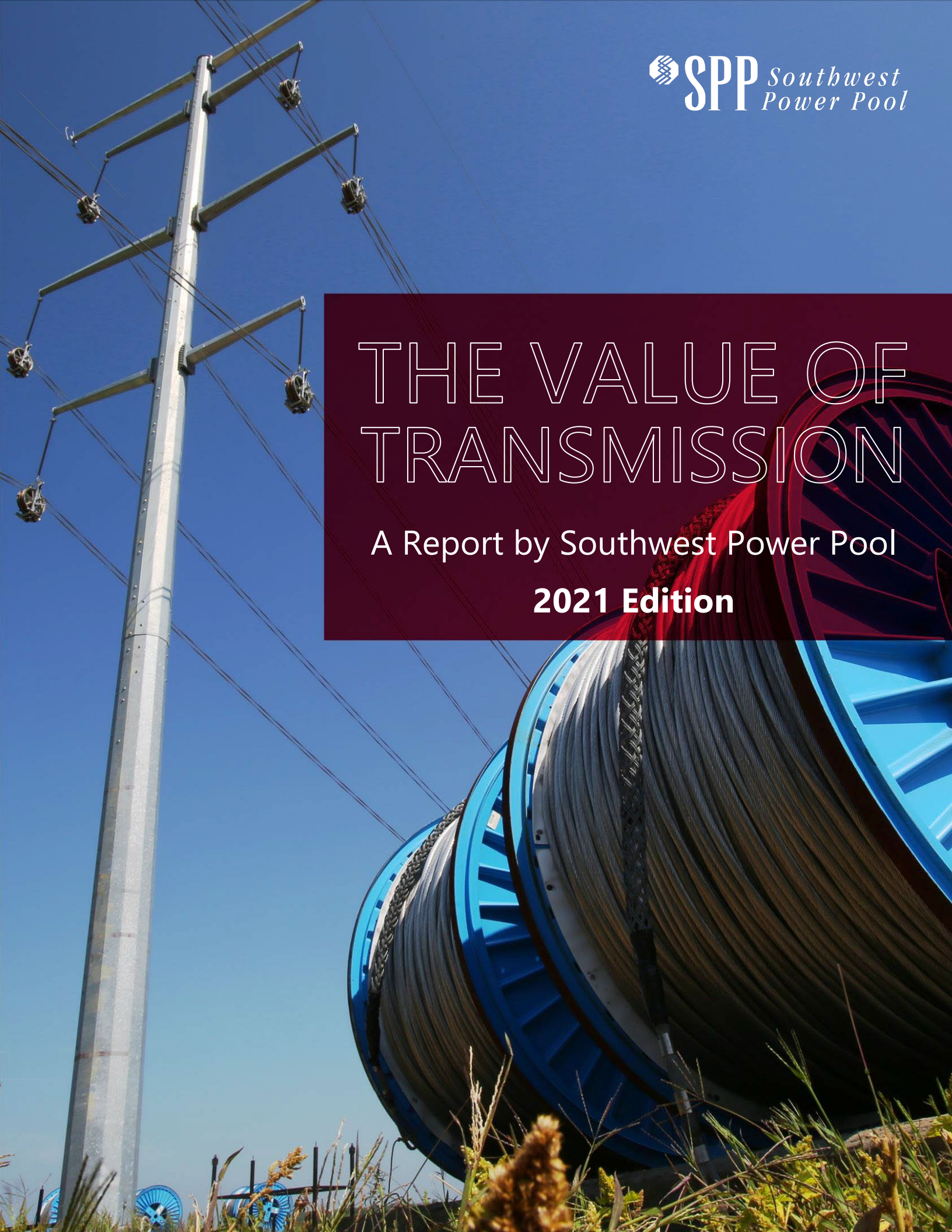

SPP Southwest Power Pool

THE VALUE OF TRANSMISSION

A Report by Southwest Power Pool

2021 Edition

SPP Southwest Power Pool

THE VALUE OF TRANSMISSION

A 2021 STUDY AND REPORT BY SOUTHWEST POWER POOL

By SPP Transmission Planning

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EXECUTIVE SUMMARY

Since becoming a Regional Transmission Organization (RTO) in 2004, Southwest Power Pool (SPP) has approved the construction of significant transmission expansion. This report quantifies the value of transmission expansion projects that SPP placed in service from 2015 through 2019.

In its 2016 Value of Transmission Study, SPP calculated that the net present value (NPV) of benefits of projects installed from 2012-2014 were expected to exceed $16.6 billion, a benefit-cost ratio of 3.5. That study, which the Brattle Group called a "path-breaking effort," recognized it did not capture all benefits and could be improved in the future.

SPP's 2021 Value of Transmission Study evaluates the benefits of $3.4 billion of transmission projects placed in service between March 1, 2015, and Dec. 31, 2019. This study improves the methodology used in 2016 to create a more accurate assessment of the projects' value. The 2015-2019 projects primarily include regional reliability projects and high priority transmission projects. This study evaluated production cost benefits realized during actual operations resulting from transmission expansion. Analytical models simulated a subset of actual 2020 system conditions.

The estimated production cost benefits are significant and higher than previous estimates from planning models. This analysis estimated adjusted production cost (APC) savings at more than $1.0 million per day, representing an annualized savings of $382.7 million per year. The NPV of these APC benefits is expected to exceed $20.7 billion over the next 40 years, compared to a present value of revenue requirements of less than $5.2 billion.

This study quantified $6.5 billion in benefits associated with increased wheeling revenues, reliability and resource adequacy, reduced transmission losses, and benefits associated with optimal wind development. **Overall, the NPV of quantified benefits associated with transmission expansion is expected to exceed $27.2 billion over the next 40 years, resulting in a benefit-cost ratio of 5.24.**

Some additional sources of value — including environmental, storm hardening and economic development benefits — were either partially captured in other measures or excluded and not quantified separately. The values of these benefits may be large. Appendix B includes a table of all benefits considered in the study.

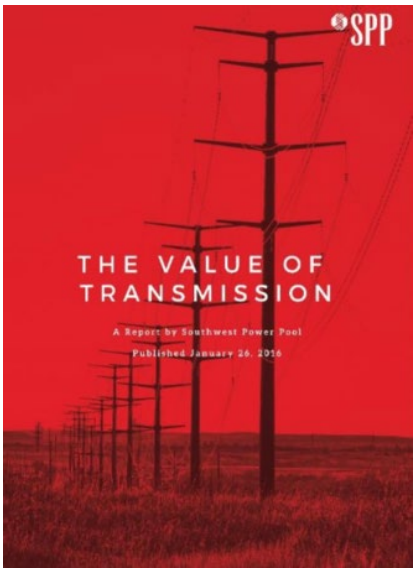
The Brattle Group independently assessed the 2021 study and called it the "best available industry practice" that "provides a more accurate and realistic estimate of the benefits provided by SPP-approved transmission projects." The Brattle Group agreed with SPP's assessment that the new study's evaluation remains conservative, saying "the benefits of the 2021 Study may be underestimated." A letter from the Brattle Group is presented on Page 26.

BACKGROUND

SPP's members want to understand the value they get from SPP membership and the net benefits they receive from SPP's services. Benefits may be either explicit or implied, and include those realized through services like transmission planning, reliability coordination, grid operation and SPP's Integrated Marketplace. Appendix B outlines the benefits that were evaluated and quantified as part of this analysis.

The most significant monetary benefits come from transmission projects constructed within SPP's membership footprint. SPP members have approved and invested over $6.8 billion in transmission expansion since 2012. It is important for members to know that these investments have proven valuable. Benefits related to transmission build-out are known as *benefits of transmission* and are calculated via multiple metrics like APC, reliability and resource adequacy benefits and generation capacity cost savings.

SPP published its first study titled "The Value of Transmission," Jan. 26, 2016. It outlined the benefits of transmission from almost $3.4 billion in transmission expansion projects constructed and placed into service 2012 through 2014. The results showed the NPV of the quantified benefits for these projects will exceed $16.6 billion over 40 years, resulting in a benefit-to-cost ratio of 3.5.



The 2016 study was unique as it estimated market savings using actual operational data. APC and mandated reliability projects were the biggest contributors to overall benefits in the 2016 study.

SPP's Value and Affordability Task Force (VATF) formed in January 2019 as a result of increased attention on the cost and affordability of SPP membership compared to benefits delivered. The VATF looked for opportunities to increase SPP's value and improve affordability while maintaining and protecting its mission. In its report to SPP's board of directors published Oct. 1, 2019, the VATF recommended an updated scope and strategy for a new Value of Transmission study. The scope was completed December 2020, endorsed by applicable working groups and approved by the Strategic Planning Committee Jan. 13, 2021. The updated study, which is the subject of this report, evaluates and demonstrates enhanced member value and affordability by studying the benefits of installed, in-service transmission projects from 2015 through 2019.

Transmission projects evaluated in this analysis fall into one of these categories:

1. Zonal reliability: projects that are included in, and constructed pursuant to, the SPP Transmission Expansion Plan to ensure the reliability of the transmission system. These projects are identified applying a transmission owner's company-specific planning criteria.

2. Transmission service: projects related to an approved request for long-term firm transmission network integration and point-to-point transmission service.

3. Sponsored upgrade: network upgrades, requested by a transmission customer or other entity, which do not meet the definition of any other category of network upgrades.

4. Regional reliability: projects required to maintain reliability in accordance with North American Electric Reliability Corporation (NERC) reliability standards and SPP criteria.

5. High priority: projects that are identified and approved by SPP as part of the high priority study process to reduce congestion, better integrate SPP's east and west regions, improve power deliverability and facilitate the addition of new generation to the grid.

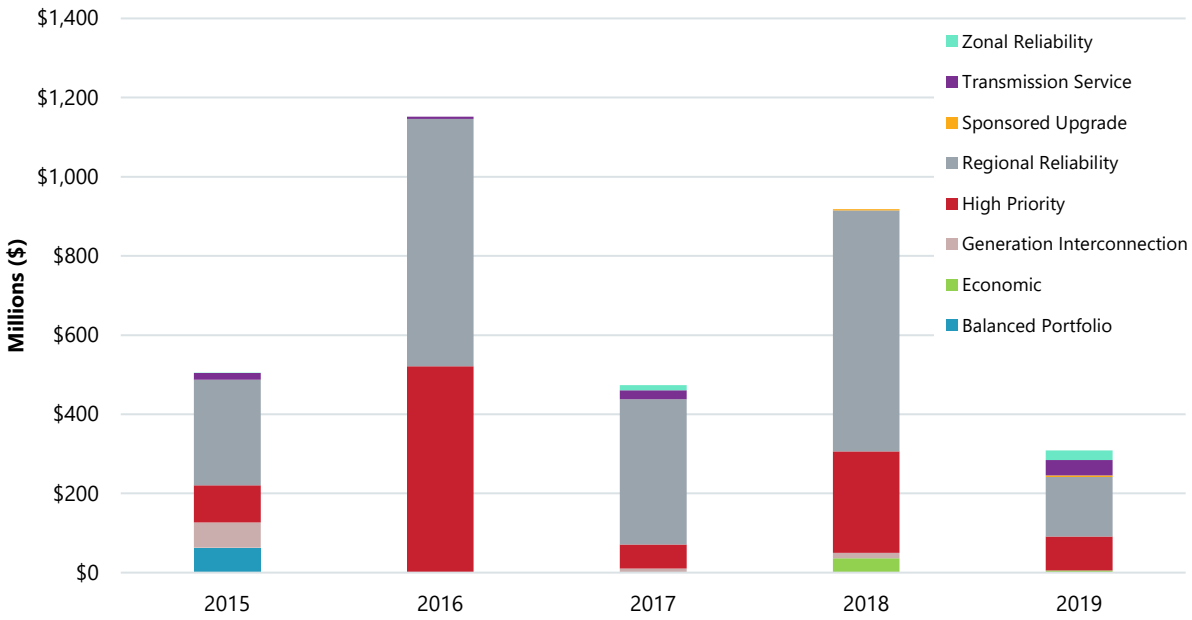
6. Generation interconnection: projects identified and approved as part of SPP's generator interconnection (GI) process that allow new generators to safely interconnect to the electric grid without negatively impacting system reliability.

7. Economic: projects implemented based on meeting or exceeding benefit/cost metrics defined in SPP's Integrated Transmission Plan (ITP) studies. These projects aim to reduce targeted congestion and lower pool production costs.

8. Balanced portfolio: projects identified and approved as part of SPP's Balanced Portfolio study process. These economic transmission upgrades benefit the entire SPP region and have their costs allocated regionally.

Figure 1 shows transmission expansion investments from 2015 through 2019 in SPP. The largest investments have been from regional reliability projects (shown as the gray bar in Figure 1).

FIGURE 1: TOTAL INVESTMENT PER IN-SERVICE YEAR



This study captured the benefits associated with new transmission lines, rebuilds of existing lines and the addition of other equipment such as transformers. Line rebuilds and transformer additions are crucial to increasing transmission system capability, and it is important to capture their impacts in this analysis. SPP's extra high voltage (EHV) 345 kilovolt (kV) system, the primary voltage for bulk power transfer, saw the addition of more than 1,000 miles of new transmission from 2015 to 2019. The EHV projects are a small portion of the transmission projects completed in the SPP footprint.

Table 1 on the next page includes all projects included in this study: new lines, rebuilt lines and other transmission assets[1] encompassing all SPP transmission voltages. In total, the projects installed from 2015 to 2019 represent more than $3.35 billion of transmission investment. However, there are projects that could not be included in this study due to model changes. The total investment for transmission projects included in this study is $3.25 billion, representing 97% of the total cost of projects for the period.

[1] Other assets include device installations, line raises, line work, substations, transformers, and voltage conversions.

