# TWIN CITIES MEETING MATERIALS

# Minnesota Power
# 2020 Integrated Resource Plan

## Twin Cities Stakeholder Meeting 1
## Wednesday, December 4th, 2019. 10:00am-3:00pm

Walker Art Center, Crosby Conference Room
725 Vineland Place, Minneapolis, MN 55403

### Meeting Objectives:

1. Build a shared understanding of the 2020 IRP requirements and timeline, as well as the current state of Minnesota Power's system and service territory.
2. Identify stakeholders' must-have and nice-to-have considerations/scenarios for Minnesota Power's 2020 IRP filing.
3. Identify questions and discussion items to be addressed in the second meeting, on December 17, 2019.

### Agenda:

**10:00AM** **NETWORKING AND COFFEE**

**10:30AM** **WELCOME, INTRODUCTIONS, PROCESS OVERVIEW**

**10:45PM** **PRESENTATION AND Q&A WITH MINNESOTA POWER STAFF**

- Requirements and timing for the 2020 IRP filing
- Minnesota Power's system characteristics (# of customers; balance of residential, commercial, industrial; load profile; current resource mix; achievements to date)
- Details and demographics on the customers and communities in Minnesota Power's service territory

**12:00PM** **LUNCH**

**1:00PM** **PRESENTATION AND Q&A (CONTINUED)**

**1:30PM** **FACILITATED STAKEHOLDER DISCUSSION:**

- Given the information you have today, what are your "must-haves" and "nice-to-haves" for considerations/scenarios in Minnesota Power's next IRP?
- What additional questions or discussions should be addressed in the second stakeholder meeting on December 17, 2019?

**3:00PM** **ADJOURN**

| Minnesota Power 2020 IRP Twin Cities Advocates Stakeholder List (Meeting 1) | | |
|---|---|---|
| **First Name** | **Last Name** | **Organization** |
| Ingrid | Bjorklund | Advanced Energy Management Alliance |
| Mike | Bull | Center for Energy and Environment |
| Jessica | Burdette | MN Department of Commerce |
| John | Christensen | Minnesota Power |
| Riley | Conlin | Large Power Intervenors |
| Trevor | Drake | Great Plains Institute |
| Allen | Gleckner | Fresh Energy |
| Bree | Halverson | Blue Green Alliance |
| Ray | Higgins | Minnesota Forest Industries |
| Eric | Hyland | Minnesota Forest Industries |
| Kelsey | Johnson | Iron Mining Association |
| Sarah | Johnson Phillips | Large Power Intervenors |
| Will | Kenworthy | Vote Solar |
| Kevin | Lee | MN Center for Environmental Advocacy |
| Annie | Levenson-Falk | Citizens Utility Board |
| Jessica | Looman | Minnesota State Building and Construction Trades Cou |
| Peder | Mewis | Clean Grid Alliance |
| Drew | Moratzka | Large Power Intervenors |
| Evan | Mulholland | MN Center for Environmental Advocacy |
| Eric | Palmer | Minnesota Power |
| Audrey | Partridge | Center for Energy and Environment |
| Jennifer | Peterson | Minnesota Power |
| Julie | Pierce | Minnesota Power |
| Kevin | Pranis | Laborers' International Union of North America |
| John | Reynolds | MN Chamber of Commerce |
| Michelle | Rosier | MN Public Utilities Commission |
| Beth | Soholt | Clean Grid Alliance |
| Benjamin | Stafford | Clean Energy Economy MN |
| Jessica | Tritsch | Sierra Club |
| Thor | Underdahl | Minnesota Power |
| Ana | Vang | Minnesota Power |
| Laurie | Williams | Sierra Club |
| Shane | Zarht | Coalition of Utility Cities |

# Minnesota Power
# 2020 Integrated Resource Plan

## Twin Cities Stakeholder Meeting 1 Notes
## Wednesday, December 4th, 2019. 10:00am-3:00pm

**Given the information you have today, what are your "must-haves" and "nice-to-haves" for considerations/scenarios in Minnesota Power's next IRP?**

### MUST-HAVES:

- The difference between high and low demand scenarios (industrial especially) – how does that impact rates and resource options?
- Confidence bars for forecasts
- Rate impact and bill impact analysis for 5-year action plan
- Renewable scenarios with current grid constraints vs. assumed grid build out in the future with lower gen costs
- Reliable and high-quality electricity
- Competitive energy costs for large industrial businesses – EITE statute compliance
- Scenarios with different commitment statuses for coal plants – self-schedule vs. economic dispatch
- Different retirement dates for Boswell – before 2030; all cost implications (Boswell Rider for environmental retrofits)
    - Full consideration of all costs and benefits
- NTEC – revisit whether it will be a cost-effective resource through end of life (2064)
    - Fuel switching?
- Storage, demand response, and other emerging ways to manage load (resource and shaping)
- Job impacts of retirements and replacement resources
- Local governments – tax base impacts, land use, economic ripple effects of resource changes
- Include in IRP how MN products stack up in terms of environmental attributes.
    - How is that valued in the market?
    - Is there a path to value environmental attributes in the product market?
- Customer sited distributed generation – range of projections (MP currently nets DG from load forecast)
    - Should there be a consideration of MP rebates for DG solar (potential based on high rebates vs. low)
- Range of projections for EE, including industrial/CIP-exempt customers
- What drives high and low forecasts for electrification scenarios, EE, DG, DR?
- A full discussion of demand response, including industrial, non-emergency

- Recognition that the credit to participants must be enough to offset the negative aspects of participating in DR as a large customer

### NICE-TO-HAVES:

- As information is provided to the Commission, provide background for why and how assumptions were developed and selected. How approaches differ.
- If stakeholders introduce new concepts into the IRP process, provide information about how the PUC has authority to consider the concepts presented.
- More information about EE from CIP-exempt customers
    - How it's accounted for in the IRP
    - What's the plan for the next 15 years?
- Discussion of cogeneration with large industrials
- Consideration of cost implications for demand charges for large industrials – possible offerings
- Stakeholder process – overview of new MP programs

## What additional questions or discussions should be addressed in the second stakeholder meeting on December 17, 2019?

- Reliance on MISO
- Demand response

# Minnesota Power
# 2020 Integrated Resource Plan

## Twin Cities Stakeholder Meeting 2
## Tuesday, December 17th, 2019. 10:00am-3:00pm

American Swedish Institute
2600 Park Ave, Minneapolis, MN 55407

### Meeting Objectives:

1. Build a deeper shared understanding of the local economic benefits of Boswell 3 and 4, and the related potential impacts of retirement.
2. Build a deeper shared understanding of how Minnesota Power incorporates key stakeholder considerations into its load forecasting for the IRP.
3. Refine the "must-have" and "nice-to-have" criteria for the IRP that stakeholders began developing in the first meeting.
4. Identify stakeholders interests for discussion on transmission considerations/impacts in Meeting 3.

### Agenda:

**10:00AM** **WELCOME, INTRODUCTIONS, PROCESS REVIEW**

**10:15AM** **PRESENTATION AND DISCUSSION – IRP TIMING AND NEXT MEETING**

- Julie Pierce, Minnesota Power, on process timing
- Brief discussion: What do stakeholders want to discuss around transmission impacts/considerations in the IRP, at Meeting 3?

**10:45AM** **PRESENTATION AND Q&A: BOSWELL ECONOMIC IMPACTS**

- Coalition of Utility Cities on local impacts
- Ben Levine, Minnesota Power, on economic impacts modeling

**12:00PM** **LUNCH**

**12:30PM** **PRESENTATION AND Q&A: BOSWELL ECONOMIC IMPACTS (CONTINUED)**

**1:00PM** **PRESENTATION AND Q&A: ANNUAL FORECAST REPORT**

- Electrification

- Conservation (CIP and CIP-exempt)
- Distributed generation
- Large industrial load variability

**2:00PM** **FACILITATED STAKEHOLDER DISCUSSION**

- Review must-have and nice-to-have considerations from Meeting 1 and modify as needed:
    - Can anything be better defined/clarified to give more specific guidance to Minnesota Power?
    - Is anything missing from the list?
    - Do any of the items seem complementary (or uncomplementary), such that they could be consolidated into scenarios?
    - How do these items align to timing in the overall process (e.g., at what step will they be addressed)?

**3:00PM** **ADJOURN**

## Minnesota Power 2020 IRP Twin Cities Advocates (Meeting 2)

| First Name | Last Name | Organization |
|---|---|---|
| Ingrid | Bjorklund | Advanced Energy Management Alliance |
| Mike | Bull | Center for Energy and Environment |
| Jessica | Burdette | MN Department of Commerce |
| Riley | Conlin | Large Power Intervenors |
| Trevor | Drake | Great Plains Institute |
| Allen | Gleckner | Fresh Energy |
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| Jennifer | Peterson | Minnesota Power |
| Julie | Pierce | Minnesota Power |
| Kevin | Pranis | Laborers' International Union of North America |
| John | Reynolds | MN Chamber of Commerce |
| Benjamin | Stafford | Clean Energy Economy MN |
| Sean | Stalpes | Minnesota Public Utilites Commission |
| Jessica | Tritsch | Sierra Club |
| Thor | Underdahl | Minnesota Power |
| Laurie | Williams | Sierra Club |
| Shane | Zahrt | Coalition of Utility Cities |
| Ana | Vang | Minnesota Power |
| Max | Peters | City of Cohasset |
| John | Christensen | Minnesota Power |
| Eric | Palmer | Minnesota Power |
| Arik | Forsman | Minnesota Power |
| Ben | Levine | Minnesota Power |

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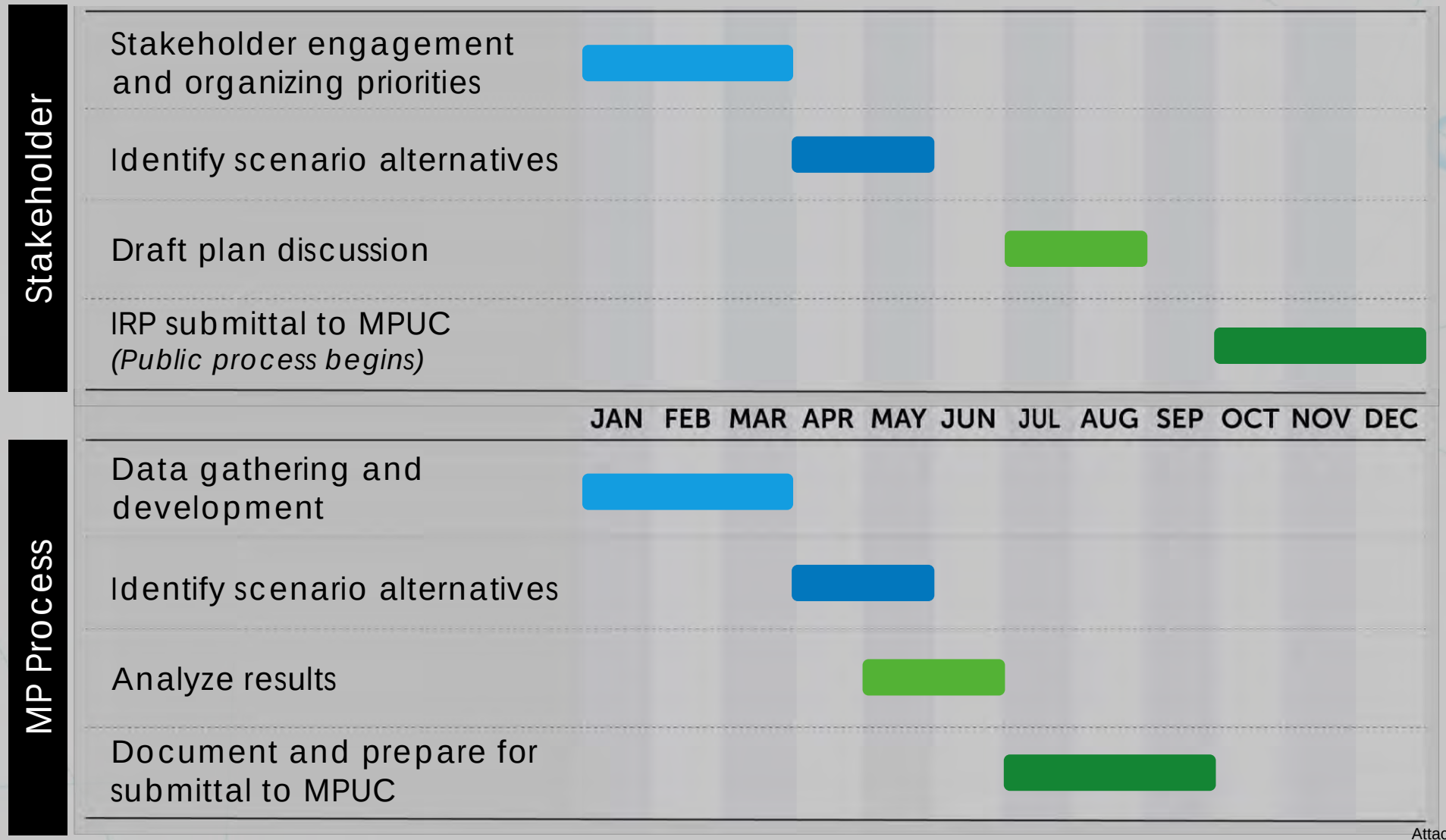
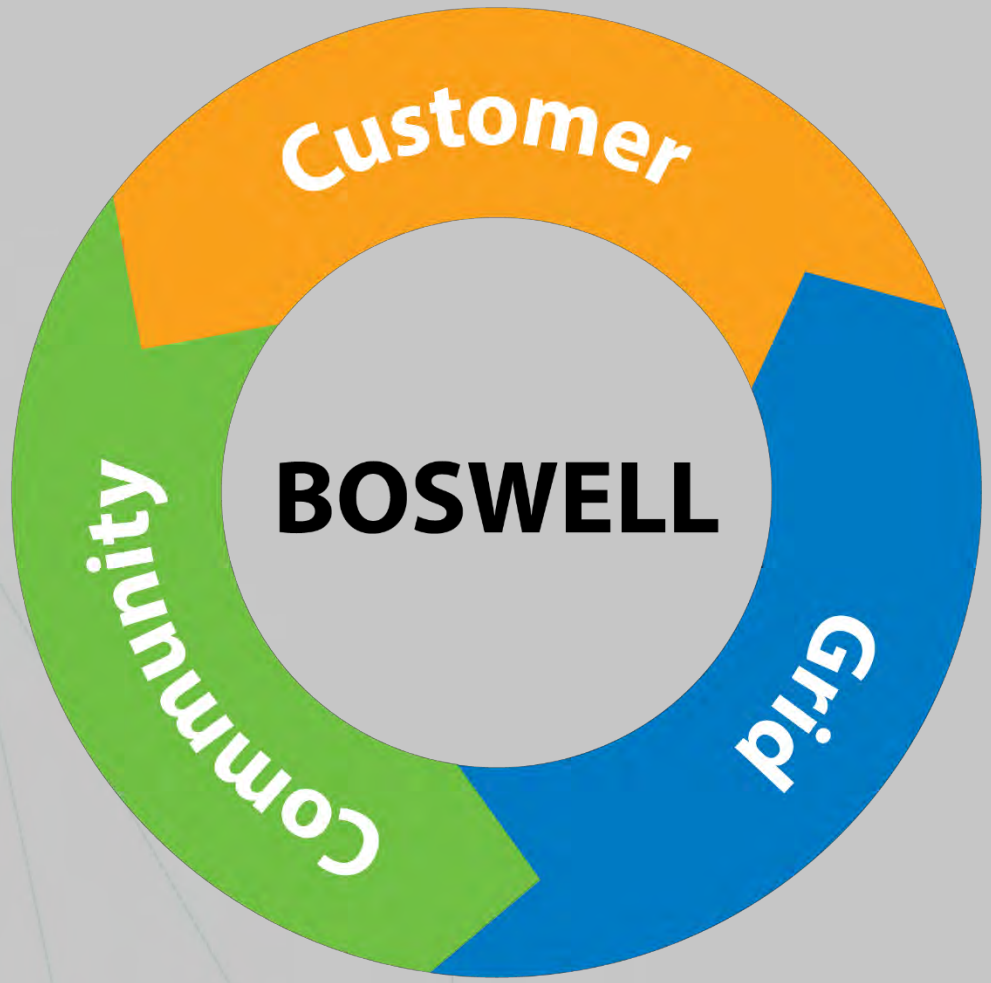
# Integrated Resource Plan Stakeholder Engagement Meeting Three Planning

Julie Pierce, Minnesota Power Vice President of Strategy and Planning

# Our Timeline

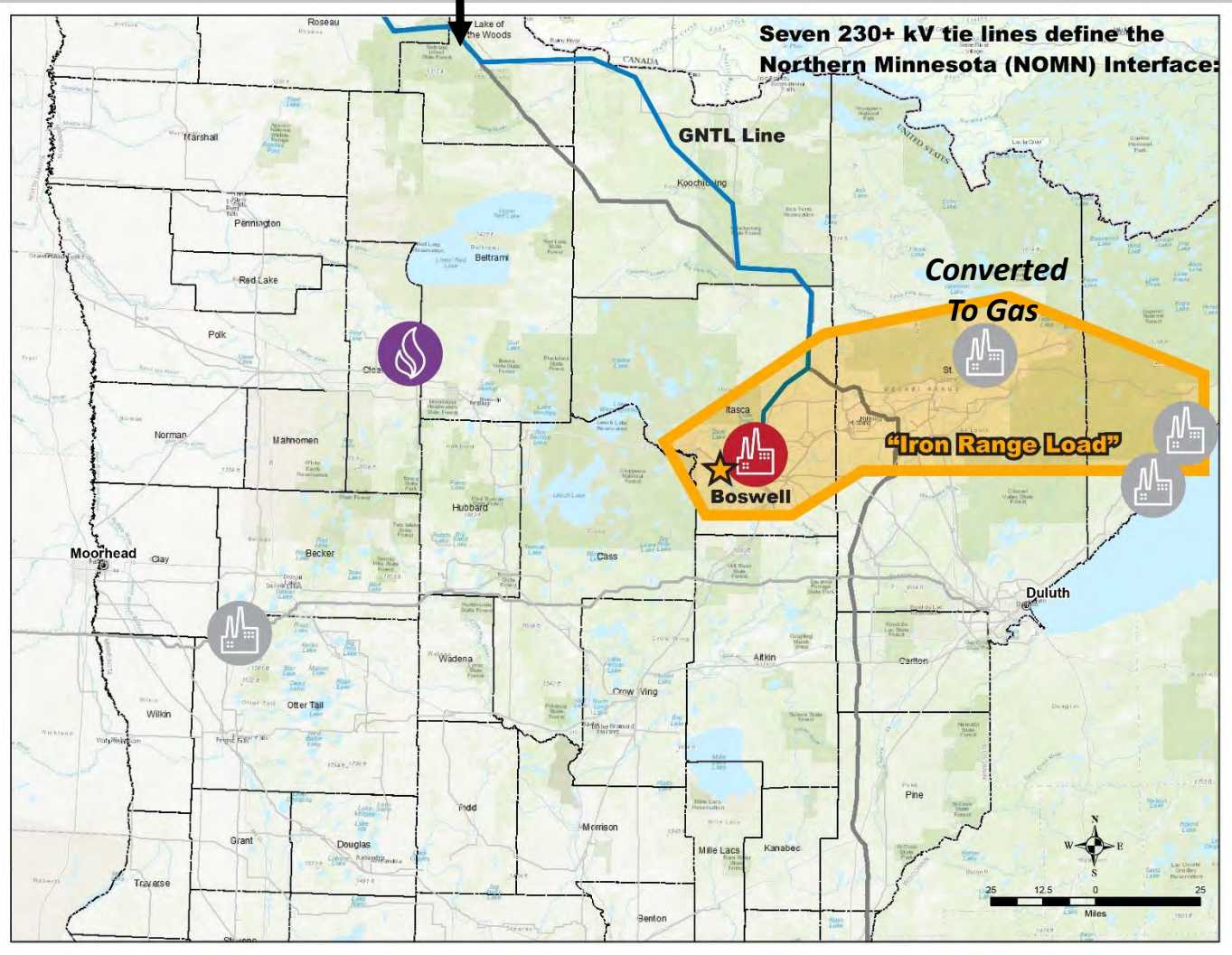


# Key Areas of Impact




- Today's Discussion: ***Community***
- Upcoming
  - **Grid**
  - **Customer**

# Boswell Facility

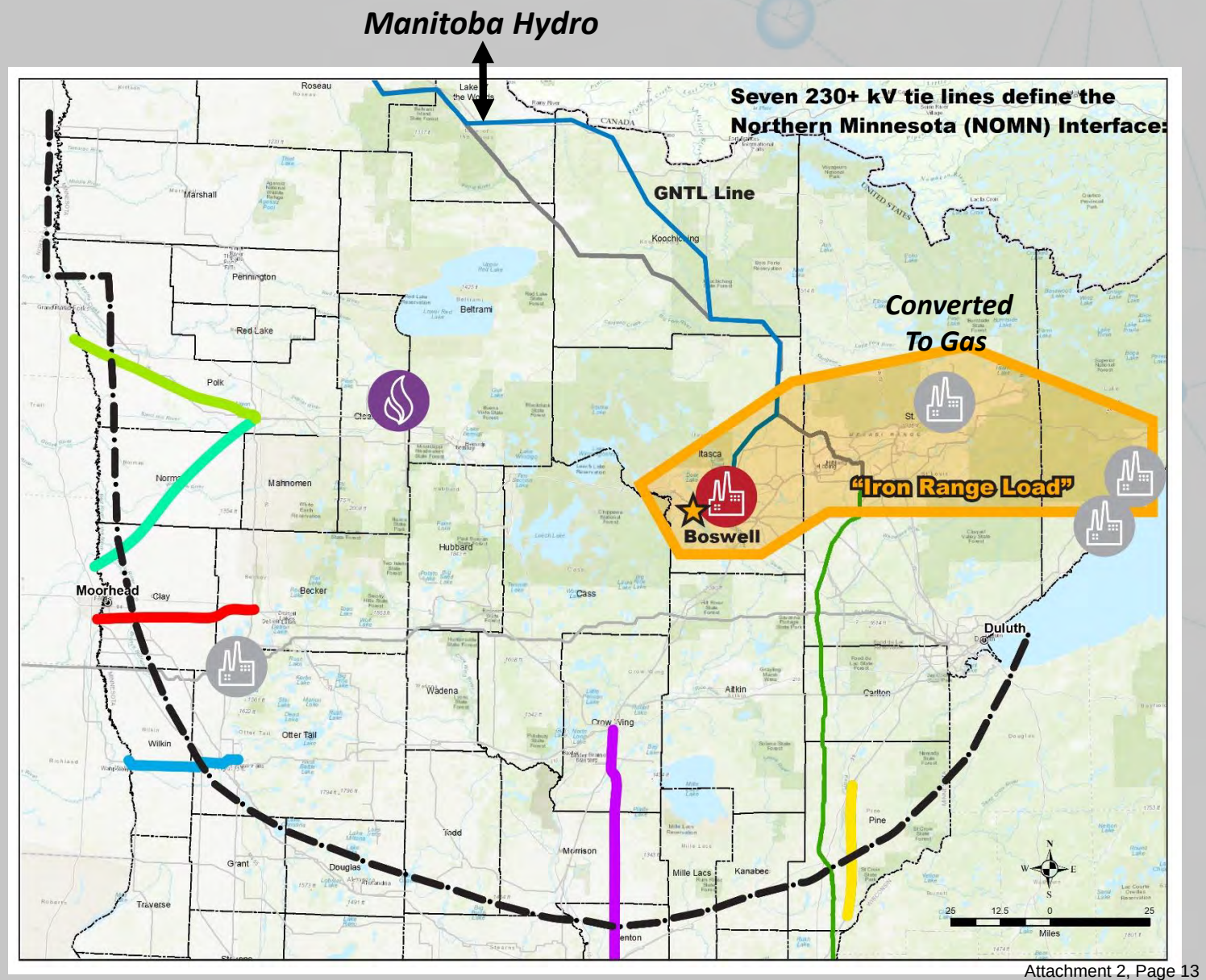



- Large geographical area of impact on the grid
- Last baseload generation center in region
- Supporting interstate and international electricity flow in the region
- Over 900MW of grid support

# Determining Initial Grid Impact

**Northern MN Voltage Stability**

- **Direct impact spans the northern half of state and Manitoba**
- **Seven 230+ kV lines are impacted as flows change**
- **Stability of the geographic region impacted , more than just Minnesota Power**
- **Northern MN will lean more heavily on tie lines to regional generation**



# Accounting for Energy Efficiency in MP's Energy Sales Forecast

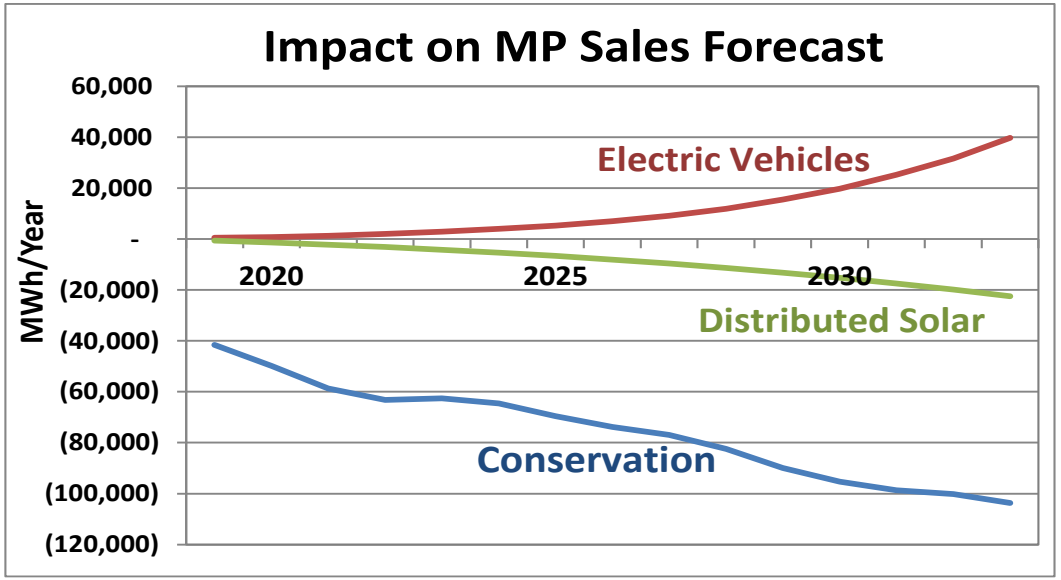
IRP Stakeholder Meeting 12/17/2019

# Overview

- Impacts of Conservation, DG Solar & Evs
- Conservation Forecasting Options
- Advantages of “EE as a RHS Variable” (our selected methodology) & why it works
- DG Solar & Electric Vehicle Forecasting methods

# Conservation, DG Solar & EVs

- Conservation:
  - Forecast assumptions are consistent with recent historical CIP savings
  - Accounting for residential, commercial and resale conservation via regression modeling
  - Industrial savings are assumed to be inherent in forecast
- Electric Vehicles:
  - Only modeled residential adoption
  - Currently serving 165 vehicles (0.2% penetration)
  - Forecasting about 8,000 vehicles (7% penetration) by 2030
- Distributed Solar:
  - Modeled residential & commercial
  - Currently about 4.5 MW of installed DG solar capacity
  - Projecting 15 MW of new capacity (~20MW total) by 2030
  - New installs will displace about 15,000 MWh (0.6%) of MP sales to residential & commercial classes



# Conservation Forecasting Options

| *Methodology | Known Local Use by: | Advantages | Disadvantages |
|---|---|---|---|
| Already Embedded – No Adjustment Needed | MP's Past Method | Easy to implement | Only useful with limited/stable DSM,<br>Can't account for increased intensity of DSM |
| Already Embedded – Adjust for Incremental DSM | Otter Tail's Method | Easy to implement,<br>Can partially account for increased intensity of DSM | Amount of Endogenous DSM savings is unknown. Total DSM assumption is unknown |
| Reconstructed Sales – As if No DSM (Gross/Net) | Xcel's Method | Can account for considerable changes in historical DSM | Forecast accuracy depends on quality of DSM savings data<br>Assumes utility-driven CIP is the only conservation affecting sales (doesn't account for consumer-driven conservation) |
| **DSM as a RHS Variable** | MP's Proposed Method | **No need to estimate Exogenous DSM Savings** | **Model results can be distorted, and inappropriate inference draw.** |
| Hybrid Model (SAE) | GRE's Method | Capture both naturally occurring efficiency trends and DSM impacts | Need software, trained personnel, and accurate appliance saturation data for the utility's customers. |
| Combination of Approaches Above | | Can reap the benefit of multiple approaches | Costly, most effective combination is unknown. |

MP doesn't have limited/stable DSM

Quantifying the DSM assumption is critical

Savings data are estimates & Customers are perusing conservation

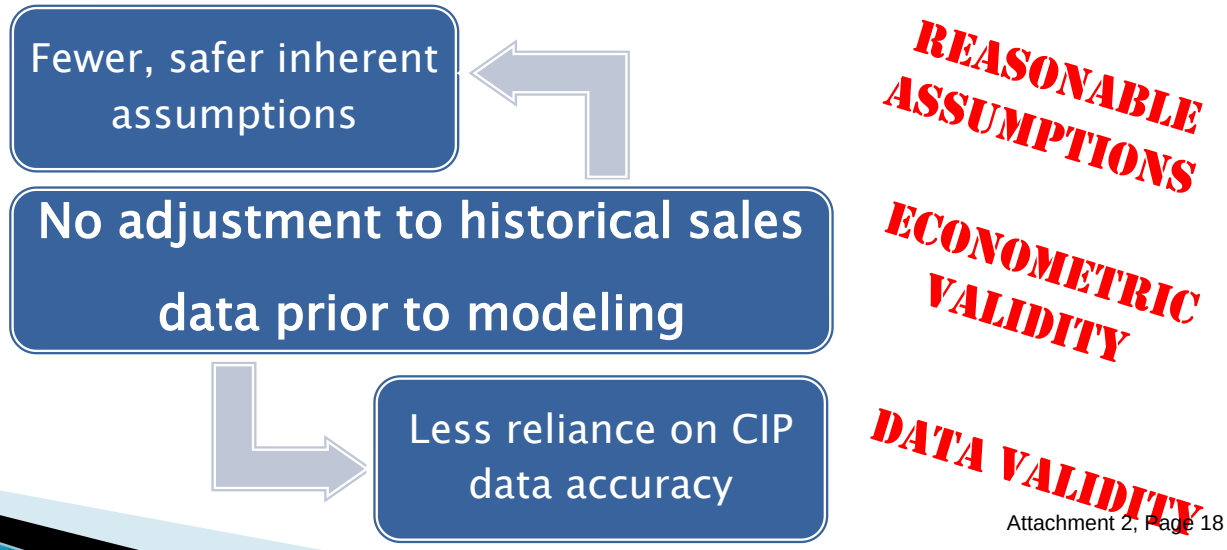
MP customers' characteristics differ from Census region



*Ahmad Faruqui, Ph.D. Zhen Wang, Ph.D. September 14, 2017

# Recommendation: DSM as a Right-Hand-Side (RHS) Variable

- Use claimed CIP savings as an predictor (RHS) variable in the regression model
- Conservation variable is an indicator of total savings
  - Savings achieved by MP, and
  - Organic savings, customer-driven conservation

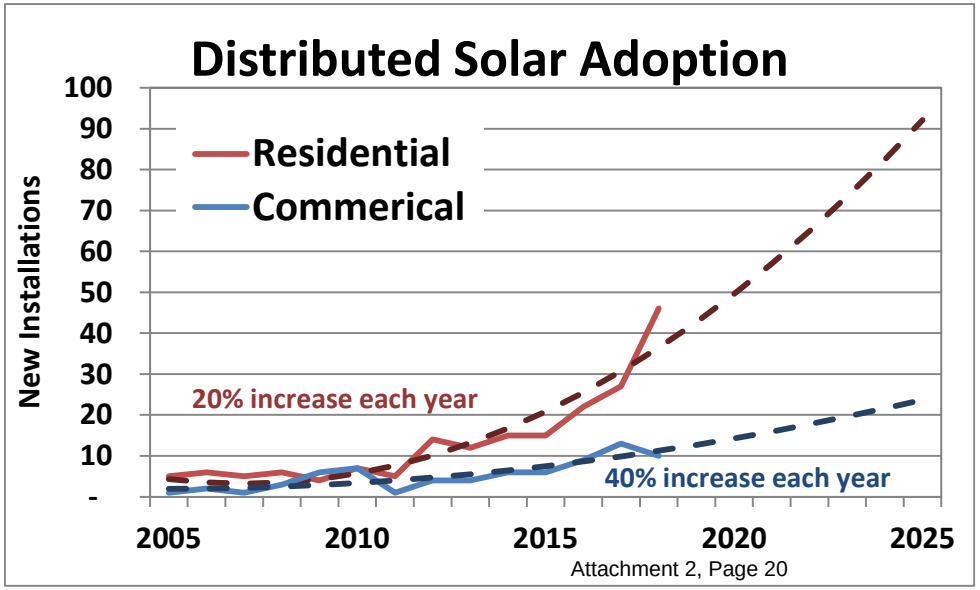


# Advantages of "EE as a RHS Variable"

- **Avoids double-counting** energy efficiency impacts in the forecast timeframe.
- **Accounts for** historical and projected conservation resulting from both **Company programs and organic, customer-driven** efforts.
- **Leverages raw sales data** in regression modeling: sales data are not adjusted for conservation impacts prior to modeling.
- **Doesn't require after-the-fact adjustments** to econometric outputs: the energy sales forecasts already contain the effects of energy efficiency.

