Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

March 28, 2012

Web Conference

• SUMMARY OF ACTIONS TAKEN •

1. The ESWG approved the future weighting values that will be used to consolidate the transmission plans to one recommended transmission portfolio in the 2013 ITP20.
2. The ESWG approved the 2013 ITP20 Scope document.

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

March 28, 2012

Web Conference

• MINUTES •

Agenda Item 1 – Administrative Items

Agenda Item 1a – Call to Order, Introductions

Chair Alan Myers (ITC Great Plains, LLC) called the meeting of the Economic Studies Working Group (ESWG) to order at 9:05 a.m., welcomed those in attendance, and asked for introductions (Attachment – Attendance List).

There were 33 web conference participants representing 12 of 13 members.

Agenda Item 1b – Receipt of Proxies

Tim Miller (SPP staff) received proxy statements. There were no proxies identified.

Agenda Item 1c – Review of Agenda

Chair Alan Myers (ITC Great Plains, LLC) presented the agenda for review and asked for any additions or corrections. The agenda was amended to include discussion of the 2013 ITP20 future weightings (Attachment – Agenda).

Agenda Item 2 – 2013 Integrated Transmission Planning 20-Year Assessment (2013 ITP20)

Agenda Item 2a – 2013 ITP20 Weighting Values

Chair Alan Myers (ITC Great Plains, LLC) led a discussion of the future weighting proposals that will be used to determine the 2013 ITP20 recommended transmission plan. The group discussed five different proposals (Attachment – Weighting Proposals) and accepted one of them for inclusion in the 2013 ITP20 scope.

> **A motion to accept the staff proposal for the 2013 ITP20 weightings with a greater than or equal to 60% threshold. F1: 50%, F2: 15%, F3: 10%, F4: 15%, F5: 10% was made by Leon Howell (OGE) and seconded. The motion was approved unanimously.**

Agenda Item 2b – 2013 ITP20 Scope

Tim Miller (SPP staff) asked for comments and changes to the 2013 ITP20 scope and provided a summary of each section, including changes reflecting proposals by ESWG members at the last meeting and those being considered by the Transmission Working Group (TWG). (Attachment – ITP20 Scope).

The following items were discussed and modifications made to the scope:

- Load shapes,
- Energy values,
- Wind modeling (including price, wind profile shape, and coordination with load shape data),
- Treatment of proposed commercial DC ties, and
- A verification of "scenario" and "future" language pertaining to the use of metrics.

> **A motion to approve the scope and changes as presented today was made by David Ried (OPPD) and seconded. The motion was approved unanimously.**

Closing Items

Chair Alan Myers (ITC Great Plains, LLC) requested if any other items merited discussion. Finding none, the meeting was adjourned at 11:22 a.m. on Wednesday, March 28, 2012.

Respectfully Submitted,

Tim Miller,

Secretary

Southwest Power Pool, Inc.

ECONOMIC STUDIES WORKING GROUP

March 28, 2012

Web Conference

• A T T E N D A N C E L I S T •

Attendee	Company	Attendee	Company
Al Tamimi	Sunflower	Josh Ross	SPP staff
Alan Myers	ITC Great Plains	Juliano Freitas	SPP staff
Bennie Weeks	Xcel Energy	Kirk Hall	SPP staff
Bruce Walkup	AECC	Mike Collins	OGE
David Ried	OPPD	Nathan McNeil	Midwest Energy
Greg Sweet	Empire	Roy Boyer	Xcel Energy
Kip Fox	AEP	Steve Gaw	Wind Coalition
Kurt Stradley	LES	Temujin Roach	Texas PUC
Leon Howell	OGE	Tim Owens	NPPD
Michael Watt	OMPA	Tony Gott (AECI)	AECI
Paul Dietz	Westar	Jim Krajecki	CES-LTD
Randy Collier	City Utilities Springfield, MO	John Krajewski	JK Energy Consulting
James Sanderson	KCC	Dan Hartman	
Tim Miller	SPP staff	Dan Lenihan	OPPD
Antoine Lucas	SPP staff	Gerald Deaver	Xcel Energy
Brittney Miller	AR PSC	Jason Shook	GDS Associates
Dan Jones	SPP staff		

ECONOMIC STUDIES WORKING GROUP

March 28, 2012
Web Conference

• A G E N D A •

9:00 am – 11:00 am

1. Administrative items
    a. Call to Order, Introductions..... Alan Myers (10 minutes)
    b. Receipt of Proxies ..... Tim Miller (5 minutes)
    c. Review of Agenda ..... Alan Myers (5 minutes)
2. 2013 ITP20
    a. 2013 ITP20 Weighting Values..... All
    b. 2013 ITP20 Scope (Approval Item[1]) .....SPP staff (1.5 hours)
3. Closing Items..... Alan Myers (10 minutes)

[1] Background Materials Included

ECONOMIC STUDIES WORKING GROUP

March 28, 2012

Web Conference

• WEIGHTING PROPOSALS •

Weighting Example

- **Threshold >= 60% (Example)**
- **Project A included in recommended portfolio**
- **Projects B, C, and D NOT in recommended portfolio**

	Future 1 50%	Future 2 15%	Future 3 10%	Future 4 15%	Future 5 10%	Score	Inclusion in Expansion Plan?
Project A	✓	✓				65%	Yes
Project B		✓	✓	✓		40%	No
Project C		✓	✓		✓	35%	No
Project D	✓					50%	No

SPP | 7

I am not a voting member of this panel; however, it is my opinion the weighting values as shown are flawed. My opinion is based on the appearance that as presented, the weighting is merely a restatement of the BAU case. Futures 2-5, under the present values should be simply sensitivities under the BAU scenario, not separate Scenarios. To effectively exclude scenarios outside of the BAU seems counterproductive to a future plan. The only confirmable value we can depend on for any future planning is change. A weighting system which allows for potential deviation from BAU seems more responsive to the uncertainty of planning future expansion. It is much easier to bend future planning to fit our current reality than to stretch that planning to accept broader potentials. On that basis I would recommend weighting values of 45%, 15%, 15%,15%,1 5% for Futures 1-5 respectively and an inclusion threshold of 50%. This opens the possibility that a project could be considered in future expansion planning outside of the BAU. It may be advisable to adjust F2-5 weighting values even further, up or down, based on the plausibility of each scenario gauged over a twenty year horizon.

