Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

October 20th, 2016

OMPA Board Room – Edmond, OK

• SUMMARY OF ACTIONS TAKEN •

1. Accepted SPP staff's proposal for updating peak load, hourly load, and monthly peak and energy data items (ITP scope standardization).
2. Accepted SPP staff's proposal for updating load and loss factor and demand group (ownership) mapping data items (ITP scope standardization).
3. Accepted SPP staff's proposal for utilizing vendor generator names and vendor data as a starting point for generator data review (ITP scope standardization).
4. Approved SPP staff's recommendation for updating fuel and emission prices (ITP scope standardization).
5. Approved SPP staff's recommendation for DC tie modeling in the economic models (ITP scope standardization).
6. Approved SPP staff's proposal for modeling of future renewable generation, as modified (ITP scope standardization).

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

October 20th, 2016

OMPA Board Room – Edmond, OK

• MINUTES •

Agenda Item 1 – Administrative Items

Agenda Item 1a - Call to Order, Introductions

Chair Alan Myers (ITC) called the meeting of the Economic Studies Working Group (ESWG) to order at 8:02 AM, welcomed those in attendance, and asked for introductions.

There were 18 in-person participants and 43 web conference participants, representing 17 of 17 ESWG members. (Attachment 1 – October 20th, 2016 Attendance List)

Agenda Item 1b – Receipt of Proxies

Chair Alan Myers (ITC) asked for any proxy statements; four proxies were identified. Al Tamimi (Sunflower) named Wayne Penrod (Sunflower) as his proxy and Jody Holland (SCMCN) named Eric Burkey (SCMCN) as his proxy. (Attachment 2 – Proxy Statements)

Agenda Item 1c – Review of Agenda

Chair Alan Myers (ITC) presented the agenda for review and asked for any additions or corrections. (Attachment 3 – October 20th, 2016 Agenda)

Tim Owens (NPPD) made a motion; seconded by Kurt Stradley (LES) to adopt the agenda as modified. The motion was approved unanimously.

Agenda Item 2 – Review of Past Action Items

Kelsey Allen (SPP Staff) reviewed the list of past action items and asked for any comments or questions. (Attachment 4 – Past Action Items)

Agenda Item 3 – Consent Agenda

The consent agenda included the following items:

Meetings Minutes – September 15th, 2016 (Attachment 5 – September 15th, 2016 ESWG Minutes)

Alan Myers (ITC Great Plains) asked if any items should be removed from the consent agenda.

The consent agenda was approved unanimously.

Agenda Item 4 – Study Schedules

Agenda Item 4a – 2017 ITP10

Juliano Freitas (SPP) reviewed the 2017 ITP10 schedule with the group. Staff has completed the Project Grouping milestone as scoped and is continuing on with Portfolio Consolidation and Project Staging to be complete by the November meeting. Final assessments including benefit metric calculations are on track for completion by the December meeting. (Attachment 6 – 2017 ITP10 Schedule)

Agenda Item 5 – Incorporating Additional Analysis in the 2017 ITP10

Juliano Freitas (SPP Staff) reviewed the additional analysis being performed to supplement the work completed so far in the 2017 ITP10 that will be used to inform a recommended plan to the MOPC and Board. Tim Owens (NPPD) expressed concern with the volume of information that could be brought to the Stakeholders so late in the process. SPP staff explained that the additional analysis performed for the Multi-Variable Portfolio and the "Side-Bar" won't produce additional portfolios but rather recommendations regarding currently selected projects or alternative project recommendations in certain key areas for consideration. Gayle Nansel (WAPA) pointed out the misnomer of "model corrections" being used to describe the changes made for the "Side-Bar" analysis, stating that many of these changes were model updates made due to timing.

In order to bring the study to completion, a final recommended plan must be developed for consideration by the Stakeholders. This includes incorporation of the additional analysis as well as consolidation of the CPP and reference case portfolios. The group discussed the similarities between the current plans and the idea of developing a core set of projects, with consideration of additional projects that may hedge against the future in general and specifically related to the outcome of the CPP. (Attachment 7 – 2017 ITP10 Additional Analysis)

<u>Agenda Item 6 – ITP Scope Standardization</u>

<u>Agenda Item 6a – Discussion Items Checklist</u>

Kelsey Allen (SPP Staff) gave an update on the discussion items checklist. It is currently being reviewed internal to SPP for completeness and reasonableness and will be rolled out to the group before the November meeting.

<u>Agenda Item 6b – Chronic Operational Issues Criteria</u>

Will Tootle (SPP Staff) reviewed the draft criteria for defining potential operational needs to be evaluated in the new ITP process. The current draft describes different issues experienced in operations that could warrant a planning solution. Frequency and/or cost thresholds were applied to those issues to develop a list of potential candidates based on the latest data for informational purposes. Will requested that the group consider the different issues and provide feedback, including recommended adjustments to the frequency and cost thresholds to be used, within the next couple of weeks. (Attachment 8 – Chronic Issues Summary_October_2016) (Attachment 9 – TPITF - Chronic Operational Issues Criteria)

ACTION ITEM: Stakeholders to submit comments on the chronic operational issues criteria to SPP Operations (Will Tootle, wtootle@spp.org) within the next couple of weeks.

<u>Agenda Item 6c – Load and Generation Review</u>

Clayton Mayfield (SPP Staff) reviewed SPP staff's proposal for standardization of the load and generation review study milestones. The proposals generally involve utilization of available data from either information submitted through the MDWG model development process or leveraging vendor data supplied with each economic model release. Many of these were short-term recommendations with a longer term goal to coordinate potential changes and standardization of a methodology for all common data across SPP studies, specifically coordinating with the newly formed Supply Adequacy Working Group (SAWG) on economic data. There was discussion regarding the level of company granularity that is available in leveraging vendor data and whether or not it would be sufficient in the future. A methodology should be developed long term to achieve the desired model granularity.

> **Leon Howell (OGE) made a motion; seconded by Kurt Stradley (LES) to accept SPP staff's proposal for updating peak load, hourly load, and monthly peak and energy data items. The motion was approved unanimously.**
>
> **Kurt Stradley (LES) made a motion; seconded by Wayne Penrod (Sunflower) to accept SPP staff's proposal for updating load and loss factor and demand group (ownership) mapping data items. The motion was approved unanimously.**
>
> **Leon Howell (OGE) made a motion; seconded by Done Le (NEET) to accept SPP staff's proposal for utilizing vendor generator names and vendor data as a starting point for generator data review. The motion was approved unanimously.**

(Attachment 10 - ITP Scope Standardization – Load and Generation Review)

<u>Agenda Item 6d – Economic Model Data Items</u>

Kelsey Allen (SPP Staff) reviewed recommendations for modeling of fuel and emission prices and DC ties with the Texas and Western Interconnections in the economic model. These recommendations would be implemented in a reference case type future with potential adjustments to be discussed during the scoping (assumptions) phase of each ITP study.

Wayne Penrod (Sunflower) made a motion; seconded by Bethany King (EDE) to approve SPP staff's recommendation for updating fuel and emission prices. The motion was approved unanimously.

There was some concern expressed by some members with both capping the DC tie transactions to long-term firm transmission service and the modeling of those transactions based on historical flows rather than economic signals.

Bennie Weeks (SPS) made a motion; seconded by Leon Howell (OGE) to approve SPP staff's recommendation for DC tie modeling in the economic models. The motion was approved with four abstentions, Wayne Penrod (Sunflower), Alan Myers (ITC), Gayle Nansel (WAPA), and Jeremy Severson (Basin).

(Attachment 11 - ITP Scope Standardization – Economic Model Data Items)

Agenda Item 6e – Resource Plan

Josh Ross (SPP Staff) began review of SPP staff's proposals for standardization of resource planning, beginning with a methodology for determining renewable additions. The original (posted background materials) proposal was modified to what is seen in the attachments to these minutes.

Natasha Henderson (GSEC) made a motion; seconded by Wayne Penrod (Sunflower) to approve SPP staff's proposal for modeling of future renewable generation, as modified. The motion was approved unanimously.

Josh continued discussion modeling of future renewable generation for exporting out of the SPP system. The group agreed that some level of future renewable export should be considered but expressed concerns regarding the lack of transmission service for non-firm resources and overall cost allocation impacts. The SPP Strategic Planning Committee formed the Export Pricing Task Force (EPTF) to specifically address these concerns. Michael Wegner (ITC) suggested adjusting the proposed calculation to consider historical trends to extrapolate a new ratio of export/total wind instead of using a ratio based on existing in order to consider a potential rate of increase of wind installed in SPP for export. (Attachment 12 – ITP Scope Standardization - Resource Plan)

Agenda Item 6f – Resource Siting Plan

[This item was not covered in the allotted time]

(Attachment 13 – ITP Scope Standardization - Resource Siting Plan)

Agenda Item 7 – 2017 ESWG Meeting Schedule

Kelsey Allen (SPP Staff) briefly mentioned the remaining unscheduled meetings for 2017 that would be in conjunction with the TWG. SPP has internally proposed locations and dates and will be sending those out for review by the Stakeholders.

Closing Items

Chair Alan Myers (ITC Great Plains) requested other items meriting discussion.

List of action items from the meeting:

1. Stakeholders to submit comments on the chronic operational issues criteria to SPP Operations (Will Tootle, wtootle@spp.org) within the next couple of weeks.

The meeting was adjourned at 2:45 PM.

Respectfully Submitted,

Kelsey Allen
ESWG Secretary

Southwest Power Pool, Inc.

ECONOMIC STUDIES WORKING GROUP

October 20, 2016

OMPA Office/Edmond, OK

• ATTENDANCE LIST •

Name	Company
Alan Myers	ITC
KURT STRADLEY	LES
Tim Owens	NPPD
Leon Howell	OG&E
Don Le	NEET
Gayle Mansel	WAPA
Pat McCool	KCPL
Michael Wegner	ITC
JULIANO FREITAS	SPP
Jason Davis	SPP
Michael Massery	AECC
Bennie Weeks	Xcel Energy
Bethany King	EDE
Natasha Henderson	GSEC
ZAC HAGER	OGE
Michael Watt	OMPA
Kelsey Allen	SPP

Name	Email
Alan Myers	
Alex Borden	alex.borden@xcelenergy.com
Antonio	abarber@spp.org
Ben Abing	babing@itctransco.com
Bennie Weeks	
Bethany King	
Bill Leung (NPRB)	bleung@bjleung.com
Bret Toplyn (ABB)	bret.toplyn@us.abb.com
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Bryan Ramler	bryan.ramler@xcelenergy.com
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Chris Matthes (AEP)	camatthes@aep.com
Clayton Mayfield	cmayfield@spp.org
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Don Le	
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Eric Burkey	eburkey@ameren.com
Geyle Nansel	
Gunnar Shaffer	gshaffer@spp.org
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Jamie Hajek (NWE)	jamie.hajek@northwestern.com
Jarrod Wolford	jwolford@ntecpower.com
Jason Davis	
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Jeremy Harris (WERE)	jeremy.harris@westarenergy.com
Jeremy Severson (BEPC)	jseverson@bepc.com
Joe Fultz	jfultz@grda.com
John Boshears	john.boshears@cityutilities.net
Jon Iverson	jiverson@oppd.com
Jon Shipman	jeshipman@oppd.com
Jordan Schmick	jordan.h.schmick@xcelenergy.com
Jose Restrepo (SNC-Lavalin)	jose.restrepo@snclavalin.com
Josh Ross	jross@spp.org
Josh Verzal	jverzal@oppd.com
Josie Daggett (WAPA)	daggett@wapa.gov
Juliano Freitas	
Kelsey Allen	kallen@spp.org
Kevin Foflygen (SPRM)	kevin.foflygen@cityutilities.net
Kurt Stradley	
Leon Howell	
Liz Gephardt	lgephardt@spp.org
M Wagner	mwagner01@itctransco.com
matthew stoltz	mstoltz@bepc.com
Michael Massery	
Michael Watt	

