**Southwest Power Pool**

**ECONOMIC STUDIES WORKING GROUP**

**September 13th - 14th, 2017**

**8th Floor AEP Offices – Dallas, TX**

**• SUMMARY OF ACTIONS TAKEN •**

1. Approved the minutes from the August 16-17th, 2017 meeting in Denver.
2. Approved the inclusion of a reciprocating engine prototype using an average of the Lazard (high cost and low cost) data, with a 50 MW installation increment.
3. Approved using a 20% capacity accreditation on new wind, with a cap for renewables of 12% of the total load.
4. Approved using a 70% capacity accreditation on new utility scale solar, with a cap for renewables of 12% of the total load.
5. Approved assigning must-run designations to co-generation and nuclear units only, unless an exception is requested with pass 2 of the Gen review (by November 17th, 2017), and approved by the ESWG.

**Southwest Power Pool**

**ECONOMIC STUDIES WORKING GROUP**

**September 13-14th, 2017**

**8th Floor AEP Office – Dallas, TX**

**• 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 8:00a.m., welcomed those in attendance, and asked for introductions.

There were 22 in-person participants and 51 web conference participants, representing 15 of 15 ESWG members. (Attachment 1 – September 13th-14th, 2017 Attendance List)

### Agenda Item 1b – Receipt of Proxies

Alan Myers (ITC) asked for any proxy statements; three proxies were identified. (Attachment 2 – Proxy Statements)

- Eric Burkey (SCMCN) proxy for Jody Holland (SCMCN) on September 14th
- Wayne Penrod (SUNC) proxy for Al Tamimi (SUNC) both days
- Josie Daggett (WAPA) proxy for Gayle Nansel (WAPA) on September 13th
- Chris Colson (WAPA) proxy for Gayle Nansel (WAPA) on September 14th

### Agenda Item 1c – Review of Agenda

Chair Alan Myers (ITC) presented the agenda for review and asked for any additions or corrections. (Attachment 3 – August 16th - 17th, 2017 ESWG Agenda).

> **Leon Howell (OGE) made a motion; seconded by Kurt Stradley (LES) to adopt the agenda. The motion was approved unanimously.**

## Agenda Item 2 – 2019 ITP Futures

Amber Greb (SPP Staff) presented three possible futures for the 2019 ITP study to the ESWG. The futures presented; reference case, emerging technologies, and a renewables future were narrowed down from a larger list during the August meeting. Amber reminded the group that the goal is to have a recommendation for the SPC during their meeting on October 20th. Amber began by describing each future and the drivers behind them. After presenting an overview for each future, Amber brought up an assumptions document listing some of the inputs that make up each future. The ESWG reviewed the document and discussed what would be an appropriate lifetime for age-based retirements of fossil fuel generation. The group came to the conclusion that units over age 60 in a study year would be retired, with the exception that in the reference case, stakeholders will have the opportunity to review the retirements list and request a waiver (subject to ESWG approval). In the renewable future, the retirement age was lowered to units over 50 years. Stakeholders discussed the carbon adder in the emerging technologies future, and ultimately decided that there was not a driver in this future to trigger the adder. The carbon adder will only be considered for the renewables future. Demand response, distributed generation, and energy efficiency will be included in the stakeholder submitted load forecasts. Staff proposed to model distributed generation and load separately, however ESWG members stated that they can't provide this information in the way proposed by Staff. The emerging technology future would include 300 and 500 MW of additional distributed generation over the reference case, in years 5 and 10 respectively. In all three futures, the ESWG thought that we would expect to see increased capacity factors in new or re-powered wind farms. Jason Schmidt (NextEra) mentioned that they are seeing a 10-15% increase today. The group ran out of time to finalize the discussion and make a recommendation to the SPC. Staff will send out a doodle poll to set up a

conference call to finish the discussion. (Attachment 4 – 2019 ITP Futures) (Attachment 4 – Future Drivers Discussion)

**Agenda Item 3 – Review of Past Action Items**

SPP Staff confirmed with the RARTF secretary that RARTF action items 165, 166, and 167 should be removed from the ESWG action items list. The RARTF is still discussing the future of the RCAR. The ESWG determined that action item 172, synergies of powerflow and economic generation should be an overarching process for stakeholders and staff, but that it doesn't have an actual deliverable and therefore should be removed from the action items list. Amber Greb informed the group that item 184 should be completed in November 2017, and we are making progress towards the other items on the list. (Attachment 5 – Past Action Items)

**Agenda Item 4 – Consent Agenda**

The consent agenda included the following items:

Meeting Minutes – August 16-17th, 2017 (Attachment 6 – August 16-17th, 2017 ESWG Minutes-revised)

Alan Myers (ITC Great Plains) asked if any items should be removed from the consent agenda. There was a minor edit to the posted minutes, so the meeting minutes from August 16-17th were removed from the consent agenda for discussion. The group had no issues with the edits.

**Kurt Stradley (LES) made a motion; seconded by Tim Owens (NPPD) to approve the August minutes as amended. The motion was approved unanimously.**

**Agenda Item 5 – 2019 ITP Schedule**

Juliano Freitas (SPP Staff) gave an overview of the 2019 ITP draft schedule. He presented a flow chart showing milestone dates and dependencies. SPP Staff is intending to bring a final schedule to the ESWG in October, including the final dates for each milestone, as well the time and dates for members to review and approve items. Staff is evaluating the possibility of extending the two windows designated for members to submit estimated costs for projects. (Attachment 7 – 2019 ITP Schedule)

**Agenda Item 6 – 2019 ITP Load and Generation Review**

Nikki Roberts (SPP Staff) presented an update on the progress of the load and generation review milestones for the 2019 ITP Study. Stakeholders were provided comparisons of peak loads submitted for planning models, the dates the load and generation review spreadsheets were posted to TrueShare, when feedback is due, and expectations regarding the ABB data to be reviewed during the generation review feedback period. Nikki reminded stakeholders that the RAR/Waiver request form would be sent out the following day (September 15th). Tim Owens (NPPD) asked for SPP staff to provide information on the auxiliary load assumptions in the planning powerflow models, and how maximum capacities were updated in the generation review workbook to reflect auxiliary loads. Staff stated they would follow up with stakeholders and try to indicate where changes have been made to the generator maximum capacities. Staff informed the group that the last chance for Stakeholders to make changes to load and generation review is November 17th, 2017. Leon Howell (OGE) asked for SPP staff to provide a comparison of load submitted in the planning models versus historical load for the ESWG to review. Staff intends to bring this comparison to the ESWG at the October meeting. (Attachment 8 - 2019 ITP Load and Generation Review)

**ACTION ITEM:** SPP Staff to bring a comparison of load submitted in the planning models versus historical load to the ESWG for review.

## Agenda Item 7 – 2019 ITP Scope Items

### Agenda Item 7a – Renewable Resource Expansion Plan

Chris Jamieson (SPP Staff) presented on the renewable resource expansion plan. Chris went over the basic ideas that guided his presentation. Past studies have underestimated wind expansion, wind and solar costs are expected to continue to decline into the future, higher growth is expected until 2020 to capitalize on the PTC and ITC incentives. Chris showed historical trends and future wind announcements. The ESWG had a good debate about the appropriate amount of wind to include in the reference case. There were some that the reference case should only include the currently installed wind of 18 GW. Bennie Weeks (Xcel/SPS) stated that SPS will not be submitting a resource addition request for the wind they have recently announced. That any associated upgrades will be paid for by them. Others in the room felt that the goal of the reference case should be to model what is expected to be on our system in years 2, 5 and 10; and that cost allocation should be left out of that decision. Juliano Freitas (SPP Staff) reminded the group that during the GI process, upgrades associated with the additional wind would be identified. The ITP process will only identify additional downstream issues. To illustrate his point, he mentioned that in the 2017 ITP10, the total cost of the GOF's in the model was more expensive than the final cost of the approved portfolio. The ESWG took a straw poll to determine where the group was headed, the results showed that the majority of the group does want add renewables to the reference case over what is currently installed. Due to time limitation the group deferred the rest of the conversation to a conference call to be scheduled in the next two weeks. Alan Myers (ITC) challenges stakeholders to really think about what amount of renewables would be appropriate and to bring proposals to the call. (Attachment 9 – Renewable Resource Expansion Plan)

### Agenda Item 7b – Conventional Generation Prototypes

Amber Greb (SPP Staff) provided an updated presentation on conventional generation prototypes. Staff added prototype information for reciprocating engines to the generation table. Four options were included; a high cost and low cost gas reciprocating engine based on Lazard data, and a high cost and low cost option developed by stakeholders. The group felt that it was important to use publicly available data for our prototype options. (Attachment 10 – Conventional generation prototypes)

**Leon Howell (OGE) made a motion; seconded by Wayne Penrod (SUNC) to include a reciprocating engine prototype using an average of the Lazard (high cost and low cost) data, with a 50 MW installation increment. The motion was approved unanimously.**

### Agenda Item 7c – Renewable Accreditation

Chris Jamieson (SPP Staff) continued discussions on renewable accreditation with the ESWG. Chris suggested that wind and solar that would normally default to 0% to 10% by the SPP planning criteria should be adjusted to an accreditation of 20%. He also suggested that non-designated renewables should be set at 20% accreditation. Stakeholders were not comfortable with non-designated renewables getting a 20% accreditation, stating that we shouldn't treat them any differently that non-renewables. (Attachment 11 – Renewable Accreditation)

**Leon Howell (OGE) made a motion; seconded by Bennie Weeks (Xcel/SPS) to account for 20% capacity accreditation on new wind, with a cap for renewables of 12% of the total load. The motion was approved unanimously.**

**Leon Howell (OGE) made a motion; seconded by Bethany King (EDE) to account for 70% capacity accreditation on new utility scale solar, with a cap for renewables of 12% of the total load. The motion was approved unanimously.**

### Agenda Item 7d – Must Run Criteria

Nikki Roberts (SPP Staff) reviewed Must Run Criteria. SPP staff recommended assigning must-run designations to co-generations and nuclear units only. Staff offered the option of potentially implementing must run designations as a sensitivity during the project selection milestone. Chris Colson (WAPA)

voiced his concern with must run not being assigned to hydro units. Steve Gaw (Wind Coalition) questioned why this would be an issue since we do not have the minimum run time start issue with hydro units. SPP Staff is working on adjusting how hydro is dispatched, and it will be discussed at a later date. Zac Hager (OGE) stated we need rationale for assigned must run designations to nuclear and co-generation units only, as to not inadvertently overlook any units that meet the same criteria as nuclear and co-generation units. (Attachment 12 – Must Run Criteria)

**Leon Howell (OGE) made a motion; seconded by Natasha Henderson (GSEC) to assign must-run designations to co-generation and nuclear units only, unless an exception is requested with pass 2 of the Gen review (by November 17th, 2017), and approved by the ESWG. The motion carries with one abstention, Wayne Penrod (SUNC).**

**Agenda Item 7e – Operational Project Evaluation**

Will Tootle (SPP Staff) reviewed SPP Staff's proposed language for Operational Needs Solution Evaluation (Reliability and Economic). The ESWG has questions about the 40 days to be used to calculate an average production cost savings. Will explained to the group that the Value of Transmission study was performed using a selection of 40 days with various operating conditions. The ESWG requested the list of days, and would like more time to think about the topic. Staff will bring this back in October for approval. (Attachment 13 - Operational Project Evaluation)

**Agenda Item 7f – Stability Analysis**

Chris Jamieson (SPP Staff) updated the ESWG on the scope development for the stability assessment. Staff is currently working with the TWG, the main decision point is when to perform the stability assessment. Historically it has been performed at the end of the study for informational purposes. The TWG is discussing the option of moving it to right after the constraint assessment. Staff will bring the topic back to the ESWG as we begin to develop the scope language.

**Agenda Item 8 – Siting Manual Action Plan**

[This item was not covered in the allotted time]

**Agenda Item 9 – Transmission Outage Metric**

[This item was not covered in the allotted time]

**Agenda Item 10 – Renewable Pricing**

[This item was not covered in the allotted time]

**Agenda Item 11 – GlobalScape Migration**

[This item was not covered in the allotted time]

**Agenda Item 12 – 2018 ESWG Meeting Schedule**

Amber Greb (SPP Staff) showed the ESWG the proposed dates for meeting in 2018. The December meeting is right before Christmas, Amber will send out a doodle poll and try to move this meeting. Bennie Weeks (Xcel/SPS) volunteered to look for meeting space in Denver for the May meeting and Don Frerking (KCPL) volunteered to look for meeting space in Kansas City for the April meeting. Staff will bring back the proposed calendar to the October meeting. (Attachment 14 – 2018 ESWG Meeting Schedule)

**Closing Items**

Vice-Chair Tim Owens (NPPD) requested other items meriting discussion.

The meeting was adjourned at 2:40 PM.

Respectfully Submitted,

Amber Greb

ESWG Secretary

| Participant | Name | Email |
|---|---|---|
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| 20 | Mounika Kurra (Quanta) | mkurra@quanta-technology.com |
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| 10 | Pat Hayes | phayes@lspower.com |
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| | | |
|---|---|---|
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| 15 | Steve Gaw | rsgaw1@gmail.com |
| 23 | Steve Hohman | shohman@oppd.com |
| 45 | Will Tootle | wtootle@spp.org |
| 28 | Yan Du | ydu@lspower.com |
| | Amber Greb | SPP |
| | Alan Myers | ITC |
| | Anita Sharma | AEP |
| | Bethany King | EDE |
| | Calvin Daniels | WFEC |
| | Eric Burkey | SCMCN |
| | Juliano Freitas | SPP |
| | Jarrod Wolford | NTEC |
| | John Fernandes | Invenergy |
| | Wayne Penrod | SUNC |
| | Michael Wegner | ITC |
| | Tim Owens | NPPD |
| | Kurt Stradley | LES |
| | Leon Howell | OGE |
| | Zac Hager | OGE |
| | Tim Hall | Southern Power |
| | Jason Davis | SPP |

SPP Southwest Power Pool

**Southwest Power Pool, Inc.**

**ECONOMIC STUDIES WORKING GROUP**

~~August 16-17, 2017~~ Sept. 13

~~Grand Hyatt Denver – Denver, CO~~

AEP Dallas

**• ATTENDANCE LIST •**

| Name | Company |
|---|---|
| Amber Gray | SPP |
| JULIANA FREITAS | SPP |
| Leon Howell | OGE |
| Zac Hager | OGE |
| Bethany King | EDE |
| DON FRERKING | MEP+L |
| Tim Hall | Southern Power |
| Calvin Daniels | WFEC |
| Meena Thomas | Texas PUC |
| Tim Owens | NPPD |
| KURT STRADLEY | LES |
| Michael Wegner | ITC |
| Alan Myers | ITC |
| Jarrod Walford | NTEC |
| Erik Burkey | SCMCN |
| WAYNE PENROD | SunFlower |
| John Fernandes | Invenergy |
| Anita Sharma | AEP |

SPP Southwest Power Pool

**Southwest Power Pool, Inc.**

**ECONOMIC STUDIES WORKING GROUP**

~~August 16-17~~ Sept. 14, 2017

~~Grand Hyatt Denver – Denver, CO~~ AEP Dallas

**• ATTENDANCE LIST •**

| Name | Company |
|---|---|
| Wayne Penrod | wpenrod@sunflower.net Sunflower Electric |
| Michael Wegner | ITC |
| Tim Owens | NPPD |
| Kurt Strasser | LES |
| Steve Gaer | Wind Coalition |
| Eric Burkey | SCMCN |
| Jarred Wolford | NTEC |
| Juliano Freitas | SPP |
| Leon Howell | OTE |
| Zac Hager | OGE |
| Bethany King | EDE |
| Anita Sharma | AEP |
| Meena Thomas | Texas PUC |
| Calvin Daniels | WFEC |
| John Fernandes | Invenergy |
| Alan Myers | ITC |
| Bennie Weeks | Xcel/SPS |
| Natasha Henderson | OSEC |

**1.** Eric Burkey (SCMCN) proxy for Jody Holland (SCMCN)

**From:** Jody Holland [mailto:JHolland@gridliance.com]
**Sent:** Thursday, September 14, 2017 9:34 AM
**To:** Alan Myers (amyers@itcgreatplains.com) <amyers@itcgreatplains.com>
**Cc:** Eric Burkey <EBurkey@gridliance.com>
**Subject:** [EXT] proxy to Eric

Alan,
I've given my proxy to Eric. Thanks.