# DG Solar Adoption Forecasting

- Model historical adoptions per year by class
  - Typical technology adoption curve
  - Exponential function describes accelerating adoption
- Apply the average installation's size to installation count forecast
- Energy impact calc
  - Cumulate installed capacity
  - Assume 11.2% capacity factor



# MP Electric Vehicle Forecasting

- MP's current EV saturation is about 4 years behind national average (Bloomberg)
- Assumption: MP saturation continues to trail the nation by 4 years
- Saturation forecast

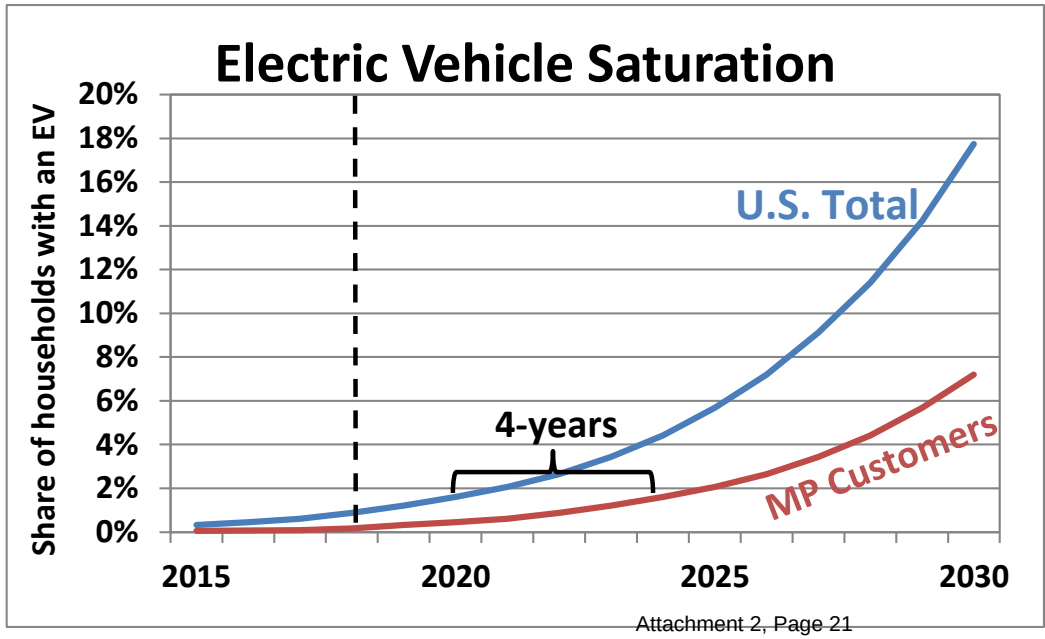
x

MP Customer count

=

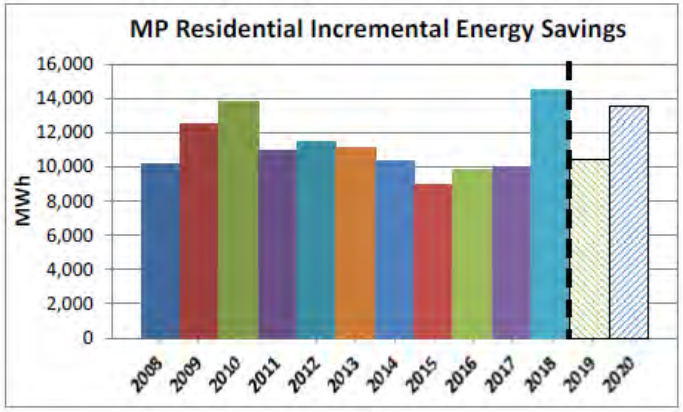
EV count forecast

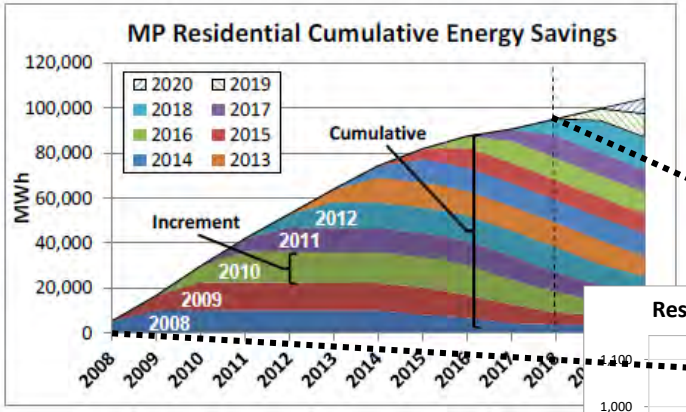
- Assume each EV uses about 2,520 KWh per year

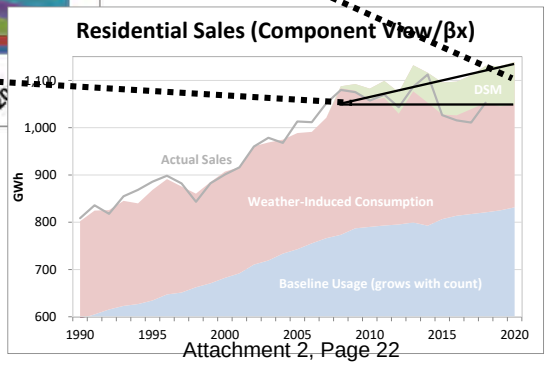


# Appendix:
# EE as RHS Var, why it works

- A cumulative savings metric represents the lasting impacts of all past conservation measures on a given year. It accumulates, so it has a slope.
- From an econometric modeling perspective, this is indicative of a **change in growth rate/trajectory of annual sales.**




# Host Communities in Transition

Max Peters, City of Cohasset
Shane Zahrt, Flaherty & Hood, P.A.

# What is a "Utility City"

- The Coalition of Utility Cities is a group of 8 cities that host large, baseload power plants owned by Investor-owned utilities

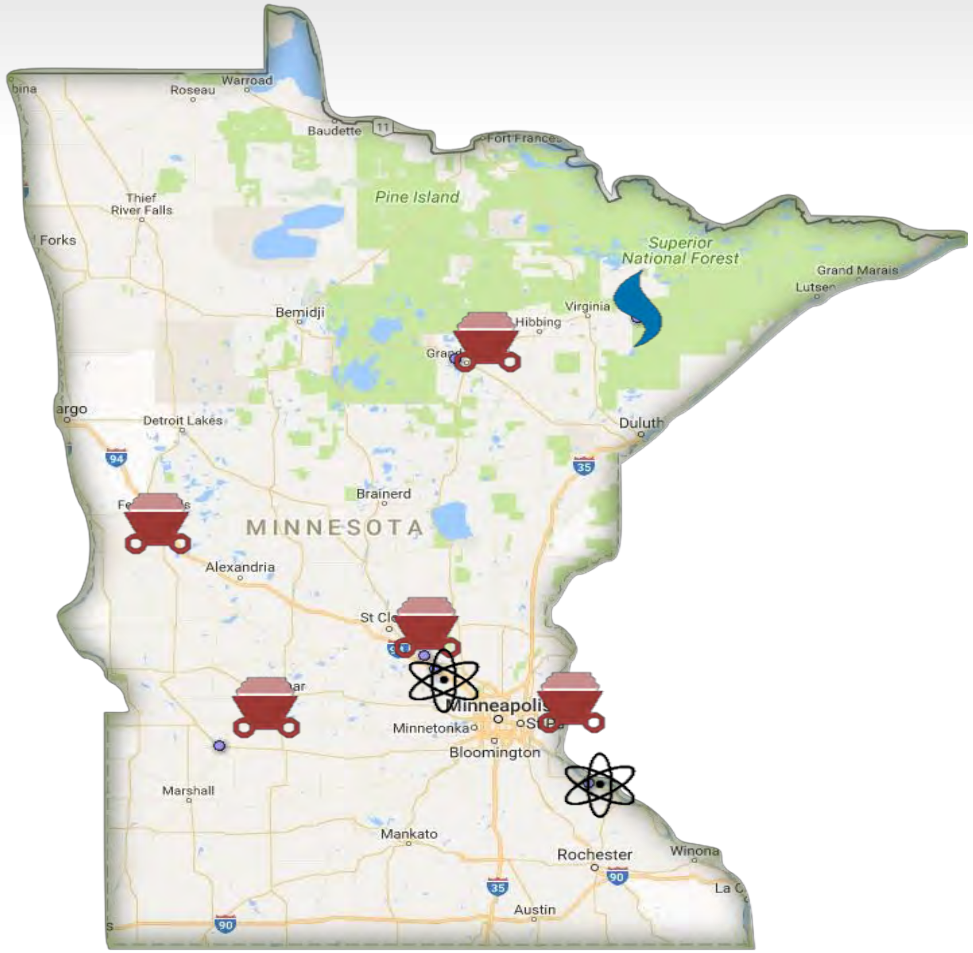
- 2 Minnesota Power; 5 Xcel; 1 Ottertail Power

- 5 host coal plants; 2 nuclear; 1 natural gas

COALITION OF UTILITY CITIES

# CUC Members

- Becker
- *Cohasset
- Fergus Falls
- Granite Falls
- *Hoyt Lakes
- Monticello
- Oak Park Heights
- Red Wing




COALITION OF UTILITY CITIES

# About CUC

- Formed in 1997
- Cities formed the Coalition to have their interests represented at the legislature
- Historically focused on taxation
- Cities collectively represent over 60,000 residents

COALITION OF UTILITY CITIES

# Hosting plants have major local impacts

- Infrastructure
- Safety & preparedness
- Land use implications
- Economic development challenges

# Plants are integral to their host communities

- Largest property taxpayers
- Major employers
- Utility & plant employees tied into every aspect of civic life

# Host communities role in transition

- Protecting local taxpayers and residents
- Working to re-shape our communities for post-plant life
- Maximizing existing assets to develop for the future

# Host communities role in transition

- It's the unknowns that keep community leaders up at night
  - Replacing economic impact of plants
  - Impact on local housing markets
  - Impact on local philanthropy community
  - Impact on school systems

- Socio-economic impact study underway with CEE
  - Hope that participation in this study can start to answer some questions and identify others

COALITION OF UTILITY CITIES

COALITION OF UTILITY CITIES

# Laskin Energy Center & City of Hoyt Lakes

# City of Hoyt Lakes – Laskin Energy Center

# City of Hoyt Lakes – Laskin Energy Center

- Population: 1,975 (2018)
- Tax Impact of Plant
  - Around 40% of City's budget
- Jobs
  - 12 Full Time
  - Down from 45 prior to gas conversion


COALITION OF UTILITY CITIES

# Boswell Energy Center & City of Cohasset

Max Peters, City of Cohasset

# City of Cohasset – Clay Boswell Energy Center

- Population: 2,809
- Tax Capacity:
  - 2020
    - $9.1M city tax base
    - Boswell = 54.4%
  - 2019
    - $11.3M city tax base
    - Boswell = 69.3%
- Jobs
  - 185 full-time employees


COALITION OF UTILITY CITIES

# City of Cohasset – Clay Boswell Energy Center

- 185 full-time employees
- $10.0M total tax contribution (2019)
- $17.0M Annual Payroll


COALITION OF UTILITY CITIES

# Impossible to replace

- 185 employees at Boswell 3 & 4
- 90% of Boswell employees live within Itasca County
- Average Boswell salary = $88,317/year
  - Compared to rest of Itasca County:
    - Median Household Income: $52,050
    - Median earnings for full-time year-round worker: $42,536

COALITION OF UTILITY CITIES

# Lake Country Service Center Project

- Largest economic development project in recent memory
- Opened October 2019
- $12.8 million investment
- 65 full-time jobs

# City of Cohasset

Boswell Tax Capacity =

# What happens after Boswell?

- Without support and careful planning, closure of Boswell will lead to:
  - Massive property tax shifts onto local residents/businesses
  - Significant reduction in city services
  - Cascading impacts through housing markets

- Impacts will ripple throughout the region and the state
  - Top contributor to Range Fiscal Disparities program

COALITION OF UTILITY CITIES

# What do communities need?

- Time

- State aid
  - Accommodations within existing programs (Local Government Aid; Fiscal Disparities)
  - Additional funds to protect local taxpayers

- Access to Economic Development Opportunities
  - State grant programs
  - Partnership with utilities

COALITION OF UTILITY CITIES

# What do communities need?

- A seat at the table
  - Discussions about climate change/clean energy transitions must include communities and workers

- <u>Specifics</u>
  - Clear communication on timelines
  - Commitments from utilities on:
    - Economic development support
    - Plans for plant site/facilities, including clean up

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# Thank you

Questions?

# Host Community Study: Boswell Economic Impacts

Minnesota Power IRP Stakeholder Meeting
12/17/2019

# Overview:

- Summary of Preliminary Results
- Current Economic Benefits of Boswell
- Study Methodology
- Deeper Dive on Preliminary Results
- Key Takeaways

# Summary of Preliminary Results: Retirement of Boswell Units 3 & 4

- Itasca County
  - Reduction of about 800-900 jobs (Direct & Indirect)
  - Gross County Product reduced $200-220 Million (6.5%)
- State of MN:
  - Reduction of about 1,500-1,650 jobs (Direct & Indirect)
  - Gross State Product reduced by $350-390 Million (0.1%)

# Current Economic Benefits of Boswell

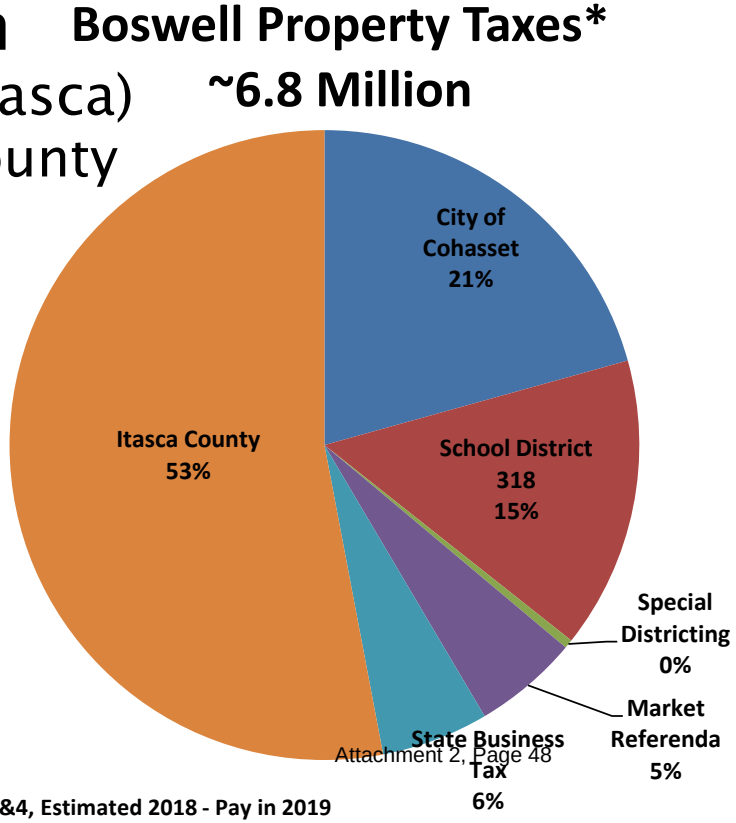
- Boswell direct benefit to:
  - MN is around $48 Million/yr
  - Itasca County is over $28 Million/yr

- Employment – Highly skilled/High paid Jobs
  - Boswell employs 167 MN Residents (incl. Itasca)
  - 151 residents of Itasca County
  - Average salary = $88,300 + 40-50% Overhead
  - Total Labor spending in MN = $20.5 Million
  - Labor spending in Itasca = $18.6 Million

# Current Economic Benefits of Boswell (Cont.)

- Vendor Payments for O&M and Capital:
  - $20 Million paid annually to MN Vendors (incl. Itasca)
  - $3.5 Million to vendors just within Itasca County

- Property Taxes* = $6.8 Million
  - ~94% to local authorities (within Itasca)
  - Over 50% paid directly to Itasca County



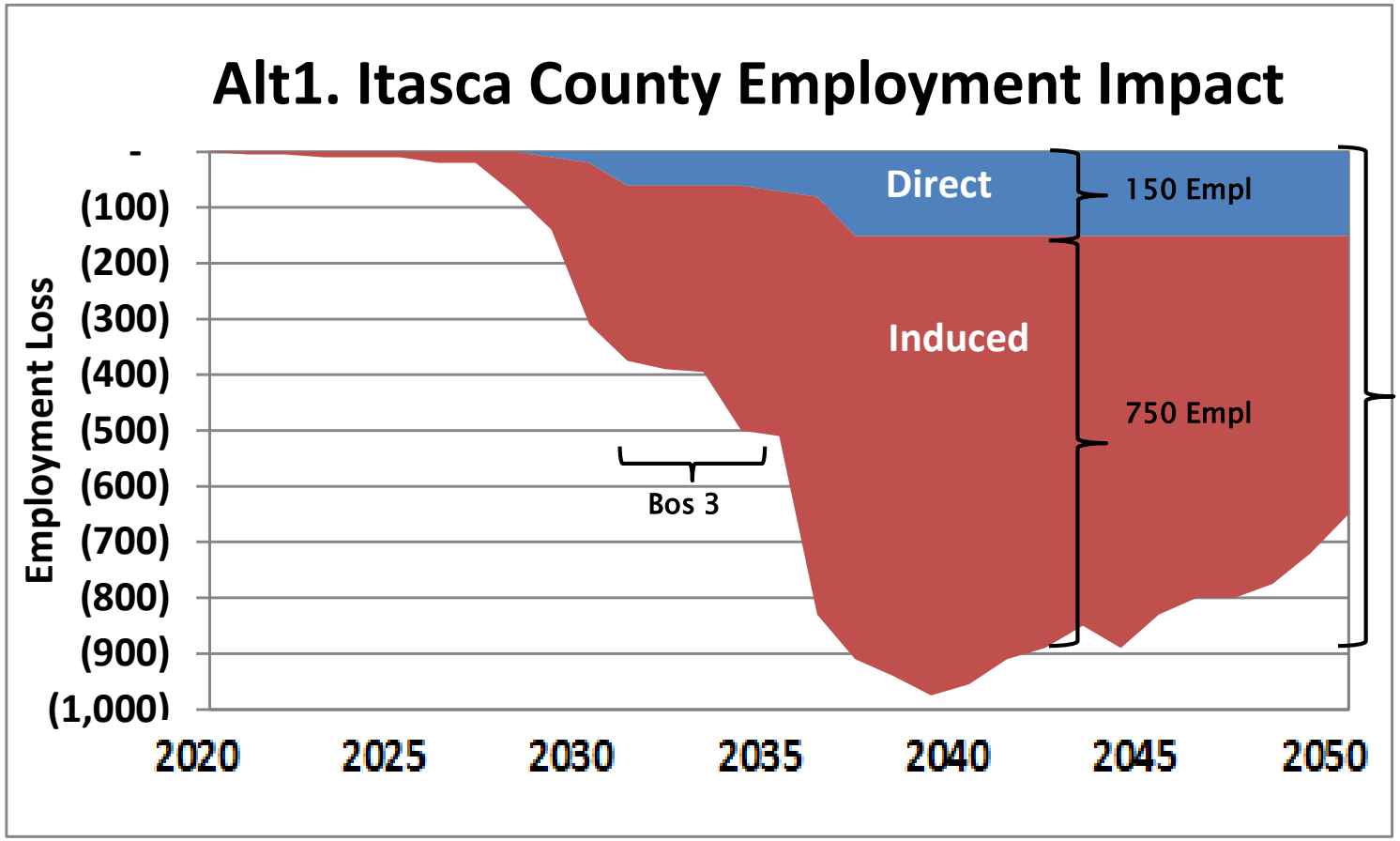

*Units 3&4, Estimated 2018 - Pay in 2019

# Study Methodology

- Purpose – quantify the benefit Boswell brings to the community and general MN state economy
- Economic Impact Methodology:
  - ID each scenario's direct impacts (Boswell's jobs, taxes, etc.)
  - Simulate economy with each scenario's direct impacts
  - Compare economic conditions
- Scenarios for Initial/Preliminary Screening:
  - Baseline = Boswell operates indefinitely to:
  - Alternative 1 = Staggered retirement of Bos 3 and 4
  - Alternative 2 = Units 3 and 4 retired at same time

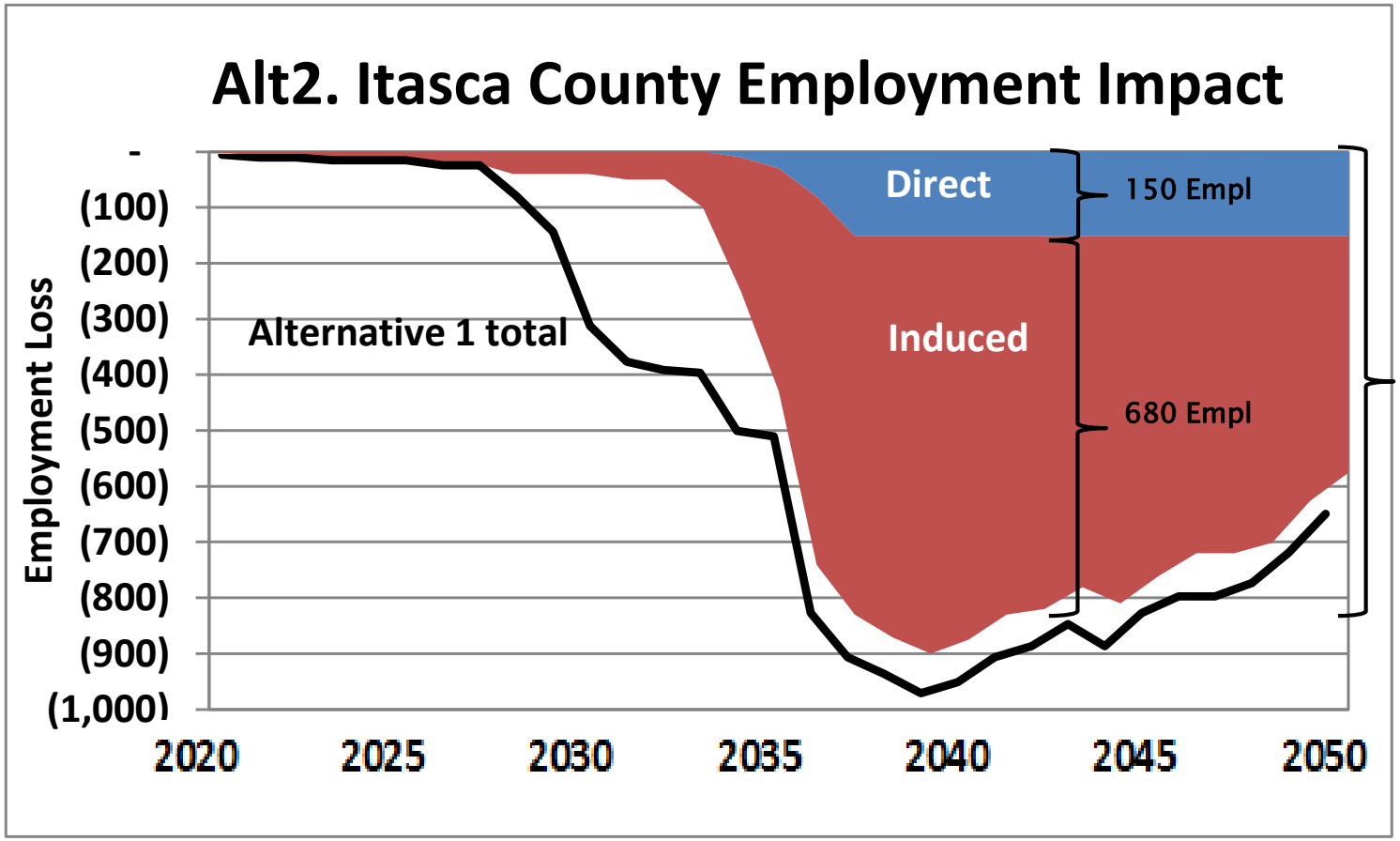
# Deeper Dive on Preliminary Results

# Alternative 1:
# Bos3 retires 2030 and Bos4 in 2036



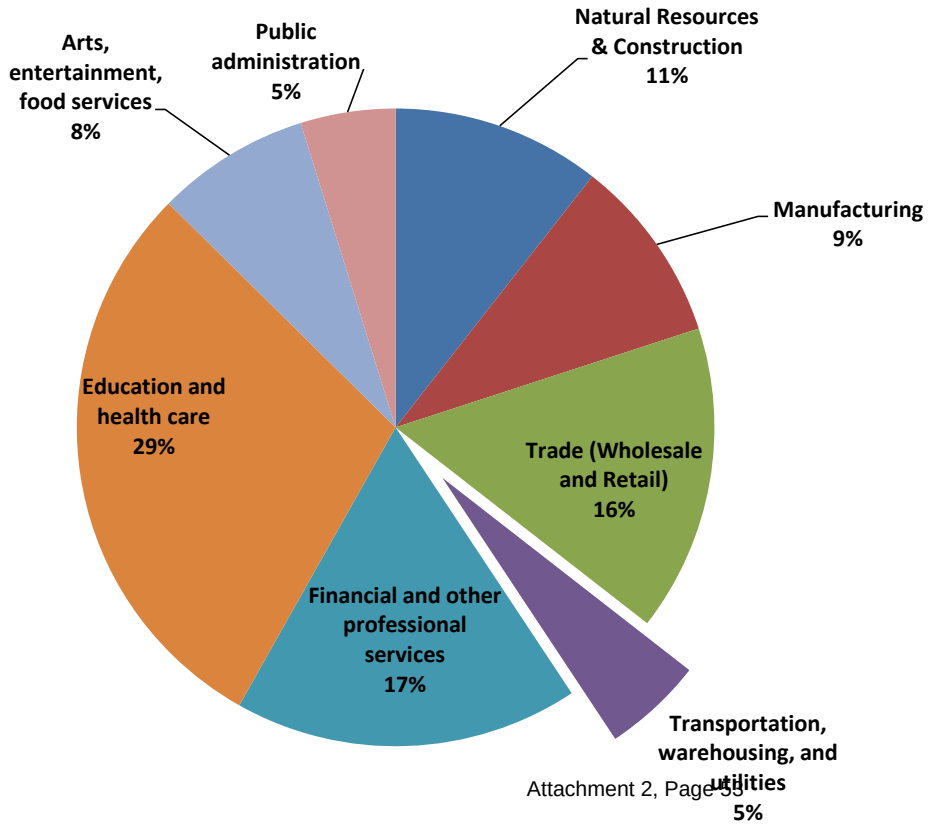

Itasca Co. Total Employment = 19,000

# Alternative 2:
# Bos3 retires 2035 and Bos4 in 2036



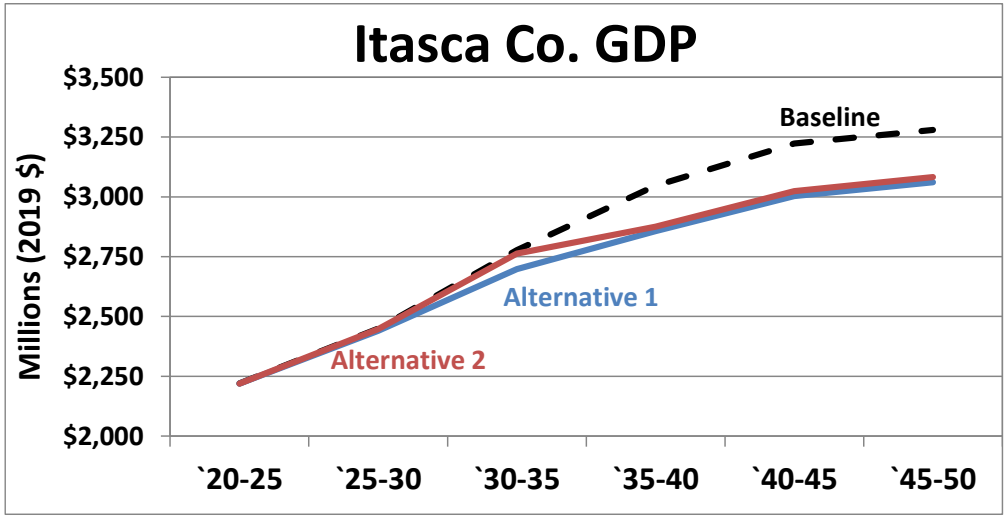
# Itasca Employment by Industry

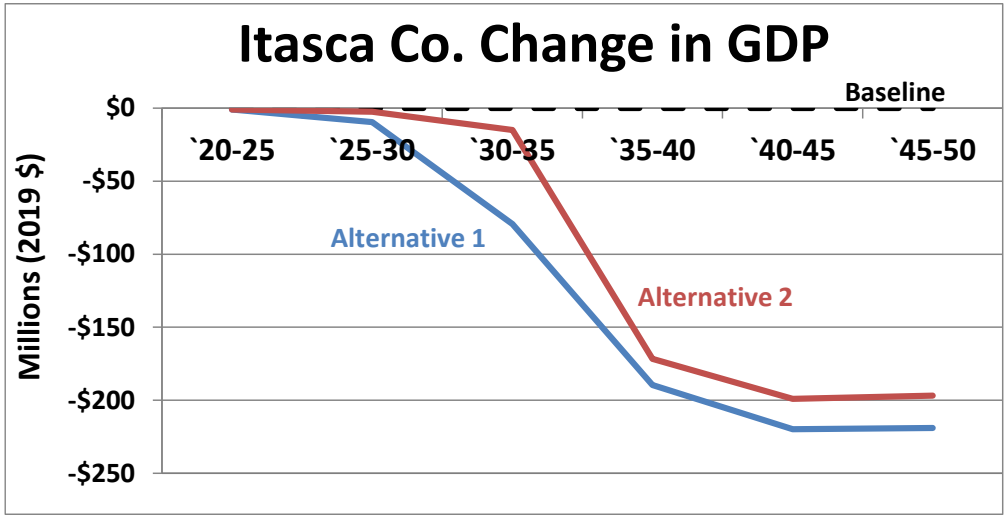
- Boswell's direct support:
  - 151 jobs = 0.8% of total Itasca Employment
  - 15% of Industry category (TWU)
- Boswell's indirect:
  - 750 jobs = 4% of total Itasca Employment
  - Largest losses in:
    - Public admin
    - Construction
    - Education & Health



# Itasca Co. GDP Impacts

- Itasca Co GDP
  - ~$2.25 Billion
- MP direct Bos spending
  - $0.03 Billion ($30 Mil)
  - 1.3% of Co. GDP
- MP total econ value
  - $0.2 Billion ($200 Mil)
  - 6.5% of Co. GDP






St. Louis, Carlton, Douglas (WI) GDP = ~12 Billion

# Key Takeaway:

- Boswell is a pillar of Itasca County's economy
  - Directly accounts for about 1% of County's employment
  - Indirectly supports another 4%

  - Directly supports 1.3% of GDP
  - Indirectly supports another 5.2% of County GDP

# Minnesota Power
# 2020 Integrated Resource Plan

## Twin Cities Stakeholder Meeting 2 Notes

## Given the information you have today, what are your "must-haves" and "nice-to-haves" for considerations/scenarios in Minnesota Power's next IRP?