Michael Wegner	
Natasha Henderson	
Nikki Roberts	nroberts@spp.org
Pat McCool	
Raj Pudhota	rpudhota@quanta-technology.com
Randy Collier (CUS)	randy.collier@cityutilities.net
ross hohlt	dhohlt@ameren.com
Shawnee Claiborn-Pinto (PUCT)	shawnee.claiborn-pinto@puc.texas.gov
Steve Gaw	rsgaw1@gmail.com
Tim Owens	
Todd Tadych (DATC)	ttadych@atcllc.com
Wayne Penrod	
Will	wtootle@spp.org
Yan Du	ydu@lspower.com
Zac Hager	

Company	Attendance
ITC	In Person
	Webex
	Webex
	Webex
Xcel Energy	In Person
EDE	In Person
	Webex
	Webex
	Webex
	Webex
	Webex
	Webex
	Webex
	Webex
NEET	In Person
	Webex
	Webex
WAPA	In Person
	Webex
	Webex
	Webex
	Webex
SPP	In Person
	Webex
	Webex
	Webex
	Webex
	Webex
	Webex
	Webex
	Webex
	Webex
	Webex
	Webex
	Webex
	Webex
SPP	In Person
SPP	In Person
	Webex
LES	In Person
OGE	In Person
	Webex
	Webex
	Webex
AECC	In Person
OMPA	In Person

ITC	In Person
GSEC	In Person
	Webex
KCPL	In Person
	Webex
	Webex
	Webex
	Webex
	Webex
NPPD	In Person
	Webex
Sunflower	In Person
	Webex
	Webex
OGE	In Person

1. **Al Tamimi (Sunflower) proxy to Wayne Penrod (Sunflower)**

From: Tamimi, Al
Sent: Thursday, October 20, 2016 8:27 AM
To: Myers, Alan
Cc: Kelsey Allen; Penrod, Wayne; Anderson, Angie
Subject: **External Email** Proxy

I am in a CIP audit today and can't attend. Wayne Penrod have my Proxy.

Al Tamimi, Ph.D., P.E.
***V.P.,* Transmission Planning & Policy**
Sunflower Electric Power Corporation
Office: 785-623-3336
Cell: 785-656-0435
atamimi@sunflower.net

2. **Jody Holland (SCMCN) proxy to Eric Burkey (SCMCN)**

From: Jody Holland [mailto:JHolland@gridliance.com]
Sent: Thursday, October 20, 2016 8:40 AM
To: Myers, Alan K. <amyers@Itctransco.com>; Kelsey Allen <kallen@spp.org>
Cc: Eric Burkey <EBurkey@gridliance.com>
Subject: Proxy

Alan/Kelsey,
Eric has my proxy for the 1st half of the meeting today. Thx.

Jody Holland
Director, Transmission Planning
South Central MCN, LLC
Midcontinent MCN, LLC
Mid-Atlantic MCN, LLC
Cell: 501-681-5950
jholland@gridliance.com

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ECONOMIC STUDIES WORKING GROUP

October 20th, 2016

OMPA Offices – Edmond, OK

• A G E N D A •

8:00am – 3:00pm

1. Administrative Items
   a. Call to Order, Introductions........Alan Myers (5 minutes)
   b. Receipt of Proxies........Kelsey Allen (1 minute)
   c. Review of Agenda[1]........Alan Myers (1 minute)
2. Review of Past Action Items[1]........Kelsey Allen (5 minutes)
3. Consent Agenda[1] (Approval Item)........Alan Myers (5 minutes)
   a. Approval of Meeting Minutes – September 15th, 2016
4. Study Schedules[1]........Juliano Freitas (15 minutes)
   a. 2017 ITP10
5. Incorporating Additional Analysis in the 2017 ITP10........Juliano Freitas (30 minutes)
   a. Multi-Variable Portfolio
   b. "Side-Bar" Analysis
6. ITP Scope Standardization........SPP Staff (240 minutes)
   a. Discussion Items Checklist
   b. Chronic Operational Issues Criteria[1] (Will Tootle)
   c. Load and Generation Review[1] (Clayton Mayfield)
   d. Economic Model Data Item[1] (Kelsey Allen)
   e. Resource Plan[1] (Josh Ross)
   f. Resource Siting Plan (Chris Jamieson)
7. 2017 ESWG Meeting Schedule........All (5 minutes)
8. Closing Items........All (5 minutes)
   a. Summary of Action Items (Kelsey Allen)
   b. Future Meetings
      i. November 16th-17th, 2016: SPP Corporate Office, Little Rock, AR

[1] Background Material Included

ii. December 8th, 2016: 8th Floor AEP Offices, Dallas, TX
iii. January 12th, 2017: 8th Floor AEP Offices, Dallas, TX
iv. March 16th, 2017: 8th Floor AEP Offices, Dallas, TX
v. April 20th, 2017: 8th Floor AEP Offices, Dallas, TX
vi. June 15th, 2017: 8th Floor AEP Offices, Dallas, TX

Southwest Power Pool, Inc.

ECONOMIC STUDIES WORKING GROUP

Pending Action Items Status Report

October 20th, 2016

	Action Item	Date Originated	Status	Comments
057	SPP staff will write a straw-man procedure or portion of the ITP manual that deals with conventional and wind generation planning and siting within the ITP process. The process should be in place by the Spring of 2015.	August 23rd, 2012	In Progress Staff	A draft resource siting whitepaper will be developed for review mid-2016.
151	Staff to look into optional software tools for use in ITP studies.	May 20th, 2015	In Progress Staff	Staff is meeting with software vendors and users and expects to have a recommendation on any potential resource planning software changes by 4th quarter 2016.
160	SPP Staff and the ESWG are to formalize standard procedures for data requests and member review of information related to ITP studies.	January 21st, 2016	In Progress Staff/ESWG	Combined item representative of AI148 and AI149.
161	Staff to report on carbon emissions as the 2017 ITP10 study moves forward through the different milestones.	February 24th-25th, 2016	In Progress Staff	
163	SPP Staff and members to prepare for discussion on scope standardization and prioritization of discussion items.	April 21st, 2016	In Progress Staff/Members	
165	ESWG to review the assumed benefit of mandated reliability projects	May 13th, 2016 RARTF	In Progress ESWG	
166	ESWG to review the impacts of using the system reconfiguration hybrid approach for the Assumed Benefit of Mandated Reliability Projects	May 13th, 2016 RARTF	In Progress ESWG	
167	ESWG to review the classification of projects in the ITP process	May 13th, 2016 RARTF	In Progress ESWG	
168	Staff and the ESWG to evaluate the issues seen in the DC to AC model	May 18th-19th,	In Progress	

	conversion process.	2016	Staff/ESWG	
169	Staff to investigate the requirements for approval of a new standard ITP scope in order to determine the date of approval by the working groups needed prior to final approval by MOPC and the Board.	June 16th, 2016	In Progress Staff	7/21: Approval by April, 2017 for July MOPC/BOD approval. 8/23: Potential for work needing to be complete by January, 2017 in order to go through all necessary working groups.
170	Staff to coordinate with other SPP groups regarding requirements and opportunities for standardization of requesting and utilizing peak load data.	June 16th, 2016	In Progress Staff	August 23rd: Staff brought a proposal to coordinate data with the SAWG. October 20th: ESWG approved a methodology for the ITP standard scope. Discussions should continue with SAWG for coordination of methodology, as appropriate.
171	Staff to investigate coordination opportunities regarding request for member hourly load data.	June 16th, 2016	In Progress Staff	
172	Staff to develop examples and language for tackling synergies of powerflow and economic generation data.	June 16th, 2016	In Progress Staff	October 20th: ESWG approved a methodology for the ITP standard scope. Discussions should continue with SAWG for coordination of methodology, as appropriate.
173	Staff to develop a process for annual update of the economic model with vendor data.	June 16th, 2016	In Progress Staff	
174	Staff to develop criteria and methodology to developing resource plans absent a software tool.	June 16th, 2016	In Progress Staff	
177	Staff to develop a checklist of decision points for development of the ITP standard scope.	July 21st, 2016	In Progress Staff	September 15th: Include timeline for bringing items to each meeting. October 20th: Still vetting internally. Should be ready for member consumption prior to

				November meeting.
~~178~~	~~Staff to develop a presentation on the technical details, limitations and recommendation regarding the Transmission Outage benefit metric.~~	~~July 21st, 2016~~	~~Complete~~ ~~Staff~~	
~~180~~	~~SPP Staff to investigate whether the current ITP manual needs to go through a more formal revision process (RR) in order to implement the recommendations of the TPITF.~~	~~August 23rd, 2016~~	~~Complete~~ ~~Staff~~	~~Updates to the ITP manual require TWG, ESWG, MOPC and BOD approval but is not identified as a document under the current RR process.~~
~~181~~	~~SPP Staff to reach out to the BPWG, ORWG, and RTWG regarding coordination with and level of involvement of those groups in the ITP Manual Task Force efforts to implement TPITF recommendations.~~	~~August 23rd, 2016~~	~~Complete~~ ~~Staff~~	~~BPWG, ORWG, and RTWG have been contacted. Robert Pick (NPPD) will represent RTWG in necessary discussions.~~
182	SPP Staff to post models and data utilized for the 2017 ITP10 side-bar analysis when complete.	September 15th, 2016	In Progress Staff	
183	SPP Staff to perform the outage analysis to determine the appropriate APC benefit % to utilize in the mitigation of transmission outages benefit metric in the first part of 2017.	September 15th, 2016	In Progress Staff	
184	Stakeholders to submit comments on the chronic operational issues criteria to SPP Operations (Will Tootle, wtootle@spp.org) within the next couple of weeks.	October 20th, 2016	In Progress Stakeholders	

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

September 15th, 2016

8th Floor AEP Offices – Dallas, TX

• SUMMARY OF ACTIONS TAKEN •

1. Approved the ITP Manual TF charter as posted.
2. Approved the APC benefit % established during the RCAR I analysis to proxy the benefit of transmission outage mitigation for use in the 2017 ITP10.

Southwest Power Pool

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

September 15th, 2016

8th Floor AEP Offices – Dallas, TX

• MINUTES •

Agenda Item 1 – Administrative Items

Agenda Item 1a - Call to Order, Introductions

Chair Alan Myers (ITC Great Plains) called the meeting of the Economic Studies Working Group (ESWG) to order at 8:02 AM, welcomed those in attendance, and asked for introductions.