**Jody Holland**
Vice President, Planning & Engineering
South Central MCN, LLC
Midcontinent MCN, LLC
MidAtlantic MCN, LLC
Gridliance West Transco, LLC
Cell: 501-681-5950
jholland@gridliance.com

**2.** Wayne Penrod (SUNC) proxy for Al Tamimi (SUNC)

From: Tamimi, Al
Sent: Wednesday, September 13, 2017 9:20 AM
To: Myers, Alan <amyers@itctransco.com>; Amber Greb <agreb@spp.org>
Cc: Penrod, Wayne <wpenrod@sunflower.net>
Subject: **External Email** Proxy

Wayne Pernod has my proxy for today's ESWG meeting. I am charging the GIITF meeting today and can't get on the ESWG

**From:** Tamimi, Al
**Sent:** Thursday, September 14, 2017 10:51 AM
**To:** Myers, Alan <amyers@itctransco.com>
**Cc:** Amber Greb <agreb@spp.org>; Penrod, Wayne <wpenrod@sunflower.net>
**Subject:** **External Email** Wayne Penrod Has my proxy for the rest of Today's ESWG meeting

**Al Tamimi, Ph.D., P.E.**
Sunflower Electric Power Corporation
V.P. Transmission Planning & Policy
Hays, KS 67601
785-623-3336
atamimi@sunflower.net

3. Josie Daggett (WAPA) proxy for Gayle Nansel (WAPA) on September 13th
4. Chris Colson (WAPA) proxy for Gayle Nansel (WAPA) on September 14th.

**From:** Nansel, Gayle
**Sent:** Tuesday, September 12, 2017 9:54 AM
**To:** Kelsey Allen <kallen@spp.org>
**Cc:** Josephine Daggett WAPA <Daggett@WAPA.GOV>; Amber Greb <agreb@spp.org>; Myers, Alan <amyers@itctransco.com>; Chris Colson WAPA <Colson@WAPA.GOV>
**Subject:** RE: [EXTERNAL] **External Email** Economic Studies Working Group 9/13/17 Face to Face Meeting Registration

Kelsey:

Update on my proxy for the coming ESWG meetings.

Josie Daggett proxy on 9/13
Chris Colson proxy on 9/14.

**Gayle R. Nansel | Transmission Planning Manager**
Western Area Power Administration | Upper Great Plains Region
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# ECONOMIC STUDIES WORKING GROUP

## September 13th - 14th, 2017

## 8th Floor AEP Offices – Dallas, TX

## • A G E N D A •

### *Wednesday 1:00pm – 5:00pm*

1. Administrative Items
    a. Call to Order, Introductions ..... Alan Myers (5 minutes)
    b. Receipt of Proxies ..... Amber Greb (1 minute)
    c. Review of Agenda[1] ..... Alan Myers (1 minute)
2. 2019 ITP Futures ..... Amber Greb (4 hours)

### *Thursday 8:00am – 3:00pm*

3. Review of Past Action Items[1] ..... Amber Greb (15 minutes)
4. Consent Agenda ..... Alan Myers (1 minute)
    a. Meeting Minutes – August 16-17th, 2017
5. 2019 ITP Schedule[1] ..... Juliano Freitas (15 minutes)
6. 2019 ITP Load and Generation Review[1] ..... Nikki Roberts (15 minutes)
7. 2019 ITP Scope Items[1] ..... SPP Staff (165 minutes)
    a. Renewable Resource Expansion Plan[1] (Chris Jamieson) ..... (60 minutes)
    b. Conventional Generation Prototypes[1] (Amber Greb) ..... (30 minutes)
    c. Renewable Accreditiation[1] (Chris Jamieson) ..... (15 minutes)
    d. Must Run Criteria[1] (Nikki Roberts) ..... (15 minutes)
    e. Operational Project Evaluation[1] (Will Tootle) ..... (30 minutes)
    f. Stability Analysis (Chris Jamieson) ..... (15 minutes)
8. Siting Manual Action Plan[1] ..... Chris Jamieson (30 Minutes)
9. Transmission Outage Metric[1] ..... Antonio Barber (30 minutes)

[1] Background Material Included

10. Renewable Pricing[1] ..... Chris Jamieson (15 minutes)
11. GlobalScape Migration[1] ..... Amber Greb (30 minutes)
12. 2018 ESWG Meeting Schedule[1] ..... All (30 minutes)
13. Closing Items ..... All (5 minutes)
    a. Summary of Action Items (Amber Greb)
    b. Future Meetings
        i. October 12th, 2017: 8th Floor AEP Offices, Dallas, TX
        ii. November 8th-9th, 2017: SPP Corporate Offices, Little Rock, AR
        iii. December 14th, 2017: 8th Floor AEP Offices, Dallas, TX
        iv. January 11th, 2018: 8th or 41st Floor AEP Office, Dallas, TX


SPP
Southwest
Power Pool
HELPING OUR MEMBERS WORK TOGETHER
TO KEEP THE LIGHTS ON... TODAY AND IN THE FUTURE.

# 2019 ITP Futures

Amber Greb

September 13, 2017

# 2019 ITP Futures

- Reference Case
- Emerging Technologies
- Renewables Future

# Reference Case

The reference case will reflect the current trends of the power system industry. Natural gas and coal prices follow current long term forecasts. In the reference case, we do not predict any new environmental regulations, coal and gas retirements may be based on average lifespan. Renewable generation (Solar and Wind) additions will exceed current Renewable Portfolio Standard Requirements (RPS) due to economics, public appeal, and the potential for future policy changes, as reflected in historical renewable installations.

- Demand and energy growth rates as submitted
- Natural gas prices are consistent with industry long-term reference forecasts
- Renewable additions continue following current and historical installation trends, while taking into consideration the expiration of the Production Tax Credits and also Investment Tax Credits
- Renewable resources continue to be competitive
- Coal and gas units may be retired reflecting average lifespan, 60+ plus years, subject to stakeholder input
- No nuclear unit retirements within study period

# Emerging Technologies

The emerging technology future is driven primarily by the assumption that electrical vehicles, distributed generation, demand response, energy efficiency, and storage will have a major impact on load and energy growth rates. Coal retirements may be based on average lifespan and economics. New technologies will increase the capacity factor at new or re-powered wind farms.

- Electric vehicles penetration will increase to the extent that energy requirements have noticeable growth, and a change in load shape
- Distributed generation will increase by 300 MW in year 5 and 500 MW in year 10
- Natural gas prices are consistent with industry long-term reference forecasts
- New technologies will increase the capacity factor at new or re-powered wind farms
- Coal units will be retired reflecting average lifespan and economics
- No nuclear unit retirements

# Renewables

The renewables future is driven primarily by the assumption that renewable additions will escalate beyond renewable policy standards and the historical installation trends. This is due to the need for new generation, technological advancement, carbon regulations, and fracking regulations. The additional renewable generation will create the opportunity for exports. Load and Energy growth rates are as submitted by stakeholders. Coal retirements may be based on average lifespan, economics and policy requirements. New technologies will increase the capacity factor at new or re-powered wind farms.

- Distributed generation consistent with reference case
- Natural gas prices rise due to regulations on fracking
- New technologies will increase the capacity factor at new or re-powered wind farms
- Coal units will be retired reflecting age, economics, and policy requirements
- Nuclear unit retirements based on economics
- Lines connecting SPP region to load centers out of our footprint
- Carbon Tax adder

# ESWG Recommendation

| Drivers | Description/Notes | Reference Case |
|---|---|---|
| Reference Case | 50/50 Load, Carbon at regulations, age based retirements, etc | |
| Electric vehicle market penetration | Increased usage of electric vehicles | |
| Lower electric rates | Duck Curve Effect | |
| Continued renewable development | | |
| Increased utility scale renewables | And possible energy storage development to serve EV load. (e.g., solar during the day, with higher loads due to EV charging at night) | |
| Net Metering Structures | Reduced load. Does it incentivize rooftop? | |
| Stresses to the Reference Case: | | |
| Accelerated Fleet | | |
| Load Growth | Demand and/or Energy growth | 50/50 |
| Flat load growth | | |
| High Gas Prices | | |
| High Renewables | Scope and Location being a large transmission driver. Some percentage of the additional wind will be flowing out of SPP, possibly in a similar ratio to what we see today. As such, we think it is reasonable to make this a base assumption.<br>Repowering Old Windfarms<br>Higher capacity factors for new wind farms | Maybe |
| Economical Retirements | More aggressive retirement of old coal, gas units in urban centers and location of new flexible generation on outskirts of urban areas | Maybe |
| Batteries | | |
| Transmission retirements | Retireing underused lines? | |
| Federal infrastructure bill? | | |
| Must Runs Units | | Self Commits? |
| Paris Accords Carbon Reductions | | |
| Transmission De-rate variable | Most of the western side of SPP is at maximum capacity, there is 0 injection capability at many points. Pockets of stranded generation and high LMPs, significant curtailments are occurring and not being addressed. Recommendation: use a Transmission De-rate variable. This would be applied to the interchange allowed when performing the capacity expansion between regions and in the production cost modeling. | Yes |
| Declining Capital costs for Wind | | |

| | |
|---|---|
| Significant capital costs to solar and battery storage | Significant increases in solar and battery recognized with a penetration factor variable to ensure they are included in the models |
| Higher reserve margins | Because of the higher forced outage rates of natural gas units as already being seen in the market |
| Hydraulic fracking regulations | Increased gas prices |
| Mountain West | How to reflect in modeling. DC ties flows/planning |
| Confirm that load forecasts are including behind the meter | |

Futures

| Low Demand | Robust Economy | Emerging Technologies | Renewable Future | Clean Energy Future |
|---|---|---|---|---|
| | | Yes | | |
| Maybe | | Yes | | |
| Low | High Demand | Base + | | High |
| No | Yes | | | |
| | Yes | Yes | 43GW in Y10 | |
| | Yes | Yes | Yes | Yes |
| | No | | No<br>X | |
| | | | | Yes, higher than refernce |
| | | | | Yes |

Yes

Yes

Yes

| Key Assumptions | Reference Case |
|---|---|
| Demand Growth Rates | Flat |
| Energy Growth Rates | Flat |
| Natural Gas Prices | Vendor long-term forecast |
| Coal Prices | Vendor long-term forecast |
| Emissions Prices | Vendor long-term forecast |
| Retirements | Coal age-based; No nuclear retirements |
| Renewable Growth | Above RPS, Moderate + |
| Wind | Above RPS, Moderate + |
| Solar | Above RPS, Moderate + |
| Environmental Regulation | No new regulations |
| Demand Response | Moderate |
| Distributed Generation | Moderate |
| Energy Efficiency | Moderate |
| DC Lines | No |
| Maturity Cost Curves | Only for new generation |
| Storage | No |

| Drivers | |
|---|---|
| Emerging Technologies | Renewable Future |
| Electric Vehicles | Flat |
| Electric Vehicles | Flat |
| Vendor long-term forecast | High (Regulations) |
| Vendor long-term forecast | Vendor long-term forecast |
| Vendor long-term forecast, $CO_2$ High | Vendor long-term forecast, $CO_2$ High |
| Coal age-based, economic; No nuclear retirements | Coal age-based + policy regulations + economic; Nucle |
| Above RPS, Moderate + | High |
| Above RPS, Moderate + | High |
| Above RPS, Moderate + | High |
| New Regulations | New Regulations |
| High | Moderate |
| High | High |
| High | Moderate |
| No | Yes |
| New and re-built wind farms | New and re-built wind farms |
| Yes | Yes |

ear - economic

| Key Assumptions | Reference Case | | |
|---|---|---|---|
| | Year 2 | Year 5 | Year 10 |
| Peak Demand Growth Rates | 50/50 | 50/50 | 50/50 |
| Energy Demand Growth Rates | 50/50 | 50/50 | 50/50 |
| Natural Gas Prices | Vendor | Vendor | Vendor |
| Coal Prices | Vendor | Vendor | Vendor |
| Emissions Prices | Vendor | Vendor | Vendor |
| Retirements | | | |
| Fossil Fuel | Age-Based 60+, subject to stakeholder input | | |
| Nuclear | No | No | No |
| Renewable Growth | Increased capacity Factor | | |
| Solar (Wind Coalition) | | | 5 |
| Wind (Wind Coalition) | 23.8/27 | 26/29 | 31/32 |
| Environmental Regulations | No new regulations | | |
| Demand Response | Moderate | | |
| Distributed Generation | Moderate | | |
| Energy Efficiency | Moderate | | |
| Export Lines | No | | |
| Increased renewable CF's | For new generation and re-powered | | |
| Storage | No | | |

| Drivers | | | |
|---|---|---|---|
| Emerging Technologies | | Renewable Future | |
| Year 5 | Year 10 | Year 5 | Year 10 |
| 50/50 | 50/50 | 50/50 | 50/50 |
| Change in load shape | Change in load shape | 50/50 | 50/50 |
| Vendor | Vendor | 10% increase | 10% increase |
| Vendor | Vendor | Vendor | Vendor |
| Vendor | | Vendor, $CO_2$ $22 adder | |
| Age-based 60+, economic (Heat Rate/capacity factor) | | Age-Based 50+ | |
| No | No | Economic? | Economic? |
| Increased capacity Factor | | Increased capacity Factor | |
| | 12 | | 12 |
| 35 | 43 | 35 | 43 |
| No new regulations | No new regulations | New Regulations | |
| Moderate | | Moderate | |
| additional 300 over reference | 500 | Moderate | |
| Moderate | | Moderate | |
| No | | Yes | |
| New and re-built wind farms | | New and re-built wind farms | |
| No | | No | |

| State | RPS Type | Generation Type | Capacity- or Energy-Based | Year 2 % | Year 5 % | Year 10 % |
|---|---|---|---|---|---|---|
| Kansas | Goal | Both | Capacity | 20 | 20 | 20 |
| Minnesota | Mandate | Both | Energy | 20 | 20 | 25 |
| Missouri | Mandate | Both | Energy | 15 | 15 | 15 |
| Montana | Mandate | Both | Energy | 15 | 15 | 15 |
| North Dakota | Goal | Both | Energy | 10 | 10 | 10 |
| New Mexico | Mandate | Wind | Energy | 15 | 15 | 15 |
| New Mexico | Mandate | Solar | Energy | 4 | 4 | 4 |
| South Dakota | Goal | Both | Energy | 10 | 10 | 10 |
| Texas | Mandate | Both | Capacity | 5 | 5 | 5 |

**Southwest Power Pool, Inc.**

**ECONOMIC STUDIES WORKING GROUP**

**Pending Action Items Status Report**

**September 14th, 2017**

| | Action Item | Date Originated | Status | Comments |
|---|---|---|---|---|
| 151 | SPP staff to look into optional software tools for use in ITP studies. | May 20th, 2015 | In Progress<br>SPP Staff | February, 2017: Presentation on EGEAS. Hold on investigation of alternatives until EGEAS and ABB's new Capacity Expansion tool are able to be fully tested and compared. |
| ~~165~~ | ~~ESWG to review the assumed benefit of mandated reliability projects~~ | ~~May 13th, 2016 RARTF~~ | ~~In Progress<br>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<br>ESWG~~ | |
| ~~167~~ | ~~ESWG to review the classification of projects in the ITP process~~ | ~~May 13th, 2016 RARTF~~ | ~~In Progress<br>ESWG~~ | |
| ~~172~~ | ~~SPP staff to develop examples and language for tackling synergies of power flow and economic generation data.~~ | ~~June 16th, 2016~~ | ~~In Progress<br>SPP Staff~~ | ~~Discussions should continue with SAWG for coordination of methodology, as appropriate.~~ |
| 173 | SPP staff to develop a process for annual update of the economic model with vendor data. | June 16th, 2016 | In Progress<br>SPP Staff | |
| 183 | SPP staff to perform transmission outage analysis in the first part of 2017 to determine the appropriate APC benefit percentage to utilize for the mitigation of transmission outages benefit metric. | September 15th, 2016 | In Progress<br>SPP Staff | |
| 184 | ESWG to have a future agenda item for education and discussion of the derivation and use of the net plant carrying charge (NPCC) value used in the ITP process for project cost calculations. | April 20th, 2017 | In Progress<br>ESWG | |

| | | | | |
|---|---|---|---|---|
| 185 | ESWG to continue working on and finalize the Resource Siting Manual | June 29th, 2017 | In Progress ESWG | |
| 186 | Formalize the economic model data guidelines and submission process | July 20th, 2017 | In Progress SPP staff | Replaces action item 160 |
| 187 | Address the objections raised to the approved renewable VOM modeling detailed in the ITP manual | July 20th, 2017 | In Progress SPP staff/ESWG | |

**Southwest Power Pool**

**ECONOMIC STUDIES WORKING GROUP**

**August 16 - 17th, 2017**

**Grand Hyatt – Denver, CO**

**• SUMMARY OF ACTIONS TAKEN •**

1. Approved the consent agenda
2. Approved using Lazard High Cost CC prototypes and low cost CT prototypes and adding large scale reciprocating engines as a prototype option, and eliminating nuclear and coal as options.
3. Accepted the results of the 2017 Regional Review study as having met the approved scope.