## Must-haves:

### 1. SCENARIOS:

a. Scenarios with different commitment statuses for coal plants – self-schedule vs. economic dispatch

b. Different retirement dates for Boswell:

   i. Before planned retirement, at planned retirement, and after planned retirement. Some parties definitely want to see before 2030.

   ii. All cost implications (Boswell Rider for environmental retrofits)

   iii. Full consideration of all costs and benefits – intention is to capture full costs of retirement and replacement, plus transmission build out.

      1. In order for rate and bill impacts (by customer class, as required in IRP rules) to have meaning, we need to look at impacts if MP loses large customers

c. Evaluate NTEC's utilization in the different scenarios that are being run by MP.

   i. Fuel switching?

   ii. RMI study showing that some new plants might become uneconomic sooner than expected – may have studied NTEC (e.g., if it will not be economic in 2034, would be an issue for some stakeholders). Want to avoid a stranded asset.

   iii. Note: NTEC will not be included in 2020 IRP scenario alternatives.

d. Renewable scenarios with current grid constraints vs. assumed grid build out in the future with lower gen costs

e. Customer sited distributed generation – range of projections (MP currently nets DG from load forecast)

   i. Should there be a consideration of MP rebates for DG solar (potential based on high rebates vs. low)

f. Range of projections for EE, including industrial/CIP-exempt customers

g. Inclusion of storage, demand response, and other emerging ways to manage load (resource and shaping)

h. Expectation of seeing different assumptions around wind and solar pricing and storage.

i. Transmission and non-transmission solutions, including synchronous condensers.

## 2. SCENARIO TRANSPARENCY:

a. The difference between high and low demand scenarios (industrial especially) – how does that impact rates and resource options?

b. Confidence bars for forecasts

c. What drives high and low forecasts for electrification scenarios, EE, DG, DR?

d. A full discussion of demand response, including industrial, non-emergency

   i. Recognition that the credit to participants must be enough to offset the negative aspects of participating in DR as a large customer

## 3. SCENARIO IMPACTS:

a. Affordability:

   ii. Rate impact and bill impact analysis, by customer class, for 5-year action plan within each final scenario

   iii. Competitive energy costs for large industrial businesses – EITE statute compliance

b. Reliability:

   iv. General reliability

   v. Power quality

   vi. Technical analysis on renewable integration – want to avoid having a lack of technical support to answer whether more renewables can be integrated while maintaining reliability.

   vii. Vortex events – general discussion of managing future events.

   viii. Interrelationship between electrification, reliability, and tolerance. Also a safety question around saturation of fully electric customers. Concern about outages in winter.

c. Economic:

   ix. Job impacts of retirements and replacement resources. Would like as much specificity as possible, and project examples to help with understanding and evaluating impacts. Provide data sources that underly assumptions.

x. Local governments – tax base impacts, land use, education, housing, transportation, economic ripple effects of resource changes

xi. Capture the complexity of the transition – types of jobs that are being lost and types that are replacing those (i.e., salary, benefits, skill).

xii. Understanding of cascading impacts (both negative and positive) to employees, customers, communities, regional economy.

d. Environmental:

xiii. Include in IRP how MP's industrial customer products stack up in terms of environmental attributes. An emissions leakage concern.

1. How is that valued in the market? Is there a path to value environmental attributes in the product market?
2. See California study and Germany example of exempting large industrials.

xiv. Carbon impacts in relation to MP corporate goals and state 2050 goal

1. Retirement study was linked to 2050 state goal, so interested in seeing modeling that looks at progress towards that goal (but acknowledge that MP is not required to model beyond 15 year IRP period).

xv. Environmental impacts other than tons of carbon

1. May be included in social cost of carbon calculation (docket 14-643)
2. Interest in seeing the broad environmental impacts of different scenarios.

## Nice-to-haves:

### 4. SCENARIO TRANSPARENCY:

a. As information is provided to the Commission, provide background for why and how assumptions were developed and selected. How approaches differ.

b. More information about EE from CIP-exempt customers

i. How it's accounted for in the IRP

ii. What's the plan for the next 15 years?

### 5. STAKEHOLDER PROCESS REQUESTS:

a. If stakeholders introduce new concepts into the IRP process, provide information about how the PUC has authority to consider the concepts presented.

b. Discussion of cogeneration with large industrials

c. Consideration of cost implications for demand charges for large industrials – possible offerings

d. Stakeholder process – overview of new MP program

# Minnesota Power
# 2020 Integrated Resource Plan

## Twin Cities Stakeholder Meeting 3
## Tuesday, March 3, 2020. 10:00am-3:00pm

American Swedish Institute
2600 Park Ave, Minneapolis, MN 55407

### Meeting Objectives:

1. Build a deeper shared understanding of…
    a. The process for upcoming joint meetings with Northern MN based stakeholders
    b. National energy system trends and implications for resource planning
    c. Environmental impacts of Boswell and recent investments made in the plants
    d. Transmission and market considerations for Boswell retirement
2. Review and refine the "must-have" and "nice-to-have" criteria for the IRP that stakeholders began developing in the first meeting.

### Agenda:

**10:30AM** **WELCOME, INTRODUCTIONS, AGENDA REVIEW**

**10:35AM** **OVERVIEW OF UPCOMING JOINT MEETING PROCESS**

- 3 joint meetings with Northern Regional stakeholder group
- IRP modeling subcommittee (3 additional meetings)
- Review must-have and nice-to-have considerations and modify as needed

**11:00AM** **PRESENTATION AND Q&A: NATIONAL ENERGY TRENDS**

- Rolf Nordstrom, Great Plains Institute

**11:45AM** **LUNCH**

**12:30PM** **PRESENTATION AND Q&A: BOSWELL ENVIRONMENTAL IMPACTS**

- Frank Kohlasch, MN Pollution Control Agency

**1:45PM** **PRESENTATION AND Q&A: TRANSMISSION & MARKET CONSIDERATIONS**

- Alison Archer, Derek Mosolf, and James Okullo; MISO

  ***NOTE: MISO staff will NOT be talking about Boswell specifically, but about considerations and solutions for large coal plant retirements generally.*

**3:00PM** **ADJOURN**

# MINNESOTA POWER 2020 IRP

## Twin Cities Stakeholder Meeting 3

**Tuesday, March 3, 2019. 10:00am-3:00pm**

American Swedish Institute

Folke-Bernadotte Room

2600 Park Ave, Minneapolis, MN 55407

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# MEETING OBJECTIVES:

1. Build a deeper shared understanding of…
   - The process for upcoming joint meetings with Northern MN based stakeholders
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   - Environmental impacts of Boswell and recent investments made in the plants
   - Transmission and market considerations for Boswell retirement
2. Review and refine the “must-have” and “nice-to-have” criteria for the IRP that stakeholders began developing in the first meeting.

# Agenda:

**10:00AM** Arrival and Networking

**10:30am** Welcome, Introductions, Agenda Review

**10:35AM** Overview of Upcoming Joint Meeting Process

**11:00AM** Presentation and Q&A: National Energy Trends

*Rolf Nordstrom, Great Plains institute*

**11:45Am** LUNCH

**12:30PM** Presentation and Q&A: Boswell Environmental Impacts

*Frank Kohlasch, MN Pollution Control Agency*

**1:45pm** Presentation and Q&A: Transmission & Market Considerations

*Alison Archer, Derek Mosolf, and James Okullo; MISO*

**3:00pm** Adjourn

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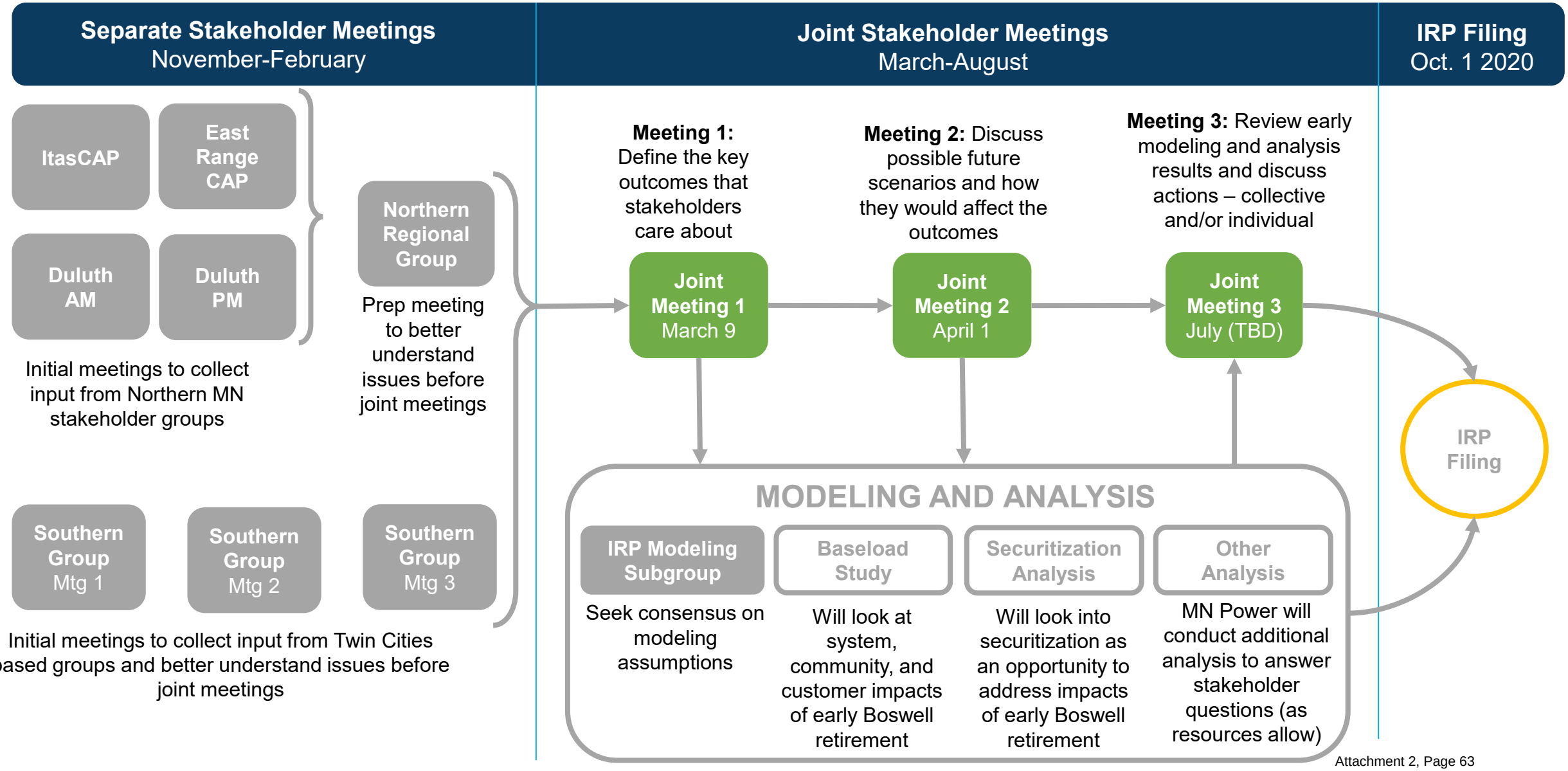
# MINNESOTA POWER 2020 IRP JOINT STAKEHOLDER MEETING TIMELINE






*NOTE: Dates and topics are subject to change to meet the needs of the stakeholder group*

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# OBJECTIVES OF THE JOINT MEETINGS

A. **Build a shared understanding** of the diversity of stakeholder perspectives, priorities, and concerns with regard to Minnesota Power resource planning, including customer, community, and environmental concerns.

B. **Enable collaboration** among stakeholders to identify key challenges and potential solutions for Minnesota Power's service territory that relate to resource planning.

C. **Inform considerations** for the 2020 IRP and review and provide feedback to an early draft of the plan.

# STAKEHOLDER DISCUSSION

Review must-have and nice-to-have considerations

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# Presentation: National Energy Trends

*Rolf Nordstrom, Great Plains Institute*

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# Energy System Trends & Implications

Rolf Nordstrom, CEO
Great Plains Institute

MP IRP Stakeholder Mtg. #3
March 3, 2020
American Swedish Institute
Minneapolis, MN

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# FIVE Macro Energy System Trends

1. Changing Consumer Preferences
2. Rise of renewables + market challenges for “baseload” plants
3. Grid Modernization
4. Beneficial electrification
5. CO2 as a potential liability & an economic opportunity

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# 1. Consumers asking for Clean Energy

## Households, Businesses, Communities & States

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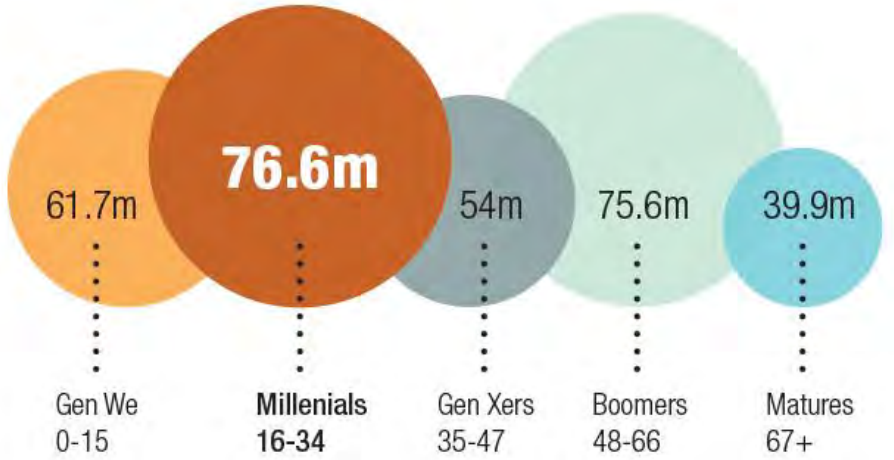
# Demographics is Destiny

## Millennials (age 18-34) = largest demographic block




## They want more clean energy.

**Source**: Deloitte **". . .millennial generation. . .increasingly an influential factor in the transformation of electricity providers."**


# Renewables Wildly Popular w/Consumers

**70 percent want 100% renewable electricity "in the near future."**

**51 percent say they want 100% renewables even if it raises their energy bills by *30 percent*.**

**"We want clean, modern energy, and we'll pay for it. We're willing to let experts work out the details, but we don't want to hear that it can't be done. Just do it."**

# our truth

**Utility**

100% RE goals have a direct impact on how we're able to serve our customers. 100% RE is not technically feasible, nor does it make practical sense.

# their truth

**Consumer**

100% RE goals sound great. This is a step in the right direction. We need more renewable energy to protect the environment.

*"It is **a lofty and worthwhile ideal** that may not be feasible right away, but **we can strive for it**."*
– Survey Open End Response


# The 100% Debate

**100 percent renewables is the right target even if we can't do it right away.**

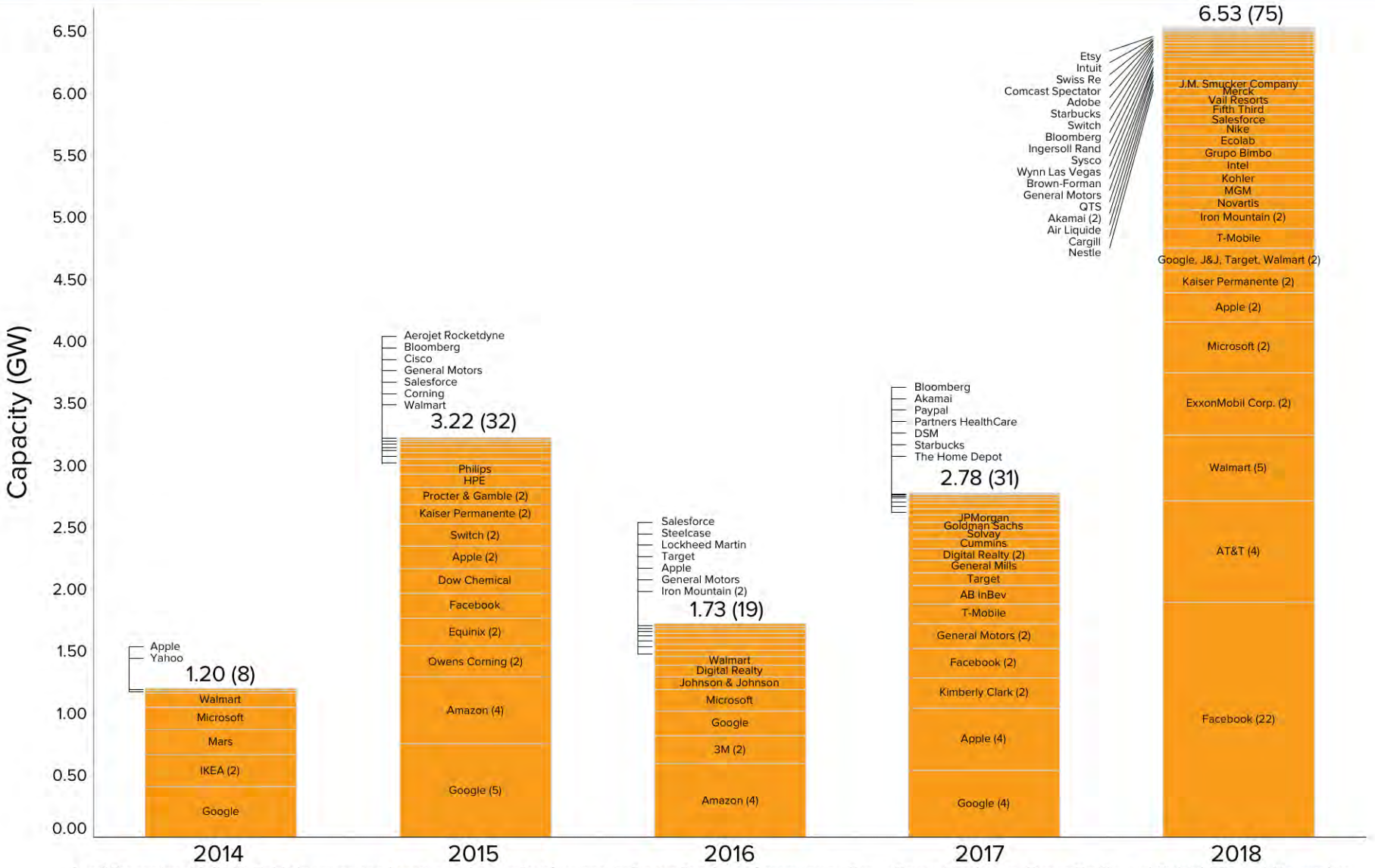
**100% carbon-free is the better goal, both technically and economically**

**100% renewables or carbon-free is impossible any time soon, and would leave lots of stranded assets**

BUSINESS RENEWABLES CENTER

# Corporate Renewable Deals

## 2014 – 2018




As of December 31, 2018. Publicly announced contracted capacity of corporate Power Purchase Agreements, Green Power Purchases, Green Tariffs, and Outright Project Ownership in the US, 2014 – 2018. Excludes on-site generation (e.g., rooftop solar PV) and deals with operating plants. (#) indicates number of deals each year by individual companies.

Copyright 2018 by Rocky Mountain Institute.

## Signs of Corporate Demand:

**In 2015, for the first time ever, a majority of new wind energy capacity was purchased by companies.**

**Nearly two-thirds of Fortune 100 and nearly half of Fortune 500 companies have set ambitious renewable energy targets.**

Credit: Rocky Mountain Institute

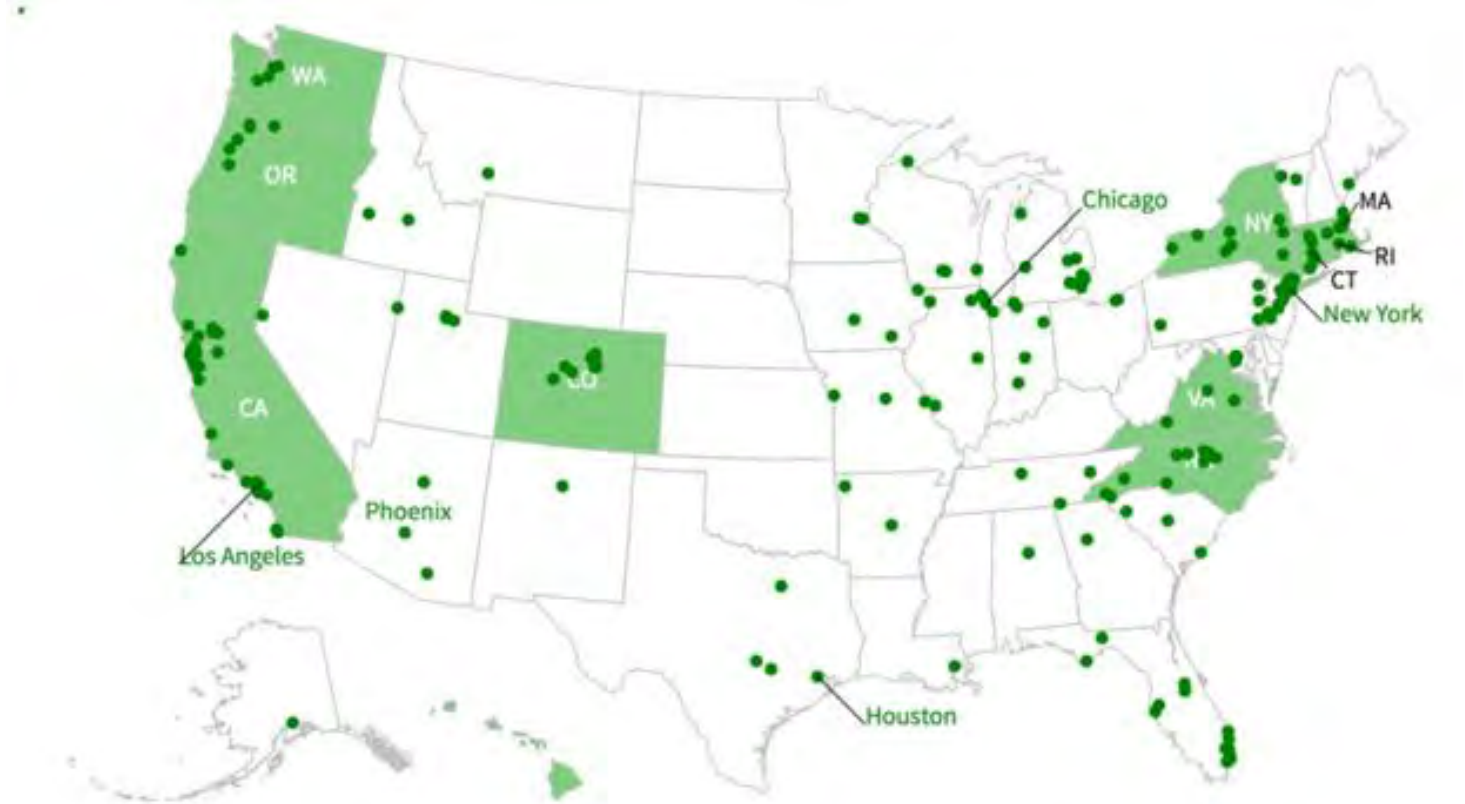
# 30 Top Businesses in MN


## Minnesota Sustainable Growth Coalition Members

- Surpassing the State of Minnesota's current economy-wide greenhouse gas emissions targets of 30 percent reduction by 2025 and 80 percent reduction by 2050
- Increasing access to affordable, reliable, clean energy to improve racial, economic, social and public health outcomes
- Fueling economic growth for all Minnesotans

Cities as Consumers

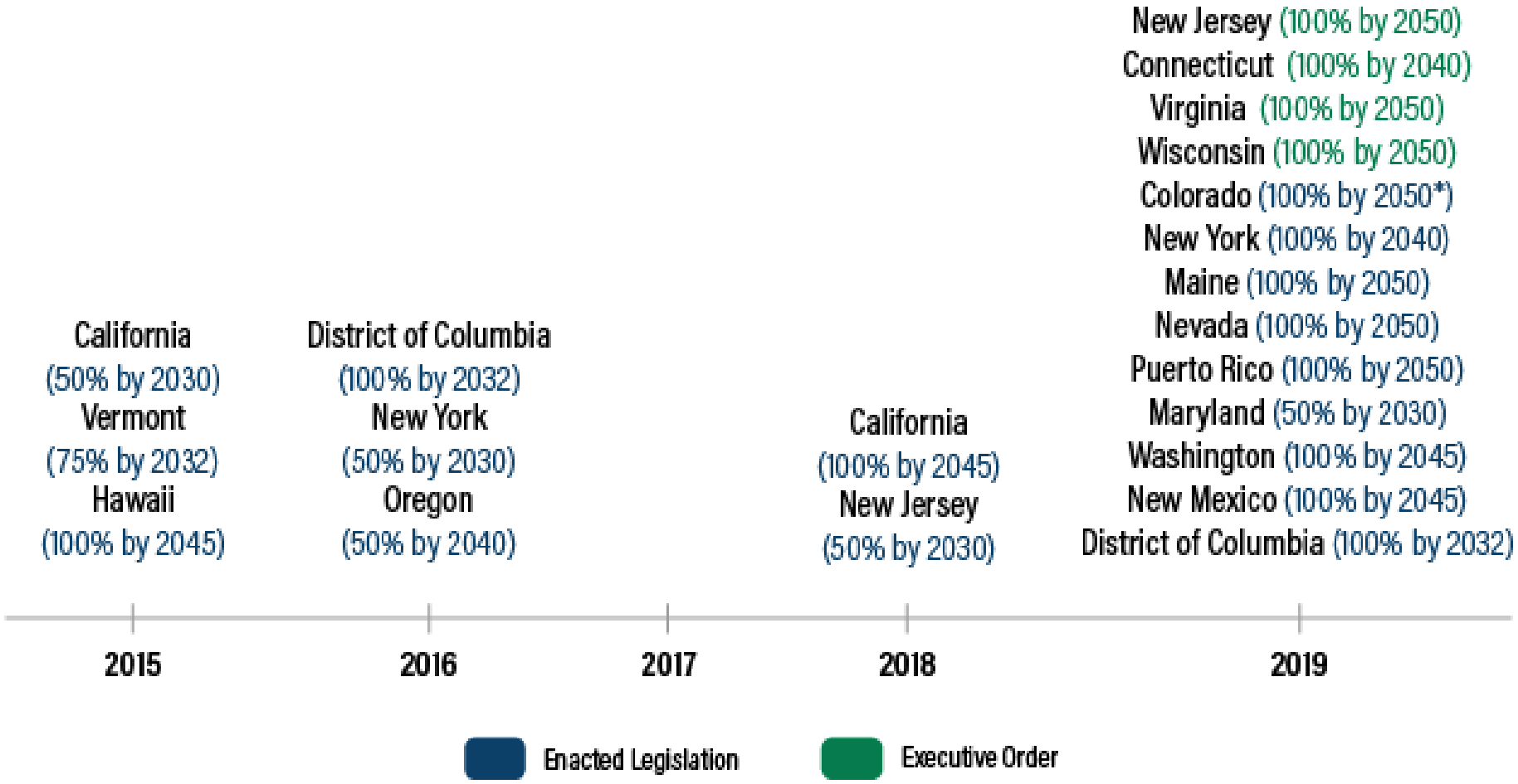
# Cities Committing to Clean Energy




**More than 500 U.S. cities (and growing) have made significant commitments to renewables.**

# State Commitments

## U.S. States' Clean Electricity Commitments




*Source:* WRI.
*Note:* * Applies to large investor-owned utilities

WORLD RESOURCES INSTITUTE

# 2. Economic competitiveness of renewables

## And market challenges for “baseload” plants

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# Coal increasingly uncompetitive next to renewables & gas

