



# 20-Year Assessment Manual

SPP Staff



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**Revision History**

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Date	Author	Change Description
5/8/17	SPP Staff	Initial Draft
5/15/17	SPP Staff	Edits per 5/12/17 Net Conference Feedback
10/12/17	SPP Staff	Edits per 10/5/17 Net Conference Feedback
3/29/19	SPP Staff	Updates to Links and General Clean-Up

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## Table of Contents

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Revision History .....	2
Table of Contents.....	3
Introduction .....	5
Objective .....	5
Working Group Involvement .....	5
Economic Studies Working Group.....	5
Transmission Working Group.....	6
Model Development Working Group.....	6
Seams Steering Committee.....	6
Markets and Operations Policy Committee .....	6
Strategic Planning Committee.....	6
Board of Directors .....	6
Regional State Committee .....	6
Stakeholder Reviews.....	6
Load Forecast Review.....	6
Renewable Policy Review .....	7
Generation Review .....	7
Economic Model Review .....	7
Constraint Assessment Review .....	7
Study Process .....	8
Data Inputs.....	9
Market Structure.....	9
Scenarios.....	9
Resource Plan.....	9
Renewable Policy Review.....	10
System Topology.....	10
Generation Parameters.....	10
Renewables .....	10
Siting.....	10

DC Ties and Lines.....	10
Fuel Prices .....	10
Emission Prices.....	11
Hurdle Rates.....	11
Benchmarking .....	11
Analysis .....	12
Define Constraints .....	12
Needs Assessments.....	12
Economic Assessment.....	12
Policy Assessment .....	12
Solution Development .....	13
Develop 300 kV+ Solutions .....	13
Economic Project Solutions.....	13
Public Policy Project Solutions .....	13
Cost Estimates.....	13
Sensitivities.....	13
Benefit Metrics.....	14
Timeline.....	15
Deliverables.....	16
Final Report.....	16
Changes in Process and Assumptions.....	17

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## Introduction

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The 20-Year Assessment is conducted in accordance with the SPP Open Access Transmission Tariff (OATT) Attachment O and under the guidance of the SPP Strategic Planning Committee (SPC).

### **Objective**

The objective of the 20-Year Assessment is to develop a long-range extra high voltage (EHV), 300 kV and above, transmission road map for the SPP region. The assessment will result in the identification of projects that economically deliver energy within the SPP region while addressing a reasonable range of future industry uncertainty. The resulting library of projects will provide a source of candidate projects that will inform shorter-term planning assessments for the purpose of injecting longer-term vision into those assessments.

### **Working Group Involvement**

The Economic Studies Working Group (ESWG) identifies and maintains the economic data, data sources, models, economic planning methodology and processes, and adjusted production cost (APC) to be used in the evaluation of economic expansion needs in the SPP region.

The Transmission Working Group (TWG) oversees and maintains the study processes for constraint assessment, topology, and load and generation review to be used in the 20 year model.

The Model Development Working Group (MDWG) identifies and maintains the generation review to be used in the 20-year model.

The SPC will be responsible for the scenarios and policy decisions.

The Seams Steering Committee (SSC) will evaluate the seams impact.

The 20-Year Assessment recommended plan will be reviewed and may be endorsed by the ESWG, TWG, Markets and Operations Policy Committee (MOPC), Regional State Committee (RSC), and SPP Board of Directors (board).

### **Economic Studies Working Group**

The ESWG will be responsible for the review of the data and results for the following:

- Renewable policy review
- Scope
- Scenarios
- Benefit metrics
- Sensitivities
- Economic model review and assumptions
- Resource plan review
- Load forecasts
- Generation review
- Economic analysis
- Public Policy analysis
- 20-Year Assessment Report

### **Transmission Working Group**

The TWG will be responsible for review of the data and results for the following:

- Scope
- Transmission topology inputs to the models
- Load forecasts
- Generation review
- Constraint assessment
- 20-Year Assessment Report

### **Model Development Working Group**

The MDWG will be responsible for the review of the data for the following:

- Generation review

### **Seams Steering Committee**

The SSC will be responsible for the review of the following:

- Seams impacts

### **Markets and Operations Policy Committee**

The MOPC will make a recommendation to the board regarding approval decisions of the following:

- 20-Year Assessment Report

### **Strategic Planning Committee**

The SPC will provide input for the following:

- Scenarios development
- Policy decisions

### **Board of Directors**

The board will make approval decisions for the following:

- 20-Year Assessment Report

### **Regional State Committee**

The RSC will review the following:

- 20-Year Assessment Report

### **Stakeholder Reviews**

The following is a list of reviews provided by stakeholders during the 20-Year Assessment.