TABLE 1: TRANSMISSION INVESTMENTS (MILES AND COST) BY VOLTAGE								
NEW LINES IN SPP: 2015-2019	MILES	VOLTAGE	2015	2016	2017	2018	2019	TOTAL
		69	3	0	0	3	5	**12**
		115	102	119	75	145	53	**494**
		138	14	26	27	160	12	**239**
		161	0	0	0	0	19	**19**
		230	88	3	0	17	0	**108**
		345	0	452	133	256	57	**898**
		Total	**207**	**600**	**235**	**582**	**147**	**1,770**
NEW LINES IN SPP: 2015-2019	COST ($M)	VOLTAGE	2015	2016	2017	2018	2019	TOTAL
		69	$0.0	$0.0	$0.0	$11.5	$4.9	**$16.3**
		115	$85.8	$106.3	$72.0	$123.0	$37.4	**$424.5**
		138	$1.4	$17.3	$22.5	$137.2	$7.5	**$186.0**
		161	$0.0	$0.0	$0.0	$0.0	$24.9	**$24.9**
		230	$27.0	$3.7	$0.0	$35.9	$0.0	**$66.6**
		345	$0.0	$737.7	$152.7	$276.0	$98.6	**$1,265.1**
		Total	**$114.2**	**$865.0**	**$247.3**	**$583.6**	**$173.4**	**$1,983.4**
REBUILDS IN SPP: 2015-2019	MILES	VOLTAGE	2015	2016	2017	2018	2019	TOTAL
		69	133	99	33	108	22	**395**
		115	17	8	43	60	27	**155**
		138	9	32	155	2	20	**218**
		161	0	0	11	0	0	**11**
		230	0	0	30	0	0	**30**
		345	0	0	0	0	0	**0**
		Total	**159**	**139**	**271**	**170**	**70**	**809**
REBUILDS IN SPP: 2015-2019	COST ($M)	VOLTAGE	2015	2016	2017	2018	2019	TOTAL
		69	$110.4	$14.0	$59.1	$65.4	$39.2	**$288.1**
		115	$11.7	$15.2	$23.4	$24.3	$20.5	**$95.2**
		138	$8.5	$30.4	$8.9	$7.9	$18.0	**$73.7**
		161	$0.0	$0.0	$9.2	$0.0	$0.3	**$9.5**
		230	$0.0	$0.0	$34.6	$10.2	$0.0	**$44.8**
		345	$0.0	$0.0	$0.0	$0.0	$0.0	**$0.0**
		Total	**$130.7**	**$59.6**	**$135.2**	**$107.8**	**$78.0**	**$511.3**
ALL OTHER PROJECTS IN SPP: 2015-2019	COST ($M)	VOLTAGE	2015	2016	2017	2018	2019	TOTAL
		69	$24.9	$11.0	$0.0	$3.2	$4.5	**$43.6**
		115	$113.2	$71.5	$29.1	$79.0	$31.5	**$324.3**
		138	$31.4	$1.2	$6.0	$13.3	$7.8	**$59.6**
		161	$0.0	$0.6	$22.8	$6.8	$1.7	**$31.9**
		230	$2.6	$59.0	$3.8	$17.8	$12.1	**$95.2**
		345	$87.4	$83.8	$29.3	$106.3	$0.0	**$306.7**
		Total	**$259.4**	**$227.2**	**$91.0**	**$226.4**	**$57.6**	**$861.5**
TOTAL PROJECTS IN SPP: 2015-2019	COST ($M)	VOLTAGE	2015	2016	2017	2018	2019	TOTAL
		69	$135.4	$25.1	$59.1	$80.0	$48.5	**$348.1**
		115	$210.7	$193.1	$124.5	$226.3	$89.4	**$844.0**
		138	$41.3	$48.9	$37.4	$158.4	$33.3	**$319.3**
		161	$0.0	$0.6	$32.0	$6.8	$27.0	**$66.4**
		230	$29.5	$62.6	$38.3	$64.0	$12.1	**$206.6**
		345	$87.4	$821.5	$182.1	$382.3	$98.6	**$1,571.8**
		Total	**$504.2**	**$1,151.7**	**$473.4**	**$917.9**	**$308.9**	**$3,356.2**

This study is limited in its horizon and cases analyzed, only considering the realized benefits from SPP's market for calendar year 2020. A list of the 2015-2019 portfolio of projects evaluated in this study is included in Appendix C. Benefits for these projects energized between 2015 and 2019 were not calculated for years before 2020.

The annual transmission revenue requirement (ATRR) for the expansion projects is approximately $559.9 million per year at the beginning of 2020 and assumed to depreciate at 2.5% per year over the typical 40-year project life. All of the evaluated projects were operational in the 2020 system operating data.

While planning studies typically assume some uncertainty, actual system operations encounter unplanned events caused by human or mechanical issues and natural phenomena. These events can create opportunities to improve the efficiency and effectiveness of grid operations. Any valuation study should consider a system's ability to handle a wide variety of system conditions.

ANALYSIS

ADJUSTED PRODUCTION COST (APC) SAVINGS

PRODUCTION COSTS ARE REDUCED DUE TO INCREASED EFFICIENCIES IN UNIT COMMITMENT, ECONOMIC DISPATCH AND TRANSACTIONS WITH NEIGHBORING SYSTEMS

Analytical models from actual Integrated Marketplace operations were used to evaluate the transmission system's impact on the footprint's production costs. SPP's day-ahead reliability unit commitment (RUC) models were utilized for this analysis. SPP uses day-ahead RUC models (after the day-ahead market closes and before the targeted operating day) to assess resource and operating reserve adequacy for the day-ahead period and commit or de-commit resources as necessary. Increased transmission capability allows the system to reduce production costs through lower unit commitment costs and dispatch more efficient resources to serve SPP obligations. For each month in 2020, benefits were evaluated using five days with production costs corresponding to the 10th, 25th, 50th, 75th and 90th percentiles. These percentiles capture the value transmission provides under a diverse set of system operating and load conditions.

A noteworthy change from the 2016 Value of Transmission study is the inclusion of incremental capacity associated with transmission rebuilds and transformer upgrades. The 2016 study only reflected the benefits associated with new-build projects that changed system topology. This study captures the incremental capacity offered by such projects and the benefits associated with incremental capacity offered by transmission rebuilds and transformer upgrades. Table 2 shows 2020 APC savings.

TABLE 2: CALCULATED TRANSMISSION VALUE

DATE	SEASON	PROD. COST PERCENTILE	ADJUSTED PRODUCTION COST SAVINGS
1/5/2020	Winter	75th	$603,122
1/9/2020	Winter	90th	$545,557
1/20/2020	Winter	10th	$242,257
1/28/2020	Winter	25th	$6,787
1/31/2020	Winter	50th	$268,283
2/1/2020	Winter	75th	$183,211
2/16/2020	Winter	25th	($52,464)
2/19/2020	Winter	10th	$633,659
2/26/2020	Winter	50th	$506,900
2/29/2020	Winter	90th	$516,227
3/9/2020	Spring	50th	$1,234,403
3/10/2020	Spring	10th	$740,152
3/14/2020	Spring	25th	$732,931
3/25/2020	Spring	75th	$557,739
3/27/2020	Spring	90th	$777,839
4/4/2020	Spring	10th	$346,084
4/8/2020	Spring	25th	$419,504
4/12/2020	Spring	90th	$1,763,865
4/17/2020	Spring	75th	$512,479
4/18/2020	Spring	50th	$1,073,620
5/6/2020	Spring	50th	$930,064
5/16/2020	Spring	10th	$284,812
5/19/2020	Spring	25th	$16,529
5/23/2020	Spring	90th	$708,455
5/24/2020	Spring	75th	$999,026
6/18/2020	Summer	50th	$735,872
6/19/2020	Summer	10th	$227,136
6/24/2020	Summer	25th	$26,005
6/27/2020	Summer	75th	$680,479
6/29/2020	Summer	90th	($1,139,741)
7/2/2020	Summer	10th	$432,067
7/16/2020	Summer	50th	$462,076
7/24/2020	Summer	90th	N/A
7/25/2020	Summer	75th	$174,627
7/26/2020	Summer	25th	$284,886
8/3/2020	Summer	75th	$279,244
8/9/2020	Summer	90th	$2,432,884
8/18/2020	Summer	10th	$330,432
8/20/2020	Summer	50th	$229,832
8/29/2020	Summer	25th	$497,654
9/8/2020	Fall	90th	$773,659
9/14/2020	Fall	25th	$422,556
9/15/2020	Fall	10th	$485,995
9/20/2020	Fall	75th	$457,031
9/21/2020	Fall	50th	$682,506
10/3/2020	Fall	50th	$505,206
10/4/2020	Fall	90th	$1,578,846
10/6/2020	Fall	25th	$326,904
10/13/2020	Fall	75th	$1,616,905
10/29/2020	Fall	10th	$2,094,961
11/10/2020	Fall	25th	$2,527,575
11/19/2020	Fall	75th	$3,715,306
11/23/2020	Fall	90th	$3,144,858
11/25/2020	Fall	50th	$2,868,138
11/27/2020	Fall	10th	$1,250,499
12/4/2020	Winter	10th	$2,580,072
12/7/2020	Winter	25th	$1,606,023
12/17/2020	Winter	75th	$2,920,777
12/20/2020	Winter	50th	$3,774,750
12/21/2020	Winter	90th	$2,341,775

SPP validated production cost savings using analytical models. Over the 60 days simulated, the models were unable to solve for one day (shown as N/A) and showed negative benefits in two other days.

SPP concluded that the model was unable to solve for 7/24/2020 because of a model convergence issue. The two days with simulated negative benefits encountered situations with substantial system congestion, resulting in negative locational marginal prices (LMPs). Due to the nature of APC calculations and the relative location of generation to negative LMPs, this calculation can result in net negative benefits, and this nuance is considered an outlier. Thus, the day that failed to solve and the two days with negative benefits were considered outliers and excluded from average daily savings calculations.

The average daily production cost for 2020 using actual Integrated Marketplace data was $5.0 million. The average daily production cost, with all transmission projects in-service, for days chosen for this analysis is $5.1 million. The close alignment between actual Integrated Marketplace results and the simulations used in this analysis confirms this analysis uses representative data for calendar year 2020.

Simple averages were calculated for the production cost savings presented in Table 2. The daily production cost savings were combined by season and by percentile. Table 3 includes the number of data points, after excluding outliers, corresponding to each season and percentiles used in Table 2.

TABLE 3: NUMBER OF DATA POINTS

# OF DATA POINTS	10th PERCENTILE	25th PERCENTILE	50th PERCENTILE	75th PERCENTILE	90th PERCENTILE	TOTAL
Fall	3	3	3	3	3	15
Spring	3	3	3	3	3	15
Summer	3	3	3	3	1	13
Winter	3	2	3	3	3	14
TOTAL	**12**	**11**	**12**	**12**	**10**	**57**

The simple average was calculated for data corresponding to each season and percentile to develop an estimate of production cost savings. Table 4 on the next page includes the simple average production cost savings by season and percentile. The simple average of each data point in the table indicates a daily production cost savings of $1,045,720 to SPP's Integrated Marketplace for 2020.

This amounts to an annualized savings of $382.7 million associated with the transmission expansion projects included in this analysis. The resulting NPV of APC savings represents over $20 billion in savings over the 40-year study period.

TABLE 4: SIMPLE AVERAGES					
SEASON	10th PERCENTILE	25th PERCENTILE	50th PERCENTILE	75th PERCENTILE	90th PERCENTILE
Fall	$1,277,152	$1,092,345	$1,351,950	$1,929,747	$1,832,454
Spring	$457,016	$389,654	$1,079,362	$689,748	$1,083,386
Summer	$329,878	$269,515	$475,927	$378,117	$2,432,884
Winter	$1,151,996	$806,405	$1,516,644	$1,235,703	$1,134,519
Simple Average Daily Savings	$804,011	$639,480	$1,105,971	$1,058,329	$1,620,811
ANNUAL AVG. DAILY SAVINGS (simple average)	**$1,045,720**				

TABLE 5: ITP APC SAVINGS						
Study	Future 1 APC Savings			Future 2 APC Savings		
	Y5 ($M)	Y10 ($M)	Y5-Y10 Growth	Y5 ($M)	Y10 ($M)	Y5-Y10 Growth
2021 ITP	$236.7	$406.5	11%	$375.0	$420.5	2%
2020 ITP	$71.2	$123.8	12%	$98.4	$173.3	12%
2019 ITP	$29.8	$63.4	16%	$56.1	$127.7	18%

Consistent with the 2016 Value of Transmission study, 2020 APC savings were escalated at 10% per year. The resulting NPV of APC savings represents over $20 billion in savings over the 40-year study period. Prior ITP analyses were considered to establish an escalation rate for future APC savings. Table 5 above includes the APC savings from the three latest ITP studies along with average APC growth rates. In the 2019 through 2021 ITP studies, Future 1 APC growth rates exceeded 10% in the initial five years of the study. Using a 10% APC escalation rate is a conservative approach to estimating the value of future APC savings and is consistent with recent SPP's analyses.

The average daily savings of $1,045,720 per day represents a greater than 50% increase from the 2016 Value of Transmission daily savings of $661,298 per day. Changes to the study scope and market factors contribute to the increase from the 2016 study.

A major update from the 2016 study was the inclusion of transmission rebuilds and transformer upgrades. The 2016 study did not include transmission rebuilds and transformer upgrades. This

change increased the number of transmission projects that were removed between baseline and change cases and contributed to the increase in average daily savings.

Another factor influencing the APC savings is the increased adoption of wind energy since the 2016 study. Between 2015 and 2019, SPP interconnected over 12 gigawatts (GW) of additional wind generation to the system, resulting in over 22 GW of nameplate wind capacity installed by the end of 2019. The transmission projects evaluated in this study include a significant amount of EHV transmission that provides additional transfer capability between wind generation and load centers. The increased ability to transfer zero-dispatch-cost energy from wind generators to load centers lowers system production cost. In study cases without additional EHV build-out, wind generation was curtailed due to transmission limitations that required more expensive generation must be dispatched to serve load, resulting in higher system production costs across the footprint. As SPP continues to increase the amount of load served by renewable generation, the ability to transfer this power to load centers will become an increasingly important value provided by the transmission system.

A major component of APC savings is the capture of impacts of power purchases and sales between SPP and neighboring areas. In this analysis, power transactions were assumed to be constant in quantity and cost across all cases. This understates the value of grid expansion with respect to interchange opportunities with adjacent regions. While not reflected in this study's results, increased interchange capability associated with transmission expansion projects can increase market efficiencies and opportunities for economic interchange.

Brattle Group's analyses (Page 26) have recognized that actual production costs savings are typically larger than projected in planning analysis. Most planning analyses focus on accurately simulating typical system conditions rather than extreme events. Excluding extreme events from planning analyses tends to understate the value of the transmission system, as a robust transmission system helps operators manage and react to extreme system operations.

ADDITIONAL PRODUCTION COST SAVINGS

The simplified nature of traditional planning studies fails to capture the full range of production cost savings provided by transmission investments. For example, planning studies typically do not consider the impacts of multiple, concurrent transmission outages; the impacts of investment on transmission-related energy losses; or the uncertainty and variability of real-time loads and intermittent generation. Generally, capturing production cost savings associated with these benefits requires additional analysis. This study's methodology to estimate production cost savings by performing a backward-looking analysis of SPP's day-ahead RUC captures many of the benefits as summarized on the next two pages.