**NREL's "low case" cost projection shows solar and wind outpacing 86% of coal plants.**

**Energy Information Administration (EIA), analysis has shown renewable energy additions may even outpace natural gas.**

**Last fall, Pacificorp said 60% of its coal units are uneconomic.**

**Northern Indiana Public Service Co. says via their 2018 IRP that building renewable energy will be cheaper than keeping coal plants open.**

“. . .solar and wind plus storage will be cheaper than coal, oil or nuclear, [and] this will be ‘massively disruptive’ to the conventional fleet”

— NextEra Energy’s, CEO Jim Robo

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# Utilities Pivoting to Renewables & Lower Carbon Fleets

**Minnesota Power**

**Xcel Energy**

**AEP**

**Consumers Energy**

**Duke Energy**

**NextEra**

# 3. Grid Modernization

## A “when” not an “if”

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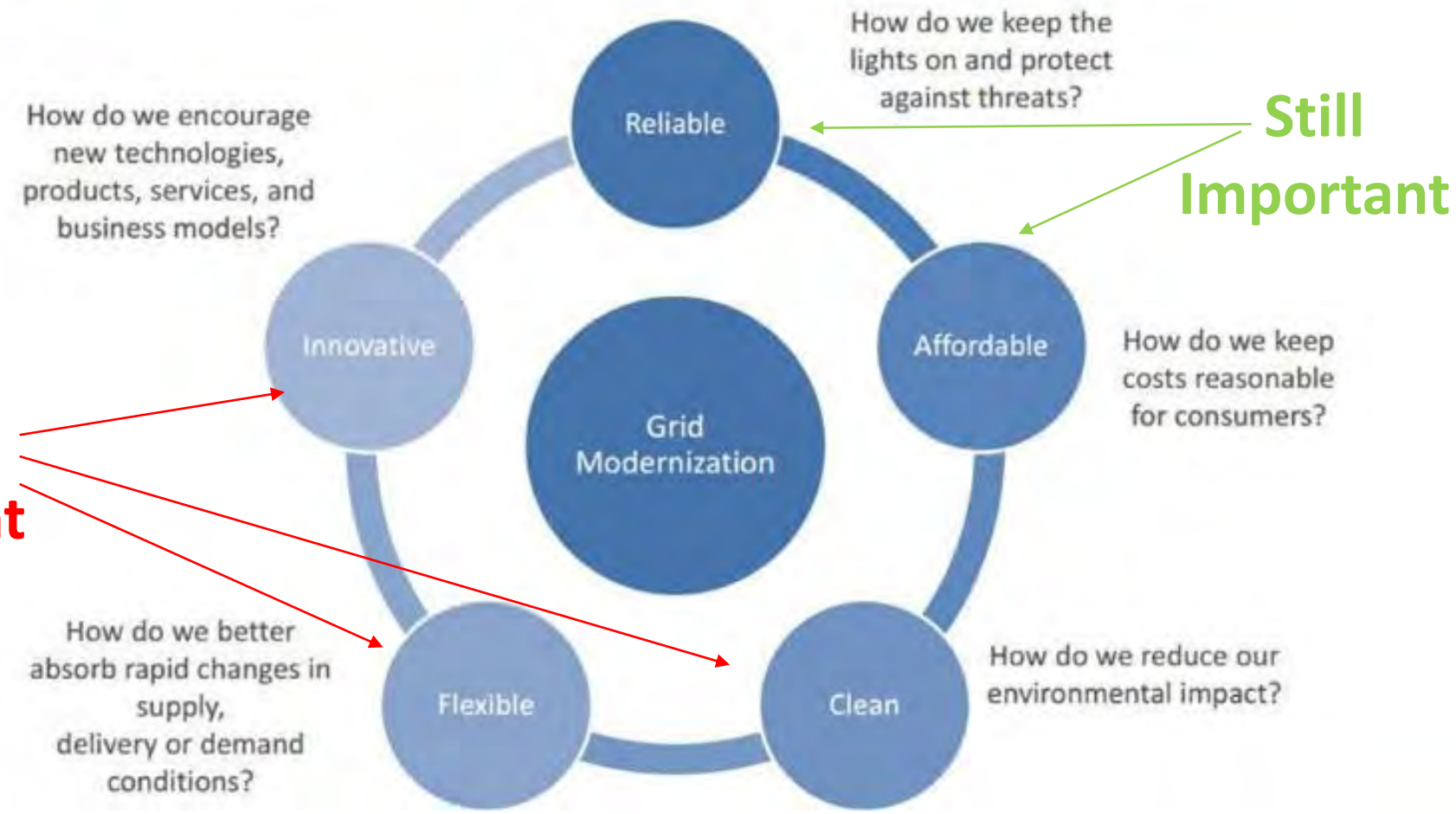
# What Must a Modern Grid Do?

## Key Attributes of a Modernized Grid

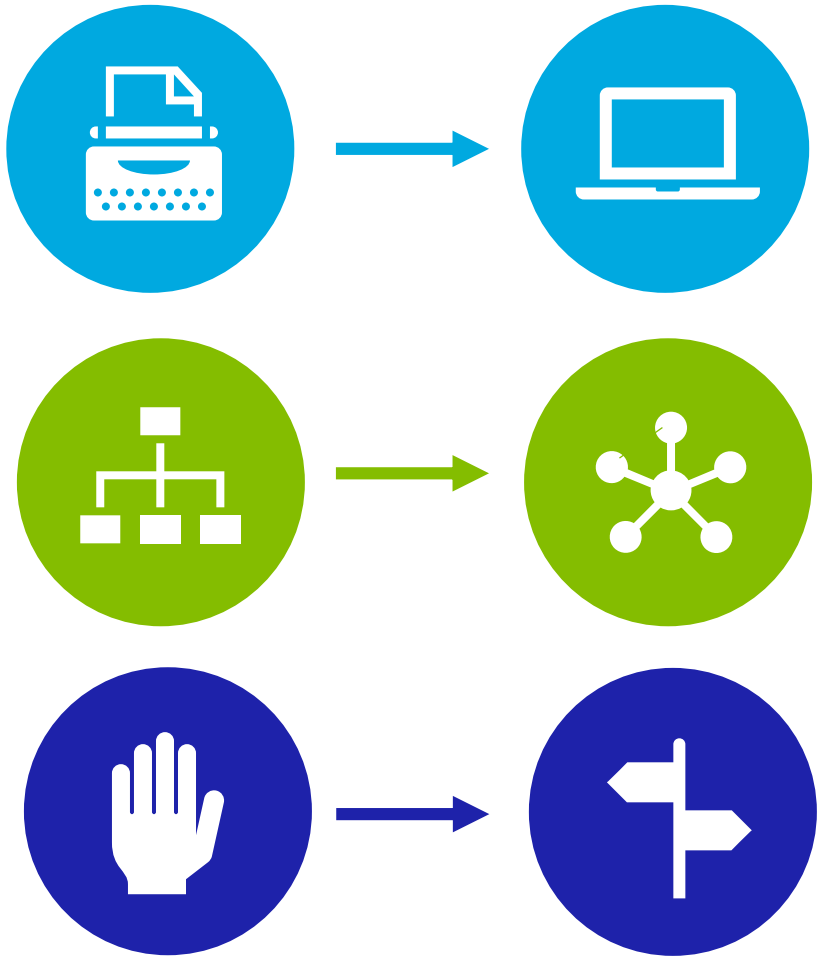


# The Changing Electric System

Analog & Manual → Digital & Automated

Centralized One-way flow → Cleaner More Distributed Multi-directional flow

Little consumer choice → More consumer choice



e21 INITIATIVE

# MN PUC- Initiated Investigations

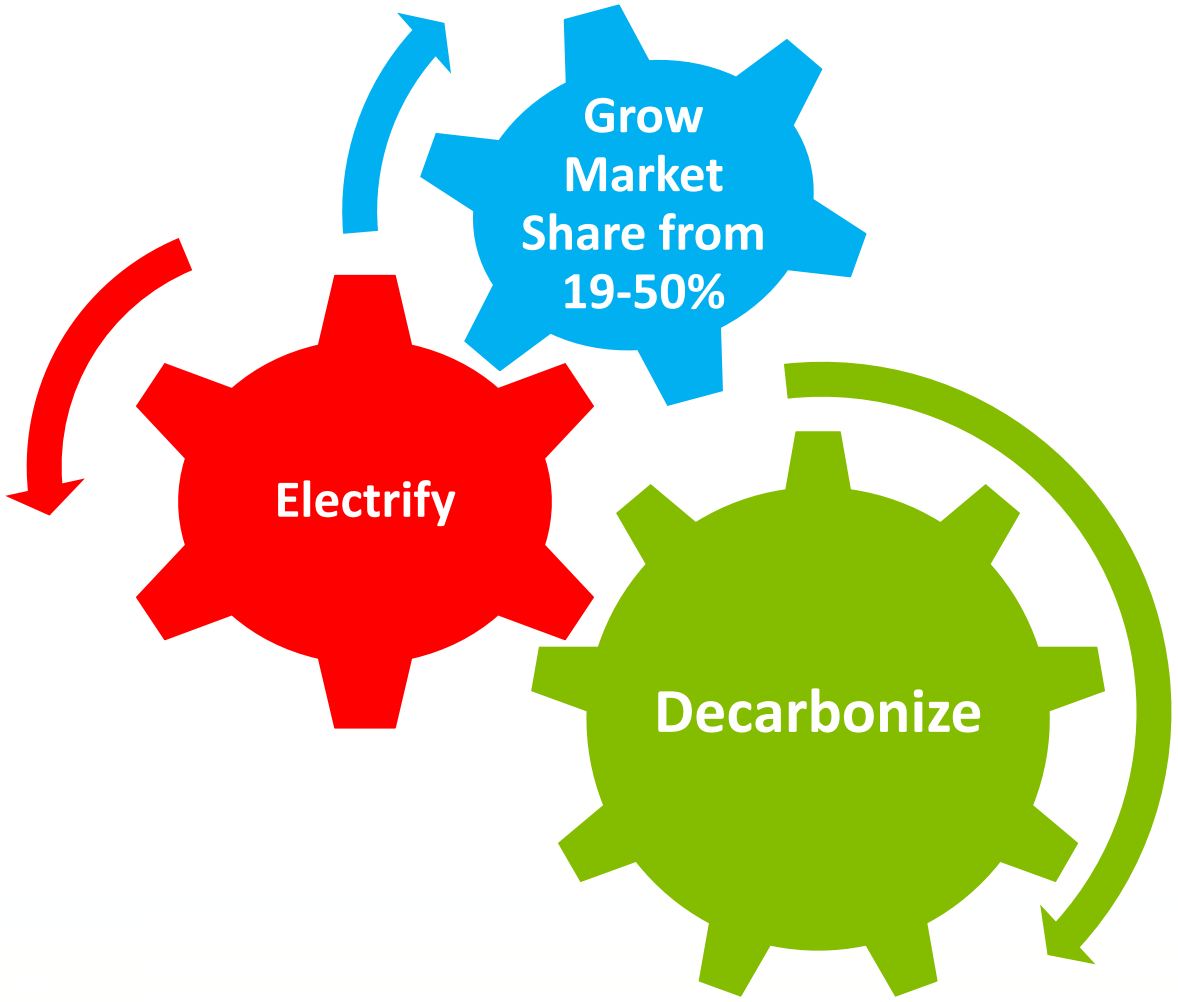
| | |
|---|---|
| 2015 | • Grid Modernization |
| 2015 | • Advanced Rate Design |
| 2016 | • Distribution Interconnection |
| 2017 | • Performance Metrics/Incentives |
| 2018 | • Transportation Electrification |

e21 INITIATIVE

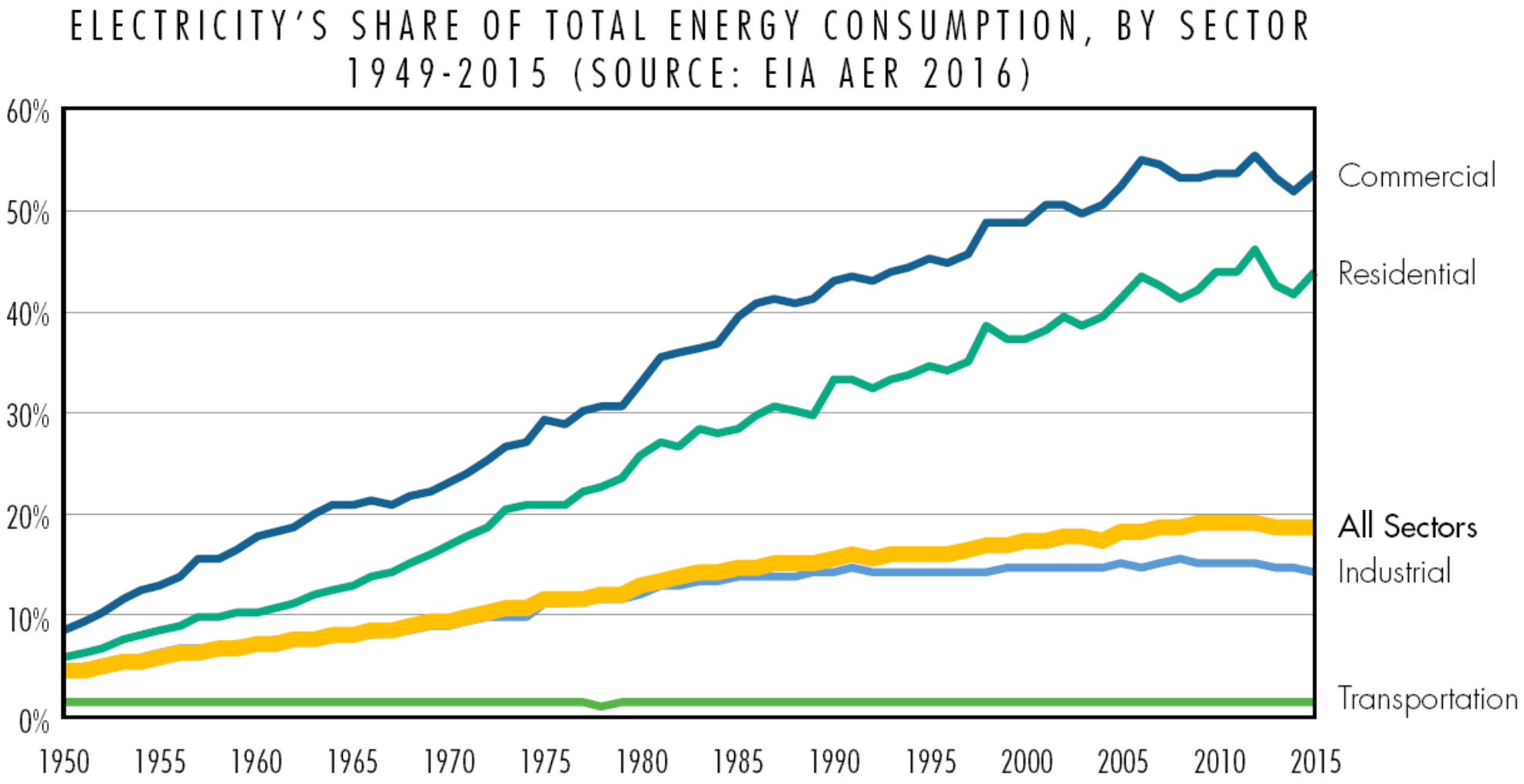
# 4. Growing interest in electrification

Electricity Can Grow Market Share

# "Less Carbon, More Electricity"



# Electricity share of total energy



# 5. C02 = liability & opportunity

## Participants

- Accelergy
- AFL-CIO
- Air Liquide
- Air Products
- AK Steel
- American Carbon Registry
- ArcelorMittal
- Arch Coal
- Archer Daniels Midland Co.
- Baker Hughes, a GE Company
- Bipartisan Policy Center
- Capital Power
- Carbon180
- Carbon Wrangler LLC
- Center for Climate and Energy Solutions
- Citizens for Responsible Energy Solutions Forum
- Clean Air Task Force
- ClearPath Foundation
- Cloud Peak Energy
- Conestoga Energy Partners
- Core Energy LLC
- DTE Energy
- EBR Development LLC
- EnergyBlue Project
- Energy Innovation Reform Project
- Glenrock Petroleum
- Great River Energy
- Greene Street Capital
- Impact Natural Resources LLC
- ION Engineering LLC
- International Brotherhood of Boilermakers
- International Brotherhood of Electrical Workers
- Jackson Hole Center for Global Affairs
- Jupiter Oxygen Corporation
- Lake Charles Methanol
- LanzaTech
- Linde LLC
- Mitsubishi Heavy Industries America, Inc.
- National Audubon Society
- National Farmers Union
- National Wildlife Federation
- NET Power
- New Steel International, Inc.
- NRG Energy
- Occidental Petroleum Corporation
- Pacific Ethanol
- Peabody
- Prairie State Generating Company
- Praxair Inc.
- Shell
- SMART Transportation Division (of the Sheet, Metal, Air, Rail and Transportation Workers)
- Summit Power Group
- Svante
- Tenaska Energy
- The Nature Conservancy
- Third Way
- Thunderbolt Clean Energy LLC
- United Mine workers of America
- United Steel Workers
- Utility Workers Union of America
- White Energy
- Wyoming Outdoor Council

## Observers

- Algae Biomass Organization
- Biomass Power Association
- Carbon Engineering
- Carbon Utilization Research Council
- Chart Industries
- Cornerpost CO2 LLC
- Enhanced Oil Recovery Institute, University of Wyoming
- Environmental Defense Fund
- Growth Energy
- Institute of Clean Air Companies
- Melzer Consulting
- Renewable Fuels Association
- Tellus Operating Group
- World Resources Institute

CARBON CAPTURE COALITION

# Reform of 45Q Tax Credit Passes in 2018 Budget Deal

H. R. 1892

## One Hundred Fifteenth Congress of the United States of America

AT THE SECOND SESSION

*Begun and held at the City of Washington on Wednesday, the third day of January, two thousand and eighteen*

## An Act

To amend title 4, United States Code, to provide for the flying of the flag at half-staff in the event of the death of a first responder in the line of duty.

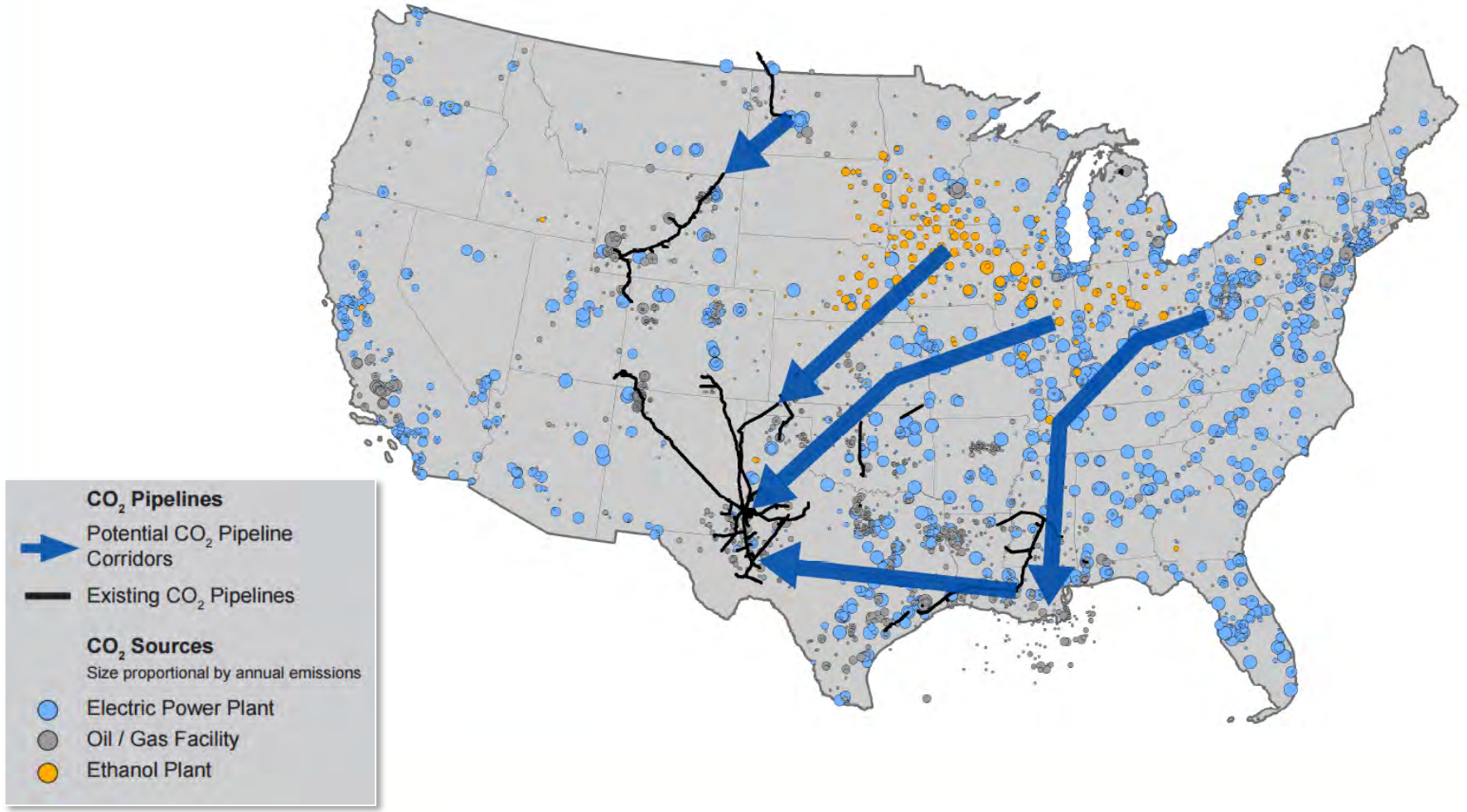
*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

**SECTION 1. SHORT TITLE.**

This Act may be cited as the "Bipartisan Budget Act of 2018".

Managing Carbon

# Five Potential CO2 Pipeline Corridors to Enable Large-Scale Carbon Management



# Main Take Aways & Challenges

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# Future Grid Looks Like Ds: Decarbonized, Digital, Distributed

- Efficiency, incl. waste heat
- Some Gas w/CCS
- Renewables, incl. Hydro
- RNG (incl. Power to Gas)?
- Hydrogen?
- Nuclear?
- Demand Flexibility (DERs, e.g. DR, Storage, EVs)
- More Transmission
- Better forecasting


# Main Challenges

1. **Decarbonize to meet consumer demands**
2. **Modernize to enable a more flexible digital, multi-directional grid**
3. **Avoid building tomorrow's stranded assets**
4. **Do all that while keeping bills competitive**
5. **Help affected industries, workers and communities navigate these changes**

# MINNESOTA POWER 2020 IRP

## Twin Cities Stakeholder Meeting 3

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# Presentation: Boswell Environmental Impacts

*Frank Kohlasch, Minnesota Pollution Control Agency*

cee
Center for Energy and Environment

MINNESOTA POLLUTION CONTROL AGENCY

# Minnesota Power
# 2020 Integrated Resource Plan Stakeholder Meeting 3

Frank Kohlasch | Climate Director

March 3, 2020

# 2018 IPCC Climate Update

- Intergovernmental Panel on Climate Change report
  - High confidence that human activities have warmed the planet 1.0° C
  - High confidence that at current rate, warming will reach 1.5° C between 2030 & 2050
  - High confidence in the need for net zero emissions by 2050 to maintain 1.5° C increase
  - High confidence in the need for net zero emissions by 2070 to maintain 2.0° C increase
  - High confidence that “rapid and far-reaching transitions” in all sectors is needed
  - High confidence that 1.5° C warming reduces risks to oceans, land, humans, and infrastructure compared to 2.0° C warming

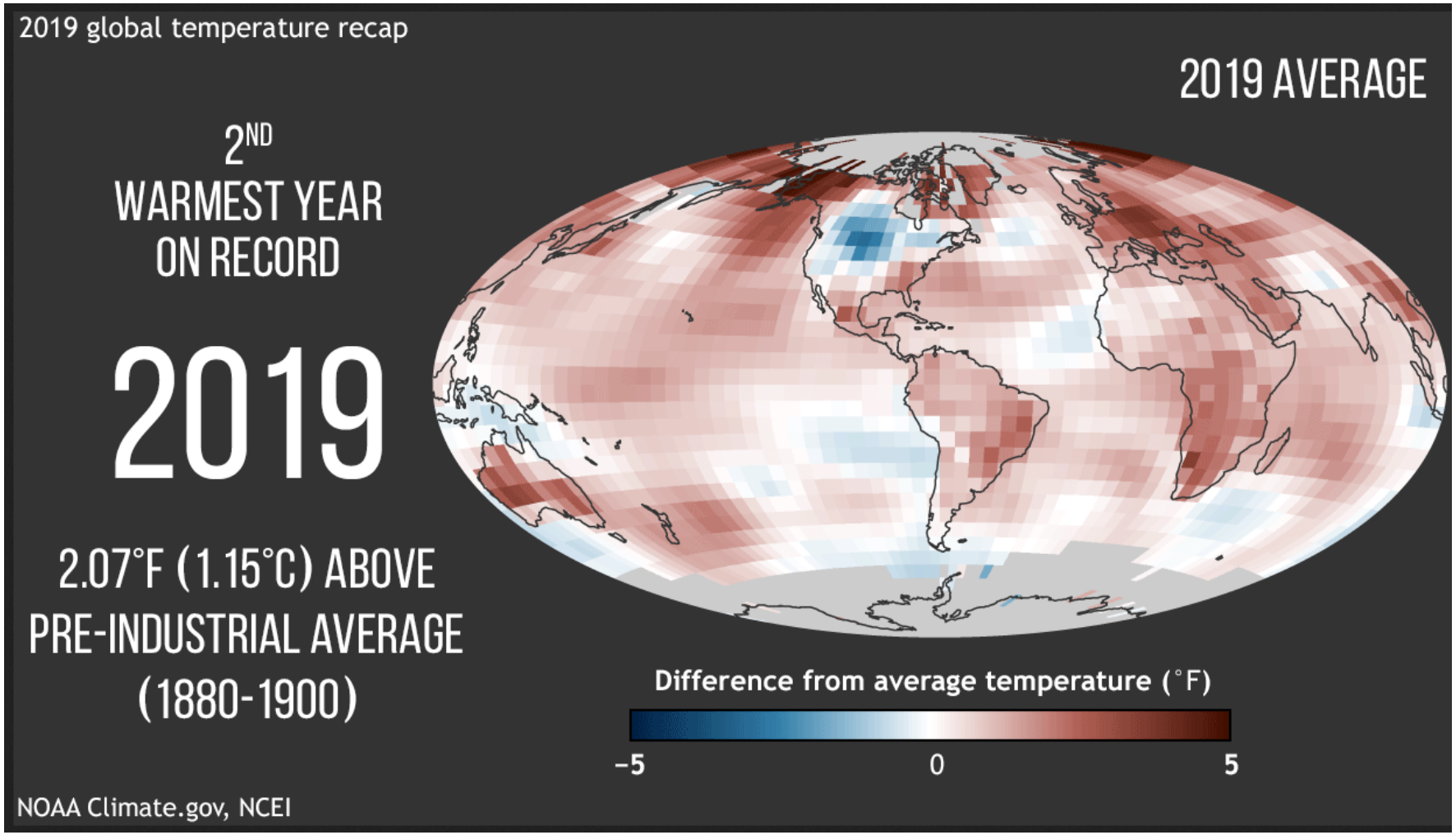
# 2018 Fourth National Climate Assessment

- U.S. Global Change Research Program
  - Impacts of global climate change already being felt in the US
  - Impacts of global climate change expected to intensify
  - Multiple indicators of climate change in the U.S.
  - Humans are adding $CO_2$ faster than it is removed

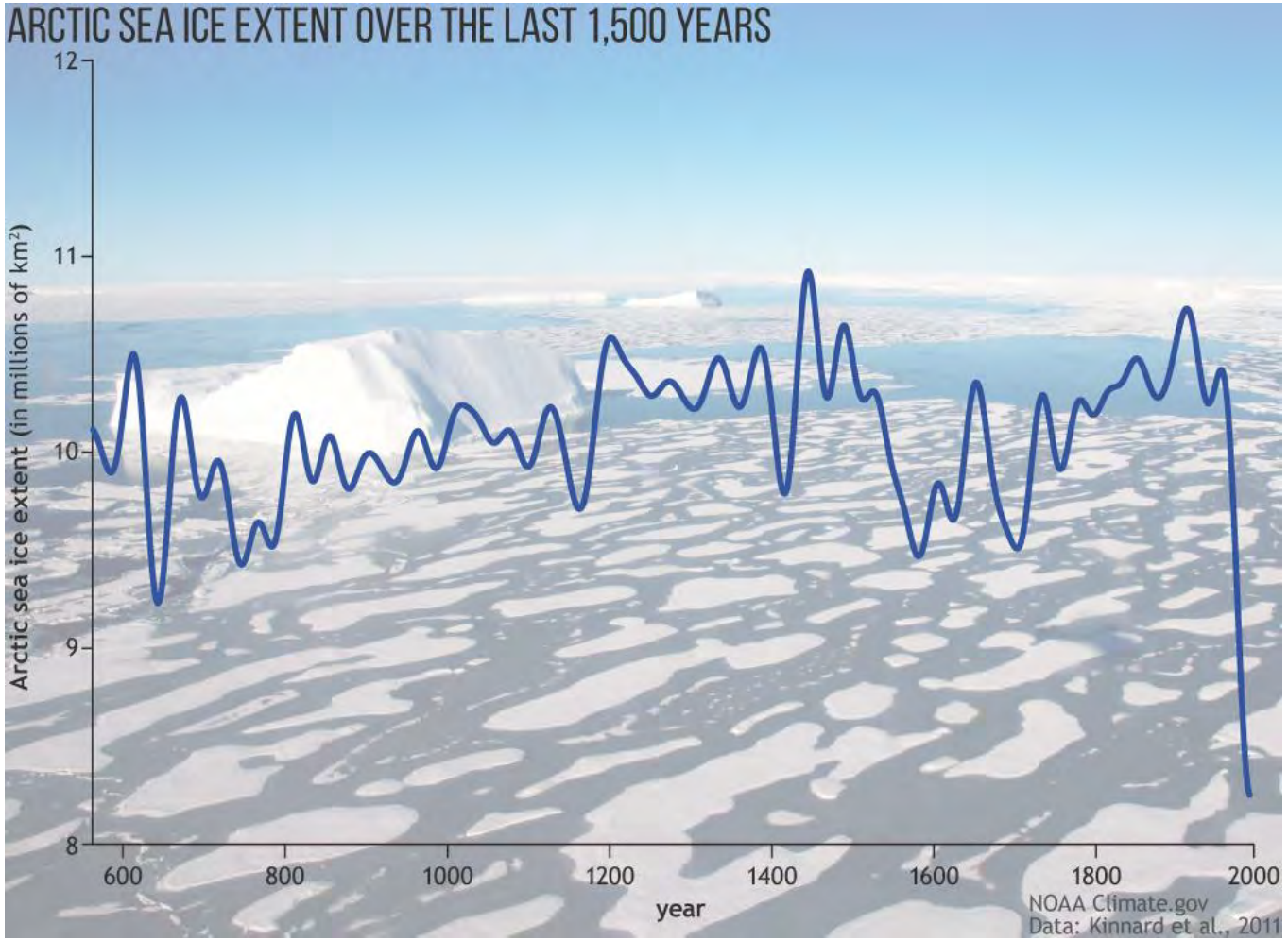
# 2018 Fourth National Climate Assessment

- U.S. Global Change Research Program
  - Largest expected temperature increases are in northern latitudes, including MN
  - Largest sea level increase possible in Gulf of Mexico
  - Without mitigation and adaptation, significant costs to land & infrastructure
  - Predicts impacts at emission reduction to limit temperature increase to 2° C
  - Predicts impacts at emissions that lead to up to 6° change

# 2019 – a very warm year



# Loss of artic sea ice



# National Climate Assessment: Midwest Climate Impacts

"Projected changes in precipitation, coupled with rising extreme temperatures before mid-century, will reduce Midwest agricultural productivity to levels of the 1980s without major technological advances."