There were 14 in-person participants and 50 web conference participants, representing 17 of 17 ESWG members. (Attachment 1 – September 15th, 2016 Attendance List)

Agenda Item 1b – Receipt of Proxies

Alan Myers (ITC Great Plains) asked for any proxy statements; four proxies were identified. Jeremy Severson (Basin) named Matthew Stoltz as his proxy, Leon Howell (OGE) named Zac Hager (OGE) as his proxy, Michael Massery (AECC) named Brad Johnston (AECC) as his proxy, and Randy Collier (CUS) named John Boshears (CUS) as his proxy. Natasha Henderson (GSEC) temporarily named Jett Price (GSEC) as her proxy within agenda item 5. (Attachment 2 – Proxy Statements)

Agenda Item 1c – Review of Agenda

Chair Alan Myers (ITC Great Plains) presented the agenda for review and asked for any additions or corrections. Kelsey Allen (SPP Staff) asked to strike the Generation Siting Whitepaper agenda item. (Attachment 3 – September 15th, 2016 ESWG Agenda)

Kurt Stradley (LES) made a motion; seconded by Natasha Henderson (GSEC) to adopt the agenda as modified. The motion was approved unanimously.

Agenda Item 2 – Review of Past Action Items

Kelsey Allen (SPP Staff) reviewed the list of past action items and asked for any comments or questions. (Attachment 4 – Past Action Items)

Agenda Item 3 – Consent Agenda

The consent agenda included the following items:

Meetings Minutes – July 21st, 2016 (Attachment 5 – July 21st, 2016 ESWG Minutes)
Meetings Minutes – August 23rd, 2016 (Attachment 6 – August 23rd, 2016 ESWG Minutes)

Alan Myers (ITC Great Plains) asked if any items should be removed from the consent agenda.

The consent agenda was approved unanimously.

Agenda Item 4 – Study Schedules

Agenda Item 4a – 2017 ITP10

Juliano Freitas (SPP) reviewed the 2017 ITP10 schedule with the group. Staff is currently working on the project grouping milestone and expecting to have draft portfolios to review at the end of the month. The group discussed holding a joint conference call with a TWG to review the projects.

ACTION ITEM: Staff to send out a poll for a joint ESWG/TWG conference call on September 30th.

(Attachment 7 – 2017 ITP10 Schedule)

Agenda Item 5 – RR180-ITP Transmission Needs

Liz Gephardt (SPP Staff) reviewed RR180 suggested changes to references in Attachment O to the SPP Tariff to transmission needs being identified in the ITP scope. The intent of the changes is to bring clarity to the process for defining transmission needs. Steve Gaw (Wind Coalition) expressed concern regarding the removal of language related to Public Policy Needs and Stakeholder identification of transmission needs, stating that the inclusion of the language in the Tariff was a FERC requirement under SPP's Tariff filing. Other members expressed the need for additional clarity, including the definition of a transmission need and other sections referencing Public Policy Requirements and methodology of determination of transmission needs.

The group took no action on RR180, citing the need for the concerns raised to be taken back to the RTWG as comments, and made slight modifications to the proposed document for RTWG consideration. (Attachment 8 - RR180 - ITP Transmission Needs_ Recommendation Report_ESWG edits)

Agenda Item 6 – ITP Manual Task Force Charter

Juliano Freitas (SPP Staff) reviewed the ITP Manual Task Force Charter with the group and requested approval.

> **Natasha Henderson (GSEC) made a motion; seconded by Kurt Stradley (LES) to approve the ITP Manual TF charter as posted~~adopt the agenda as modified~~. The motion was approved unanimously.**

(Attachment 9 – ITP Manual TF Charter)

Agenda Item 7 – 2017 ITP10 Economic Project Grouping

Kelsey Allen (SPP Staff) reviewed the process for grouping economic projects into potential portfolios and discussed some additional work being performed by Staff to help inform the 2017 ITP10 study. Jody Holland (~~SCMCM~~SCMCN) expressed concern regarding the type of projects reviewed by SPP Staff at the Planning Summit and posted in the draft project list and challenged Staff to look for more opportunity for new transmission build out rather than small upgrades to existing facilities, given the 10^{th}-year horizon of the study.

As a part of the grouping process, SPP Staff is developing of a multi-variable portfolio that encourages the use of additional criteria and judgement to select projects that address the needs of the study. Staff intends to utilize this portfolio to address some current SPP initiatives related to transmission issues continually experienced in real-time operations, coordination with seams neighbors, and RCAR II. Staff will be looking for more robust solutions in the current target areas of the eastern seam near southwest Missouri, and one of the current top congested areas in the Texas panhandle.

SPP Staff is also working to better understand the impact of the model corrections submitted by stakeholders and NTC's issued by SPP after the powerflow model approval in October, 2015. Due to the volume of changes, Staff deemed it prudent to rebuild models and reassess system constraints with these changes to understand the impact to the 2017 ITP10 posted transmission Needs. This analysis will be considered when making project recommendations at the end of the study to ensure the appropriate transmission is being proposed.

(Attachment 10 – 2017 ITP10 Economic Project Grouping)

ACTION ITEM: SPP Staff to post models and data utilized for the 2017 ITP10 side-bar analysis when complete.

Agenda Item 8 – Mitigation of Transmission Outages Metric-2017 ITP10

Josh Ross (SPP Staff) reviewed the mitigation of transmission outages metric and the work involved to develop the data necessary for the calculations. Staff is proposing to continue using the % multiplier to APC calculated during the RCAR I for use in the 2017 ITP10 benefit metrics calculation. (Attachment 11 – 20160915_Mitigation_of_Transmission_Outages_Metric)

> **Pat McCool (KCPL) made a motion; seconded by Don Le (NEET) to approve the APC benefit % established during the RCAR I analysis to proxy the benefit of transmission outage mitigation**

for use in the 2017 ITP10~~adopt the agenda as modified~~. **The motion was approved unanimously.**

ACTION ITEM: SPP Staff to perform the outage analysis to determine the appropriate APC benefit % to utilize in the mitigation of transmission outages benefit metric in the first part of 2017.

Agenda Item 9 – ITP Scope Standardization

Kelsey Allen (SPP Staff) began discussion on the ITP scope standardization by reviewing a more detailed checklist of items that will need to be discussed by the group with the goal of approving a criteria, methodology or data source for documentation in the ITP manual. The group requested that an outline with a timeline indicating ~~for~~ when these items will be discussed be developed.

ACTION ITEM: SPP Staff to develop an outline and timeline of upcoming discussion items related to ITP scope standardization.

Josh Ross (SPP Staff) reviewed a proposed methodology for resource planning under the new ITP study process. The group expressed a few concerns related moving away from the current standardized process and the standardizing specificity around renewables, but was generally supportive of the direction of the proposal. While the process would allow for more stakeholder input in identification of appropriate resource technology, Staff is still recommending that the location of the sites of new resources without firm commitment follow a standard methodology.

(Attachment 12 – ITP Scope Standardization)

Closing Items

Chair Alan Myers (ITC Great Plains) requested other items meriting discussion.

List of action items from the meeting:

1. Staff to send out a poll for a joint ESWG/TWG conference call on September 30th.
2. SPP Staff to post models and data utilized for the 2017 ITP10 side-bar analysis when complete.
3. SPP Staff to perform the outage analysis to determine the appropriate APC benefit % to utilize in the mitigation of transmission outages benefit metric in the first part of 2017.
4. SPP Staff to develop an outline and timeline of upcoming discussion items related to ITP scope standardization.

The meeting was adjourned at 2:40 PM.

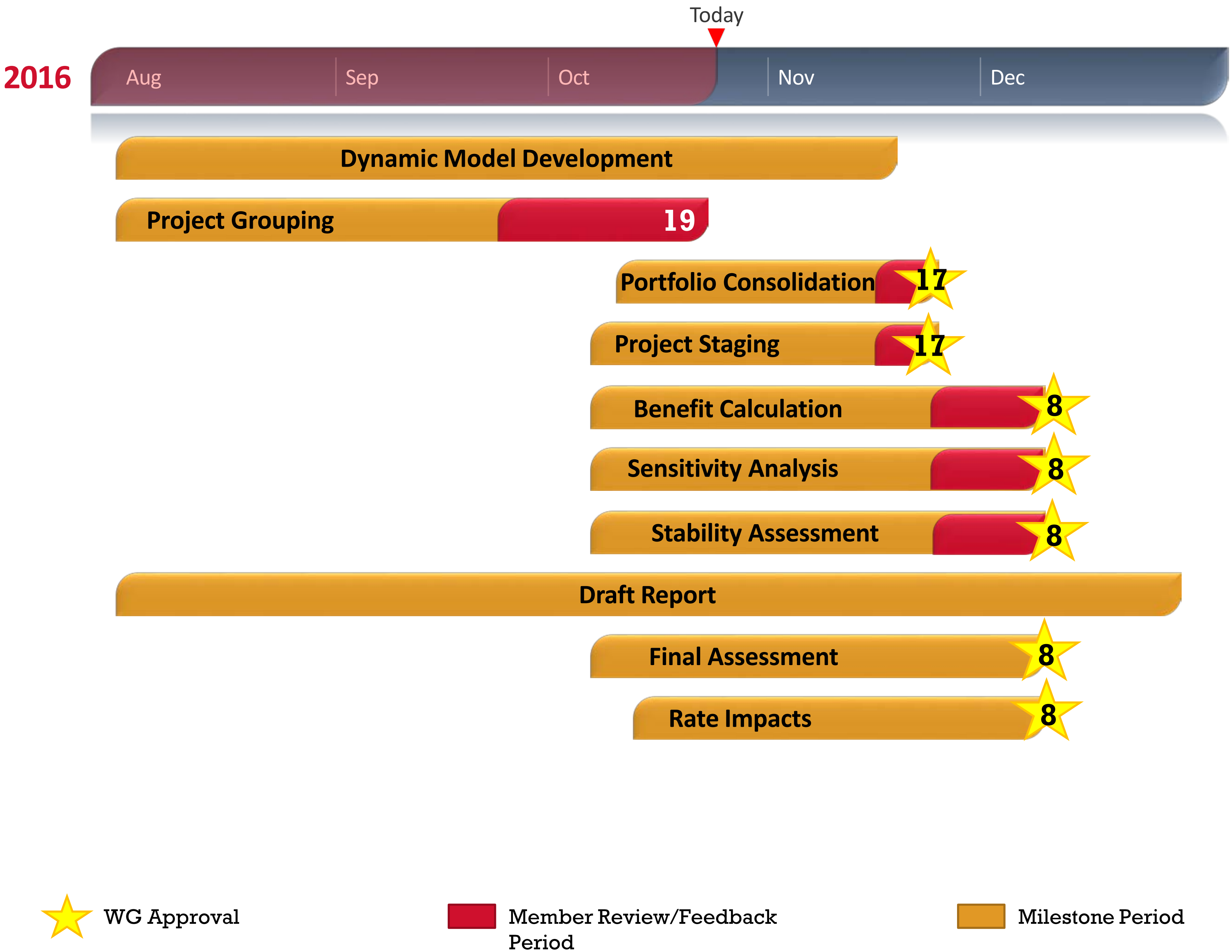
Respectfully Submitted,

Kelsey Allen
ESWG Secretary

2017 ITP10 Schedule

ESWG

September 15th, 2016


Today
2016
Aug
Sep
Oct
Nov
Dec
2016
Dynamic Model Development
Project Grouping
19
Portfolio Consolidation
17
Project Staging
17
Benefit Calculation
8
Sensitivity Analysis
8
Stability Assessment
8
Draft Report
Final Assessment
8
Rate Impacts
8
WG Approval
Member Review/Feedback Period
Milestone Period