DR Hartman, NWKREC

SPS suggested weightings (threshold is >= 60%)

Future 1	Future 2	Future 3	Future 4	Future 5
55	15	5	10	15

David Ried approach

BAU – any project goes to recommended plan
F2, F3, F4, and F5 are then weighted out of 100%, a threshold of >=50% applied to these

Al Tamimi – in lieu of weightings utilize BAU, if in F1 then projects are in plan
Compare each other future's project against Future 1 to determine added value provided by the project from the other future in Future 1.

Re: ESWG email vote preparation - weighting & threshold values

kmfox@aep.com [kmfox@aep.com]

At this point, AEP offers no change to the proposed weighting. Our only request is that the Business as Usual
case (Futures 1 and Future 5) add up to 60%.

Thanks, Kip
Kip Fox
American Electric Power Company
214-777-1063 office
8-777-1063 audinet
972-400-1384 cell

Draft 2013 ITP20 Scope

March 16, 2012

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SPP staff

Revision History

Date or Version Number	Author	Change Description	Comments
12/16/11	SPP staff	Initial draft	
01/31/12	SPP staff	Revised internal draft	
2/9/12	SPP staff	Presented to ESWG for comment	
2/21/12	SPP staff	Presented to TWG for comment	
3/8/12	SPP staff	Presented to ESWG	
3/16/12	SPP staff	Revised draft based on 3/8 and 3/16 ESWG meetings	

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Overview

This document presents the scope for the second Integrated Transmission Planning Year 20 Assessment (ITP20). The assessment is conducted in accordance with the SPP Open Access Transmission Tariff (OATT) Attachment O, and the approved ITP Manual. The assessment will be conducted on the year 2033. The assessment begins in January 2012 and is an 18 month study scheduled to be finalized in July 2013. The 2013 ITP20 will hereafter be referred to as the ITP20.

Objective

The objective of the ITP20 is to develop an EHV backbone (345 kV and above) transmission plan for a 20th year plan. The assessment will identify a robust transmission plan that is capable of reliably and economically providing deliverability of energy to the SPP market while enabling policy initiatives.

Stakeholder Process

Working Group Involvement

Economic Studies Working Group (ESWG)

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

1. Policy survey
2. Scope
3. Futures
4. Benefit metrics
5. Sensitivities
6. Model review and assumptions
7. Resource plan review
8. Economic analysis
9. Report

Transmission Working Group (TWG), Model Development Working Group (MDWG)

The TWG and/or the MDWG will be responsible for review of the data and results for the following items:

1. Scope
2. Transmission topology inputs to the models
3. Load forecasts
4. Constraint assessment
5. Stability assessment
6. Final reliability impact assessment
7. Report

Seams Steering Committee (SSC)

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

1. Seams impacts

Markets and Operations Policy Committee (MOPC)

The MOPC will make a recommendation to the Board of Directors regarding approval decisions of the following items:

1. ITP20 Report
2. ITP20 Expansion Plan

Strategic Planning Committee (SPC)

The SPC will provide input for the following items:

1. Futures development

2. Policy decisions

Board of Directors (BOD)

The BOD will make approval decisions for the following items:
1. ITP20 Report
2. ITP20 Expansion Plan

Regional State Committee (RSC)

The RSC will review the following items:
1. ITP20 Report
2. ITP20 Expansion Plan

Member Reviews

The following is a list of reviews provided by members during the ITP20 study:

Load Forecast Review

Projected peak load per area for the year 2033 will be submitted by the modeling contacts for the development of a peak 2033 model. Energy per area for 2033 will be obtained from publically available sources and reviewed and updated by stakeholders. Members will review projected peak load and energy per area. Peak load and energy will also be identified for load serving entities within member areas, for example, Hastings Utilities and City of Grand Island load will be reviewed by NPPD.

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No actual 2033 model

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Policy Survey

Members will provide feedback through a survey, conducted by the ESWG, on current and planned renewable generation plants, renewable targets, EPA regulation impacts including unit retirements, de-ratings, and fuel switching, and other policy level drivers that will impact the study.

Generation Resource Plan Review

ESWG will review the data for all generators added to the model. This will include conventional and renewable generation. The review will focus on the siting and capacity of new units. For conventional generation, the zonal demand and capacity figures will be provided, as well as expected capacity margins for 2033. For wind generation, the siting, capacity, and average capacity factor of each new wind farm will be provided, and the calculations for renewable targets, mandates, and new renewable generation required will be provided.

Economic Model Review

ESWG will be provided with model data indicating generators and the parameters used in the economic model. Non-confidential parameters such as maximum capacity, ramp rates, O&M costs, etc. will be provided for review. Confidential parameters, such as heat rates, will not be part of the review. Information from a third party vendor will be used for confidential parameters..

Constraint Assessment Review

A list of constraints will be developed to be used in the economic dispatch, as detailed in the Define Constraints section. The constraints will be provided to TWG for review. TWG will approve theconstraints to use, as well as the constraint ratings. The TWG-vetted constraints will be used in analysis to perform the security constrained unit commitment (SCUC) and security constrained economic dispatch (SCED).

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Project Development Request

Stakeholders will be asked to provide suggestions on EHV projects they would like to see analyzed in the study. All member-submitted project requests will be analyzed to assess the project's potential to meet needs. This includes reliability, economic, and policy needs as detailed in the Analysis section of this document.

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Study Process

1. The input assumptions will be refined through the various stakeholder groups (ESWG, TWG).
2. The 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.
3. A list of constraints to be used in the economic model dispatch will be developed.
4. An economic assessment will be performed, using the economic model and constraints to identify congested facilities on the transmission system. This will be done using security constrained unit commitment (SCUC) and security constrained economic dispatch (SCED) tools over 8,760 consecutive hours.
    a. Reliability, economic, and policy needs will be identified across futures.
5. A voltage stability analysis will be conducted for the transmission system with no new ITP20 upgrades. This assessment will help to identify any transfer limitations on existing infrastructure in SPP.
6. EHV solutions (300 kV+) will be developed and tested to assess their ability to meet the needs of the different futures.
    a. A portfolio will be developed for each future that meets that future's reliability, economic, and policy needs in a cost effective way.
    b. The portfolios for each future will be consolidated into a single portfolio.
    c. Multiple robust portfolios may be developed from the consolidated portfolio.
7. Benefit metrics for the robust portfolios will be calculated.
8. A single recommended portfolio will be identified.
    a. A 40-year financial analysis will be conducted.
    b. A reliability assessment will be conducted to ensure that the final recommended portfolio meets reliability needs. A voltage stability analysis will be conducted for the expansion upgrades. The transfer limit of the system with upgrades will be identified.
    c. Sensitivity analysis will be performed on the recommended portfolio to address how versatile the plan is in handling a range of uncertainties.