(A) IMPACT OF GENERATION OUTAGES AND OR UNIT DESIGNATIONS

SPP's backward-looking analysis relies on simulation of actual day-ahead markets for calendar year 2020. The analysis simulated actual generation outages and unit capability assigned to

provide operating reserves. This captures the value and flexibility offered by transmission expansion projects. The APC savings quantified in this assessment reflect these benefits.

(B) REDUCED TRANSMISSION ENERGY LOSSES

The software used for market simulations fully evaluated hourly energy losses and how transmission-facility outages and additions impacted them. The inclusion of hourly energy losses and the extent to which new transmission facilities can reduce energy losses has been captured in the APC savings presented in this assessment.

(C) REDUCED CONGESTION DUE TO TRANSMISSION OUTAGES

As part of ITP planning studies, SPP typically includes the mitigation of transmission outage costs. In this analysis, actual system outages from the Control Room Operations Window (CROW) system are reflected in the analytical models and simulations. As infrastructure ages and volatile and extreme weather patterns become more common, it is increasingly critical for SPP's planning analyses to accurately forecast outages and capture their impacts in long-term plans.

To maintain an efficient and reliable grid, it may be necessary to install overlay facilities or accelerate EHV projects to address situations in which the system is unable to accommodate necessary outages. As electric load increases, it becomes increasingly costly and difficult to accommodate necessary outages for routine maintenance and facility rebuilds. SPP expects that transmission projects included in this analysis will increase flexibility for scheduling outages; however, these benefits are not quantified as part of this study.

(D) MITIGATION OF EXTREME EVENTS AND SYSTEM CONTINGENCIES

This analysis captured a wide range of system operating conditions by selecting days with production costs in the 10th, 25th, 50th, 75th and 90th percentiles. The benefits associated with extreme events and unusually challenging system conditions are included to the extent those conditions are captured in the upper and lower percentile data points. None of the days selected for this study included clearly identified extreme weather or system conditions similar to those experienced during February 2021's winter storm.

(E) MITIGATION OF WEATHER AND LOAD UNCERTAINTY

The APC savings capture the benefits of mitigating extreme weather and load uncertainty to the extent that the selected days reflect those conditions. The days were selected based on the regional APC percentile rather than specific weather or load conditions. For example, additional benefits would likely be captured in days with 90/10 peak load days or days with disparate weather conditions in southeastern and northwestern portions of SPP. This sampling of operating days partially captured these benefits associated with transmission expansion.

(F) REDUCED COST DUE TO IMPERFECT FORESIGHT OF REAL-TIME SYSTEM CONDITIONS

Increased transmission capability allows system operators more flexibility to accommodate imperfect foresight of real-time system conditions. For this assessment, only the day-ahead RUC model was simulated, based on day-ahead forecasts. Real-time market benefits offered by transmission expansion were not quantified as part of this analysis.

(G) REDUCED COST OF CYCLING POWER PLANTS

The 2015-2019 transmission expansion projects allowed for more flexible system operations and resulted in generators cycling less frequently. Cost savings associated with reduced cycling are only partially captured as potential cost savings from avoided equipment replacement; other capital expenditures are not included in this analysis.

(H) REDUCED AMOUNTS AND COSTS OF OPERATING RESERVES

This analysis left operating reserve requirements unchanged. Benefits associated with operating reserves provided by more efficient units, along with other operational impacts, are partially captured in this analysis. Impacts on operating reserve requirements were not included in this analysis, though increased transmission capabilities would likely impact operating requirements.

(I) MITIGATION OF RELIABILITY-MUST-RUN (RMR) CONDITIONS

The software used in market simulations incorporated reliability-must-run (RMR) conditions. The inclusion of RMR conditions and the extent to which new transmission facilities can reduce RMR requirements is captured in the APC savings presented in this assessment.

RELIABILITY AND RESOURCE ADEQUACY BENEFITS

As part of the 2021 Value of Transmission study, SPP identified benefits associated with reliability and resource adequacy. The following sections include an overview of the selected metrics.

(A) BENEFITS OF MANDATED RELIABILITY PROJECTS

This metric reflects the reliability benefits of the transmission projects built to meet transmission reliability standards (classified as Reliability Projects in the ITP Manual). Consistent with the methodologies used in ITP and Regional Cost Allocation Review (RCAR) studies, such reliability benefits are assumed to be equal to the projects' costs. Reliability projects in this analysis are categorized into regional reliability and zonal reliability projects based on project-specific criteria. Both regional reliability and zonal reliability projects are considered as part of mandated reliability projects. The ATRR associated with the mandated reliability projects installed in SPP from 2015 through 2019 is estimated to be $351.1 million in 2020. The ATRR is assumed to decline with depreciation over 40 years, which results in an NPV of $3.1 billion for the projects.

This method may underestimate the value of reliability benefits, since it implies the value of reliability-related costs is no higher than the cost of reliability upgrades. The value of additional reliability provided by reliability projects is higher than the costs of such upgrades.

As with the 2016 Value of Transmission study, the industry has struggled to develop a methodology to quantify benefits of grid reliability improvements through transmission expansion. Existing reliability metrics such as Customer Average Interruption Duration Index and System Average Interruption Index are important performance measures for distribution systems, radial loops and open loops at the transmission and sub-transmission levels. These metrics provide valuable insights into improving operational efficiencies regarding optimal scheduling of maintenance outages. Increased transmission capabilities associated with network expansion can reduce the occurrences of service interruptions at the customer and system level.

Reduced and shorter-duration transmission facility outages can limit the risk and exposure of customers to outages and reliability problems. Reduced interruptions lower the use of costly measures like dispatching emergency generation or curtailing interruptible loads.

As existing infrastructure ages, outages related to inspection and replacement of aging transmission facilities will become increasingly expensive. The Federal Energy Regulatory Commission (FERC) is actively considering transmission investment metrics to help the bulk power industry quantify the value provided by major transmission projects.

(B) AVOIDED/DEFERRED RELIABILITY PROJECTS

Increased transmission capability associated with economic transmission projects can defer or avoid reliability projects. This metric captures the benefits of deferred or avoided reliability projects based on the avoided cost of reliability projects. The benefits associated with avoided

or deferred reliability projects are based on the cost of the projects that have been avoided or deferred. These benefits are estimated at $148,000 for 2020, with a 40-year NPV of $1.3 million in benefits.

(C) REDUCED LOSS OF LOAD PROBABILITY OR REDUCED PLANNING RESERVE MARGIN

The long-term benefits of efficiently integrating the bulk power system and delivery network are difficult to quantify but substantial. Resource and load diversity, along with the network's ability to accommodate outages and integrate resources while maintaining system reliability, are critical for establishing planning reserve margins. Increased coordination within the bulk power system can increase system utilization and resiliency.

The 2016 Value of Transmission study assumed transmission expansion would facilitate a 2% reduction in SPP's planning reserve margin. Transmission expansion projects during 2012 to 2014, covered in the 2016 Value of Transmission study, represented a substantial expansion in backbone EHV facilities and increased transfer capabilities within the SPP footprint.

For the purposes of this analysis, the 2% reduction previously captured in the 2016 Value of Transmission study is reflected in existing SPP planning reserve margin requirements. Incremental transmission expansion since the 2016 study does not alter network topology or transfer capability enough to facilitate further reductions in planning reserve requirements. Due to this assumption, this study does not assign any value associated with reductions in loss of load probability or planning reserve margins.

INCREASED WHEELING REVENUES

The transmission projects evaluated in this study provide additional capacity for long-term firm transmission export reservations. SPP has approved 156 megawatts (MW) of long-term firm transmission exports, which provides $4.9 million of additional wheeling revenue on an annual basis to offset wholesale transmission costs. Leveraging prior analysis from SPP staff and applying those results to this analysis, SPP estimated that additional wheeling revenues in 2020 would be $4.9 million with a 40-year NPV of $73 million.

The $4.9 million annual benefit is calculated using the incremental amount of firm point-to-point transmission service sold along with incremental revenues based on Schedules 7 and 11 of the SPP Open Access Transmission Tariff. The incremental capacity was assumed to remain flat through the 40-year study period. The Schedule 7 and 11 rates were escalated at 2% annually, consistent with the inflation rate SPP uses for long-term planning.

Pricing of export services in SPP needs to reflect the true cost of those services, which should include appropriate contributions to offset a portion of major system enhancements. Many of these large, high-capacity projects in the 2015-2019 portfolio enable those transactions.

This $4.9 million annual benefit is a significant reduction from the 2016 Value of Transmission study, which showed a $43.3 million annual benefit. This reduction is attributed to the nature of the benefit calculation, which relies on actual firm export service being approved. This study observed an increase in firm export reservations of only 156 MW, whereas the 2016 Value of Transmission study observed 800 MW of new firm exports. SPP believes it is likely there is additional wheeling benefit to be captured with new firm export reservations.

REDUCED ON-PEAK LOSSES

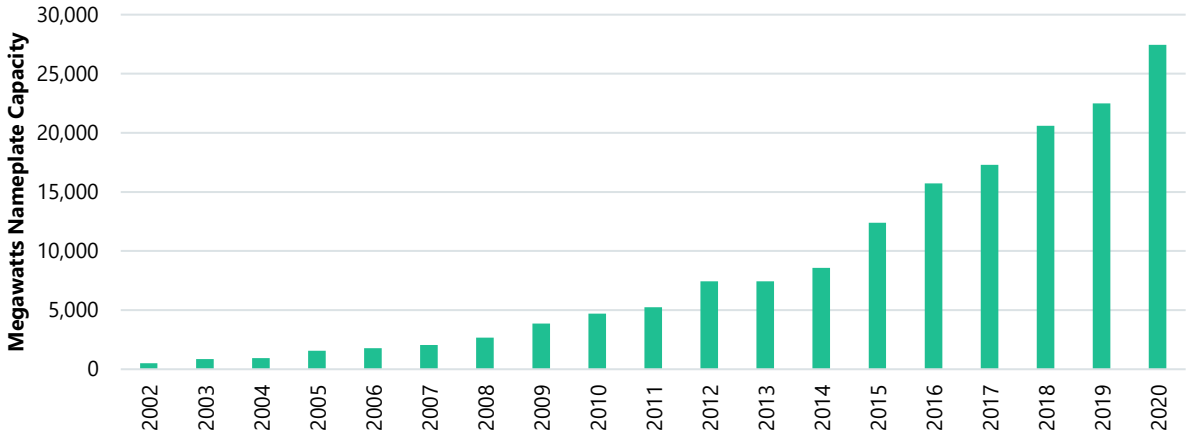
While lower unit commitment and energy dispatch costs are captured in production cost simulations and APC savings, the addition of new transmission capacity could also improve overall system efficiency by reducing system losses. Separate from the analytical model simulations performed when quantifying APC benefits, SPP quantified the benefits associated with reduced on-peak loses. Reduction in losses during on-peak hours provides capacity cost savings due to reduced need for generation capacity. These benefits are captured in this assessment based on the analysis of the actual 2020 system peak hour on July 2, 2020.

Analytical models showed that transmission projects built in 2015-2019 reduced SPP's system losses by 240 MW during the 2020 system peak hour. On-peak losses were simulated to be 901 MW without the 2015-2019 transmission projects, and 662 MW with the projects. Using ITP-approved calculations and assumptions, the capacity cost savings from reduced on-peak losses for the 2015-2019 project portfolio is estimated to be about $23 million per year, which is then escalated at 5% per year over time. The 40-year NPV of these benefits is $518 million.

OPTIMAL WIND GENERATION DEVELOPMENT

Transmission is necessary and very effective for integrating renewable resources and creating value for these resources across SPP's broad geographic footprint. The annual nameplate capacity of wind generation installed on SPP's system is shown in Figure 2.

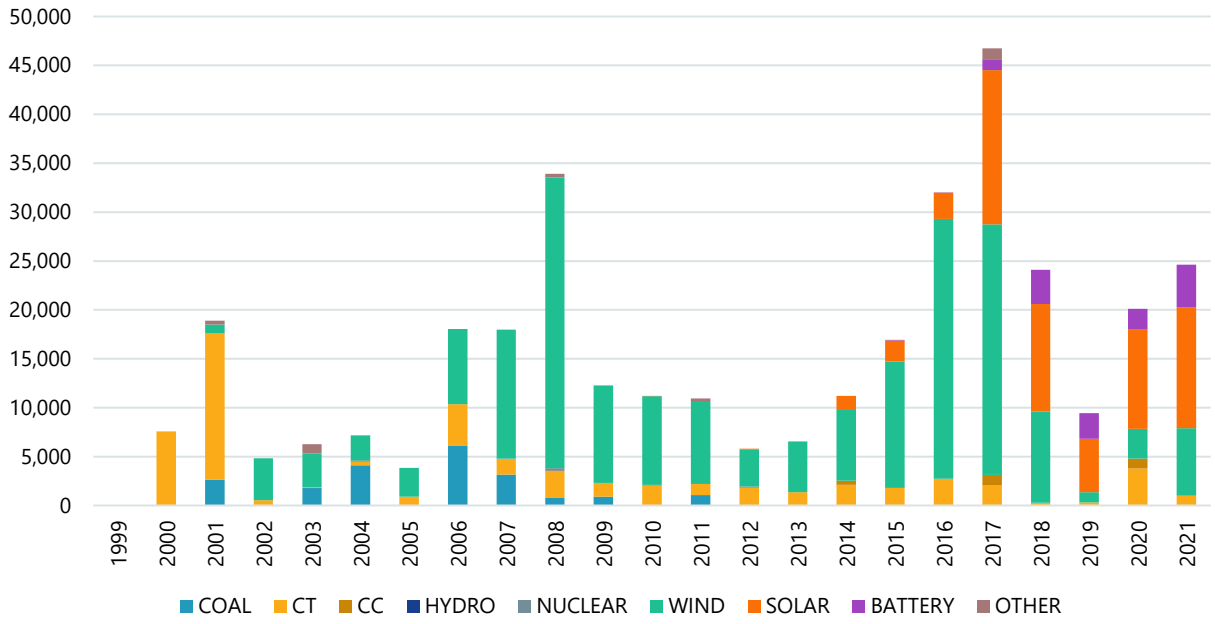
FIGURE 2: WIND IN SPP



Much like wind installations, the GI queue has seen exponential growth in the past decade, as shown in Figure 3. As the economics of renewable generation continue to improve, the accommodation of large amounts of new generation will require expansion and upgrades of the existing transmission system.

The concentration of renewable generation in pockets distant from load centers will require continued transmission expansion to facilitate the bulk transfer of power. Transmission is also effective at integrating diverse resources to smooth out natural variability. Diverse resources over large regions can reduce the need to dispatch more expensive quick-start generation.