#### **Load Forecast Review**

Projected peak load per area for year the study will be submitted by the modeling contacts for the development of a peak model. Energy per area will be obtained from publically available sources and reviewed and updated by stakeholders. Stakeholders will review and submit revisions to the projected peak

load and energy per area where applicable. Peak load and energy will also be identified for load serving entities within SPP Regional Transmission Organization (RTO) areas.

### **Renewable Policy Review**

The Renewable Policy Review will follow the process outlined in the Integrated Transmission Planning (ITP) Manual.<sup>1</sup> If any significant changes to renewable mandates or goals occur during a 20-Year Assessment, stakeholders can bring them to the ESGW for review and potential approval for use in the assessment. If exemptions to the mandates or goals are allowed (e.g. the applicable technology is cost prohibitive or municipals are exempt), those exemptions will be considered as SPP staff is notified during the renewable policy review.

### **Generation Review**

The ESGW, TWG, and MDWG will review the data for all generators added to the model as part of the 20-Year Assessment. This will include conventional and renewable generation. The ESGW will be responsible for reviewing and approving economic data.

Proposed resources and facilities will be included and designated to a utility if it meets the resource inclusion criteria approved by the ESGW. Non-designated resources will be included based on commercial operation statuses and results of a transmission owner and generator interconnection customer survey of interconnection agreements with an on-schedule status.

### **Economic Model Review**

The ESGW will be provided with model data indicating generators and the parameters used in the economic model. Parameters such as maximum capacity, run status, operations and maintenance (O&M) costs, etc. will be provided for review.

### **Constraint Assessment Review**

A list of constraints will be developed to be used in the economic dispatch, as detailed in the Constraint Review section below. The constraints will be provided to the TWG for review; they will approve the final list of constraints to use as well as the associated constraint ratings.

### **Scenarios**

The SPC will begin the process by defining the high-level, strategic characteristics of potential study scenarios. Utilizing these characteristics, the ESGW will develop a maximum of five scenarios to be utilized in the development of potential transmission plans for the SPC's consideration. The ESGW's scenario development will include pertinent study details including but not limited to generation fleet trends, load growth assumptions, fuel price trends and assumptions, recommendations regarding environmental policies, and penetration of new technologies. The SPC will be responsible for the final approval of the scenarios for use in the 20-Year Assessment.

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<sup>1</sup> [ITP Manual](#)

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## Study Process

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1. SPC and ESWG will define and develop study scenarios.
2. Input assumptions will be refined through stakeholder groups (ESWG, TWG, MDWG, MOPC, and RSC).
3. ESWG will oversee the development of the economic models that incorporate the inputs developed in step 1 above. This will include review of input data.
4. List of TWG-approved constraints to be used in the economic model dispatch will be developed. All constraints will be for 100 kV and above facility outages within SPP and first-tier neighbor systems.
5. Economic assessment will be performed to analyze congested facilities on the SPP transmission system. This will be done using a security constrained unit commitment (SCUC) and security constrained economic dispatch (SCED) model over 8,760 consecutive hours.
  - a. Economic and policy needs will be identified across scenarios.
6. EHV solutions (300 kV+) will be developed and tested to assess their ability to meet the needs of the different scenarios.
  - a. A project list will be developed for each scenario that meets each scenario's economic and policy needs in a cost-effective way.

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## Data Inputs

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The analysis for the 20-Year Assessment will consist of engineering models used to facilitate the development of long-range transmission plans. The models will be economic models based on market based dispatch. These models require input assumptions as to generation resources, parameters, and locations (detailed in the following sections). The output of these models will allow SPP staff to determine the appropriate transmission needs from a regional perspective.