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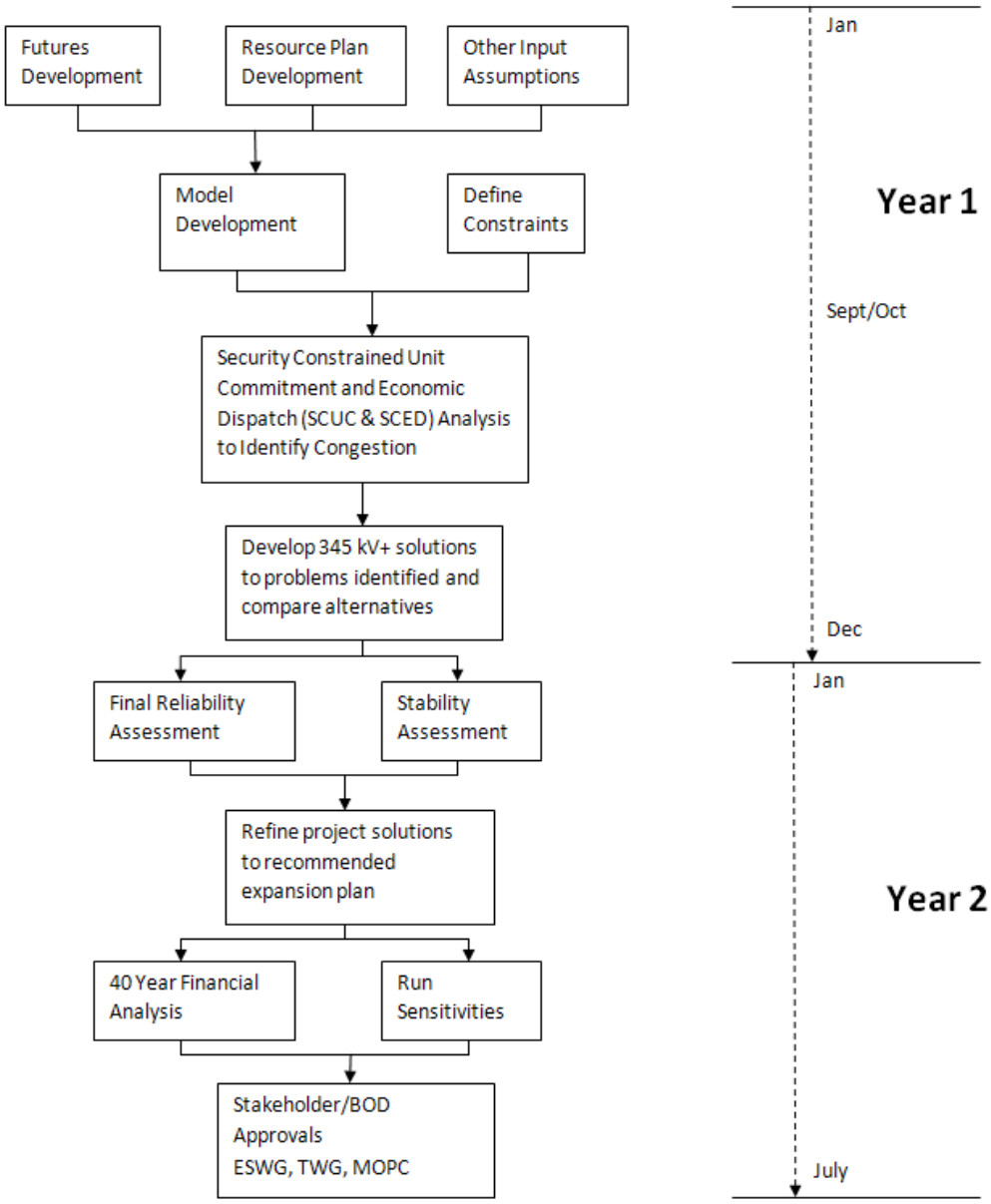
<#>Sensitivity analysis will be performed on the recommended portfolio to address how versatile the plan is in handling a range of uncertainties.¶


Futures Development
Resource Plan Development
Other Input Assumptions
Model Development
Define Constraints
Security Constrained Unit Commitment and Economic Dispatch (SCUC & SCED) Analysis to Identify Congestion
Develop 345 kV+ solutions to problems identified and compare alternatives
Final Reliability Assessment
Stability Assessment
Refine project solutions to recommended expansion plan
40 Year Financial Analysis
Run Sensitivities
Stakeholder/BOD Approvals
ESWG, TWG, MOPC
Jan
Year 1
Sept/Oct
Dec
Jan
Year 2
July

Data Inputs

The analysis for the ITP20 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 engineers to determine the appropriate transmission needs from a regional perspective.
The major assumptions needed to construct the models are detailed below and contain, but are not limited to: market structure, load forecasts, fuel pricing and availability, transmission topology, resource forecasts and parameters, and others. Once these assumptions are input into a model, the model will perform a security constrained unit commitment (SCUC) and security constrained economic dispatch (SCED).

Futures

The study will be conducted on a set of futures. These futures will take consider evolving changes in technology and public policy that may influence the transmission system and energy industry as a whole. By accounting for multiple futures scenarios, SPP can look at what transmission needs are for various uncertainties. All futures will incorporate the EPA regulations outlined in the Environmental Policy section, and all futures will assume that Entergy will be a member of MISO.

Future 1: Business as Usual

This future will include all state renewable mandates and targets as identified in the policy survey, load growth projected by load serving entities through the MDWG model development process, and the impacts of the EPA regulations that are outlined in the Environmental Policy section.

Future 2: Additional Wind

This future will include a 20% Renewable Energy Standard (RES) for the SPP region.

