Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

October 22nd, 2015

NextEra Offices, Juno Beach, FL

• SUMMARY OF ACTIONS TAKEN •

1. Approved 9/23 and 10/9 meeting minutes
2. Approved member requests to make model changes impacting the approved generation review for the 2017 ITP10
3. Approved the use of the ABB reference case as the source of the natural gas price forecast for the 2017 ITP10 instead of the previous approval to use NYMEX futures and DOE growth rates
4. By way of no action, previous approvals on solutions to the load pocket and trapped generation modeling issues for RCAR II stand as the current recommendation
    a. Load pocket – add CTs to the base case model
    b. Trapped generation – hybrid approach utilizing total benefit from status quo simulation and zonal allocation factors from removing wind from base case

Southwest Power Pool

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

October 22nd, 2015

NextEra Offices, Juno Beach, FL

• 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 9:00 AM (EDT), welcomed those in attendance, and asked for introductions.

There were 19 in-person participants and 46 web conference participants, representing 13 of 13 ESWG members. (Attachment 1 – October 22nd, 2015 Attendance List)

Agenda Item 1b – Receipt of Proxies

Alan Myers (ITC Great Plains) asked for any proxy statements. Two proxies were identified; Kip Fox (AEP-Transource) named Wayman Smith (AEP) as his proxy, Al Tamimi (Sunflower) named Ryan Yokely (Sunflower) as his proxy from 10:00am – 12:00 am (CST). (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) requested item 8c. Futures Assumptions be removed from the agenda. (Attachment 3 – October 22nd, 2015 Agenda)

Kurt Stradley (LES) made a motion; seconded by Don Le (NextEra) to adopt the agenda. The motion was approved unanimously.

Agenda Item 2 – Review of Past Action Items

Kelsey Allen (SPP Staff) reviewed the list of past action items. (Attachment 4 – Past Action Items)

Agenda Item 3 – Consent Agenda

The Consent Agenda included the following items:

Meetings Minutes – September 23rd, 2015 (Attachment 5 – ESWG 09.23.15 Minutes)
Meetings Minutes – October 9th, 2015

Alan Myers (ITC Great Plains) asked if any items should be removed from the consent agenda. The October 9th minutes were removed.

The remaining consent agenda was approved unanimously.

A correction to language comparing current natural gas prices to the 2015 ITP10 was made to the October 9th minutes.

Wayman Smith (AEP) made a motion; seconded by Pat McCool (KCPL) to approve the October 9th, 2015 minutes as modified. The motion was approved unanimously.

(Attachment 6 – ESWG 10.09.15 Minutes)

Agenda Item 4 – Transmission Planning Improvement Task Force (TPITF) Update

Alan Myers (ITC Great Plains) gave an update on the status of the TPITF. The current hurdles for the group are related to combining the NERC TPL and ITP processes and the impact to the TSR process. The group planned to complete its charge in January 2016 but the SPP Board of Directors (Board) and Strategic Planning Committee (SPC) have allowed the group to continue until April 2016, if needed, in order for the TPITF to provide a better product. Other smaller discussions have hinged around incorporating more economic analysis in reliability studies performed by SPP.

Agenda Item 5 – Study Schedules

Agenda Item 5a – 2017 ITP10

Juliano Freitas (SPP Staff) gave an update on the status of the 2017 ITP10 Study. He asked the group if the amount of time given to the membership for review of data for this study has been sufficient, the group affirmed. (Attachment 7 – 2017 ITP10 Schedule)

Agenda Item 5b – RCAR II

Juliano Freitas (SPP Staff) gave an update on the status of the RCAR II. (Attachment 8 – RCAR II Schedule)

Agenda Item 6 – Economic Model Updates

Kelsey Allen (SPP Staff) reviewed a list of requests for model updates submitted by the membership through review of the resource planning data and results. Some of the updates impact previous approvals made by the group. Staff believes the changes are valid but the main concern is the potential impact to the resource planning schedule. If the changes received to date can be incorporated without allowing time for additional submittals the data can be incorporated into the resource planning process. The group was amenable to the proposal. (Attachment 9 – Proposed Economic Model Changes)

> **Leon Howell (OKGE) made a motion; seconded by Wayman Smith (AEP) to approve the proposed model changes. The motion was approved unanimously.**

Agenda Item 7 – Miso Regional Review

Arash Ghodsian (MISO Staff) gave an overview of MISO's Regional Review Process and study results. Arash reviewed the overall process and then covered the detailed MISO's results of the three Interregional Projects approved in the SPP-MISO Coordinated System Planning study. (Attachment 10 - MISO Regional Review Process)

Agenda Item 8 – 2017 ITP10 Assumptions

Agenda Item 8a – Benchmarking (Hurdle Rates)

Kelsey Allen (SPP Staff) presented the results of the analysis performed on the various options for hurdle rates to be used in the 2017 ITP10 study. Staff tested the ABB zonal and nodal hurdle rates presented previously as well as a comparison to the 2015 ITP10 data. Staff concluded that the resultant import/export for the SPP region is similar for all data sets. There was concern about the level of imports shown by all three data sets. Staff suggested that other data should be investigated during the benchmarking process to adjust imports to an expected level rather than hurdle rates. Staff recommended using the ABB zonal hurdle rates developed from OASIS Tariffs. Staff will bring back overall benchmarking results with the recommended hurdle rates at a later date. (Attachment 11 – 2017 ITP10 Benchmarking)

Agenda Item 8b – Portfolio Consolidation Methodology

Alan Myers (ITC Great Plains) briefly covered the goal of portfolio consolidation and things the members should be thinking about in order to develop a methodology. Alan urged consideration of separating the Clean Power Plan (CPP) futures from the Business as Usual (BAU) in the methodology. The ultimate goal is to provide the Board of Directors (BOD) with enough information to make a decision on a set of projects to approve for Notification to Construct (NTC). Natasha Henderson suggested that the resulting methodology should address the structure of the state-by-state future model and its unlikeliness of implementation.

Agenda Item 9 – 2017 ITP10 Resource Plan Phase 2

Josh Ross (SPP Staff) presented the adjusted inputs and results for phase two of the Future 3 (no CPP implementation) resource plan. Staff started discussion on the natural gas prices and the impact to the dispatch being seen in the results, suggesting consideration of other data sources other than the NYMEX futures forecast. The group vehemently discussed the reasonableness of the price forecast and other data sources that could be used. Many suggested the forecast was too high, some suggested it was accurate, and others suggested it may be too low. The group suggested many options including continuing with the NYMEX forecast, updating with the ABB reference case or EIA, using independent 3rd party vendor forecasts, and multiple combinations of the discussed sources. It was also discussed that must run units should be considered in Future 3 in order to better reflect current operation of units and as a potential correction to the unit operation results in that future. After much discussion, it was suggested that now that the ABB data has the granularity that is needed for more accurate forecasting (monthly data instead of annual data, previously), the ABB reference case should be used in order to gain consistency with the other fuel prices being derived from the same source.

Wayman Smith (AEP) made a motion; seconded by Pat McCool (KCPL) to utilize the ABB reference case for the natural gas forecast of the 2017 ITP10. The motion was approved with one opposed, Natasha Henderson (GSEC), and one abstention, Alan Myers (ITC Great Plains).

Natasha voted no for the following reason: GSEC believes that natural gas prices will be lower than the NYMEX curve based upon updated supply and demand forecasts. The NYMEX curve has been used in the past, but now that it has dropped significantly and changed the mix of CT and CC, the methodology has changed. The ABB curve is higher than the NYMEX curve in middle and later parts of the curve. An updated ABB curve is scheduled to be released November 6, quite possibly lower, but the vote was not to consider the update (given it was to avoid possible timeline delays for the ITP10).

Staff requested feedback from the group regarding the interchange method used in the Future 3 model to simulate expected energy transfers between the four subregions. There was concern about utilizing a one year simulation (2015 ITP10 2025) to determine interchange for all years, given the amount of planned unit retirements in the different zones, especially nearing 20 years in the future. Staff suggested developing new annual interchange values from a regional resource plan simulation or simply converting the Future 3 model to a regional structure instead of the four subregions. The group directed staff to move forward with converting the model to a regional structure.

Kelsey Allen (SPP Staff) presented the results of the Future 1 (regional CPP implementation) focusing on the operation of gas and coal units. The current results do not include any additional requirements that could be implemented from the potential retirement methodology and survey previously reviewed by the members. Staff requested feedback on additional retirements and how they should be implemented. Some of the members suggested that they would not retire any units and would run units seasonally or keep active for capacity margin purposes. After discussion, the group directed Staff to follow the previously discussed methodology regarding retirements for units operating at low capacity factors, utilizing the exclusion list provided through member feedback during the previous survey. (Attachment 12 - 2017 ITP10 Resource Plan Phase 2)

Agenda Item 10 – RCAR Modeling Issues

Josh Ross (SPP Staff) reviewed the modeling issues of the RCAR process. He covered the previous ESWG approvals as well as the Staff recommendation for the load pocket and trapped generation issues. After discussion the group did not recommend a new methodology for either issue, therefore previous approvals stand.

- Load pocket – add CTs to the base case model
- Trapped generation – hybrid approach utilizing total benefit from status quo simulation and zonal allocation factors from removing wind from base case

Wayman Smith (AEP) noted that the process is too broken to fix the issue with any interim approach. (Attachment 13 – RCAR Modeling Issues)

Agenda Item 11 – 2016 ESWG Meeting Schedule

Kelsey Allen (SPP Staff) briefly reviewed the 2016 meeting schedule and requested all members review the dates and locations for any suggested changes. Kelsey solicited member meeting space for the four dates do not have locations picked. (Attachment 14 – 2016 ESWG Meeting Schedule)

Closing Items

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

List of action items from the meeting:

1. None

The meeting was adjourned at 4:00 PM (EDT).

Respectfully Submitted,

Kelsey Allen
ESWG Secretary

Southwest Power Pool

Southwest Power Pool, Inc.

ECONOMIC STUDIES WORKING GROUP

October 22, 2015

NextEra HQ/Juno Beach, FL

• ATTENDANCE LIST •

Name	Company
Kelsey Allen	SPP
Arash Ghodsian	MISO
Jeremy Severson	Basin Electric Power Coop
Jody Holland	South Central MCN
Bethany King	Empire District Electric
Kurt Stradley	LES
Alan Myers	ITC
JULIANO FREITAS	SPP
Jason Davis	SPP
Steve Gaw	Wind Coalition
Michael Wegner	ITC
Aaron Pupa	LS Power
Don Le	NextEra Energy Trans.
BRIAN GEDRICH	NEXTERA TRANS.
JORDAN SCHMIDT	XCEL ENERGY
Natasha Henderson	GSEC
Pat McCool	KCPL
Brett Hooton	SPP

Southwest Power Pool

Southwest Power Pool, Inc.

ECONOMIC STUDIES WORKING GROUP

October 22, 2015

NextEra HQ/Juno Beach, FL

• ATTENDANCE LIST •

Name	Company
Eric Burkey	Ameren

Name	**Email**	**Company**	Attendance
Aaron Pupa		LS Power	In Person
Al Tamimi	atamimi@sunflower.net		Webex
Alan Myers		ITC	In Person
Antoine Lucas	alucas@spp.org		Webex
Arash Ghodsian		MISO	In Person
Auudrey	audreykwhite@yahoo.com		Webex
Bennie Weeks	bennie.weeks@xcelenergy.com		Webex
Bethany King		Empire District Electric	In Person
Bill Leung (NPRB)	bleung@bjleung.com		Webex
Blaine Erhardt	berhardt@bepc.com		Webex
Brett Hooton		SPP	In Person
Brian Gedrich		NextEra Trans.	In Person
Carrie Dixon	carrie.e.dixon@xcelenergy.com		Webex
Chris Giles	cgiles@tcec.coop		Webex
Chris Jamieson - SPP	cjamieson@spp.org		Webex
Clayton Mayfield	cmayfield@spp.org		Webex
Don Le		NextEra Energy Trans.	In Person
ed pfeiffer (quanta)	epfeiffer@quanta-technology.com		Webex
Eric Burkey		Ameren	In Person
Evan Racine-Johnson (GSEC)	eracine-johnson@gsec.coop		Webex
Jake Langthorn (OG&E)	langthjs@oge.com		Webex
Jason Chaplin	j.chaplin@occemail.com		Webex
Jason Davis		SPP	In Person
Jason Shook (GDS/ETEC)	jason.shook@gdsassociates.com		Webex
Jason Speer	jspeer@spp.org		Webex
Jay Caspary	jcaspary@spp.org		Webex
Jenell McKay	jmckay@misoenergy.org		Webex
Jeremy Harris	jeremy.harris@westarenergy.com		Webex
Jeremy Severson		Basin Electric Power Coop	In Person
Jerry Bradshaw (SPRM)	jerry.bradshaw@cityutilities.net		Webex
Jody Holland		South Central MCN	In Person
Joe Fultz (GRDA)	jfultz@grda.com		Webex
John Boshears	john.boshears@cityutilities.net		Webex
John Olsen	john.olsen@westarenergy.com		Webex
Jon Iverson	jiverson@oppd.com		Webex
Jon Shipman (OPPD)	jeshipman@oppd.com		Webex
Jonathan Abebe	jabebe@cleanlineenergy.com		Webex
Jordan Schmick		Excel Energy	In Person
Juliano Freitas		SPP	In Person
Kelsey Allen	kallen@spp.org		In Person
Kevin Foflygen (SPRM)	kevin.foflygen@cityutilties.net		Webex
Kurt Stradley		LES	In Person
Leon Howell	howelllc@oge.com		Webex
Liz Gephardt (SPP)	lgephardt@spp.org		Webex
Michael Massery (AECC)	michael.massery@aecc.com		Webex
Michael Odom (SPP)	modom@spp.org		Webex

Michael Watt (OMPA)	mwatt@ompa.com		Webex
Michael Wegner		ITC	In Person
Natasha Henderson	nhenderson@gsec.coop	GSEC	In Person
Nathan McNeil	nathan.mcneil@westarenergy.com		Webex
Nikki Roberts	nroberts@spp.org		Webex
Noumvi Ghomsi	noumvi.ghomsi@psc.mo.gov		Webex
Pat McCool		KCPL	In Person
Paul Dietz	paul.dietz@westarenergy.com		Webex
Randy Collier (CUS)	randy.collier@cityutilities.net		Webex
Rosemary Mittal	rmittal@spp.org		Webex
Ryan Yokley	ryokley@sunflower.net		Webex
sam loudenslager (SPP)	sam.loudenslager@gmail.com		Webex
Sandeep Baidwan	sbaidwan@continuum-associates.com		Webex
Shawnee Claiborn-Pinto	shawnee.claiborn-pinto@puc.state.tx.us		Webex
Steve Gaw	rsgaw1@gmail.com	Wind Coalition	In Person
Tim Owens (NPPD)	tjowens@nppd.com		Webex
Tim Soles	tim_soles@oxy.com		Webex
Todd Tadych (DATC)	ttadych@atcllc.com		Webex
Wayman Smith (AEP)	wlsmith1@aep.com		Webex

1. **Kip Fox proxy to Wayman Smith**

From: Kip M Fox [mailto:kmfox@aep.com]
Sent: Thursday, October 08, 2015 3:54 PM
To: Myers, Alan; Juliano Freitas; Kelsey Allen
Cc: Smith, Wayman
Subject: Proxy for Wayman Smith

I will not be able to attend the ESWG meeting on 10/22 at NextEra's offices in Florida. Please allow this email to have Wayman Smith as my proxy.

Thank you, Kip

Kip Fox
Director, Transmission Asset Strategy and Grid Development
American Electric Power
Transource Energy, LLC
1201 Elm Street
Suite 800
Dallas, Texas 75250
kmfox@aep.com
office: 214-777-1063
cell: 972-400-1384

2. **Al Tamimi proxy to Ryan Yokely**

From: Tamimi, Al [mailto:atamimi@sunflower.net]
Sent: Wednesday, October 21, 2015 8:59 PM
To: Myers, Alan
Cc: Kelsey Allen; Yokley, Ryan
Subject: Proxy

Kelsey and Alan,
I will be attending the meeting on 10/22/2015 by conference. However, from 10 am central to 12 pm central and from 3 central to the end of the meeting, Ryan Yokley will have my proxy.

Al Tamimi, Ph.D., P.E.
Sunflower Electric Power Corporation
V.P., Transmission Planning, Policy & Corporate Compliance
P.O.BOX 1020
Hays, Kansas 67601
Office: 785-623-3336
Cell: 785-656-0435
atamimi@sunflower.net

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

October 22nd, 2015

NextEra Offices, Juno Beach, FL

• A G E N D A •

8:00am – 3:00pm CT

(9:00am – 4:00pm ET)

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 23rd, 2015
   b. Approval of Meeting Minutes – October 9th, 2015
4. Transmission Planning Improvement Task Force (TPITF) Update..................Alan Myers (10 minutes)
5. Study Schedules[1] .... Juliano Freitas (15 minutes)
   a. 2017 ITP10
   b. RCAR II
6. Economic Model Updates (Approval Item).. SPP Staff (15 minutes)
7. MISO Regional Review ....Arash Ghodsian (30 minutes)
8. 2017 ITP10 Study Assumptions .... SPP Staff (60 minutes)
   a. Benchmarking (Hurdle Rates)
   b. Portfolio Consolidation Methodology
9. 2017 ITP10 Resource Plan Phase Two .... SPP Staff (180 minutes)
10. RCAR Modeling Issues (Approval Item).. Josh Ross (60 minutes)
11. 2016 ESWG Meeting Schedule...Kelsey Allen (15 minutes)

---

[1] Background Material Included

12. Closing Items .... All (5 minutes)

   a. Summary of Action Items (Kelsey Allen)

   b. Future Meetings

      i. November 18th-19th, 2015: SPP Corporate Offices, Little Rock, AR

      ii. December 10th, 2015: 8th Floor AEP Offices, Dallas, TX

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

Pending Action Items Status Report

October 22nd, 2015

ID	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 23, 2012	In Progress Staff	A draft straw man will be provided in the future.
127	SPP Staff will develop a process to address interaction between SPP departments (Generation Interconnection, Aggregate Studies, Economic Planning, Steady State and Modeling) to detect basic errors in our models.	August 7, 2014	In Progress Staff	
128	SPP Staff will explain to ESWG Members the process to submit data to model on demand.	August 7, 2014	In Progress Staff	
147	ESWG to re-evaluate the modeling issues related to load pockets and wind in the RCAR II.	March 31st, 2015	In Progress ESWG	June 18th: Continue discussion for both a near term (2017 ITP10) and longer term solution.
148	Staff to develop a formal member review procedure for review of data and results related to economic studies.	March 31st, 2015	In Progress Staff	
149	ESWG to discuss how staff will request generation and load data in future studies.	May 1st, 2015	In Progress ESWG	
151	Staff to look into optional software tools for use in ITP studies	May 20th, 2015	In Progress Staff	
152	Continue review resource siting methodology with utilities and develop a recommendation for the 2017 ITP10	May 20th, 2015	In Progress Staff	
153	MOPC action item 255: Review the method to determine the cost of congestion, as it relates to outages for rebuilds approved.	July 9, 2015	In Progress ESWG	September 23rd: ERCOT does not include this cost in their analysis of transmission projects.
154	SPP staff to work with ESWG members to create a data request to gather the energy efficiency amount included in the model	July 30, 2015	In Progress Staff	

155	Staff to draft a disclaimer for decisions in the 2017 ITP10 related to the Clean Power Plan	August 19-20, 2015	In Progress Staff	
157	Staff to bring back a brushed up portfolio consolidation proposal to the next meeting; Alan Myers to bring back a counter-proposal	August 27th, 2015	In Progress Staff/Alan Myers	
158	Staff to develop a decision tree of approval items for the members	August 27th, 2015	In Progress Staff	For the 2017 ITP10 scope and study
159	Staff to contact MISO regarding presentation of the MISO Regional Review results at the October meeting	September 23rd, 2015	~~In Progress~~Complete Staff	
160	Staff to send out any changes made by the TWG at their meeting on September 29th	September 23rd, 2015	~~In Progress~~Complete Staff	
161	SPP members to review posted detailed results of the Future 3 resource plan	October 9th, 2015	In Progress Members	

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

September 23rd, 2015

AEP Offices 8th Floor, Dallas, TX

• SUMMARY OF ACTIONS TAKEN •

1. Recommended the rebuild of South Shreveport – Wallace Lake 138 kV as an interregional project for approval by the MOPC.
2. Recommended the new NSUB – Elm Creek 345kV as an interregional project for approval by the MOPC.
3. Approved the 2017 ITP10 Scope

Southwest Power Pool

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

September 23rd, 2015

AEP Offices 8th Floor, 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 8:00 AM, welcomed those in attendance, and asked for introductions.