SPP
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SEVENTY-FIVE YEARS OF
RELIABILITY THROUGH RELATIONSHIPS

2017 ITP10 Additional Analysis

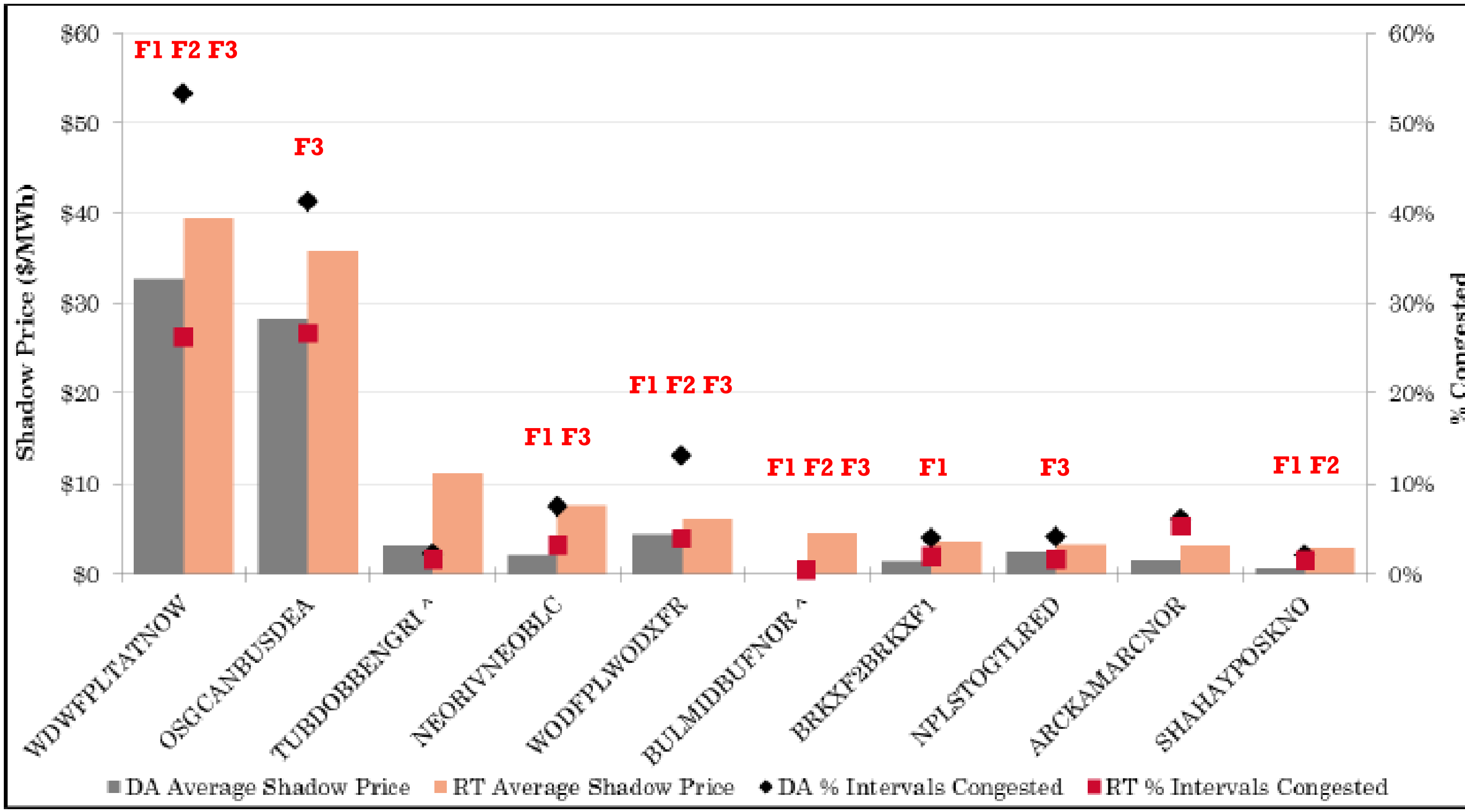
October 20th, 2016

ESWG/TWG

SPP Staff

2015 State of the Market Report
Top 10 Flowgates – ITP Correlation

Figure 5–5 SPP Congestion by Shadow Price, 2015



% Intervals Congested includes both breached and binding intervals

*Future specific ITP10 need correlation in red text above each flowgate

Final Portfolios

- Staff will consolidate the projects from each CPP Future (Futures 1 & 2) into a single portfolio. This CPP portfolio and the reference case portfolio (Future 3) will move on for additional benefit metric calculations and sensitivity analysis.
- Economic Consolidation
  - Weighted sum 1-year APC B/C methodology
  - The projects performance in Future 1 will contribute 75% of the weighting.
  - The projects performance in Future 2 will contribute 25% of the weighting.
- Reliability Consolidation
  - All Future 1 Needs will be addressed by the CPP portfolio.
  - A subset of Future 2 Needs will be addressed by the CPP portfolio if:
    - A monitored element's % loading is 95% or greater in Future 1 and greater than 100% in Future 2; or
    - The per unit voltage of a bus is .92 p.u. or lower in Future 1 and lower than 0.9 p.u. in Future 2.

Multi-Variable Portfolio

- Certain transmission issues identified under out of scope criteria were posted for informational purposes
- This was done to allow for submittal and further evaluation of projects that may support SPP initiatives but are not addressing official Needs per the ITP10 Scope
  - RCAR II
  - Seams
  - Operational issues
- Current target areas for potential project recommendations
  - Eastern Seams
    - Southeast Kansas – Southwest Missouri
    - Northeast Oklahoma – Northwest Arkansas
  - Texas Panhandle
    - SPS North to South

"Side-Bar" Analysis

- SPP is currently performing additional analysis to help inform project recommendations due to schedule differences with NT studies
- Analysis
  - Inclusion of all known model corrections and NTC projects in base model
  - Additional economic model changes to support improvements
  - Restart process at constraint assessment
- Status
  - Current: performing DC-AC conversion
  - Next: reassess system congestion and reliability criteria violations to determine impacts to 2017 ITP10 needs and project portfolios

75

Developing a Recommended Plan

- CPP and Non-CPP
- Multi-Variable Portfolio
- “Side-Bar” Analysis

Schedule

- ESWG and TWG
  - November 15-17
    - Provide “Side-Bar” Analysis Impacts
    - Provide CPP and Non-CPP consolidation
    - Provide Multi-Variable Portfolio Findings
- TWG
  - December 7
  - December 14
- ESWG
  - December 8

Objective:

The TPITF made several recommendations to the current planning process to improve the identification of projects and process timelines. Per the TPITF white paper recommendation SPP staff has developed strawman criteria in order to identify chronic operational events that need long term transmission solutions proposed. An initial list of chronic operational issues has been identified below based on the proposed criteria.

Flowgate Issues:

- Congested > 20% of previous 24 months
  - OSGCANBUSDEA
    - 50,670 market intervals or 24.1%

- VRL Analysis, > $10 million over previous 24 months

Cost of Congestion	IDC Number	Flowgate Name	Element Type	Area	Element
$77,081,843	5563	WDWFPLTATNOW	Monitored	OKGE	Woodward - FPL Switch 138 kV
	5563	WDWFPLTATNOW	Contingent	OKGE	Tatanga - Matthewson 345 kV
$42,192,030	5371	OSGCANBUSDEA	Monitored	SPS	Osage - Canyon East 115 kV
	5371	OSGCANBUSDEA	Contingent	SPS	Bushland - Deaf Smith 230 kV
$21,010,899	5548	SUNAMOTOLYOA	Monitored	SPS	Sundown - Amoco 230 kV
	5548	SUNAMOTOLYOA	Contingent	SPS	Tolk - Yoakum 230 kV
$18,256,273	5228	IATSTRNASHAW	Monitored	KCPL	Iatan - Stranger 345 kV
	5228	IATSTRNASHAW	Contingent	KCPL	Nashua - Hawthorn 345 kV
$13,674,547	21931	TMP203_21931	Monitored	OKGE	CIMARRON 345/138 kV Transformer CKT 1
	21931	TMP203_21931	Contingent	OKGE	CIMARRON 345/138 kV Transformer CKT 1
$13,072,821	5577	NASXFRNASHAW	Monitored	KCPL	Nashua 345/161 kV Transformer
	5577	NASXFRNASHAW	Contingent	KCPL	Nashua - Hawthorn 345 kV
$12,033,385	5567	WODFPLWODXFR	Monitored	OKGE	Woodward - FPL Switch 138 kV
	5567	WODFPLWODXFR	Contingent	OKGE	Woodward 138/69 kV Transformer
$10,359,270	5576	SILSPRTONFLI	Monitored	GRDA	Siloam - Siloam Springs 161 kV
	5576	SILSPRTONFLI	Contingent	GRDA	Tonnece - Flint Creek 345 kV

- IROLs:

IDC Number	Flowgate Name	Flowgate Type	Area	Element
5042	NWTPATLYDVAL	Monitored	CSWS	NW Texarkana - Patterson 138 kV
5042	NWTPATLYDVAL	Contingent	CSWS	Valliant - Lydia 345 kV
5215	VALLYDELDSAR	Monitored	CSWS	Valliant - Lydia 345 kV
5215	VALLYDELDSAR	Contingent	EES	ElDorado - Sarepta 345 kV
5217	SARELHVALLYD	Monitored	EES	Sarepta - Longwood 345 kV
5217	SARELHVALLYD	Contingent	CSWS	Valliant - Lydia 345 kV
6006	GGS	Monitored	NPPD	Gentleman - North Platt 230 kV CKT 1
6006	GGS	Monitored	NPPD	Gentleman - North Platt 230 kV CKT 2
6006	GGS	Monitored	NPPD	Gentleman - North Platt 230 kV CKT 3
6006	GGS	Monitored	NPPD	Gentleman - Red Willow 345 kV
6006	GGS	Monitored	NPPD	Gentleman - Sweewater 345 kV CKT 1
6006	GGS	Monitored	NPPD	Gentleman - Sweewater 345 kV CKT 2

High/Low Voltage Issues:

- Brookline – Flint Creek 345 kV
    - 82 days or 22.47% of previous 12 months

Required Reconfiguration due to Ineffective redispatch:

- Red Willow 345/115 kV transformer
    - 135.8 days or 37% of previous 12 months

10/6/16

Objective:

The TPITF made several recommendations to the current planning process to improve the identification of projects and process timelines. Per the TPITF white paper recommendation SPP staff has developed strawman criteria in order to identify chronic operational events that need long term transmission solutions proposed. This criteria will be inserted into the ITP Manual.

- Flowgate issues
  - Flowgates must reference monitored elements under the SPP Tariff. Flowgates congested for at least 20% of the previous 24 months, either in a breached or binding state in the Real-Time Balancing Market solution, will be added to the ITP needs list. Periods of time when a flowgate's related congestion is deemed to be the result of an outage(s) will be excluded.
  - Flowgates with congestion costs totaling more than $10 million over the previous twenty four months will also be added to the ITP needs list. Congestion costs will be calculated using the same methodology as the VRL Report process. Periods of time when a flowgate's related congestion is deemed to be the result of an outage(s) will be excluded.
  - IROL Flowgates identified in operations shall be added to the needs list.
- High/Low Voltage issues
  - Operating Guides that require reconfiguration, documenting mitigations for high and low voltage issues, will be reviewed from the last cycle and related voltage issues will be added to the ITP needs list. The mitigation to avoid the high/low voltage issue must be implemented 10% of the time of the year due to non-outage issues.
    - Mitigations that are implemented less than 10% of the year, but risk greater than 100 MW of load will also be considered.
- Manual Commitments (Economic)
  - Generation that is dispatched uneconomically in order to support voltage in the local area. Manual commitment events which include startup and extension 25% of the year will be added to the ITP needs list. DPP solutions will be compared against the Make Whole Payments during the cycle as well as expected payments over the next 40 years. Make Whole Payments occurring over the last cycle will be compared to transmission solutions to see if a B/C ratio is greater than .9.