Future 3: Additional Wind plus Exports

This future will include the 20% RES of Future 2, plus approximately 10 GW of additional wind generation that will be exported outside of SPP. ESWG and staff will work through the details of where this wind gets exported to.

Future 4: Combined Policy

This future will approximate the effects of Demand Side Management and SMART grid. An annual 1 percentage point reduction to the growth of load will be applied in concert with the 20% RES of Future 2 and a carbon constraint, as described in the Environmental Policy section.

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The details of the reduction to the growth of load and the impact of these technologies upon the shape of the load curve will be refined by the ESWG. For example, if the peak demand forecasted in the MDWG models increased 1.3% from year to year, this future would reflect a 0.3% increase – a 1% reduction in the annual growth rate.

Future 5: Joint SPP/MISO Future

SPP's ESWG and MISO's PAC will coordinate input assumptions and models for a joint future. The data used in the model developed between SPP and MISO for the joint future is intended to be used in the other futures as well. This future will be based on the same guidelines as the business as usual future: normal load growth, state targets for renewable generation, etc. However, some of the actual assumption values may vary from Future 1 due to collaboration with MISO on these values for the joint future.

Environmental Policy

The impact of the Cross-State Air Pollution Rule (CSAPR)[1], Mercury and Air Toxics Standards (MATS)[2], Section 316(b) of the Clean Water Act[3], and EPA's Regional Haze[4] Program will be accounted for in the resource planning, production cost modeling and benefit metric calculations for all futures. Four techniques will be employed to capture these impacts:

- unit retirements,
- unit derates,
- unit retrofits,
- unit fuel switching, and
- emission price forecasts for SO_2, NO_X, and CO_2

The unit retirements, derates, and fuel switching decisions will be guided by the Policy Survey. Emission price forecasts for SO_2 and NO_X for the 2033 study year will be based upon Ventyx simulation ready data (specifically, the 2012 Spring Reference Case to be released in the first week of May 2012). A CO_2 price will only be utilized in Future 4, as this is the only future with the carbon constraint. The CO_2 price in this future will be determined by ESWG.

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Resource Plan

A generation resource plan will be developed for use in the study for each future, for each of the years 2023, 2028, and 2033. This resource plan includes renewable and conventional generation. Additionally, new renewable and conventional generation resources will be sited as detailed below.

Each SPP RTO zone must meet the 12% capacity margin requirement outlined in SPP Criteria 2.1.9. The siting of new generation in the resource plan will target a 12% capacity margin for each zone. Additionally, a 16% capacity margin will be utilized for all generation in the SPP region. Today, SPP operates with a 16-20% capacity margin. Although the 16% capacity margin for the region will not be required by the SPP Criteria, the additional market based generation available will provide a more realistic expectation of how the transmission system will perform in the future. Only 5% of the total wind energy will be counted towards the capacity margin requirement, due to the

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[1] http://epa.gov/airtransport/
[2] http://www.epa.gov/mats/
[3] http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/
[4] http://www.epa.gov/visibility/program.html

unpredictability of wind levels. Capacity needs will be identified for each future for each of the years 2023, 2028, and 2033.

Renewable generation, for the purposes of this study, includes hydro, wind, solar, and bio-fuel. Designated resources (DR) will be identified through the policy survey. The ownership of the generation at each wind farm will be based on the designations provided in the survey. Additional wind sites will be developed as needed to meet the renewable assumptions in all futures. The wind ownership designations will be reviewed by stakeholders and posted on SPP.org.

Renewable generation, primarily wind, hydro, and solar, operate as energy resources that will require the development of hourly generation profiles for individual plants. The economic dispatch model will attempt to realistically model renewable generation curtailment, based on weather patterns, historical market behavior, expected market conditions and reliability requirements.

Policy Survey

A policy survey will be administered by ESWG, and will be used by members to provide assumptions regarding specific policy level information. The previous CAWG renewables surveys will be used as a reference for development of the survey. The survey will contain, at a minimum, the following information:

- Name, zone, and capacity for all specific wind sites that are in-service or expected to be on-line in the near future;
- Name, zone, and capacity for all non-wind renewables that are in-service or expected to be on-line in the near future;
- Renewable energy targets for 2033 based on state and utility targets;
- Expected unit retirements based on EPA regulations;
- Expected unit de-ratings or unit changes in fuel type based on EPA regulations;
- Any other specific changes to modeling based on policy

For all renewable sites in the models, the renewable energy output for each hour of the year 2033 will be based on the maximum capacity provided in the survey, as well as capacity factors and profiles to be developed. Capacity factors and profiles will be based on expected or historical behavior. Capacity factors for wind will be based on NREL wind profiles that correspond to a similar location as the wind site and are based on historical weather patterns.

Capital Costs

New generation needs that arise as part of the resource plan will be addressed with attention paid to total capital costs. Capital costs will be obtained from the resource planning software package that will be utilized in this phase of the study. Generation technologies with lower capital costs are more likely to be sited in the resource plan in order to meet capacity margins. Other factors, such as the available capacity for the generation type, and the environmental needs of the generation type (rivers, etc.) will also be considered when siting new generation.

System Topology

Power flow models will be required for the assessment. The models will include all approved NTC and NTC-C projects. Projects with ATP's will not be included in the base topology. These power

Comment [A4]: Inclusion of Tres Amigas and/or Clean Line to be done by email vote

Comment [A5]: TWG still reviewing

flow models will serve as a topology input into the modeling program to develop a market based economic dispatch for the system. The projects developed as part of the 2013 ITP Near-Term Assessment (ITPNT), scheduled for BOD in January 2013, will not be incorporated in to the ITP20 base models.

Modeling of External Regions

As detailed in the futures section, SPP will be coordinating a joint future with MISO. This joint future will lead to the development of a common model for both SPP and MISO. This common model is expected to be used for all futures in the ITP20. This will lead to ITP20 models in which the MISO region has been reviewed and endorsed by MISO, which should provide the most accurate modeling of MISO that can be provided. Entergy will be modeled as a member of MISO in all models. In modeling external regions besides MISO, the modeling data will be based on publicly-available information as well as any other information obtained directly from other regions.

As with the SPP region, the market structure used in other regions will be a day-ahead market with a consolidated balancing authority per region. Parts of the Eastern Interconnect outside of SPP and Tier 1 entities will be equivalenced in the model.