**Southwest Power Pool**

**ECONOMIC STUDIES WORKING GROUP**

**August 16 - 17th, 2017**

**Grand Hyatt – Denver, CO**

**• 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 8:00a.m., welcomed those in attendance, and asked for introductions.

There were 24 in-person participants and 45 web conference participants, representing 12 of 14 ESWG members. (Attachment 1 – August 16th-17th, 2017 Attendance List)

### Agenda Item 1b – Receipt of Proxies

Alan Myers (ITC) asked for any proxy statements; three proxies were identified. (Attachment 2 – Proxy Statements)

- Eric Burkey (SCMCN) proxy for Jody Holland (SCMCN)
- Ryan Yokley (SUNC) proxy for Al Tamimi (SUNC)
- Josie Daggett (WAPA) proxy for Gayle Nansel (WAPA)

### Agenda Item 1c – Review of Agenda

Chair Alan Myers (ITC) presented the agenda for review and asked for any additions or corrections. (Attachment 3 – August 16th - 17th, 2017 ESWG Agenda).

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

## Agenda Item 2 – Review of Past Action Items

SPP Staff will get conformation from the RARTF secretary in regards to RARTF action items 165, 166, and 167. These may need to be removed from the action items list until RCAR discussion have completed. Confirm continuing working on action items or hold until RCAR discussion has completed. Amber Greb informed the group that item 184 should be completed in the last quarter of 2017, we are waiting on a final date from the regulatory department. (Attachment 4 – Past Action Items)

## Agenda Item 3 – Consent Agenda

The consent agenda included the following items:

Meeting Minutes – April 20th, 2017 (Attachment 5 – April 20th, 2017 ESWG Minutes)

Meeting Minutes – May 17th, 2017 (Attachment 6 – May 17th, 2017 ESWG Minutes)

Meeting Minutes – May 17th, 2017 (Attachment 7 – May 17th, 2017 TWG.ESWG Minutes)

Meeting Minutes – June 15th, 2017 (Attachment 8 – June 15th, 2017 ESWG Minutes)

Meeting Minutes – June 29th, 2017 (Attachment 9 – June 29th, 2017 TWG.ESWG Minutes)

Meeting Minutes – July 20th, 2017 (Attachment 10 – July 20th, 2017 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 – 2019 ITP Schedule**

Juliano Freitas (SPP Staff) gave an overview of the 2019 ITP draft schedule. He presented a flow chart showing milestone dates and dependencies. SPP Staff is intending to bring a final schedule to the ESWG in October, including the final dates for each milestone, as well the time and dates for members to review and approve items. Staff is evaluating the possibility of extending the two windows designated for members to submit estimated costs for projects. (Attachment 5 – 2019 ITP Schedule)

**Agenda Item 5 – 2019 ITP Load and Generation Review**

Nikki Roberts (SPP Staff) presented an update on the progress of the load and generation review milestones for the 2019 ITP Study, providing Staff findings on ABB data, and reminding stakeholders of the generation resource inclusion criteria and the RAR/Waiver process. Tim Owens (NPPD) asked for SPP Staff to provide information on the origin of the hourly profiles in the ABB data. Staff stated they would email the following day. Throughout discussion on the generation review the following topics were discussed:

- The maximum capacities for generating units will be gross maximum capacities since moving forward SPP Staff will utilize the ITP models for TPL compliant sensitivity cases, and those models must include aux loads in the generating unit maximum capacities.
- SPP Staff reminded stakeholders that RARs allow generators to be included that may not have gone through all of the appropriate tariff processes, and that the window for the RARs to be submitted is September 15th through October 11th.
- When submitting RARs, Stakeholders should state which criteria they believe they are meeting, and the necessary working groups will determine if it meets the criteria

Nikki concluded the presentation by reminding the ESWG of Stakeholder expectations regarding the ABB data to be reviewed during the generation review feedback period. (Attachment 12 - 2019 ITP Load and Generation Review)

**Agenda Item 6 – Economic Model Data Guidelines**

Juliano Freitas (SPP Staff) presented an example of the Load and Generation Data submittal workbooks to the ESWG. These workbooks have an instructions tab that explains what information is being requested and how it will be used. Staff is working to develop the guidelines and stakeholders are welcome to provide feedback on the data submittal workbooks.

**Agenda Item 7 – EI-WECC Interconnections Seems Study Update**

Jay Caspary (SPP Staff) gave an overview of the DOE Interconnection Seams Study. He explained the key inputs and the timeline of the study. Jay presented the preliminary results of the study and will bring the topic back to the working groups when detailed results of the study are available and have been reviewed. (Attachment 13 - Interconnection Seams Study update)

**Agenda Item 8 – 2019 ITP Scope Items**

**Agenda Item 8a – 2019 ITP Futures**

Steve Gaw (Wind Coalition) presented ideas and suggestion to be considered in the futures discussion to the group. His presentation focused on the amount of wind generation that should be included in the model, stating that SPP has underestimated the wind build in previous studies. Steve proposed that the 2019 ITP reference case should include 26 GW of wind by the end of 2024 and 31 GW of wind by the end of 2029. For the second future, his presentation suggested wind levels of 35 GW in 2024 and 43 GW in 2029. Amber Greb (SPP Staff) then showed the group a workbook outlining the results of the future drivers' survey that was sent out a few weeks before. The ESWG discussed the results and offered different opinions. Staff showed how the submission could be grouped into 6 possible future scenarios: Reference Case, Low Demand, Robust Economy, Emerging Technologies, Renewable Future, and Clean Energy Future. The ESWG took a straw poll, and requested that staff build a proposal for the reference case and two additional futures, emerging technologies and renewable future. The ESWG also decided

to add an additional half day to the September meeting to finalize a recommendation for the SPC. SPP Staff will bring the details of the three futures to this half day meeting. (Attachment 14 – Futures Wind Coalition) (Attachment 15 – Future Drivers Discussion)

**Agenda Item 8b – Renewable Resource Expansion Plan**

Chris Jamieson (SPP Staff) gave an overview of the criteria to develop a renewable resource expansion plan for the ITP study. He talked about a number of things that should be considered in resource expansion planning such as: futures, government regulations, historical trends, natural gas prices, installation trends, integrated resource plan projections, and stakeholder feedback. Tim Owens (NPPD) commented that seasonal curtailment results, as well as any geographic variation in those results, if available, might also be valuable information. Chris will provide additional details at the September ESWG meeting. (Attachment 16 – Renewable Resource Expansion Plan)

**Agenda Item 8c – Conventional Generation Prototypes**

Amber Greb (SPP Staff) provided a presentation on conventional generation prototypes. Two data sources have been used in previous ITP studies, EIA Annual Energy Outlook (AEO) Report and Lazard Levelized Cost of Energy Analysis. These sources were used to create a chart comparing prices for prototypes for the following unit types: combined cycles, combustion turbines, coal generators, nuclear units, wind units, and solar. Stakeholders discussed the options and requested that reciprocating engines be added for comparison. Some members requested the addition of wind and solar as possible alternatives, Staff advised the group that it can significantly increase simulation time and that the ITP Manual states that wind and solar generation additions will be specified in our models. The amounts and methodology are being discussed and developed and will be included into the 2019 ITP Scope. (Attachment 17 – Conventional generation prototypes)

**Leon Howell (OGE) made a motion; seconded by Tim Owens (NPPD) to approve using Lazard High Cost CC prototypes and low cost CT prototypes, adding large-scale reciprocating engines, and eliminating nuclear and coal as options. The motion was approved unanimously.**

**Agenda Item 8d – Renewable Accreditation**

Chris Jamieson (SPP Staff) presented on renewable accreditation. Chris referenced the ITP manual language stating that renewable capacity accreditation feeds into the resource expansion plan. He talked about what was used in previous studies and SPP Planning Criteria 7.1.5.3. SPP Staff suggested that the ITP study count future renewable resources at a regional average of accreditation percentages submitted by stakeholders. Members questioned if the average would include units with a 0% accreditation and if we should assume the future wind will have firm service. Stakeholders also asked SPP Staff to consider using different criteria for the two futures. (Attachment 18 – Renewable Accreditation)

**Agenda Item 8e – Must Run Criteria**

Nikki Roberts (SPP Staff) reviewed Must Run Criteria. SPP staff recommended assigning must-run designations to co-generation and nuclear units only. Also, potentially implement must-run designations to additional units as a sensitivity during the Project Selection milestone. Chris stated average capacity factor was assumed 80%. The availability of historical capacity factor was questioned. (Attachment 19 – Must Run Criteria)

**Agenda Item 8f – Operational Project Evaluation**

Will Tootle (SPP Staff) reviewed SPP Staff's proposal for Operational Project Evaluation and selection of projects for operational needs. The proposed methodology includes Persistent Operational Solution Evaluations (Reliability, Economic), Persistent Operational Solution Screening, and Persistent Operational Portfolio Development. More details were requested for benefits calculations. The language needs to clarify how we validate the operational needs, and how to determine if the project is redundant with a project coming out of the planning model. The operational analysis will be performed parallel with the economic and reliability assessments. (Attachment 20 - Operational Project Evaluation)

**Agenda Item 9 – Siting Manual Action Plan**

[This item was not covered in the allotted time]

**Agenda Item 10 – Transmission Outage Metric**

[This item was not covered in the allotted time]

**Agenda Item 11 – Renewable Pricing**

[This item was not covered in the allotted time]

**Agenda Item 12 – SPP-MISO CSP Regional Review**

Clayton Mayfield (SPP Staff) presented the final results of the 2017 SPP-MISO CSP Regional Review to the ESWG and requested the approval of the 2016 SPP-MISO CSP project, Loop One Split Rock-Lawrence 115kV ckt into Sioux Falls (I18), as an Interregional Project. Stakeholders asked if the CSP study considered system impacts to MISO and Generation Interconnection costs as a result of this project and Clayton responded that only SPP benefit, as a whole, was considered in the analysis. Jeremy Severson (Basin) expressed concern that the 2016 SPP-MISO CSP study did not reassess needs after the model merging, and instead used previously identified needs from SPP and MISO regional processes. Alan Myers (ITC) asked what MISO's recommendation was and Clayton informed the ESWG that MISO was recommending to continue operating Sioux Falls – Lawrence 115kV as open, Jordan Schmidt (EXCEL) also confirmed the MISO recommendation. Jim Jacoby (AEP) informed the group that the SSC was relying on ESWG's expertise before recommending I18 as an Interregional Project and asked the ESWG to make their recommendation based on how the project impacts SPP and not based on MISO's recommendation. Questions were asked about what's next for this project and Kelsey Allen (SPP Staff) informed ESWG that despite I18 not being indorsed by ESWG, staff could still make a recommendation to MOPC to approve I18 as an Interregional Project.

> **Jeremy Severson (Basin) made a motion; seconded by Josephine Daggett (WAPA) to acknowledge that the ESWG accepts the results of the 2017 Regional Review study as having met the approved scope. The motion was approved with one no vote, Alan Myers (ITC)**

**Agenda Item 13 – 2018 ESWG Meeting Schedule**

[This item was not covered in the allotted time]

**Closing Items**

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

The meeting was adjourned at 11:45 PM.

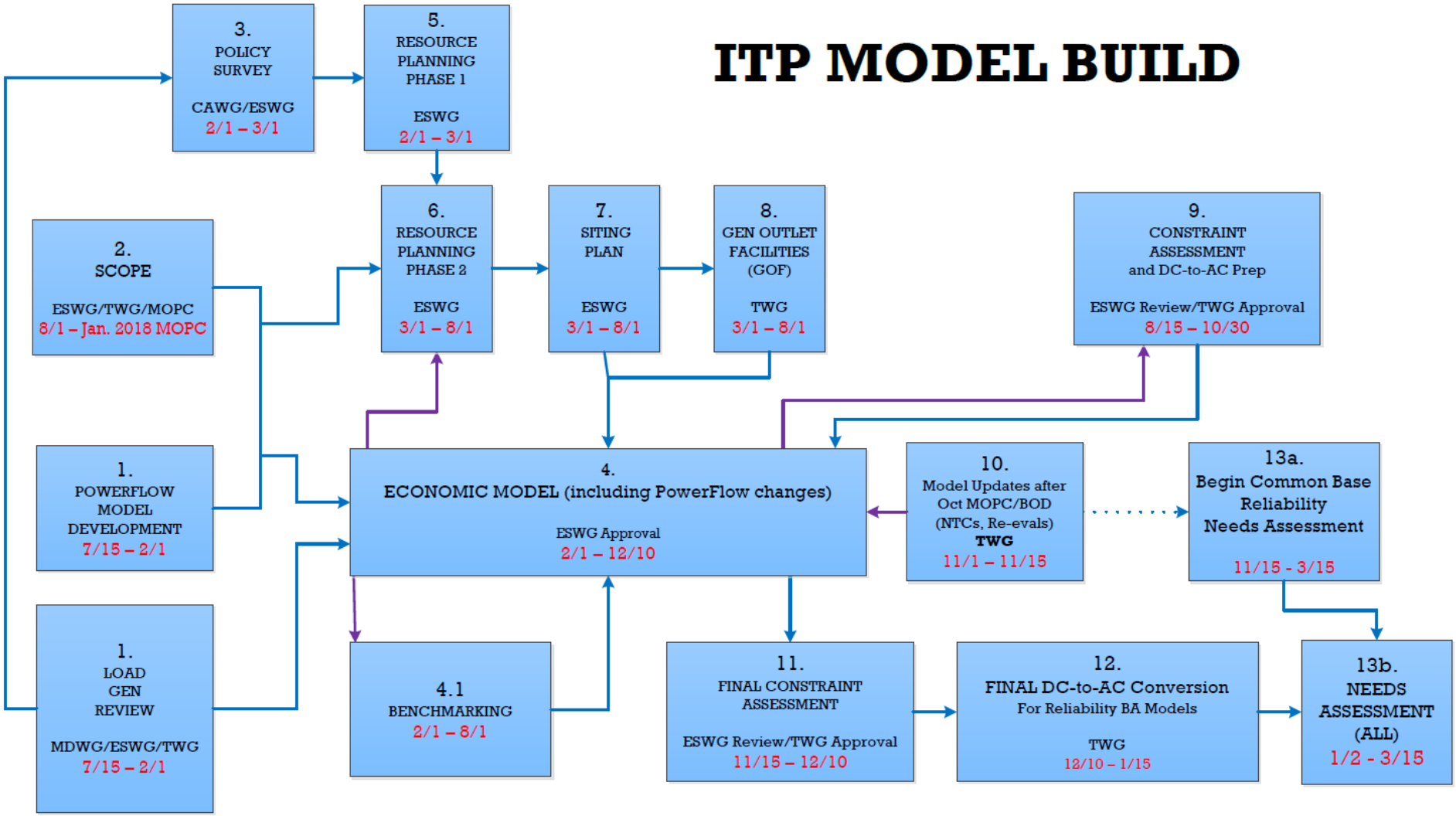
Respectfully Submitted,

Amber Greb

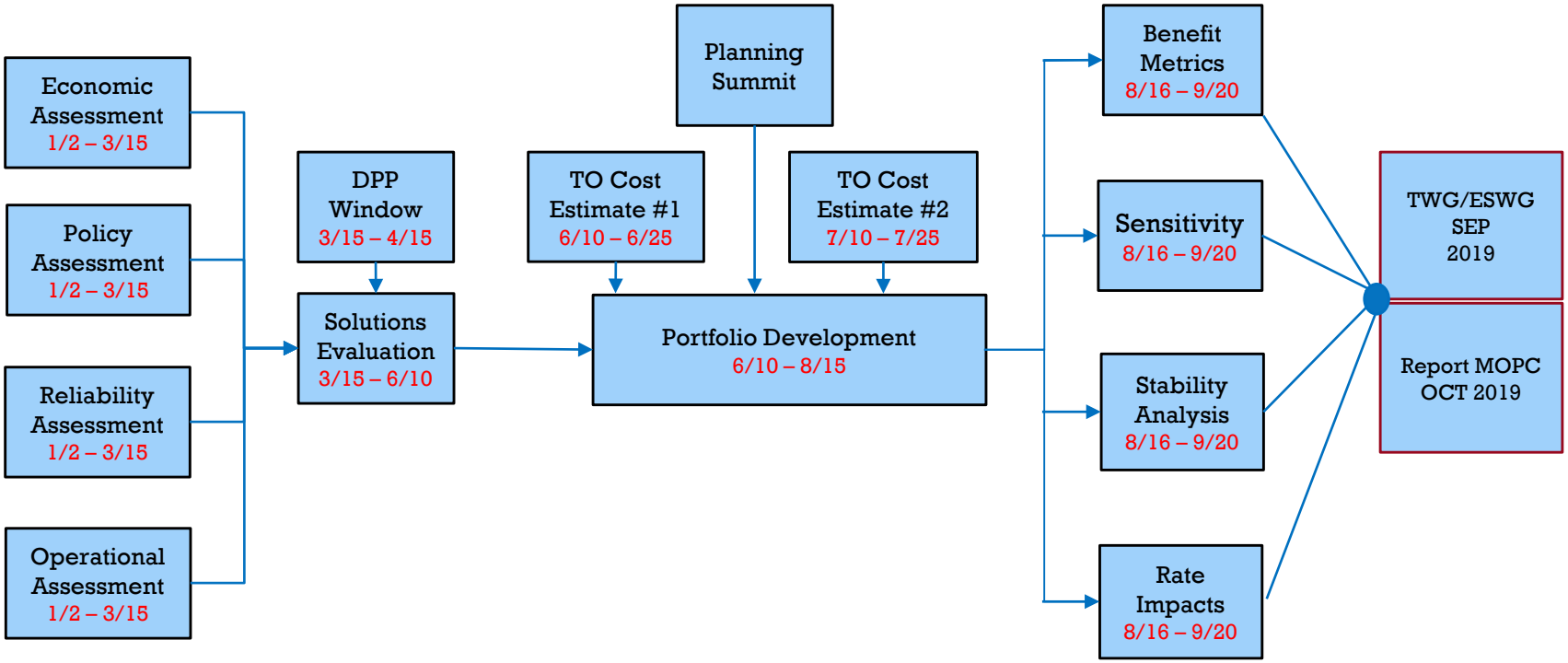
ESWG Secretary

# ITP Study Draft Schedule

# ITP MODEL BUILD



# ITP ASSESSMENTS AND ANALYSIS

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# 2019 ITP Load and Generation Review