"…threats from a changing climate are interacting with existing stressors such as invasive species and pests to increase tree mortality and reduce forest productivity. Without adaptive actions, these interactions will result in the loss of economically and culturally important tree species such as paper birch and black ash and are expected to lead to the conversion of some forests to other forest types or even to non-forested ecosystems by the end of the century."

# National Climate Assessment: Midwest Climate Impacts

"Species and ecosystems, including the important freshwater resources of the Great Lakes, are typically most at risk when climate stressors, like temperature increases, interact with land-use change, habitat loss, pollution, nutrient inputs, and nonnative invasive species."

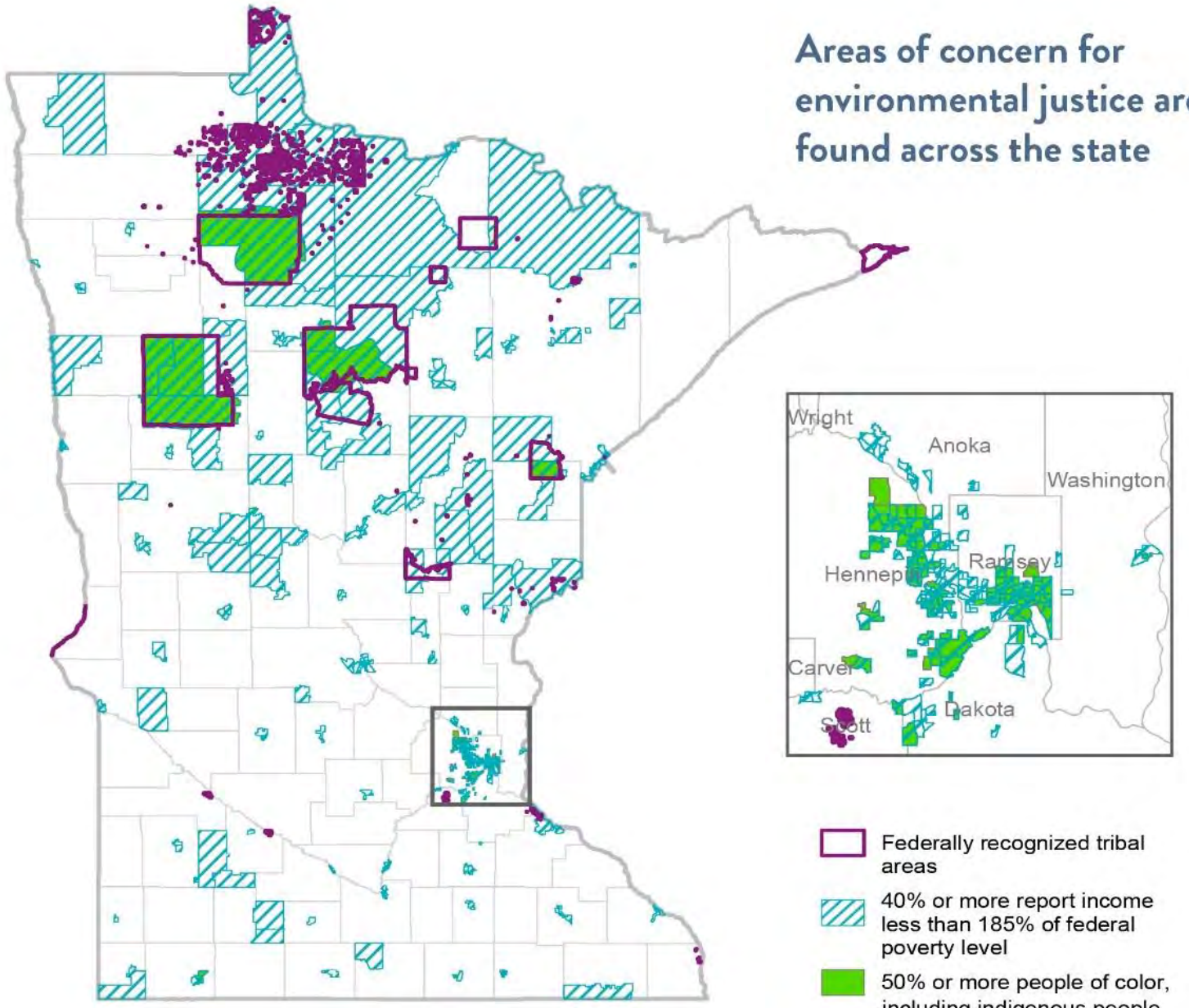
"Climate change is expected to worsen existing health conditions and introduce new health threats by increasing the frequency and intensity of poor air quality days, extreme high temperature events, and heavy rainfalls; extending pollen seasons; and modifying the distribution of disease-carrying pests and insects. By mid-century, the region is projected to experience substantial, yet avoidable, loss of life, worsened health conditions, and economic impacts estimated in the billions of dollars as a result of these changes."

# National Climate Assessment: Midwest Climate Impacts

"The annual cost of adapting urban storm water systems to more frequent and severe storms is projected to exceed $500 million for the Midwest by the end of the century…"

"At-risk communities in the Midwest are becoming more vulnerable to climate change impacts such as flooding, drought, and increases in urban heat islands. Tribal nations are especially vulnerable because of their reliance on threatened natural resources for their cultural, subsistence, and economic needs…"

# Areas of concern for environmental justice are found across the state



# Minnesota's climate is already changing

**Heavy rains are now more common and intense than at any time on record**

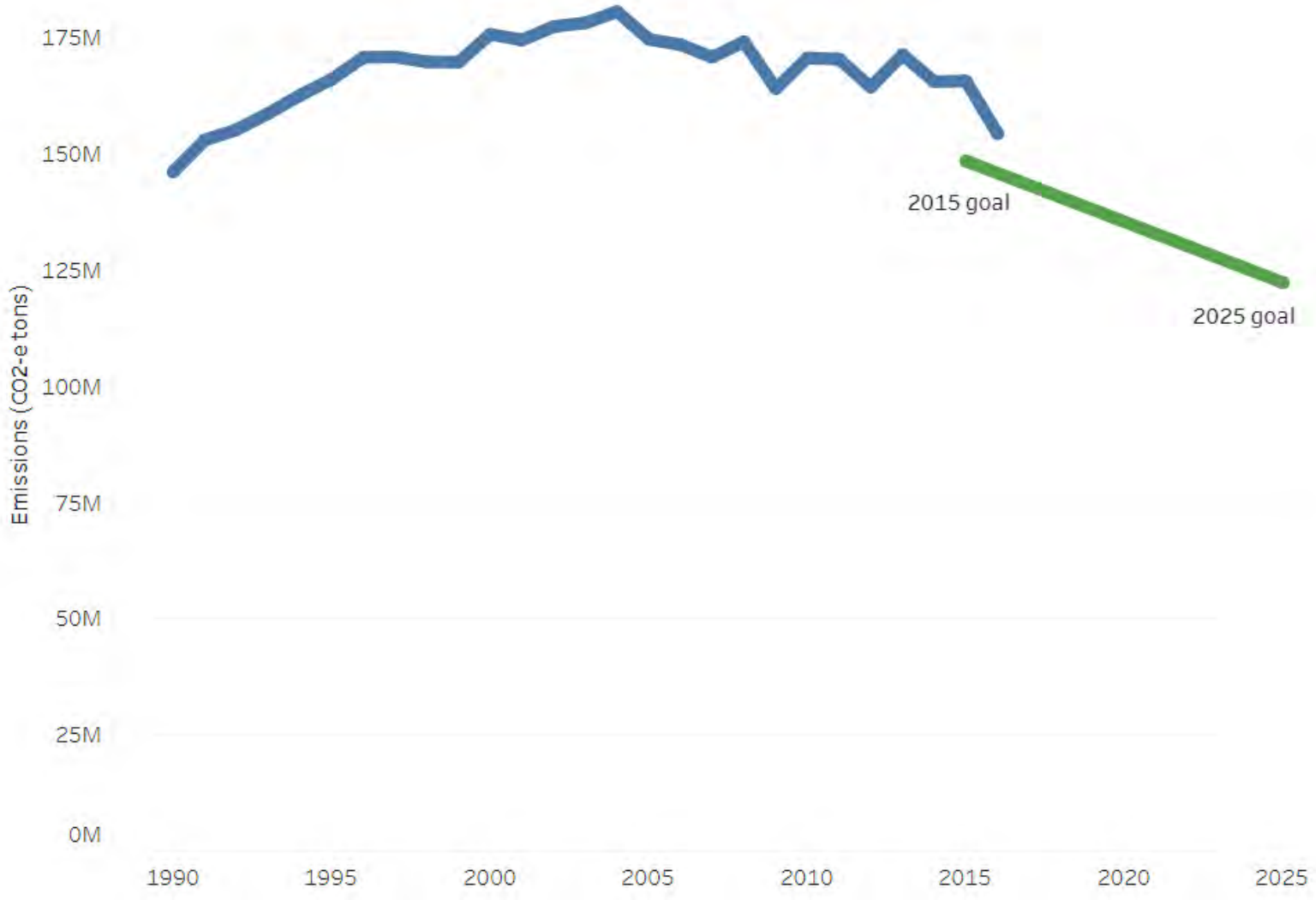
**Minnesota has warmed by 2.9F between 1895 and 2017**

**Dramatic increases in 1-inch rains, 3-inch rains, the heaviest rainfall of each year**

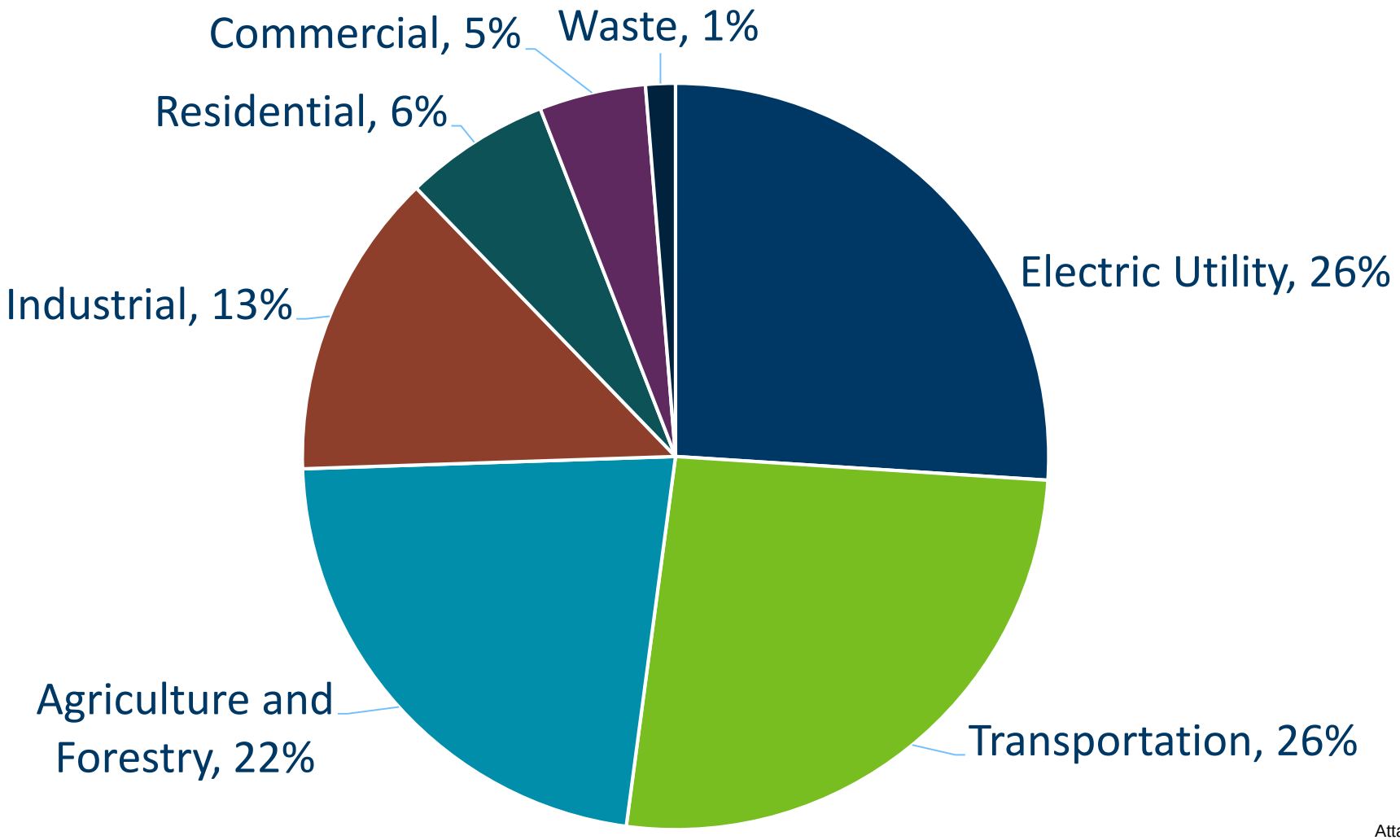
**The top-10 combined warmest and wettest years on record occurred between 1998 and 2017**

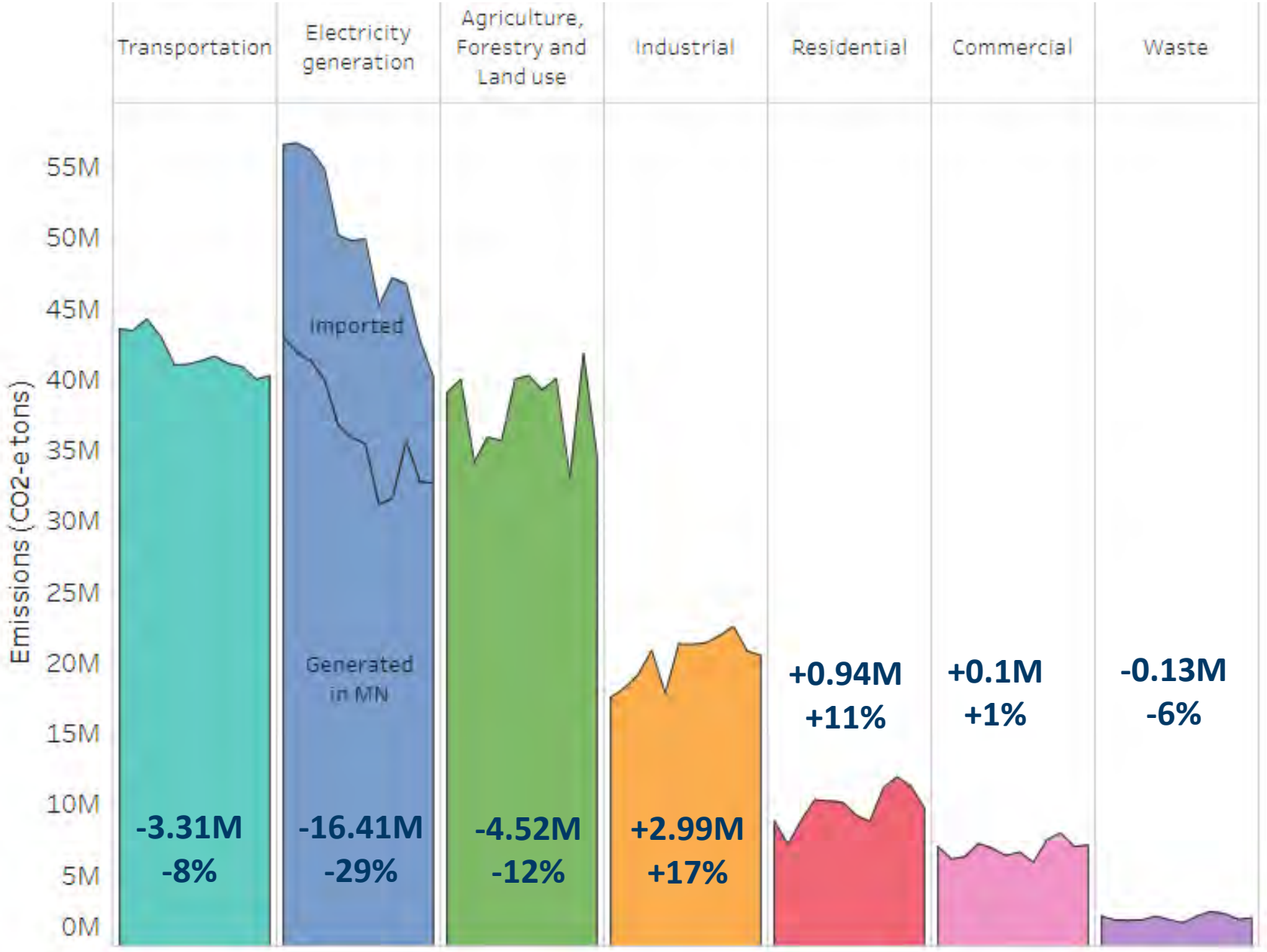
**Winter has warmed 13 times faster than summer**

# Progress toward Next Generation Act GHG reduction goals



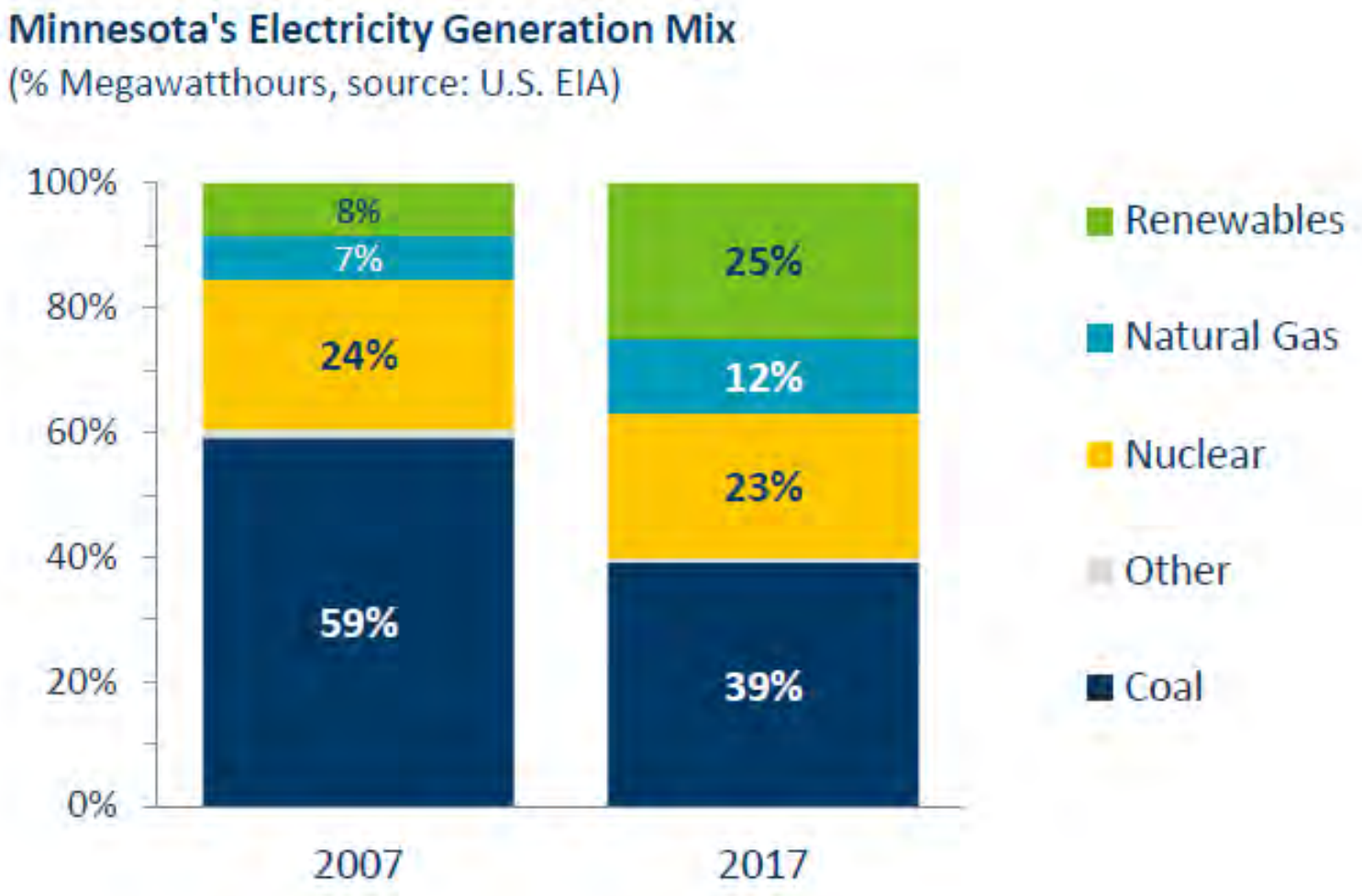
# Greenhouse gas emissions by sector, 2016



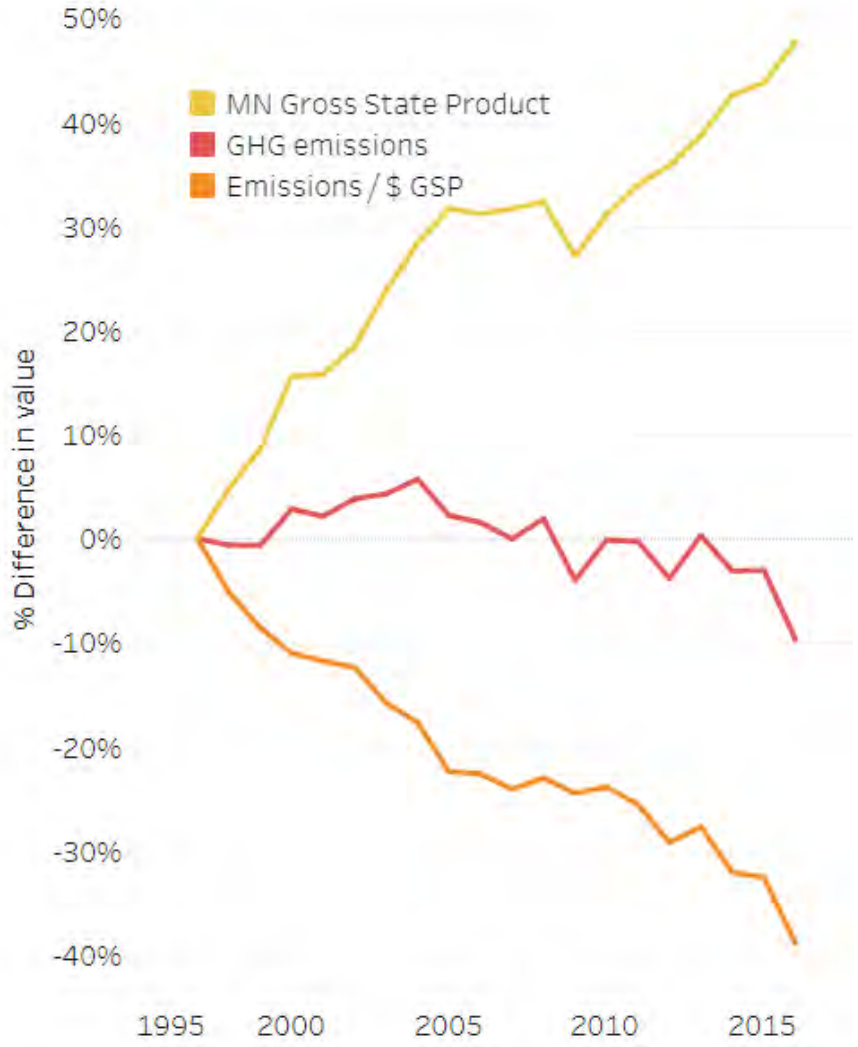



# Emission change by sector, 2005-2016

# Electricity generation by fuel type

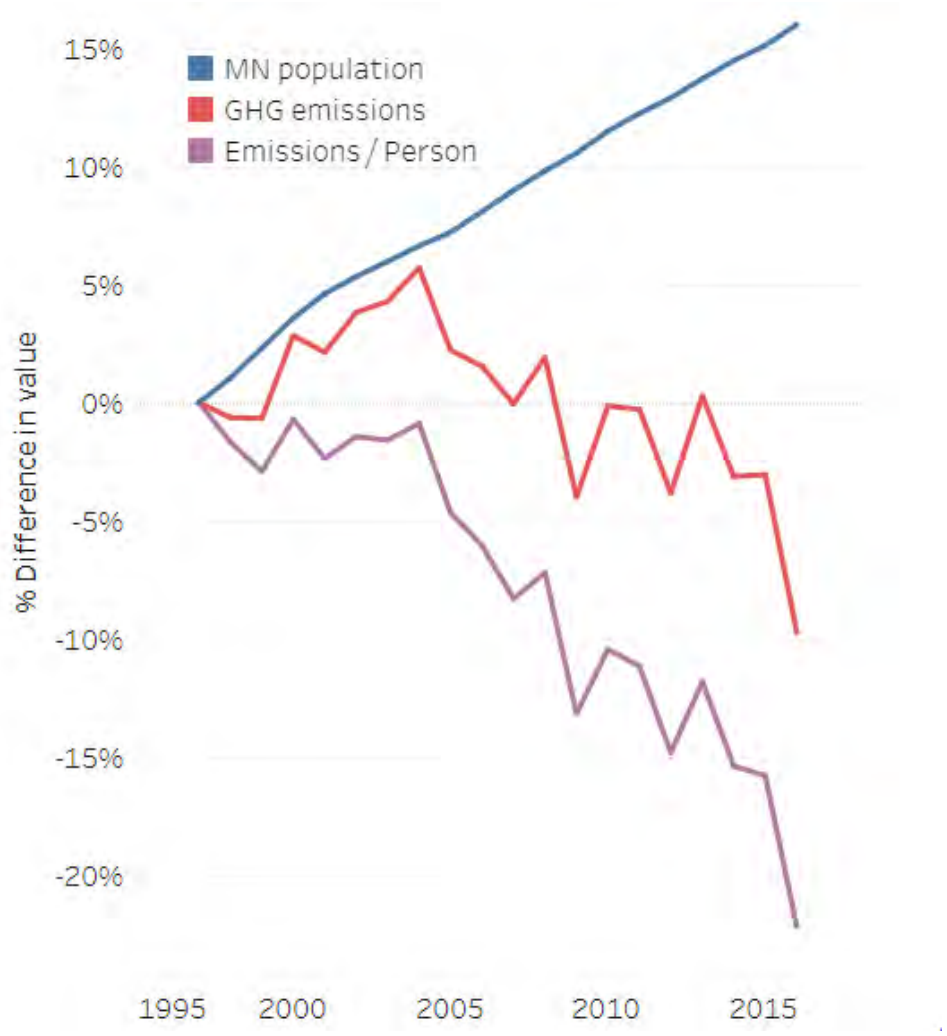


# GHG emissions decreased while the economy expanded




- Since 1995, gross state product has increased dramatically while greenhouse gas emissions declined, due to:
  - Improved energy efficiency
  - Increased fuel efficiency
  - Cleaner fuels
  - Renewable energy

# GHG emissions decreased while population grew




- Since 1995, Minnesota's population rose more than 15%, and greenhouse gas emissions decreased, due to:
  - Lower carbon emissions from generating electricity
  - More fuel-efficient cars
  - Renewable energy

# One Minnesota Climate Vision

Establish and accelerate policies that put Minnesota on track to meet or exceed our greenhouse gas goals and achieve greater resiliency in the face of climate change.