Generation Parameters

The parameters for each generator in the economic model (startup cost, ramp rates, O&M costs, etc.) will be updated by ESWG as part of the economic model review.

Fuel Prices

Fuel forecasts will be utilized in the resource planning, production cost modeling, and benefit metric calculations. Fuel prices for coal, oil, and uranium, including transportation costs, will be forecasted for the 2033 study year based upon Ventyx simulation ready data (specifically the 2012 Spring Reference Case, to be released in the first week of May 2012). NYMEX futures will be utilized for natural gas prices, with growth rates from the DOE Annual Energy Outlook applied for years 11-20. The specific NYMEX and DOE numbers will be obtained during the resource planning phase of the study, and will be locked down for the remainder of the study.

If prices for coal, oil, and uranium are needed for resource planning prior to the early May release of the Ventyx Reference Case, NYMEX futures will be utilized for these fuel prices, with growth rates from the DOE Annual Energy Outlook applied for years 11-20. As soon as the Ventyx Reference Case data is available, it will then be used instead.

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Hurdle Rates

Hurdle rates will be utilized in the economic model between SPP and neighboring systems to help keep imports and exports at a reasonable exchange. Hurdle rates for imports and exports between SPP and other entities will be set to $8/MWh for minimum – unit commitment and $5/MWh for minimum – economic dispatch.

Hurdle rates between non-SPP entities will be set as needed to model minimal and reasonable exchange between these entities. These hurdle rates between non-SPP entities are necessary because without them, flows will be unrealistically high between regions.

Load Forecasts

The study will require load forecasts for SPP members and non-members within the SPP footprint, as well as areas outside of the SPP footprint, for the year 2033. SPP staff queries its members through the MDWG for applicable load forecasts to use in each of the pricing zones for the modeling footprint. Energy forecasts will be provided by the ESWG and other contacts. Load shapes will be based on historical data averages over the last 3-5 years, obtained from a third party source.

Comment [A6]: Add review and/or benchmark langauge

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For load forecasts outside of the SPP footprint, publicly available data will be utilized as the initial source of the load forecasts, where available. If it's not available, publicly available information on projected load growth will be extrapolated to develop a good representation for load expected in the study timeframe.

Market structure

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

DC Ties

DC ties connect SPP to the WECC and ERCOT systems. Confirmed firm transmission service will be used as a basis for modeling the flow levels of existing DC ties. If there is no confirmed firm transmission service on DC ties, ESWG and TWG will develop a methodology to model the DC ties consistent with the developed futures. These DC interconnections will include Tres Amigas and Clean Line Energy Partners proposed projects.

Comment [A7]: Incorporate language on an impact analysis of Tres Amigas and Clean Line

Comment [A8]: TWG still reviewing langauge

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Benchmarking

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

In order to complete the ITP20 benchmarking effort, a model will be developed based upon the year 2011. Simulation results from that economic model will be compared with historical statistics and measurements from the SPP real time data, NERC data and the Energy Information Administration data.

The ESWG will review the benchmarking data as part of the model review process. Specific benchmarks will include the following: capacity factor by unit type, generation by unit category, maintenance outages, 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.

Analysis

Define Constraints

An assessment will be conducted to develop a list of constraints for use in the Security Constrained Unit Commitment and Economic Dispatch (SCUC & SCED). Elements that limit the incremental transfer of power throughout the system will be identified. Each of the limiting elements identified for any of the studied paths will be added to the constraint list. The TWG will review the list and revise accordingly. Such revisions may include normal and emergency rating changes, removal of invalid contingencies from the constraint definition, or modification of the contingency definition based upon terminal equipment. Any changes to the list will be presented to the TWG for approval if the need for additional constraints is identified[5].

Each constraint will be identified will include normal and emergency ratings. The list will be limited to the following types of issues:

- System Intact and N-1 situations
- Existing common right-of way and tower contingencies for 300+ kV facilities[6]
- Thermal loading and voltage stability interfaces
- Contingencies of 345 kV or higher voltages transmission lines only
- Contingencies of transformers with a 345 kV or higher voltage winding only
- Monitored facilities of 115 kV and above voltages only

The list of constraints in neighboring areas will be supplied to neighboring areas for review and modification.

SCUC & SCED Analysis

The reliability, policy, and economic, needs of the system will be identified in each future in order to develop a portfolio for each future. All of the system needs will be identified through the use of a SCUC & SCED simulation that accounts for 8,760 hours representing each hour of the year 2033. Line loading will be determined using direct current (DC) models[7].

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[5] The need for additional constraints could be triggered as projects are added to the portfolio. For instance, contingencies of the new facilities would need to be included in the list. The list may also require modification following the inclusion of the 2013 ITPNT projects.

[6] The current NERC Standard TPL-001-0.1 includes outages of any two circuits of a multiple circuit tower line within Category C, and the loss of all transmission lines on a common right-of-way within category D. NERC Standard TPL-001-2 will replace this standard (pending FERC approval) and includes such outages in Category P7 and Table 1 – Steady State & Stability Performance Extreme Events.

[7] The use of an alternating current (AC) model would provide greater precision in these calculations and yields not only thermal loading, but voltage levels as well. The complexity of such a model development is not justified given the strategic rather than detailed nature of this assessment. An AC model will be utilized for the stability assessment (see below). Apart from the stability assessment to verify line loadability and general system stability, the correction of voltage limitations will be addressed in the ITP10 and ITPNT.

Reliability Needs

Thermal overloads will be identified in 4 hours that represent situations that uniquely stress the grid[8]. An N-1 contingency scan of binding constraints identified in each of these hours will be conducted on a less-than-fully constrained simulation to verify the facility loading. Facilities loaded at more than 100% of the emergency rating for contingencies identified by the constraint assessment will be identified as reliability needs.

- Summer peak – highest coincident load during summer months
- Winter peak – highest coincident load during winter months
- Low hydro – highest ratio of coincident load to hydro output during summer months[9]
- Peak wind – highest ratio of wind output to coincident load

In addition, any constraints that breach (indicating that the SCED was unable to honor the facility rating) will be identified as reliability needs.