There were XX in-person participants and XX web conference participants, representing 11 of 13 ESWG members. (Attachment 1 – September 23rd, 2015 Attendance List)

Agenda Item 1b – Receipt of Proxies

Alan Myers (ITC Great Plains) asked for any proxy statements. One proxy was identified; Leon Howell (OGE) named Jake Langthorn (OGE) as his proxy. (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. (Attachment 3 – September 23rd, 2015 Agenda)

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

Agenda Item 2 – Review of Past Action Items

Kelsey Allen (SPP Staff) reviewed the list of past action items. Wayman Smith (AEP) gave an update on action item 153, informing the group that ERCOT does not include the cost of transmission outages related to approved rebuilds in their analysis of transmission projects. (Attachment 4 – Past Action Items)

Agenda Item 3 – Consent Agenda

The Consent Agenda included the following items:

Meetings Minutes – July 9th, 2015 (Attachment 5 – ESWG 07.09.15 Minutes)
Meetings Minutes – July 30th, 2015 (Attachment 6 – ESWG 07.30.15 Minutes)
Meetings Minutes – August 19th, 2015 (Attachment 7 – ESWG 08.19.15 Minutes)
Meetings Minutes – August 27th, 2015 (Attachment 8 – ESWG 08.27.15 Minutes)
RR56 (Attachment 9 - Business Practices RR 56 Recommendation Report_09102015)

The consent agenda was approved unanimously.

Agenda Item 4 – Transmission Planning Improvement Task Force (TPITF) Update

Alan Myers (ITC Great Plains) gave an update on the status of the TPITF. The group is still discussing the combination of the ITPNT and ITP10 analyses into a single 18-month cycle that would produce an annual report. The group expressed concern with the sustainability and staffing needs of the process. Alan explained that the stakeholders want faster results and the TPITF is proposing a streamlined and standardized scope to be able to accomplish this. SPP Staff would be added as needed to support the new process.

Agenda Item 5 – Study Schedules

Agenda Item 5a – 2017 ITP10

Juliano Freitas (SPP Staff) gave an update on the status of the 2017 ITP10 Study. Powerflow model topology changes are due 10/1. A preliminary economic model will be posted 10/1 and Staff will continue to re-post the models as major milestones are completed in order to give interested members more time to review the model database and preliminary outputs. (Attachment 10 – 2017 ITP10 Schedule)

Agenda Item 5b – RCAR II

Juliano Freitas (SPP Staff) gave an update on the status of the RCAR II. Staff needs approval of solutions to the current modeling issues by the October 22ND meeting in order to stay on schedule. Kip Fox (AEP) asked if the RARTF is aware of the overall process issue and expressed concern about moving forward with an interim fix when real money could exchange hands through the remedy process. Antoine Lucas (SPP Staff) said the RARTF is looking for details of the problem and a recommendation from the technical working groups. RARTF is currently set on finishing the RCAR II in 2016 as planned. (Attachment 10 – RCAR II Schedule)

Agenda Item 6 – TARA Overview

Brandon Henstchel (SPP Staff) gave an overview of the TARA software tool used for the ITPNT CBA dispatch model. He reviewed the process and compared that to the process using PROMOD to acquire a CBA dispatch, highlighting the efficiency and time savings. (Attachment 11 – CBA-TARA)

Agenda Item 7 – 2015 Regional Review

Brett Hooton (SPP Staff) gave an overview of the final 2015 Regional Review Study results. There were some corrections to the benefit analysis that clarified some of the results presented last time. Staff is recommending approval of the South Shreveport – Wallace Lake 138 kV rebuild and not recommending approval of the Elm – Creek NSUB. There was much discussion over the Iatan – Stranger Creek/Elm Creek – NSUB analysis. The group disagreed with Staff's assessment regarding the project's impact to coal and potential Clean Power Plan implications and labelling it marginally cost effective. (Attachment 12 – 2015 Regional Review_v16)

Kip Fox (AEP-Transource) made a motion; seconded by Paul Dietz (Westar) to recommend the rebuild of South Shreveport – Wallace Lake 138 kV and NSUB – Elm Creek 345kV as interregional projects for approval by the MOPC. Natasha Henderson (GSEC) asked the group if they are confident that there will be benefit in the Elm Creek project in the environment that the industry will encounter moving forward. Kip Fox referenced the evidence as presented today for justification. The motion was withdrawn.

Kip Fox (AEP-Transource) made a motion; seconded by Paul Dietz (Westar) to recommend the rebuild of South Shreveport – Wallace Lake 138 kV rebuild as an interregional project for approval by the MOPC. The motion passed with one abstention, Randy Collier (CUS).

Randy Collier abstained for the following reason:

City Utilities reviewed the preliminary results from the Regional Review of the South Shreveport – Wallace Lake 138kV reconductor project. The preliminary results indicated that City Utilities' zonal benefit/cost ratio for this project was 24.8/1, which appeared high based on the voltage level of the project and the geographical distance from City Utilities. City Utilities and its power marketing agent (The Energy Authority - TEA) worked with SPP staff to investigate if there were any issues in the Regional Review model that could be affecting the results.

Although City Utilities' investigation is not complete, some items were discovered that could have affected the results as follows:

- **The 2019 Adjusted Production Cost (APC) for City Utilities' zone increased, which caused a negative benefit. The 2024 APC for City Utilities decreased, which resulted in a benefit. The slope (delta) between 2019 and 2024 was extrapolated out for 40 years in determining total benefits. City Utilities believes that the 2019 negative benefit and related extrapolation has resulted in overstated benefits.**

Utilization of a third data point (i.e. 2029) and a different extrapolation method would result in more realistic benefits.

- **Modeling resulted in capacity factors for City Utilities' coal generation units in 2024 ranging from 86.42% to 96.89%. These capacity factors are unreasonably high when compared to current operations. Significant future additions of wind and solar resources in the SPP footprint would also reduce the likelihood of attaining those capacity factors. High capacity factors would result in additional generation (and sales) in the model and unrealistically increase APC savings.**

SPP staff indicated that the Iatan-Stranger Creek project has been removed from the model since the issuance of the preliminary report, resulting in approximately a 50% reduction in 2024 zonal benefits. The 40 year zonal net present value benefit was reduced by approximately 26%. This development allowed for more realistic results but City Utilities continues following up on additional items.

As City Utilities (and TEA) have not completed their investigation of the benefit/cost calculation for the South Shreveport – Wallace Lake 138 kV project, City Utilities does not believe they are currently in a position to approve or reject the project, and will abstain from this vote.

Kip Fox (AEP-Transource) made a motion; seconded by Paul Dietz (Westar) to recommend the new NSUB – Elm Creek 345kV as an interregional project for approval by the MOPC. The motion passed with three opposed; Bennie Weeks (SPS), Natasha Henderson (GSEC) and Jake Langthorn (OGE), and one abstention, Randy Collier (CUS).

Natasha Henderson voted no for the following reason: Staff provided evidence that raises the question of if the B/C would still exist in the futures that are now being considered in the 2017 ITP10.

Steve Gaw (Wind Coalition) asked about changes made in the model between the Coordinated System Plan (CSP) and Regional Review studies that caused the change in benefits and if this alludes to a pattern that requires changes to the process(es) moving forward. Both RTOs have their own regional process that may not line up with the CSP process. The group requested that Staff contact MISO to determine their availability to present the MISO Regional Review results in October.

ACTION ITEM: Staff to contact MISO regarding presentation of the MISO Regional Review results at the October meeting.

Agenda Item 8 – NTC Re-evaluation

Kelsey Allen (SPP Staff) reviewed the re-evaluation process of the Iatan – Stranger Creek voltage conversion, an economic project approved via the 2015 ITP10. BPR 7160 states that economic and public policy projects meeting the NTC re-evaluation criteria will be reviewed during the next ITP10 cycle. The impact to the planning processes is that this project will remain in the current 2016 ITPNT base models and will be removed from the 2017 ITP10 base models. (Attachment 13 – NTC Re-evaluation)

Kip Fox (AEP–Transource) named Wayman Smith (AEP) as his proxy beginning at 11:30 AM.

Agenda Item 9 – 2017 ITP10 Scope

Juliano Freitas (SPP Staff) reviewed the latest version of the 2017 ITP10 scope and asked for approval of the document from the group. There are some sections that have yet to be discussed in detail but more generic language has been included in order to seek MOPC approval in October. The group made some minor changes to the language in the Futures, Resource Plan, Siting, Transmission Operating Guides, and Timeline sections. (Attachment 14 – 2017 ITP10 Scope)

Kurt Stradley (LES) made a motion; seconded by Natasha Henderson (GSEC) to approve the 2017 ITP10 scope as modified. The motion was approved unanimously.

ACTION ITEM: Staff to send out any changes made by the TWG at their meeting on September 29th.

Agenda Item 10 – 2017 ITP10 Assumptions

Agenda Item 10a – TWG Approval Updates

Kirk Hall (SPP Staff) informed the group of the latest 2017 ITP10 scope items approved by the Transmission Working Group (TWG). He reviewed the constraint assessment methodology, reliability assessment hours, determination of reliability needs, generator outlet facility methodology, and the final stability assessment approvals as well as the TWG discussion on portfolio consolidation methodology for reliability projects. (Attachment 15 – 2017 ITP10 TWG_Approvals_ESWG Meeting_rev)

Agenda Item 10b – Data Inputs and Methodology

[This item was not covered]. (Attachment 16 – 2017 ITP10 Data Inputs and Methodology) (Attachment 17 – Siting Methodology Update)

Agenda Item 10c – Portfolio Consolidation Methodology

[This item was not covered]. (Attachment 18 – 2017 ITP10 Portfolio Consolidation)

Agenda Item 10d – Futures Assumptions

[This item was not covered]. (Attachment 19 – 2017 ITP10 Futures Assumptions)

Agenda Item 11 – 2017 ITP10 Resource Plan Phase 2

Josh Ross (SPP Staff) reviewed the assumptions and results of the Future 3 resource plan phase 2 simulations. The simulations include four separate subregions (Integrated System, Nebraska, Kansas/Missouri, South) with the resource plan phase one renewable policy additions and utility and rooftop solar assumptions included in the base model. The results showed capacity additions of almost 10GW needed by 2025 and very minimal wind additions through 2035. Steve Gaw (Wind Coalition) asked if the wind Production Tax Credits (PTC) were reflected in the modeling, what the gas price assumption is being modeled, and what the trigger for wind in the later years might be. The gas price is lower than the projections used in the 2015 ITP10, Staff will investigate whether the PTC is included in the approved prototypes. The group agreed that the wind additions seemed low and discussed the effect the low gas price and 5% wind accreditation assumptions might have. The group asked staff to adjust some of these parameters to assess the impact to the resource plan results, as well as showing results on a zonal basis. (Attachment 20 – 2017 ITP10 Resource Plan Phase 2)

Agenda Item 12 – Market Impacts of Transmission Expansion

Catherine Mooney (SPP Staff) gave an overview of the 2014 Annual State of the Market report, focusing on system losses and LMPs, geographical congestions patterns, frequently constrained areas, and the impacts of recent transmission expansion. The SPP Market Monitoring Unit (MMU) is seeking to educate and assist the planning groups with their expertise to help shape transmission planning. SPP planning and MMU staff will meet to discuss opportunities. (Attachment 21 – ASOM 2014 Draft Congestion and Losses I) (Attachment 22 – MMU ASOM Cong & Losses)

Closing Items

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

List of action items from the meeting:

1. Staff to contact MISO regarding presentation of the MISO Regional Review results at the October meeting.
2. Staff to send out any changes made by the TWG at their meeting on September 29th.

The meeting was adjourned at 3:00 PM.

Respectfully Submitted,

Kelsey Allen

ESWG Secretary

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

October 9th, 2015

Net Conference

• SUMMARY OF ACTIONS TAKEN •

1. None

Southwest Power Pool

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

October 9th, 2015

Net Conference

• 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 8:30 AM, welcomed those in attendance, and asked for introductions.

There were 45 web conference participants, representing 13 of 13 ESWG members. (Attachment 1 – October 9th, 2015 Attendance)

Agenda Item 1b – Receipt of Proxies

Alan Myers (ITC Great Plains) asked for any proxy statements. No proxies were identified.

Agenda Item 1c – Review of Agenda

Chair Alan Myers (ITC Great Plains) presented the agenda for review and asked for any additions or corrections. (Attachment 2 – October 9th, 2015 Agenda)

> **Kurt Stradley (LES) made a motion; seconded by Kip Fox (AEP-Transource) to adopt the agenda. The motion was approved unanimously.**

Agenda Item 2 – 2017 ITP10 Resource Plan Phase Two

Josh Ross (SPP Staff) presented updated results of the Future 3 resource plan phase 2 simulations. Staff has incorporated some changes since the September 23rd meeting including the requested adjustment of wind capacity accreditation, addition of sub-regional interchange to reflect those subregions that are typical importers and exporters of power. The wind accreditation adjustments had minimal effect on the resource plan results, up to nearly 25% accreditation. The largest driver of the results seems to be the current natural gas price forecast, which is 40%-60% lower for any given year than the forecast utilized in the 2015 ITP10. After a debate about natural gas prices the ESWG agreed to keep using the NYMEX as an index to forecast natural gas prices, according some members NYMEX is the best public source available for the current study. The current results are similar to the preliminary, with mostly CC ant CT additions and slight wind additions into year 20. After discussion, the group agreed that the wind levels are much lower than expected. Steve Gaw (Wind Coalition) asked if the PTC was included in the prototype data and mentioned the driver of the Futures for competitive wind. Staff reported that the approved prototypes do not have the PTC reflected and agreed that we need to honor the drivers of the Futures. Staff suggested that if competitive wind is not being honored we should develop a methodology to add wind in the base model as done for solar generation. Staff suggested 20% of peak load by company for Future 3 and 25% of peak load by company for Future 1 and 2. The results of implementing this has not been calculated but expected to be less than 1 GW of additional wind for Future 3 in 2025. The group was concerned about the relative wind and solar additions, and that the wind additions should be at least as much as solar. Staff will investigate this concern and develop a reasonable level for all renewables. (Attachment 3 – 2017 ITP10 Resource Plan Phase 2)

Staff has posted detailed data from the Future 3 results and requested that members review these for anomalies or suspect input data, especially with the effect of the natural gas price on coal generation. (Attachment 4 – 2017 ITP10 Resource Plan Phase 2_Data)

ACTION ITEM: SPP members to review posted detailed results of the Future 3 resource plan.

Kelsey Allen (SPP Staff) presented preliminary results of the Future 1 resource plan phase 2 simulations. The Future 3 model was adjusted and combined into a single regional model and adjusted to meet Future 1 assumptions for solar. Staff ran multiple simulations testing the impact of different adjustments one at a time, including coal retirements, additional wind, and varying levels of a carbon cost adder. Staff also simulated two carbon cost adder scenarios with the natural gas price forecast utilized in the 2015 ITP10. (Attachment 5 - 2017 ITP10 Resource Plan Phase 2_F1)

Agenda Item 3 – 2017 ITP10 Assumptions

Agenda Item 3a – Data Inputs and Methodology

Kelsey Allen (SPP Staff) reviewed the hurdle rate methodology currently being developed through the benchmarking process. Staff has found that performing analysis in the context of the ITP study may not be the best way to develop hurdles between regions, as they are modeling tool to create a kind of friction between markets that exists in the operational realm. In discussion with ABB, Staff is suggesting utilizing one of two approaches used in their analysis, rates utilized in their nodal analysis or rates in their zonal analysis. The nodal hurdle rates are general numbers developed over time from industry analysis and are consistent across most pools. The zonal rates are developed from actual transmission tariff rates found on Oasis. The group generally agreed that moving forward with one of these approaches is reasonable. Staff is currently performing simulations comparing the options and plans to bring some results to the next meeting. (Attachment 6 - 2017 ITP10 Data Inputs and Methodology)

Agenda Item 3b – Siting Methodology Update

Chris Jamieson (SPP Staff) reviewed some of the methodologies and considerations being investigated and gave an update on the progress of the siting development. It is still a work in progress but analysis is currently being done to assess potential sites and more will be discussed in the future. (Attachment 7 - Siting Methodology Update)

Agenda Item 3c – Portfolio Consolidation Methodology

[This item was not covered]. (Attachment 8 - 2017 ITP10 Portfolio Consolidation)

Agenda Item 3d – Futures Assumptions

The discussion on the resource plan carried forward into the assumptions and modeling for Future 2 and the structure that would be implemented in the simulations. Chris Jamieson (SPP Staff) reviewed the different options Staff has discussed internally, including modeling the SPP portion of each state separately, modeling each state separately but disregarding Planning Authority (PA) boundaries. Some members were concerned with the lack of trading [of carbon allowances or emission reduction credits] that would be represented in either of the proposed options. A third option could be to model a subregional approach that would allow some trading but less than the regional approach. Staff agreed with the issue of trading but suggested that a state-by-state approach is more in line with the original future definition and while it may not be reflective of how the future may unfold, it would be more informative for stakeholders than implementing a subregional approach. The group did not take immediate issue with this; Staff will continue work assuming option 2, to build a model state by state disregarding PA boundaries. (Attachment 9 - 2017 ITP10 Futures Assumptions)

Closing Items

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

Upcoming meetings and locations:

- October 22nd, 2015: NextEra HQ, Juno Beach, FL
- November 18th-19th, 2015: SPP Corporate Offices, Little Rock, AR
- December 10th, 2015: 8th Floor AEP Offices, Dallas, TX

List of action items from the meeting:

1. SPP members to review posted detailed results of the Future 3 resource plan.

The meeting was adjourned at 11:30 AM.