# Executive Order 19-37

Climate change is an existential threat that impacts all Minnesotans

- We must take action now to reduce impacts
- We also have a responsibility to respond and adapt to these changes

# Climate Change Subcabinet

Put Minnesota back on track to meet or exceed our goals to reduce statewide GHG emissions

Enhance the climate resiliency of Minnesota's natural resources, working lands, and communities

# Climate Change Advisory Council

Identify opportunities for, and barriers to, the development and implementation of the policies and strategies to reduce GHG emissions and promote resiliency

# Climate Change Public Engagement

Ensure those impacted by climate policies and strategies, including frontline communities, indigenous peoples, industry, and workers, have a voice in the process

# 100% Clean Energy by 2050

Reduce dependence on fossil fuels

Increase clean energy resources and support a green economy

+59,000 clean energy jobs and growing

# Clean Cars Minnesota

## Transportation is our largest source of GHG emissions

- LEV and ZEV clean car standards by end of 2020
- Reduce carbon emissions, protect public health, and increase consumer choice

# Transportation

## Volkswagen settlement

- $7 million for heavy-duty EVs
- $4.7 million for electric school buses
- 2,400 miles of EV corridors

## EV infrastructure bonding

## Clean Transportation Fuels

# Sustainable Communities and Climate Resiliency Initiative

**Fund up to 10 pilot projects throughout the state**

*$15 million*

# Minnesota's Regional Partnerships

## Minnesota's regional efforts

- U.S. Climate Alliance
- Under 2 MOU
- We're Still In
- Power Past Coal
- Midcontinent Power Sector Collaborative
- Midcontinent Transportation Electrification Collaborative

# Federal Regulatory Landscape

## Mercury and Air Toxics Standard (MATS) reconsideration

- Required mercury and acid gas controls at coal-fired power plants
- Compliance date = April 2015
- Supreme Court found that EPA failed to consider costs as “appropriate and necessary”
- Proposal is a revised cost-benefit analysis restricted to pollutants subject to the standard
- Proposal finds that regulation of mercury costs more than benefits provided
- Not modifying the standard…yet

# Federal Regulatory Landscape

## Carbon Pollution Standard Revision

- NSPS for new coal-fired steam generation in 2015
- Changes Best System of Emission Reduction (BSER) for new coal-fired power plants
- Revokes current requirement for partial carbon capture technology
- 2018 proposal based on efficient operation
- Raises the emission limit to 1,900 lbs $CO_2$/MWh

# Federal Regulatory Landscape

## Affordable Clean Energy (ACE) Rule

- Replaces the Clean Power Plan (CPP)
  - Limits technology to “inside the fence line” options as best system of emissions reduction (BSER)
- New Implementing Regulations for Section 111(d)
  - Does not provide emission reduction standards, only a list of technologies
  - States must evaluate for possible application to each affected unit
- Proposed revisions to NSR
  - Allows an emissions unit to increase **annual** emissions as long as they don’t increase **hourly** emissions.
- Will likely result in no emission reductions for Minnesota

# Federal Regulatory Landscape

## Safer Affordable Fuel Efficient (SAFE) I: Vehicle Standards

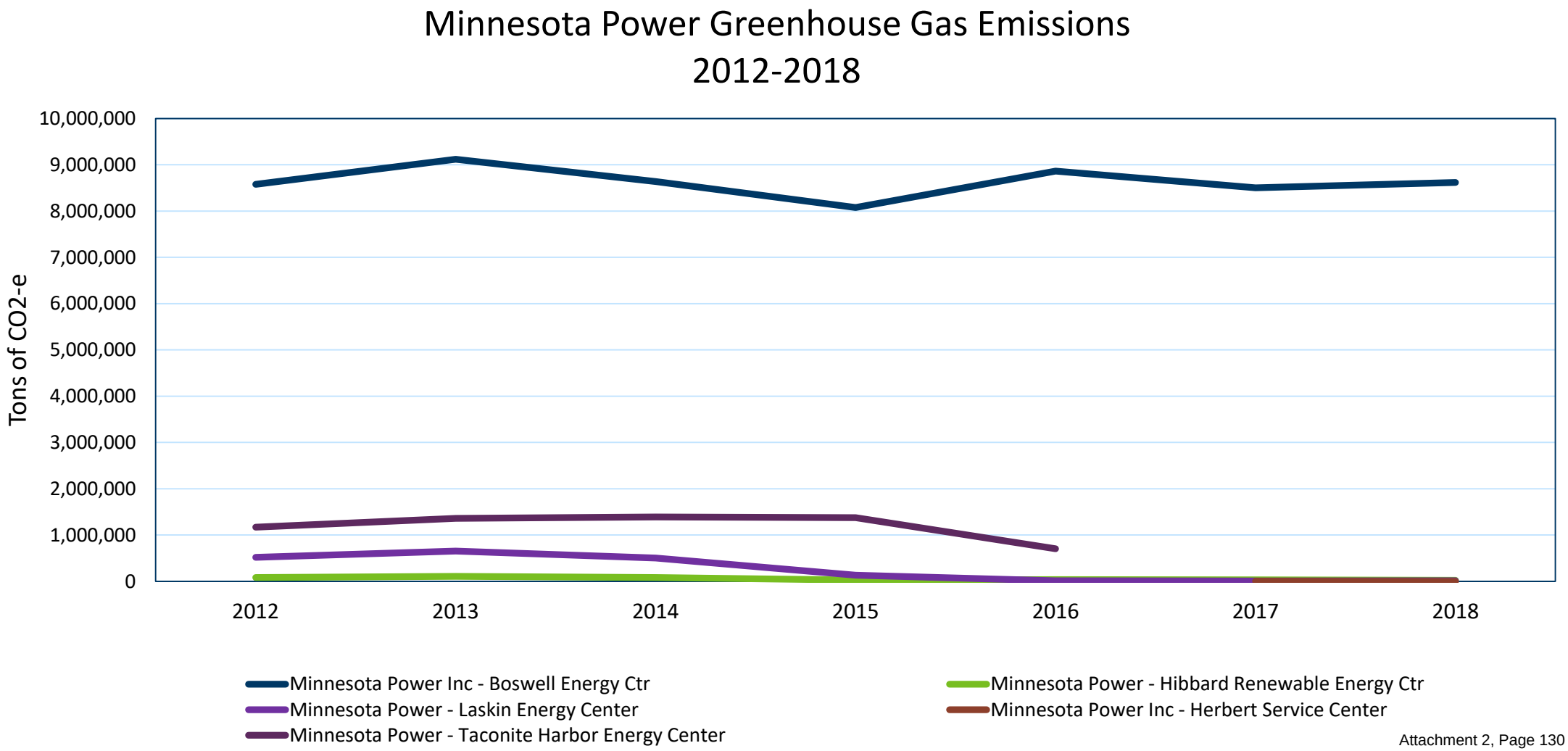
- Revokes CA's 2013 vehicle emission standards waiver for greenhouse gases
- Claims Energy Policy and Conservation Act preemption of CA's Advanced Clean Car program
  - Low Emissions Vehicle III GHG (LEVIII) standards
  - Zero Emissions Vehicle (ZEV) regulations

# Federal Regulatory Landscape

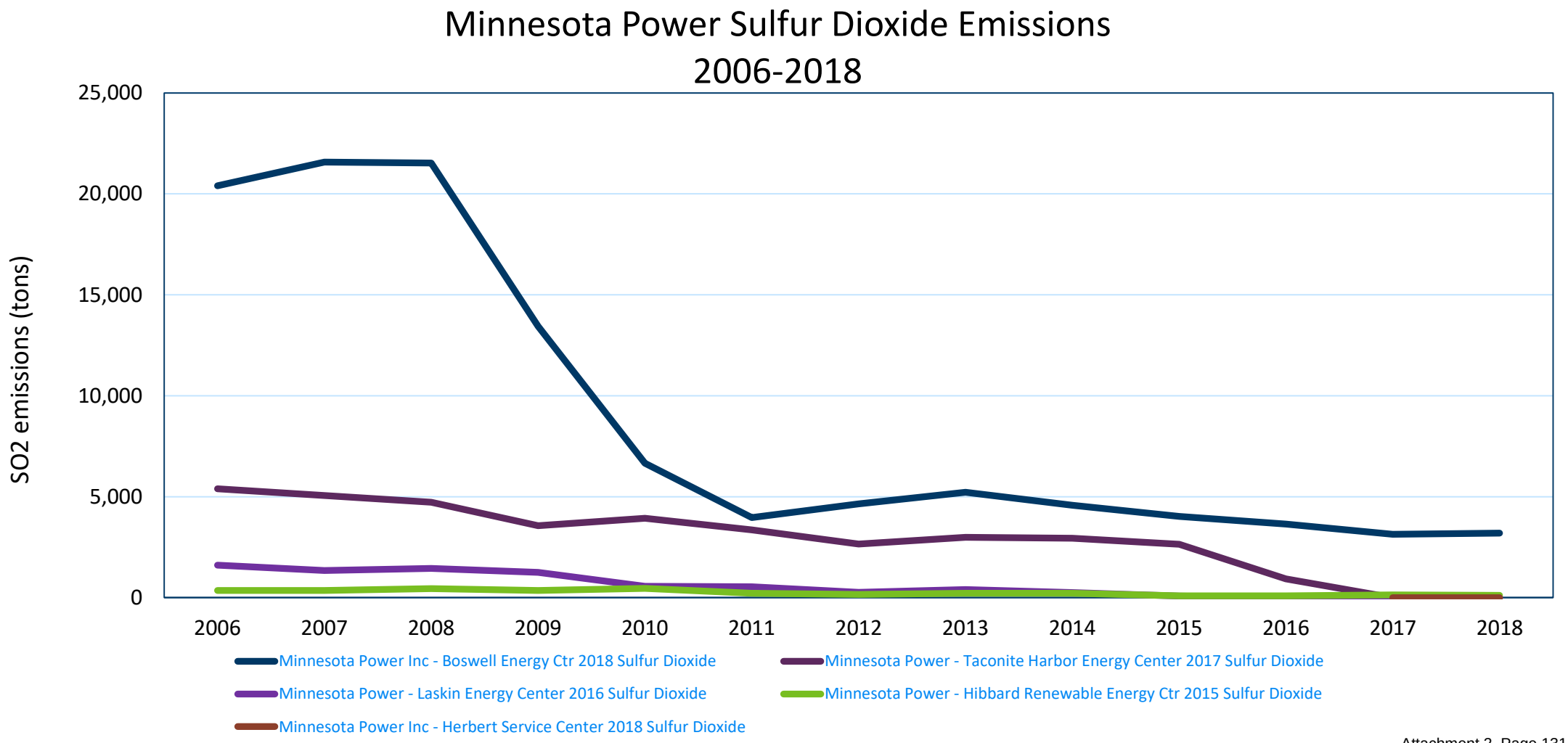
## Safer Affordable Fuel Efficient (SAFE) II: Federal Vehicle Standards

- Relies upon updated Mid-term Review on vehicle technology
- First proposal held the fuel economy standards at model year 2020 levels through 2026
- Leaks on the final proposal indicate modest fuel economy improvements
- Removes the inclusion of refrigerant regulations after model year 2020

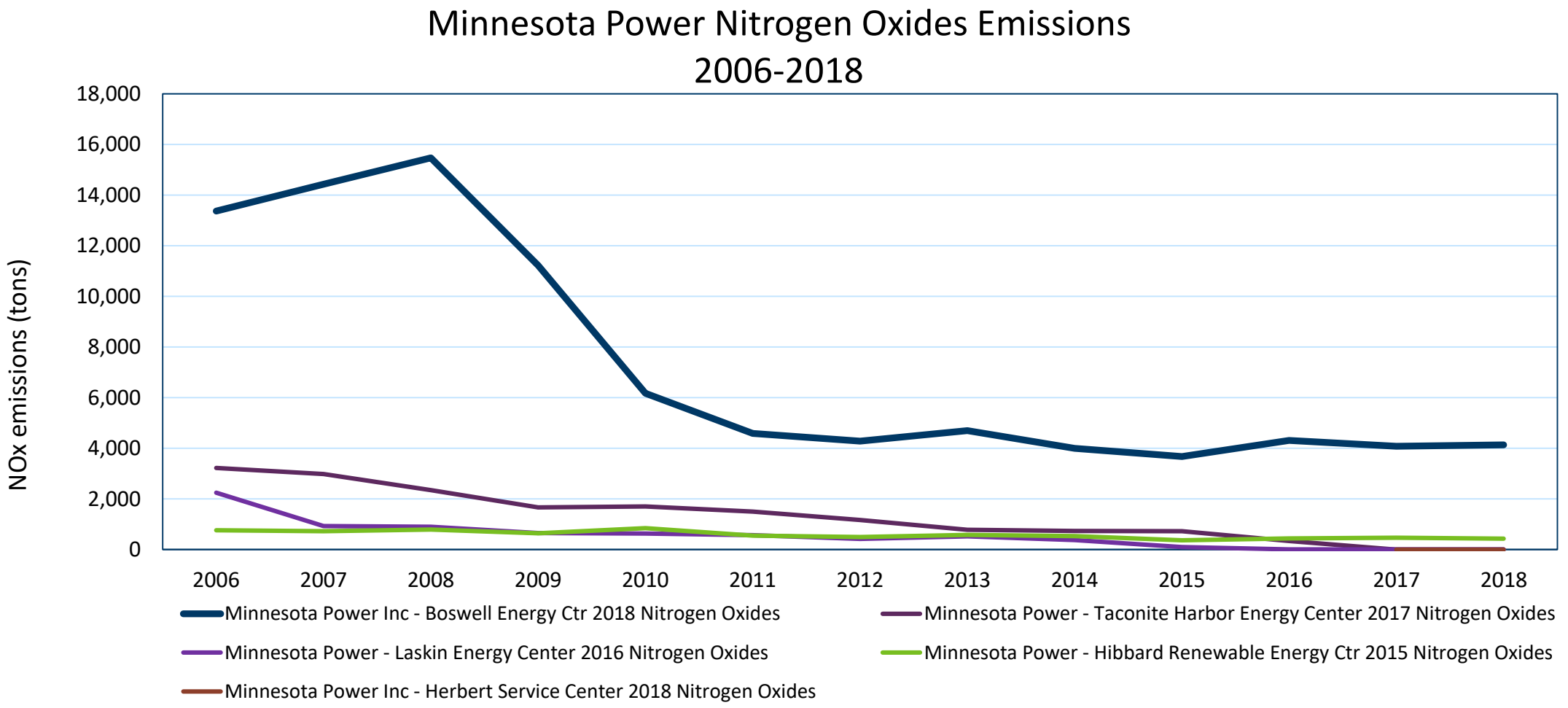
# Minnesota Power Emissions



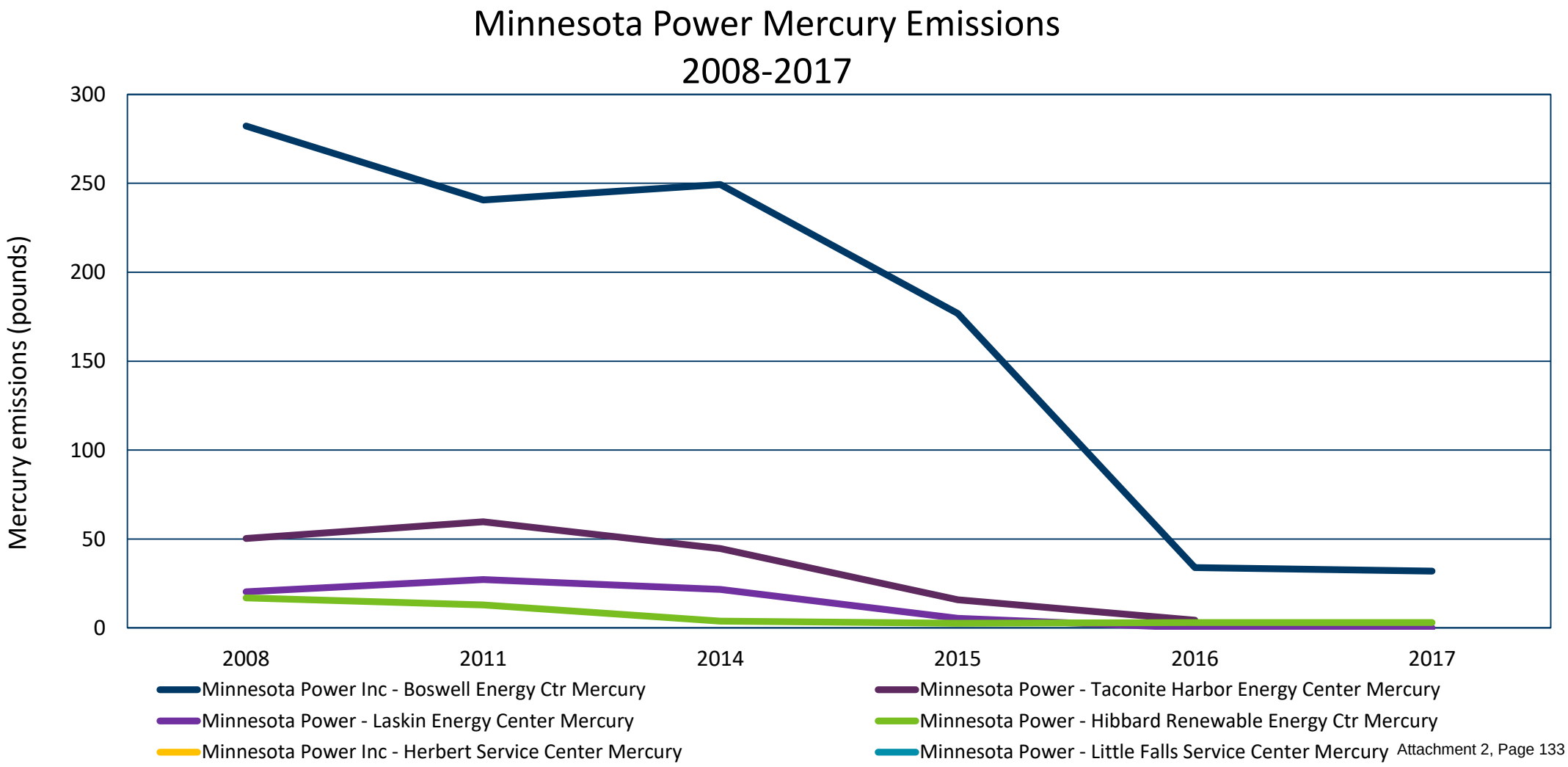
# Minnesota Power Emissions



# Minnesota Power Emissions



# Minnesota Power Emissions



# Our future depends on action now

Commissioner Bishop, Numa Zahra, and Lt. Gov. Peggy Flanagan

# Questions?

**Frank Kohlasch**

*Frank.Kohlasch@state.mn.us*

651-757-2500

MINNESOTA POLLUTION CONTROL AGENCY

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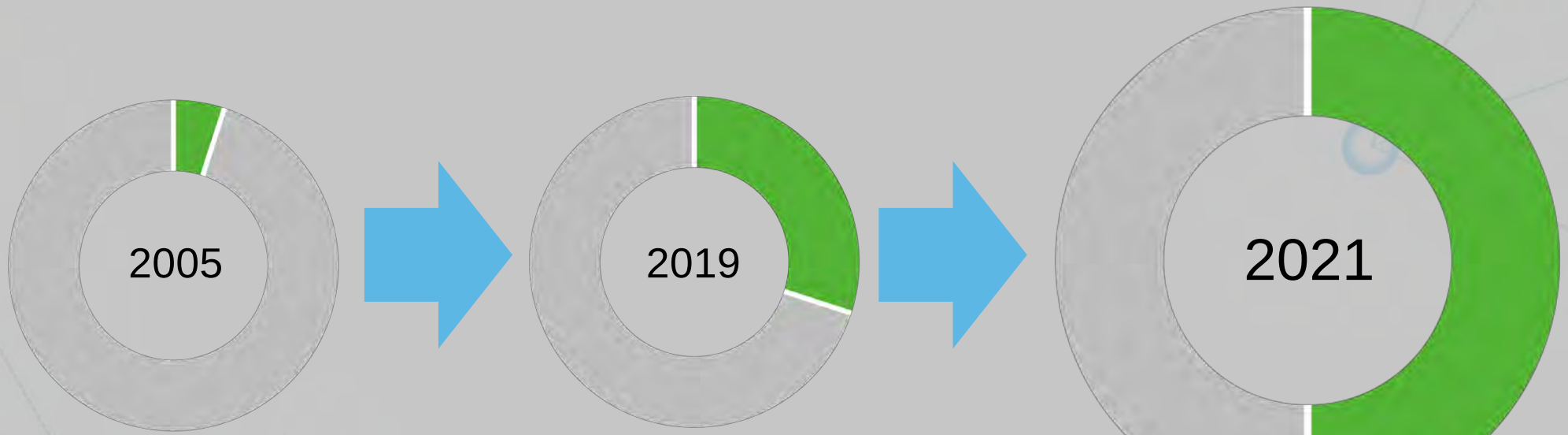
# Integrated Resource Plan

## Stakeholder Meeting - March 3, 2020

Julie Pierce, Minnesota Power Vice President of Strategy and Planning

Jennifer Peterson, Minnesota Power Manager of Regulatory Strategy and Policy

# Leading Minnesota in Renewables




5%
Renewable

30%
Renewable

No. 1 in Minnesota
No. 2 in the Midwest*

50%
Renewable

*Source: Navigant Consulting

# MP's Clean Energy Transition

Since the 2015 IRP, MP Generation has eliminated 180 positions

Job eliminations are the result of:

- Early closure of Boswell 1 & 2
- Rapids Energy Center refueling
- Laskin Energy Center refueling
- Idling of Taconite Harbor Energy Center
- Mission change for the Hibbard Renewable Energy Center
- Rescaling of professional and technical services group

With time and thoughtful transition, MP managed this downsizing through hiring freezes, relocations and planned retirements

- Of 180 positions eliminated in 4 years, only 5 employees were laid off
- Laid off employees have preference for rehire

185 employees currently operated Boswell Energy Center Units 3 and 4

**Jane Orazem**
**Ash Handling Technician**

**Troy Beckner**
**Fleet Maintenance**

# Boswell Energy Center

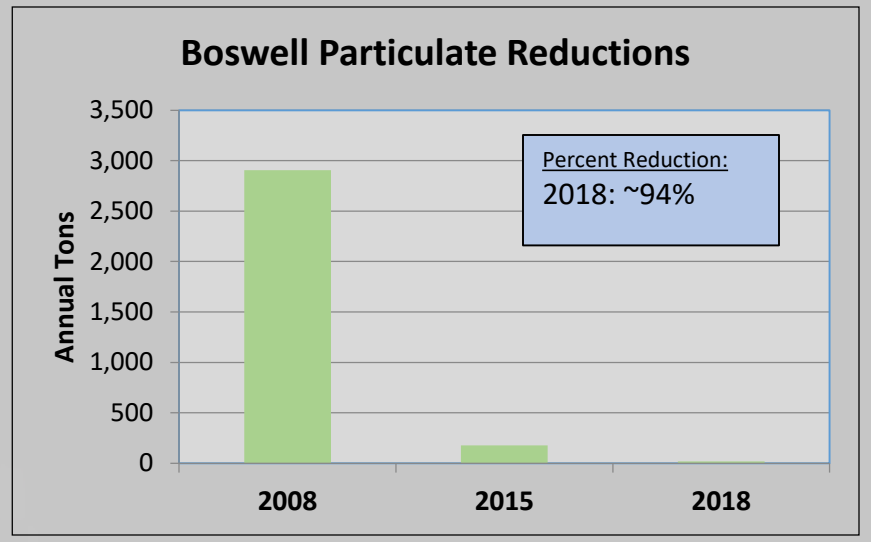
## MP's Largest Generating Site

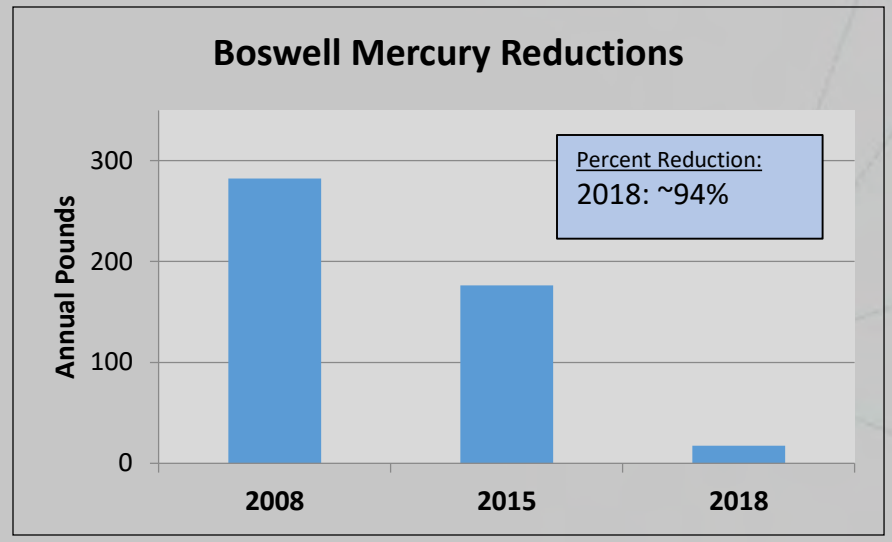
- 4 Generating Units (937 MW)
  - BEC 1-2 (67 MW's each) ***1958 & 1960***
    - ***Idled in Dec 2018***
  - BEC 3 *(352 MW's)* ***1973***
  - BEC 4 *(585 MW's)* ***1980***

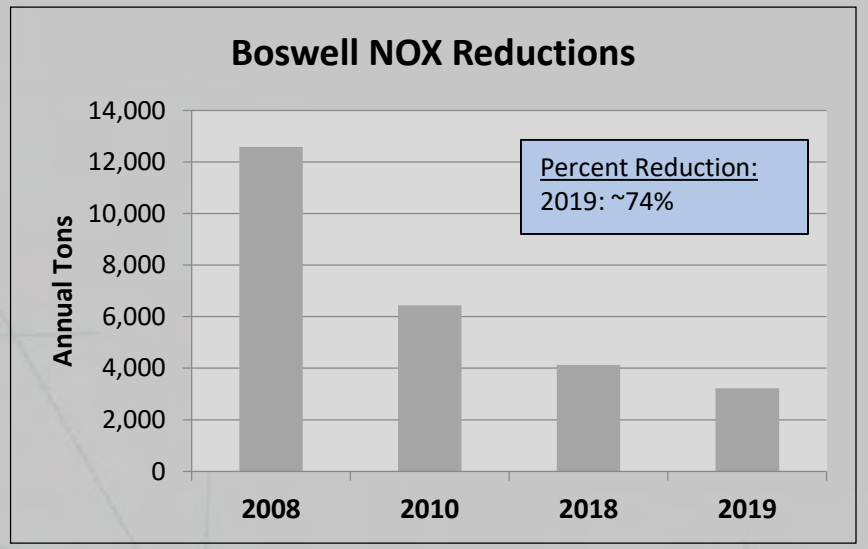
## Recently complete environmental projects:

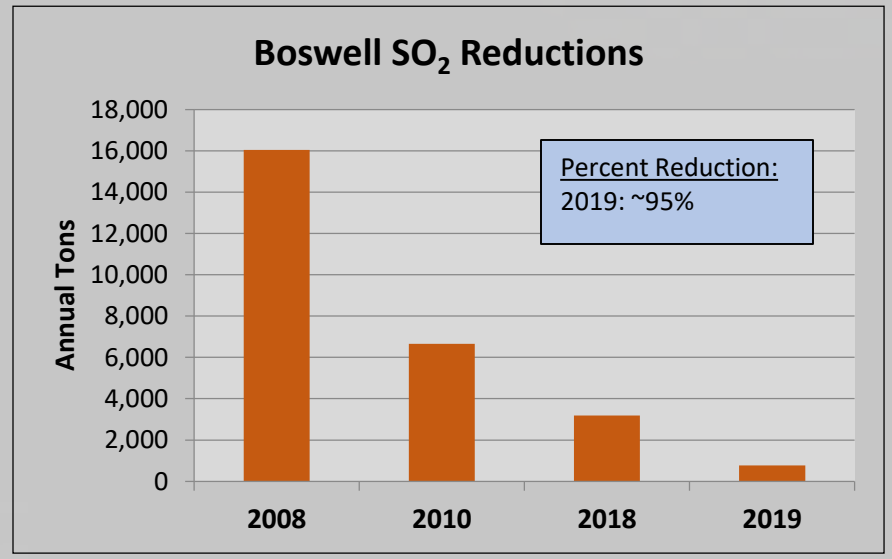
- BEC 12, and 4 Low Nox (2008) ~$80M
- Boswell Turbine Upgrades (+60 MW) ~$50M
- BEC 3 Env Retrofit (2007-2009) ~$240M
- BEC 4 Env Retrofit (2013 – 2015) ~$300M