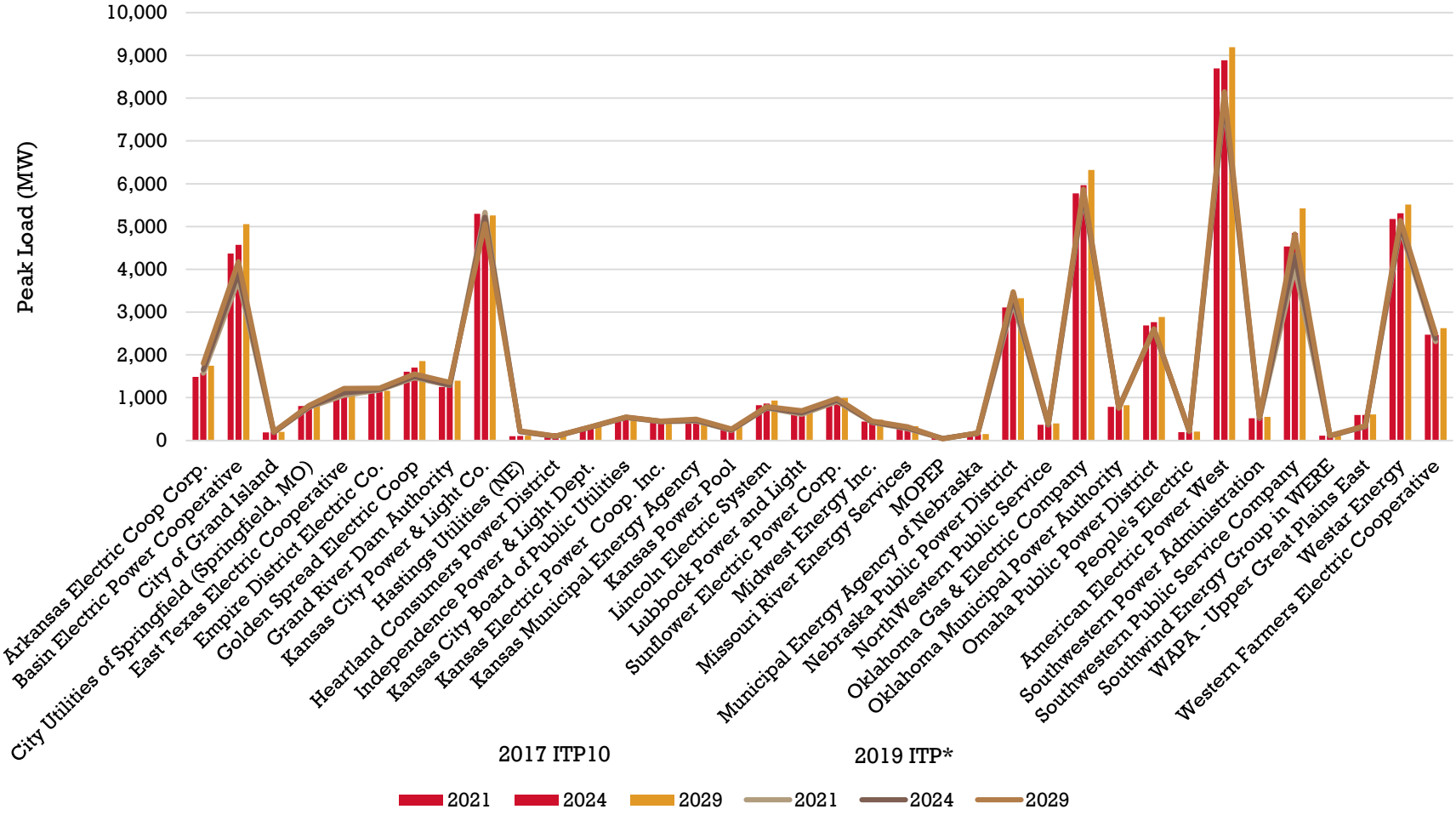
Nikki Roberts

September 14, 2017

# Load Review Update

- Minor demand group changes
- Non-scalable/non-conforming designations have been included as part of the load review
- Load Review 1st pass posted on 9/1/2017
- Stakeholder Feedback due by 10/2/2017
- Load Review 2nd pass will be posted on 11/3/2017
  - Intended to be nformational posting only
  - SPP Staff will update the bus demand group mappings per the 2019 ITP powerflow models and post for Stakeholders to view.

# Peak Load Comparison



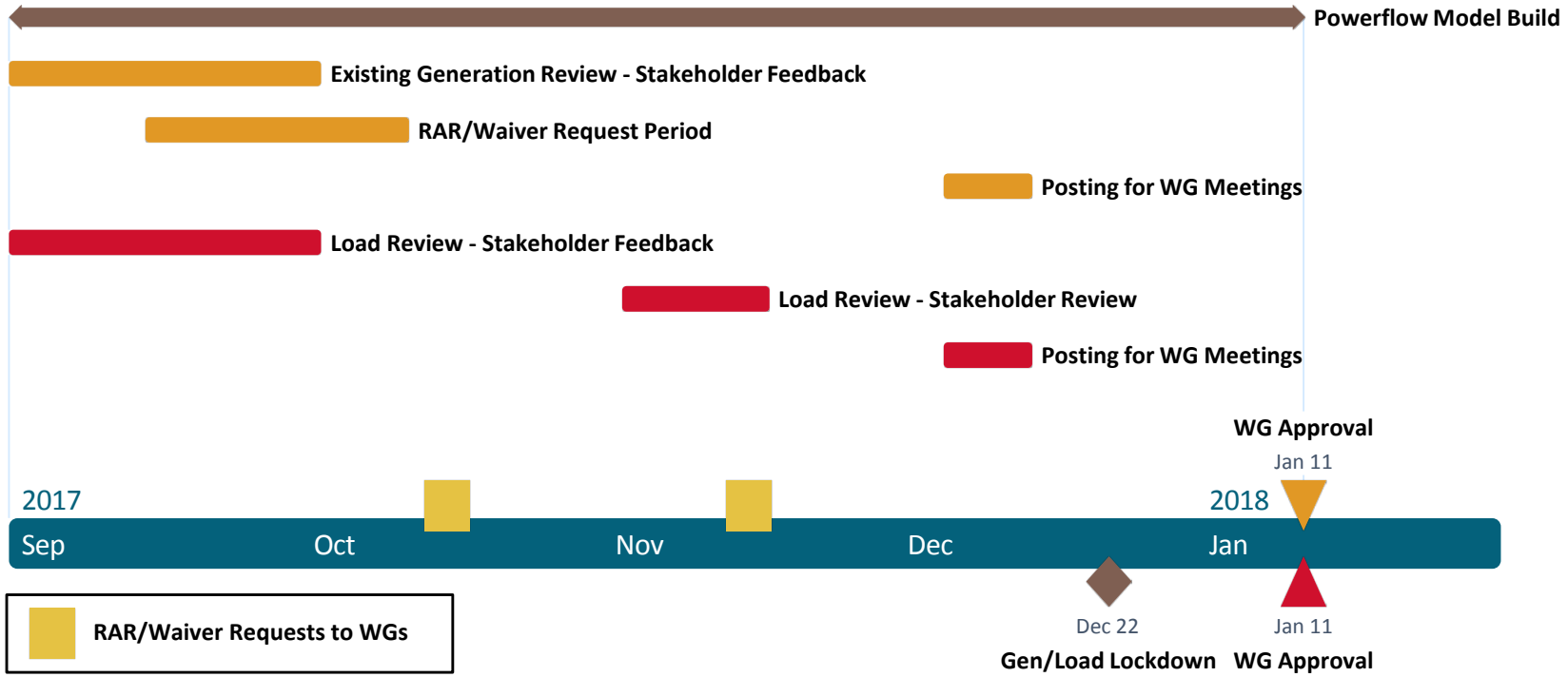

*Preliminary peak loads using the 2018NT powerflow models

# Gen Review Update

- 2017 ITP10 generator names are mapped to ABB Reference case generator names in generation review workbook as a reference.
- Generation Review 1st pass posted on 9/1/2017
- Stakeholder Feedback due by 10/2/2017
- Generation Review 2nd pass will be posted on 11/3/2017
  - Intended to be informational posting only
  - Update the machine bus mappings per the 2019 ITP powerflow models and post for Stakeholders to view.
  - Update Must run flags and hydro transactions to reflect approved Scope items

# Stakeholder Gen Review Expectations

- Do not anticipate a lot of changes submitted by stakeholders for ABB data review items.
  - Any changes submitted should include rationale in order to maintain consistency across the footprint.
  - Exceptions:
    - Commission and Retirement Dates
    - Min and Max Capacities due to modeling of gross capacity and station service/aux loads
- Reminder: RAR and Waiver request will be sent out on September 15th


Powerflow Model Build
Existing Generation Review - Stakeholder Feedback
RAR/Waiver Request Period
Posting for WG Meetings
Load Review - Stakeholder Feedback
Load Review - Stakeholder Review
Posting for WG Meetings
WG Approval
Jan 11
2017
2018
Sep
Oct
Nov
Dec
Jan
RAR/Waiver Requests to WGs
Dec 22
Gen/Load Lockdown
Jan 11
WG Approval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# Renewable Resource Expansion Plan

Chris Jamieson

September, 2017

# ITP Manual Language

Section 2.2.2.1.1 Renewable Resource Expansion Plan

"SPP shall develop a resource plan to meet renewable expectations for the region. This will include capacity as required through the renewable policy review, as well as capacity identified through criteria developed by SPP and stakeholders. Consideration will be given to the futures being studied and factors such as government regulations, historical trends, natural gas prices, installation trends, integrated resource plan projections, and SPP stakeholder feedback.

Renewable additions will be computed using criteria that can be applied uniformly across pricing zones. For example, each pricing zone should have renewable capacity of at least a certain percentage of their annual peak-load responsibility. Renewable resources other than wind and solar (such as biomass) shall only be added to the model as defined in the Generation Resource Inclusion and Generation Resources sections."

"Resource expansion software is not currently adequate for identifying new renewable resources. As resource expansion software improves, SPP may incorporate renewable resources additions in the software as an additional factor for consideration."

# Criteria

- Futures
- Government regulations
- Historical trends
- Natural gas prices
- Installation trends
- Integrated resource plan projections
- And, SPP stakeholder feedback

# NREL technical wind capacity potential by State

| State | Potential Installed capacity[1] (MW) | SPP % of State | SPP Potential Installed Capacity (MW) |
|---|---|---|---|
| KS | 884,359 | 100% | 884,359 |
| NE | 881,369 | 100% | 881,369 |
| SD | 844,019 | 70% | 590,813 |
| TX | 1,418,439 | 30% | 425,532 |
| OK | 390,592 | 100% | 390,592 |
| ND | 742,276 | 40% | 296,910 |
| NM | 340,116 | 30% | 102,035 |
| MO | 58,020 | 30% | 17,406 |
| IA | 464,787 | 10% | 46,479 |
| MN | 354,998 | 10% | 35,500 |
| AR | 2,126 | 30% | 638 |
| MT | 687,803 | 0% | 0 |
| WY | 422,713 | 0% | 0 |
| LA | 0 | 20% | 0 |

1. Potential installed capacity assuming land availability >= 35% GCF 80m hub height, circa 2008 turbine technology (http://apps2.eere.energy.gov/wind/windexchange/windmaps/resource_potential.asp)
2. As of 7/27/2015 (http://apps2.eere.energy.gov/wind/windexchange/wind_installed_capacity.asp)

# NREL technical Utility-scale PV solar potential by State

| State | GW | GWh | Capacity Factor | SPP % of State | GW (SPP) | GWh (SPP) |
|---|---|---|---|---|---|---|
| KS | 6960 | 14500149 | 0.237826 | 100% | 6960 | 14500149 |
| TX | 20411 | 38993582 | 0.218084 | 30% | 6123.3 | 11698074.6 |
| OK | 4783 | 9341920 | 0.222962 | 100% | 4783 | 9341920 |
| NE | 4870 | 9266757 | 0.217217 | 100% | 4870 | 9266757 |
| SD | 5345 | 10008873 | 0.213763 | 70% | 3741.5 | 7006211.1 |
| NM | 7087 | 16318543 | 0.262854 | 30% | 2126.1 | 4895562.9 |
| ND | 5483 | 9734448 | 0.20267 | 40% | 2193.2 | 3893779.2 |
| MO | 3157 | 5335269 | 0.19292 | 30% | 947.1 | 1600580.7 |
| AR | 2747 | 4986389 | 0.207216 | 30% | 824.1 | 1495916.7 |
| MN | 6510 | 10792814 | 0.189256 | 10% | 651 | 1079281.4 |
| LA | 2394 | 4114605 | 0.1962 | 20% | 478.8 | 822921 |
| IA | 4021 | 6994159 | 0.198563 | 10% | 402.1 | 699415.9 |
| WY | 2854 | 5727224 | 0.229079 | 0% | 0 | 0 |
| MT | 4403 | 8187341 | 0.212271 | 0% | 0 | 0 |

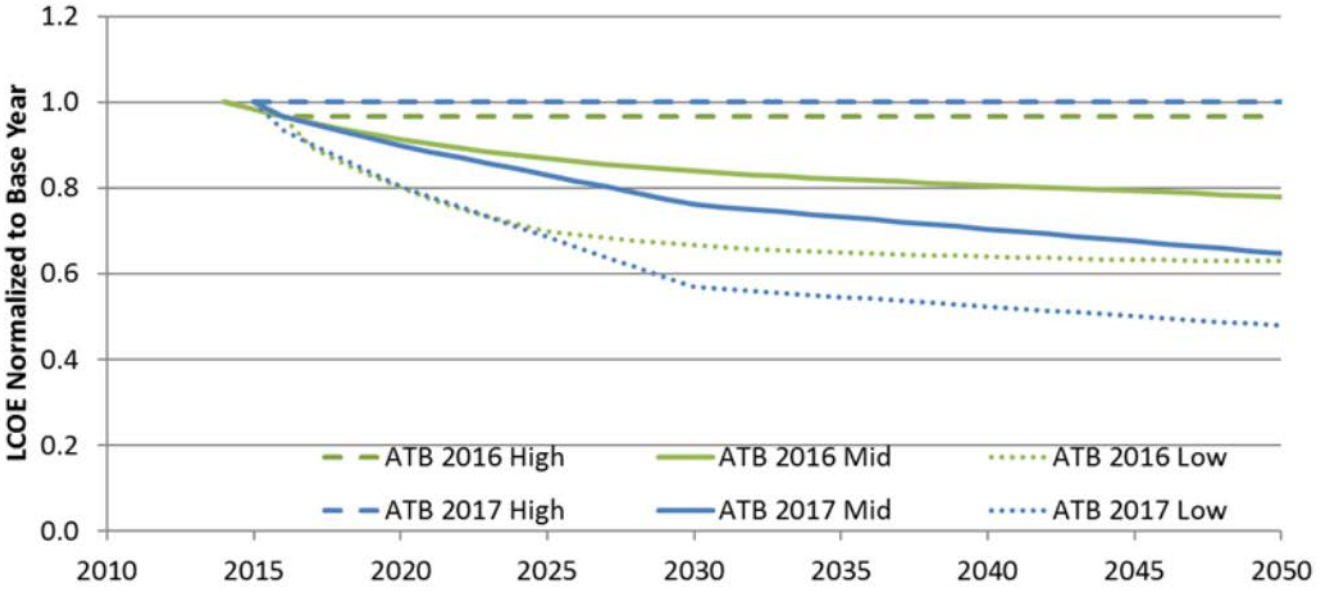
http://www.nrel.gov/docs/fy12osti/51946.pdf

