corona effects and audible noise must be carefully planned and mitigated.
- Performance, service life, and lead times will remain approximately the same as those of 345-kV, but procurement costs would increase relative to the amount of material required as the voltage increases.

- There is no difference between 345-kV, 500-kV, or 765-kV substations in terms of engineering complexity or life expectancy, but there would be slightly higher procurement costs due to the physical size of the structures.
- The production slot allocation with manufacturers puts most 765-kV substation equipment at the same or better lead time as lower-voltage equipment.
- Transformer costs will be higher in 500/765-kV stations as single-phase units need to handle the larger size and weight, which impacts shipping and hauling logistics, though the cost per MW capacity still remains lower.
- EHV stations will also have slightly longer lead times due to the limited number of capable manufacturers.
- AEP's design target for audible noise levels at the edge of right-of-way (ROW) for all transmission lines, including 765-kV, is 55 dBA or less.
- AEP designs all transmission lines with EMF levels well below the IEEE limits at the edge of ROW. EMF levels decline sharply with distance away from the centerline and further from the edge of ROW.

Routing:

- ROW Easement Width Requirements:
    - 150-foot ROW for 345-kV single-circuit and double-circuit transmission lines.
    - 175-foot ROW for 500-kV single-circuit transmission lines.
    - 200-foot ROW for 765-kV single-circuit transmission lines.
- Equivalent ROW Requirements for Same Carrying Capability:
    - One 765-kV line is equivalent to three 500-kV lines and six 345-kV lines.
    - For example, a single-circuit 100-mile 765-kV line would require 2,424 acres of ROW, whereas the same 100-mile equivalent at 500-kV would require 6,634 acres of ROW and at 345-kV would require 10,909 acres of ROW.
    - Using EHV lines reduces the ROW impact to human and environmental resources overall throughout Texas.

Operation & Maintenance:

- No significant difference between operation costs of 345-kV lines versus 500/765-kV lines.
- No significant difference between maintenance costs of 345-kV lines versus 500/765-kV lines, with one exception: ROW/forestry maintenance will be greater/wider, but overall less with fewer lines required for the same capacity.
- No significant difference between operation and maintenance costs of 345-kV stations versus 500/765-kV stations, except for minor additional testing and maintenance of individual units.