FIGURE 3: GENERATOR INTERCONNECTION QUEUE



Analytical models were used to simulate wind curtailments with and without the transmission expansion projects. The transmission projects precluded an average of 815 MW of wind generation from being curtailed based on the 2020 market simulations. Without considering the energy's value and impact on market prices, 7.1 million MWh of wind curtailments equates to approximately $180 million in lost revenue to developers in terms of production tax credits (PTC).[2] The actual value of lost wind production is driven by federal, state and local programs; specific data was not available to quantify the value of lost wind production for this analysis. This lost revenue does not directly benefit customers like other metrics, but it does improve the profitability of other resource providers and can be expected to translate into lower costs to consumers.

[2] Assumes all wind farms operating in SPP in 2020 qualified for 100% of the PTC and the inflation adjusted PTC is worth 2.5 cents per kWh. Source: https://www.govinfo.gov/content/pkg/FR-2020-05-13/pdf/2020-10273.pdf

SPP is ideally situated with ample access to high quality wind and solar renewable resources. A robust transmission system enables the effective integration and delivery of renewable resources across a wide geographic area. Increased geographic diversity of renewable resources increases their aggregate capacity contribution, which is additional value that SPP's transmission network provides to its members and customers. Other independent system operators (ISO) and regional transmission organizations (RTO) have attempted to quantify increased access to higher quality renewable resources provided by transmission expansion. SPP has not developed a robust process to quantify these benefits and the associated incremental value has not been captured in this analysis.

For the purposes of this study, the optimal wind development benefits are quantified as the avoided wind investment and local transmission costs. Transmission expansion during 2015-2019 enabled the development of approximately 7,400 MW of higher quality wind resources with an improvement in capacity factor. SPP staff estimates the avoided wind investment costs, due to these resources, to be about $53 million per year, which equates to an NPV of $630 million over 40 years. Additionally, the 2015-2019 projects help avoid the higher local transmission costs that would have been necessary to integrate wind resources located closer to the buyers' load centers. The avoided local transmission cost benefit is estimated at $184 million per year, which equates to an NPV of $2.2 billion over 40 years.

OTHER BENEFITS

(A) STORM HARDENING

In recent years, increased focus has been placed on grid resiliency and the desire for effective system restoration plans. Long lead time on critical components of the bulk power system, like EHV autotransformers, poses an increasingly growing risk with aging infrastructure and difficulties scheduling maintenance outages.

Adequate transmission to deliver power is critically important to decrease the impacts of future extreme conditions. Transmission adds resilience and could mitigate the need to implement load-shed procedures. Severe weather events like the February 2021 winter storm emphasize the importance of preparing the grid for extreme weather conditions. Transmission interconnections with neighboring systems were essential to prevent uncontrolled blackouts, and robust interconnections and weatherization promote system reliability. The exact value of these benefits is not quantified, and this metric is not captured in this analysis.

(B) FUEL DIVERSITY

This metric has not been fully quantified in this assessment. Some benefits of fuel diversity may have been partially captured to the extent that fuel diversity in the integrated footprint was enhanced because of the transmission expansion projects installed from 2015-2019.

(C) SYSTEM FLEXIBILITY

This metric has not been fully quantified in this assessment. Some benefits of increased system flexibility may have been partially captured to the extent that system flexibility in the integrated footprint was enhanced because of the 2015-2019 transmission expansion projects.

(D) REDUCED EMISSIONS OF AIR POLLUTANTS

This metric has not been quantified in this assessment. However, the 2015-2019 transmission portfolio facilitated emissions reduction by reducing or eliminating curtailment of wind resources and enabling the integration of additional renewable resources.

(E) IMPROVED UTILIZATION OF TRANSMISSION CORRIDORS

This metric has not been quantified in this assessment. However, it is likely that large, high-capacity transmission projects in the 2015-2019 portfolio utilize transmission corridors more effectively than smaller, incremental upgrades that would be required over time.

(F) INCREASED EMPLOYMENT AND ECONOMIC ACTIVITY; INCREASED TAX REVENUES

SPP has not quantified the value of increased employment, economic activity or tax revenues associated with the $3.35 billion spent on transmission infrastructure between 2015 and 2019. These benefits can be large, particularly considering the high-quality renewable generation sited in SPP.

In its *REPOWERING AMERICA: Transmission investment for economic stimulus and climate change*[3] report, London Economics International LLC, on behalf of WIRES Group, documented the direct and indirect economic impacts associated with transmission investments in SPP and across the United States. This study identified increases to the gross domestic product (GDP), increases in high-paying jobs and boosted local spending during the construction phase of transmission projects. The study also identified annual increases in GDP and permanent job additions during the assets' life.

Note: Appendix B summarizes the metrics and quantified benefits in terms of NPV for the SPP transmission expansion projects placed in service from 2015 through 2019 based on Integrated Marketplace data from Jan. 1, 2020, through Dec. 31, 2020.

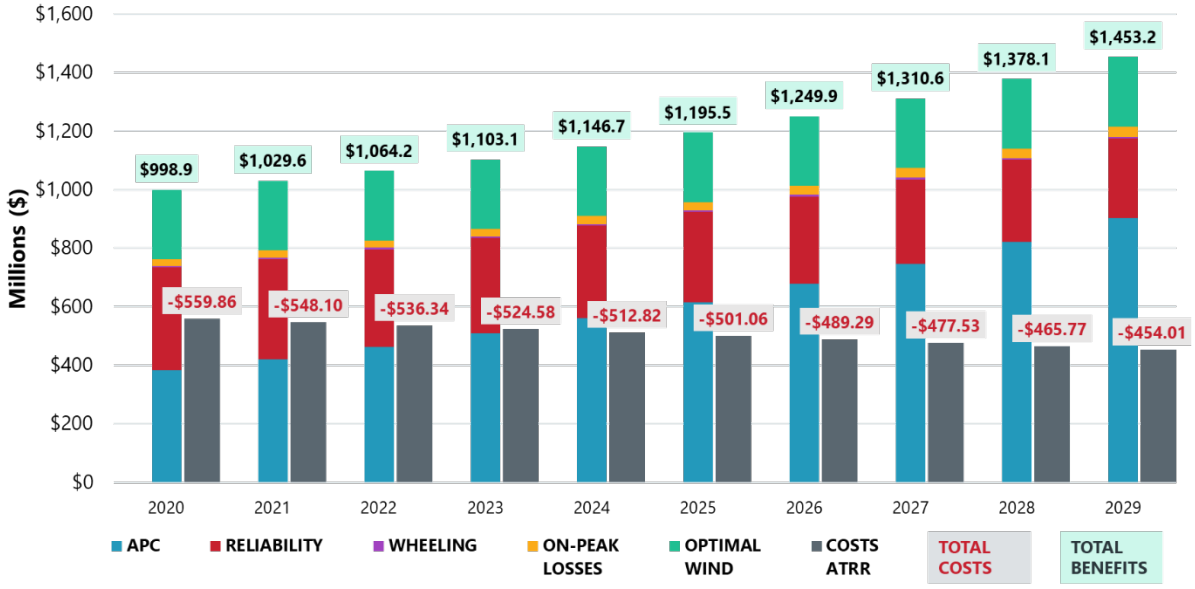
[3] WIRES Group (May 2021), REPOWERING AMERICA: Transmission investment for economic stimulus and climate change. https://wiresgroup.com/wp-content/uploads/2021/05/WIRES-Repowering-America-transmission-investment-May-5.pdf

SUMMARY

This Value of Transmission assessment for transmission expansion projects installed from 2015 through 2019 quantified benefits based on 2020 Integrated Marketplace operational data. The annual benefits, starting in 2020, are included in Table 6 and Figure 4 (in millions of nominal dollars). These benefits are based only on data quantified as part of this assessment.

TABLE 6: VALUE OF TRANSMISSION BASED ON QUANTIFIED BENEFITS ($M)							
YEAR	APC	RELIABILITY	WHEELING	ON-PEAK LOSSES	OPTIMAL WIND	TOTAL VALUE	COSTS ATRR
2020	$382.7	$351.3	$4.9	$23.0	$237.0	$998.9	$559.9
2021	$421.0	$342.5	$5.0	$24.1	$237.0	$1,029.6	$548.1
2022	$463.1	$333.7	$5.1	$25.3	$237.0	$1,064.2	$536.3
2023	$509.4	$324.9	$5.2	$26.6	$237.0	$1,103.1	$524.6
2024	$560.4	$316.1	$5.3	$27.9	$237.0	$1,146.7	$512.8
2025	$616.4	$307.3	$5.4	$29.3	$237.0	$1,195.5	$501.1
2026	$678.0	$298.6	$5.5	$30.8	$237.0	$1,249.9	$489.3
2027	$745.8	$289.8	$5.6	$32.3	$237.0	$1,310.6	$477.5
2028	$820.4	$281.0	$5.7	$33.9	$237.0	$1,378.1	$465.8
2029	$902.5	$272.2	$5.8	$35.6	$237.0	$1,453.2	$454.0

Figure 4: Quantified Benefits* and Costs for 2020-2029



The benefits associated with the expansion projects evaluated in this analysis are substantial. A 40-year planning horizon was used in conjunction with an 8% discount rate. Based on the metrics quantified in this analysis, 2020 operational data from SPP's Integrated Marketplace estimates the upgrades to have a benefit-cost-ratio of 5.24-to-1 as demonstrated in Table 7.

TABLE 7: NET PRESENT VALUE (NPV) OF STUDY METRICS	
METRIC*	**40-Year NPV ($M)**
APC	$20,731
Reliability - Mandated	$3,080
Reliability - Avoided/Deferred	$1
Losses	$518
Wheeling	$73
Optimal Wind	$2,826
Quantified Benefits	**$27,230**
Cost (ATRR)	**$5,194**
B/C	**5.24**

When accounting for the time-value of money, discount rates and inflation rates have a major impact on the present value of benefits received over time. SPP typically uses an 8% discount rate and a 2% inflation rate in long-term planning calculations, and also did so in this study.

Proponents of EHV transmission assert it is long-term enabling infrastructure that provides public good and should be assessed at a lower "societal" discount rate in the range of 3-5% per year. Applying a lower discount rate to the portfolio of transmission projects, as show in Table 8, would further increase the benefit-cost (B/C) ratio shown above.

TABLE 8: COMPARISON OF DISCOUNT RATES		
Discount Rate	**B/C Ratio**	**B/C Ratio: years 16-40 adjusted to 2.5%**
8% Discount Rate	5.24	3.62
5% Discount Rate	7.33	4.31
3% Discount Rate	9.47	4.95

Table 9 compares results from the 2016 Value of Transmission Study to 2021's results. Notably, the B/C ratio substantially increased between the 2016 and 2021 studies. The 2021 study saw significant increases in APC versus the 2016 study. Between 2015 and 2019, SPP interconnected over 12 GW of additional wind generation to the system.

TABLE 9: COMPARISON OF 2016 & 2021 STUDY		
METRIC*	**2016 Study NPV (2020 $M)[4]**	**2021 Study NPV (2020 $M)**
APC	$11,333	$20,731
Reliability - Mandated	$2,345	$3,080
Reliability - 2% Reserve Margin Reduction	$1,466	N/A
Reliability - Avoided/Deferred	$114	$1
Losses	$100	$518
Wheeling	$1,226	$73
Optimal Wind	$1,389	$2,826
Quantified Benefits	**$17,972**	**$27,230**
Cost (ATRR)	**$5,143**	**$5,194**
B/C	**3.49**	**5.24**

* Conservative benefits using quantified metrics and average APC savings compared to 2021 year-end costs.

The APC benefit in this study is escalated by 10% to calculate the benefit of future years, identical to the 2016 study methodology. For informational purposes, SPP also calculated the 40-year NPV of APC benefit using a 2% escalation rate for years 16-40, which is the terminal value used in ITP studies for those later years. Table 10 shows results of this calculation.

TABLE 10: NPV CALCULATION WITH 2% ESCALATION RATE FOR YEARS 16-40	
METRIC	**40-Year NPV ($M)**
APC	$12,291
Reliability - Mandated	$3,080
Reliability - 2% Reserve Margin Reduction	N/A
Reliability - Avoided/Deferred	$1
Losses	$518
Wheeling	$73
Optimal Wind	$2826
Quantified Benefits	**$18,789**
Cost (ATRR)	**$5,194**
B/C	**3.62**

[4] Values from the 2016 Value of Transmission report were escalated at 2% to compare both studies in 2020 dollars.

The 345 kV backbone that SPP stakeholders built in the early half of the 2010s provided crucial capacity to facilitate the installation of intermittent resources during 2015 to 2019. These prior transmission investments allowed the installation of more renewable generation without triggering costly transmission upgrades and additions.

The transmission projects included in this analysis were constructed to meet updated NERC standards and address reliability and economic concerns. Absent these projects, deliverability and system reliability become a concern, which could result in larger curtailment of low-cost renewable generation. The increased ability to transfer energy from where renewable generation is located to SPP's load centers provides a 40-year APC savings NPV of $20.7 billion.

Mandated reliability projects accounted for $2.1 billion in transmission investment between 2015 and 2019. This is an increase of from the $1.8 billion[5] in reliability projects from those included in the 2016 Value of Transmission study.

Wheeling benefits quantified in this study reflect an incremental 156 MW of long-term firm transmission exports facilitated by transmission projects placed in service between 2015 and 2019. This is a decrease from the incremental 800 MW of long-term firm transmission exports facilitated by transmission projects placed in service between 2012 and 2014. The lower incremental amount of long-term transmission exports directly reduces the benefits associated with incremental wheeling revenues.

TRANSMISSION BENEFITS BEYOND THE QUANTIFIED METRICS ARE SIGNIFICANT

Adequate transmission to deliver power is critically important in decreasing the impact of future extreme weather conditions, provides added resilience and could mitigate the need to implement load-shed procedures. During the February 2021 winter storm, SPP's system experienced unprecedented system demands coinciding with disrupted fuel supplies and generation outages.

Although the SPP region experienced severe congestion at times during the 2021 winter weather event, significant transmission investments over the last 10-15 years allowed SPP to more fully utilize available generation resources. Over 35 GW of generation was unavailable to meet demand during the winter storm event.