A supplemental reliability analysis may be performed at the discretion of the TWG if it is determined that the economic models and reliability models exhibit a heavy singular regional power transfer bias through a large portion of the SPP footprint (e.g. most or all models show heavy North-to-South transfer through the Eastern SPP footprint). If deemed necessary by the TWG, the supplemental analysis would involve creation of a DC model in one or multiple futures that forces a regional power transfer bias in the opposing direction. The N-1 contingency scan as described above would be performed on this newly created DC model to determine reliability needs.

Comment [A9]: Language added from Dan Lenihan's comments

Comment [A10]: TWG still reviewing.

Economic needs

The SCED will solve nodal Locational Marginal Prices (LMPs) while dispatching the generation economically. The LMPs 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 future and ranked based upon the average shadow price associated with each constraint. The top fifteen constraints based upon this ranking will be identified as economic needs.

Policy Needs

Wind farms may experience the effects of congestion and be curtailed by the SCED. Shortfall in the achievement of the renewable requirements of each future due to this curtailment will be identified. Renewable resources that experience an annual energy output of less than 97% of the targeted energy will be identified as policy needs. The targeted energy is based on maximum capacity, capacity factor, and generation profile.

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Consolidate Needs across Futures¶

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¶
The reliability, economic, and policy needs will be consolidated across the futures in accordance with the future weights and scoring threshold. For instance, Table 5 lists weights and needs for each future. For a scoring threshold of 60%, the only needs that would move forward for further analysis and project selection are needs A (identified in futures 1 and 2) and D (identified in futures 1 and 5). ¶
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Moved down [4]: Table 5: SCUC & SCED Analysis Scorecard¶

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Develop 345 kV+ Solutions

Projects[10] will be proffered by staff and stakeholders based on the needs of all futures and will be tested to determine the most cost-effective set of projects. The solution set will be limited to 345 kV and higher voltage facilities. Needs that warrant lower voltage solutions will be noted and will be

[8] Summer peak, winter peak, low hydro, and high wind situations have been studied in various SPP studies since 2006.
[9] Hydro generation in SWPA and WAPA will be included in the calculations to select the low hydro hour.
[10] Projects refer to individual upgrades and/or upgrades meant to work in tandem.

addressed in the ITP10 and ITPNT processes, assuming they continue to show up as problems in those processes.

Project Screening

Each of the individual projects will be evaluated to see if they meet the needs of the futures. Each project must meet at least one need in a future in order to be included in that future's portfolio.

- Projects to address reliability needs must mitigate the thermal overload and reduce loading less than 100% of the emergency rating due to the identified contingency.
- Projects to address economic needs must provide a B/C ratio greater than 1.0 by reducing the congestion. If multiple solutions meet this criterion for the same economic need, the project with the highest weighted net benefit will be utilized.
- Projects to address policy needs must enable the achievement of the annual energy output of at least 97% of the targeted output. Where multiple solutions meet this criterion, the project with the highest net economic benefit will be identified.

	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6
Need A				✓		
Need B		✓				
Need C					✓	✓
Need D	✓					
Need E		✓	✓			
Cost		$20M	$10M		$60M	$50M
Further Study?	yes	yes	no	yes	no	yes

Table 1: Project Screening Dashboard – Single Future Only

Table 1 is specific to a single future only; there will be a Project Screening Dashboard table for each future. If there is only one project that meets a need, as is the case for Project 2 and Project 4 in the table above, that project will be further evaluated in that future.

If there are multiple projects that each meet the same need(s), the project with the least cost will be chosen among alternative projects for further evaluation, as shown in the table above for Project 6. A portfolio for each future will be developed that meets all of the identified needs of that future. Specific projects will be removed from the future-specific portfolios if the behavior of the system within the context of the portfolio exhibits any of the three behaviors listed below.

- Thermal overload(s) identified with project mitigations are mitigated by other projects in the portfolio.
- Congestion targeted by a project with positive net benefit is relieved by other projects in the portfolio.
- Shortfall to renewable requirements resolved with project mitigations are mitigated by other projects in the portfolio.

Consolidation of Projects Across Futures

The five portfolios (one for each future) will be consolidated into a single portfolio for all futures. The futures will each be weighted based on their probability and magnitude of impact. Each future

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<#>Using this methodology, projects with good net benefit (benefit minus cost, for one year) will be valued, and utilized to meet needs over projects with less net benefit. The use of weighted net benefit will also help to address the value of a project providing benefit in multiple futures. For example, a project with a moderate net benefit that performs well across all futures may be superior to a project with a high net benefit in one or two futures but poor performance across other futures. Using the future weightings identified in the SCUC & SCED Analysis Scorecard Table, the formula for weighted net benefit of a project is:¶
¶
$Weighted\ Net\ Benefit\ =$¶
$(0.45) * (F1\ Benefit - F1\ Cost) + (0.20) * (F2\ Benefit - F2\ Cost) + (0.10) * (F3\ Benefit - F3\ Cost) + (0.15) * (F4\ Benefit - F4\ Cost) + (0.10) * (F5\ Benefit - F5\ Cost)$

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will be weighted using a percentage, such that the sum of weights for all futures is 100%. A threshold value will be used along with the weights to consolidate projects across futures. Table 2 provides an example of the consolidation of projects from each future into a single portfolio. The example assumes a threshold of 60%. Please note that this threshold value and the weightings used in this table are not final, they are only an example; the final values will be determined by ESWG.

	Future 1 50%	Future 2 15%	Future 3 10%	Future 4 15%	Future 5 10%	Score	Further Study?
Project A	✓	✓				65%	Yes
Project B		✓	✓	✓		40%	No
Project C		✓	✓		✓	35%	No
Project D	✓					50%	No

Table 2: Project Consolidation Scorecard

The futures weighting approach enables development of a single transmission plan that is versatile across multiple futures. After the consolidation of least cost portfolios across futures, robust alternatives to the projects in this portfolio will be considered, but only if the alternative project is able to mitigate the same need(s). Other EHV solutions will be considered in addition to 345 kV solutions in this phase of the assessment. Multiple portfolios may be developed from the single consolidated portfolio, and benefits and costs of these final robust portfolios will be assessed and presented to stakeholders. A final recommended portfolio will be identified for final analysis (reliability assessment, 40-year financial analysis, sensitivities, etc.).