Respectfully Submitted,

Kelsey Allen
ESWG Secretary

2017 ITP10 Schedule

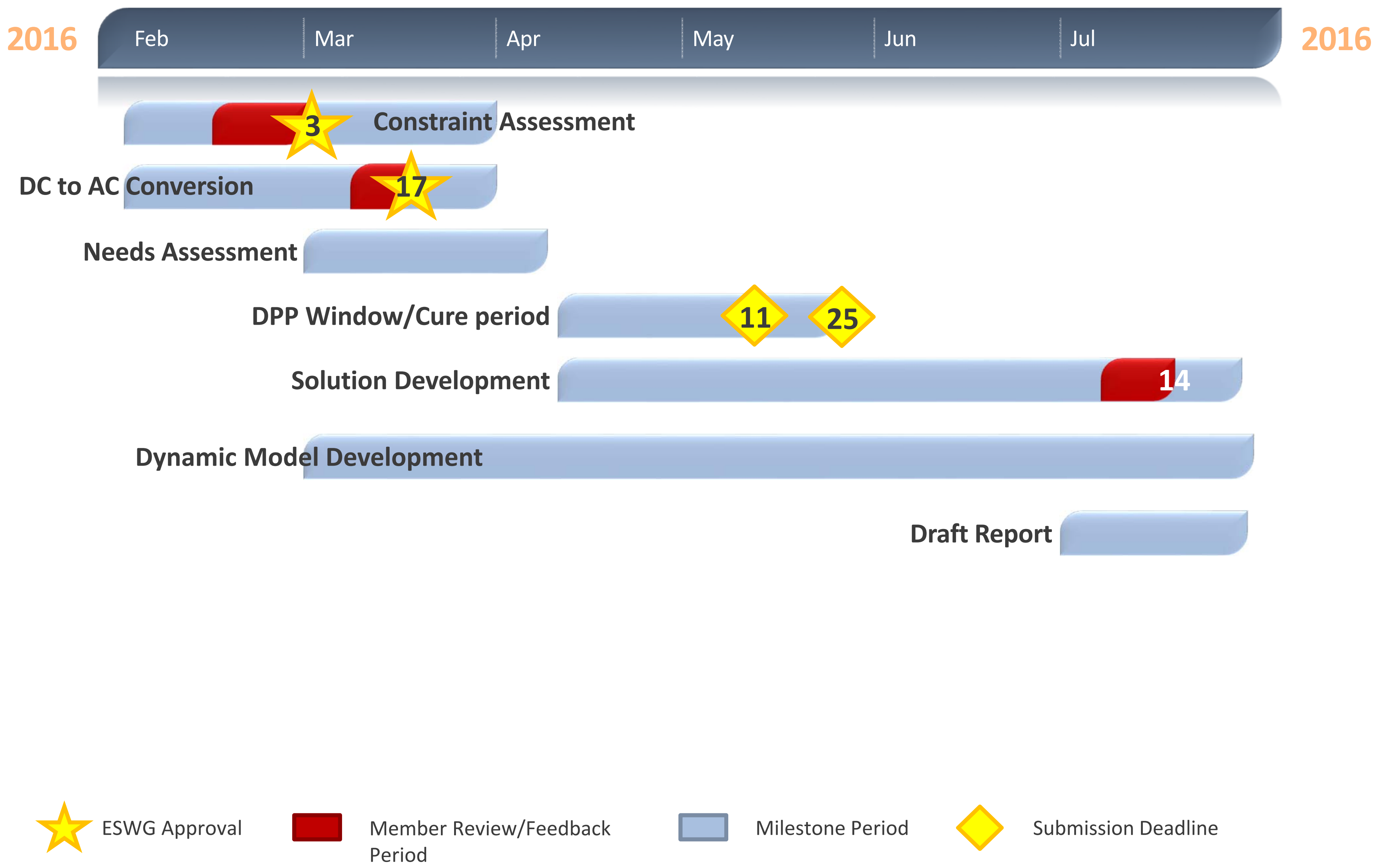
October 22nd , 2015

ESWG

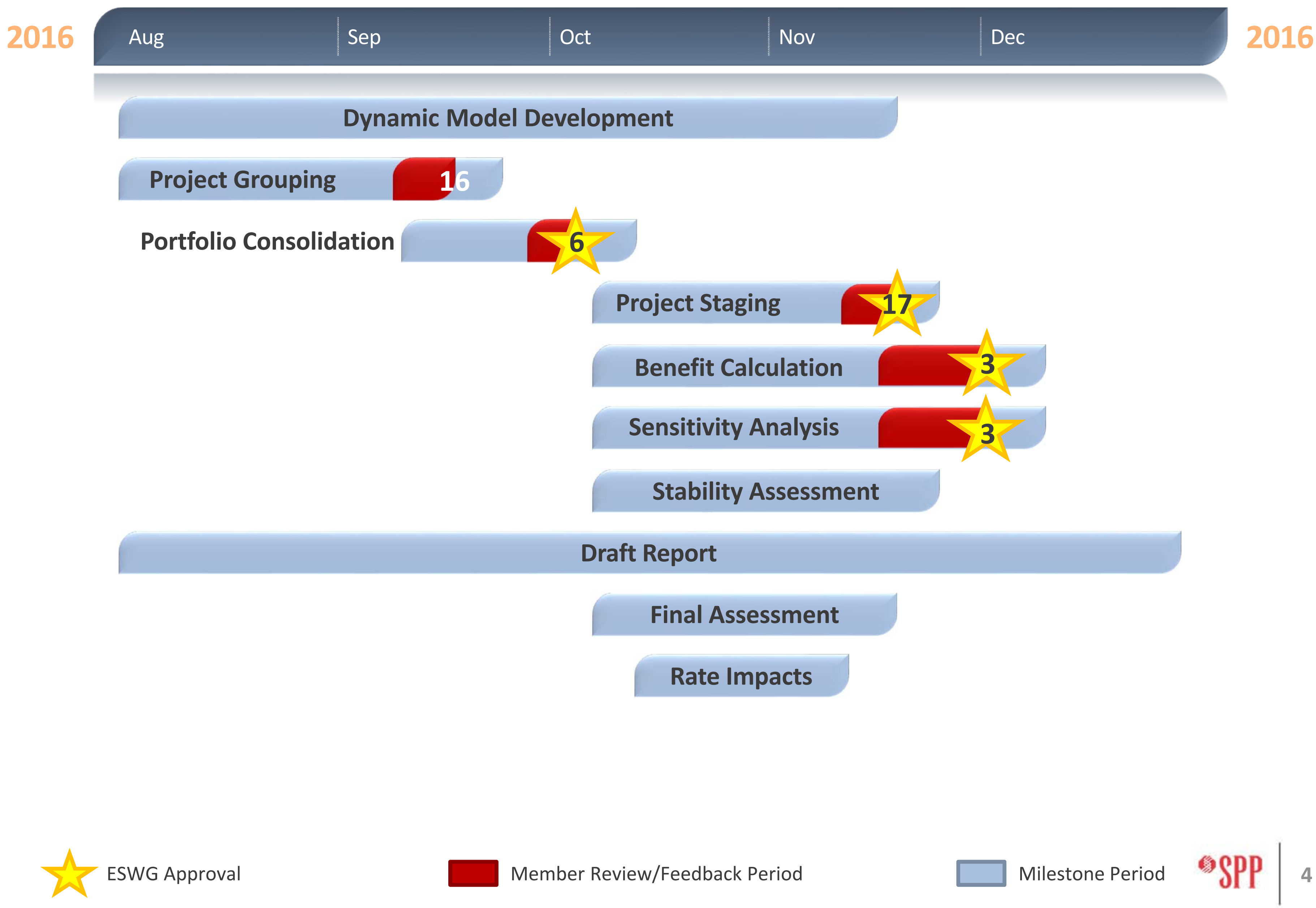
Juliano Freitas

Southwest Power Pool


2015
Aug
Sep
Oct
Nov
Dec
Jan 2016
2016
Today
Scoping (Complete)
23
Resource Plan Phase 1 (Complete)
Resource Plan Phase 2
27
19
Siting Plan
10
Powerflow Model Development
15
Economic Model Development
27
Benchmarking
10
Constraint Assessment
Generator Outlet Facilities
15
ESWG Approval
Member Review/Feedback Period
Milestone Period



2016
Feb
Mar
Apr
May
Jun
Jul
2016
3
Constraint Assessment
DC to AC Conversion
17
Needs Assessment
DPP Window/Cure period
11
25
Solution Development
14
Dynamic Model Development
Draft Report
ESWG Approval
Member Review/Feedback Period
Milestone Period
Submission Deadline


2016
Aug
Sep
Oct
Nov
Dec
2016
Dynamic Model Development
Project Grouping
16
Portfolio Consolidation
6
Project Staging
17
Benefit Calculation
3
Sensitivity Analysis
3
Stability Assessment
Draft Report
Final Assessment
Rate Impacts
ESWG Approval
Member Review/Feedback Period
Milestone Period

ITP10 Milestone Schedule - Summary

Task Name	Start	Finish	Review Period	Feedback Cutoff	ESWG Approval
Scoping	October ‘14	October ‘15	Multiple Reviews		9/23/15
Load Review	February	July	Thru 6/2/2015	6/2/2015	6/18/15
Renewable Survey	May	July	Thru 6/4/15	6/4/2015	7/8/15
Generation Review	February	July	Thru 6/2/2015	6/2/2015	6/18/15
Resource Plan Phase 1	June	August	7/14/15 - 7/28/15		7/29/15
Resource Plan Phase 2	June	October	9/3/15 - 9/17/15		10/22/15
Siting Plan	September	December	11/12/15 - 12/10/15		12/10/15
Powerflow Model Development	May ‘15	January ‘16	1/4/16 - 1/19/16		January '16
Economic Model Development	June ‘15	January ‘16	12/21/15 – 1/9/16		January '16
Benchmarking	June	December	11/12/15 - 12/2/15		12/10/15
Constraint Assessment (TWG)	August ‘15	March ‘16	2/22/15 – 2/26/15		February ’16
Generator Outlet Facilities	October	December	12/1/15 - 12/15/15		12/16/15
DC-to-AC Conversion	February ‘16	March ‘16	3/10/15 - 3/16/15		March ’16
Needs Assessments	March ‘16	April ‘16			
DPP Window/Cure Period	April ‘16	May ‘16	4/11/16 - 5/11/16 5/12/16 - 5/25/16	5/11/2016	
Solution Development	April ‘16	July ‘16	7/7/16 - 7/14/16		
Project Grouping	August ‘16	September ’16	9/9/16 - 9/16/16		Sept '16
Portfolio Consolidation	September ‘16	October ’16	9/29/16 - 10/5/16		October '16
Project Staging	October ’16	November’16	11/9/16 - 11/16/16		November '16
Sensitivity Analysis	October ’16	December ’16	11/18/16 - 12/2/16		December '16
Benefit Calculation	October ’16	December ’16	11/18/16 - 12/2/16		December '16
Draft Report	July ‘16	December ‘16	Multiple Reviews		December '16

Note: Most review period dates are subject to change based on future WG meeting schedules and do not include normal meeting material review times (generally 1 week).

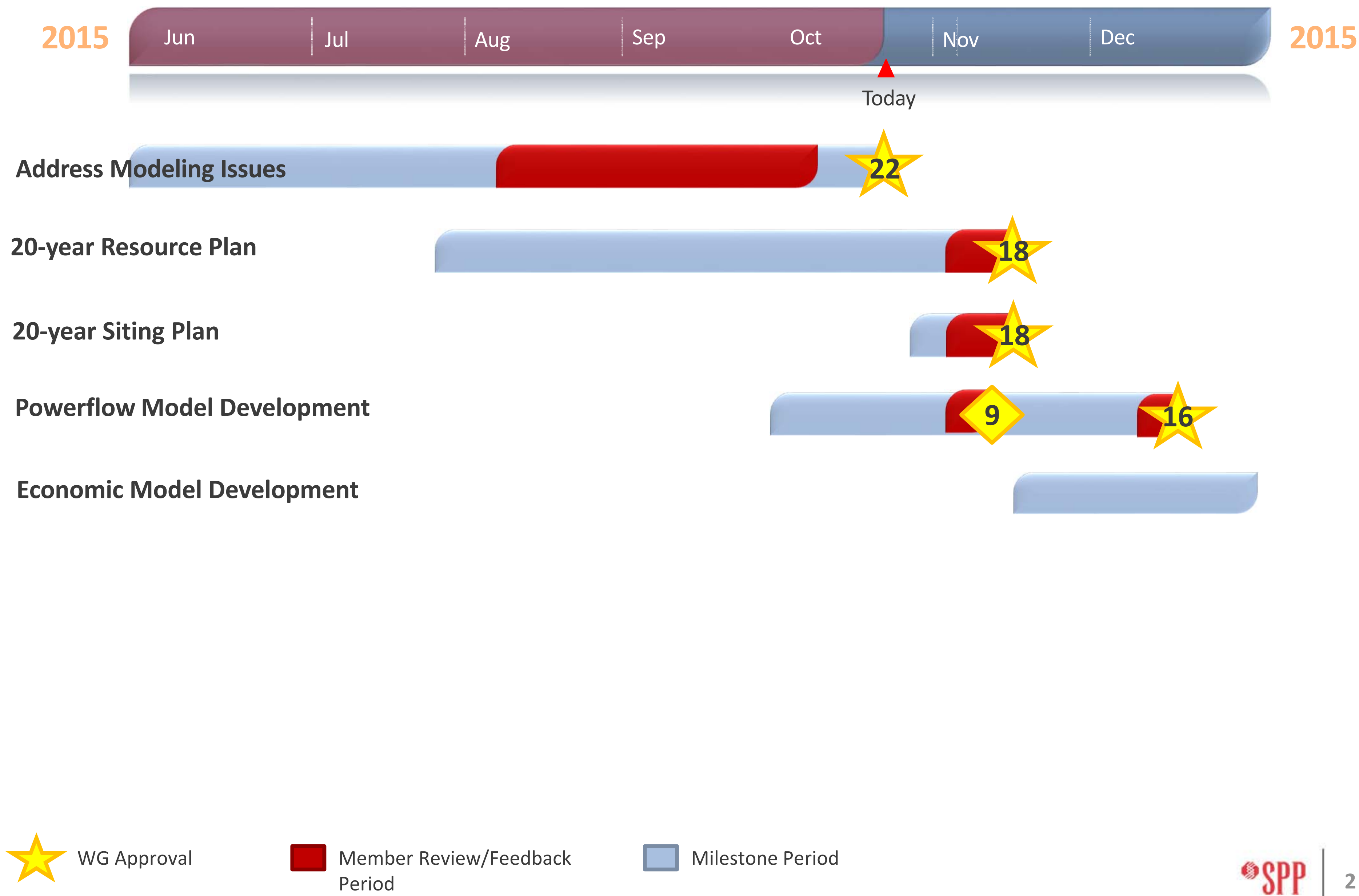
RCAR II Schedule

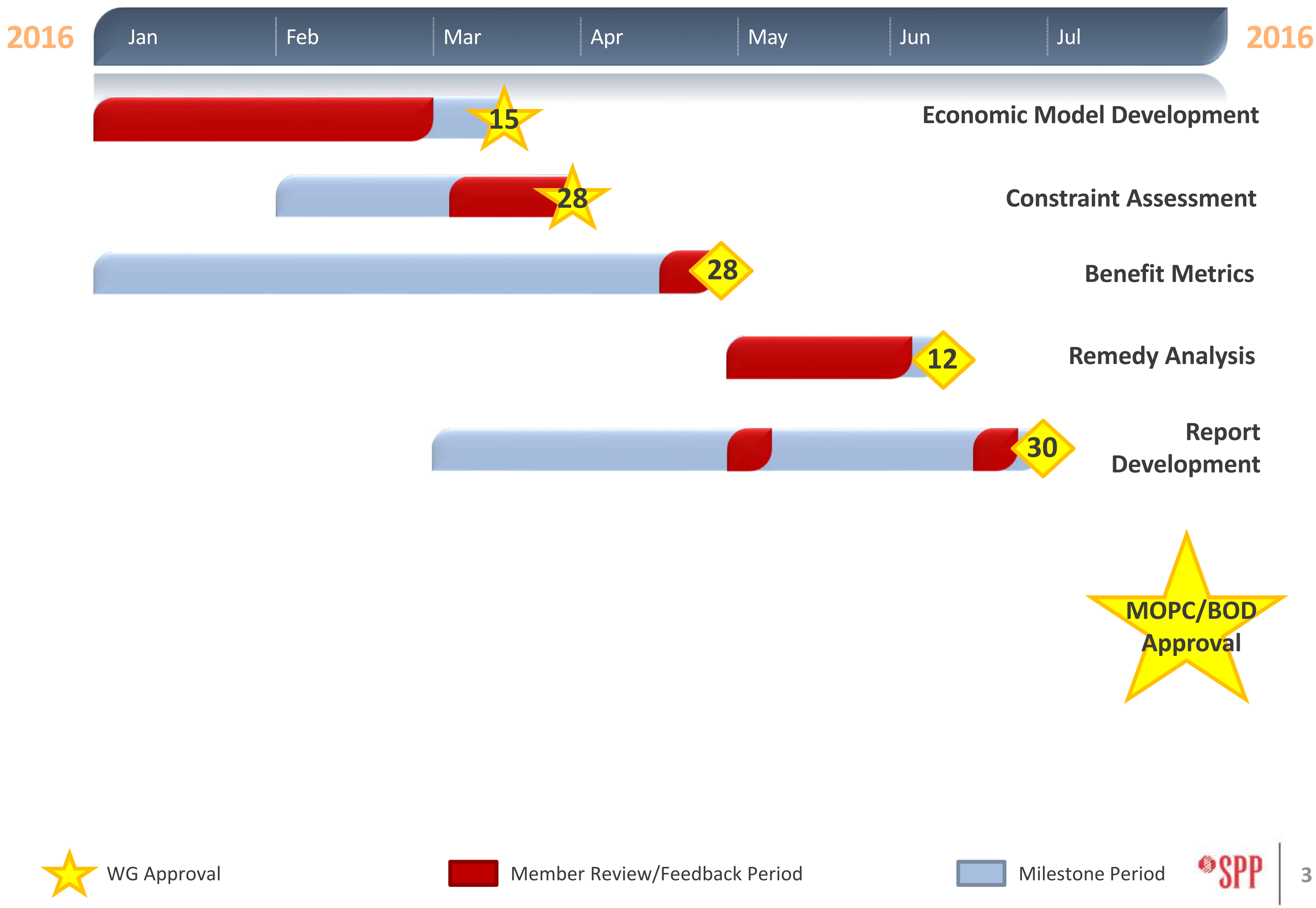
October 22nd, 2015

ESWG

Juliano Freitas

SPP Southwest Power Pool


2015
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2015
Today
Address Modeling Issues
22
20-year Resource Plan
18
20-year Siting Plan
18
Powerflow Model Development
9
16
Economic Model Development
WG Approval
Member Review/Feedback Period
Milestone Period


2016
Jan
Feb
Mar
Apr
May
Jun
Jul
2016
15
Economic Model Development
28
Constraint Assessment
28
Benefit Metrics
12
Remedy Analysis
30
Report Development
MOPC/BOD Approval
WG Approval
Member Review/Feedback Period
Milestone Period

RCAR II Milestone Schedule - Summary

Task Name	Start	Finish	Review Period	Feedback Cutoff	End of Milestone
Address Modeling Issues	**April '15**	**October '15**	Multiple Reviews	10/15/15	11/22/15
20-year Resource Plan	**July '15**	**November '15**	11/02/15 – 11/09/15	11/09/15	11/18/15
20-year Siting Plan	**October '15**	**November '15**	11/02/15 – 11/09/15	11/09/15	11/18/15
Powerflow Model Development	**October '15**	**December '15**	11/06/15 – 11/24/15	11/24/15	12/16/15
Economic Model Development	**November '15**	**March '16**	01/01/16 – 03/01/16	03/01/16	03/15/16
Constraint Assessment	**February '16**	**March '16**	03/03/16 – 03/17/16	03/17/16	03/28/16
Benefit Metrics	**January '16**	**April '16**	April '16		04/28/16
Remedy Analysis	**May '16**	**June '16**	May, June '16		06/12/16
Report Development	**March '16**	**June '16**	May, June '16		06/30/16
Study Concludes		**July '16**			Late July, 2016

Note: Most review period dates are subject to change based on future WG meeting schedules.