SPP

# Renewable Expansion

- Prior planning studies have underestimated wind expansion
- PTCs/ITCs drive expansion in near-term
- NREL 2016 Annual Technology Baseline
  - Shows continued cost declines into the future for wind and solar
  - "Renewable energy growth will continue over the long term, but the long-term annual additions are projected to be lower than the annual additions over about the next five years."
  - "greater growth projected to occur from 2016 to 2020 in order to capitalize on the PTC and ITC incentives. After 2020, annual growth rates are in line with historical (2010–2016) growth rates"
  - https://www.nrel.gov/docs/fy17osti/66939.pdf
- Renewable expansion hedges against
  - Potential environmental regulations
  - Energy market and natural gas price volatility

# NREL 2016/2017 Annual Technology Baseline Comparison

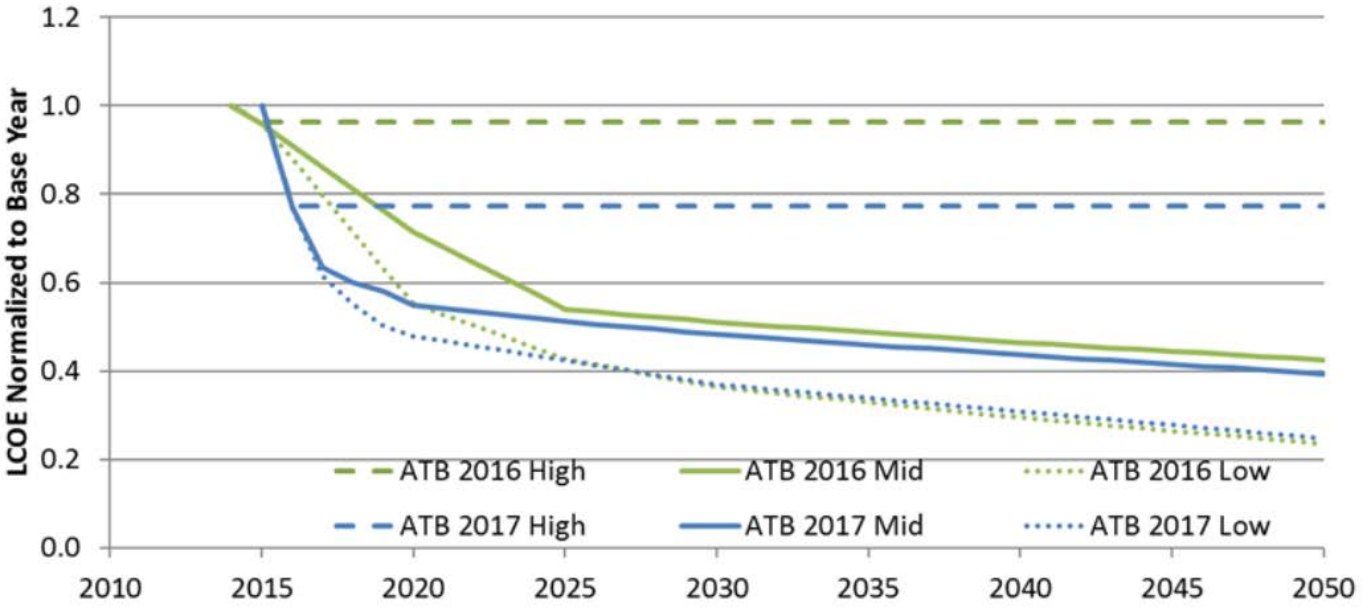



**Differences between ATB 2016 and ATB 2017 - land-based wind**

Source: National Renewable Energy Laboratory Annual Technology Baseline (2017), http://atb.nrel.gov

- https://atb.nrel.gov/electricity/2017/changes.html

# NREL 2016/2017 Annual Technology Baseline Comparison




**Differences between ATB 2016 and ATB 2017 - utility-scale PV**

Source: National Renewable Energy Laboratory Annual Technology Baseline (2017), http://atb.nrel.gov

- https://atb.nrel.gov/electricity/2017/changes.html

# NREL 2016 Annual Technology Baseline

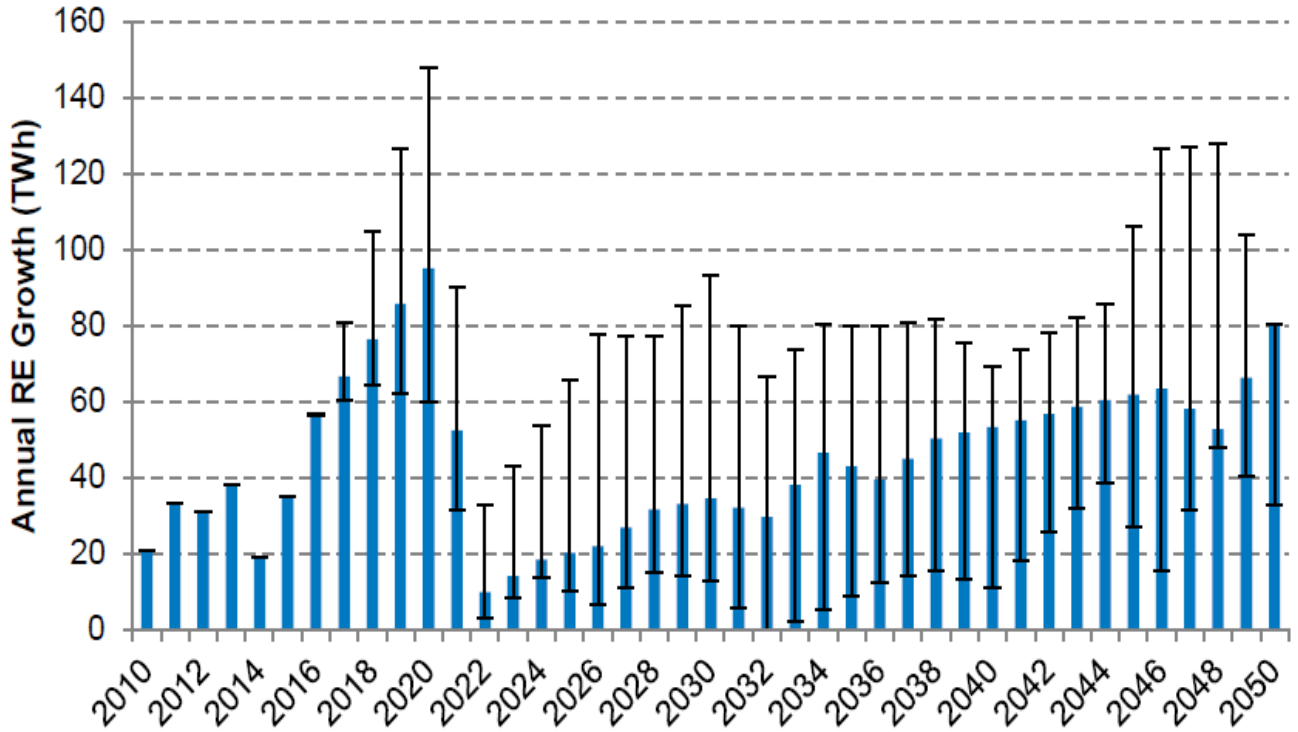



**Figure 13. Annual growth in renewable energy generation.** 2010–2015 values are taken from EIA data (EIA 2016d). The blue bars show the annual growth in the Mid-case Scenario, and the error bars show the minimum and maximum values in each year from the suite of bidirectional scenarios.

# Wind Expansion

- 2017 Q3 ~ 18 GW
- Historical and Installation Trends
  - Non traditional PPAs with non-LSEs
    - 2014 – 2017 ~ 2.4 GW
    - 2017 Q1-3 ~ 1.2 GW
  - Traditional PPAs with LSEs
    - 2014 – 2017 ~ 6.7 GW
    - 2017 Q1-3 ~ 1.1 GW
  - ~2 to 3 GW per year
  - Equates to ~24 to 27 GW by 2021
- Integrated resource plan projections
  - AEPW announced 2000 MW
  - Xcel-SPS announced 1230 MW by 2021
  - AEPW and Xcel-SPS additions equates to over 21 GW by 2021

# Wind Expansion Recommendation

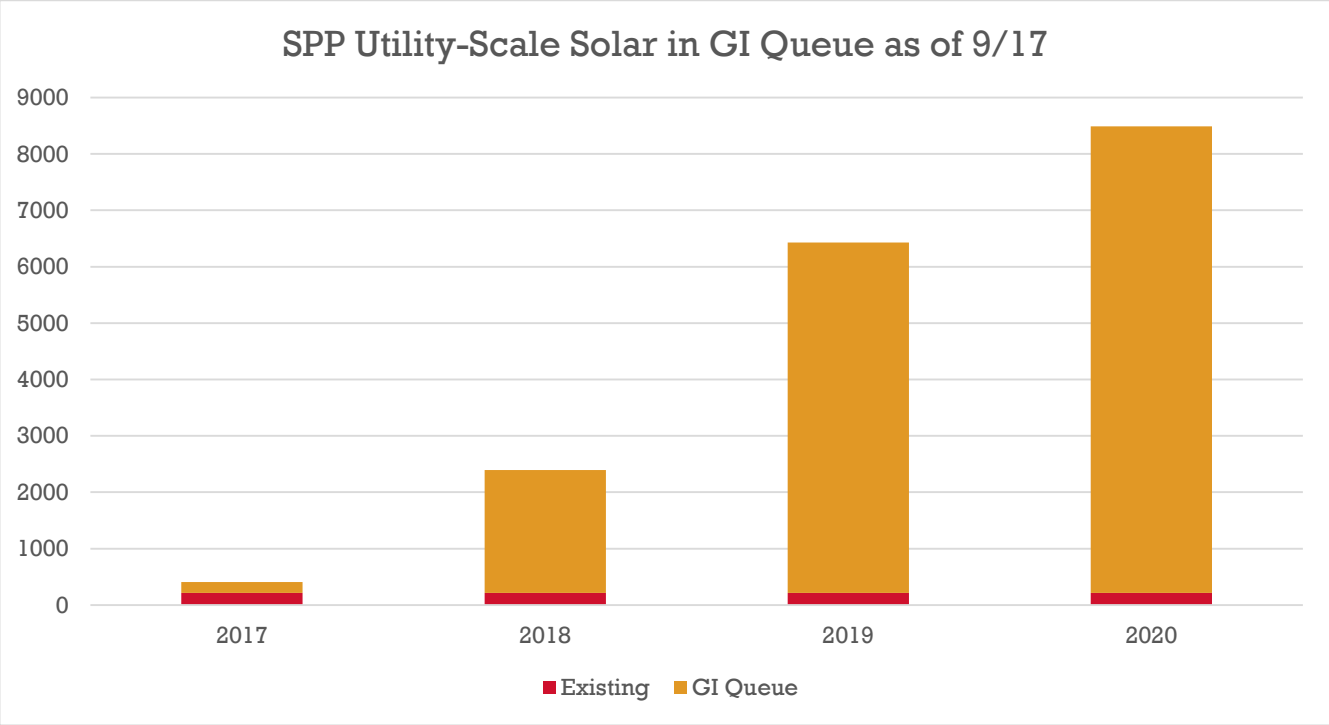
- By 2018 ~ 18 GW Installed
- Reference Future (~NREL Mid-Case Growth Rates)
  - Year 2 2021 ~ 27 GW ~ 48% of system peak demand ~ 32% of annual energy
    - ~1 GW per year for 3.2 GW for AEPW and SPS announcement
    - ~1 GW per year for remainder of SPP LSEs on pro rata load – existing wind assignment per SPP LSE
    - ~1 GW per year for Non traditional PPAs with non-LSEs
  - Year 5 2024 ~ 29 GW ~ 50% of system peak demand ~ 33% of annual energy
    - ~1 GW for 2021
    - ~0.5 GW per year for 2022 and 2023
  - Year 10 2029 ~ 32 GW ~ 54% of system peak demand ~ 36% of annual energy
    - ~0.5 GW per year
  - Year 20 2039 ~ 42 GW ~ 69% of system peak demand ~ 46% of annual energy (as needed for conventional resource forecasting model)
    - ~1 GW per year

# Wind Expansion Recommendation

- By 2018 ~ 18 GW Installed
- Year 2 2021 ~ 27 GW ~ 48% of system peak demand ~ 32% of annual energy
- Emerging Technology/Renewable Future (~NREL Max Value Growth Rates)
  - Year 5 2024 ~ 34 GW ~ 59% of system peak demand ~ 39% of annual energy
    - ~3 GW for 2021
    - ~2 GW per year for 2022 and 2023
  - Year 10 2029 ~ 44 GW~ 74% of system peak demand ~ 49% of annual energy
    - ~2 GW per year
  - Year 20 2039 ~ 54 GW~ 89% of system peak demand ~ 59% of annual energy
  - (as needed for conventional resource forecasting model)
    - ~2 GW per year

# Utility-Scale Solar Expansion

- 2017 Q3 ~ 215 MW
- GI Queue Requests



# Solar Expansion

- 2015 SWEPCO and TVA Integrated Resource Plan Projections
  - Utility scale solar as percentage of peak demand

| IRP | 2021 | 2024 | 2029 | 2039 |
|---|---|---|---|---|
| SWEPCO | 4% | 7% | 12% | 21% |
| TVA | <1%-3% | 1%-3% | 5%-7% | 12-14% |

  - Distributed solar as percentage of peak demand

| IRP | 2021 | 2024 | 2029 | 2039 |
|---|---|---|---|---|
| SWEPCO | <1% | <1% | ~1% | ~1% |
| TVA | <1%-3% | 1%-3% | 2%-5% | 2%-9% |

# Solar Expansion

- 2017 ITP10 projections
  - Utility scale solar as percentage of peak demand

| Future | 2020 | 2025 | 2035 |
|---|---|---|---|
| F1 and F2 | 3% | 5% | 6% |
| F3 | 1% | 3% | 6% |

  - Distributed solar as percentage of peak demand

| Future | 2020 | 2025 | 2035 |
|---|---|---|---|
| F1 and F2 | 0% | 0% | 0% |
| F3 | 0.5% | 1% | 2% |

# Utility-Scale Solar Expansion Recommendation

- By 2018 ~ 215 MW Installed
- Reference Future (~NREL Mid-Case Growth Rates and diversification of variable renewables)
  - Year 2 2021 ~ 3 GW
    - ~1 GW per year
    - ~5% of system peak
  - Year 5 2024 ~ 4 GW
    - ~0.2 GW per year
    - ~6% of system peak
  - Year 10 2029 ~ 5 GW
    - ~0.4 GW per year
    - ~10% of system peak
  - Year 20 2039 ~ 9 GW (as needed for conventional resource forecasting model)
    - ~0.4 GW per year
    - ~16% of system peak