The major assumptions needed to construct the models are: market structure, load forecasts, fuel pricing and availability, transmission topology, resource forecasts, and parameters. Additional assumptions necessary to construct appropriate models will be addressed at the discretion of the stakeholders. Once the model(s) is constructed based on these assumptions, a SCUC and SCED analysis will be performed.

### **Market Structure**

SPP implemented its Integrated Marketplace and Consolidated Balancing Authority (CBA) in March 2014. The Integrated Marketplace and CBA will be baseline assumptions for the analysis.

### **Scenarios**

The study will be conducted on a set of up to five scenarios. These scenarios will consider evolving changes in technology, load growth patterns, fuel price trends, and public policy, among others, that may influence the transmission system and energy industry as a whole. By accounting for multiple scenarios, SPP can assess transmission needs over various uncertainties.

### **Resource Plan**

A generation resource plan will be developed for use in the study for each scenario. This resource plan will include both renewable and conventional generation in accordance with the approved study scenarios. Additionally, new renewable and conventional generation resources will be sited as detailed below.

Additional renewables will be included in the plans, as needed, to meet the renewable Mandates and Goals projections as supplied by the Renewable Policy Review. In addition to meeting renewable Mandates and Goals, each pricing zone must meet the current resource adequacy requirement based on the SPP reserve margin requirement in effect at the commencement of the resource planning milestone of the study. The siting of new generation in the resource plan will target the current reserve margin requirement for each zone. Capacity needs will be identified for each scenario.

Renewable generation, for the purposes of this study, includes but is not limited to hydro, wind, solar, and bio-fuel. Designated renewable resources will be identified through the Generation Review and will feed into the Resource Plan. Additional renewables may also be included which have been identified by the resource planning software or are needed to match approved scenario assumptions.

Generator designations will be reviewed by stakeholders and posted on SPP's secure website, viewable to those with access to the website<sup>2</sup> and corresponding ITP assessment folder. Joint ownership of unit additions may be used to avoid excessive additions of new resources to individual pricing zones.

SPP first-tier neighbors will be provided the opportunity to provide feedback and input into the generation resource plan for their area.

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<sup>2</sup> Access to the website can be requested through the [SPP Request Management System](#) (RMS).

An alternative to using software to develop the resource plan is to use spreadsheets to create CC/CT ratios instead of resource planning software. The spreadsheets will also include tier-1 resources.

### **Renewable Policy Review**

The Renewable Policy Review will follow the process outlined in the ITP Manual.<sup>3</sup> If any significant changes to renewable mandates or goals occur during a 20-Year Assessment, stakeholders can bring them to the ESWG for review and potential approval for use in the assessment. If exemptions to the mandates or goals are allowed (e.g. the applicable technology is cost prohibitive or municipalities are exempt), those exemptions will be considered as SPP staff is notified during the renewable policy review.

### **System Topology**

The base reliability model set will serve as an input into the economic (production) modeling program to develop a market-based economic dispatch for the system.

The topology used to account for the transmission system, excluding generation, will be the current transmission system and the following transmission upgrades: SPP upgrades that have been approved for construction, SPP Transmission Owner's Zonal Reliability Upgrades, Sponsored Upgrades endorsed by the board, and first-tier entities' planned upgrades.

### **Generation Parameters**

The generation parameters (e.g., startup cost, operating costs, minimum/maximum operating levels, etc.) will be updated by the ESWG as part of the generation review and economic model review.

### **Renewables**

Renewable generation, primarily wind and solar, operate as energy resources that will require the development of hourly generation profiles for individual plants based on historical data or modeled time-series wind speed datasets. The economic dispatch model will attempt to realistically model renewable generation curtailment based on expected market conditions and reliability requirements. A curtailment price consistent with the variable O&M cost will be used to simulate the behavior of the wind and solar generation within the SCED.

### **Siting**

The development of siting locations will follow the process as set forth in the ITP Resource Siting Manual.<sup>4</sup>

### **DC Ties and Lines**

DC ties and lines connect SPP to the Western Electricity Coordinating Council, Electric Reliability Council of Texas, and Eastern Interconnect systems. Methodology to model DC ties and lines will be created during the scope development.

