2021 ITP Needs Assessment Posting Information

As part of the ITP assessment, SPP conducts economic, reliability, public policy, short circuit, and operational needs assessments, as detailed in Section 4 of the ITP Manual, which results in a comprehensive list of needs being posted for SPP stakeholders.

DPP Submittal Form Updates

The Detailed Project Proposal (DPP) Submittal form has been updated for 2021. The updates are itemized below and were also discussed during the April 28, 2021 DPP Educational Session:

Main Form Page

- 1 General Project Information:
  - 1.b Supporting documentation provided - removed. We ask that you put the list of supporting files with the description of the project in section 1.a
  - 1.c Preliminary transmission line engineering and design data – removed
  - 1.d Proposed line routing – removed
  - 1.d.1 Total numerical line mileage has been incorporated in the main General Project Information (1.b Numerical straight line mileage purposed)
  - 1.e Describe significant scope items – removed
  - 1.f Preliminary substation engineering and design– removed
  - 1.f.1 GPS coordinates have been incorporated in the main General Project Information (1.c GPS coordinates)
  - 1.g Describe significant scope items – removed
- 3 Proposed Project Schedule section – removed
- 4 Risk(s) Identification Section – removed
  - 4.a Describe anticipated risk(s) - removed
  - 4.b Mitigation plan - removed
- 5 Environmental Impact(s) – removed
- 6 Engineering and Modeling Data Required – removed
- 7 Changes to Modeling Assumption – changed to section 3 Changes to Modeling Assumption
- 8 Transmission Economic or Reliability Analysis removed – moved to tab 'Section 4'

Individual Tabs

- Removed tabs: Section 1a, Section 1b, Section 1d, Section 1e, Section 1g, Section 3, Section 4a, Section 4b, Section 5, Section 6, Section 7, Section 8
- Renamed tabs: Section 1f1 renamed to Section 1c
- Renamed tabs: Section 9 renamed to Section 4
  - Added to Section 4
  - Adjusted Production Cost (APC) table
  - Suggested Interface limit table

- Additional information necessary to evaluate or calculate cost
- Reliability or economic analysis performed

SPP's uses automation to complete a data verification process identifying situations when errors associated with the application of files is discovered, but it is unable to ensure the correct format/syntax was used. There is a possibility that data using incorrect format/syntax passes through the verification process without producing an error, however the file may not be applied as intended by the submitter. The risk of improper application resides with the submitter. For this reason, we suggest that you utilize format/syntax associated with the recommended PSS®E or PROMOD version.

SPP recommends that PROMOD and PSS®E files should be submitted using commands or syntax in the recommended versions to avoid the risk of improper application of desired solutions.

For the 2021 ITP Assessment, the following versions were used and are the recommended version for any data supplied to SPP in support of a submitter's DPP:

- PROMOD: Version 11.2.0
- PSS®E: Version 34.6.1

2021 ITP Needs Assessment

SPP has posted the 2021 ITP Needs Assessment under a mitigated schedule where the expected completion date has been pushed back from October 2021 to early December 2021. As a result, SPP has worked with its members to identify ways to reduce the efforts to complete the study in order to ensure the study can be completed with quality in the 2021 calendar year. This mitigation effort includes removing or relaxing some efforts of a normal study.

The first of two major scope reductions of the 2021 is the removal of the Market Powerflow Models (MPMs) from the ITP assessment. The MPMs are utilized to verify the DC economic dispatch under AC system conditions and assess the system's reactive powerflow needs on a regional and local level. The removal of the MPMs allowed staff to post the Needs Assessment and open the DPP Window as quickly as possible.

The second of two major scope reductions is the relaxing of the economic needs criteria used to identify economic needs. The scope of the economic Needs Assessment has been reduced per SPP staff's recommendation and approval by both the ESWG and TWG. The economic needs assessment will focus on needs that:

- Fall within the 2021 ITP target areas

- Correlation with the SPP-MISO Joint Targeted Interconnection Queue (JTIQ) study needs
- Overlap with reliability or operational needs
- Are terminally limited and are not related to bulk transfer issues, or
- Have higher than minimum required congestion scores (detailed below)

Staff has generally included constraints that have a congestion score of greater than $200k/MW, as opposed to the typical starting value of $50k/MW, as economic needs.

Staff has also used engineering judgment to modify the list of economic needs. This engineering judgment included reducing the list based upon: the potential APC benefit observed by relieving constraints through relaxation runs, identification of consistent congestion score values through multiple ITP assessments, or constraints with increasing or decreasing congestion that may need to be studied in the upcoming 2022 20-Year Assessment.