Transmission interconnections with neighboring regions provided vital support to the grid during extreme cold weather and helped avoid uncontrolled blackouts. Imports provided up to 10% of SPP's energy during the winter storm event, enabling SPP to maintain system operations in the face of extensive generation outages. SPP issued three Energy Emergency Alerts during the winter storm event, calling for load shed during two of the alerts. Interconnections with neighboring regions allowed SPP to avoid larger load shed events and helped maintain system

[5] Values from the 2016 Value of Transmission report were escalated at 2% to compare both studies in 2020 dollars.

stability during extreme weather and operating conditions. Transmission, both within and outside SPP, proved critical and beneficial in avoiding longer, controlled interruptions of service.

Transmission offers a multitude of benefits above and beyond the production cost savings calculated in this analysis. A robust transmission network facilitates more efficient operations of power supply assets and increases flexibility for scheduling network maintenance. As infrastructure continues to age, the ability to accommodate transmission outages without adversely impacting grid operations will continue to be a concern of grid operators.

As the amount of intermittent generation on the SPP system increases, robust transmission infrastructure allows for the effective integration of renewable generation by increasing the ability to transfer power from generation centers to load centers. Increased transmission capability allows SPP to capitalize on the widespread geographic diversity of its footprint and increases the value of renewable resources. Investments in transmission provide flexibility for incorporating new technologies and adaptation to ever-changing environmental targets. Reaching net-zero emissions from the power generating sector will require a dramatic transformation of the existing power supply system. Transmission expansion is a critical piece of reaching net-zero emissions.

The benefits of transmission expansion are cumulative. Increasing the transmission network's interconnectedness is a major contributor to the value of incremental expansion. These network effects are difficult to capture in incremental, snapshot analyses. Centralized and coordinated planning allows for more-optimal network development and a unified approach to achieving long-term goals.

Capturing efficiencies through coordinated planning is a critical success factor of SPP's transmission planning process. Central planning is especially impactful for long-life transmission projects which provide increased optionality for future resource planning decisions.

The magnitude of transmission facilities which will require rebuilds in the next 20 years is unknown. While significant rebuilds of 69-161 kV facilities have been accomplished since 2015, SPP has limited experience needing to rebuild EHV facilities. Projects like the Wichita – Reno Co – Summit 345 kV expansion by Westar in central Kansas have been driven by the need to rebuild aging 115 kV and 138 kV facilities and the ability to accommodate EHV expansion using double circuit towers in existing rights of way.

CONCLUSIONS

Electric transmission allows for the bulk transfer of power across long distances, between centers of commerce and energy hubs. Transmission assets provide system flexibility and optionality to improve operating efficiencies. Expansion of transmission assets provides other benefits to grid operations and planning, though some metrics are difficult to quantify.

The actual benefits associated with transmission expansion, similar to market benefits, typically exceed planning model projections due to assumptions used in those methodologies. Uncertainties and volatility in real-time operations increase system costs and the value provided by transmission assets. Extreme market conditions and weather events multiply the tremendous values regularly provided by transmission projects. The February 2021 winter storm is a prime example: SPP experienced record demand concurrent with generation outages and fuel shortages. Transmission between SPP and neighboring regions provided vital support to the SPP system during that storm and helped prevent additional load shedding.

The calculated benefits associated with transmission expansion projects from 2015 through 2019 are substantial and expected to grow. The net present value (NPV) of savings and benefit-to-cost ratio for these projects are significant, as demonstrated by 2020 operational data.

This study evaluated the benefits of $3.35 billion of transmission projects placed in service between 2015 and 2019. It analyzed production cost benefits from transmission expansion that were realized during actual operations. From these projects, SPP achieved an estimated adjusted production cost (APC) savings of more than $1.0 million per day, representing an annualized savings of $382.7 million per year. SPP expects the NPV of these APC benefits to exceed $20.7 billion over the next 40 years, compared to a present value of revenue requirements of less than $5.2 billion.

This study quantified $6.5 billion in benefits associated with increased wheeling revenues, reliability and resource adequacy, reduced transmission losses and optimal wind development. Overall, SPP expects the NPV of quantified benefits associated with transmission expansion to exceed $27.2 billion over the next 40 years, resulting in a benefit-cost ratio of 5.24.

Major expansions in the transmission system provide numerous benefits and allow for more optimal development of long-term resource plans. Transmission expansion can facilitate increased economic transfers with neighboring systems that are difficult, if not impossible, to forecast in advance. Continued transmission expansion is key to maximizing value and maintaining SPP's ability to plan and address uncertainties.

BRATTLE GROUP LETTER

MEMORANDUM

TO	Casey Cathey, Britt Runion, Southwest Power Pool
FROM	T. Bruce Tsuchida, Johannes P. Pfeifenberger, Pablo A. Ruiz, Akarsh Sheilendranath, The Brattle Group
SUBJECT	**SPP 2021 Value of Transmission Study Report**
DATE	January 4, 2022

Thank you for the opportunity to review the Value of Transmission Study report prepared by SPP staff in December 2021 (2021 Study). The 2021 Study quantifies the overall value provided by transmission projects placed in service within the SPP footprint between 2015 and 2019. This 2021 Study, together with its preceding path-breaking study that quantified the value for projects put in service between 2012 and 2014 (2016 Study), represents best available industry practice and provides a more accurate and realistic estimate of the benefits provided by SPP-approved transmission projects. SPP performed this evaluation by fully rerunning the select representative days in its Day Ahead Reliability Unit Commitment (DA RUC) software with and without the SPP-approved transmission projects (benchmark scenario) in place. [1]

Based on our review of the 2021 Study, we find that the benefits of the 2021 Study may be underestimated. This is the case because:

1. The benchmark scenario without the transmission projects assumes the same amount of wind resources to be installed, while transmission projects likely enabled lower-cost wind developments that would not have been realized without the new transmission;
2. Extreme events are not included in the evaluation. The value of transmission tends to be disproportionately high during such events as transmission enables additional power transfers from areas less affected by the events to the areas most affected;

[1] The 2021 Study uses 60 selected days from the year 2020 based on production costs. The 60 selected days split evenly over 12 months (i.e., 5 days per month) represent days with the 10th, 25th, 50th, 75th, and 90th percentile production costs within a given month.

3. Other quantifiable benefits, such as the avoided costs of necessary reliability upgrades (or avoided replacements of aging assets in the near future), are not included in the evaluation; and
4. The analysis only captures benefits accruing in the day-ahead market. Additional transmission-related benefits associated with real-time conditions that diverge from the day-ahead timeframe are not quantified.

Going forward, we believe SPP's continued evaluation of transmission projects on a periodic basis would greatly improve the understanding of transmission-related benefits by SPP, its stakeholders, and the overall industry. In fact, this type of analysis could become a standard for others to follow. With that potential in mind, we also offer the following recommendations, along with examples, for further refinements that could be implemented in future Value of Transmission Studies:

- Discuss some of the underlying study assumptions in more detail. SPP staff may be versed in them but the general audience may not be as familiar.
    - For example, the report does not elaborate on the various SPP-specific parameters used, such as the escalators for calculating net present values over a longer time horizon. In the report, SPP assumes 5% fuel price and 10% adjusted production cost (APC) benefit escalation factors. SPP also assumes 8% discount and 2% inflation rates. There is no discussion of how these factors and rates were derived, or if there are any correlations amongst them. Discussions of how these parameters were derived could help others develop their own studies using the SPP Value of Transmission Studies as a reference.
- Include further analysis that compares the benefits (and costs) to earlier vintage studies. For example:
    - The 2021 Study does not elaborate on why some of the benefits, such as wheeling benefits, changed markedly from the 2016 Study.
    - APC savings, which is a significant portion of the benefits evaluated, are largely dependent on reduced fuel costs. A simple comparative analyses of the underlying fuel cost assumptions, and the quantity of newly integrated renewable resources with very low (i.e., near zero) marginal operating costs,

could provide additional insights into why and how production cost savings changed between two studies.[2]

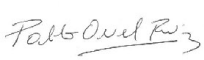
- Add qualitative discussions on benefits that have not been quantified.
    - For example, the additional benefits of transmission during rare but challenging events (such as during Winter Storm Uri in early 2021) are not quantified. If quantifying such benefits is difficult in the immediate-term, it can start by referring to third-party studies of such events, so the audience can understand the potential magnitude of such benefits.

We appreciate the opportunity to review and provide these comments on the 2021 Value of Transmission Study (which improved on the 2016 Study). The 2021 Study showcases how to provide a more accurate and realistic estimate of the value that the SPP-approved transmission projects provide to the SPP system, its members, and the electricity customers served in SPP's footprint.

Respectfully submitted,


T. B. Tsuchida


J. P. Pfeifenberger


P. A. Ruiz


A. Sheilendranath

[2] In SPP, a large portion of the APC savings are from low marginal cost renewable resources, such as wind, replacing generation from fossil fuel resources. If renewables replace the same amount of generation from fossil fuel, higher fossil fuel prices (i.e., costs) will lead to higher APC benefits. Similarly, allowing more wind generation to be integrated without curtailments will lead to higher APC benefits, even under the same fossil fuel prices.

APPENDIX A: ACRONYMS

ACRONYM	DESCRIPTION
APC	Adjusted Production Cost
ATRR	Annual Transmission Revenue Requirement
B/C	Benefit-cost
CAIDI	Customer Average Interruption Duration Index[6]
CROW	Control Room Operations Window software
Day-Ahead RUC	Day-Ahead Reliability Unit Commitment
EHV	Extra High Voltage
FERC	Federal Energy Regulatory Commission
GDP	Gross Domestic Product
GI	Generation Interconnection
GW	Gigawatt
ISO	Independent System Operator
ITP	Integrated Transmission Plan
kV	Kilovolt
MW	Megawatt
N/A	Not Applicable
NERC	National Electric Reliability Council
NPV	Net Present Value
RCAR	Regional Cost Allocation Review
RTO	Regional Transmission Organization
SAIDI	System Average Interruption Duration Index[7]
SPP	Southwest Power Pool
VATF	Value and Affordability Task Force

[6] CAIDI is a measure of duration of the average amount of time a customer is without power per interruption.
[7] SAIDI is a measure of duration of minutes over the year that the average customer is without power.

APPENDIX B: NPV BY CATEGORY

Projected net present value (NPV) of transmission projects installed between March 1, 2015, and Dec. 31, 2019, based on Integrated Marketplace data from Jan. 1, 2020, through Dec. 31, 2020.

BENEFIT CATEGORY	TRANSMISSION BENEFIT	NPV ($M)
Adjusted Production Cost Savings	Reduced production costs due to lower unit commitment, economic dispatch, and economically efficient transactions with neighboring systems	20,731*
1. Additional Production Cost Savings **	a. Impact of generation outages and OR unit designations	INCLUDED
	b. Reduced transmission energy losses	INCLUDED
	c. Reduced congestion due to transmission outages	INCLUDED
	d. Mitigation of extreme events and system contingencies	PARTIAL
	e. Mitigation of weather and load uncertainty	PARTIAL
	f. Reduced cost due to imperfect foresight of real-time system conditions	N/Q
	g. Reduced cost of cycling power plants	PARTIAL
	h. Reduced amounts and costs of operating reserves	PARTIAL
	i. Mitigation of reliability-must-run (RMR) conditions	N/Q
2. Reliability and Resource Adequacy Benefits	a. Mandated reliability projects	3,080
	b. Avoided/deferred reliability projects	1
	c. Reduced loss of load probability or c. reduced planning reserve margin (2% assumed)	N/A
3. Wheeling Revenues	a. Increased wheeling revenues	73
4. Generation Capacity Cost Savings	a. Reduced on-peak losses	518
5. Public Policy Benefits	a. Optimal wind generation development	2,826
6. Other Benefits	a. Storm hardening	N/Q
	b. Fuel diversity	PARTIAL
	c. System flexibility	PARTIAL
	d. Reduced emissions of air pollutants	N/Q
	e. Improved utilization of transmission corridors	N/Q
	f. Increased employment and economic activity; Increased tax revenues	N/Q
	TOTAL	**27,230+**

** Benefits limited to SPP footprint since transactions with neighbors fixed*

*** Partially captured since APC savings based on 57 days and did not include extreme weather events, increased capital investments for rebuilds to address wear and tear impacts beyond in variable operating and maintenance, etc.*

APPENDIX C: INCLUDED TRANSMISSION PROJECTS

UPGRADE ID	PROJECT NAME	R / E / DA	TYPE	IN-SERVICE DATE	COST
10176	Line - OGE Woodward - WFEC Woodward 69 kV	R	Regional Reliability	5/1/2017	$2,369,867
10179	Line - ACME - W Norman 69 kV	R	Regional Reliability	8/1/2015	$1,033,064
10413	Multi - Cowskin - Westlink - Tyler - Hoover 69 kV	R	Regional Reliability	5/22/2015	$3,832,862
10414	Multi - Cowskin - Westlink - Tyler - Hoover 69 kV	R	Regional Reliability	12/1/2015	$5,504,049
10471	Line - Fletcher - Marlow Jct 69 kV	R	Regional Reliability	9/25/2015	$2,218,635
10519	Line - Lindsay - Wallville 69 kV	R	Regional Reliability	3/13/2015	$1,609,327
10523	Multi - Granfield - Cache SW 138 kV	R	Regional Reliability	3/31/2015	$1,431,399
10524	Multi - Granfield - Cache SW 138 kV	R	Regional Reliability	4/1/2016	$4,868,110
10538	Line - 64th - Eastborough 69 kV Rebuild	R	Regional Reliability	5/29/2015	$5,149,880
10583	Multi - Chamber Springs - Farmington 161 kV	R	Regional Reliability	3/28/2017	$9,206,275
10597	Line - Curry - Bailey 115kV	R	Regional Reliability	9/29/2016	$38,607,163
10604	Sub - Arkansas City - Paris 69 kV Terminal Upgrades	R	Transmission Service	2/24/2017	$209,202
10615	Line - Forbing Tap - South Shreveport 69 kV	R	Regional Reliability	4/13/2016	$1,221,505
10629	XFR - Chaves 230/115 kV Transformer Ckt 2	R	Regional Reliability	4/1/2015	$2,751,165
10646	Line - Evenside - Northwest Henderson 69 kV	R	Regional Reliability	5/11/2018	$11,168,315
10649	Line - Brownlee - North Market 69 kV	R	Regional Reliability	3/22/2017	$17,132,431
10657	Line - Ellerbe Road - Forbing Tap 69 kV Ckt 1	R	Regional Reliability	4/13/2016	$8,174,689
10828	Multi: Eagle Creek 115 and 69 kV Taps - 116/69 XF - 3 new lines	R	Regional Reliability	11/14/2015	$0
10935	Multi - Iatan - Nashua 345 kV	E	Balanced Portfolio	4/30/2015	$62,949,252
10945	Multi - Iatan - Nashua 345 kV	E	Balanced Portfolio	4/8/2015	$0
50499	Multi - Iatan - Nashua 345 kV	E	Balanced Portfolio	4/8/2015	$0
11007	XFR - Happy County 115/69 kV Transformers	R	Regional Reliability	6/30/2016	$2,057,140
11009	XFR - Happy County 115/69 kV Transformers	R	Regional Reliability	6/30/2016	$2,074,528
11010	XFR - Newhart 230/115 kV Ckt 2	R	Regional Reliability	12/2/2016	$8,734,222
11017	Line - Carlisle - Wolfforth 230 kV	R	Regional Reliability	3/27/2018	$31,474,329
11023	Multi - Cherry Sub add 230kV source and 115 kV Hastings Conversion	R	Regional Reliability	3/13/2015	$0
11027	Sub - East Plant 115 kV Terminal Upgrade	R	Regional Reliability	6/1/2017	$0
11052	Multi - Pleasant Hill 230/115 kV	R	Regional Reliability	2/26/2016	$16,427,217
11053	Multi - Pleasant Hill 230/115 kV	R	Regional Reliability	5/1/2015	$10,981,451
11054	Multi - Pleasant Hill 230/115 kV	R	Regional Reliability	9/10/2015	$16,001,657
11064	XFR - Eddy Co. 230/115 kV Transformer Ckt 1	R	Regional Reliability	3/31/2017	$4,490,583
11067	Multi - Bowers - Howard 115 kV Ckt 1	R	Regional Reliability	4/22/2015	$3,012,039
50453	Multi - Bowers - Howard 115 kV Ckt 1	R	Regional Reliability	2/28/2016	$35,910,939
11082	Line - Gill Energy Center East - MacArthur 69 kV	R	Regional Reliability	5/21/2015	$6,605,340
11101	Line - Portales - Zodiac 69 kV to 115 kV Conversion	R	Regional Reliability	11/30/2015	$8,084,263
11110	XFR - Graham 115/69 kV Ckt 1	R	Regional Reliability	12/9/2015	$1,337,255
11142	Line - Sub 917 - Sub 918 69 kV Ckt 1	R	Regional Reliability	5/21/2018	$155,546