- N-1-1 (outage scenarios)
    - Operations will identify situations during outages that may result in the loss of load in the event of the next contingency due to a lack of voltage support or lack of transmission sources to serve load. In circumstances that risk the loss of load transmission solutions would be required. Load risk issues must be present at least 10% of the year.   If there are long term solutions planned for the area then the need for additional support would be excluded.
        - 100 MW of load at risk would be an alternative to not showing up 10% of the time
- Required reconfigurations due to ineffective redispatch
    - Transmission capacity limitations can usually be controlled by flowgates. Applying a threshold to TDFs can leave some transmission paths overloaded with no way to control loading through redispatch. Reconfiguration will relieve the most limiting element, but it often degrades the robustness of the transmission system and increases risk due to the next contingency. The reconfiguration will require an agreed upon Operating Guide that has been implemented in real time 25% of the year.

Project Acceleration:

- Projects that have previously been identified by SPP Planning may be subject to Accelerated Need Dates based on issues identified in Real Time Operations.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ITP Scope Standardization

ESWG

10/20/2016

Load Review Items

ITP Scope Standardization

Load Review Items

- Peak Load
  - Use latest ITP powerflow model series (Staff preferred)
  - ESWG and SAWG to standardize process for transmission and generation planning load forecasts
- Hourly Load Shape
  - Utilize ABB Simulation Ready Data and provide Stakeholders with opportunity to review (Staff preferred)
  - ESWG and SAWG develop process for creating and periodically updating load shape (Backup)
  - Create a synthetic load shape based off of historical data points and FERC Form 714 (Backup)
- Monthly Peak and Energy
  - Utilize ABB Simulation Ready Data and provide Stakeholders with opportunity to review (Staff preferred)
  - Calculate using hourly load shape data (Backup)

Load Review Items Con't

- Load Factor
  - Stakeholders provide annual load factor (Staff preferred)
  - Use previous study values (Backup A)
  - Calculate utilizing hourly load shape (Backup B)
- Transmission Loss Factor
  - Stakeholders provide annual loss factor (Staff preferred)
  - Use previous study values (Backup)
- Demand Group Bus Mapping
  - Merge SPP Modeling and Economic group's load ownership identification process and assign load to Areas/Demand Groups (Staff preferred)
  - Stakeholders map bus and ID to Powerbase Demand Groups (Backup A)

Generation Review Items

ITP Scope Standardization

Generation Data

- Utilize ABB Simulation Ready Data Generator Names

- Utilize ABB Simulation Ready Data as starting point for:
- Reviewable data:
  - Category Types
  - Conventional Variable O&M
  - Conventional Fixed O&M
  - Heat Rate
  - Heat Rate Profiles
  - State Unit is located in
  - Annual Maintenance Hours
  - Forced Outage Rate
  - Effluents (% Removed)
  - Emission Rates
  - Fuel Forecast
  - Hydro Energy Limits
  - Seasonal Max Capacity by Year
  - Retirement Dates
  - Commission Dates
  - Must Run designation

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RELIABILITY THROUGH RELATIONSHIPS

ITP Scope Standardization

ESWG

10/20/2016

Fuel and Emission (Effluent) Prices Recommendation

- Fuel prices
  - Natural gas, oil, uranium and coal, including transportation costs are forecasted based upon the latest ABB Simulation Ready Data for the Reference Case Future
- Emission prices
  - CO_2, SO_2 and NOX prices are forecasted based upon the latest ABB Simulation Ready Data for the Reference Case Future
- Future(s) adjustments
  - Potential adjustments to the fuel and emission prices will be determined by the ESWG to appropriately reflect each "Future's" definition

DC Ties Recommendation

- Approximate interchange across DC ties that connect SPP to the Texas and Western Interconnections
- Develop hourly profiles based on at least 3 years of historical flows across each DC tie capped at long-term firm transmission service amounts
- Modeled as fixed transactions with no curtailment price assumed
- Future DC ties and future expansion of DC ties will be contemplated on a case by case basis


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ITP Scope Standardization – Resource Planning

ESWG

10/20/2016

Renewable Additions

- Renewable additions will be identified prior to conventional additions
- Wind and solar additions shall be computed using criteria that can be applied uniformly across zones
  - In order to have consistency across the region and to maintain some simplicity, renewable additions will not include surveying different members for each's expected additions in 5-10 years
  - Criteria for proposed additions in each study will consider factors such as government regulations, historical trends, NG prices, installation trends, and IRP projections
- Hydro, Biomass, Other – RAR process

Wind Export Additions

- Calculate ratio of (existing export wind)/(total existing wind)
  - Then add export wind in order to keep the same ratio for (export wind additions)/(total wind additions)
- Example: 10 GW existing wind for SPP entities, 1 GW existing wind for export
  - If adding 4 GW of wind for SPP entities, add 400 MW of wind for export

Conventional Additions

- Perform zonal resource shortfall calculations by spreadsheet
  - Include renewable additions from the previous step
- Identify CC and CT prototype parameters – recommend use of the latest Lazard Levelized Cost of Energy Analysis
- No software simulations, but we are leveraging previous resource planning simulations to develop criteria

Conventional Additions

- Futures with carbon constraints
  - 2017 ITP10 F1 and F2: 96%-100% of conventional resource additions were CCs, based on software simulations
  - Because of this, we propose adding only CCs as needed to meet zonal reserve margin requirements in future studies
- Futures without carbon constraints
  - Based on 2017 ITP10 Future 3 model and resource planning results, identify peaking gen/total gen ratio by zone and zonal load factors to develop a new target peaking gen/total gen ratio by zone
  - CCs and/or CTs will be added to zones with shortfall in order to pull the zonal peaking gen/total gen ratio closer to the target

Conventional Additions – non-carbon constrained future

- 2017 ITP10 used as historical reference point
  - Load Factor (LF) by zone
  - Peaking Gen/Total Gen Ratio by zone
- In future studies, zonal target ratios would be calculated as:

$$\text{Target Peaking Gen/Total Gen Ratio} = \frac{\text{Historical LF}}{\text{New study LF}} * \text{Historical Peaking Gen/Total Gen Ratio}$$

- Zones keep a similar resource mix to what was included in the 2017 ITP10, adjusted for updated load factors

Conventional Additions –Example (non-carbon constrained future)

- In future study, AEPW has new load factor of 40%
  - Because of the LF reduction, AEPW additions would include more peaking resources
- AEPW target peaking gen/total gen ratio =
  $\frac{53.2\%}{40\%} * (35.7\%) = \underline{47.5\%}$
- CC and CT resources are added to AEPW as needed to reach reserve margin requirements, while aiming for a target peaking gen/total gen ratio of 47.5%
  - Resource additions will not result in hitting the target ratios, but rather getting closer to the target ratios
- This should keep the region equipped with adequate peaking resources and baseload resources

2017 ITP10 Future 3

Zone	Peaking Gen/Total Gen Ratio After Resource Additions	Load Factor
AEPW	35.7%	53.2%
BPU	43.4%	56.9%
CUS	24.0%	47.4%
EMDE	22.4%	53.0%
GMO	50.7%	54.0%
GRDA	2.5%	58.1%
INDN	42.8%	45.8%
KCPL	19.0%	51.0%
LES	27.0%	53.6%
MIDW	27.8%	52.3%
MKEC	77.6%	56.1%
NPPD	13.6%	53.6%
OKGE	42.5%	56.8%
OPPD	31.8%	53.0%
SPA	5.9%	54.3%
SPS	30.9%	63.9%
SUNC	28.4%	61.3%
WFEC	23.3%	53.9%
UMZ	18.2%	64.8%
WERE	30.8%	53.9%
TOTAL	29.4%	56.1%

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Conventional Resource Additions – Alternative Methodology

- If it is determined at the onset of the study that some variables have changed that indicate the addition of only CCs and CTs is not the best option, then Staff and ESWG may elect to use Resource Planning software to determine conventional resource additions
  - Examples: Significant change in NG price forecast, or a new public policy

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External RP Proposal – Conventional

- MISO – use conventional resource additions from the current MTEP model (future-specific)
- AECI, TVA, SaskPower, Manitoba, any others – use the same methodology for each that is being proposed for SPP
  - Start with capacity shortfall calculations
  - Add CCs and/or CTs based on load factor, peaking gen, and total gen
  - Previously, external areas have been planned in a similar manner – spreadsheet work (no simulations) to determine some mix of CC and CT additions. This proposed method is a little more detailed, as it takes into account each entity's current peaking generation and total generation.

RP Proposal – Baseline

- Members submit expected future generation (conventional/renewable) through the MDWG model development process
  - Load and generation review
  - Reflective of company IRP
  - No siting considerations at this stage
- Use member-submitted generation parameters
  - If member is unable to provide parameters, Reference Case data for that technology type would be used

Resource Plan – Years 2, 5, 10

- Year 2
  - High Certainty for any planned resource additions
  - IPP resources assigned to resource deficient zones
  - Ensure region meets reserve margin requirements
  - SPP will not identify resource additions
- Years 5 and 10
  - Could have Less Certainty for any forecasted resource additions
  - Add conventional and renewable resource plan units as needed for year 10
    - 50% of unit additions are in-service in year 5


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ITP Resource Siting Plan

October 20th, 2016

ESWG

Chris Jamieson

Resource Siting Plan - Conventional

- Investigating process questions and details for members to add publicly available Integrated Resource Planning resources with siting into Model on Demand
  - Applicability to planning models
  - Requirement for Resource Addition Requests
- Leverage conventional generation siting repository
  - Collection of sites from GI Queue, previous studies, staff and member alternatives
  - Includes retirement dates of existing resources for replacement
  - Includes transmission interconnection capability screening
  - Provided to members for new site updates and ranking at beginning of milestone
  - Rank sites by zone
  - Tracking of study to study resource plans
- Assignment by Zone