2021 ITP Target Areas

The 2021 ITP includes two stakeholder approved target areas. These areas are the SPS South area and the Bakken area.

Along the Texas – New Mexico border is the SPS New Mexico Ties (SPSNMTIES) voltage stability interface that restricts the flow into the New Mexico transmission system to 895 MW in the summer and 825 MW in the winter. The interface is comprised of two 345 kV lines and two 230 kV lines. This area is in the southwest corner of the SPP footprint, mostly surrounded by the Western Interconnection and ERCOT Interconnection, isolating this area of interest via limited transmission capacity to the rest of SPP.

In the Bakken shale formation area (Bakken) of North Dakota (primarily in the Basin Electric Power Cooperative (Basin) footprint), gas and oil production have been rapidly increasing, driving significant load growth in the northwest corner of the SPP footprint. This load increase combined with both wind and gas unit availability in winter-peaking conditions drove the need for additional analysis in the area. Furthermore, this area is generally surrounded to the north by the Canadian border and the Western Interconnection to the west, somewhat isolating this area of interest.

Additional documentation is included with the Needs Assessment posting to provide education on the target areas, how to submit solutions, potential use of sensitivity models, and staff's plans for analysis of solutions intended to address either target area.

Butler-Altoona 138 kV Line

The 2021 ITP models include both the Butler-Altoona 138 kV as it exists today and the recommended 2020 ITP Assessment project consisting of a new 138 kV line from Butler to Tioga. The Butler-Altoona line is energized both the Base Reliability (BR) and Market Economic Models (MEM), while the Butler-Tioga line is de-energized. The 2021 ITP models **do not** accurately reflect the TO-planned project, which calls for rebuilding a portion of the existing Butler-Altoona 138 kV line to a new Otter Creek substation (located about 35 miles east of the Butler substation) with transformation to the 115 kV level, and a new line heading north to an existing East Eureka substation. The remaining portion of the line from Otter Creek to Altoona would not change.

The SPP Board of Directors requested a re-evaluation of the 2020 ITP recommended solution leading to a withdrawal of the project. During the re-evaluation, staff discovered that modeling the topology from the TO-planned project increases the congestion score associated with this corridor as a result of the lowered line impedance from the new conductor. DPPs submitted for this area will be screened against the current approved model set, as noted below. The modification of these facilities to match the TO-planned project will occur during the re-baselining effort of the MEMs. This normally occurs between phase 3 and 4 of the project grouping milestone and may affect project recommendations.

As observed over the last two ITP cycles, this area has complexities associated with it and exhibits the potential for an economic solution. Additionally, the 2021 ITP increases this complexity because the TO-planned topology is not modeled. Because of the 2021 ITP's mitigation status and the complexities associated with this area, staff wants to ensure DPP submitters understand that while staff is expects to make an honest effort to address the congestion in this area and find best regional solution, it will receive less focus than the previously discussed target areas in the 2021 ITP. Staff expects to continue discussion on the 2021 ITP's mitigation status throughout the remainder of the study and will continue to inform stakeholders on efforts during those discussions.

Midwest-Franklin Operational Need

The Midwest-Franklin 138 kV line was approved by the ESWG as a persistent economic operational need. Real-time congestion costs have surpassed $70 million dollars over the last two years; however, the ITP Market Economic Model (MEM) does not reflect that level of congestion. Staff is considering accelerating a previously-approved least cost solution to address this issue in lieu of detailed work to implement modeling changes that would align the MEM with what real-time operations is observing with regards to this facility.

SPP Evaluation of Model Changes Not Included in the Approved Model Set

SPP staff will evaluate the impacts of model changes submitted during the 2021 ITP DPP window, as appropriate. As noted in the DPP form, please check the box if your submittal includes a model correction. This includes model corrections submitted after the models were approved by either the TWG or ESWG, known Notification to Construct (NTC) projects not included in the approved model set, and modeled NTCs that have been withdrawn or will be withdrawn during the development of transmission portfolios.

- No changes will be made to the current base models to capture the impacts of model changes during initial project screening, specifically:
  - Defined needs will be based on the current approved models
  - All solutions will be screened against the approved reliability models without consideration of model changes
  - The impacts of all model changes will be captured and considered in development of the transmission portfolio
  - No new needs will be identified due to the impact of any model changes; any new violations will be assessed in future studies
  - Model corrections will be evaluated to determine the impact on posted transmission needs and either utilized to invalidate system needs or as solutions in development of the transmission portfolio(s)
  - Current NTCs not already modeled will be evaluated and utilized as potential solutions to transmission needs; this is not to be considered a re-evaluation of those existing NTCs

Informational Needs

Various needs have been included for informational purposes only. Please refer to the "Overview" and "Legend" tabs of the "2021 ITP Needs Assessment.xlsx" workbook for identification and additional description of these needs.