Reliability Assessment

A reliability assessment will be conducted on the recommended portfolio for Future 1 to examine any potential overloads that are caused by the recommended portfolio. A DC contingency scan (N-1) will be conducted for each of the four peak hours, for the base case as well as the change case with the recommended portfolio. The list of constraints (see page 18) will be utilized in this scan. Overloads in the base and change cases will be compared, and any overloads that occur in only the change case will be documented, in order to show potential reliability concerns that the recommended portfolio may be causing.

Stability Assessment

Once the models have been finalized, a voltage stability assessment will be conducted on the base case model (no new transmission) to assess the transfer limit (MW) due to transfer of wind west to east across the SPP footprint. This will be conducted for Future 1, and will utilize the MDWG 2033 summer peak AC model. Additional generation sited in the resource plan will be added to this model.

This assessment will identify an approximate tipping point in the west to east transfer limitation of the current 345 kV system, and will factor into a decision on the recommendation of 345 kV upgrades vs. other EHV upgrades for the ITP20 expansion plan.

After development of a change case that includes ITP20 topology upgrades, this same voltage stability assessment will be conducted to assess the transfer limit of the base case transmission

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A single recommended portfolio that best meets needs will be developed from the project groupings. Specific projects will be removed from the recommended portfolio if the behavior of the system within the context of the portfolio exhibits any of the three behaviors listed below.¶
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Congestion targeted by a project with positive net benefit is relieved by other projects in the portfolio.¶
Shortfall to renewable requirements resolved with project mitigations are mitigated by other projects in the portfolio.¶
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system plus ITP20 upgrades in Future 1. A comparison of the transfer limit assessed without any new ITP20 upgrades and with new ITP20 upgrades will be shown in the final report. Additional expansion plan upgrades or modifications may be made to the recommended portfolio resulting from the voltage stability assessments.

Cost Estimates

The cost estimates used for projects that are tested in the initial project screening phase will be Conceptual Estimates as defined by the NTC Business Practice (revisions with new cost estimation process are expected to be approved by MOPC in early 2012). The Conceptual Estimates will be developed by SPP staff and will use standardized estimates and multipliers that are based on historical data. Projects that pass the initial screening phase will be designated for Study Estimates as defined by the NTC Business Practice.

A Study Estimate will be prepared by the designated TO(s) by completing a Standardized Cost Estimate Reporting Template (SCERT) for all upgrades that are required to complete that project. The Study Estimate will provide a more refined cost estimate for potential project approval. After a completed Study Estimate is submitted, this cost will be the only cost used for a project during the ITP20 study. For all Study Estimates, staff will provide TO's a minimum of one month from the date of request before the estimate is due.

Interregional considerations

In the development of transmission plans for the SPP footprint, SPP will review expansion plans of neighboring utilities and Regional Transmission Organizations (RTOs). Based upon that review, other external plans may be taken into account. As noted in the Futures section, SPP will be coordinating with MISO on a joint ITP20 future that will include the coordination of input assumptions and modeling.

Seams projects will be considered as part of the ITP20 study and expansion plan as potential solutions, and SPP will collaborate with neighboring entities regarding the benefits, costs, and possible inclusion of any seams projects. For the neighbors that SPP has an agreement with, joint coordination will be done in accordance with that agreement.

Final Expansion Plan

Benefit metrics will be calculated for the final robust portfolios for all futures. After a final recommended portfolio has been identified, a 40-year financial analysis will be conducted for Future 1, and sensitivities will be run to assess how versatile the final recommended portfolio is in handling a range of uncertainties.

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Forty-Year Financial Analysis

The ITP20 shall assess the cost effectiveness of the recommended portfolio over a forty-year time horizon in accordance with Section III.3.c of Attachment O of the SPP OATT. To calculate the benefits over 40 years, three years will be utilized: 2023, 2028, and 2033. Between the different years' models, transmission topology will be identical, while load will be scaled up or down, and the specific generation resource plan for that year will be utilized. The slope between the selected points will be used to extrapolate the benefits beyond 2033 over a 40 year timeframe. The costs will be calculated using the formula for Annual Transmission Revenue Requirement (ATRR). The total

benefits and costs will be reported in net present value (NPV) dollars. ESWG and staff will work together to further define and develop this forty-year analysis methodology.

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. Many zones are only in one state. 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 B/C ratios will be calculated based on NPV benefit and NPV cost, and will be reported based on present dollars (2013).

Metric Development and Usage

The metrics used to measure the value of the final robust portfolios in the ITP20 are identified here, and will be vetted with the ESWG. These metrics will be used to measure the value of the final robust portfolios in each future. The list of metrics has been simplified from previously used metrics in order to narrow the focus of the assessment to three vital areas: cost benefits realized through various generation scenarios in each future; the impact alternative topology will have on ATC capabilities within SPP; and the impact alternative transmission topology and congestion can have on competitiveness in the SPP market. Additionally, another metric that has been considered (Backstop to Catastrophic Events) will be further developed for use in the ITP20. If any other metrics are developed through the Regional Cost Allocation Review conducted during the ITP20 study, these may be used in the ITP20 as well.

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Comment [A11]: Look at metrics manual to ensure this is the meaning.

Monetized Cost Benefits

The monetized costs benefits will be calculated in the SCED simulations. The production costs, purchases, and sales of all energy within the eastern interconnect will be tracked under each transmission expansion scenario.

Metric Description
APC Savings
Value of Replacing Previously Approved Projects
Reduced Losses
Reduced Capacity Costs
Reduction of Emissions Rates and Values

Table 3: Monetized Cost Benefit Metrics for ITP20

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Available Transfer Capability Benefits

The increases to ATC transfer capability will be calculated on the four hours utilized to identify reliability needs (see page 19). Transfers will be analyzed between each SPP area as well as between each load center in SPP. Load centers have been identified through the use of Geographic Information Systems (GIS) and the approximate area around each of the large cities in SPP (see Table 5). Results will be reported by the largest percentage improvement in each transfer, with the MW increase also provided.

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Metric Description
Value of Improved Available Transfer Capabilities
Limited Export/Import Improvements
Ability to Serve New Load

Table 4: ATC Benefit Metrics for ITP20

City	State
Fayetteville	AR
Wichita	KS
Shreveport	LA
Kansas City	MO
Springfield	MO
Omaha & Lincoln area	NE
Oklahoma City	OK
Tulsa	OK
Lubbock area	TX

Table 5: Load centers used by Metric 14

Competitive Benefits

Opportunity for competition within the footprint will be calculated as a part of the SCED simulations. These metrics will record the differences in LMP price from the average and provides a qualitative and relative comparison between plans regarding which plan provides the most opportunities for generators to compete in the market.