75

Resource Siting Plan - Wind

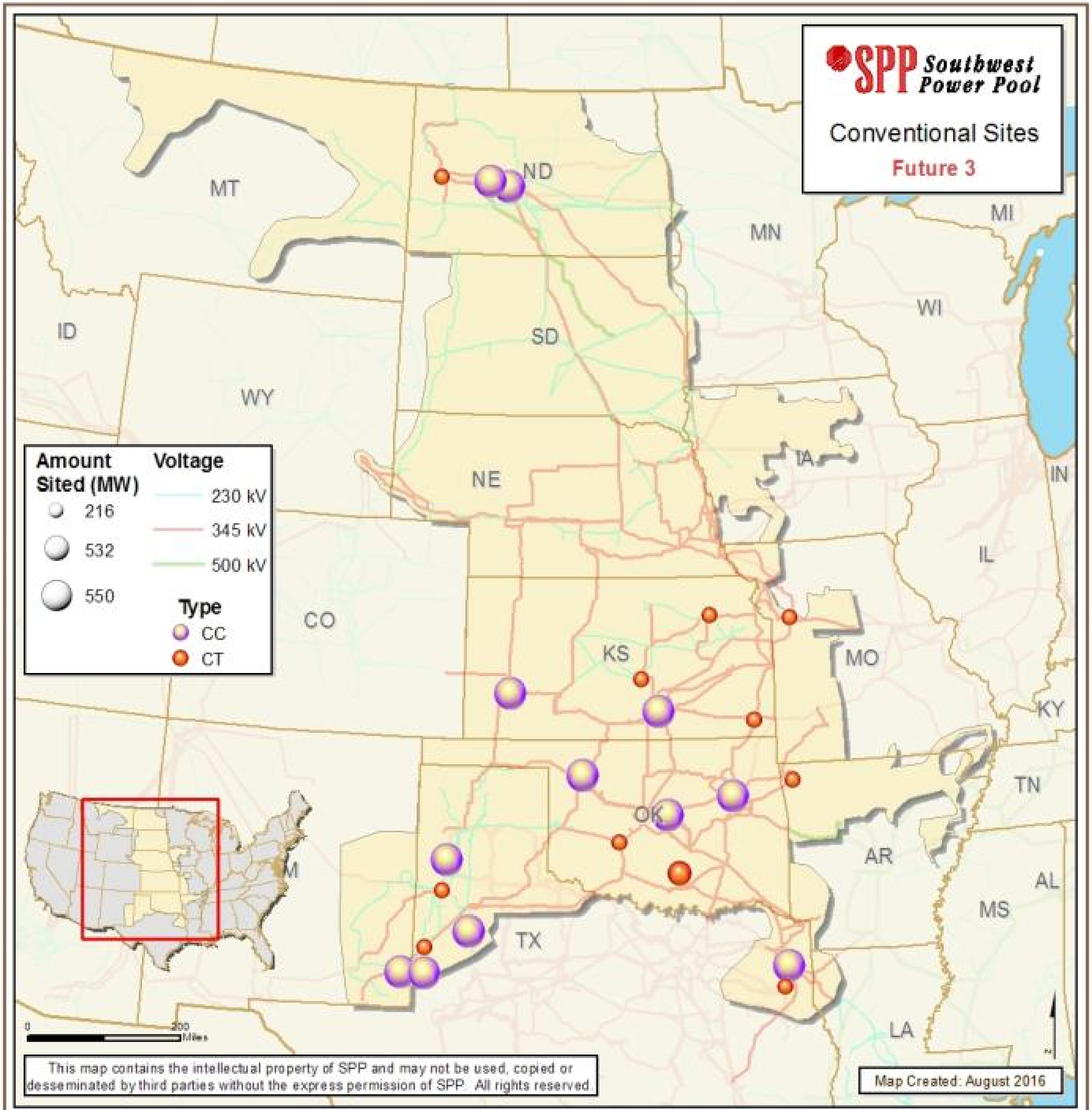
- Leverage Generation Interconnection queue until such time the resources plan additions exceed ranked statuses
- Ranked generation interconnection queue statuses
  - IA on-schedule
  - IA on-suspension
  - IA commercial operation not fully on-line
  - IA Pending
  - Facility Study
- Additional rankings by capacity factor by interconnection costs
- Assignment by Zone by State by Region

Resource Siting Plan - Solar

- Leverage Generation Interconnection queue then supplement using NREL comprehensive data set
- Additional rankings by capacity factor by interconnection costs or interconnection capability screening
- Assignment by Zone by State by Region

2017 ITP10 Siting Plan

Conventional Maps


SPP Southwest Power Pool
Conventional Sites
Future 3
Amount Sited (MW)
216
532
550
Voltage
230 kV
345 kV
500 kV
Type
CC
CT
MT
ND
MN
MI
ID
SD
WI
WY
NE
IA
IN
IL
CO
KS
MO
KY
OK
TN
AR
AL
MS
TX
LA
0
200
Miles
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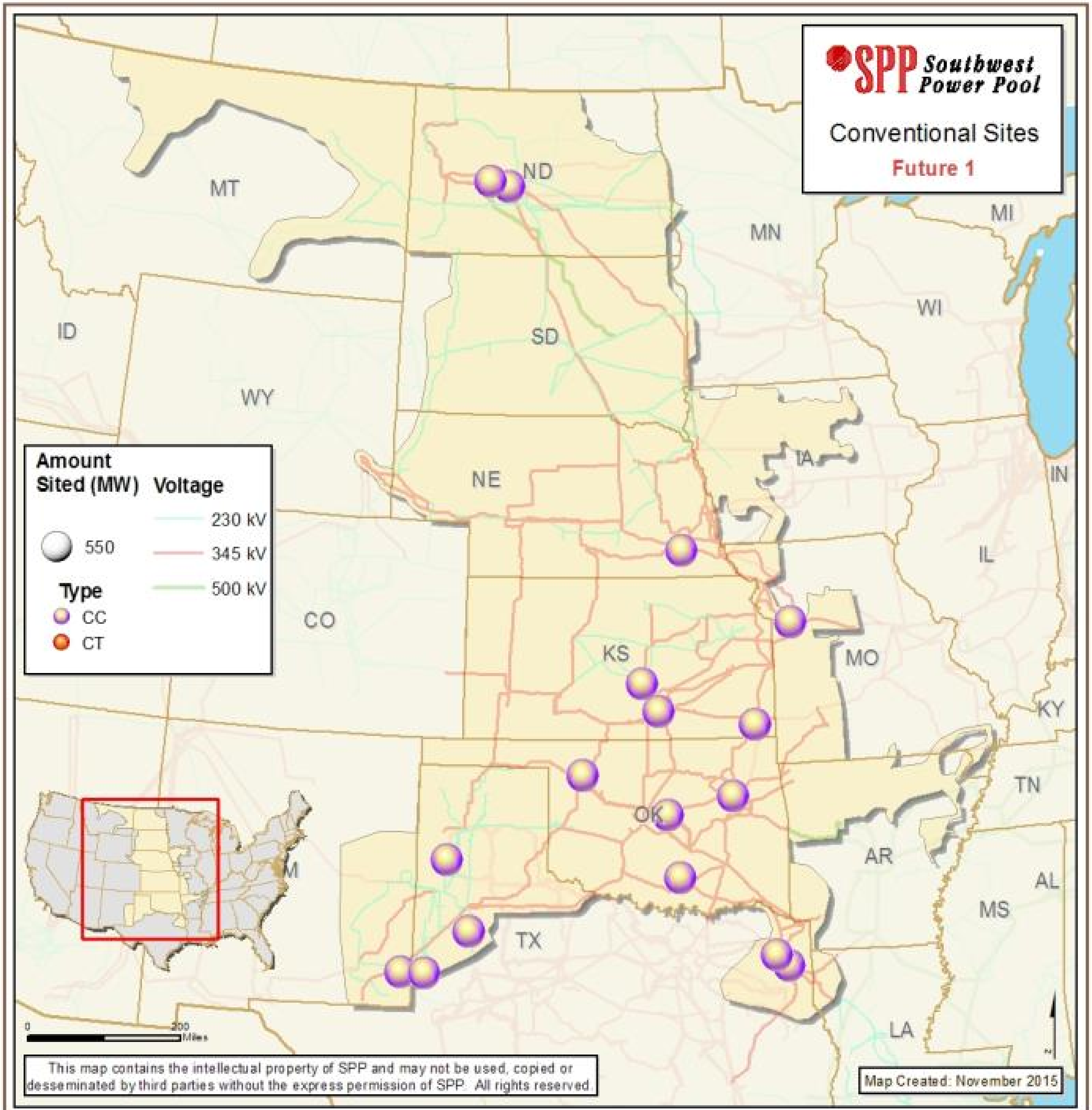