# Emissions Reductions at Boswell



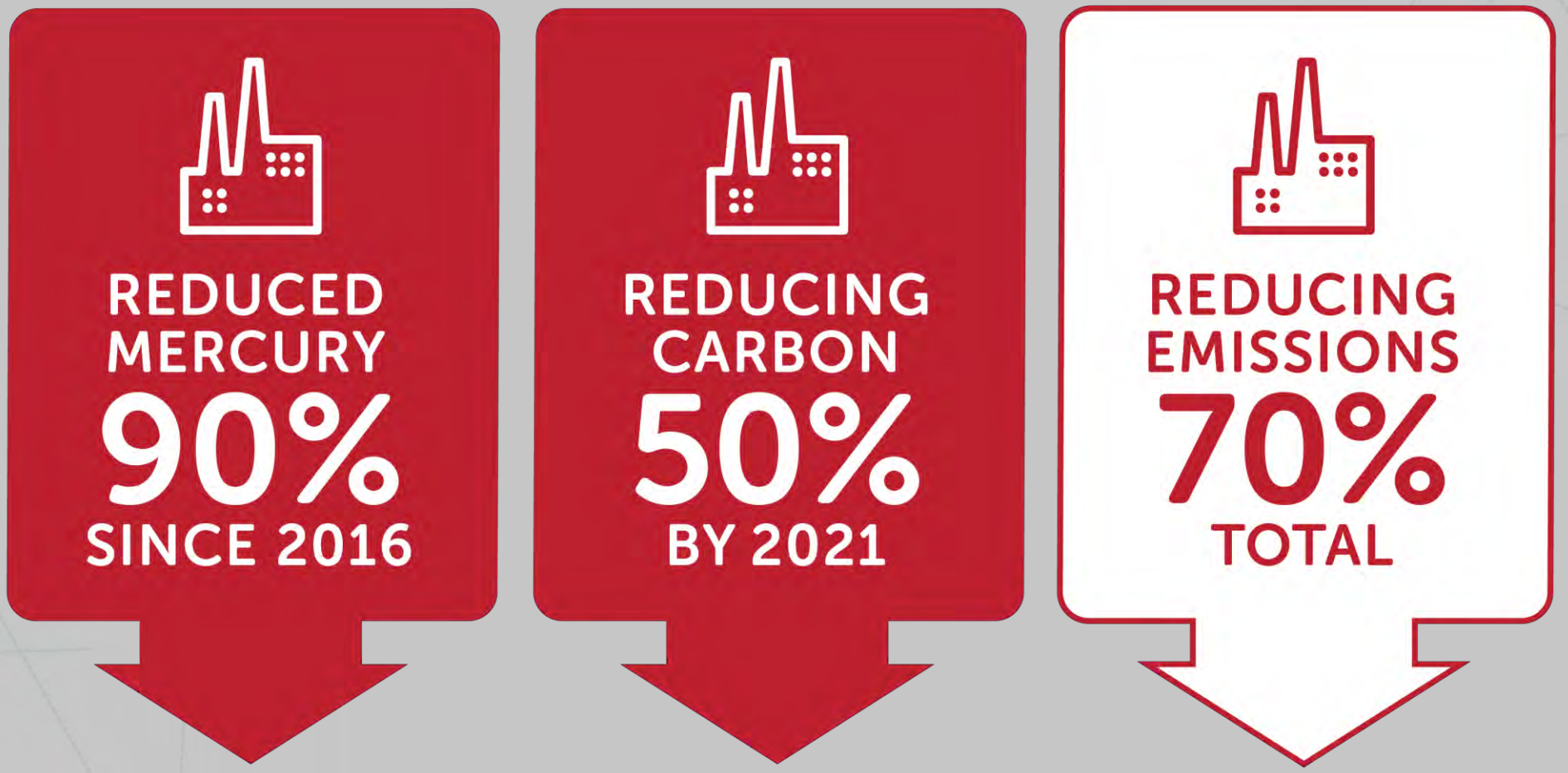





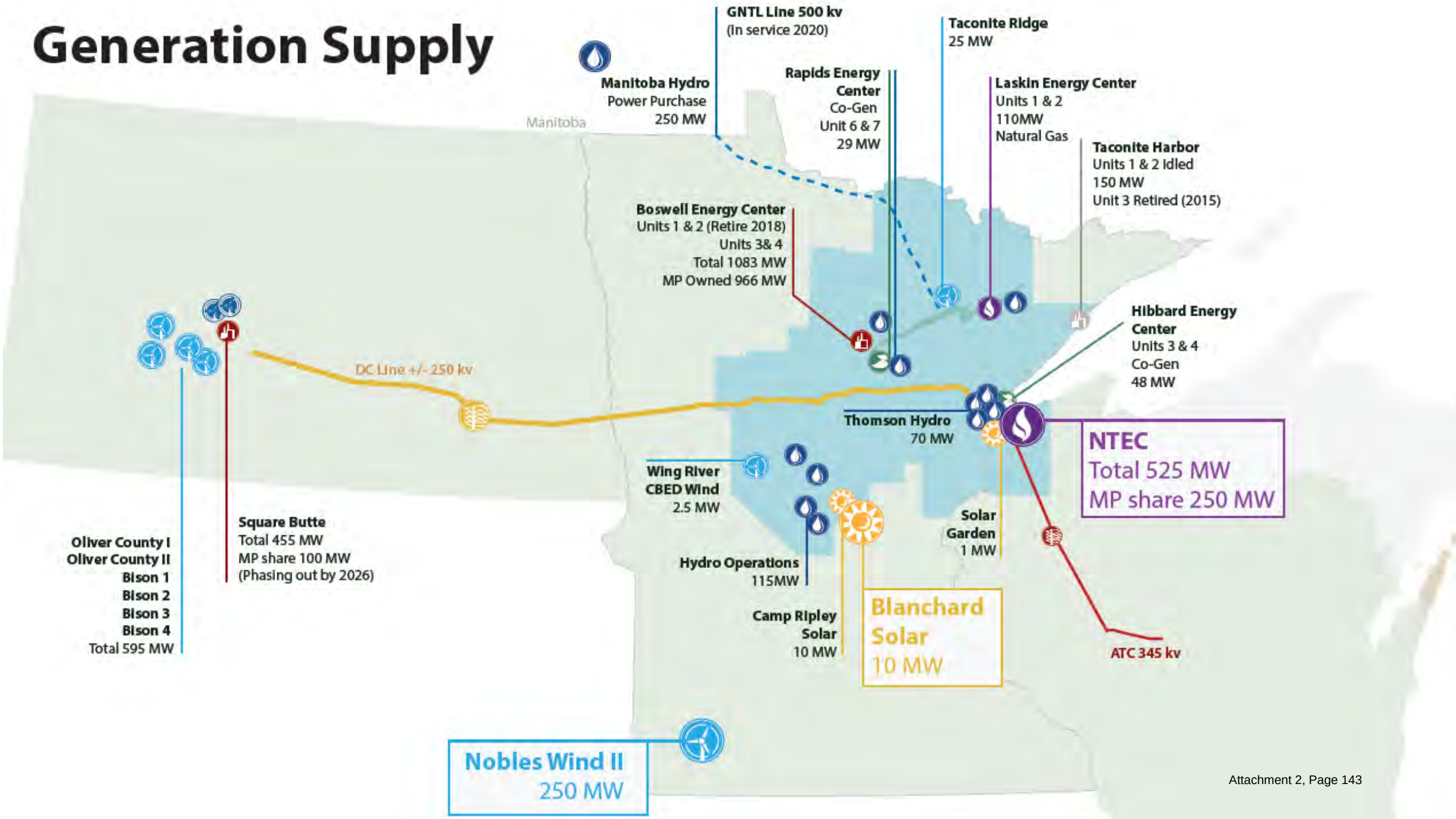

**Reductions include unit retirements*


# Thank You

# Reducing Emissions



# Generation Supply



# MP's 2020 Baseload Study

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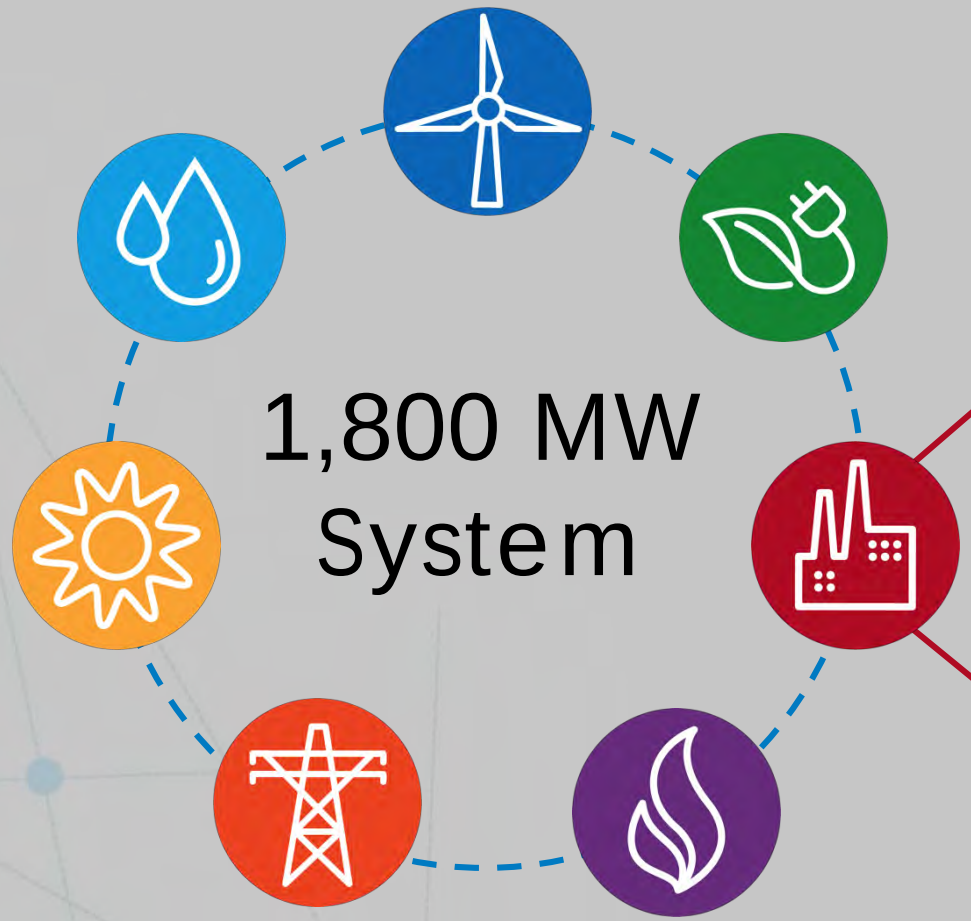



## Boswell Energy Center

| | |
|---|---|
| **935** | **megawatts** (Units 3 and 4) |
| **$300+** | **million invested** (Unit 4 emission-control) |
| **90%** | **mercury reduction** (since 2016) |
| **70%** | **emission reduction** (Boswell total) |
| **2 units** | **retired in 2018** (Units 1 and 2) |

# SAFE. RELIABLE. AFFORDABLE.

## Renewables

- Community Solar Garden
- Renewable Source

## Resiliency

- Great Northern Transmission Line

## Customer

- MyAccount
- Mobile App
- CARE program

## Conservation

- Energy Analysis
- Rebates and Savings

# Presentation: Transmission & Market Considerations

*Alison Archer, Derek Mosolf, and James Okullo; MISO*

GREAT PLAINS INSTITUTE
Better Energy. Better World.

cee
Center for Energy and Environment

# Preparing for the Grid of the Future

**Minnesota Power IRP Stakeholder Meeting**

March 3, 2020

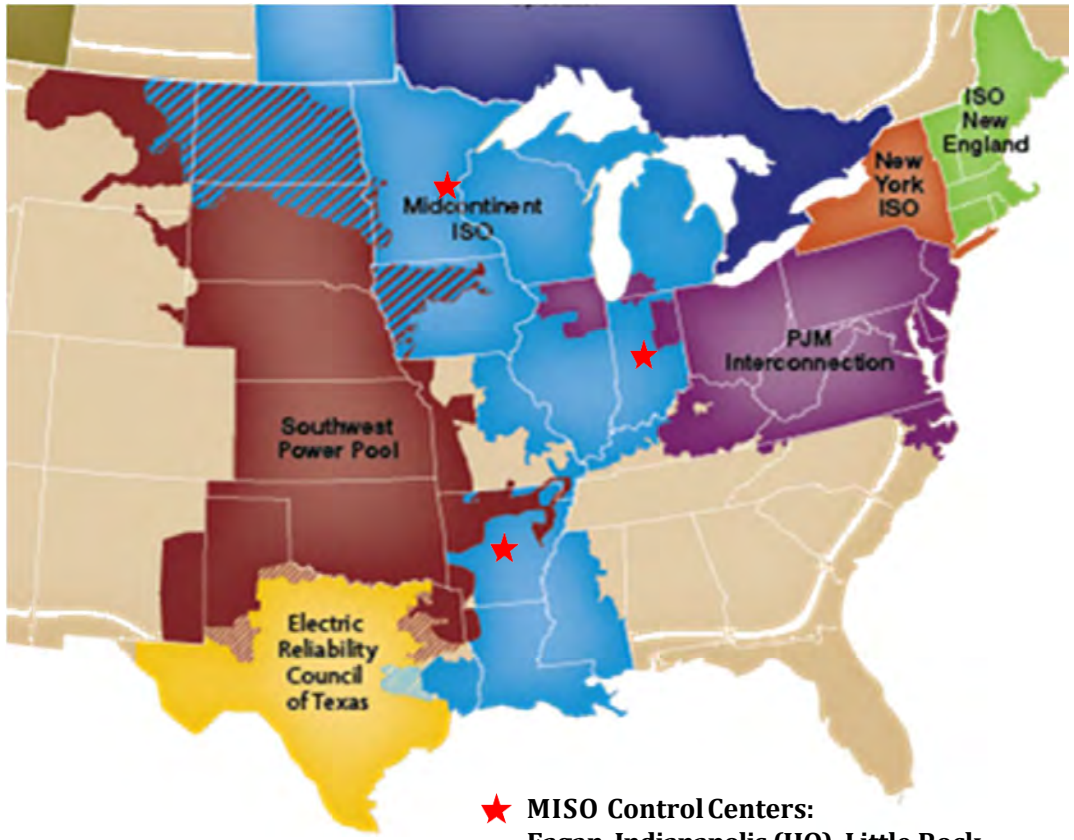
# Today's topics

- **MISO Overview**
- **The Evolving Generation Fleet**
- **Renewable Integration Impact Assessment**

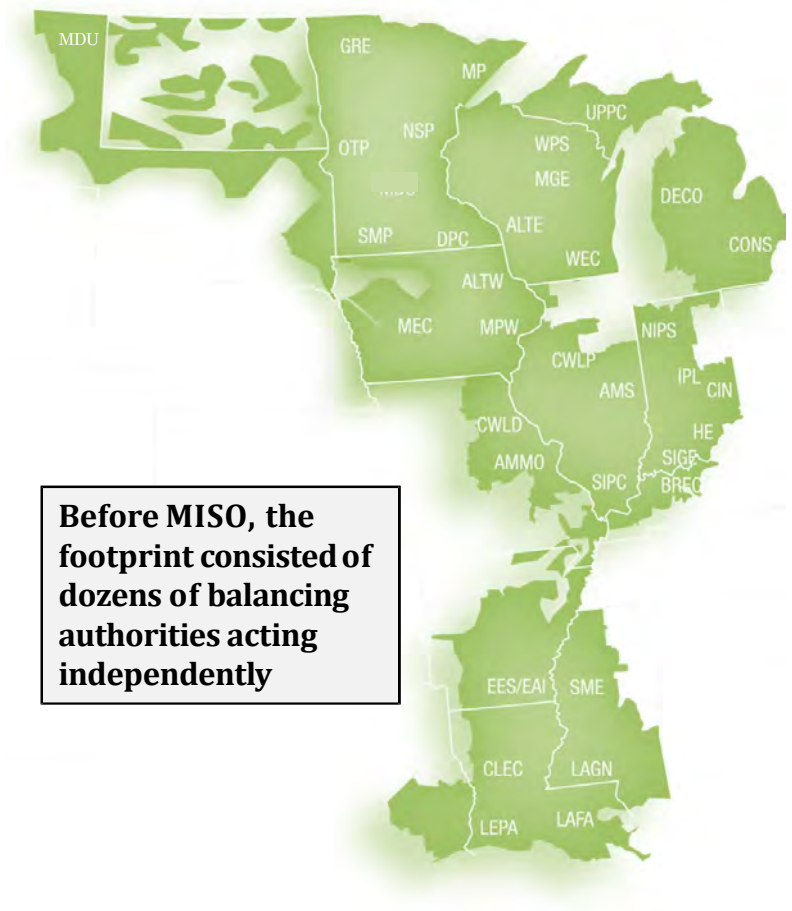
# MISO & neighboring U.S. electric grid operators

## MISO

- 15 states + Manitoba
- 42 million customers
- $30 billion market
- > 6,600 generation units with 175,000 MW capacity
- 68,500 miles of high voltage transmission lines
- > 190 member utilities
- > 460 market participants



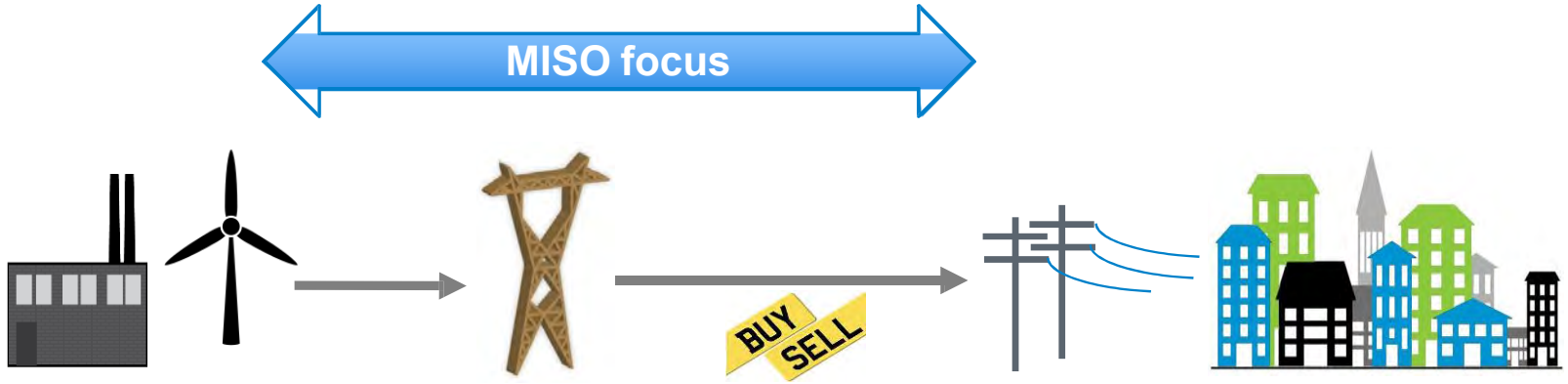
# Regional Transmission Organizations (RTOs) were formed to operate the transmission grid on a regional basis, removing transactional barriers across utility and state boundaries




**Before MISO, the footprint consisted of dozens of balancing authorities acting independently**


**With MISO, the footprint is operated as one large network and one balancing authority (with 37 local balancing areas)**

# MISO members participate across the electricity value chain




**Independent Power Producers (29)**
- *Allete Clean Energy*
- *Apex Clean Energy*
- *Geronimo*
- *NextEra*

**Competitive Transmission Developers (30)**
- *ITC-Midcontinent Development*
- *LS Power*
- *Xcel Energy Transmission Development*

**Transmission Owners (51)**
- *Dairyland Power*
- *Great River Energy*
- *Minnesota Power*
- *MN Municipal Power Agency*
- *Otter Tail Power*
- *SMMPA**
- *Xcel Energy*

**Power Marketers/ Brokers (36)**
- *EDF*
- *The Energy Authority (for SMMPA*)*

**Muni/Coop/ Transmission Dependent (31)**
- *City of Rochester*
- *Wilmar Municipal Utilities*

**Eligible End-User Customers (9)**
- *ArcelorMittal USA*
- *Midwest Industrial Customers group*

**MISO Members by Sector (#);** *Minnesota examples*

**Southern Minnesota Municipal Power Agency*

# What does MISO do?

## Efficient Wholesale Market Management & Operations to Ensure Reliability

- Conduct day-ahead and real-time energy and operating reserves markets
- Manage least cost economic dispatch of generation units
- Monitor and schedule energy transfers on the high voltage transmission system

## Comprehensive Regional Transmission Planning

- Long-range transmission planning
- New generator interconnection and retirement
- Transmission studies, e.g., Renewable Integration Impact Assessment (RIIA)

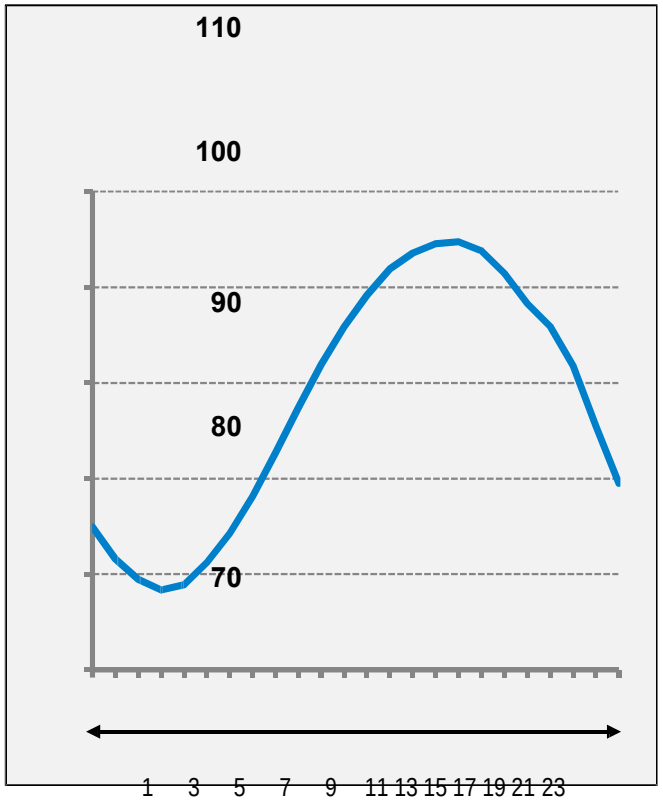


***MISO's** Vision: Be the most reliable, value-creating RTO*

# MISO conducts wholesale markets to ensure lowest cost energy and reliable operations

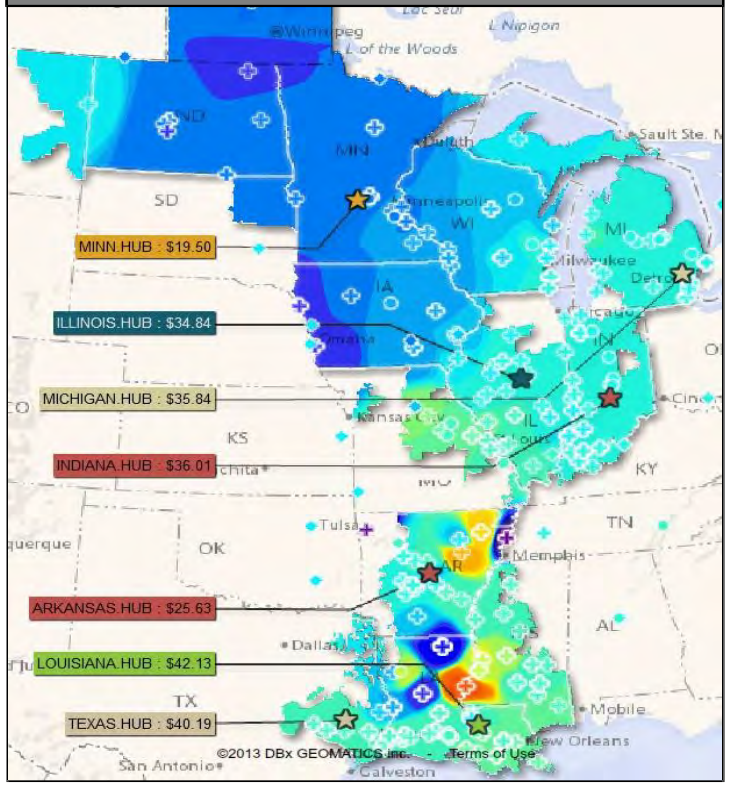
**The requirement to balance demand (load) with supply (generation) instantaneously at all points on the grid…**

**MISO Hourly Load Profile - Average Summer Day** *(Thousand MW)*

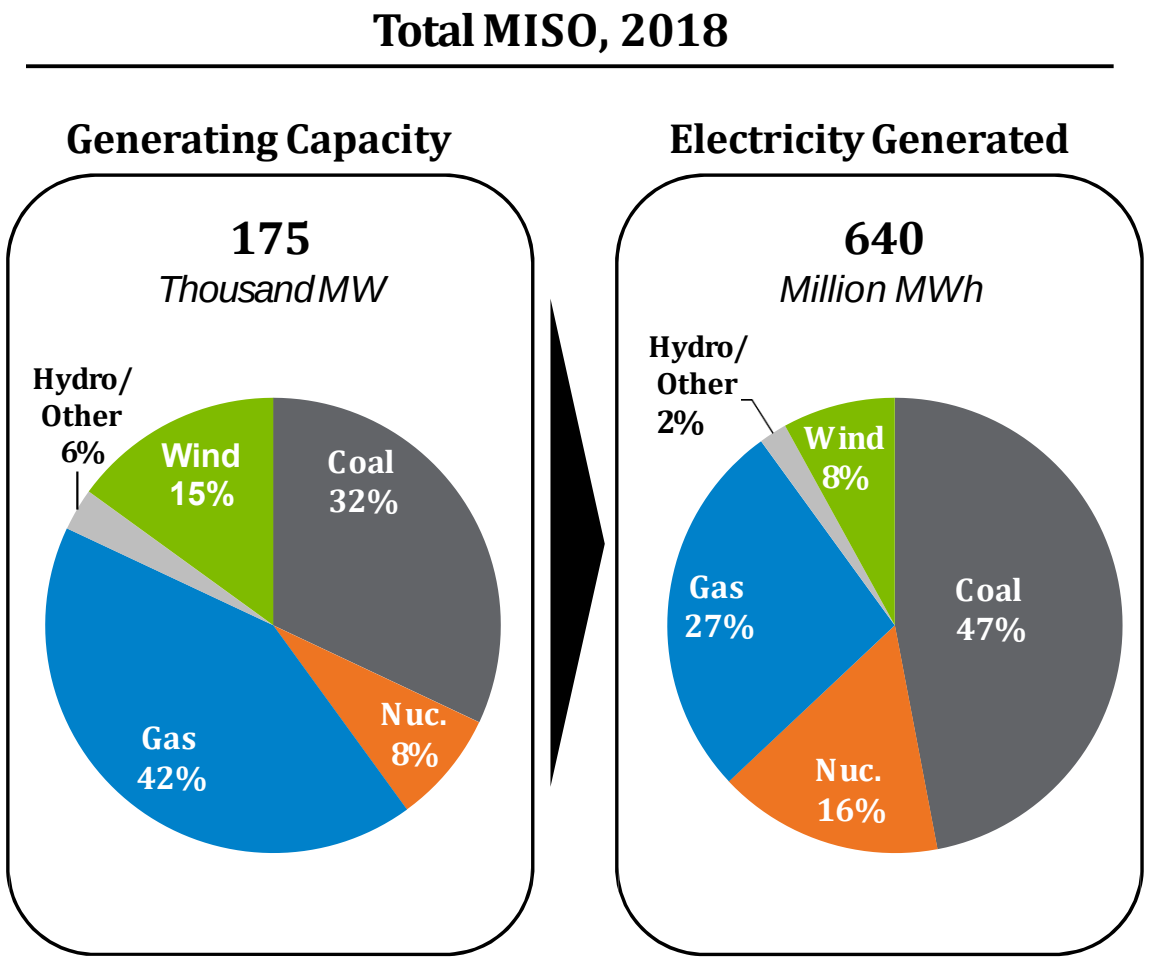



**…results in wholesale prices that can fluctuate rapidly to send timely signals to market participants.**

**MISO Real-time Energy Market Price Signals**



# MISO connects a large, diverse generation fleet

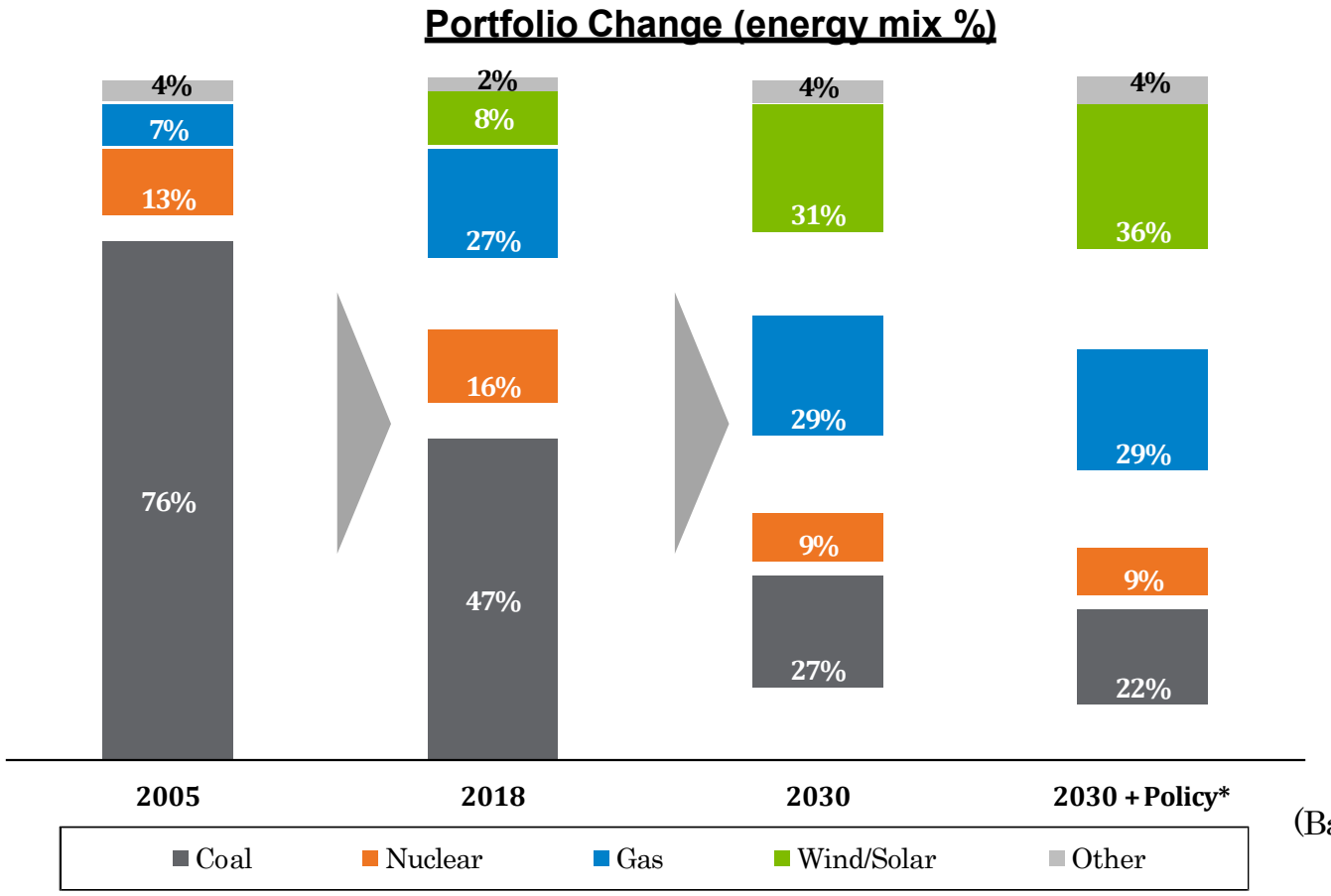




**Source:** Misoenergy.org website

# Today's topics

- **MISO Overview**
- **The Evolving Generation Fleet**
- **Renewable Integration Impact Assessment**