Event File Changes During Economic Portfolio Development

During the Economic Portfolio Development milestone, it may be necessary to add additional constraints to the event file to identify upstream and/or downstream congestion. Staff will make these determinations; however, suggestions for these additional constraints may be included as part of a DPP submittal.

Need Overlap and Project Screening Efforts

Reliability, Economic, and Operational Needs have been correlated in order to identify overlap and additional opportunities for synergy of projects. During the Project Screening milestone, all solutions will be evaluated to determine their ability to provide relief or mitigate each economic and reliability need, as applicable.[1] As discussed during the April 28 DPP Educational Session,

[1] Solutions providing only reactive support cannot be evaluated in economic analysis because the economic tool does not consider reactive flows

SPP staff does not plan to evaluate highly complex DPP submittals consisting of varying combinations of projects. Instead, SPP staff will ensure the individual components of these highly complex portfolios are evaluated. Paired solutions that work well together by addressing related needs or upstream/downstream congestion are encouraged to be submitted by stakeholders for consideration.

The evaluation of all solutions will provide information which can be leveraged in the portfolio development and optimization to aid in determining whether a reliability or economic solution addressing similar needs should be selected. During this effort, the Avoided Reliability Benefit Metric (discussed in the Benefits Metric Manual) may be calculated and considered as a supplement to the adjusted production cost savings benefit metric of an economic project that can successfully and appropriately avoid or defer a base reliability project.

Seams Consideration(s)

Seams evaluation in the ITP Assessment will be performed according to details in ITP Manual, Sections 5.3.1 and 5.3.2. Economic projects interconnecting SPP with a non-SPP TO or with an APC benefit to a neighboring entity of at least 20% of total benefit will be evaluated as a seams project. Economic projects meeting this criteria will be evaluated with at least 20% of the cost applicable to the neighboring entity. As solution development moves forward, SPP staff will coordinate with the applicable neighboring entity to determine a more accurate level of cost sharing for any potential reliability and economic seams projects. Please consider this information in your solution development.

Unlike recent ITP assessments, SPP and MISO are not performing a Coordinated System Plan assessment concurrent with the 2021 ITP. However, SPP and MISO are currently performing a Joint Targeted Interconnection Queue (JTIQ) study that generally aligns with the 2021 ITP assessment schedule. The JTIQ study has three distinct study goals, one of which focuses on "identifying solutions that meet the needs of interconnection customers and provide benefits to load in both SPP and MISO near the seam." SPP identified economic needs (as indicated by the JTIQ flag) that may benefit from the recommendation of a proposed reliability or economic solution from the JTIQ study.

Detailed Project Proposal (DPP) Submittal Expectations

Interface Ratings Changes

If a DPP adjusts the SPSNMTIES and/or the related SPPSPSTIES interface ratings,[2] Section 1.a.4. of the DPP Submittal Form must be marked "Yes" and the Suggested Interface Limit Changes table(s) in the section 4 tab should be populated (see sections below).

[2] Per methodology in 2021 ITP SPS South Target Area Scope and Interface Guidelines document

Pursuant to SPP tariff Attachment O section III.6.a, the information in this section is considered information that should be available to support the evaluation of the project. If this information is not included, the DPP will be considered deficient.[3] DPPs intending to modify the rating of the interface **may not be evaluated as intended** if the form is filled out improperly.

1.a.4. Are there any **SUGGESTED INTERFACE LIMIT CHANGES** included in this submittal? *(Complete table in tab Section 4 of this workbook)*	*Select Yes/No*

SUGGESTED INTERFACE LIMIT CHANGES : Does project allow transfer level on SPSNMTIES interface as described in Target Area Scope Documents? If yes, please fill information in below as required by SPP Tariff, Attachment O, Section III.6.						
Place an 'X' under the transfer level achieved by the project.	T0	T1	T2	T3	T4	T5
AND/OR						
Provide the SPSNMITES interface rating the project achieves as described in the Target Area Scope Document.	MW					

Inclusion of Proxy Resources and Transmission Topology

Although the proxy SVC, CC, and GOF are base model assumptions, they should be considered as potential solutions (among others) moving forward into 2021 ITP solution development. Submitters may desire to propose a comprehensive solution that includes the proxy resource and transmission topology.

If the solution **should** include the SVC, CC, and GOF, submitters do not need to include any additional changes to the DPP IDEV. For any DPPs that **should not** include the proxy SVC, CC, or GOF, submitters should include the applicable text below at the top of the DPP's IDEV to remove these facilities.