### **Fuel Prices**

Fuel forecasts will be utilized in resource planning and production cost modeling. The latest vendor data set will be used as a guide along with feedback from participants and staff for setting fuel prices for coal, oil, uranium, and natural gas, including transportation costs at the onset of the study.

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<sup>3</sup> [ITP Manual](#)

<sup>4</sup> [ITP Resource Siting Manual](#)

**Emission Prices**

The latest vendor data set will be used as a guide along with feedback from participants and staff for setting base emission price forecasts for SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> for the study years at the onset of the study.

**Hurdle Rates**

Hurdle rates will be utilized in the economic model between SPP and neighboring systems to help keep imports and exports at reasonable exchange levels. The latest vendor data set will be used as a guide along with feedback from participants and staff for setting hurdle rates for imports and exports between SPP and other entities for the base scenario and will be reviewed and approved by the ESWG.

**Benchmarking**

After all assumptions and data are included in the economic model, it will be benchmarked against operational system behavior. This benchmarking will be used to assess the reasonability of the simulations.

Simulation results from the economic model will be compared with operational statistics and measurements from SPP real-time, NERC, and Energy Information Administration (EIA) data.

The ESWG will review the benchmarking data as part of the model review process. Specific benchmarks will include some or all of the following: capacity factor by unit type, generation by unit category, maintenance outages, renewable generation profiles, operating and spinning reserve levels, coal transportation costs, system Locational Marginal Prices (LMPs), flowgate loading, production costs, generation dispatch order, and zonal purchases and sales.

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## Analysis

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### **Define Constraints**

To identify which constraints are applicable in 20XX, SPP staff will review the existing flowgates to determine additions or deletions from the list of constraints (event file) for the economic model. Staff will perform additional analysis using software to identify the top constraints by flowgate congestion costs on the system for 8,760 hours. These additional constraints will be reviewed and approved by TWG. The following items will be considered in the analysis:

- The initial constraint list will be the then-current SPP section of the Book of Flowgates
- Constraints studies will be run over 8,760 hours (1 year)
- This analysis will use the 20XX economic model(s) for each scenario
- Contingencies 100 kV and above in SPP and first-tier
- Monitored elements 100 kV and above in SPP and first-tier

Unless other information is available, each constraint's rating will be selected based upon the applicable Rating A (normal rating) or Rating B (emergency rating) in the power flow model.

### **Needs Assessments**

The policy and economic needs of the system will be identified in each scenario in order to develop a transmission project list for each scenario. Each analysis will be performed in parallel to determine all needs across the system in 20XX.

### **Economic Assessment**

The economic needs of the system will be identified in each scenario in order to develop a needs list for the development of the project list for each scenario. All of the system needs will be identified through the use of a SCUC and SCED simulation that accounts for 8,760 hours representing each hour of the year 20XX.

The SCED will determine nodal LMPs while dispatching the generation economically. The LMPs, among other cost components, reflect the congestion occurring on the power grid's binding constraints. System congestion will be identified in each of the 8,760 hours. A list of binding constraints will be developed for each scenario and ranked based upon the congestion score associated with each constraint. Up to 25 unique constraints, with greater than \$50,000 in annual congestion score based upon this ranking, will be identified as economic needs.

### **Policy Assessment**

The policy needs of the system will also be identified for each scenario in order to develop a needs list for the development of the project list for each scenario. All of the system needs will be identified through the use of a SCUC and SCED simulation that accounts for 8,760 hours representing each hour of the year 20XX. Renewable generation may experience the effects of congestion and be curtailed by the SCED. Shortfall in the achievement of the renewable requirements of each scenario due to this curtailment will be identified. Renewable resources that experience an annual energy output of less than the statutory/regulatory mandate or goal will be identified as policy needs. The required energy is based on maximum capacity, capacity factor, and generation profile.

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## Solution Development

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### **Develop 300 kV+ Solutions**

The solution set will be limited to 300 kV and higher voltage facilities. Needs that warrant lower voltage solutions will be noted and will be addressed in the ITP process, assuming they continue to show up as problems in that process.

In order to create the 20-Year transmission plan, a pool of possible solutions will be tested to mitigate the economic and policy needs identified. This pool of solutions will come from DPPs, transmission service studies, generator interconnection studies, previous ITP studies, and any other solutions proposed by SPP staff and stakeholders. Solutions developed could meet more than one need (i.e., economic and/or policy needs) and will be classified as project types based on the criteria outlined in the sub-sections below. Staff will develop a project list for each scenario.