UPGRADE ID	PROJECT NAME	R / E / DA	TYPE	IN-SERVICE DATE	COST
11158	Line - Bluebell - Prattville 138 kV	R	Regional Reliability	6/2/2015	$8,535,104
51298	Line - Bluebell - Prattville 138 kV	R	Regional Reliability	3/9/2016	$0
50580	Multi - Payne Switching Station - OU 138 kV conversion	R	Regional Reliability	9/25/2015	$3,672,718
11236	Line - Valliant - NW Texarkana 345 kV	E	High Priority	12/16/2016	$170,354,152
11238	Multi - Nebraska City - Mullin Creek - Sibley 345 kV (GMO)	E	High Priority	12/14/2016	$240,770,219
11240	Line - Nebraska City - Mullin Creek 345 kV (OPPD)	E	High Priority	12/15/2016	$59,170,665
11261	Line - Broken Arrow North South Tap - Oneta 138 kV Ckt 1	R	Transmission Service	5/25/2016	$5,060,000
11315	Line - Randall - South Georgia and Osage Station 115 kV Line Re-termination	R	Regional Reliability	4/19/2017	$11,142,098
11317	XFR - Grassland 230/115 kV Transformer Ckt 1	R	Regional Reliability	2/19/2016	$4,013,798
11318	XFR - Swisher 230/115 kV Ckt 1	R	Regional Reliability	12/3/2015	$2,869,670
11343	Line - Arcadia - Redbud 345 kV Ckt 3	R	Transmission Service	6/28/2019	$18,000,000
11355	XFR - Crosby Co. 115/69 kV Transformers Ckt 1 and Ckt 2	R	Regional Reliability	5/1/2015	$4,204,317
11356	XFR - Crosby Co. 115/69 kV Transformers Ckt 1 and Ckt 2	R	Regional Reliability	9/10/2015	$0
11358	Line - Randall - South Georgia 115 kV reconductor	R	Regional Reliability	4/12/2017	$4,678,798
11496	XFR - Northwest 345/138 kV Ckt 3	R	Transmission Service	5/1/2015	$5,054,375
51350	XFR - Northwest 345/138 kV Ckt 3	R	Transmission Service	5/1/2015	$7,581,562
11501	Line - Allen Sub - Lubbock South Interchange 115 kV Ckt 1	R	Regional Reliability	4/26/2019	$186,265
11508	XFR - Hitchland 230/115 kV Ckt 2	R	Regional Reliability	3/29/2017	$7,012,238
11509	XFR - Carlisle 230/115 kV Ckt 1	R	Regional Reliability	3/9/2018	$3,109,347
50168	XFR - Ft Smith 500/161 kV Ckt 3	R	Transmission Service	11/10/2017	$22,598,424
50328	Line - Halstead South - Sedgwick 138 kV	R	Transmission Service	4/20/2016	$139,054
50366	Line - Canton - Taloga 69 kV ckt 1	R	Transmission Service	10/15/2015	$3,059,477
50367	XFR - Taloga 138/69 kV ckt 1	R	Transmission Service	5/1/2015	$787,310
50406	Multi - Cedar Lake Interchange 115 kV	R	Regional Reliability	8/31/2015	$6,981,891
50407	Multi - Cedar Lake Interchange 115 kV	R	Regional Reliability	8/31/2015	$9,933,961
50409	Multi - Ellsworth - Bushton - Rice 115 kV	R	Regional Reliability	3/26/2015	$20,395,064
50413	Multi - Chisholm - Gracemont 345 kV	R	Regional Reliability	12/7/2017	$87,396,515
50414	Multi - Chisholm - Gracemont 345 kV	R	Regional Reliability	12/7/2017	$0
50419	Multi - Chisholm - Gracemont 345 kV	R	Regional Reliability	3/1/2018	$35,955,045
50768	Multi - Chisholm - Gracemont 345 kV	R	Regional Reliability	12/7/2017	$0
50420	Multi - Woodward District EHV - Tatonga - Matthewson - Cimarron 345 kV	R	Regional Reliability	2/1/2018	$49,410,389
50421	Multi - Woodward District EHV - Tatonga - Matthewson - Cimarron 345 kV	R	Regional Reliability	2/15/2018	$59,039,903
50456	Multi - Woodward District EHV - Tatonga - Matthewson - Cimarron 345 kV	R	Regional Reliability	7/1/2016	$27,766,293
50458	Multi - Woodward District EHV - Tatonga - Matthewson - Cimarron 345 kV	R	Regional Reliability	6/24/2016	$22,981,628
50425	Multi - Elm Creek - Summit 345 kV	R	Regional Reliability	3/1/2018	$32,835,921
50426	Multi - Elm Creek - Summit 345 kV	R	Regional Reliability	12/31/2016	$0
50429	Multi - Elm Creek - Summit 345 kV	R	Regional Reliability	12/31/2016	$49,560,694
10425	XFR - Moundridge 138/115 kV	R	Regional Reliability	4/7/2015	$13,441,132
50440	Multi - Hoskins - Neligh 345 kV	R	Regional Reliability	6/17/2016	$51,445,755
50441	Multi - Hoskins - Neligh 345 kV	R	Regional Reliability	6/8/2018	$10,381,296
50621	Multi - Hoskins - Neligh 345 kV	R	Regional Reliability	6/17/2016	$20,412,346

UPGRADE ID	PROJECT NAME	R / E / DA	TYPE	IN-SERVICE DATE	COST
50452	Multi - Hobbs - Yoakum 345/230 kV Ckt 1	R	High Priority	3/30/2018	$14,113,711
50457	Multi - Hobbs - Yoakum 345/230 kV Ckt 1	R	High Priority	5/30/2019	$80,649,240
10600	Line - East Manhattan - Jeffrey Energy Center 230 kV Ckt 1	R	Regional Reliability	4/7/2017	$34,580,095
50503	Line - Bowers - Canadian 69 kV Rebuild	R	Regional Reliability	7/1/2015	$28,931,563
50509	Line - Ft Dodge - N Ft. Dodge - Spearville CKT 2	DA	Generation Interconnection	5/22/2015	$9,546,545
51007	Line - Ft Dodge - N Ft. Dodge - Spearville CKT 2	DA	Generation Interconnection	5/22/2015	$15,397,551
50510	XFR - Spearville 345/115kV CKT 1	DA	Generation Interconnection	5/22/2015	$15,829,550
50513	Line - Bushland Interchange - Deaf Smith County Interchange 230 kV Ckt 1	R	Regional Reliability	12/15/2017	$246,927
50515	XFR - Deaf Smith County Interchange 230/115 kV transformer CKT 1	R	Regional Reliability	2/25/2016	$3,428,156
50516	XFR - Deaf Smith County Interchange 230/115 kV Ckt 2	R	Regional Reliability	6/30/2016	$2,976,736
50517	Line - Ochiltree - Tri-County Cole 115 kV Ckt 1	R	Regional Reliability	11/20/2015	$11,735,967
50520	XFR - Mingo 345/115 kV Ckt 2 Transformer	R	Regional Reliability	1/11/2017	$8,597,207
51180	XFR - Mingo 345/115 kV Ckt 2 Transformer	R	Regional Reliability	1/11/2017	$4,332,021
50532	Multi - Geary County 345/115 kV and Geary - Chapman 115 kV	R	Regional Reliability	6/1/2018	$23,729,799
50534	Multi - Geary County 345/115 kV and Geary - Chapman 115 kV	R	Regional Reliability	12/13/2018	$30,197,842
50605	Multi - Geary County 345/115 kV and Geary - Chapman 115 kV	R	Regional Reliability	5/17/2018	$14,344,514
50533	Line - Kerr - 412 Sub 161 kV Ckt 1	R	Regional Reliability	6/1/2017	$207,691
50535	Line - 412 Sub - Kansas Tap 161 kV Ckt 1	R	Regional Reliability	9/11/2019	$409,848
50545	Line - Rock Hill - Springridge Pan-Harr REC 138 kV Ckt 1	R	Regional Reliability	9/19/2016	$25,330,929
50546	Line - Atoka - Eagle Creek 115 kV Ckt 1	R	Regional Reliability	12/31/2018	$24,272,586
50560	XFR - Potash Junction 115/69 kV Ckt 1	R	Regional Reliability	8/7/2015	$2,422,732
50563	Multi - Kilgore Switch - South Portales - Market St. - Portales 115 kV	R	Regional Reliability	2/7/2018	$4,604,052
50564	Multi - Kilgore Switch - South Portales - Market St. - Portales 115 kV	R	Regional Reliability	7/13/2018	$4,850,346
50565	Multi - Kilgore Switch - South Portales - Market St. - Portales 115 kV	R	Regional Reliability	2/7/2018	$15,189,905
50567	Line - Dekalb - New Boston 69 kV	R	Regional Reliability	6/5/2015	$15,777,911
50568	Line - Hardy Street - Waterworks 69 kV	R	Regional Reliability	6/25/2015	$5,366,606
50569	Line - Midland REC - North Huntington 69 kV	R	Regional Reliability	5/15/2015	$11,990,487
50570	Line - Midland - Midland REC 69 kV	R	Regional Reliability	5/15/2015	$0
50571	Line - Howe Interchange - Midland 69 kV	R	Regional Reliability	5/15/2015	$0
50572	Line - Chelsea - Childers 69 kV	R	Zonal Reliability	7/29/2015	$355,000
50574	Line - 6815 Tap South in Ckt 623 - Sub 6815 T3 69 kV Ckt 1	R	Regional Reliability	3/13/2015	$439,561
50581	XFR - Gill 138/69 kV Ckt 3	R	Regional Reliability	9/17/2015	$5,010,729
50582	Multi - Viola 345/138kV Transformer and 138 kV Lines to Clearwater and Gill	R	Regional Reliability	4/19/2018	$10,144,608
50583	Multi - Viola 345/138kV Transformer and 138 kV Lines to Clearwater and Gill	R	Regional Reliability	11/16/2018	$23,061,836
50584	Multi - Viola 345/138kV Transformer and 138 kV Lines to Clearwater and Gill	R	Regional Reliability	11/16/2018	$18,318,471
50612	Multi - Viola 345/138kV Transformer and 138 kV Lines to Clearwater and Gill	R	Regional Reliability	4/19/2018	$2,393,900
50606	Line - Hays Plant - South Hays 115 kV Ckt 1 Rebuild	R	Regional Reliability	10/13/2016	$10,219,608
50607	Sub - Messick 500/230 kV	R	Regional Reliability	4/29/2016	$58,649,881
50608	Multi - Bobcat Canyon 345/115 kV and Bobcat Canyon - Scottsbluff 115 kV	R	Regional Reliability	10/26/2017	$5,746,994
50609	Multi - Bobcat Canyon 345/115 kV and Bobcat Canyon - Scottsbluff 115 kV	R	Regional Reliability	10/26/2017	$21,201,741
50616	Multi - Bobcat Canyon 345/115 kV and Bobcat Canyon - Scottsbluff 115 kV	R	Regional Reliability	10/26/2017	$4,009,802