Removal of Proxy SVC

```
BAT_PURGMAC,528013,'1'
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[3] Per SPP tariff Attachment O section III.6.c

Removal of Proxy CC and GOF

```
BAT_PURGMAC,528610,'1C'
BAT_PURGBRN,528610,528611,'1'
BAT_PURGBRN,528610,528611,'2'
BAT_BSYSINIT,1
BAT_BSYSO,1,528610
BAT_EXTR,1,0,0,0
BAT_PURGBRN,528604,528611,'1'
BAT_PURGBRN,527896,528611,'1'
BAT_BSYSINIT,1
BAT_BSYSO,1,528611
BAT_EXTR,1,0,0,0
BAT_PURGBRN,528027,528604,'1'
BAT_BUS_CHNG_4,528604,0,,,,, 230.0,,,,,,,,;
BAT_BRANCH_DATA_3,527894,528604,'1',,,,,,, 0.00341, 0.04041,
0.099390,,,,,30.77,,,,, 496, 545,,,,,,,,,,," "
BAT_PURG3WND,528604,528602,528601,'1'
BAT_BUS_DATA_4,528600,0,1,526,526,1508,13.2,,,1.05,0.5,1.05,0.9,"ANDREWS_TR21"
BAT_THREE_WND_IMPED_DATA_4,528604,528602,528600,'2',,,,,3,3,2,,528600,,,,, 138207.,
0.0609, 28454.0, 0.0457, 26773.0, 0.0563, 90.0, 16.25, 16.25, 29358.0,
0.00056,,,,,,,'FROM BORDEN_1',,
BAT_SEQ_THREE_WINDING_DATA_3,528604,528602,528600,'2',,,17,,, 0.000985, 0.077015,,,
0.000555,-0.016055,,, 0.009155, 0.0269295,,,;
BAT_THREE_WND_WINDING_DATA_5,528604,528602,528600,'2',1,99,,,,,0,, 230.0,,,,,,,,,
167.0, 167.0,,,,,,,,,,;
BAT_THREE_WND_WINDING_DATA_5,528604,528602,528600,'2',2,,,528602,,-1,1,, 131.0,0.0,
1.0095, 0.74618, 1.0438, 0.95,,,,,,,,,,,,,,,;
BAT_THREE_WND_WINDING_DATA_5,528604,528602,528600,'2',3,99,,,,,0,, 13.2,-
30.0,,,,,,,, 20.1, 20.1,,,,,,,,,,;
BAT_THREE_WND_IMPED_DATA_4,528604,528602,528601,'1',,,,,3,3,2,,,,,,, 139051.,
0.0612, 28617.0, 0.0455, 27444.1, 0.0562,90.0,16.25,100, 30906.0,
0.00056,,,,,,,'FROM MIDLAND _1',,
BAT_SEQ_THREE_WINDING_DATA_3,528604,528602,528601,'1',,,,,, 0.002956, 0.038907,,,-
0.000778, 0.012704,,, 0.015078, 0.20296,,,;
BAT_THREE_WND_WINDING_DATA_5,528604,528602,528601,'1',1,99,,,,,0, 1.0, 230.0,, 1.1,
0.9,,,,,, 167.0, 167.0,,,,,,,,,,;
BAT_THREE_WND_WINDING_DATA_5,528604,528602,528601,'1',2,,,528602,,-1,1, 0.8861,
131.0,, 1.0095, 0.74618,, 0.95,,,, 167.0, 167.0,,,,,,,,,,;
BAT_THREE_WND_WINDING_DATA_5,528604,528602,528601,'1',3,,,,,,0,,,,,,,,,, 30.3,
30.3,,,,,,,,,,;
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Solutions to Non-Converged Needs

Non-converged contingencies are situations in which the powerflow solution is not able to reach convergence within the given parameters after a contingency is taken. This can be the result of a mathematical solution divergence or the case "blowing up." The first expectation to developing quality solutions for these needs is ensuring the model can reach a valid solution. Another expectation for solutions to non-converged contingencies is for the submitter to

perform limit checks and/or additional contingency analysis to ensure the solution mitigates the issue and does not result in new violations.

2021 ITP Staff Solution Development

Staff solution versions of top-performing DPPs were created and utilized for economic portfolio development in the 2021 ITP. Staff solutions were based upon Minimum Design Standard Ratings. This removes bias introduced by various submitters utilizing different DPP ratings and impedances while being screened with the same conceptual cost estimate (*e.g.,* 3000 amps vs. 4000 amps). Staff will generally prefer minimum design characteristics unless a measureable increase in benefit is expected for a solution with a rating higher than minimum design standards. In these cases, staff may request a study level cost estimate for both sets of design characteristics for a better evaluation to ensure the best project is selected.