# Utility-Scale Solar Expansion Recommendation

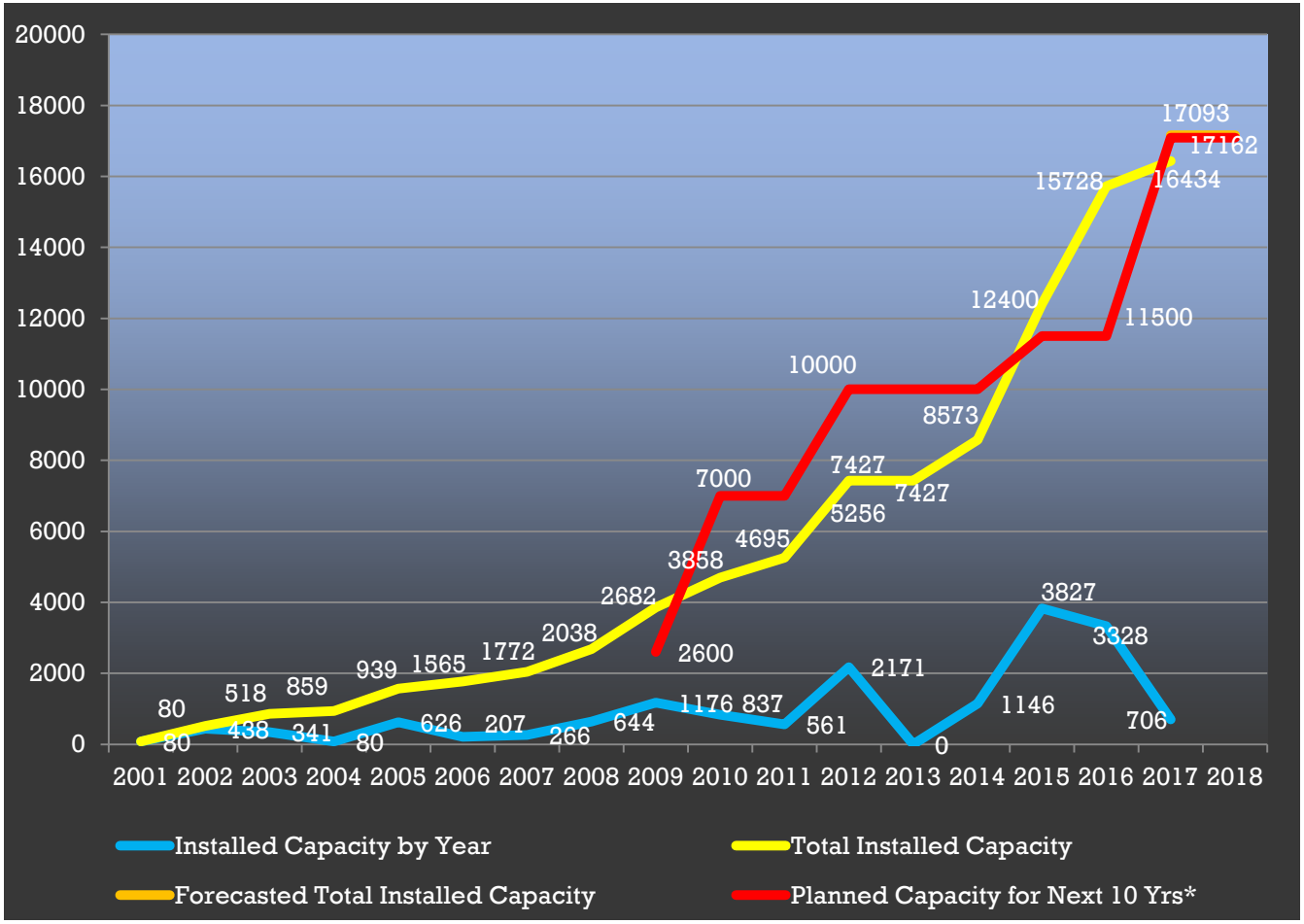
- By 2018 ~ 215 MW Installed (~NREL Max Value Growth Rates and diversification of variable renewables)
- Year 2 2021 ~ 3 GW
- Emerging Technology/Renewable Future
  - Year 5 2024 ~ 6 GW
    - ~1 GW per year
  - ~Year 10 2029 ~ 12 GW
    - ~1 GW per year
  - Year 20 2039 ~ 22 GW (as needed for conventional resource forecasting model)
    - ~1 GW per year

# PTC ($/MWh)

| Current Year | PTC % | ITC % | Wind Farm Construction (In-Service Year) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Jan. 1, 2020 |
| 2006 | 100% | | $ 23 | | | | | | | | | | | | | | |
| 2007 | 100% | | $ 23 | $ 23 | | | | | | | | | | | | | |
| 2008 | 100% | | $ 23 | $ 23 | $ 23 | | | | | | | | | | | | |
| 2009 | 100% | | $ 23 | $ 23 | $ 23 | $ 23 | | | | | | | | | | | |
| 2010 | 100% | | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | | | | | | | | | | |
| 2011 | 100% | | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | | | | | | | | | |
| 2012 | 100% | | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | | | | | | | | |
| 2013 | 100% | | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | | | | | | | |
| 2014 | 100% | | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | | | | | | |
| 2015 | 100% | 30% | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | | | | | |
| 2016 | 100% | 30% | | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | | | | |
| 2017 | 80% | 24% | | | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 18 | | | |
| 2018 | 60% | 18% | | | | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 18 | $ 14 | | |
| 2019 | 40% | 12% | | | | | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 18 | $ 14 | $ 9 | |
| 2020 | 0% | 10% | | | | | | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 18 | $ 14 | $ 9 | - |
| 2021 | 0% | | | | | | | | $ 23 | $ 23 | $ 23 | $ 23 | $ 23 | $ 18 | $ 14 | $ 9 | - |
| 2022 | 0% | | | | | | | | | $ 23 | $ 23 | $ 23 | $ 23 | $ 18 | $ 14 | $ 9 | - |
| 2023 | 0% | | | | | | | | | | $ 23 | $ 23 | $ 23 | $ 18 | $ 14 | $ 9 | - |
| 2024 | 0% | | | | | | | | | | | $ 23 | $ 23 | $ 18 | $ 14 | $ 9 | - |
| 2025 | 0% | | | | | | | | | | | | $ 23 | $ 18 | $ 14 | $ 9 | - |
| 2026 | 0% | | | | | | | | | | | | | $ 18 | $ 14 | $ 9 | - |
| 2027 | 0% | | | | | | | | | | | | | | $ 14 | $ 9 | - |
| 2028 | 0% | | | | | | | | | | | | | | | $ 9 | - |
| 2029 | 0% | | | | | | | | | | | | | | | | - |

NOTE: After construction begins the tax payer has 4 years to complete construction, e.g. a wind facility starting construction in 2019 could begin operation in 2023, and the PTC would expire in 2033.
https://www.irs.gov/irb/2016-23_IRB/ar07.html

# Wind Planning vs Wind Development

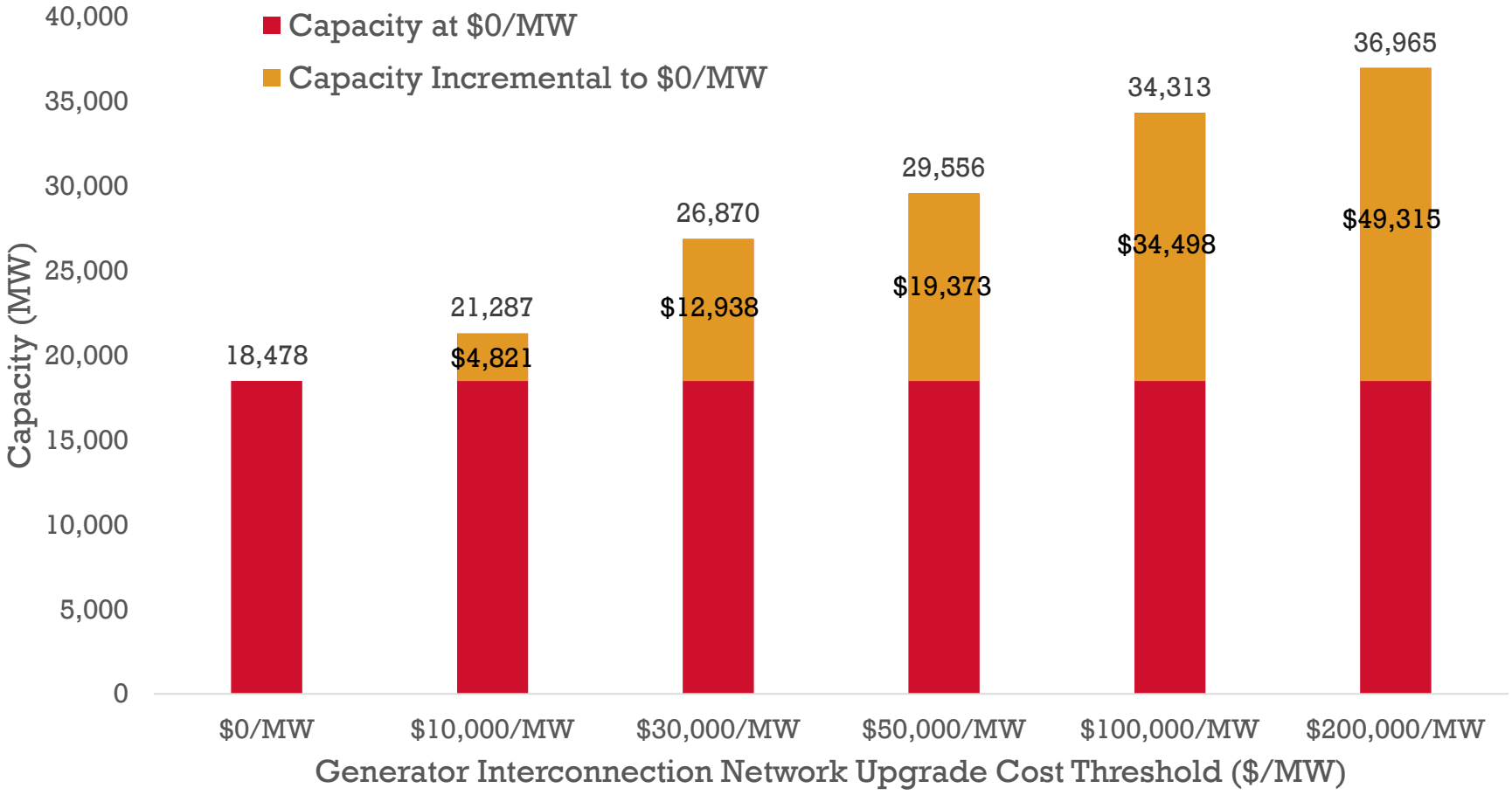



*Business as Usual/Reference Case for Economic Studies Only. Sensitivity case wind levels not included.

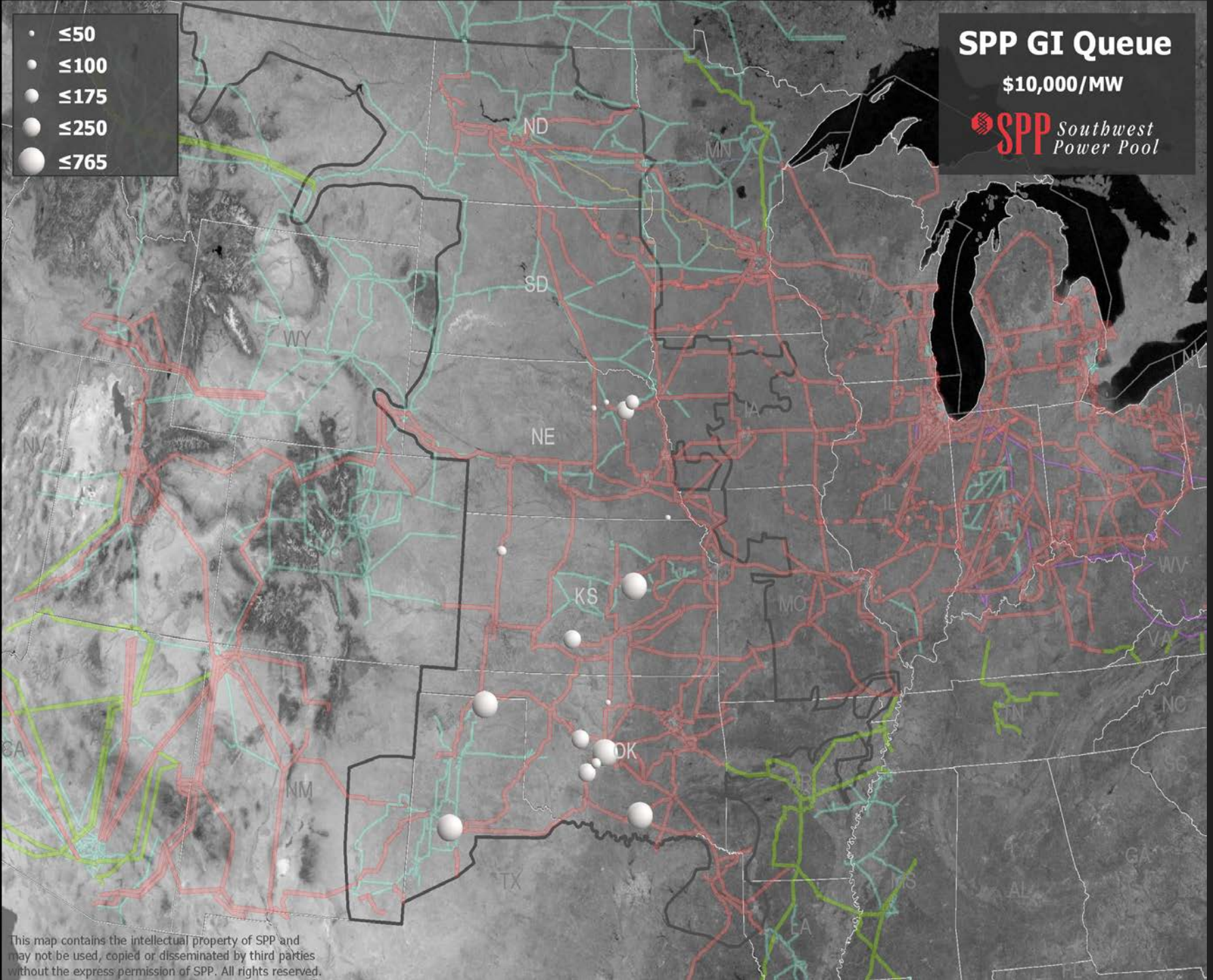
# SPP GI Queue

- SPP GI queue is renewable heavy
  - 43.4 GW analyzed to date*
  - Over 30 GW of requests in most recent windows
- Generator interconnection network upgrade costs
  - Last 7.6GW of wind was placed in service at average network upgrade cost of $32,500/MW
  - Interconnection costs under a $100,000/MW network upgrade cost threshold have an average cost of $34,500/MW
  - Some projects experience network upgrade costs greater than $1M/MW

# Installed Renewable Capacity at Interconnection Cost* Thresholds




* Remaining actual and projected Network Upgrade costs per MW requested reported for capacity incremental to $0/MW threshold



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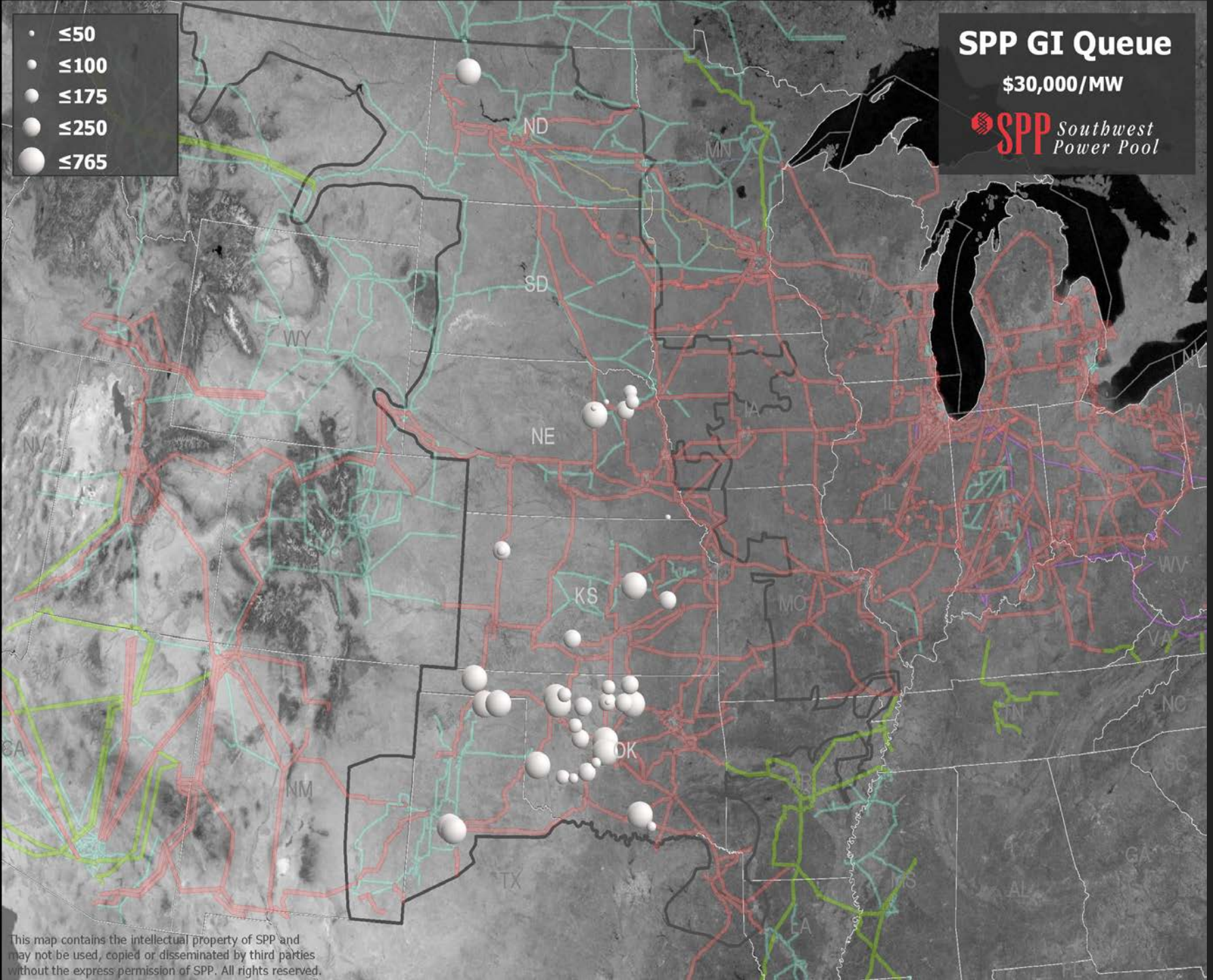