SPP Southwest Power Pool
Conventional Sites
Future 1
Amount Sited (MW)
Voltage
550
230 kV
345 kV
500 kV
Type
CC
CT
MT
ND
MN
MI
WI
ID
SD
WY
NE
IA
IN
IL
CO
KS
MO
KY
OK
TN
AR
AL
MS
TX
LA
0
200
Miles
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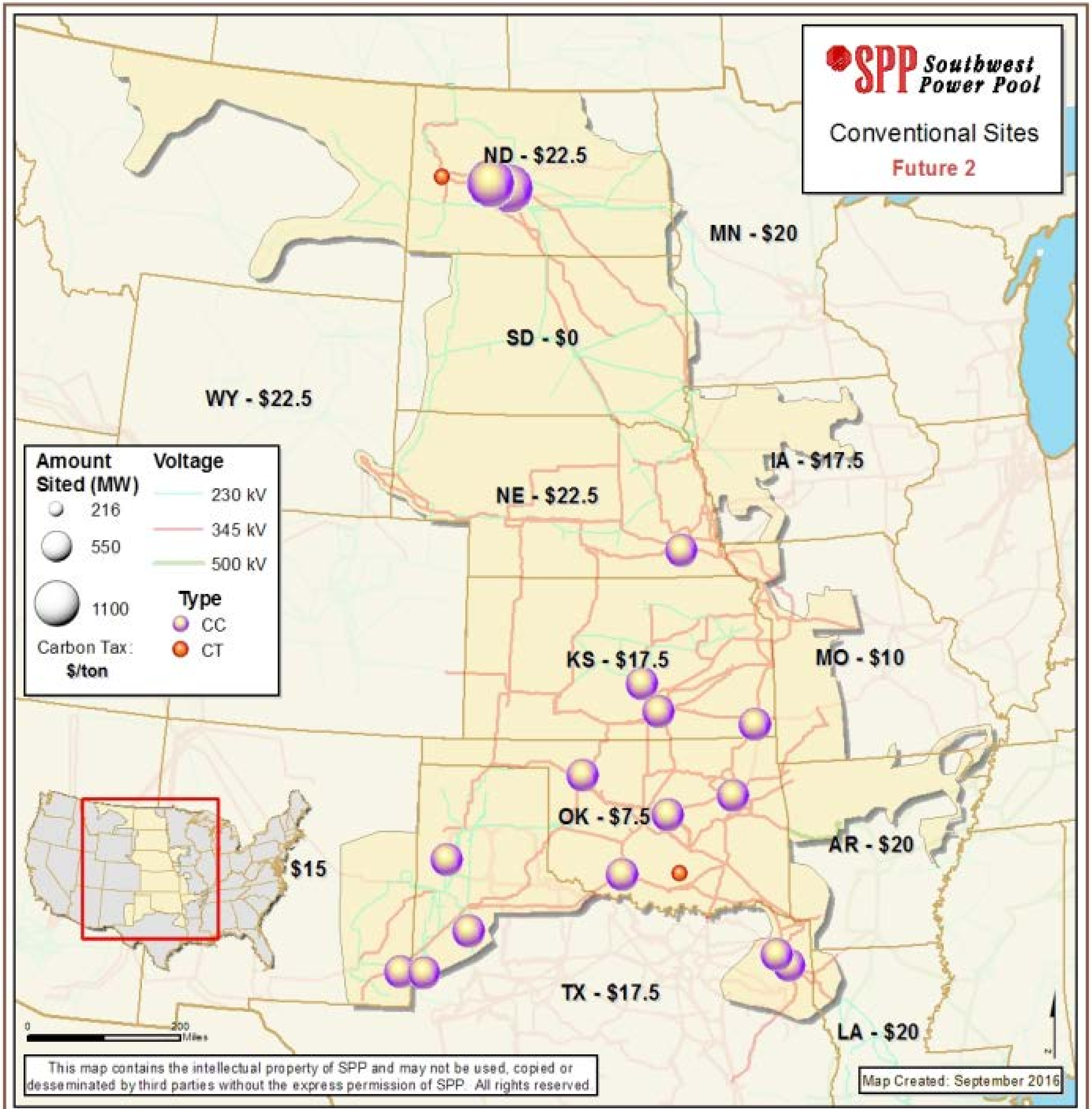
SPP Southwest Power Pool
Conventional Sites
Future 2
ND - $22.5
MN - $20
SD - $0
WY - $22.5
IA - $17.5
NE - $22.5
KS - $17.5
MO - $10
OK - $7.5
AR - $20
TX - $17.5
LA - $20
$15
Amount Sited (MW)
216
550
1100
Voltage
230 kV
345 kV
500 kV
Type
CC
CT
Carbon Tax: $/ton
0
200
Miles
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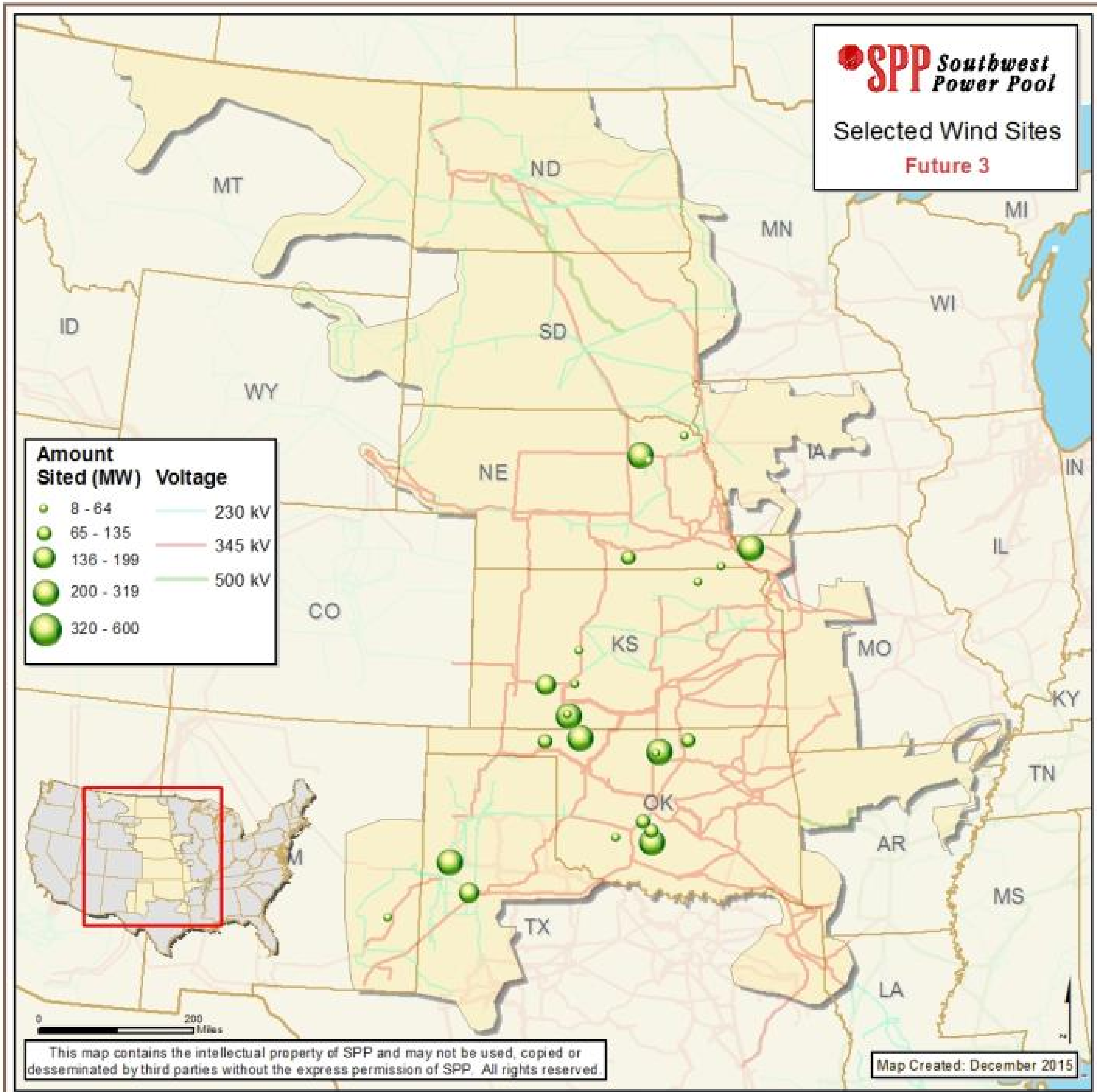
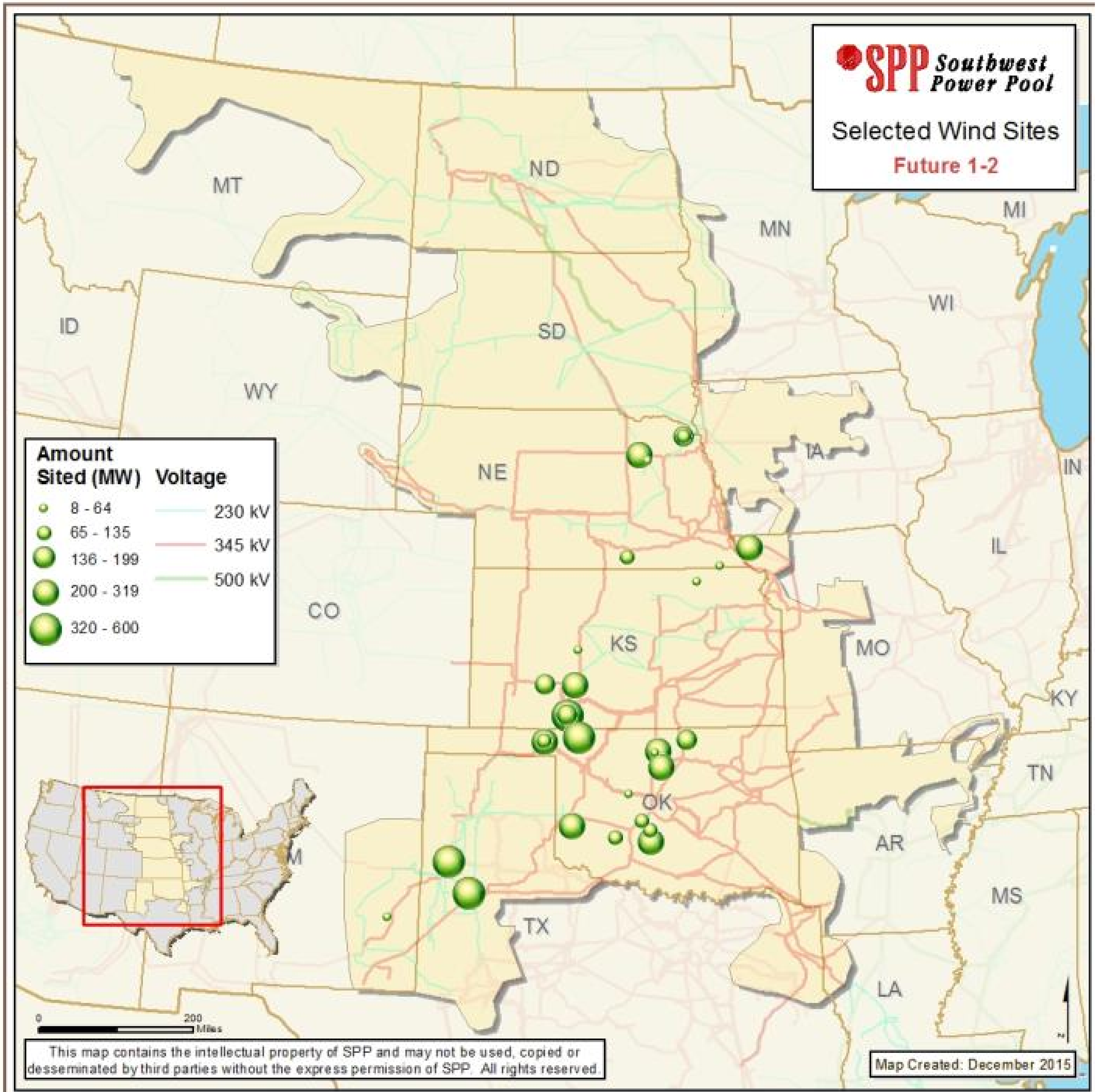
2017 ITP10 Siting Plan

Wind Maps


SPP Southwest Power Pool
Selected Wind Sites
Future 3
Amount Sited (MW)
8 - 64
65 - 135
136 - 199
200 - 319
320 - 600
Voltage
230 kV
345 kV
500 kV
MT
ND
MN
MI
ID
WY
SD
WI
NE
IA
IN
IL
CO
KS
MO
KY
OK
TN
AR
TX
MS
LA
0
200
Miles
N
Map Created: December 2015