Proposed Economic Model Changes

Generation Review

- American Electric Power
  - Change variable O & M costs of John W Turk Jr 1
- City Utilities of Springfield
  - Change category and fuel of James River 4 & 5
  - Change must run status of Southwest ST2
  - Change retirement dates for the following
    - Southwest GT1
    - Southwest GT2
- Grand River Dam Authority
  - Change heat rate of GRDA 2 and GRDA CC
- Oklahoma Gas & Electric
  - Change variable O & M costs of Muskogee 6, Sooner 1 & 2
  - Change maximum capacity of Muskogee 6
  - Change retirement dates for the following (which are all outside of 2035):
    - Muskogee 6
    - Sooner 1 & 2
    - Muskogee 4 & 5
    - Horseshoe Lake 9 & 10
  - Addition of 7 CTs upon retirement of Mustang 3 & 4
- Golden Spread Electric Cooperative
  - Change variable O & M for Antelope
  - Change heat rate of Mustang CC (SPP Staff)
- East Texas Electric Cooperative
  - Change maximum capacity of Harrison County 1a & 1b
  - Change variable O & M costs of Harrison County 1a & 1b
  - Changed fixed O&M costs of Harrison County 1a & 1b
  - Change heat rate of Dolet Hills
  - Change emission rates of Dolet Hills
- SPP Staff
  - Change category and heat rate of Eastex Cogen CC
- Southwestern Public Service
  - Remove Chaves County II solar

Other ESWG-Approved Information

- American Electric Power
  - Change cost of fuel for John W Turk Jr 1
- Oklahoma Gas & Electric
  - Change cost of fuel for Muskogee 6, Sooner 1 & 2
- East Texas Electric Cooperative

- Change cost of fuel for Dolet Hills and Pirkey
- Change emissions cost of the following:
  - CAIR Annual and Seasonal .Nox
  - CSAPR 1.SO2
  - CSAPR 2.SO2
  - CSAPR Annual .NOx
  - CSAPR Seasonal .NOx
  - SO2

Information Not Approved

- City Utilities of Springfield
  - Change minimum capacity for
    - James River 4
    - James River 5
    - McCartney 1
    - McCartney 2
    - Southwest GT1
    - Southwest GT2
    - Southwest ST1
    - Southwest ST2
  - Change ramp up and down rates for
    - James River 4
    - James River 5
    - McCartney 1
    - McCartney 2
    - Southwest GT1
    - Southwest GT2
    - Southwest ST1
    - Southwest ST2
- Nebraska Public Power District
  - Change monthly energy allocation and annual energy of transactions (NPPD_PTN, NPPD_PKG, NPPD_PB)
- Oklahoma Gas & Electric
  - Change minimum downtime of Muskogee 4B & 5B
  - Change minimum runtime of Muskogee 4B & 5B
  - Change start-up cost adder of Muskogee 4B & 5B
- Southwestern Public Service Company
  - Change operating reserve contribution of the following units:
    - Cunningham 3 & 4
    - Maddox GT 2 & 3
    - Quay

MISO Regional Review of Potential Interregional Projects

October 22, 2015

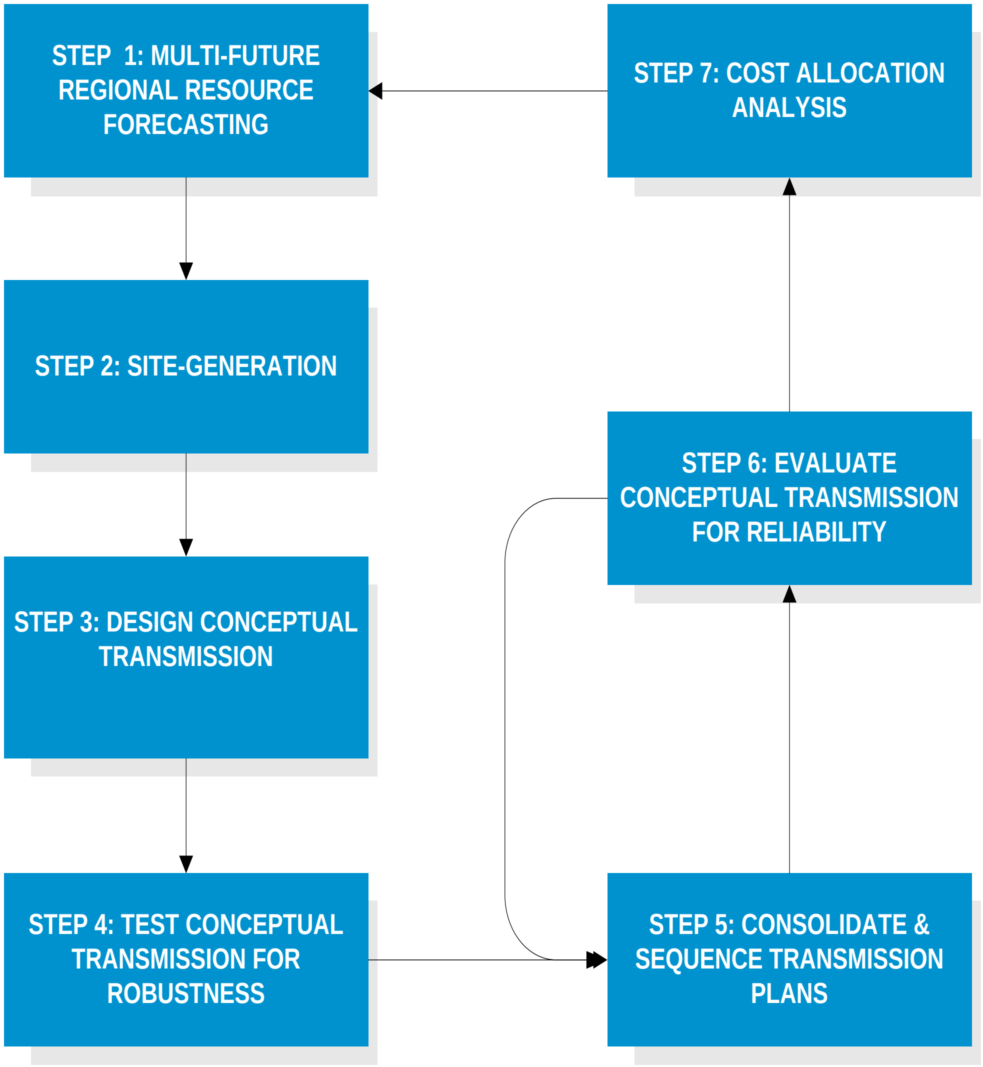
Objective

- Overview of MISO regional process
- Discuss MISO regional review of the proposed inter-regional projects

Key Takeaways

- MISO and SPP effectively collaborated over the course of the study
- Knowledge gained on our respective planning processes and insight into our cooperative interregional planning process

MISO Planning Process



- Objective of MISO value based planning is to develop the **most robust plan under a variety of future scenarios**, not the least-cost plan under a single future scenario
- Steps 1 & 2: Futures Development and Generation Siting
- Steps 3 -7: Transmission Evaluation/Analysis
- The transmission plan that is the best-fit (most robust) against all these scenarios should offer the most future value in supporting the future resource mix

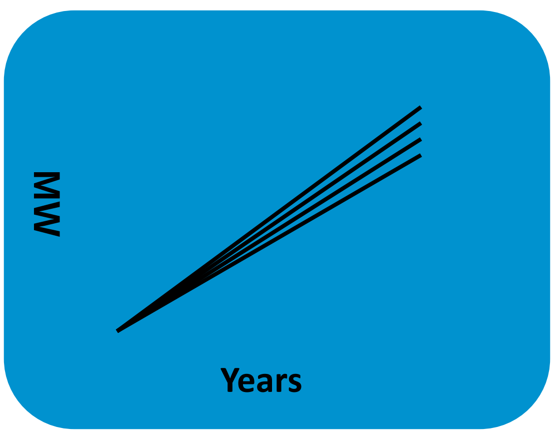
Steps 1-2: Futures Development

Policy and economic drivers

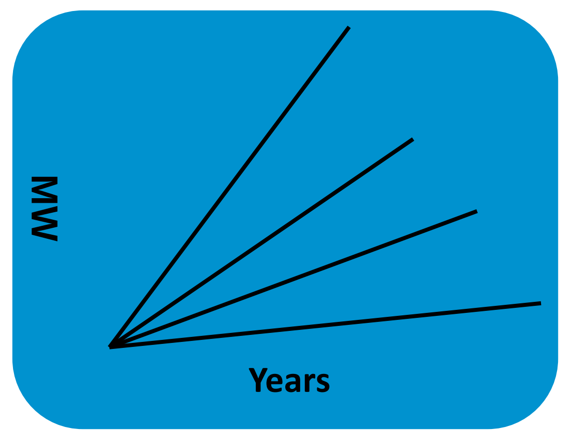
Future scenarios and underlying assumptions are developed with stakeholders through the Planning Advisory Committee (PAC)

Goal for the range of futures is likely real-life scenarios and provide an outcomes that are significantly broad, rather than a single expected forecast

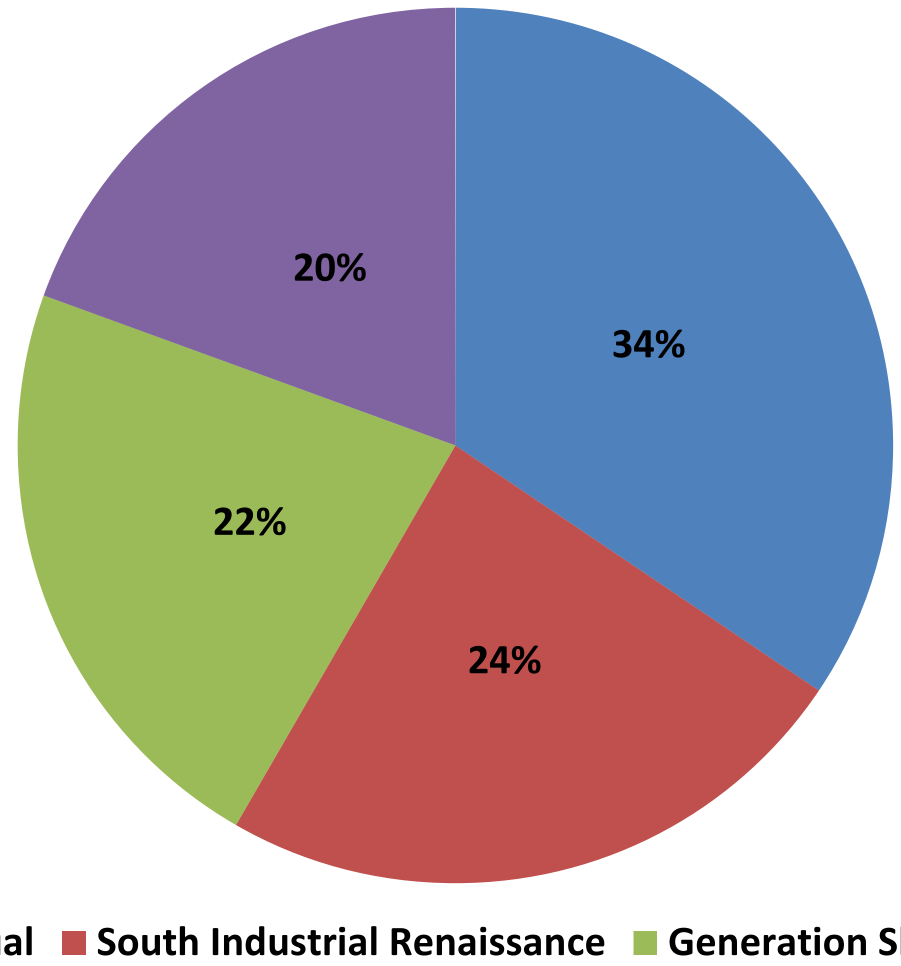
Narrow and less useful



Broad and more useful



Steps 1-2: MTEP15 South Futures and Weights



MTEP15 MCPS South Future Definition:

https://www.misoenergy.org/Events/Pages/MCPS20150306.aspx

Step 1-2: Regional Resource Forecasting & Siting

Inputs

- Reserve Margin Requirement
- Demand and Energy Forecast
- Existing Resources
- Future Resource Alternatives

→ **EGEAS** →

Outputs

Regional Resource Forecast (RRF)

- Electric Generation Expansion Analysis System (EGEAS) is used to find the least-cost resource expansion forecast for each future to meet the planning reserve margin target requirement
  - Performed on a regional level and provides a “MACRO” view of the system

- A rule set is used to site the forecasted capacity, by future, for every region ranging from queue to green field sites

Steps 3 - 7: Transmission Evaluation/Analysis

- **Need Identification (Short/Long Term)**
  - Short-Term Or Long-Term Economic Opportunities
- **Project Candidates Identification**
  - Transmission Solution Development
  - Screening
  - Solution Refinement
  - Project Candidates
- **Robustness Testing Cost Allocation**
  - Cost Estimation
  - Robustness Testing
  - Reliability Analysis
  - Recommendation Cost Allocation

Introduction to Regional Review Process

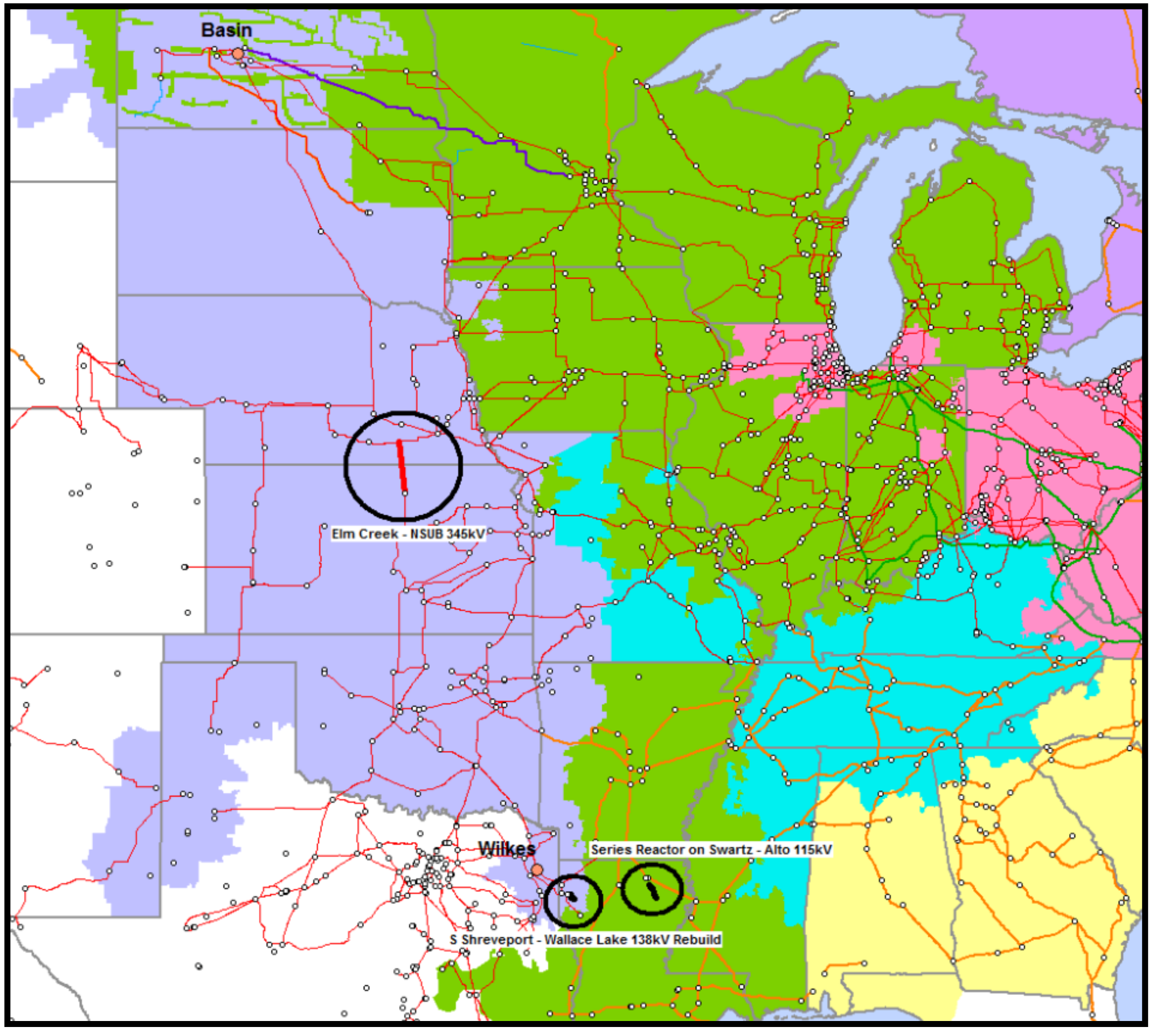
- MTEP15 Market Congestion Planning Study (MCPS) South Models

- Test projects against the broad set of MTEP futures for the 5, 10, 15 study period
  - Business as Usual (BAU)
  - Southern Industrial Renaissance (SIR)
  - Generation Shift (GS)
  - Public Policy (PP)

- Assess project candidates to ensure system reliability

MTEP15 MCPS South Future Definition:
https://www.misoenergy.org/Events/Pages/MCPS20150306.aspx

Potential Interregional Projects



Elm Creek – NSUB 345 kV
- Nebraska/Kansas
- Est. project cost: $140.6 million
  - MISO share: $28.2 million

Rebuild S Shreveport – Wallace Lake 138 kV
- Northwest Louisiana
- Est. project cost: $18.5 million
  - MISO share: $14.8 million

Alto Series Reactor
- Northcentral Louisiana
- Est. project cost: $5.3 million
  - MISO share: $4.5 million

MISO

MISO updated its regional models based on Stakeholder and SPP feedback

- MISO updated its regional congestion analysis after incorporating modeling changes
  - MISO identified future load changes between interregional and regional models
  - Stakeholders and SPP provided feedback on re-siting future generation within SPP footprint
  - Reconciled MATS regulation modeling differences between inter-regional and regional modeling

MISO Regional Review Benefit Summary

Project Description	20-Yr MISO PV Benefit (2015-M$)	20-Yr MISO PV Cost (2015-M$)	Weighted B/C Ratio	MISO Share of Const. Cost (2015- M$)
Series Reactor on Alto – Swartz 115kV	20.5*	4.7	4.34*	4.6
Rebuild S Shreveport - Wallace Lake 138kV	11.5	13.3	0.86	14.8
Elm Creek – NSUB 345kV	25.6	30.5	0.84	28.1

Note:
- *For MISO Projects, MISO Gross-Plant Weighted Average Annual Charge Rate was used*
- *For SPP Projects, SPP Average Annual Charge Rate was used*
- *In-service date (ISD) for the projects is assumed to be 2024*

* Benefit to cost ratio includes the APC benefit for the MISO South region

Project benefits decrease when replicating SPP's MATS regulation assumption in BAU future

Project Description	BAU - B/C Ratio Comparison	
	MISO MATS Retirement Methodology	Replicating SPP's MATS Retirement Methodology
Series Reactor on Alto – Swartz 115kV	6.23	5.88
Rebuild S Shreveport - Wallace Lake 138kV	1.66	0.64
Elm Creek – NSUB 345kV	0.16	(0.02)

- BAU future was chosen for this sensitivity due similarity to SPP's regional futures base generation allowing for isolation of MATS impacts

Key Takeaways

- MISO and SPP effectively collaborated over the course of the study
- Knowledge gained on our respective planning processes and insight into our cooperative interregional planning process
- Collaborate and coordinate on the planning models and assumptions

Questions/Comments?

- **Contact Information:**
  - Arash Ghodsian (aghodsian@misoenergy.org)

Appendix

MTEP15 – MCPS South Futures Definition

Business As Usual

- A status quo future that continues to model current economic trends. This future models existing policies with reference values and trends. This is the MTEP15 BAU for the North/Central region with updated load forecasts representing most recent Module E submissions.

South Industrial Renaissance

- Models significant economic development in the Southern Louisiana and East Texas areas with considerable development occurring in all the areas due to lower fuel prices providing economic opportunity for electric growth and system expansion. Also considers the effects of age-related retirements on non-coal-fired, non-nuclear generators.

MTEP15 – MCPS South Futures Definition

Generation Shift

- Captures the effects of significant amounts of age-related retirements of the non-coal, non-nuclear, thermal fleet by retiring units in the year in which they reach 60 years of age or 100 years for hydro electric. Also models a declining cost curve for solar and wind resources.

Public Policy

- Captures the effects of an additional 14 GW of carbon-reduction-targeted retirements. Also models a cost decline for solar and wind, increases in energy efficiency, and a $25 cost on CO_2 emissions. Includes RPS goals and mandates and 50% of the CPP prescribed energy efficiency. Age-related retirements of non-coal and non-nuclear units are included.