UPGRADE ID	PROJECT NAME	R / E / DA	TYPE	IN-SERVICE DATE	COST
51570	Multi - Bobcat Canyon 345/115 kV and Bobcat Canyon - Scottsbluff 115 kV	R	Regional Reliability	6/1/2017	$1,345,626
50624	Multi - Renfrow - Medford Tap - Chikaskia 138 kV	R	Regional Reliability	4/1/2016	$5,754,747
50636	Line - Canyon East Sub - Canyon West Sub 115 kV Ckt 1	R	Regional Reliability	5/18/2016	$4,300,650
50637	Line - Mustang - Shell CO2 115 kV Ckt 1	R	Transmission Service	4/29/2019	$18,699,621
50690	Line - Oxy Permian Sub - West Bender Sub 115 kV Ckt 1	R	Regional Reliability	10/28/2016	$692,678
50691	Line - Butler - Weaver 138 kV Ckt 1	R	Regional Reliability	1/28/2016	$0
50693	Quahada Switching Station 115 kV	R	Regional Reliability	7/9/2015	$7,668,328
50699	XFR - S1366 161/69 kV Ckt 1	R	Regional Reliability	5/31/2016	$623,116
50761	XFR - S1366 161/69 kV Ckt 1	R	Regional Reliability	5/31/2016	$422,270
50708	Multi - Potash Junction - Road Runner 230/115 kV Ckt 1	R	High Priority	11/30/2015	$0
50709	Multi - Potash Junction - Road Runner 230/115 kV Ckt 1	R	High Priority	11/30/2015	$59,848,300
50718	Line - Broadmoor - Fort Humbug 69 kV Ckt 1	R	Regional Reliability	6/21/2017	$4,352,349
50719	Line - Daingerfield - Jenkins Rec 69 kV Ckt 1 Rebuild	R	Regional Reliability	11/9/2017	$1,835,000
50720	Line - Hallsville - Longview Heights 69 kV Ckt 1	R	Regional Reliability	3/2/2018	$9,930,039
50721	Line - Hallsville - Marshall 69 kV Ckt 1	R	Regional Reliability	6/2/2017	$10,670,271
50722	Line - Chavis - Price - CV Pines - Capitan 115 kV Ckt 1	R	Regional Reliability	1/30/2018	$1,185,000
50723	Line - Chavis - Price - CV Pines - Capitan 115 kV Ckt 1	0	Regional Reliability	1/30/2018	$0
50724	Line - Chavis - Price - CV Pines - Capitan 115 kV Ckt 1	R	Regional Reliability	1/30/2018	$1,727,131
50726	Line - Wellington - Creswell 69 kV	R	Regional Reliability	3/16/2016	$4,418,722
50727	Line - Wellington - Creswell 69 kV	R	Regional Reliability	11/20/2015	$3,824,314
50730	Line - Crestview - Kenmar 69 kV	R	Regional Reliability	11/13/2015	$9,342,217
50733	Line - Crestview - Kenmar 69 kV	R	Regional Reliability	11/7/2017	$5,246,249
50739	Line - Montgomery - Sedan 69 kV Ckt 1	R	Zonal Reliability	12/28/2017	$12,634,488
50740	Line - Montgomery - Sedan 69 kV Ckt 1	R	Zonal Reliability	9/11/2019	$15,906,575
50745	Multi - Fremont - S991 E 161/69 kV Ckt 1	R	Regional Reliability	4/30/2019	$2,075,199
50746	Multi - Fremont - S991 E 161/69 kV Ckt 1	R	Regional Reliability	4/30/2019	$4,254,712
50747	Multi - Fremont - S991 E 161/69 kV Ckt 1	R	Regional Reliability	4/30/2019	$20,150,325
50748	Multi - S906 - S912 69 kV	R	Regional Reliability	6/1/2018	$1,143,763
50749	Multi - S906 - S912 69 kV	R	Regional Reliability	6/1/2018	$128,670
50757	Multi - Broken Bow Wind - Ord 115 kV Ckt 1	R	Regional Reliability	3/1/2018	$29,418,126
50760	Multi - Broken Bow Wind - Ord 115 kV Ckt 1	R	Regional Reliability	6/1/2018	$516,009
50758	Multi - Knob Hill - Lane - Noel 138 kV Ckt 1	R	Regional Reliability	9/30/2018	$4,367,290
51030	Multi - Knob Hill - Lane - Noel 138 kV Ckt 1	R	Regional Reliability	10/1/2018	$912,703
50802	Line - Darlington - Roman Nose 138 kV Ckt 1	R	High Priority	6/29/2017	$11,033,623
51117	Line - Darlington - Roman Nose 138 kV Ckt 1	R	High Priority	12/15/2016	$11,538,456
50805	Multi - Knipe - SW Station - Linwood & Warwick Tap 138 kV Ckt 1	R	High Priority	5/11/2018	$11,352,952
50806	Multi - Knipe - SW Station - Linwood & Warwick Tap 138 kV Ckt 1	R	High Priority	5/11/2018	$8,494,353
50807	Multi - Knipe - SW Station - Linwood & Warwick Tap 138 kV Ckt 1	R	High Priority	5/11/2018	$9,409,815
50809	Sub - Alva OGE 69 kV	R	High Priority	6/1/2015	$62,471
50851	Multi - Hobbs - Kiowa 345 kV Ckt 1	R	High Priority	3/30/2018	$11,806,387
50875	Multi - Hobbs - Kiowa 345 kV Ckt 1	R	High Priority	3/30/2018	$52,084,447

UPGRADE ID	PROJECT NAME	R / E / DA	TYPE	IN-SERVICE DATE	COST
50819	Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1	R	High Priority	6/1/2018	$20,816,118
50820	Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1	R	High Priority	6/1/2018	$25,905,391
50849	Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1	R	High Priority	6/1/2018	$5,434,144
50850	Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1	R	High Priority	6/1/2018	$6,110,103
50852	Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1	R	High Priority	6/1/2018	$6,814,454
50854	Multi - Kiowa - North Loving - China Draw 345/115 kV Ckt 1	R	High Priority	6/1/2018	$7,318,532
50862	Multi - Potash Junction - Road Runner 345 kV Conv. and Transformers at Kiowa and Road Runner	R	High Priority	4/30/2018	$6,777,778
50868	Multi - Potash Junction - Road Runner 345 kV Conv. and Transformers at Kiowa and Road Runner	R	High Priority	4/30/2018	$6,133,123
50871	Multi - Potash Junction - Road Runner 345 kV Conv. and Transformers at Kiowa and Road Runner	R	High Priority	4/30/2018	$5,136,295
50827	Line - Anthony - Harper 138 kV Ckt 1	R	High Priority	3/27/2018	$11,300,191
50828	Line - Harper - Rago 138 kV Ckt 1	R	High Priority	12/20/2017	$11,475,555
50881	Multi - Andrews 230/115 kV Transformer and Andrews - NEF 115 kV Ckt 1	R	High Priority	4/4/2016	$12,154,286
50882	Multi - Andrews 230/115 kV Transformer and Andrews - NEF 115 kV Ckt 1	R	High Priority	4/4/2016	$3,031,564
50874	Multi - Dollarhide - Toboso Flats 115 kV	0	High Priority	6/1/2018	$0
50869	Multi - China Draw - Yeso Hills 115 kV	R	High Priority	5/3/2019	$4,547,820
50988	Multi - China Draw - Yeso Hills 115 kV	R	High Priority	5/3/2019	$383,797
50915	Line - Park Lane - Seminole 138 kV Terminal Upgrades	R	Transmission Service	1/29/2016	$84,000
50920	XFR - Seminole 230/115 kV #1 and #2	R	Regional Reliability	12/28/2018	$3,355,302
50921	XFR - Seminole 230/115 kV #1 and #2	R	Regional Reliability	4/30/2019	$2,587,642
50877	Multi - Ponderosa - Ponderosa Tap 115 kV	DA	High Priority	6/1/2017	$1,109,068
50879	Multi - Ponderosa - Ponderosa Tap 115 kV	DA	High Priority	6/1/2017	$547,377
50923	Multi - Ponderosa - Ponderosa Tap 115 kV	R	High Priority	6/1/2017	$10,130,206
50925	Multi - Livingston Ridge - Sage Brush - Cardinal 115 kV	R	High Priority	12/16/2016	$2,430,161
50926	Multi - Livingston Ridge - Sage Brush - Cardinal 115 kV	R	High Priority	11/30/2017	$11,943,519
50951	Multi - Livingston Ridge - Sage Brush - Cardinal 115 kV	R	High Priority	12/15/2016	$5,687,646
50967	Multi - Livingston Ridge - Sage Brush - Cardinal 115 kV	R	High Priority	12/15/2016	$8,378,836
50954	Line - Ochoa - Ponderosa Tap 115 kV Ckt 1 Rebuild	R	Regional Reliability	6/1/2018	$4,190,439
50870	Line - Hopi Sub - North Loving - China Draw 115 kV Ckt 1	R	High Priority	5/25/2015	$10,421,028
50883	Line - Hopi Sub - North Loving - China Draw 115 kV Ckt 1	R	High Priority	5/25/2015	$11,070,902
50990	Line - Mt. Pleasant - West Mt. Pleasant 69 kV Ckt 1	R	Regional Reliability	4/20/2015	$5,738,013
50991	Multi - Anthony - Bluff City - Caldwell - Mayfield - Milan - Viola 138 kV Ckt 1	R	High Priority	5/25/2018	$45,155,249
50993	Multi - Anthony - Bluff City - Caldwell - Mayfield - Milan - Viola 138 kV Ckt 1	R	High Priority	5/25/2018	$0
50994	Multi - Anthony - Bluff City - Caldwell - Mayfield - Milan - Viola 138 kV Ckt 1	R	High Priority	5/25/2018	$0
50995	Multi - Anthony - Bluff City - Caldwell - Mayfield - Milan - Viola 138 kV Ckt 1	R	High Priority	5/25/2018	$0
51394	Multi - Anthony - Bluff City - Caldwell - Mayfield - Milan - Viola 138 kV Ckt 1	R	High Priority	5/25/2018	$0
51395	Multi - Anthony - Bluff City - Caldwell - Mayfield - Milan - Viola 138 kV Ckt 1	R	High Priority	5/31/2018	$1,992,105
51014	Line - Grady - Round Creek 138 kV Ckt 1	R	High Priority	11/5/2015	$0
50992	XFR - Tuco 230/115 kV Ckt 1	R	Transmission Service	6/15/2019	$103,149
50873	Multi - Battle Axe - Road Runner 115 kV	R	High Priority	11/12/2015	$9,000,997
50968	Multi - Battle Axe - Road Runner 115 kV	R	High Priority	12/4/2015	$2,664,288
51034	Multi - Ellerbe Road - Lucas 69 kV	R	Regional Reliability	2/27/2019	$9,375,483

UPGRADE ID	PROJECT NAME	R / E / DA	TYPE	IN-SERVICE DATE	COST
51039	XFR - Yoakum County Interchange 230/115 kV Ckts 1 and 2	R	Transmission Service	3/15/2019	$2,346,404
51050	XFR - Yoakum County Interchange 230/115 kV Ckts 1 and 2	R	Regional Reliability	5/7/2019	$3,201,912
51048	Multi - Midwest Pump - Midwest Pump Tap 115 kV Ckt 1	R	High Priority	7/2/2016	$4,057,015
51049	Multi - Midwest Pump - Midwest Pump Tap 115 kV Ckt 1	R	High Priority	7/2/2016	$0
51070	Line - Twin Church - Dixon County 230kV Ckt 1	DA	Generation Interconnection	11/1/2018	$61,774
51109	Line - Canyon West - Dawn - Panda - Deaf Smith 115 kV Ckt 1 Rebuild	R	Regional Reliability	3/9/2018	$3,483,013
51110	Line - Canyon West - Dawn - Panda - Deaf Smith 115 kV Ckt 1 Rebuild	R	Regional Reliability	11/14/2018	$1,738,575
51111	Line - Canyon West - Dawn - Panda - Deaf Smith 115 kV Ckt 1 Rebuild	R	Regional Reliability	4/1/2018	$5,289,345
51112	Carlisle Interchange - Tuco Interchange 230 kV Ckt 1	R	Transmission Service	10/24/2016	$326,937
50821	XFR - Potash Junction 230/115 kV Ckt 1	R	High Priority	5/15/2016	$3,923,562
50931	Line - China Draw - Wood Draw 115 kV Ckt 1	R	High Priority	6/15/2017	$14,514,395
51133	XFR - Sub 3459 345/161 kV Ckt 1 Transformer	R	Regional Reliability	6/1/2018	$6,588,939
51136	XFR - Sub 3459 345/161 kV Ckt 1 Transformer	R	Regional Reliability	6/1/2018	$3,604,757
51139	Sub - Cimarron - Draper 345 kV Terminal Upgrades	R	Regional Reliability	12/1/2017	$1,121,449
51140	Sub - Amoco - Sundown 230 kV Terminal Upgrades	R	Regional Reliability	2/20/2019	$714,760
51146	Sub - Claremore 161 kV Terminal Upgrades	R	Regional Reliability	11/17/2017	$11,200
51151	Line - Iatan - Stranger 345 kV Ckt 1 Voltage Conversion	E	Economic	6/1/2018	$1,885,731
51283	Line - Iatan - Stranger 345 kV Ckt 1 Voltage Conversion	E	Economic	6/1/2018	$7,688,424
51284	Line - Iatan - Stranger 345 kV Ckt 1 Voltage Conversion	E	Economic	6/1/2018	$21,830,047
51187	Line - Southwestern Station - Carnegie 138kV Ckt 1 Rebuild	R	Regional Reliability	7/6/2017	$8,899,000
51189	Line - PCA Interchange - Quahada 115 kV Ckt 1 Rebuild	R	Regional Reliability	2/25/2017	$11,174,333
51190	Line - Little River - Maud 69 kV Ckt 1 Rebuild	R	Regional Reliability	10/21/2016	$213,362
51197	XFR - South Waverly - 161/69 kV Ckt 1 Transformer	R	Regional Reliability	5/31/2016	$1,399,924
51268	XFR - South Waverly - 161/69 kV Ckt 1 Transformer	R	Regional Reliability	5/31/2016	$227,040
51200	Multi - Bassett 115 kV	R	Regional Reliability	6/1/2018	$192,099
51206	XFR - Lynn County 115/69 kV Ckt 1 Transformer	R	Regional Reliability	5/15/2019	$2,317,591
51270	XFR - Lynn County 115/69 kV Ckt 1 Transformer	R	Regional Reliability	5/15/2019	$298,747
51207	Line - Linwood - South Shreveport 138kV Ckt 1 Rebuild	R	Regional Reliability	5/10/2018	$7,885,000
51211	Sub - Benton 138 kV Terminal Upgrades	R	Regional Reliability	5/17/2016	$776,974
51215	Line - Brooks Street - Edwards Street 69kV Ckt 1 Rebuild	R	Regional Reliability	12/20/2017	$4,649,536
51235	Multi - Walkemeyer Tap - Walkemeyer 345/115 kV	R	Regional Reliability	6/1/2018	$13,433,258
51240	Multi - Walkemeyer Tap - Walkemeyer 345/115 kV	R	Regional Reliability	6/30/2018	$1,605,731
51241	Multi - Walkemeyer Tap - Walkemeyer 345/115 kV	R	Regional Reliability	6/21/2018	$8,019,463
51326	Multi - Walkemeyer Tap - Walkemeyer 345/115 kV	R	Regional Reliability	6/30/2018	$3,588,484
51327	Multi - Walkemeyer Tap - Walkemeyer 345/115 kV	R	Regional Reliability	6/30/2018	$7,129,724
50952	Multi - Road Runner 115 kV Loop Rebuild	R	Regional Reliability	3/22/2019	$4,354,881
50955	Multi - Road Runner 115 kV Loop Rebuild	R	Regional Reliability	1/26/2018	$1,987,893
50957	Multi - Road Runner 115 kV Loop Rebuild	R	Regional Reliability	3/22/2019	$2,332,087
50958	Multi - Road Runner 115 kV Loop Rebuild	R	Regional Reliability	3/22/2019	$2,790,027
51131	Multi - Road Runner 115 kV Loop Rebuild	R	Regional Reliability	12/14/2018	$3,240,716
51245	Multi - Road Runner 115 kV Loop Rebuild	R	Regional Reliability	12/14/2018	$1,285,381