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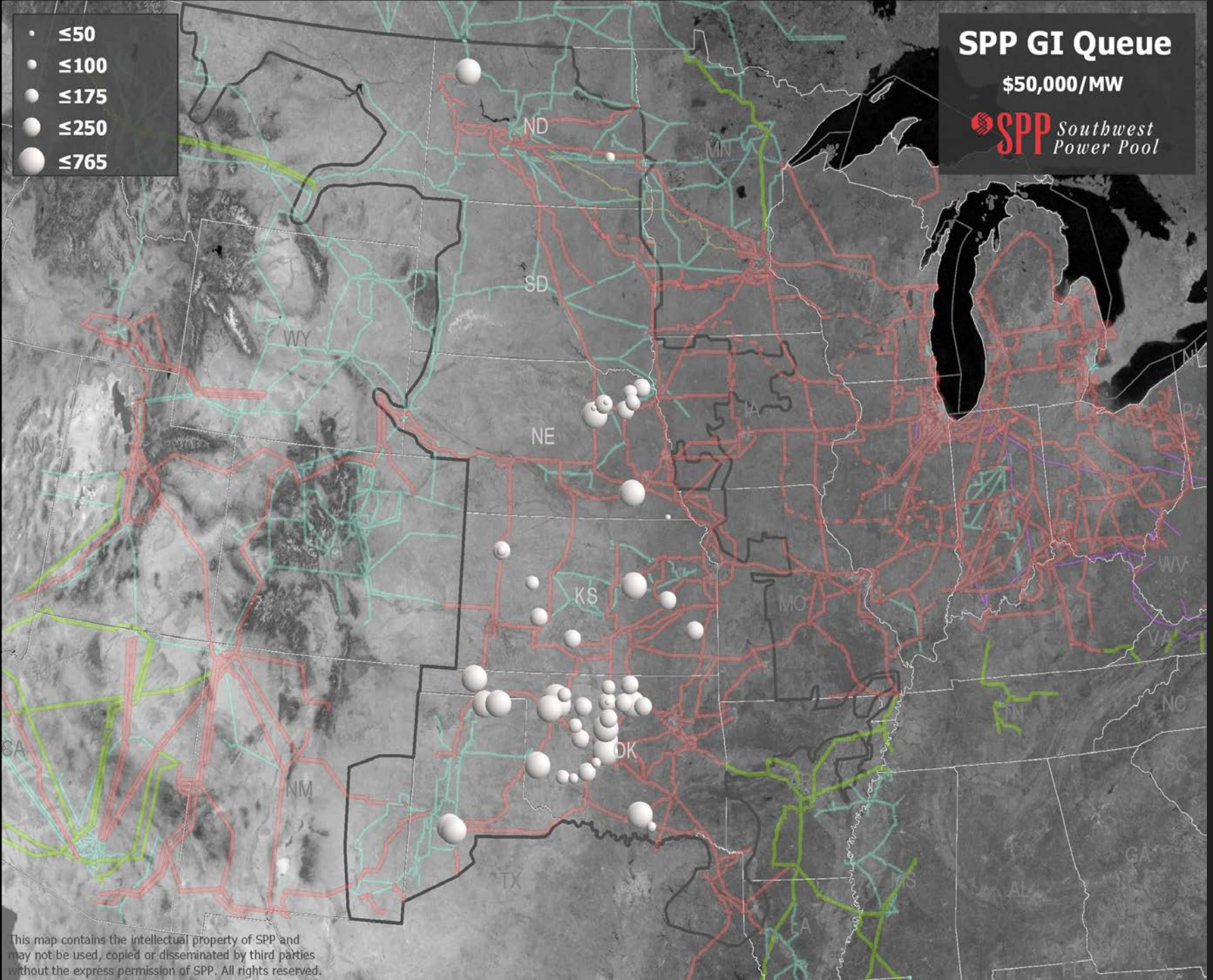




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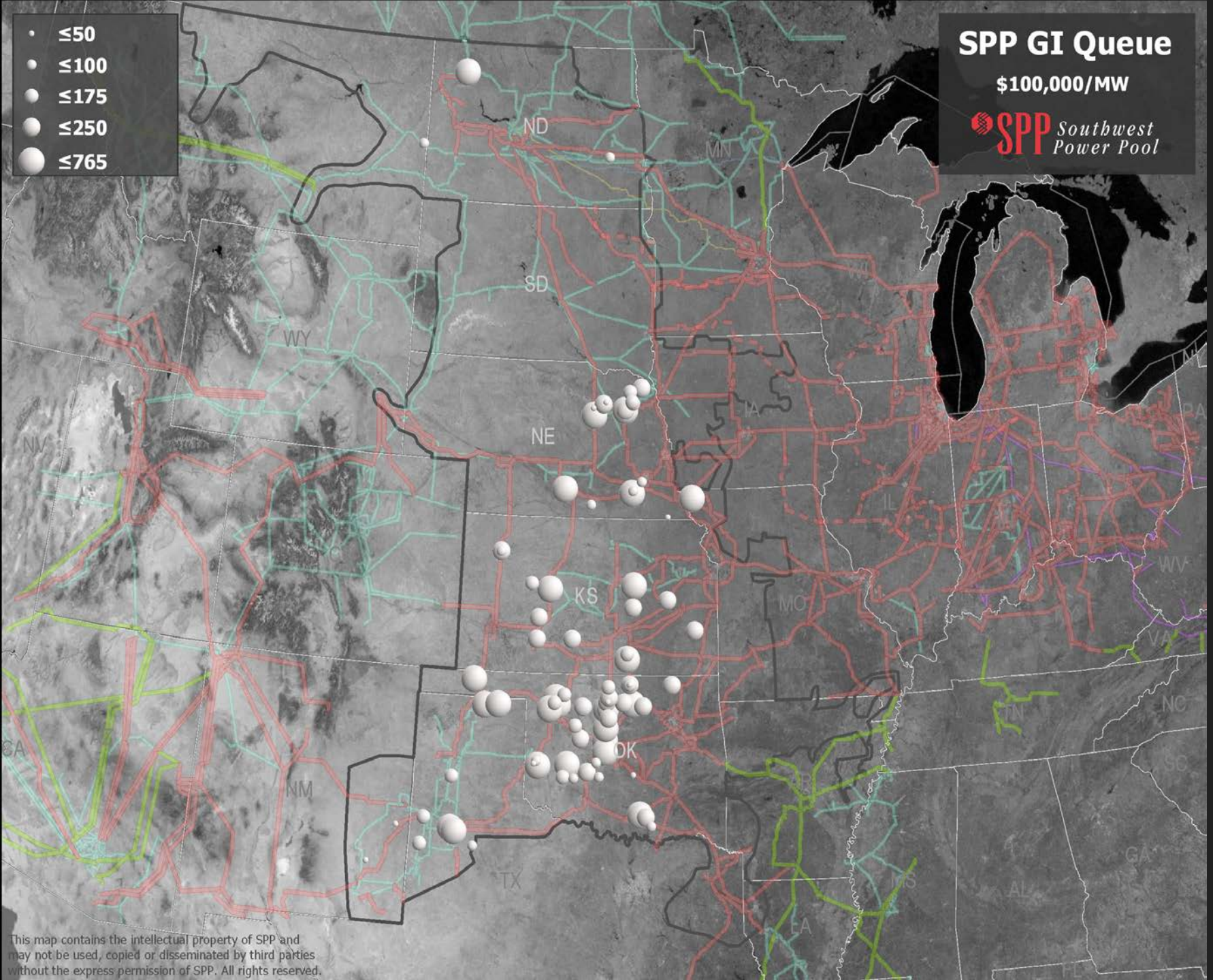




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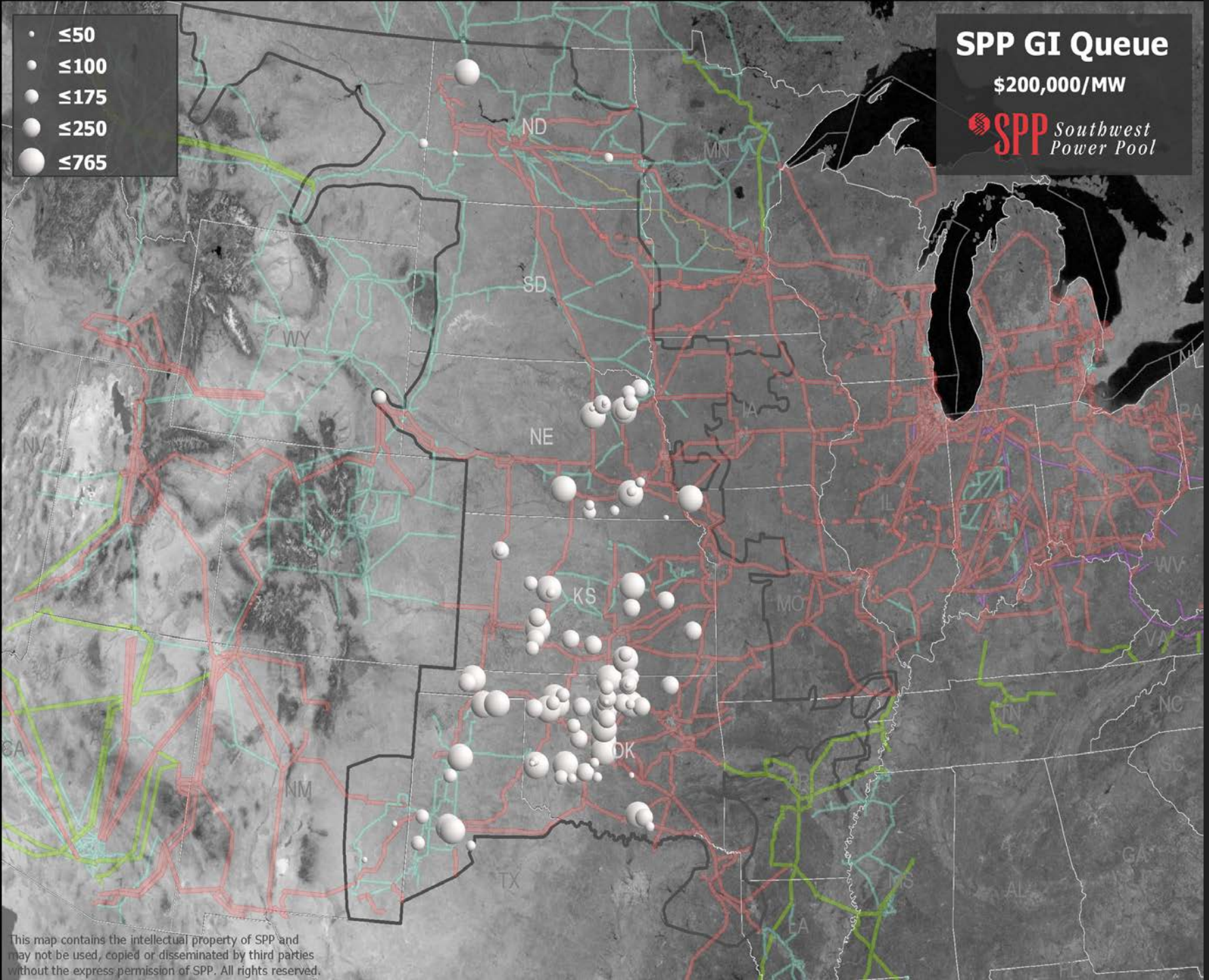




SPP

# Renewable Saturation Analysis

- Analyze installed renewable capacity by GI cost threshold to indicate the potential point of diminishing economic returns
- Analysis
  - Perform production cost simulations
  - Disable all interchange between SPP and Tier 1 to ensure no renewable energy exports
  - Disable transmission thermal limitations and losses to determine optimal unit commitment and dispatch considering only ancillary service needs and resource specific constraints
  - Analyze increases in renewable energy curtailments

# Renewable Saturation Analysis

| Interconnection Cost Ceiling | Installed Renewable Capacity* (GW) | Annual Energy Delivered (TWh) | Minimum Conventional Dispatch (MW) | Maximum Renewable Penetration | Annual Curtailment % |
|---|---|---|---|---|---|
| Base (2017ITP10 F3) | 17.1 | 70 | 10,755 | 54.2% | 0.0% |
| $10K/MW | 21.1 | 86 | 8,430 | 65.2% | 0.3% |
| $30K/MW | 26.4 | 105 | 7,523 | 72.1% | 2.8% |
| $50K/MW | 29.1 | 114 | 6,360 | 76.6% | 4.5% |
| $100K/MW | 33.6 | 127 | 3,621 | 87.4% | 8.0% |

* Scenario also contains ~2.7GW of proxy solar by 2025, not included in totals


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# Conventional Generation Prototypes