MTEP15 Futures Matrix

Future	Demand Growth (20-year)	Retirements*	Henry Hub Natural Gas Starting Price (Peak 2014 $/MMBtu)	Renewable Portfolio	Carbon Cost	Demand-Side Management
Business as Usual	MISO: 0.83% South: 1.36%	12 GW Coal (46 MW MISO-S)	$4.03	State mandates & goals for RPS	None	State mandates & goals for DSM
South Industrial Renaissance	MISO: 1.58% South: 2.05%	12 GW Coal (46 MW MISO-S) + 15 GW age-related (10 GW MISO-S)	$3.22	State mandates & goals for RPS	None	State mandates & goals for DSM
Generation Shift	MISO: 0.83% South: 1.36%	12 GW Coal (46 MW MISO-S) + 15 GW age-related (10 GW MISO-S)	$4.03	State mandates + goals + any economically chosen renewables based on maturity curves	None	State mandates & goals for DSM
Public Policy	MISO: 0.22% South: 0.71%	12 GW Coal (46 MW MISO-S) + 15 GW age-related (10 GW MISO-S) + 14 GW CPP-related Coal (600 MW MISO-S)	$4.83	State mandates + goals + any economically chosen renewables based on maturity curves	$25/ton	State mandates & goals + incremental to reach 50% of CPP recommendation

**Retirements are totals over the entire 20-year study period*

The entire MCPS15-South futures matrix is posted at https://www.misoenergy.org/Events/Pages/MCPS20150306.aspx

MTEP16 Futures Matrix

Future	Baseline Demand / Energy Growth (20-year)	Retirement Level* (GW)	Inflation	Peak Natural Gas Price (2015 $/MMBtu)	Incremental Renewables (GW) N/C: North/Central S: South	CO_2 Cost (2015 $/ton)
Business as Usual	0.75% / 0.82%	No Additional	2.5%	$4.11	N/C: 4.2 Wind/ 1.4 Solar S: 0 Wind/ 0 Solar	N/A
High Demand	1.55% / 1.61%	Age-related	4.0%	$4.11	N/C: 7.2 Wind/ 1.6 Solar S: 0 Wind/ 0 Solar	N/A
Low Demand	0.11% / 0.19%	Age-related	2.0%	$3.29	N/C: 2.4 Wind/ 1.3 Solar S: 0 Wind/ 0 Solar	N/A
Regional CPP Compliance	0.75% / 0.82%	14 GW coal + age-related	2.5%	$4.93	N/C: 4.2 Wind/ 1.4 Solar S: 0 Wind/ 0 Solar + cost maturity curves	$25 / ton
Sub-Regional CPP Compliance	0.75% / 0.82%	20 GW coal + age-related	4.0%	$4.93	N/C: 4.2 Wind/ 1.4 Solar S: 0 Wind/ 0 Solar + cost maturity curves	$40 / ton

MISO

*12 GW of MATS related coal-retirements are assumed in all Futures
Age-related retirement assumption applies to non-coal, non-nuclear generation only

2017 ITP10 Benchmarking

SPP Staff

October 22nd, 2015

Southwest Power Pool

BENCHMARKING

ESWG Approved Recommendation

- Focus Benchmarking efforts toward quality assurance and validation of the study year economic model
- Use one set of hurdle rates from SPP to all regions
- Omit 2014 Economic Model build
- *<u>New hurdle rate methodology</u>*

Hurdle Rate Methodology Options

1. Utilize the nodal hurdle rates in Ventyx East Nodal F14 data release
2. Utilize the zonal hurdle rates as calculated by ABB for the 2017 ITP10 area structure

Hurdle Rates- Option 1

Utilize the nodal, hurdle rates in the Ventyx East Nodal F14 data release

- **Leverage ABB years of research and modeling of hurdle rates**
- **Traditionally used in nodal simulations**
- **These nodal hurdle rates have simply been developed over time in various nodal studies**

Hurdle Rates- Option 2

Utilize the zonal, hurdle rates as calculated by ABB for the 2017 ITP10 area structure

- **Leverage ABB years of research and modeling of hurdle rates**
- **Traditionally used in zonal simulations**
- **These zonal hurdle rates have been developed from the bottom up using published Oasis tariffs and a friction adder**

Option 1- Hurdle Rate Values

Interface	Fwd Energy	Off-Peak Fwd Energy	Back Energy	Off-Peak Back Energy	Commit Fwd Energy	Off-Peak Commit Fwd Energy	Commit Back Energy	Off-Peak Commit Back Energy
	($/MWh)							
MISO_MH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SASK_SPP	10.24	5.12	10.24	5.12	19.20	19.20	19.20	19.20
TVA_DELTA	38.40		10.24	5.12			19.20	19.20
MISO_TVA	10.24	5.12	38.40		19.20	19.20	38.40	38.40
MH_SASK	10.24	5.12	10.24	5.12	19.20	19.20	19.20	19.20
SPP_DELTA	10.24	5.12	10.24	5.12	19.20	19.20	19.20	19.20
MISO_DELTA	10.24	5.12	10.24	5.12	19.20	19.20	19.20	19.20
MISO_SPP	10.24	5.12	10.24	5.12	19.20	19.20	19.20	19.20

Option 2- Hurdle Rate Values

Interface	Fwd Energy	Off-Peak Fwd Energy	Back Energy	Off-Peak Back Energy
	($/MWh)			
MISO_MH	0.00	0.00	0.00	0.00
SASK_SPP	12.60	4.38	9.14	2.65
TVA_DELTA	38.40	38.40	10.20	6.36
MISO_TVA	14.12	4.88	38.40	38.40
MH_SASK	16.50	6.02	12.60	4.38
SPP_DELTA	9.05	2.48	10.20	6.36
MISO_DELTA	14.12	4.88	10.20	6.36
MISO_SPP	14.12	4.88	8.83	2.41

Hurdle Rate Comparisons (1 of 2)

- **Compares both options to 2015 ITP10 hurdle rates**
- **Due to differing pool structures between ITP10s, hurdle rates cannot be compared one to one**

Interface	Fwd Energy Tariff ($/MWh)			Back Energy Tariff,($/MWh)			Off-Peak Fwd Energy Tariff ($/MWh)			Off-Peak Back Energy Tariff ($/MWh)		
	2015 ITP10	*Option 1*	*Option 2*	*2015 ITP10*	*Option 1*	*Option 2*	*2015 ITP10*	*Option 1*	*Option 2*	*2015 ITP10*	*Option 1*	*Option 2*
MAPP Non-MISO_SERC	8.27			7.22			8.27			7.22		
MH_SASK		10.24	16.50		10.24	12.60		5.12	6.02		5.12	4.38
MISO_DELTA*		10.24	14.12		10.24	10.20		5.12	4.88		5.12	6.36
MISO_SERC*	9.71			10.89			9.71			10.89		
MAPP Non-MISO_MISO~	8.27			7.22			8.27			7.22		
MISO_MH~		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00
MISO_SPP	13.12	10.24	14.12	3.28	10.24	8.83	13.12	5.12	4.88	3.28	5.12	2.41
MISO_TVA		10.24	14.12		38.40	38.40		5.12	4.88		38.40	38.40
SASK_SPP		10.24	12.60		10.24	9.14		5.12	4.38		5.12	2.65
SPP_MAPP Non-MISO	6.56			13.12			6.56			13.12		
SPP_DELTA^		10.24	9.05		10.24	10.20		5.12	2.48		5.12	6.36
SPP_SERC^	1.97			13.12			1.97			13.12		
TVA_DELTA		38.40	38.40		10.24	10.20		38.40	38.40		5.12	6.36

*The two interfaces with this symbol can be directly compared
~The two interfaces with this symbol can be directly compared
^The two interfaces with this symbol can be directly compared
Interfaces not in bold font indicate the interface is a 2015 ITP10 interface without an exact match to a 2017 ITP10 interface

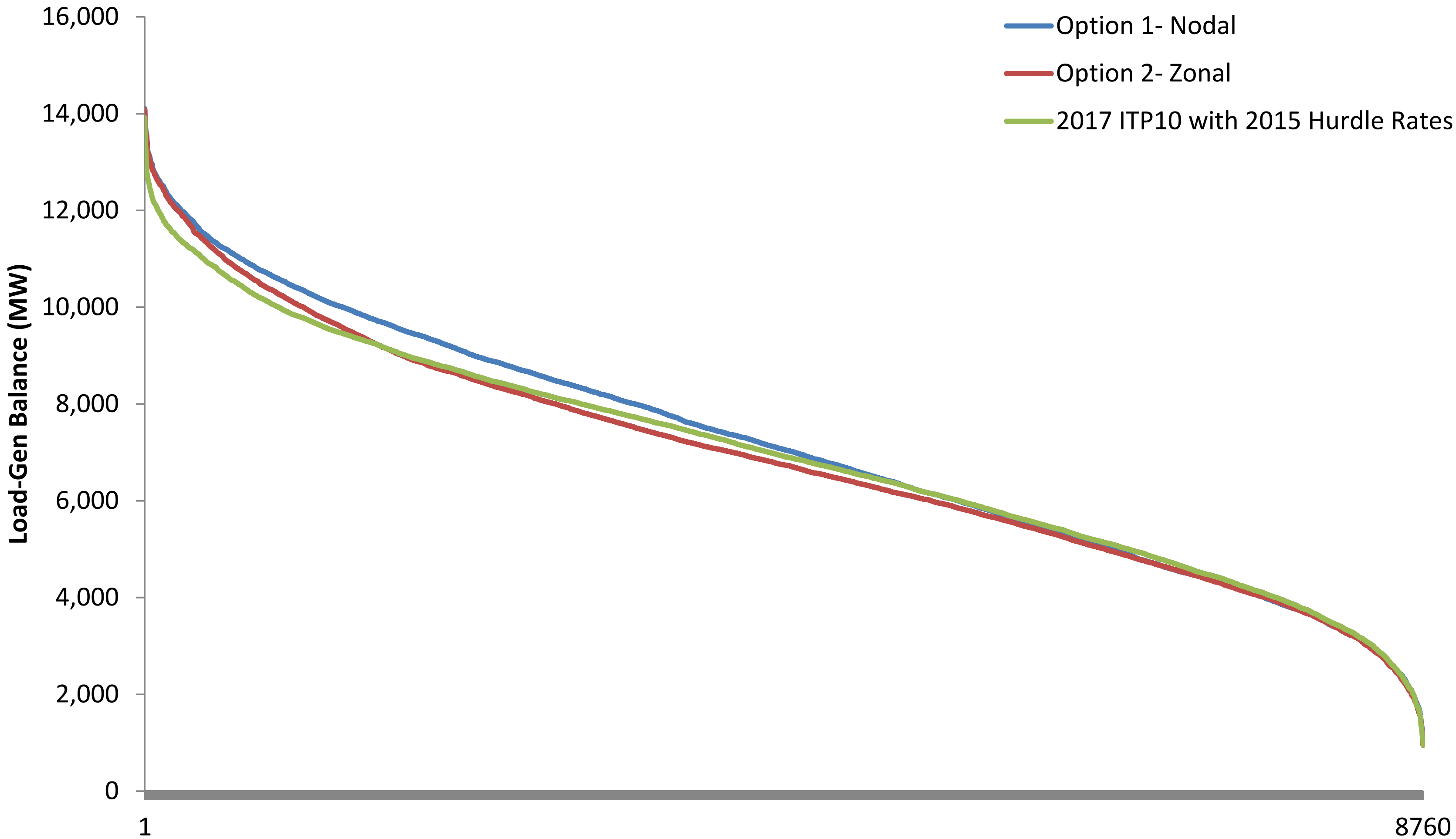
Hurdle Rate Comparisons (2 of 2)

- Compares both options to 2015 ITP10 hurdle rates
- Due to differing pool structures between ITP10s, hurdle rates cannot be compared one to one

Interface	Commit Fwd Energy ($/MWh) 2015 ITP10	Commit Fwd Energy ($/MWh) Option 1	Commit Fwd Energy ($/MWh) Option 2	Commit Back Energy ($/MWh) 2015 ITP10	Commit Back Energy ($/MWh) Option 1	Commit Back Energy ($/MWh) Option 2	Off-Peak Commit Fwd Energy ($/MWh) 2015 ITP10	Off-Peak Commit Fwd Energy ($/MWh) Option 1	Off-Peak Commit Fwd Energy ($/MWh) Option 2	Off-Peak Commit Back Energy ($/MWh) 2015 ITP10	Off-Peak Commit Back Energy ($/MWh) Option 1	Off-Peak Commit Back Energy ($/MWh) Option 2
MAPP Non-MISO_SERC	13.12			13.12			13.12			13.12		
MH_SASK		19.20	16.50		19.20	12.60		19.20	6.02		19.20	4.38
MISO_DELTA*		19.20	14.12		19.20	10.20		19.20	4.88		19.20	6.36
MISO_SERC*	13.12			13.12			13.12			13.12		
MAPP Non-MISO_MISO~	13.12			13.12			13.12			13.12		
MISO_MH~		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00
MISO_SPP	13.12	19.20	14.12	13.12	19.20	8.83	13.12	19.20	4.88	13.12	19.20	2.41
MISO_TVA		19.20	14.12		38.40	38.40		19.20	4.88		38.40	38.40
SASK_SPP		19.20	12.60		19.20	9.14		19.20	4.38		19.20	2.65
SPP_MAPP Non-MISO	13.12			13.12			13.12			13.12		
SPP_DELTA^		19.20	9.05		19.20	10.20		19.20	2.48		19.20	6.36
SPP_SERC^	13.12			13.12			13.12			13.12		
TVA_DELTA		38.40	38.40		19.20	10.20		38.40	38.40		19.20	6.36

*The two interfaces with this symbol can be directly compared
~The two interfaces with this symbol can be directly compared
^The two interfaces with this symbol can be directly compared
Interfaces not in bold font indicate the interface is a 2015 ITP10 interface without an exact match to a 2017 ITP10 interface

Hurdle Rate Testing



Hurdle Rate Data Sources

2017 ITP10 Interface	Zonal Interface Equivalent	Source
MISO_MH	MISO - Minnesota to Manitoba	0 Wheeling rate internally and to PJM
SASK_SPP	Dakotas to Saskatchewan (reversed)	http://www.oatioasis.com/WAPA/WAPAdocs/is-transmission-rates-2014-0101.pdf
TVA_DELTA	TVA to Associated Electric	http://www.oatioasis.com/TVA/TVAdocs/TVA_Transmission_Rates_2013.pdf
MISO_TVA	TVA to MISO - Arkansas (reversed)	http://www.oatioasis.com/TVA/TVAdocs/TVA_Transmission_Rates_2013.pdf
MH_SASK	Manitoba to Saskatchewan	http://www.oatioasis.com/woa/docs/MHEB/MHEBdocs/MH_OATT_Version_34_FINAL.pdf
SPP_DELTA	Associated Electric to SPP - Central (reversed)*	http://www.oatioasis.com/AECI/AECIdocs/AECI_BP_April_17_2014.pdf
MISO_DELTA	Associated Electric to MISO - Arkansas (reversed)	http://www.oatioasis.com/AECI/AECIdocs/AECI_BP_April_17_2014.pdf
MISO_SPP	MISO - Arkansas to SPP - Central*	http://www.oasis.oati.com/woa/docs/MISO/MISOdocs/Transmission_Rates.html http://www.oatioasis.com/WAPA/WAPAdocs/is-transmission-rates-2014-0101.pdf

*An average of multiple zonal tariffs

Recommendation

Staff recommends implementing the zonal, hurdle rates (Option 2) in the 2017 ITP10 study

2017 ITP10 Resource Plan Phase 2

October 22nd, 2015

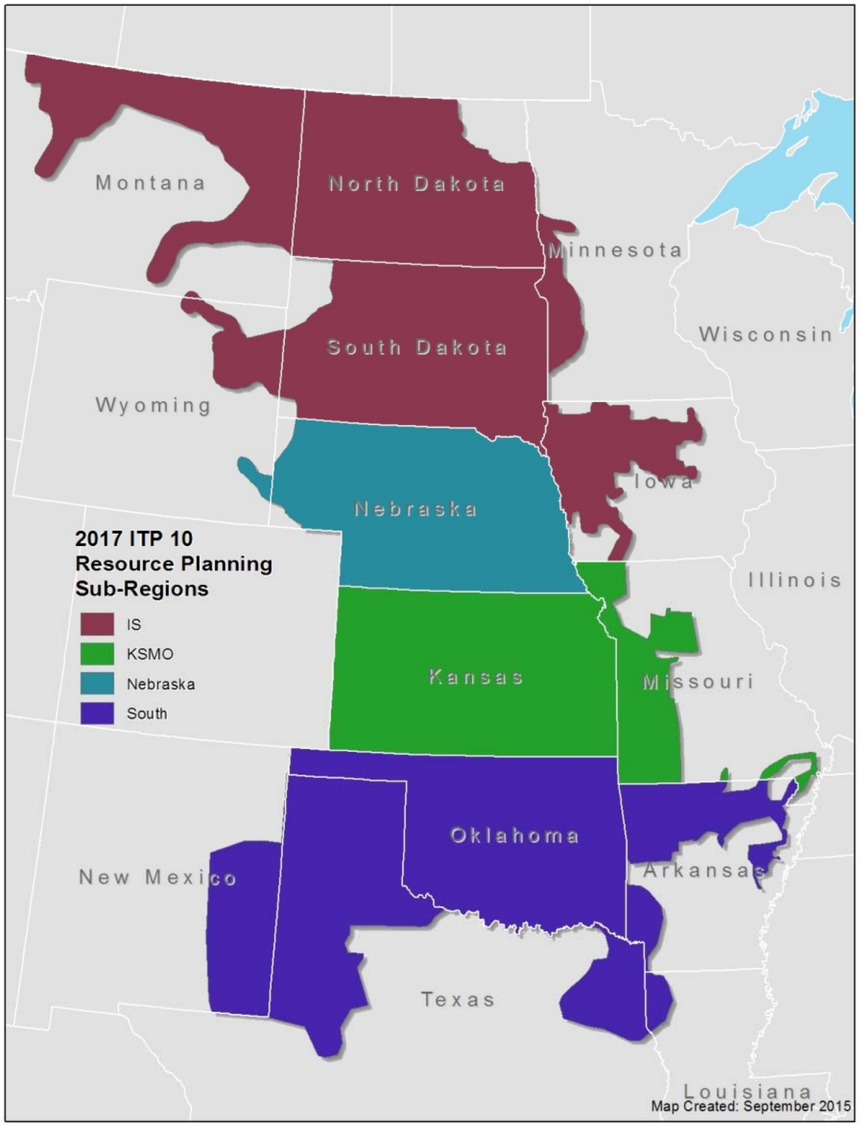
SPP Southwest Power Pool

Helping our members work together to keep the lights on... today and in the future

FUTURE 3

F3 Resource planning simulations

- Capacity expansion plan development for 4 sub-regions
  - IS, Nebraska, KSMO, South
  - Years 2020 – 2035



Discussion points from last meeting

- NG prices
- Interchange
- Forced wind and solar

Resource planning simulations

- Model inputs
  - Load and generation review
  - Fuel prices
  - RP1 renewable units (387 MW in 2025)
  - Additional wind units (2.9 GW in 2025)
  - Utility scale and rooftop solar units (2.4 GW in 2025)
- Constraints
  - Zonal load requirements and generation capacity
  - Zonal capacity margin requirement (12%)

F3 Load and Generation by Sub-Region, 2025

	IS	NEB	KSMO	South	TOTAL
Accredited Installed capacity (MW)	6,974	7,801	18,750	32,073	65,598
Peak Load (MW)	7,012	6,795	16,639	31,533	61,979
Conventional Additions (MW)	1,630	432	1,532	6,364	9,958
Renewable Additions (MW)	328	660	1,320	3,003	5,311
Total Additions (MW)	1,958	1,092	2,852	9,367	15,269

*Capacity additions are based on zonal requirements, not sub-regional requirements

Unit Retirements, by Year

- Based on Generation Review

Retirements (MW)	2020	2025	2035
Coal	2,442	3,475	4,622
Nuclear	0	0	588
Gas	1,121	2,686	6,291
Oil	25	51	346
Other	3	3	28
TOTAL	3,592	6,215	11,876

Natural Gas Prices

- NG prices derived from NYMEX futures and DOE growth rates in both 2015 ITP10 and 2017 ITP10
  - NYMEX futures prices have declined during the past two years
- Henry Hub comparison:

	2017 ITP10	2015 ITP10	Difference
2019	$3.55	$5.01	($1.46)
2020	$3.66	$5.37	($1.71)
2021	$3.79	$5.72	($1.93)
2022	$3.93	$6.13	($2.20)
2023	$4.06	$6.51	($2.46)
2024	$4.19	$6.79	($2.60)
2025	$4.35	$7.03	($2.68)
2026	$4.54	$7.38	($2.85)
2027	$4.72	$7.63	($2.90)
2028	$4.90	$7.96	($3.05)
2029	$5.15	$8.23	($3.07)
2030	$5.49	$8.54	($3.05)
2031	$5.72	$8.92	($3.20)
2032	$6.01	$9.24	($3.22)