UPGRADE ID	PROJECT NAME	R / E / DA	TYPE	IN-SERVICE DATE	COST
51250	Multi - Road Runner 115 kV Loop Rebuild	R	Regional Reliability	3/20/2019	$1,095,981
51209	Sub - Buckner - Spearville 345 kV Terminal Upgrades	R	Regional Reliability	7/20/2017	$3,640,996
51292	Line - Hoskins - Dixon County 230kV Ckt 1	DA	Generation Interconnection	11/1/2018	$308,869
51604	Line - Lake Creek - Lone Wolf 69kV Ckt 1	DA	Generation Interconnection	8/8/2015	$763,887
51306	Multi - AVS - Charlie Creek 345 kV	R	Regional Reliability	1/1/2016	$67,433,735
51307	Multi - AVS - Charlie Creek 345 kV	R	Regional Reliability	6/1/2016	$6,577,852
51308	Multi - AVS - Charlie Creek 345 kV	R	Regional Reliability	1/1/2016	$19,837,636
51310	Multi - Charlie Creek - Judson - Williston 345/230 kV	R	Regional Reliability	1/1/2016	$71,158,911
51311	Multi - Charlie Creek - Judson - Williston 345/230 kV	R	Regional Reliability	12/22/2015	$16,824,339
51312	Multi - Charlie Creek - Judson - Williston 345/230 kV	R	Regional Reliability	1/1/2016	$3,140,590
51313	Multi - Charlie Creek - Judson - Williston 345/230 kV	R	Regional Reliability	12/22/2015	$2,564,691
51314	Multi - Judson - Tande - Neset 345/230 kV	R	Regional Reliability	11/11/2017	$65,339,314
51315	Multi - Judson - Tande - Neset 345/230 kV	R	Regional Reliability	10/31/2017	$14,868,299
51316	Multi - Judson - Tande - Neset 345/230 kV	R	Regional Reliability	1/1/2016	$517,463
51317	Multi - Judson - Tande - Neset 345/230 kV	R	Regional Reliability	10/31/2017	$3,508,331
51331	Battle Creek – County Line – Antelope 115kV: Rebuild	DA	Generation Interconnection	3/31/2017	$2,047,174
51340	Battle Creek – County Line – Antelope 115kV: Rebuild	DA	Generation Interconnection	3/31/2017	$1,952,826
51352	SUB - Tap and Tie South 4th - Bunch Creek & Enid Tap - Fairmont (GEN-2012-033-Tap) 138kV	DA	Generation Interconnection	8/14/2015	$2,241,645
51522	SUB - Tap and Tie South 4th - Bunch Creek & Enid Tap - Fairmont (GEN-2012-033-Tap) 138kV	DA	Generation Interconnection	8/14/2015	$19,997,096
51523	SUB - Tap and Tie South 4th - Bunch Creek & Enid Tap - Fairmont (GEN-2012-033-Tap) 138kV	DA	Generation Interconnection	8/14/2015	$392,245
51358	Line - Cochran - Whiteface Tap 69 kV Ckt 1 Rebuild	R	Regional Reliability	11/28/2018	$2,481,675
51406	Line - Cunningham - Monument Tap 115 kV Ckt 1 Rebuild	R	Regional Reliability	12/20/2019	$5,344,209
51409	Sub - Potash Junction 230 kV Terminal Upgrade	0	Regional Reliability	6/1/2018	$0
51411	Line - National Enrichment Plant - Teague 115 kV Ckt 1 Rebuild	R	Regional Reliability	12/14/2018	$217,082
51425	XFR - Woodward EHV 138kV Phase Shifting Transformer	DA	Generation Interconnection	6/1/2017	$5,898,287
51431	Sub - Hobbs - Yoakum Tap 230 kV Substation and Transformer	R	Regional Reliability	5/1/2019	$0
51432	Sub - Hobbs - Yoakum Tap 230 kV Substation and Transformer	R	Regional Reliability	6/18/2019	$12,696,625
51436	Sub - Potter Co. - Harrington 230 kV Terminal Upgrades	R	Regional Reliability	5/16/2019	$1,196,324
51438	Line - Road Runner - Agave Red Hills/Ochoa/Custer Mountain 115 kV New Line	R	Regional Reliability	3/20/2017	$443,866
51439	Line - Road Runner - Agave Red Hills/Ochoa/Custer Mountain 115 kV New Line	R	Regional Reliability	3/20/2017	$2,449,206
51440	Line - Road Runner - Agave Red Hills/Ochoa/Custer Mountain 115 kV New Line	R	Regional Reliability	4/28/2017	$204,462
51441	Line - Road Runner - Agave Red Hills/Ochoa/Custer Mountain 115 kV New Line	R	Regional Reliability	3/28/2017	$1,137,605
51442	Line - Road Runner - Agave Red Hills/Ochoa/Custer Mountain 115 kV New Line	R	Regional Reliability	3/28/2017	$289,533
51443	Line - Road Runner - Agave Red Hills/Ochoa/Custer Mountain 115 kV New Line	R	Regional Reliability	3/28/2017	$162,507
51446	Sub - Northeastern Station 138 kV Terminal Upgrades	R	Regional Reliability	10/5/2016	$183,231
51452	Multi - Artesia County 115 kV	R	Regional Reliability	12/17/2018	$378,266
51453	Multi - Artesia County 115 kV	R	Regional Reliability	11/20/2019	$278,513
51454	Line - Duncan - Tosco 69 kV Ckt 1 Rebuild	R	Regional Reliability	5/4/2018	$8,591,402
51471	Line - Plant X - Tolk 230kV rebuild circuit #1 and #2	DA	Generation Interconnection	3/16/2018	$5,100,000
51472	Line - Plant X - Tolk 230kV rebuild circuit #1 and #2	DA	Generation Interconnection	3/16/2018	$5,100,000
51473	XFR - TUCO Interchange 345/230kV CKT 1 Replacement	DA	Generation Interconnection	6/1/2018	$3,347,036

UPGRADE ID	PROJECT NAME	R / E / DA	TYPE	IN-SERVICE DATE	COST
51481	Line - Canyon East Tap - Randall 115 kV Ckt 1 Rebuild	R	Regional Reliability	5/16/2019	$4,413,984
51503	Multi - Kummer Ridge - Roundup 345 kV New Line and Patent Gate and Roundup 345/115 kV Substations	R	Regional Reliability	9/1/2016	$3,448,356
51504	Multi - Kummer Ridge - Roundup 345 kV New Line and Patent Gate and Roundup 345/115 kV Substations	R	Regional Reliability	9/1/2016	$4,018,781
51543	Multi - Kummer Ridge - Roundup 345 kV New Line and Patent Gate and Roundup 345/115 kV Substations	R	Regional Reliability	9/1/2016	$17,510,954
51544	Multi - Kummer Ridge - Roundup 345 kV New Line and Patent Gate and Roundup 345/115 kV Substations	R	Regional Reliability	9/1/2016	$16,893,241
51506	Multi - Plaza 115 kV Substation and Blaisdell - Plaza 115 kV New Line	R	Regional Reliability	2/1/2018	$3,540,726
51507	Multi - Plaza 115 kV Substation and Blaisdell - Plaza 115 kV New Line	R	Regional Reliability	2/1/2018	$12,833,523
51509	Line - Berthold - Southwest Minot 115 kV Ckt 1 Reconductor	R	Regional Reliability	10/1/2017	$3,534,766
51524	Line - Comanche Tap - Tosco 69 kV Ckt 1 Rebuild	R	Regional Reliability	12/19/2016	$0
51529	Multi - DeGrasse - Knob Hill 138 kV New Line and DeGrasse 345/138 kV Transformer	R	Regional Reliability	4/17/2019	$7,607,868
51530	Multi - DeGrasse - Knob Hill 138 kV New Line and DeGrasse 345/138 kV Transformer	R	Regional Reliability	4/17/2019	$7,536,594
51548	Sub - Summit 115 kV Terminal Upgrades	R	Transmission Service	10/5/2016	$228,776
51549	Sub - Terry Co. - Wolfforth 115 kV Terminal Upgrades	R	Regional Reliability	6/1/2018	$598,335
51558	Line - Atoka - Atoka Pump - Pittsburg - Savanna - Army Ammo - McAlester City 69 kV Ckt 1 Rebuild	R	Zonal Reliability	12/18/2019	$8,544,022
51561	Line - Fort Towson - Kiamichi Pump Tap - Valliant 69 kV Ckt 1 Rebuild	R	Regional Reliability	12/21/2018	$11,778,983
51562	Line - Fort Towson - Kiamichi Pump Tap - Valliant 69 kV Ckt 1 Rebuild	R	Regional Reliability	12/21/2018	$7,699,929
50451	Multi - Tuco - Yoakum 345/230 kV Ckt 1	R	Regional Reliability	5/31/2019	$10,203,846
51623	Sub - Tuco - Stanton 115 kV Terminal Upgrades	0	Economic	12/31/2018	$0
51624	Sub - Stanton - Indiana 115 kV Terminal Upgrades	E	Economic	1/1/2017	$0
51626	Sub - Butler - Altoona 138 kV Terminal Upgrades	E	Economic	9/21/2018	$274,649
51628	Sub - Neosho - Riverton 161 kV Terminal Upgrades	E	Economic	12/7/2018	$107,669
51631	Line - DePaul - Girard Jct - Franklin - Frontenac 69 kV	R	Regional Reliability	11/15/2018	$5,699,405
51632	Line - DePaul - Girard Jct - Franklin - Frontenac 69 kV	R	Regional Reliability	11/15/2018	$8,977,067
51730	Line - Knoll - Post Rock 230 kV New Line Ckt 2	E	Economic	11/11/2018	$790,927
51815	Line - Knoll - Post Rock 230 kV New Line Ckt 2	E	Economic	11/11/2018	$1,938,416
51816	Line - Knoll - Post Rock 230 kV New Line Ckt 2	E	Economic	11/11/2018	$1,743,688
51738	Line - Siloam Springs - Siloam Springs City 161 kV Ckt 1 Rebuild	E	Economic	5/31/2019	$4,780,000
51739	Line - Siloam Springs - Siloam Springs City 161 kV Ckt 1 Rebuild	E	Economic	5/31/2019	$330,549
51774	Sub - Lula - Tupelo Tap 138 kV Terminal Upgrades	E	Economic	1/18/2019	$168,028
51819	Sub - Hockley County Interchange 115 kV Terminal Upgrades	R	Regional Reliability	11/15/2019	$199,390
51826	Sub - Muskogee 161 kV Terminal Upgrades	R	Regional Reliability	7/10/2018	$60,913
61834	Sub - Hale County 115 kV	R	Regional Reliability	12/1/2018	$49,956
61836	Sub - Martin - Pantex N 115 kV Terminal Upgrades	0	Economic	3/15/2018	$0
61837	Sub - Martin - Pantex N 115 kV Terminal Upgrades	0	Economic	3/15/2018	$0
61850	Terry County - LG Clauene 115 kV Terminal Upgrades	R	Regional Reliability	12/31/2019	$369,516
61856	Sub - Williston 115 kV	R	Regional Reliability	11/20/2017	$403

UPGRADE ID	PROJECT NAME	R / E / DA	TYPE	IN-SERVICE DATE	COST
61858	Line - Tulsa Southeast - E.61st 138 kV Rebuild	R	Regional Reliability	12/20/2019	$8,151,314
61869	Line - Line – Republic East – Republic Hines Street – Republic North – Nichols 69 kV Reconductor	R	Regional Reliability	4/13/2018	$9,391,929
61870	Line - Line – Republic East – Republic Hines Street – Republic North – Nichols 69 kV Reconductor	R	Regional Reliability	4/13/2018	$0
61871	Line - Line – Republic East – Republic Hines Street – Republic North – Nichols 69 kV Reconductor	R	Regional Reliability	4/13/2018	$0
61894	Line - New East Ruthville - SW Minot 115 kV New Line	R	Regional Reliability	12/19/2019	$13,837,385
61895	Line - New East Ruthville - SW Minot 115 kV New Line	R	Regional Reliability	12/19/2019	$528,350
71945	Line - Broken Arrow North - Lynn Lane East 138 kV Ckt 1	R	Regional Reliability	3/19/2019	$5,714,095
71923	Line - Renfrow-Renfrow Tap 138kV Ckt 1	DA	Generation Interconnection	10/3/2017	$90,000
71926	Multi - Roberts County - Sisseton 69kV	R	Regional Reliability	1/1/2019	$3,428,490
71927	Multi - Roberts County - Sisseton 69kV	R	Regional Reliability	9/30/2019	$5,332,510
71938	Multi - Roberts County - Sisseton 69kV	R	Regional Reliability	12/30/2019	$622,432
72005	Sub - Bismarck 115 kV and North Bismarck 115 kV Terminal Upgrades	R	Sponsored Upgrade	12/11/2019	$0
72029	Multi - Park Community - Sunshine 138 kV	R	Regional Reliability	6/15/2018	$5,762,251
72047	Sub - Brookridge - Overland Park 161kV Terminal Upgrades	R	Regional Reliability	10/15/2019	$584,053
72049	Sub - Olathe - Switzer 161kV Ckt1 Terminal Upgrades	R	Regional Reliability	11/26/2019	$706,019
72066	Multi - Fig Five - VBI 69kV	R	Regional Reliability	4/11/2019	$1,922,899
72067	Multi - Fig Five - VBI 69kV	R	Regional Reliability	5/16/2019	$32,996
82125	Line - Nixa Downtown - Nixa Espy	R	Regional Reliability	11/22/2019	$3,373,307
82139	Line - Kildare - White Eagle 138 kV	DA	Sponsored Upgrade	10/29/2019	$4,092,646
82140	XFR - James River Power Station 161/69 kV Ckt 2	DA	Sponsored Upgrade	6/1/2018	$2,885,626
112396	Sub - Getty - Skelly 69kV	DA	Regional Reliability	11/4/2019	$122,831

R = Reliability, E = Economic, DA = Direct Assignment

TYPE	COST
Regional Reliability	$2,017,866,113
Transmission Service	$84,278,291
Balanced Portfolio	$62,949,252
High Priority	$1,017,054,295
Generation Interconnection	$88,074,485
Zonal Reliability	$37,440,085
Economic	$41,538,128
Sponsored Upgrade	$6,978,272
Total	**$3,356,178,921**