Amber Greb

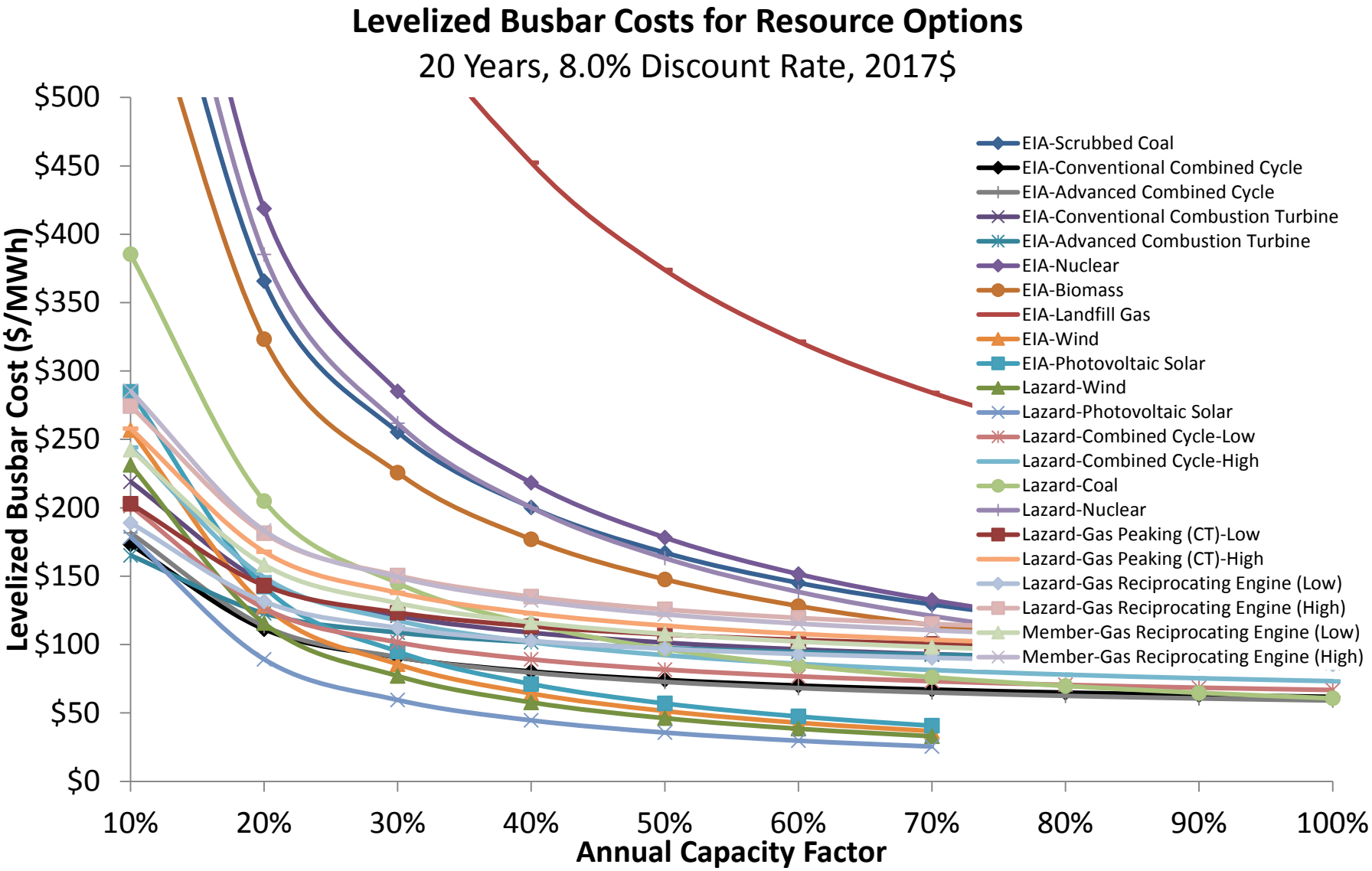
August 16-17, 2017

# Prototype Data Source Options

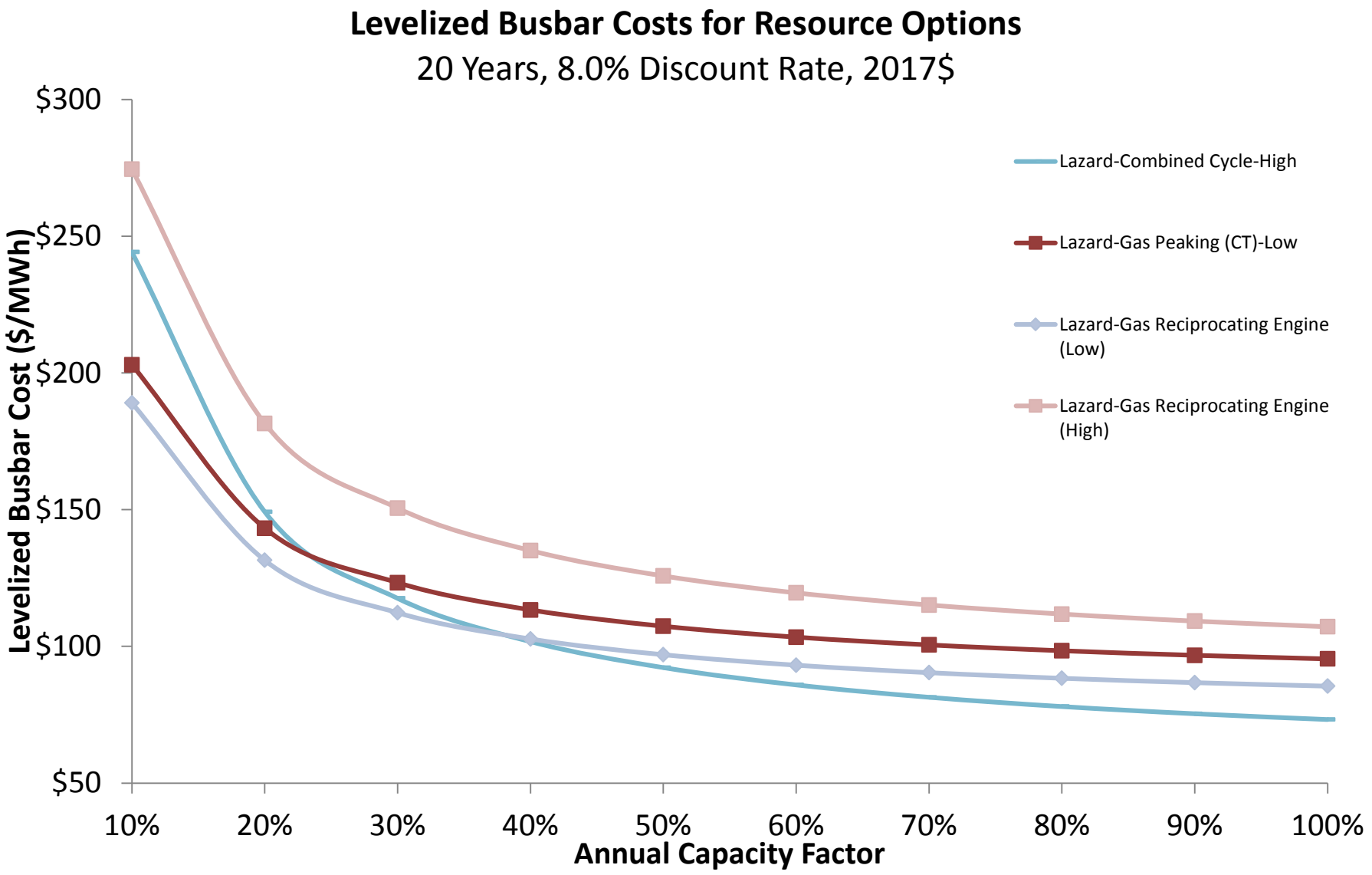
- EIA Annual Energy Outlook (AEO) Report
  - Used in 2015 ITP10
  - July 2017 Data
- Lazard Levelized Cost of Energy Analysis – Version 10.0
  - Used in 2017 ITP10
  - December 2016 data

| Generation Type | Data Source | Tech Type | Size (MW) | Total Capital Cost ($/kW) | V O&M ($/MWh) | F O&M ($/kW-yr) | Heat Rate (Btu/kWh) |
|---|---|---|---|---|---|---|---|
| Combined Cycle (CC) | EIA AEO'17 | Adv. | 429 | 1,121 | 2.04 | 10.19 | 6,300 |
| | EIA AEO'17 | Conv. | 702 | 993 | 3.57 | 11.20 | 6,600 |
| | Lazard | High | 550 | 1,333 | 2.05 | 5.64 | 6,900 |
| | Lazard | Low | 550 | 1,025 | 3.59 | 6.36 | 6,300 |
| Combustion Turbine (CT) | EIA AEO'17 | Adv. | 237 | 689 | 10.90 | 6.93 | 9,800 |
| | EIA AEO'17 | Conv. | 100 | 1,119 | 3.57 | 17.82 | 9,920 |
| | Lazard | High | 103 | 1,025 | 7.69 | 25.63 | 9,000 |
| | Lazard | Low | 216 | 820 | 4.82 | 5.13 | 10,300 |
| Coal | EIA AEO'17 | | 650 | 5,156 | 7.24 | 71.30 | 9,750 |
| | Lazard | | 600 | 3,075 | 2.05 | 41.00 | 8,750 |
| Nuclear | EIA AEO'17 | | 2,234 | 6,027 | 2.35 | 102.14 | 10,459 |
| | Lazard | | 1,100 | 5,535 | 0.51 | 138.38 | 10,450 |
| Wind | EIA AEO'17 | | 100 | 1,728 | 0.00 | 47.88 | N/A |
| | Lazard | | 100 | 1,281 | 0.00 | 35.88 | N/A |
| Solar PV (Utility Scale) | EIA AEO'17 | | 15 | 2,334 | 0.00 | 22.20 | N/A |
| | Lazard | | 30 | 1,486 | 0.00 | 12.30 | N/A |
| Gas Recip Engine | Lazard | High | 0.25 | 1,128 | 15.38 | 20.50 | 9,000 |
| | Lazard | Low | 0.25 | 666 | 10.25 | 15.38 | 8,000 |
| Gas Recip Engine | Member | High | 110 | 1,050 | 10.25 | 38.49 | 9,000 |
| | Member | Low | 225 | 900 | 7.00 | 28.82 | 8,650 |

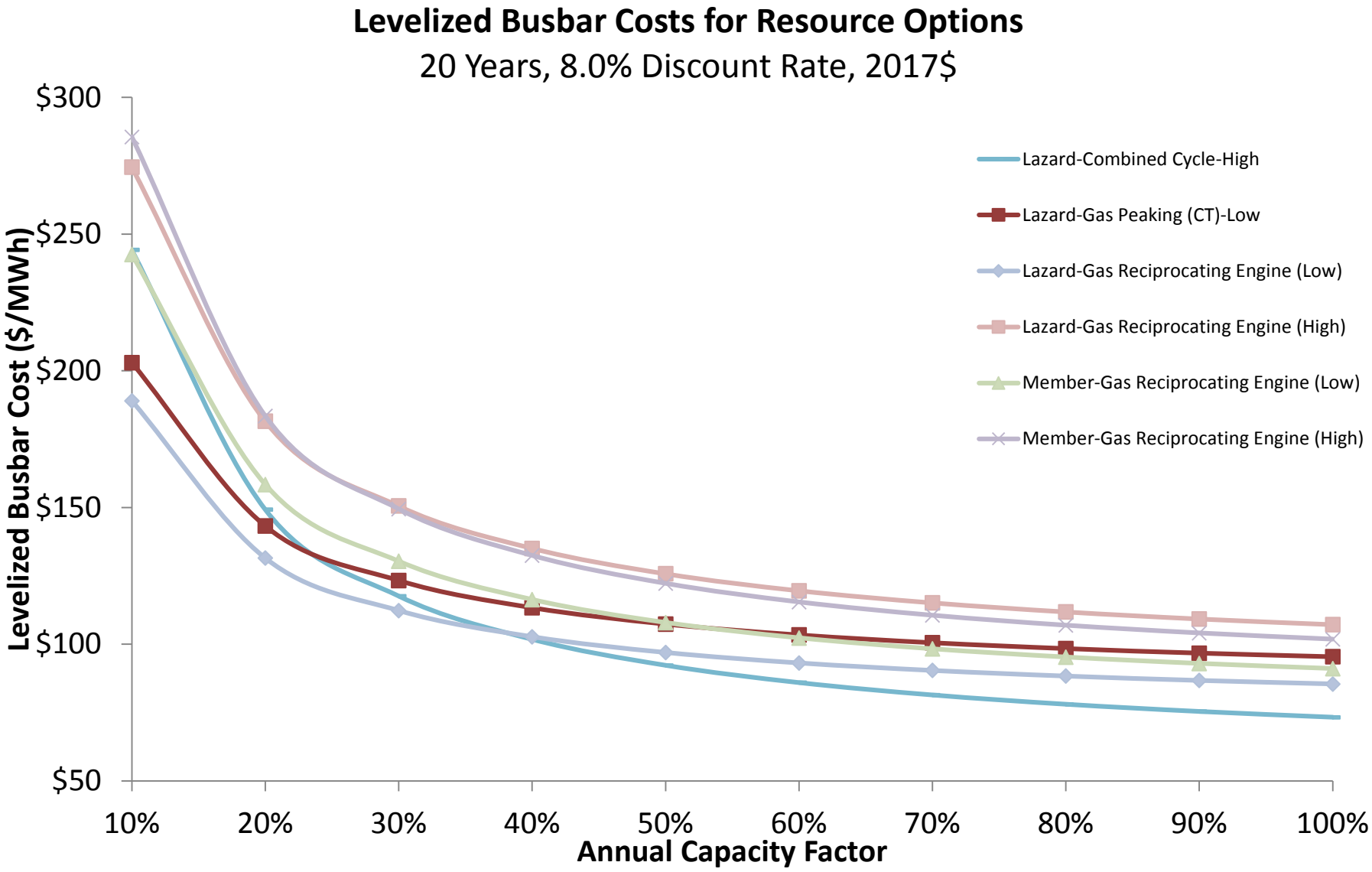
# Busbar Curves – All Units



# Busbar Curves – Gas Units



# Busbar Curves – Gas Units addtl.



# Prototypes Recommendation

SPP Staff recommends the ESWG approve using Lazard High Cost CC prototypes and low cost CT prototypes adding large scale reciprocating engines and eliminating nuclear and coal as options.

# Prototypes Recommendation

Motion that we include a reciprocating engine prototype using an average of the Lazard (high cost and low cost) data, with a 50 MW installation increment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# 2019 ITP Renewable Accreditation

SPP Staff

September, 2017

# ITP Manual Language

Section 2.2.2.1.2 Conventional Resource Expansion Plan

- Each pricing zone shall be assessed for resource adequacy by accounting for load projections, existing generation, new wind and solar additions, capacity accreditation for all renewable units, fleet PPAs, and DC tie accreditations. ”

# 2017 ITP10

- SPP Planning Criteria 7.1.5.3
  - Solar – 10% to 0% by default
  - Wind – 5% to 0% by default
- Accreditation percentages were surveyed by the stakeholders for existing and planned renewable capacity
  - Solar – Max 50% - Min 10%
  - Wind – Max 38% - Min 0%
    - 9 GWs at 5%
    - Non-designated wind at 0%
- Future renewable resources were counted at a regional average of accreditation percentages submitted by stakeholders
  - Solar – 10% accreditation
  - Wind – 20% accreditation

# 2019 ITP Recommendation

- Gen review milestone
  - Survey Wind and Solar Accreditation
    - Anticipate consistency with Resource Adequacy process going forward
- SPP Planning Criteria 7.1.5.3
  - Solar – 10% to 0% by default
  - Wind – 5% to 0% by default
    - Adjust accreditation of wind at 5% or 0% to regional average of 20%
    - Adjust solar accreditation at 10% or 0% to 20%
    - Adjust Non-designated wind and solar from 0% to 20% as needed to limit regional conventional resource expansion amounts
- Set designated renewable resource expansion amounts to 20% and non-designated amounts from 0% to 20% as needed

# 2019 ITP Recommendation

Wind

- Motion that we account for 20% capacity accreditation on new wind, with a cap for renewables of 12% of the total load.

Solar

- Motion that we account for 70% capacity accreditation on new utility scale solar, with a cap for renewables of 12% of the total load.


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# 2019 ITP Scope- MUST Run Criteria

Nikki Roberts

September 13, 2017

# ITP Manual Language

"Must-run statuses will be removed from all units at the start of each study. In the development of the ITP study scope, the ESWG will determine if must-run units will be allowed and the criteria needed for such designation. Individual generating units meeting must-run criteria will be submitted by SPP or stakeholders during the generation review and subject to approval by the ESWG."

# Must-Run Status

- ABB Simulation Ready Data
  - Units that generally run to meet a base level of load and have physical constraints that prevent it from shutting down easily.
  - Coal and Gas (CC) above 100MW.
- MISO MTEP18 Model
  - All Nuclear Units.
  - Co-generation Units in MISO South.

# Recommendation

- Motion to assign must-run designations to co-generation and nuclear units only, unless an exception is requested with pass 2 of the Gen review (by November 17th, 2017), and approved by the ESWG
- Note: ESWG will determine criteria for hydro at a later date
- Potentially implement must-run designations to additional units as a sensitivity during the Project Selection milestone.
  - ***IF*** must runs are to be included as a sensitivity, criteria will be vetted and determined through Stakeholders prior to the start of the Project Selection milestone.

## Economic Operational Needs Solution Evaluation

Flowgate Needs

Economic solutions for flowgates will be initially evaluated based the amount of MW relief that is provided by the solution. A DC analysis will be performed on operational models that reflect system conditions when congestion occurs in order to identify the amount of relief each solution provides. The project will then be placed into a relief tier based on the amount of congestion that is relieved on the flowgate. Each relief tier will have a bandwidth of 10%.

The top 3 solutions from each relief tier will be further evaluated on an economic basis. A selection of 40 days with various operating conditions will be selected to determine an average production cost savings based on daily operational models. The average production cost savings will be compared with the cost and feasibility of each project to determine the best solution. If any of the projects are deemed infeasible, staff may select alternate projects within that tier for further economic analysis

Manual Commitment of Generators

Economic solutions for needs due to manual commitments of generators in the Integrated Market will be evaluated based on the magnitude of need on operational models where the manually committed generator is not allowed to be dispatched. The annual benefit of the project will equal to the absence of the average annual Make Whole Payment requirement. Project selection will consider the cost of the solution as well as the ability of the solution to reduce or completely replace the need for the manual commitment with regards the amount of Make Whole Payment that would no longer be necessary.

## Reliability Operational Needs Solution Evaluation

System Reconfiguration for Voltage Issues

Reliability solutions for these needs will be evaluated using the CVR metric defined in the TWG Reliability Screening Metrics document.

System Reconfiguration for Thermal Issues

Reliability solutions for these needs will be evaluated using the CLR metric defined in the TWG Reliability Screening Metrics document.


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# 2018 ESWG Meeting Schedule

ESWG

August 16-17, 2017

# Proposed Schedule – 1st Semester

**January**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 04 | 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 | 9 | 7 | 08 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | | | |

**March**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 |
| 4 | 5 | 06 | 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 | 03 | 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 | 10 | 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 | 07 | 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 | 11 | Dallas |
| February | 21-22 | OKC |
| March | 15 | Dallas |
| April | 17 or 26 | Dallas or Kansas City |
| May | 15-16 | |
| June | 14 | Dallas |

- BOD
- RSC
- MOPC
- PCWG
- Summit
- CAWG
- TWG
- ESWG
- MDWG
- RTWG
- SSC
- SPC
- SAWG
- SPP Holiday

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

# 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 | | | | |

**August**

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

**September**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | | 1 |
| 2 | 3 | 4 | 5 | 06 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | | | | | | |

**October**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | 1 | 02 | 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 | 06 | 07 | 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 | 04 | 5 | 06 | 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 | 19 or 26 | Michigan |
| August | 15-16 | Billings |
| September | 13 | Dallas |
| October | 11 | Dallas |
| November | 7-8 | Little Rock |
| December | 20 | Dallas |

BOD
RSC
MOPC
PCWG
Summit

CAWG
TWG
ESWG
MDWG
RTWG

SSC
SPC
SAWG

SPP Holiday

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