(nominal $)

- This decrease in gas prices is impacting the dispatch of coal and gas in the simulations

Straw Poll Vote on NG Price Sources

1. NYMEX - 1
2. EIA - 7
3. Bentek (MISO Vendor) - 0
4. Average of publicly available forecasts (NYMEX, EIA, Bentek, ABB) - 11
5. NYMEX + Must Run - 3
6. ABB Reference Case - 13
7. Average of member forecasts - 2
8. Average (weighting) of 3rd party vendors - 4

Final Options for NG Price Sources

1. Average of publicly available forecasts (NYMEX, EIA, Bentek, ABB) - 11
2. ABB Reference Case - 13

F3 Unit Capacity Factors

- Some of the more economical CCs are displacing some of the less economical coal units
- Capacity factors by unit are posted on TrueShare
  - ITP – Confidential… -> 2017 ITP10 -> Resource Planning Data ->

	2020	2025	2035
ST Coal	51.38%	51.85%	60.34%
CC	27.58%	30.98%	27.69%
CT Gas	4.05%	3.71%	5.49%
ST Gas	1.52%	1.71%	0.65%
IC Gas	16.26%	13.04%	13.61%
Nuclear	89.08%	89.03%	89.13%
CT Oil	0.44%	0.39%	0.46%
IC Oil	0.29%	0.33%	0.77%
Internal Combustion	3.99%	4.23%	4.92%
ST Other	42.55%	42.59%	42.63%
CT Other	27.82%	28.59%	88.88%

Interchange Method

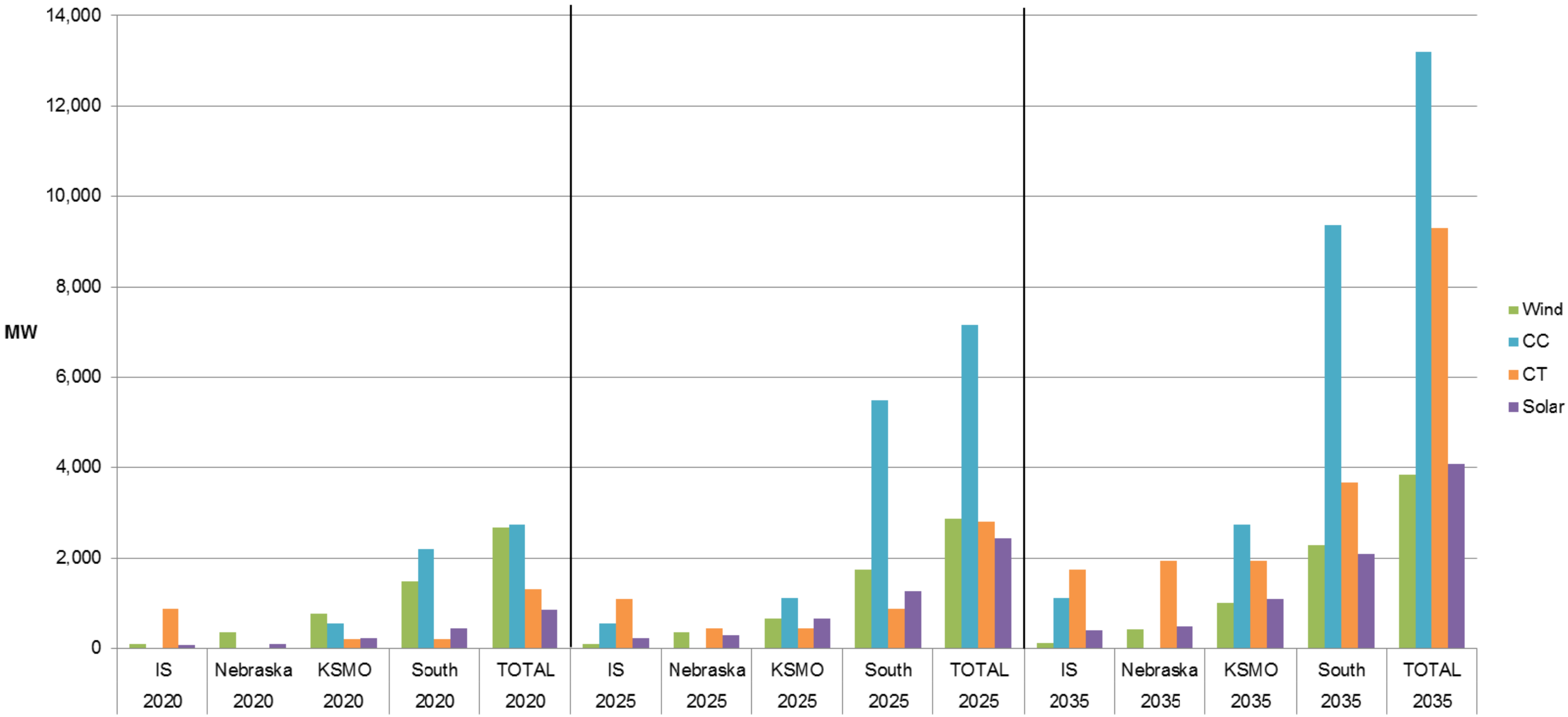
- 2015 ITP10: No interchange between sub-regions
- 2017 ITP10: Implemented fixed transactions for each sub-region to model interchange
  - Based on load/gen output from 2015 ITP10 PROMOD dispatch
  - Includes hourly profiles
  - No impact on capacity needs; impact on energy needs only

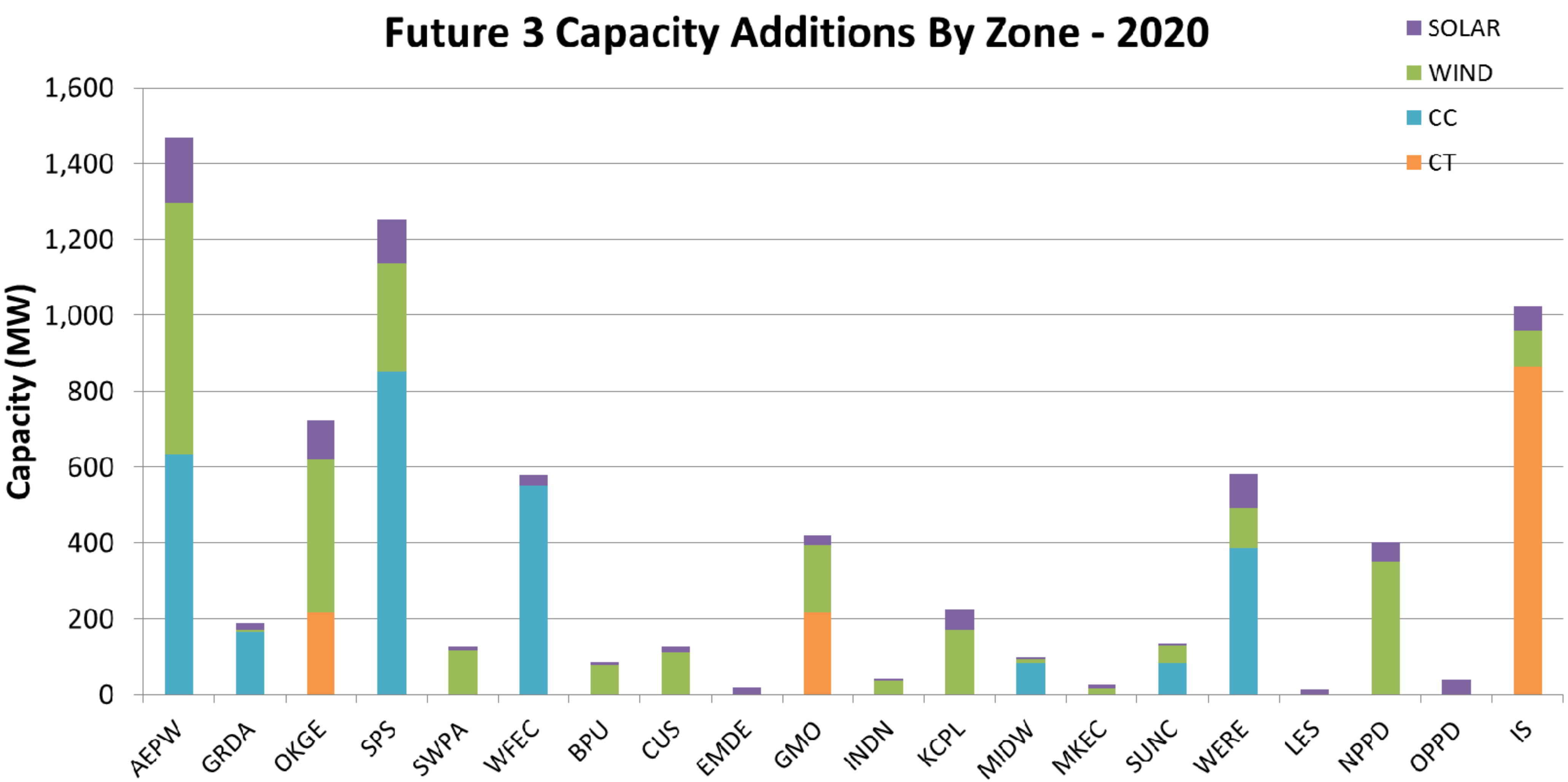
Subregion	Average Export (Import) (MW)
SPP IS	(229)
SPP KSMO	112
SPP Nebraska	1,189
SPP South	(4,659)

Future 3 Resource Additions

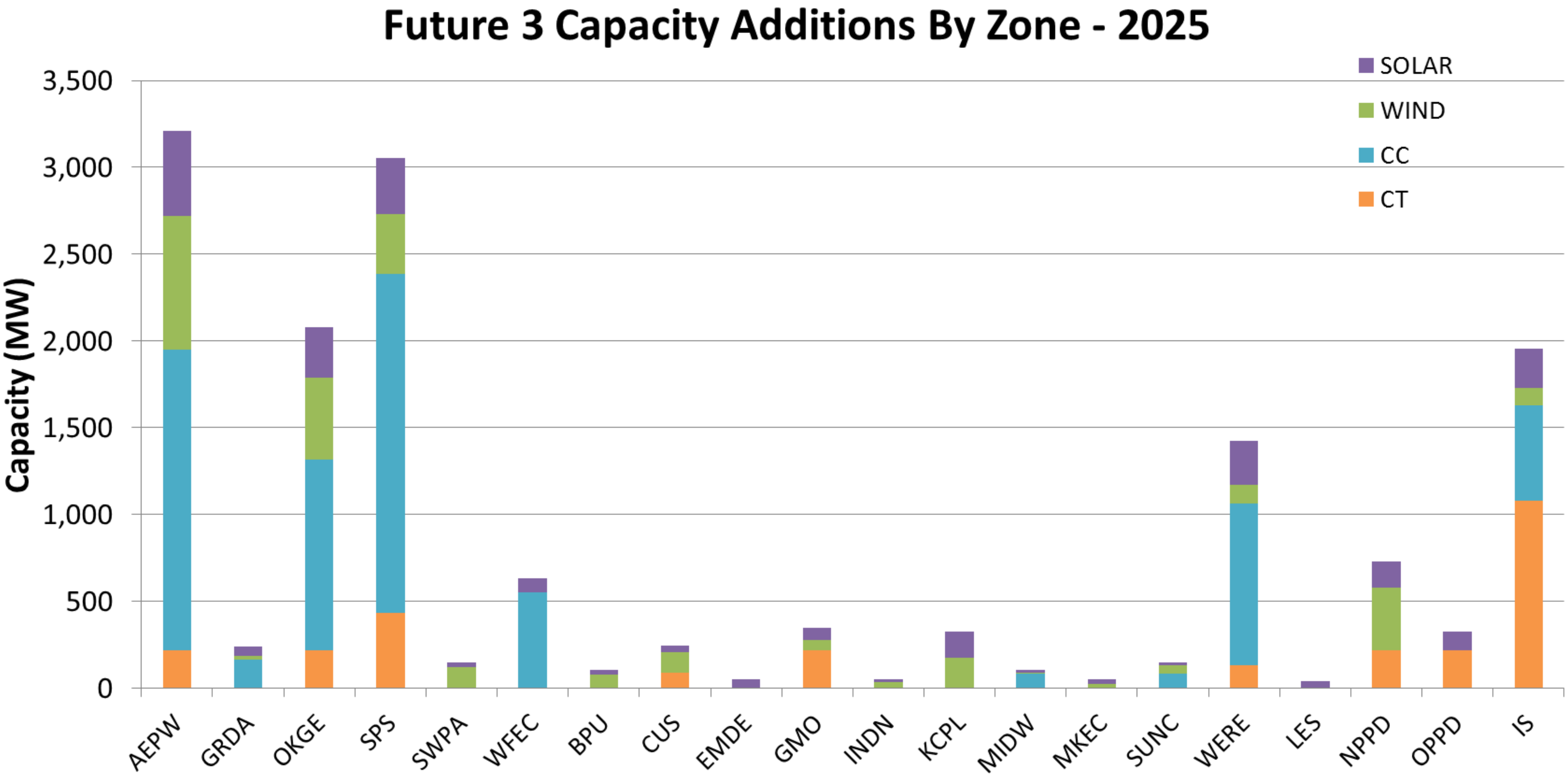
Cumulative Additions

	Conventional MW	Renewable MW	Total MW
2020	4,046	3,525	7,571
2025	9,958	5,311	15,269
2035	22,488	7,925	30,413



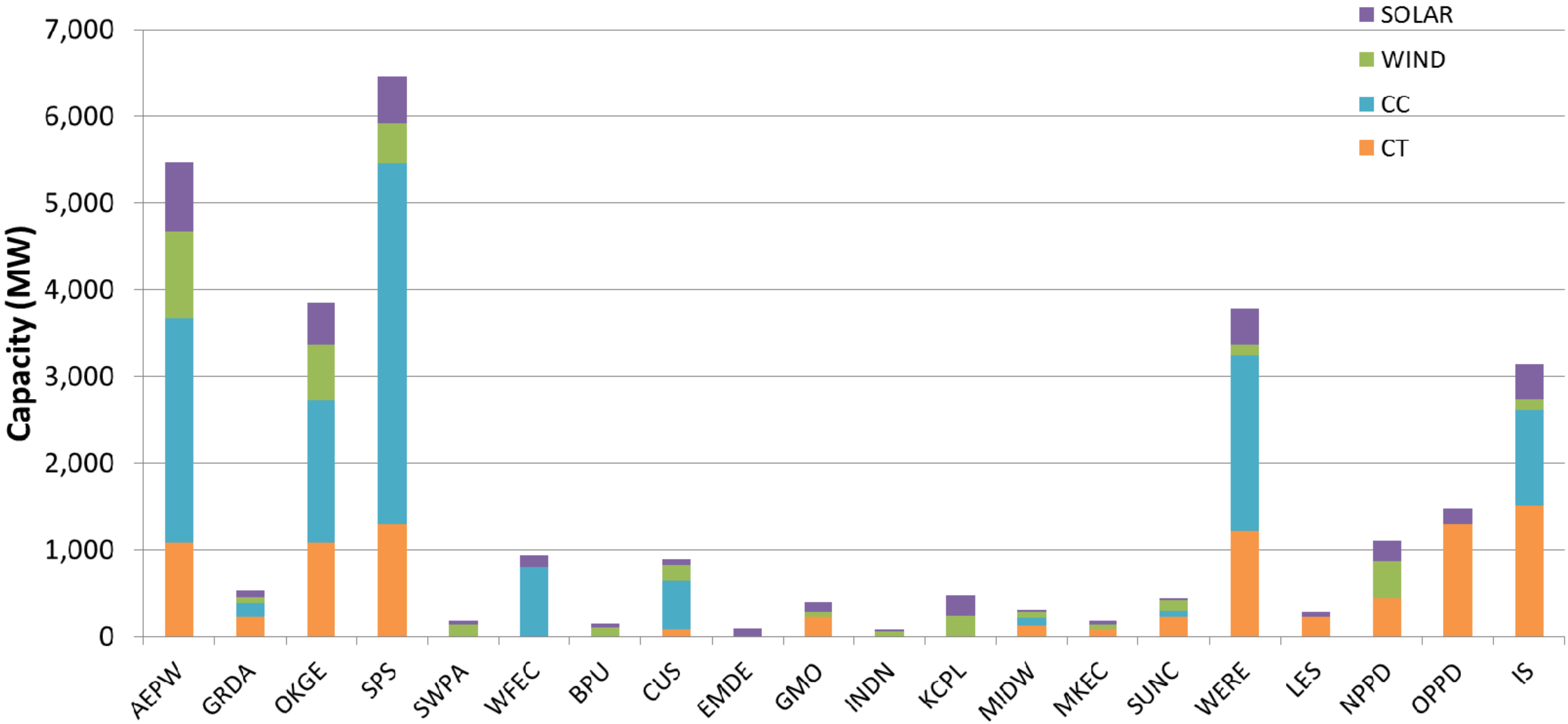


Future 3 Capacity Additions By Zone - 2020
SOLAR
WIND
CC
CT
Capacity (MW)
1,600
1,400
1,200
1,000
800
600
400
200
0
AEPW
GRDA
OKGE
SPS
SWPA
WFEC
BPU
CUS
EMDE
GMO
INDN
KCPL
MIDW
MKEC
SUNC
WERE
LES
NPPD
OPPD
IS