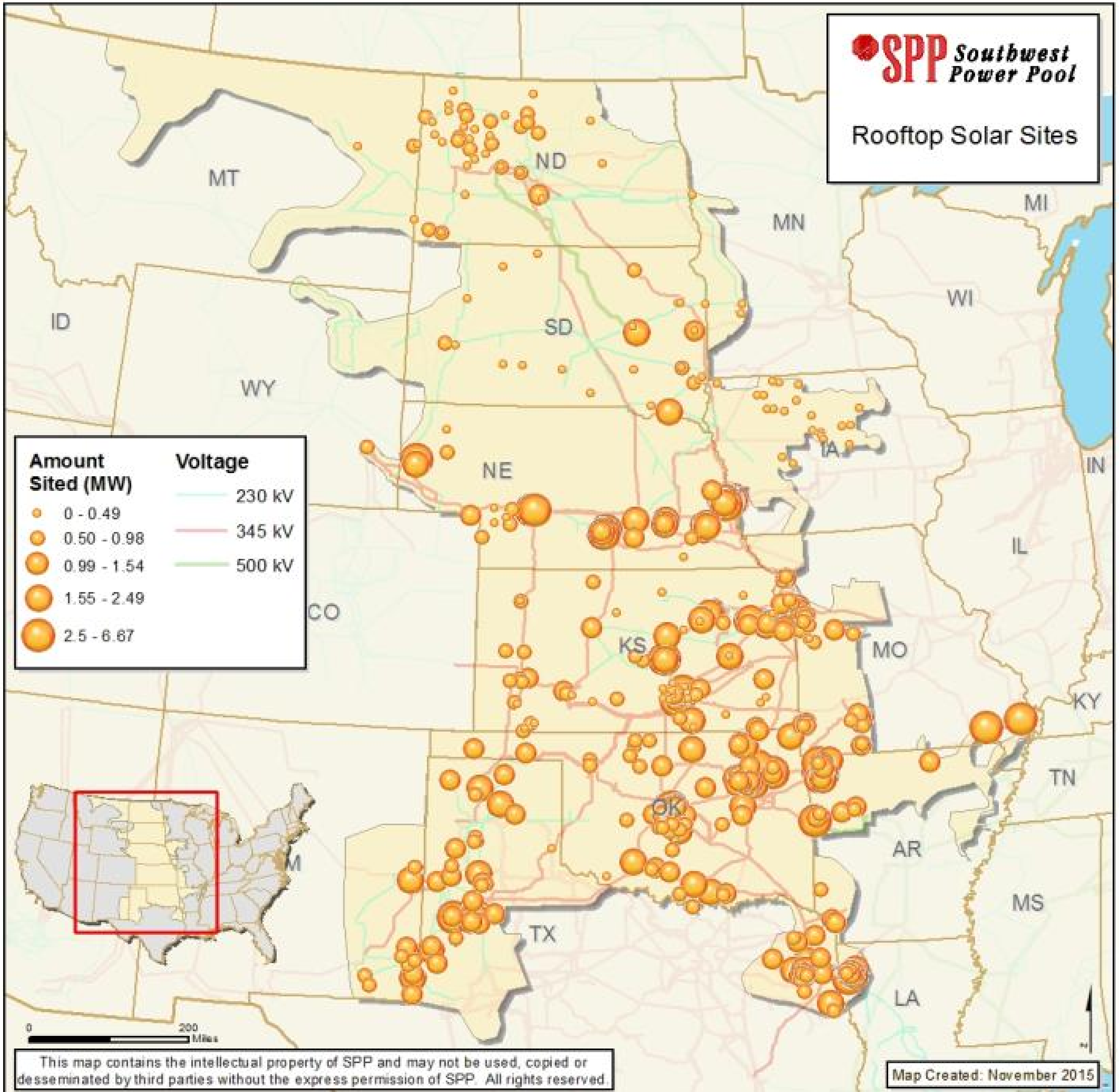


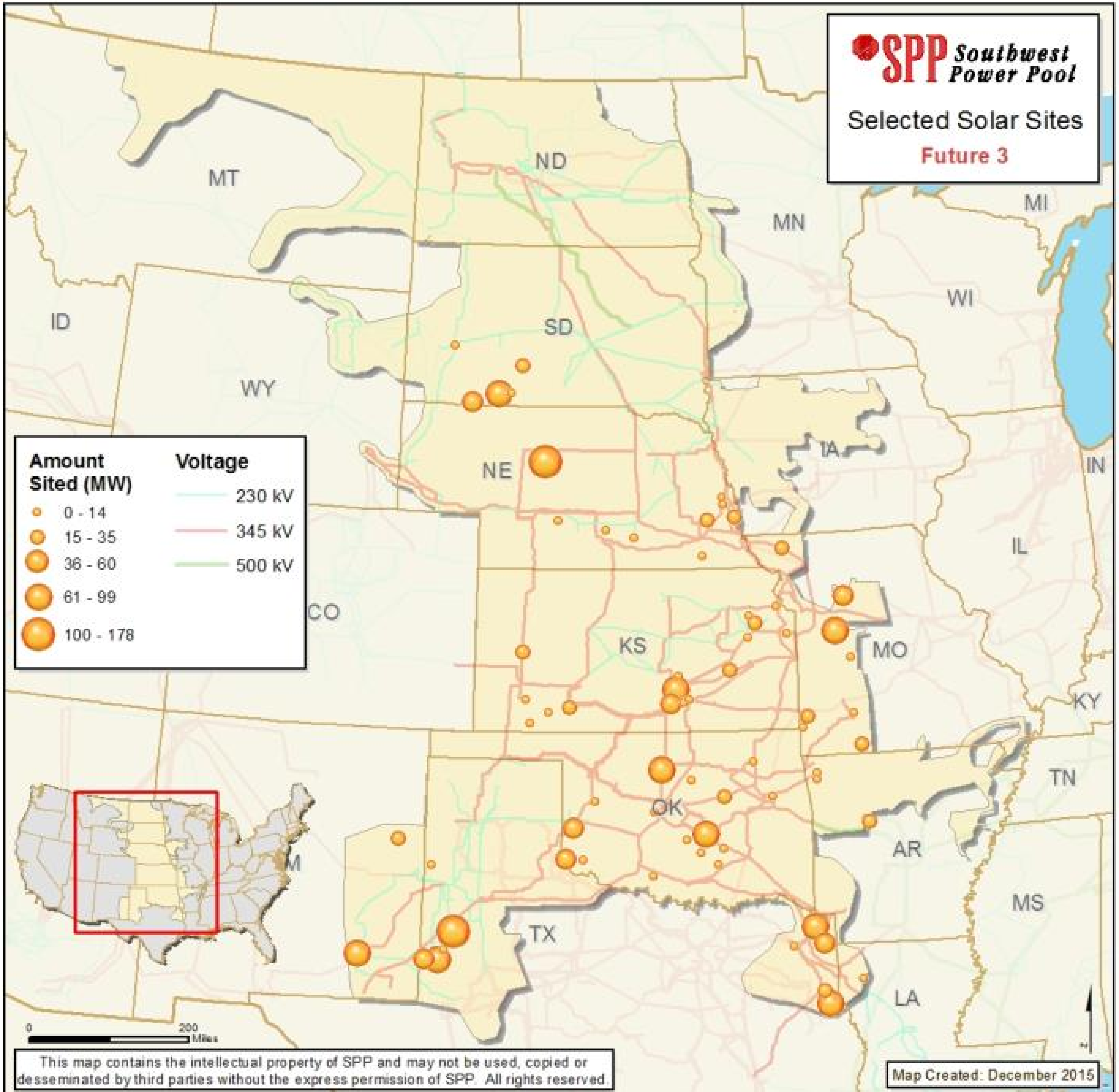
SPP Southwest Power Pool
Selected Wind Sites
Future 1-2
Amount Sited (MW)
8 - 64
65 - 135
136 - 199
200 - 319
320 - 600
Voltage
230 kV
345 kV
500 kV
MT
ND
MN
MI
WI
ID
SD
WY
IA
NE
IN
IL
CO
KS
MO
KY
TN
OK
AR
MS
TX
LA
0
200
Miles
Map Created: December 2015

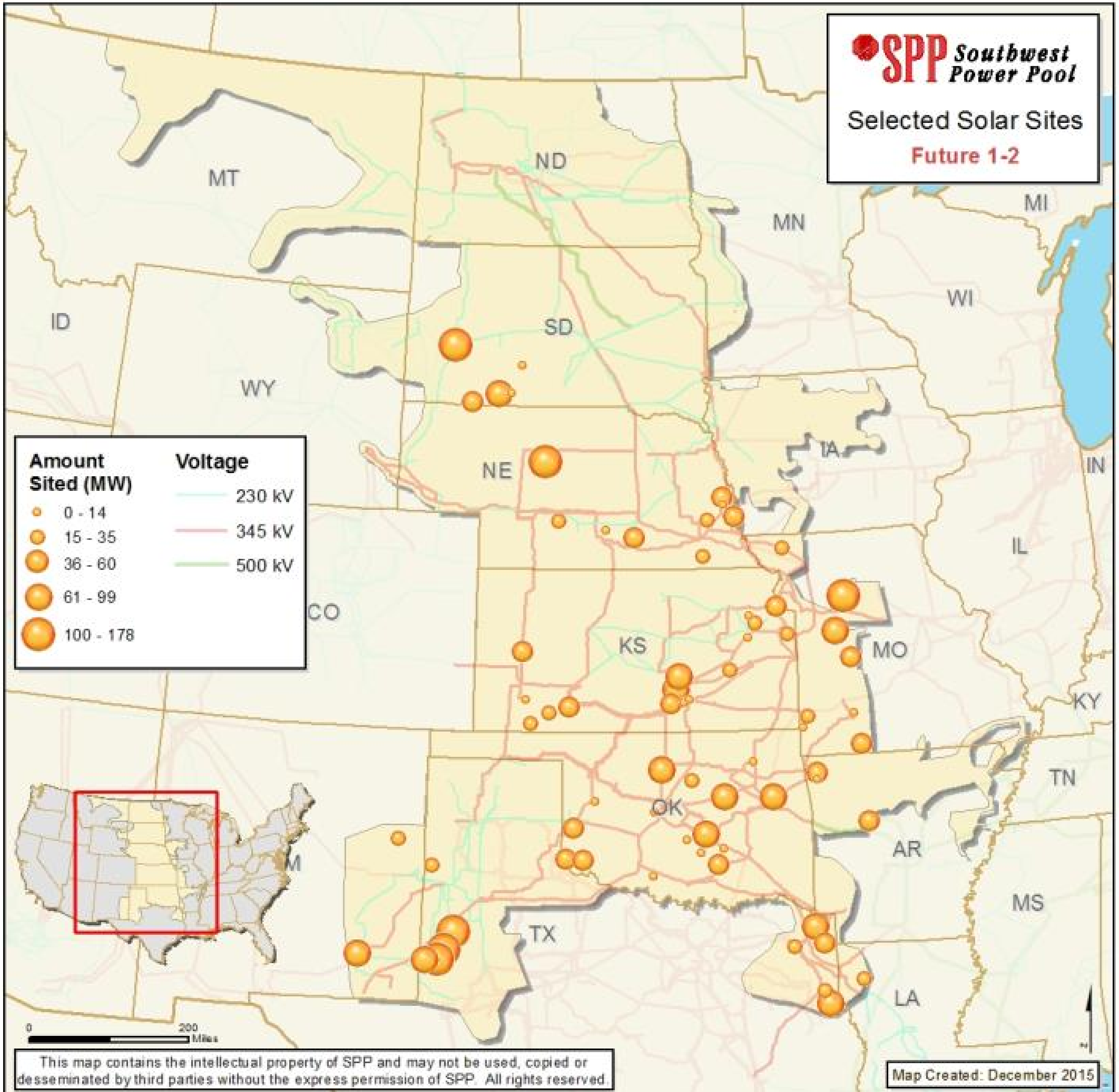
2017 ITP10 Siting Plan

Solar Maps

ITP


SPP Southwest Power Pool
Rooftop Solar Sites
Amount Sited (MW)
0 - 0.49
0.50 - 0.98
0.99 - 1.54
1.55 - 2.49
2.5 - 6.67
Voltage
230 kV
345 kV
500 kV
MT
ND
MN
MI
ID
WY
SD
WI
NE
IA
IN
IL
CO
KS
MO
KY
OK
TN
AR
MS
TX
LA
0
200
Miles
Map Created: November 2015


SPP Southwest Power Pool
Selected Solar Sites
Future 3
Amount Sited (MW)
0 - 14
15 - 35
36 - 60
61 - 99
100 - 178
Voltage
230 kV
345 kV
500 kV
MT
ND
MN
MI
ID
WY
SD
WI
NE
IA
IN
IL
CO
KS
MO
KY
OK
TN
AR
TX
MS
LA
0
200
Miles
Map Created: December 2015



SPP Southwest Power Pool
Selected Solar Sites
Future 1-2
Amount Sited (MW)
0 - 14
15 - 35
36 - 60
61 - 99
100 - 178
Voltage
230 kV
345 kV
500 kV
MT
ND
MN
MI
WI
ID
SD
WY
IA
NE
IN
IL
CO
KS
MO
KY
TN
OK
AR
TX
MS
LA
0
200
Miles
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