Metric Description
Levelization of LMP's
Improved Competition in SPP Markets

Table 6: Competitive Benefit Metrics for ITP20

Additional Metrics

A Backstop to Catastrophic Events metric has been considered by SPP, and studied by an outside consultant. This metric will quantify the value of a transmission plan's ability to provide a backstop to any catastrophic events. It will be further refined to be used in the ITP20 as further development takes place. Additionally, any other metrics developed through the Regional Cost Allocation Review (RCAR) may be included in the ITP20 study. The ESWG will approve any additional metrics to be utilized.

Metric Description
Backstop to Catastrophic Events
Any other metrics developed through the RCAR

Table 7: Additional Metrics for ITP20

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Sensitivities

Sensitivities will be conducted on the final recommended portfolio to assess how versatile the plan is in handling a range of uncertainties. The following sensitivities will be performed on the recommended portfolio for all futures:

- Natural Gas Price
- Demand levels

The sensitivities will be used as to measure the viability of the proposed transmission plans that are produced through the ITP20. These sensitivities will not be used to develop the transmission projects or filter out projects.

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Comment [A12]: Add Wind Modeling Section after the load forecast section on page 19. Should address usch things as the curtailment cios tof the wind, wind profiles, coincidence with year of load profile, etc.

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Natural Gas Price Sensitivity

The natural gas price will be varied upwards and downwards from the baseline value. The affect of these price changes upon the economic performance of the recommended portfolio will be reflected as a range. A confidence interval will be developed using historical market prices from the New York Mercantile Exchange (NYMEX). The standard deviation of the log difference from the normal, within the dataset, will be used to provide a 95% confidence interval (1.96 standard deviations) in the positive and negative directions. In addition, the lowest natural gas price at which the transmission portfolio remains cost-effective will be determined and reported.

Demand Level Sensitivity

The peak demand and annual load energy values will be varied for a demand level sensitivity in order to identify the outcomes in the case of extreme weather patterns in one year that cause deviations from the normal forecasted load patterns. A confidence interval will be developed using historical demand levels from FERC Form No. 714. The standard deviation of the log difference from the normal, within the dataset, will be used to provide a 67% confidence interval (1 standard deviation) in the positive and negative directions. The impact of this variability upon the economic performance of the portfolio will be reported as a B/C range based on demand level changes.

Staging

Staging of projects will not be performed as part of the ITP20. The ITP20 will be a toolbox for other studies; the ITP10 and ITPNT will be used to further refine and establish the staging of the projects from the ITP20.

Timeline

The study will begin in Jan 2012 with final results in July 2013. A rough timeline with approximate milestones is as follows:

ITP20	Group to review/endorse	Start Date	Completion Date
Futures & Scope	ESWG	December 2011	March 2012
Economic Input Assumptions	ESWG	January 2012	May 2012
Policy Survey	ESWG	February 2012	March 2012
Load Forecast Review	ESWG/TWG	March 2012	April 2012
Resource Plans Development & Review	ESWG	March 2012	August 2012
Model Development & Review	ESWG	April 2012	September 2012
Model Finalization	ESWG	September 2012	
Constraint Review	TWG	May 2012	August 2012
Economic Assessment Begins		Early September, 2012	
Project Development Request	ESWG/TWG	November 2012	December 2012
Final Reliability Assessment	TWG	February 2013	February 2013
Stability Assessment	TWG	January 2013	March 2013
Sensitivities Conducted	ESWG	January 2013	March 2013
Final Benefit Metrics Calculations	ESWG	March 2013	March 2013
Review draft report with recommended solutions	ESWG/TWG	March 2013	March 2013
	MOPC	April 2013	
Final report with recommended solutions	ESWG/TWG	May 2013	June 2013
	MOPC	July 2013	
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Deliverables

Policy Survey

The policy survey will be sent out to members to get member feedback regarding existing renewable generation, renewable targets, unit retirements, unit de-ratings, and fuel switches due to EPA regulations.

Data Review Packages

Stakeholders will be provided packages of data corresponding to the opportunities for review and endorsement outlined above. Multiple packages will be provided and updated throughout the study[11].

- The Input Data Workbook will include worksheets for each of these items:
  - fuel price,
  - effluent price,
  - capital costs,
  - interest rates,
  - peak demand,
  - annual energy, and
  - hurdle rates.
- The Generation Data Workbook will include worksheets for each of these items:
  - conventional generation parameters,
  - wind generation parameters,
  - resource plan,
  - generation siting, and
  - generation output statistics.
- The Congestion Data Workbook will include worksheets for each of these items:
  - constraint definitions,
  - price statistics, and
  - congestion statistics.
- The Benefits Workbook will include worksheets for the results of each benefit metric calculation identified above for the final recommended portfolio.
- A 40-Year Analysis Results Workbook will be provided for each zone showing final recommended portfolio results for:
  - Single zone 40-year benefits and costs detail
  - SPP RTO 40-year benefits and costs detail

Final Report & Recommended Portfolio

The results from the ITP20 will be compiled into a report detailing the findings and recommendations of SPP. The report will include a project list identifying each upgrade. In addition

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[11] Note: execution of necessary data sharing agreements with SPP and Ventyx® are required for access of certain data.

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to the report, modeling data representing the Recommended Portfolio will be provided for the following software packages[11]:

- automation files for PSS®E (.idv),
- powerflow models (.raw) demonstrating the topology of the system, and
- production cost modeling data for PROMOD IV (.pff, .lib, .dat, .eve)

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Changes in Process and Assumptions

In order to protect against changes in process and assumptions that could present a significant risk to the completion of the ITP20, any such changes must be vetted. If a stakeholder group votes on any process steps or assumptions to be used in the study, those assumptions will be used for the ITP20. Changes to process or assumptions recommended by stakeholders must be approved by the appropriate stakeholder group and the MOPC. This process will allow for changes if they are deemed necessary and critical to the ITP, while also ensuring that changes, and the risks and benefits of those changes, will be fully vetted and discussed.

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