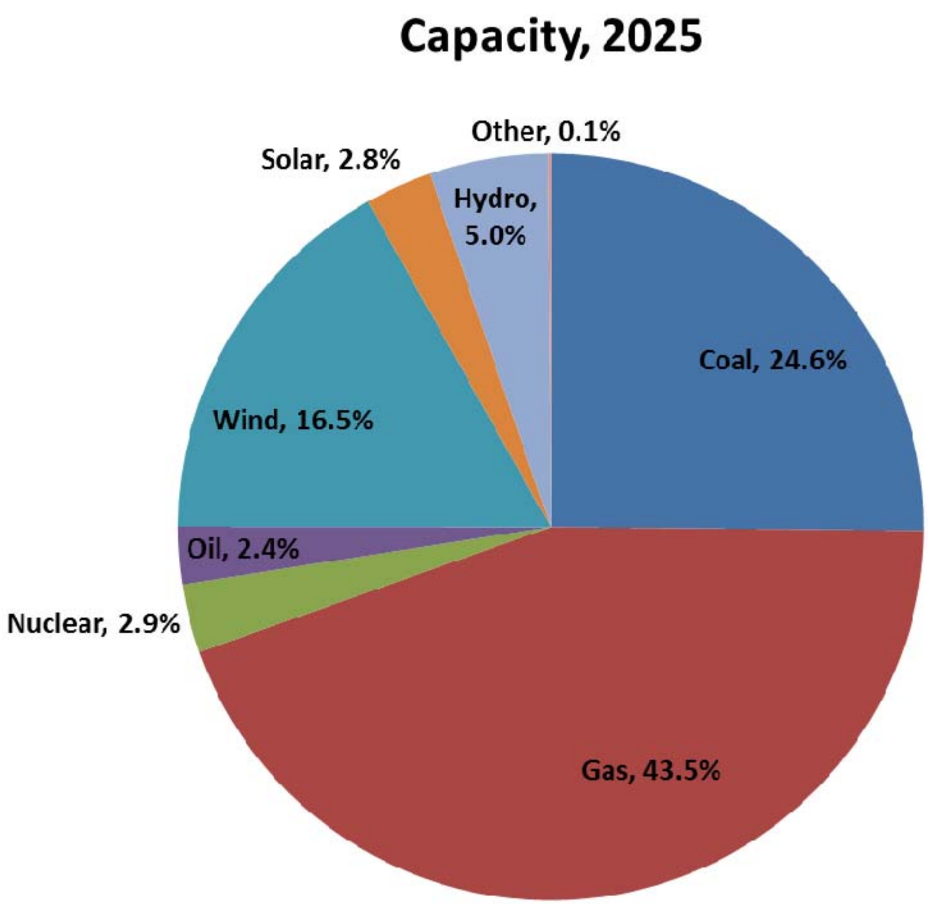


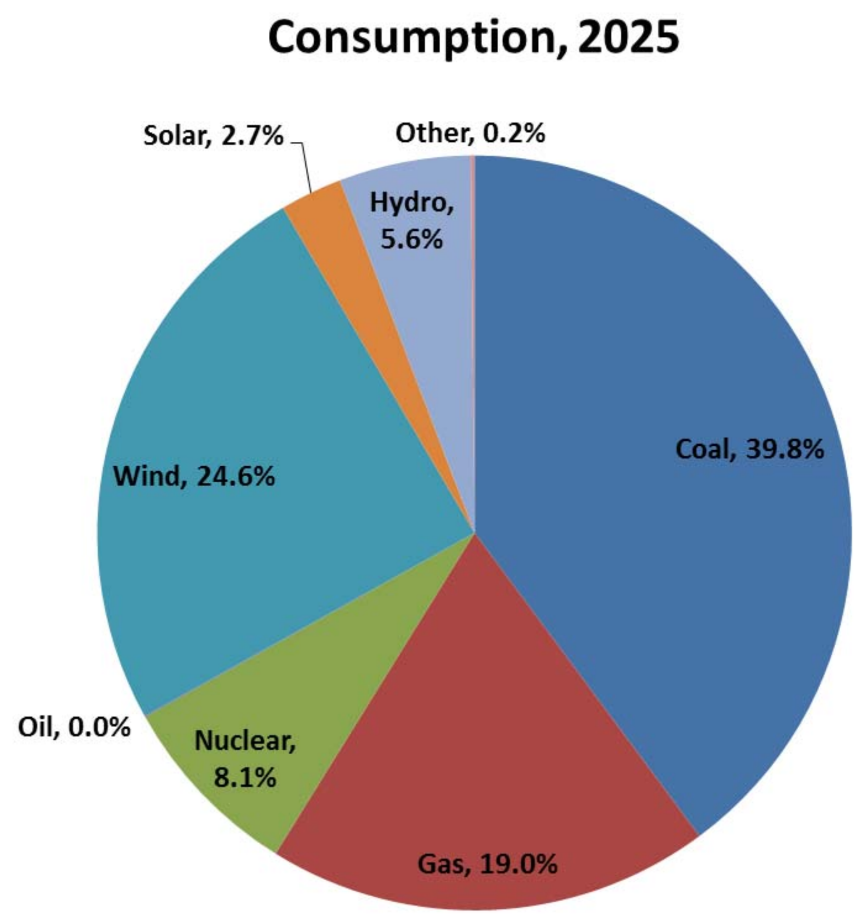
Future 3 Capacity Additions By Zone - 2025
SOLAR
WIND
CC
CT
Capacity (MW)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
AEPW
GRDA
OKGE
SPS
SWPA
WFEC
BPU
CUS
EMDE
GMO
INDN
KCPL
MIDW
MKEC
SUNC
WERE
LES
NPPD
OPPD
IS

Future 3 Capacity Additions By Zone - 2035



Future 3 Resource Operation





FUTURE 1

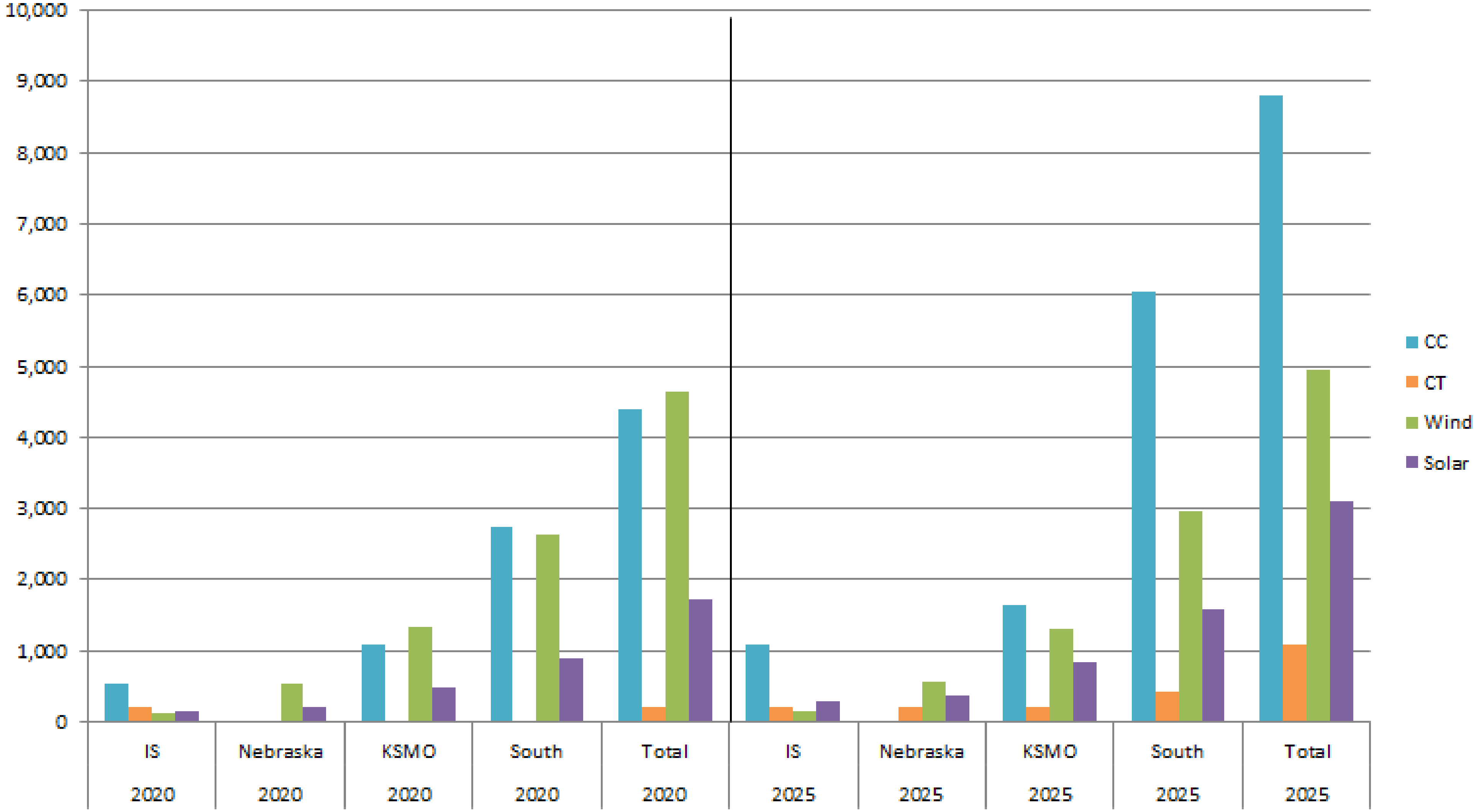
Future 1 Resource Planning Simulations

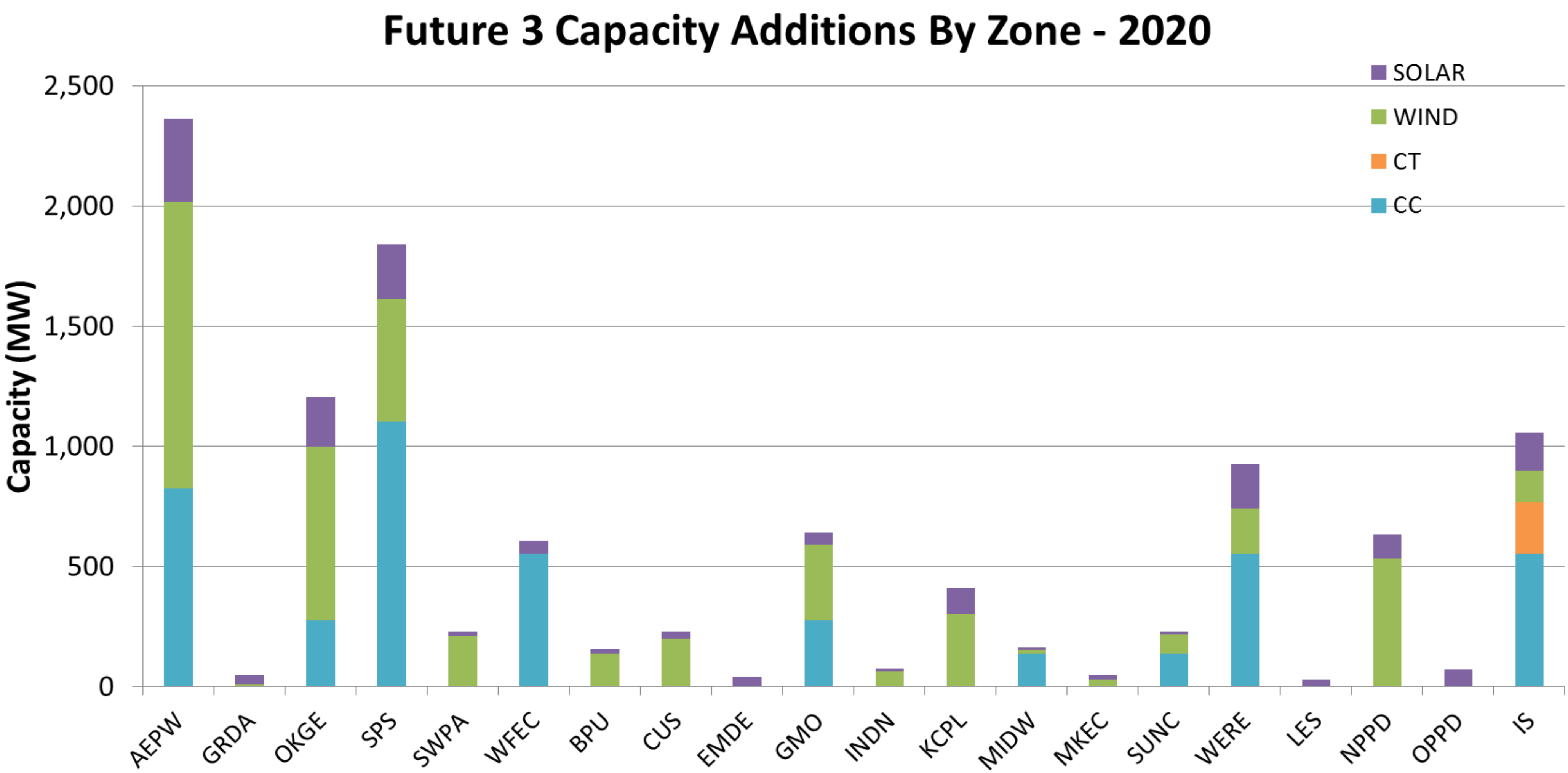
- Model changes from F3
  - Regional structure
    - IS, Nebraska, KSMO, South combined
    - Removed sub-regional transactions
    - Assumes no interregional interchange
  - Adjusted utility scale solar units (3.1 GW in 2025)
    - Removed rooftop solar
  - Utility scale solar units (3.1 GW in 2025)
  - Additional wind units (4.9 GW in 2025)

Future 1 Resource Additions

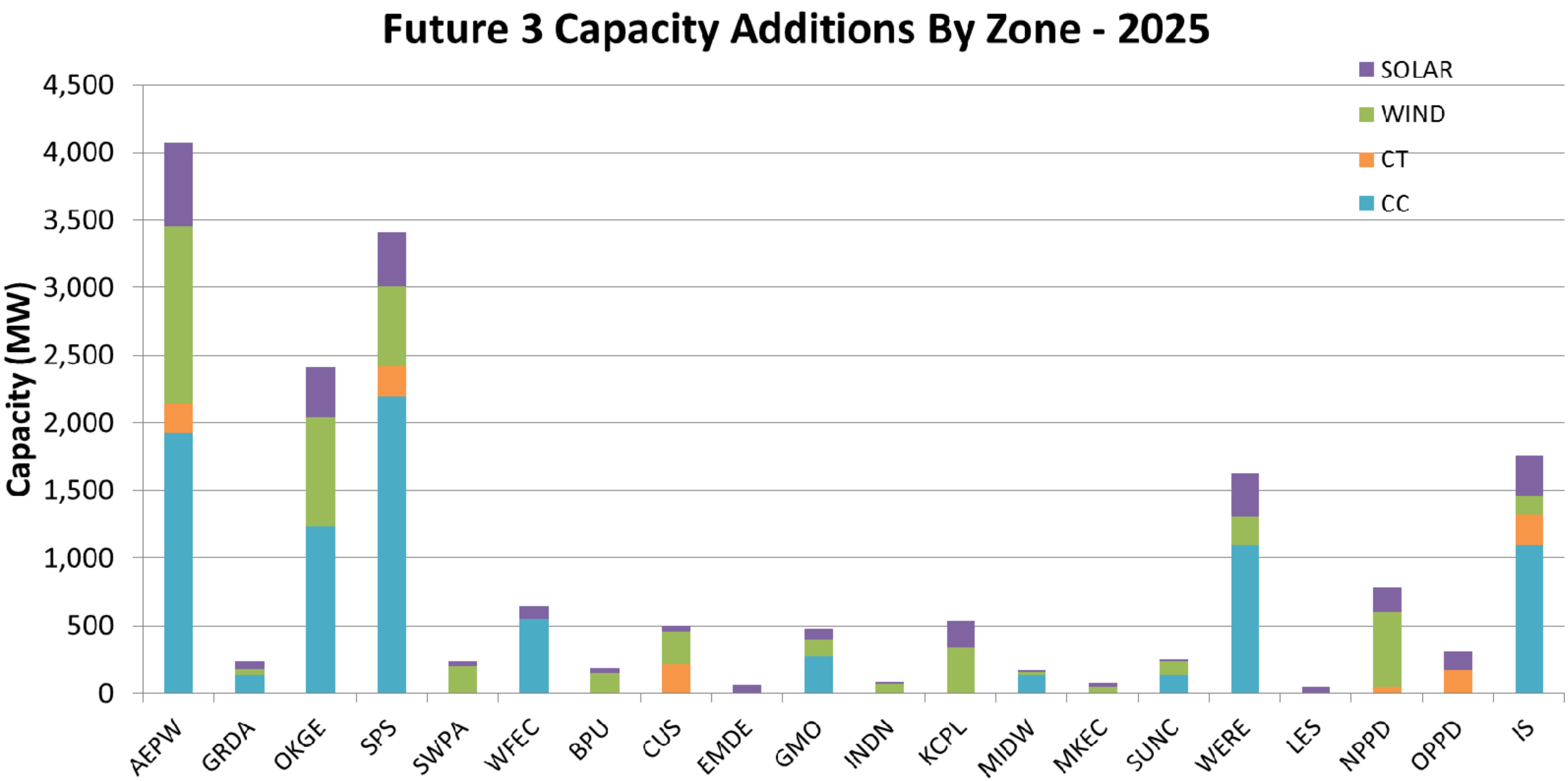
Cumulative Additions

Year	Conventional MW	Renewable MW	Total MW
2020	4,616	6,369	10,985
2025	9,880	8,045	17,925



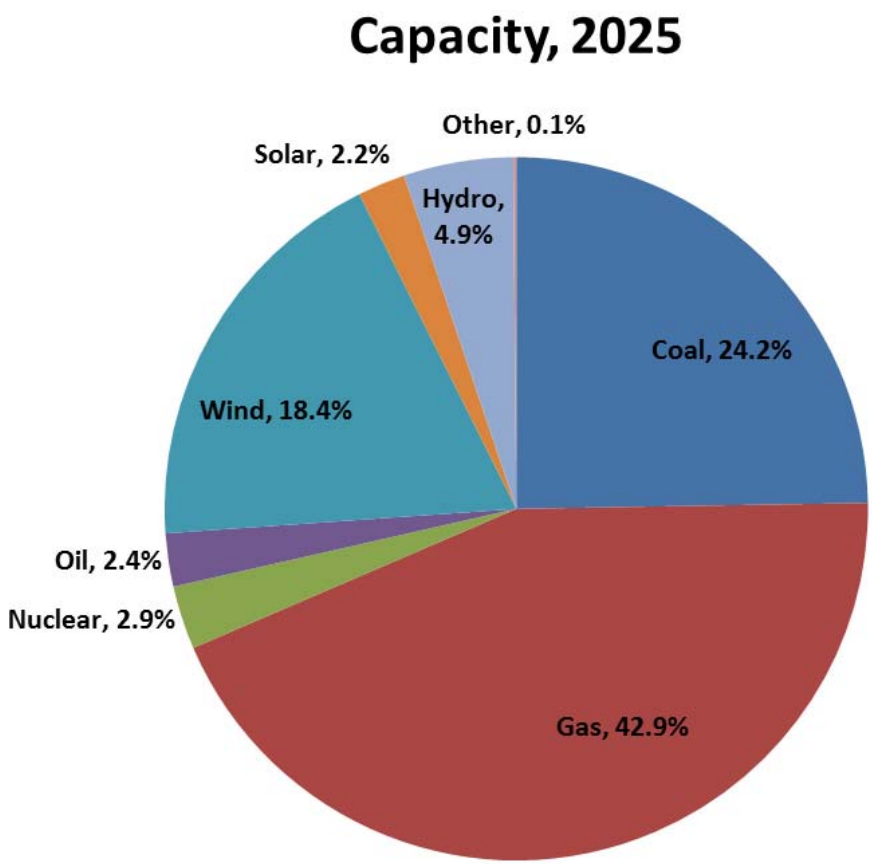


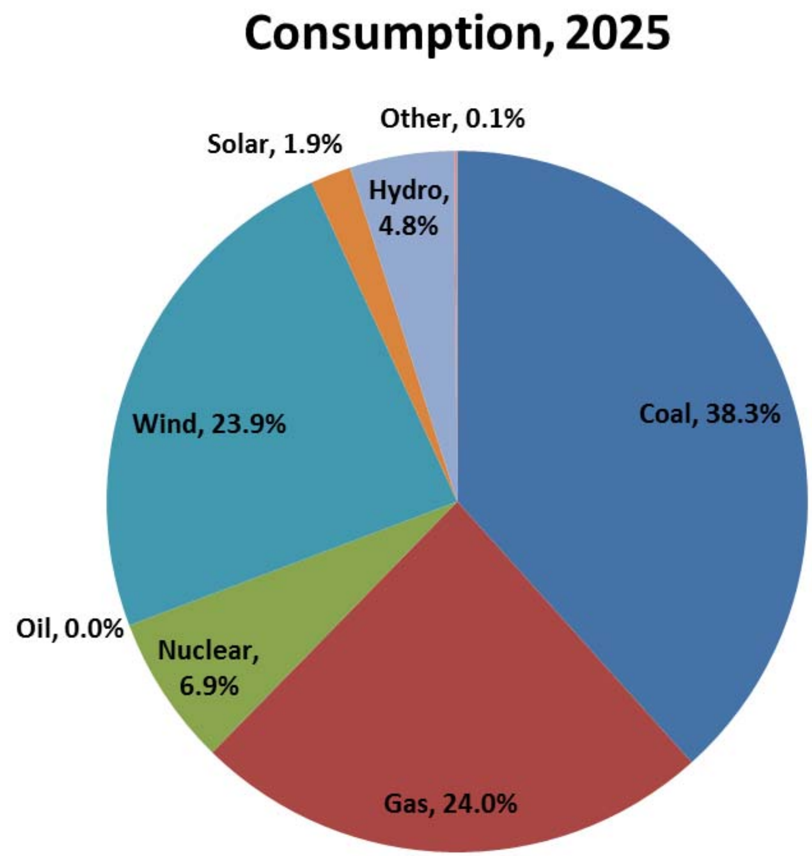
Future 3 Capacity Additions By Zone - 2020
Capacity (MW)
2,500
2,000
1,500
1,000
500
0
SOLAR
WIND
CT
CC
AEPW
GRDA
OKGE
SPS
SWPA
WFEC
BPU
CUS
EMDE
GMO
INDN
KCPL
MIDW
MKEC
SUNC
WERE
LES
NPPD
OPPD
IS