APC will be calculated for the final project list for each scenario. After a final recommended project list has been identified, a one-year financial analysis will be conducted for each scenario and sensitivities will be run to assess how versatile the final project lists are in handling a range of uncertainties.

Benefit and impact calculations will be made on a regional, zonal, and state basis. State values will be extrapolated from the zonal costs and benefits. For those zones that are only in one state, their full portion of both costs and benefits will be allocated to the state. For zones crossing state borders, their portion of both costs and benefits will be allocated to each state based on their percentage of load that is in each state.

Net benefits and benefit-to-cost (B/C) ratios will be calculated based on net present value (NPV) benefit and NPV cost and will be reported based on present dollars (20XX).

### **Economic Project Solutions**

Economic projects will be developed and evaluated based upon how well they mitigate congestion. Any economic project with a one-year B/C ratio greater than the approved ESWG threshold of XX will be included for further evaluation.

### **Public Policy Project Solutions**

Public policy projects will be developed and evaluated based upon how well they mitigate curtailment of renewable energy required by the regulatory/statutory mandates and goals as defined by the 20-Year Assessment renewable policy review. A B/C ratio will be calculated for public policy projects in order to determine the most economical project to mitigate the identified needs. Any public policy project that helps to mitigate curtailment of renewable requirements will be included for further evaluation. The threshold used to select economic projects will not be considered for public policy projects. The public policy projects are eligible if they mitigate the identified curtailments.

### **Cost Estimates**

The cost estimates used for projects that are tested in the initial project development phase will be conceptual estimates. The conceptual estimates will be developed by SPP staff and will utilize standardized estimates and multipliers that are based on historical data.

### **Sensitivities**

Sensitivities, if needed, will be conducted on the project lists for each scenario using the Scenario 1 Model to assess how versatile the plan is in handling a range of uncertainties. Economic analysis will be performed for the sensitivities such as:

- Natural gas price at a 95% confidence level (2 standard deviations)
- Demand levels at a 67% confidence level (1 standard deviation)

The sensitivities will be used to measure the viability of the proposed transmission plan that is produced through the 20-Year Assessment. These sensitivities will not be used to develop the transmission projects or filter out projects. A sensitivity on renewable output will be added at +/- 10 percent sensitivity on capacity factors to demonstrate the robustness of the capacity factors.

#### **Benefit Metrics**

APC will be the only benefit metric to be calculated per project list.

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## Timeline

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A detailed schedule for the 20-Year Assessment will be developed by staff in conjunction with appropriate working groups to identify the required milestones and corresponding timeframes.

The assessment schedule will be maintained by SPP staff and shared with study participants through working group meetings and via posting to the Transmission Planning page on [SPP.org](https://www.spp.org).

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## Deliverables

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### **Final Report**

The results from the 20-Year Assessment will be compiled into a report detailing the findings and project lists for each scenario. The report will include a project list identifying each upgrade.

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## Changes in Process and Assumptions

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Modifications to the 20-Year Assessment Manual will be submitted through the SPP Revision Request (RR) process. The RR process is a key component of SPP's stakeholder processes and allows stakeholder input into decision making. It will place guidelines around the approval and implementation of study scope changes. The Revision Requests will be made via SPP's Request Management System (RMS) which will allow for the tracking and reporting of scope revision submissions. Leveraging of the RR process will appropriately address member concerns while reducing the considerable amount of time it has taken in past studies to finalize the study scope due to numerous revisions submitted by stakeholders.

Standardized Manual items will retain flexibility by granting the appropriate working group the ability to provide guidance on items recommended for revising. An example of this flexibility may be with the scope item Fuel Prices. Standardized language may include the mechanism for setting fuel prices. Per the scope, the selected index would always be used for pricing information, however, the actual price of natural gas may change year-over-year. As the natural gas fuel prices change, the recommended prices would become a part of the assumptions while the standardized scope item would remain unchanged. If a stakeholder recommends the use of another source for pricing information, that recommendation would be submitted through the RR process for proper stakeholder vetting and approval.