- Existing Facilities
    - Determine most limiting element in series and develop staff solution to address most limiting elements. For example, if line conductor is most limiting then staff solution may either:
        - Achieve minimum amperage
        - If existing line is already at minimum amperage, then use next minimum amperage (1200 -> 2000 amp 138 kV, 161 kV, and 230 kV)
- New Facilities
    - Develop staff solutions to supplement DPPs as needed
    - Develop staff solution versions of top performing DPPs using minimum emergency rating amperages and typical impedances as needed to evaluate solutions on consistent basis. For example, a staff solution using minimum amperages and typical impedances with same new line terminations as DPP.

SPP Staff Standard Impedance Solution Development Information

Standard impedance information is being provided in order to improve stakeholder transparency and consistency in the data utilized by SPP staff. This data is utilized for solution development work performed during SPP's ITP Solution Development and Evaluation and Portfolio Development processes outlined in the ITP Manual.

Data used for SPP staff solutions:

- Emergency Rating Amperage from Minimum Transmission Design Standards for Competitive Upgrades by kV level
- Impedances from previous version of SPP MDAG Manual by kV level

Facility Ratings[4]

The minimum amperage capability of phase conductors shall meet or exceed the values shown below, unless otherwise specified by SPP. If otherwise specified by SPP, the SPP value shall govern. The amperage values shown in the table shall be considered to be associated with emergency operating conditions.

The emergency rating is the amperage the circuit can carry for the time sufficient for adjustment of transfer schedules, generation dispatch, or line switching in an orderly manner with acceptable loss of life to the circuit involved. Conductors shall be selected such that they will lose no more than 10 percent of their original strength due to anticipated periodic operation above the normal rating.

Voltage (kV)	Emergency Rating (Amps)
100 - 200	**1,200**
230	**1,200**
345	**3,000**
500	**3,000**
765	**4,000**

The conversion from conductor ampacity to conductor temperature shall be based on SPP Planning Criteria, Section 7.2.; however, any subsequent request for proposal (RFP) would specify the design wind speed and direction.

Data used for SPP ITP Staff Solutions

Typical Branch Impedance Table						
kV	**R/mi**	**X/mi**	**B/mi**	**Amps**	**MVA**	**X/R**
69	0.0054	0.0143	0.0003	600	71	2.6
115	0.00064	0.005	0.00084	1200	239	7.8
138	0.00045	0.0038	0.0012	1200	286	8.4
161	0.0002	0.0019	0.0022	2000	557	9.5
230	0.0001	0.001	0.004	2000	796	10
345	0.00004	0.00048	0.0091	3000	1792	12

[4] Minimum Transmission Design Standards for Competitive Upgrades, Rev.2_012617

Typical Branch Impedance Table						
kV	R/mi	X/mi	B/mi	Amps	MVA	X/R
500	0.00002	0.00026	0.017	3000	2598	13
765	0.000004	0.000084	0.051015	4000	5300	21

SPP will use the same impedance per kV for higher amperage line.

Typical Transformer Impedance Table				
kV	R	X	Rate A	Rate B
765/345	0.00006	0.00799	2877	3174
345/230	0.00082	0.0307	675	675
345/161	0.00022	0.03009	400	440
345/138	0.00052	0.00485	493	493
345/115	0.00078	0.00685	435	435
230/138	0.00109	0.07741	168	193
230/115	0.00028	0.05181	280	308
161/138	0.00032	0.01983	150	165
161/115	0.0005	0.00616	168	185
138/115	0.00052	0.00124	200	250
500/115	0.0002	0.03	600	600
500/230	0.0002	0.03	600	600
500/345	0.0002	0.03	600	600
138/69	0.00052	0.00124	200	250
115/69	0.004458	0.143531	84	96

SPP will use same impedance per kV for larger or smaller transformers.

Conceptual Cost Estimates

SPP calculates its own conceptual cost estimates as part of the DPP validation efforts. This provides each solution with a +100/-50% cost estimate utilized for the solution screening process. These cost estimates are based upon historical projects directed by SPP and completed by its members. The data is not available at a level of granularity that allows for conceptual cost estimates to differentiate electrically similar solutions with a significant differences in ratings, therefore staff is likely to prefer a project with a lower rating over a project with a larger rating unless the project with a larger rating performs significantly better overall than the lower rated project. A spreadsheet containing these estimates is reference in the Needs Assessment transmittal.