Future 3 Capacity Additions By Zone - 2025
SOLAR
WIND
CT
CC
Capacity (MW)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
AEPW
GRDA
OKGE
SPS
SWPA
WFEC
BPU
CUS
EMDE
GMO
INDN
KCPL
MIDW
MKEC
SUNC
WERE
LES
NPPD
OPPD
IS

Future 1 Resource Mix





F1 Unit Capacity Factors

- Capacity factors by unit are posted on TrueShare
  - ITP – Confidential… -> 2017 ITP10 -> Resource Planning Data ->

CF	2020	2025	2035
Coal	62.8%	58.1%	36.0%
CC	36.8%	43.3%	58.0%
New CC	50.0%	57.1%	70.1%
CT Gas	1.0%	0.8%	0.5%
Nuclear	89.4%	89.3%	89.6%
Oil	0.0%	0.0%	0.0%
Wind	47.8%	47.8%	46.9%
Solar	31.8%	31.8%	31.8%
Hydro	35.7%	35.7%	35.7%
Other	40.2%	40.2%	49.8%

Future 1 EGU Emissions

RCAR Modeling Issues

October 22nd, 2015

Josh Ross

SPP Southwest Power Pool

Overview

- Issues encountered in Dec 2014 – Feb 2015
- ESWG approved approaches to addressing these issues in February
  - Trapped Gen: Hybrid approach
  - Load Pockets: Add CTs in base case
  - Since then, RCAR II has been given more time by RARTF
- Today: <u>seeking approval</u> for how these issues will be addressed in RCAR II

LOAD POCKETS

Load Pockets Approaches

- Status Quo
  - Results in excessive emergency gen, breaching constraints in base case, leading to inflated APC benefit
- Add CTs in base case (recommended)
  - Approved by ESWG in February
- Others
  - Add projects to base case models
  - Add CCs and CTs
  - Account for capital costs of new resources

Add CTs in base case

Add CT resources in the load pocket for the base case only

Pros:

- Addresses the Load Pocket issue; results are more reasonable than the Status Quo
- Technically sound – in this theoretical base case situation, adding resources would be most reasonable way to serve remote load
- Shows the load pocket upgrades having some economic benefit, which is expected

Cons:

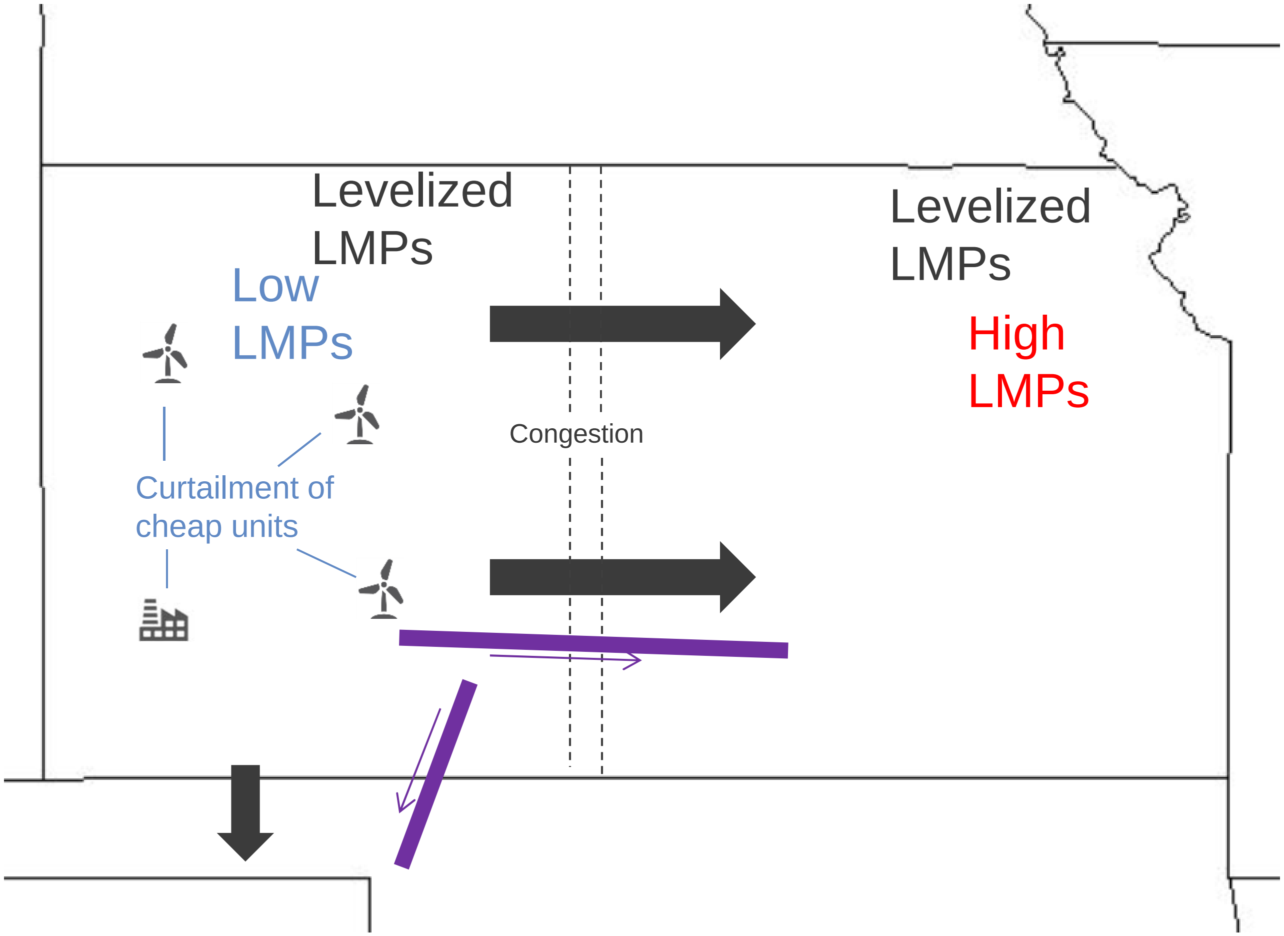
- Inconsistent generation assumptions between base and change cases

Recommendation

- Staff recommends to add CTs in the base case as needed to address the Load Pockets modeling issue
  - Previously approved by ESWG
  - Technically sound
    - Adding resources is reasonable way to serve remote load
  - Addresses the issue – results appear more reasonable than Status Quo

TRAPPED GENERATION POCKETS

Trapped Generation Pockets



Load and gen are identical between base and change cases

Base Case

Lack of transmission ->
Curtailment of cheap units ->
Large LMP differential ->
Low LMP purchase prices in west KS ->
Low APC

Change Case

Robust transmission ->
Cheap units generate more->
Levelized LMPs ->
Moderate LMP purchase prices in west KS ->
Moderate APC

Under current approach:

- APC savings is negative for west KS zones, even though the new transmission unleashes more of their cheap generation.
- Conversely, APC savings for zones to the east will be inflated due to artificially high LMPs in the base case

Trapped Generation Pockets Approaches

- Status Quo
  – Producing problematic zonal APC results with base case that is transmission deficient
- Hybrid Approach
  – Approved by ESWG in February
- Move Wind to Zonal Load Centers
  – Staff recommendation

Hybrid Approach

Regional benefit = Regional benefit of **Status Quo**

Zonal allocation factors = Zonal allocation factors from runs with HWBW wind removed

Pros:

- Addresses the Trapped Generation issue; results are more reasonable than the Status Quo
- Easy to implement

Cons:

- Zonal benefits calculation is still problematic
  - Example on next slide
- Mixing approaches/mixing results can produce unexpected and problematic final results (ABB)

Hybrid Approach Example

	Status Quo	Remove Wind	Hybrid*
Regional Benefit ($M)	$100	$500	$100
Zone A Benefit ($M)	$20	$100	$20
Zone B Benefit ($M)	($10)	$40	$8
Zone C Benefit ($M)	$50	$50	$10

$^{*}Hybrid_{zone\ X} = Status\ Quo_{regional} * (Remove\ Wind_{zone\ X} / Remove\ Wind_{regional})$

- Numbers are made up for example purposes
- Zone A – Benefit is not any more or less reasonable with hybrid approach vs. status quo
- Zone B – Representative of zone in a trapped generation pocket. Benefit is more reasonable with hybrid approach vs. status quo
- Zone C – Nowhere near any of the trapped generation or wind that is removed. **Their benefit is less reasonable with hybrid approach (should be ~$50M).**

Move Wind to Zonal Load Centers

Wind that is dependent on the HWBW transmission is moved the host zone's largest load center (~5.0 GW). Same capacity, but decreased capacity factors.

Pros:

- Logic behind the approach is technically sound.
  - Wind would not be developed at these sites if not for the HWBW transmission
  - Zones would still need to meet their public policy mandates/goals, and this allows that to happen
  - Accounts for the higher CFs for wind that would be achieved in a change case by locating wind remotely, with transmission to deliver it to load
- Generation assumptions are consistent between base and change cases (except for siting), as installed capacity is equal between the two

Cons:

- More complexity in determining where to locate the wind at load centers, and vet
  - Sited such that new congestion at the load center is minimal or avoided; add close to load, and divide into smaller units if needed
- Could mask expected base case congestion due to power flowing into a load center (although we're not noticing this in test results)

ABB Feedback

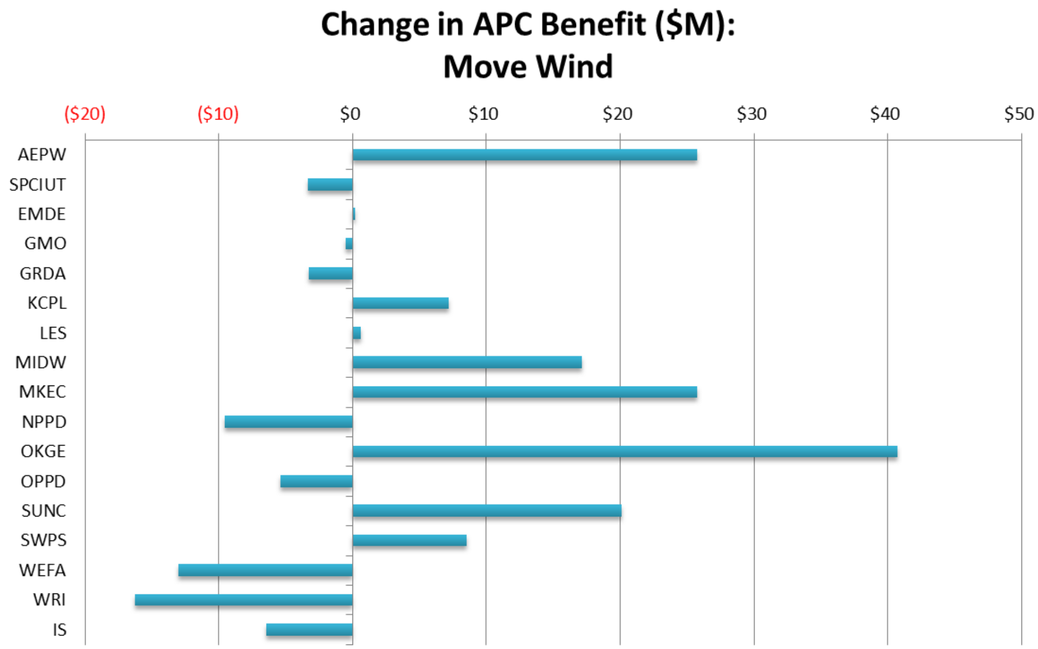
- Moving Wind to Zonal Load Centers (or removing it altogether) is preferable modeling approach
  – Moving wind also accounts for companies need to meet renewable mandates/goals
- Hybrid approach is less preferable
  – Combining approaches, or combining results from different runs to determine benefits, is asking for trouble, and can lead to final results that are less sound

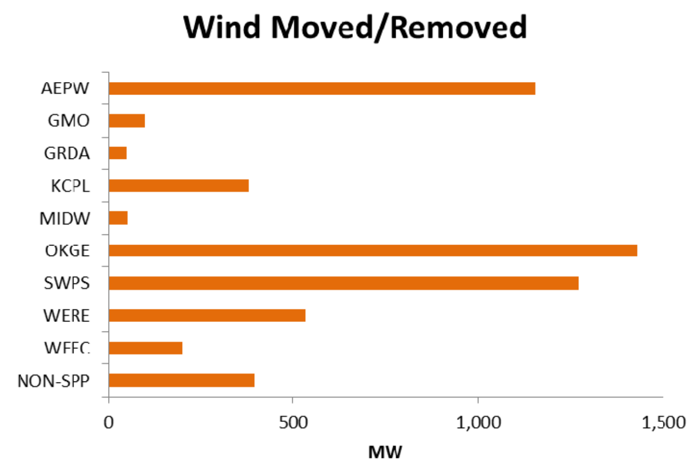
Recommendation

- Staff recommends the option to Move Wind to Zonal Load Centers for addressing the Trapped Generation Pockets modeling issue
  - Addresses the issue
  - ABB thinks this is the more reasonable approach
  - Technically sound alternative
    - Wind would not be developed at these sites if not for the HWBW transmission
    - Public policy mandates/goals
    - Accounts for higher CFs for wind that can be achieved by locating wind more remotely with transmission to deliver it to load

APPENDIX

Move Wind to Zonal Load Centers

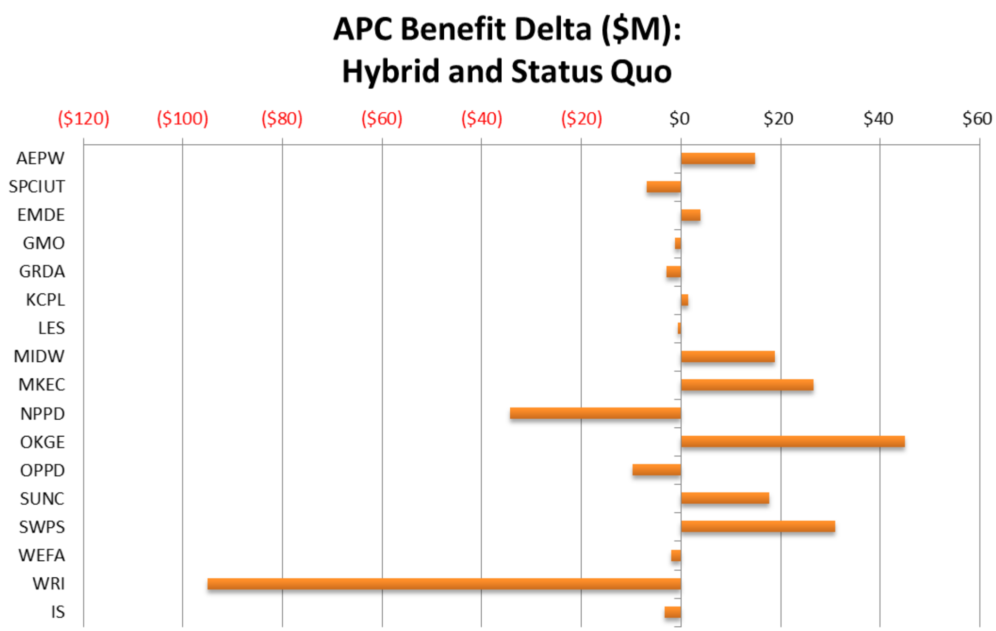


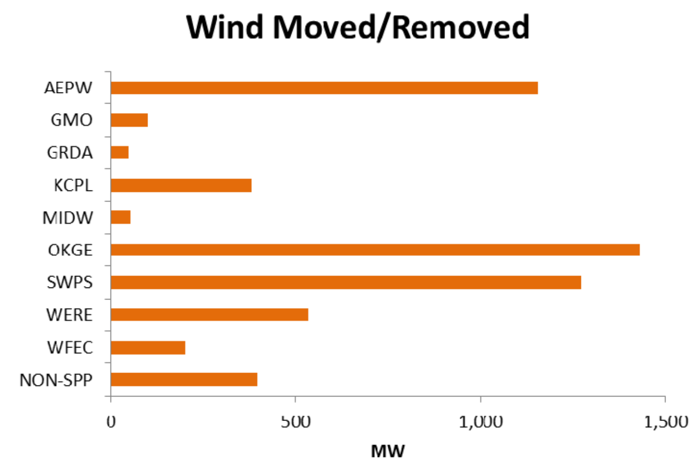


Graph compares APC benefit with this approach to APC benefit obtained with Status Quo approach. Positive means benefit is higher with this approach. 2034 year only.

Results based on preliminary RCAR II models built on 2015 ITP10 models; final RCAR II models will be built on 2017 ITP10 models.

Hybrid Approach



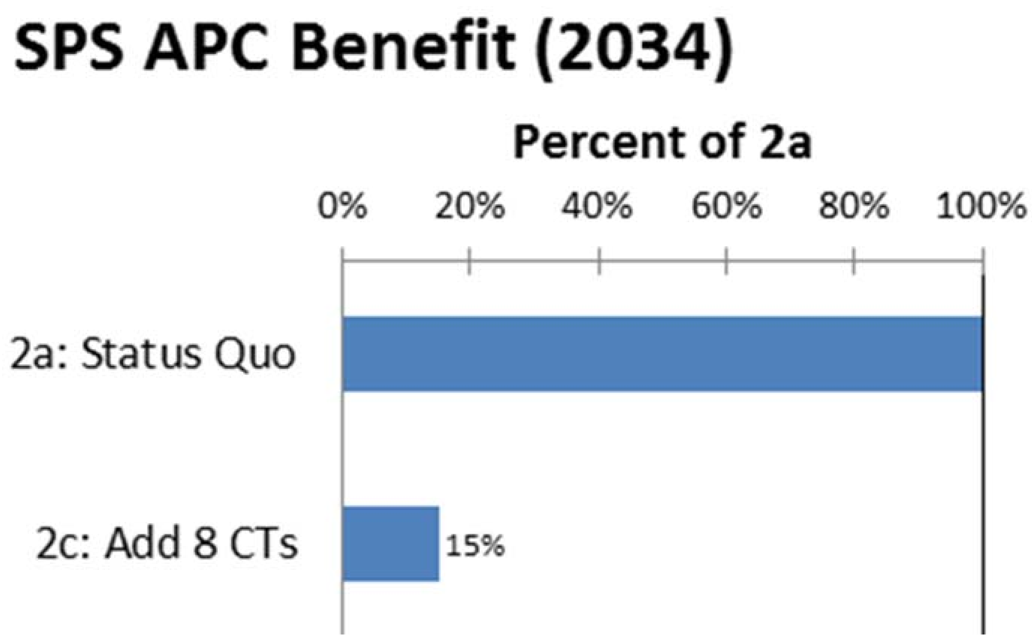


Graph compares APC benefit with this approach to APC benefit obtained with Status Quo approach. Positive means benefit is higher with this approach. 2034 year only.

Results based on preliminary RCAR II models built on 2015 ITP10 models; final RCAR II models will be built on 2017 ITP10 models.

Load Pockets – Adding CTs to base case

- Adding CTs to the base case effectively addresses the emergency generation and breaching constraint problems



2016 ESWG Meeting Schedule

October 22nd, 2015

Kelsey Allen

Southwest Power Pool

Proposed Schedule – 1st Semester

January

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

February

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29					

March

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

April

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

May

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

June

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Month	Day	Location
January	21	?
February	17-18	Kansas City/St. Louis
March	17	Dallas
April	21	?
May	18-19	Omaha
June	16	Dallas

BOD
RSC
MOPC
PCWG
SPCWG

CAWG
TWG
ESWG
MDWG

SSC
SPC
GWG

SPP Holiday

Combination Dates
ESWG/TWG
ESWG/SSC
ESWG/PCWG
SSC/CAWG

Proposed Schedule – 2nd Semester

July

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

October

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

August

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

November

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

September

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

December

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Month	Day	Location
July	21	?
August	17-18	Billings/Bismarck
September	15	Dallas
October	20	?
November	16-17	Little Rock
December	8	Dallas

- BOD
- RSC
- MOPC
- PCWG
- SPCWG
- CAWG
- TWG
- ESWG
- MDWG
- SSC
- SPC
- GWG
- SPP Holiday

Combination Dates

- ESWG/TWG
- ESWG/SSC
- ESWG/PCWG
- SSC/CAWG