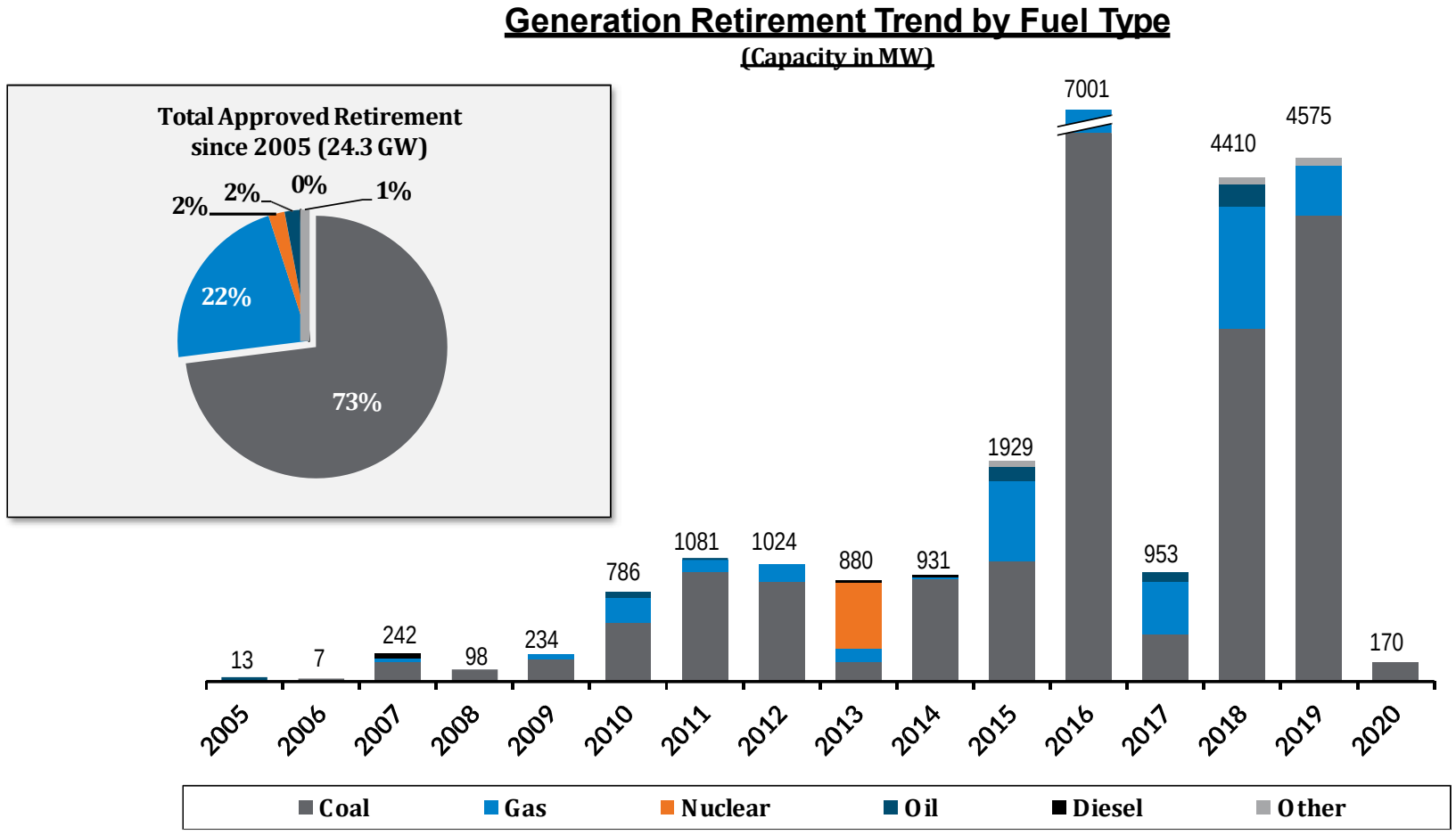
# MISO's changing resource portfolio will remain a key influencer of the way value is created movingforward




(Based on utility and state announcements)

*More aggressive utility de-carbonization goals and proposed policy changes in Illinois, Minnesota and Wisconsin may further accelerate renewables penetration

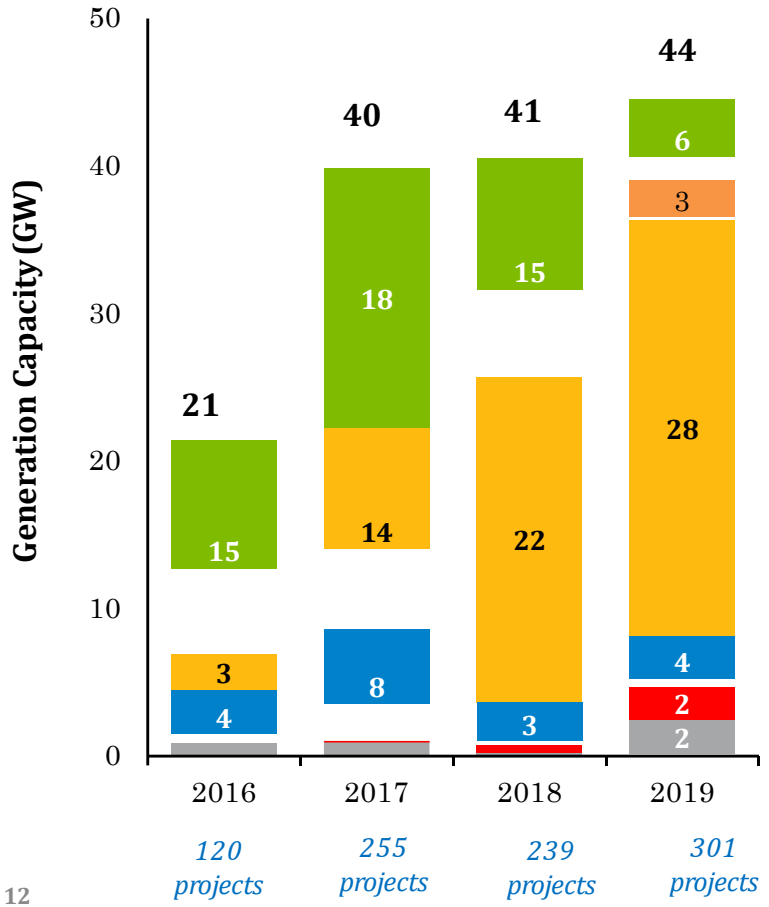
# Coal and gas retirements also contribute to the changing resource portfolio



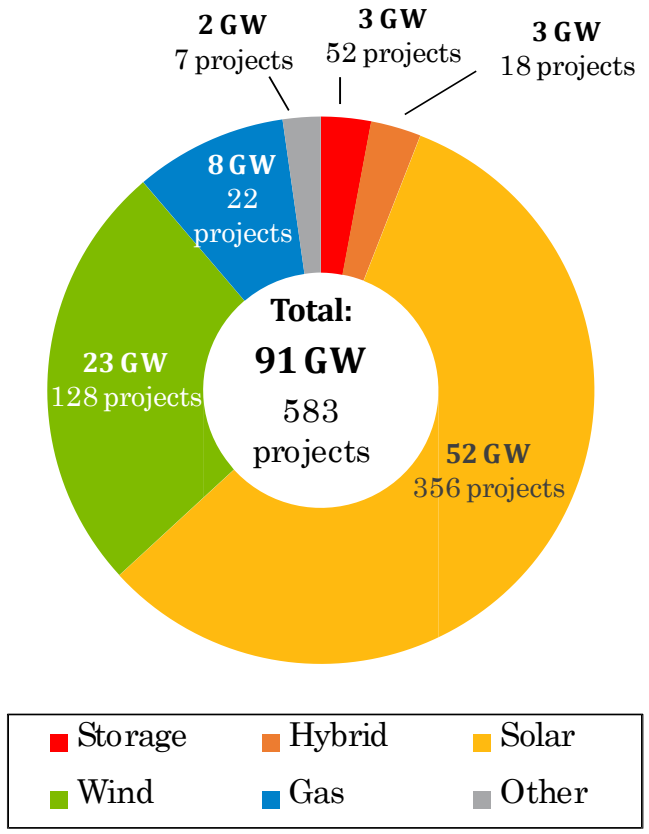
# Wind continues to grow in MISO; solar is emerging

# Renewables account for over 85% of MISO's current active generator interconnection request 'queue'

**Projects entering MISO's Generator Interconnection Queue* over the past 4 years**




**MISO's Current Generator Interconnection Queue* (currently active projects)**




*Queue data as of Oct. 2019

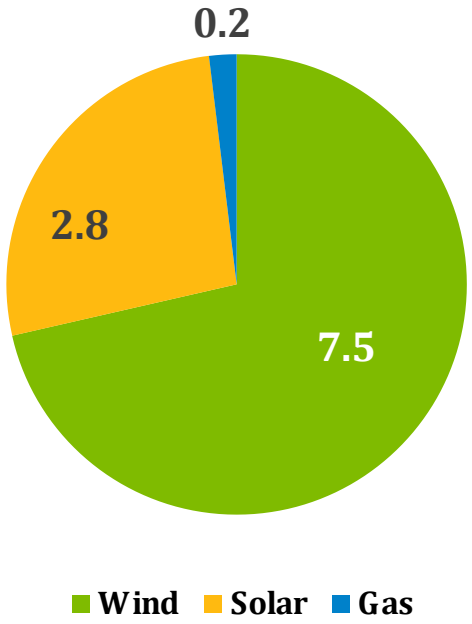


12

# Wind is concentrated in the western footprint, and continues to be a significant portion of new generation


Includes all active wind projects in the application and study phases of the interconnection queue

**2019 New Generation Interconnection Agreements (GIAs) (GW)**




**In 2019, MISO completed 69 interconnection agreements, totaling over 10 GW**



GIA – Generator Interconnection Agreement

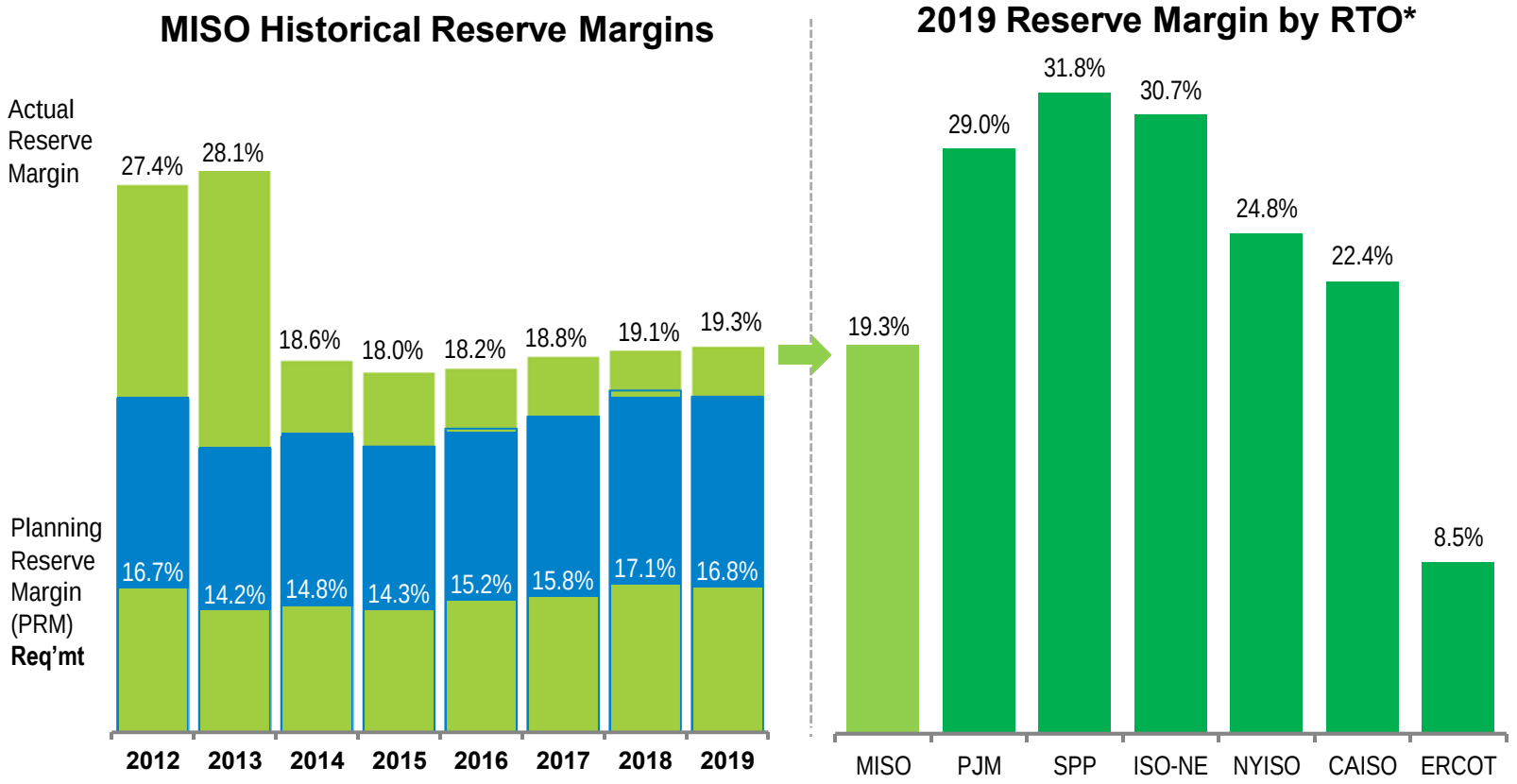
# Large number of generator interconnection requests in western MISO creates system transmission capacity challenges

**Recent Interconnection Queue experience in 'Western' MISO**
(last 3 completed queue cycles)

| Cycle -> *(date applied)* | Feb 2016 | Aug 2016 | Feb 2017 |
|---|---|---|---|
| **Initial upgrade costs ID'd** *(Thousand $/MW)* | **460** | **610** | **1,000** |
| **Capacity "In"** *(GW entering)* | **5.7** | **5.6** | **3.4** |
| **Capacity "Out"** *(GW exiting)* | **4.7** | **2.3** | **0.2** |
| **%Out** *(GW exiting/ GW entering)* | **80%** | **40%** | **5%** |

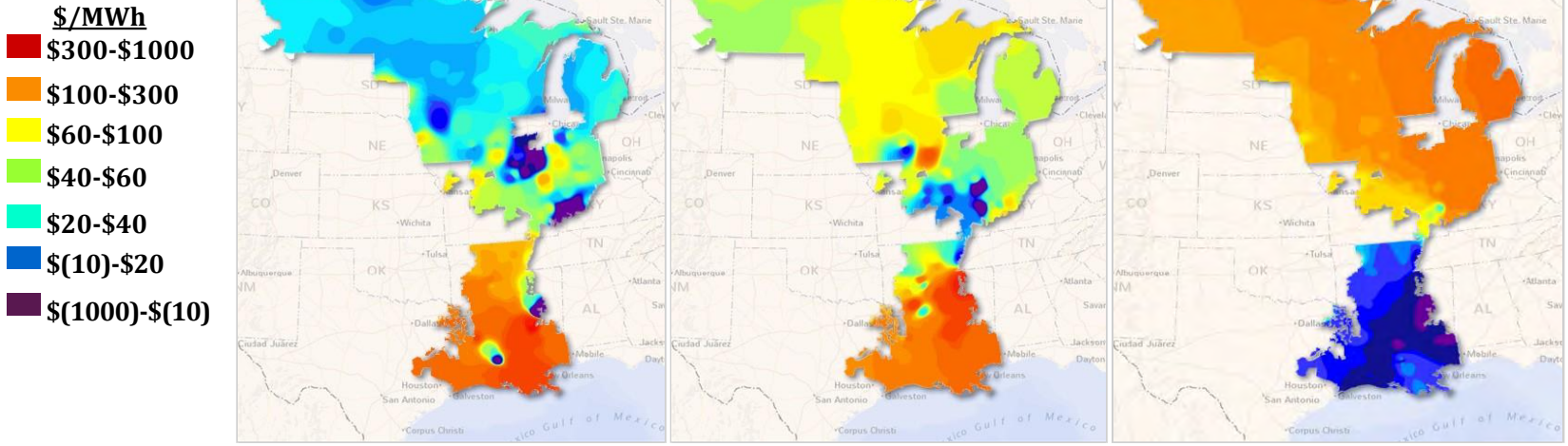
- 15 GW of generation queued for interconnection in the last 3 cycles
- Recent initial studies each indicated increasing cost to integrate, on the order of $3 billion for multiple 345 kV new line additions
- Ultimately 7+ GW of generation was able to achieve interconnection agreements for smaller rebuilds of existing facilities
- System capacity is fully committed in this area; interconnection capability is 'hitting a wall'

# Reserve margins are adequate but have tightened since 2013; our neighbors tend to have excess capacity




* **Source: NERC Long-Term Reliability Assessment publications for anticipated reserve margins**
Note: 2008 MISO is an estimate based on portions of MRO, RFC-MISO, and SERC data.
Note: 2008 PJM is RFC-PJM.

# How do we ensure reliability in all hours, including non-peak periods, as unit availability and performance decline?




| January 17, 2018 | September 15, 2018 | January 31, 2019 |
|---|---|---|
| Cold weather in South Region, excess generation in the North/Central Regions unable to move south due to transmission limitation. | Unseasonably warm temperatures in the South Region resulted in higher load than anticipated; forced outages impacted generation availability. | Historic cold in the North and Central Regions drove high load conditions; excess generation in the South Region unable to move north due to transmission limitation |

# Resource Availability and Need (RAN) guiding principles help to ensure reliability for a transforming grid

## Guiding Principles

1) **Reliability Needs and Requirements:** Reliability criteria must reflect required attributes in all horizons – "all hours matter"

2) **Reliability Contribution:** Members are responsible for meeting reliability criteria with resources that will be accredited based upon the resource's ability to deliver those attributes

3) **Alignment with Markets and Infrastructure:** Market prices must be reflective of underlying system conditions and resources must be appropriately incentivized for the attributes they provide; infrastructure should enable efficient utilization of resources

# The RAN initiative includes efforts specifically focused on addressing operational and market concerns due to portfolio change

## Progress, To Date

Improve resource transparency and performance for spring 2019 and subsequent planning year

### Load Modifying Resources (LMRs):

- Create transparency and better align LMR obligations with other resources

### Outage Coordination:

- Improve forward-looking transparency for stakeholders and MISO
- Increase early outage notification and flexibility during emergencies

### Visibility:

- Multi-day Operating Margin forecast

## In Flight

Continued refinements for 2020 Planning Resource Auction (PRA), progress on market-based solution

### PRA Inputs:

- Improve PRA inputs, focus on Load-Modifying Resources
- Create rules outlining reasonable expectations for availability or replacement during the planning year

### Visibility:

- Enhancements to the Multi-day Operating Margin forecast

## Next Focus

Continued improvement in availability and flexibility

### Resource Adequacy Construct:

- Reflect risks throughout year
- PRA reliability value reflected in auction results

### Resource Accreditation:

- Align with attributes based on all-hours reliability criteria
- Deliverability improvements

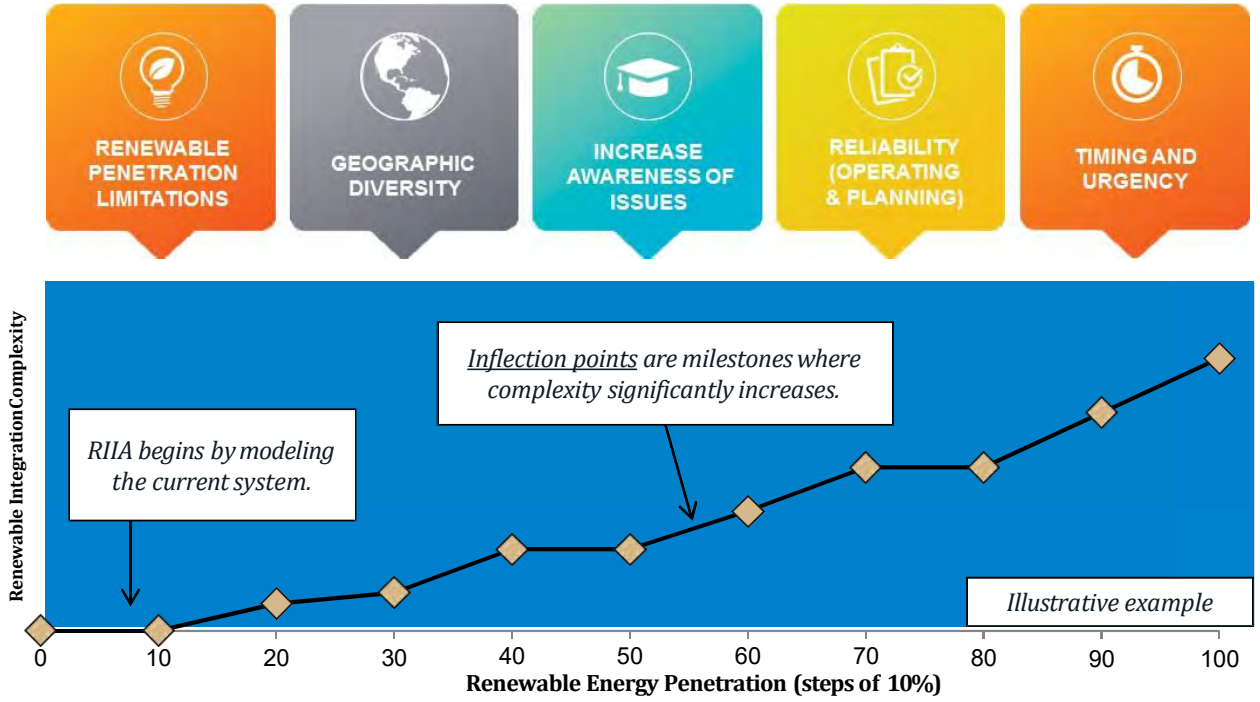
### Market Incentives:

- Prices reflect operating conditions
- Incentivize needed system attributes (e.g., multi-day market mechanism)

# Today's topics

- **MISO Overview**
- **The Evolving Generation Fleet**
- **Renewable Integration Impact Assessment**

# Renewable Integration Impact Assessment (RIIA) seeks to find inflection points of renewable integration complexity




## Focus Areas

**RESOURCE ADEQUACY**

Having the sufficient capacity of resources to reliably serve peak demand

**ENERGY ADEQUACY**

Ability to provide energy in all operating hours throughout the year

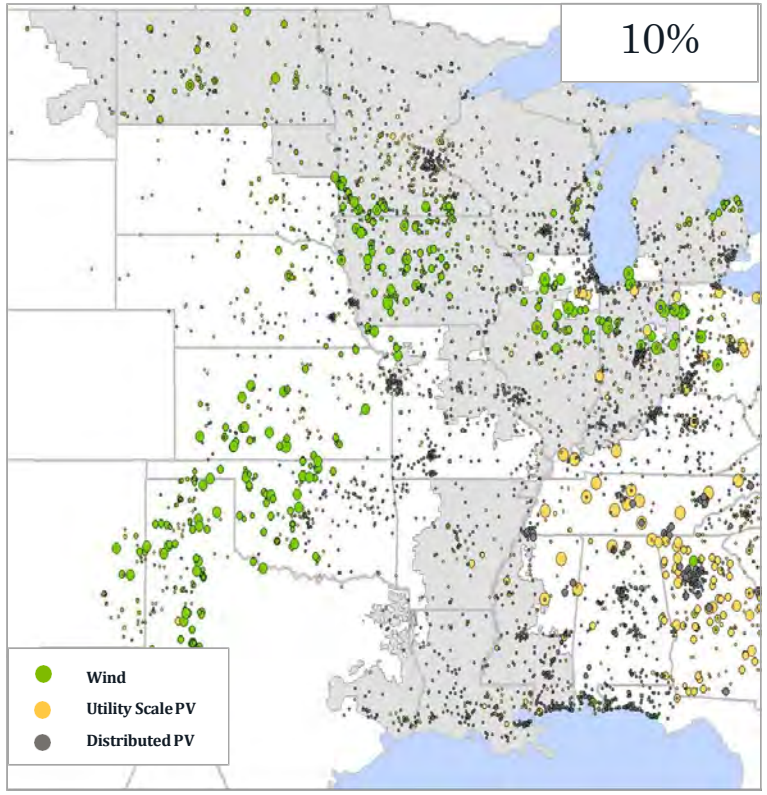
**OPERATING RELIABILITY**

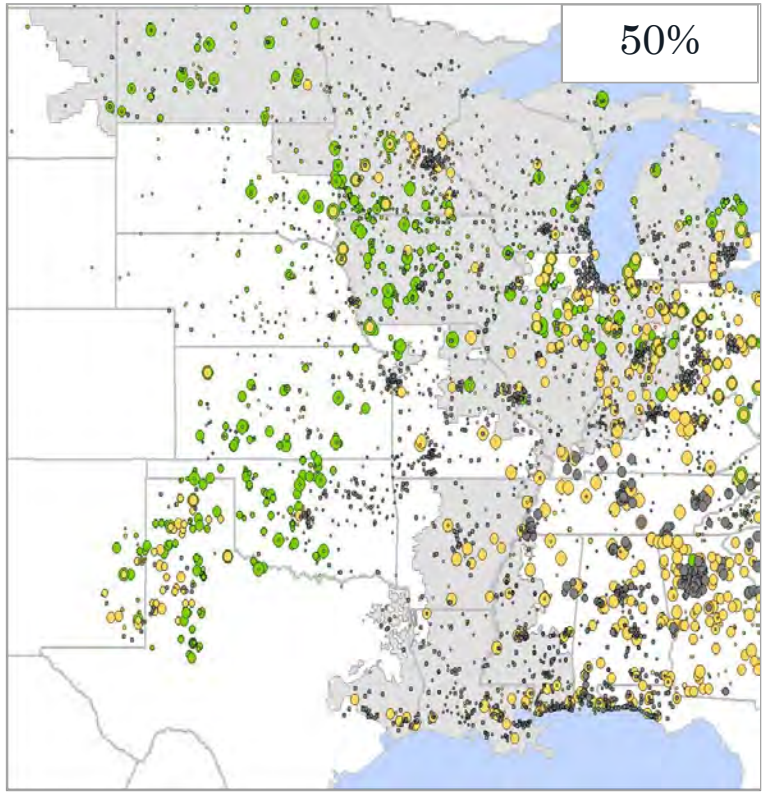
Ability to withstand unanticipated component lossesor disturbances

# Emerging Themes from RIIA

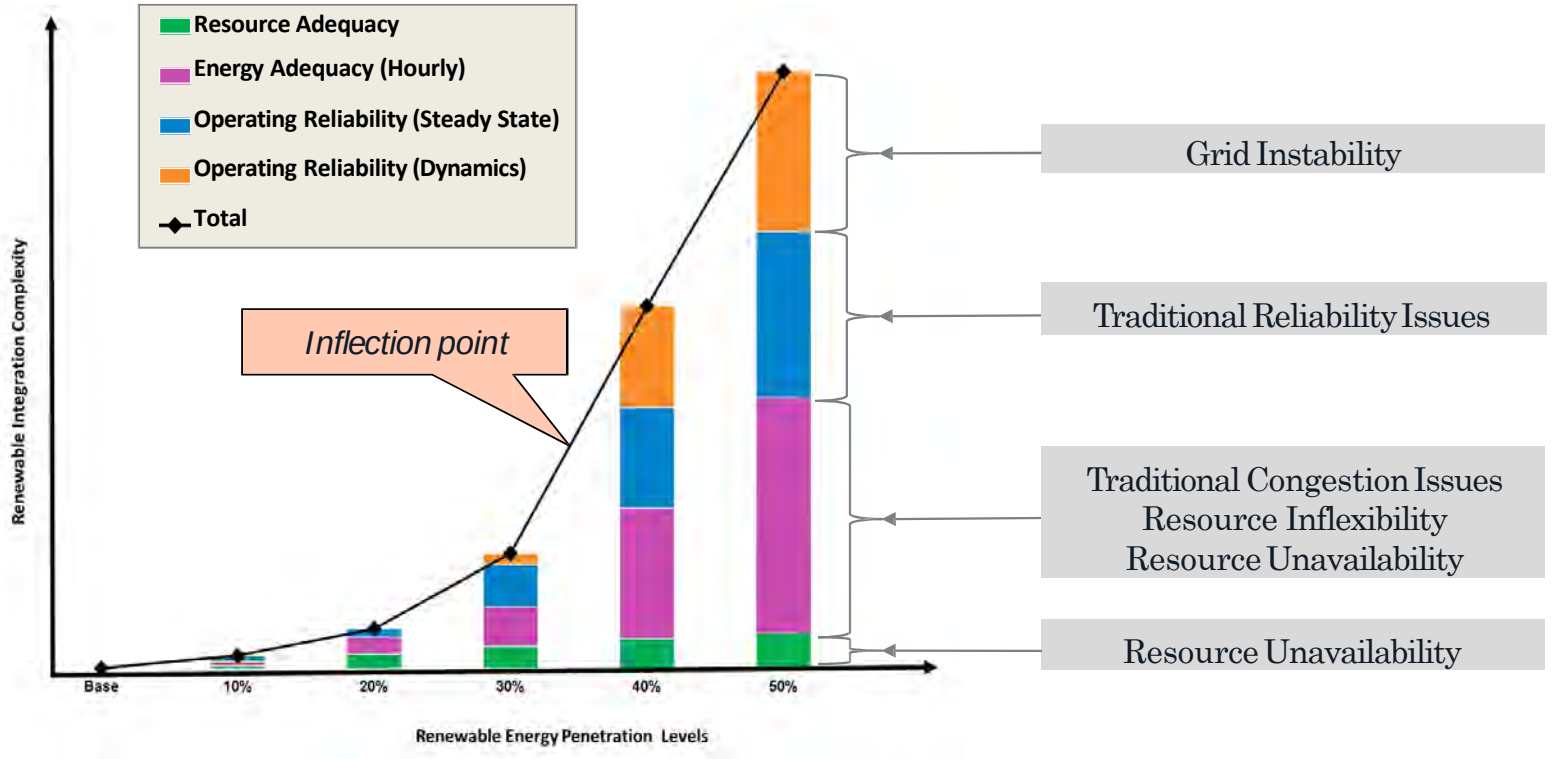
- Up to 30% renewable penetration, challenges appear manageable with incremental transmission expansion
  - However, the transmission needs are concentrated in a few local areas
- By 40%, significant challenges begin
  - 40% MISO-wide equates to 70 - >100% local penetration in wind-rich areas
  - Significant curtailment in absence of transmission solutions
  - Increased flexibility requirements (ramping from conventional generation)
  - Increased system stability concerns
- Challenges can be addressed; however, least cost solutions require careful study and regional coordination across the MISO footprint
- The value of MISO-wide diversity and 'interconnectedness' are key to understanding the best outcomes

# Renewable deployment is balanced between areas of high production potential, transmission capacity, and proximity to load

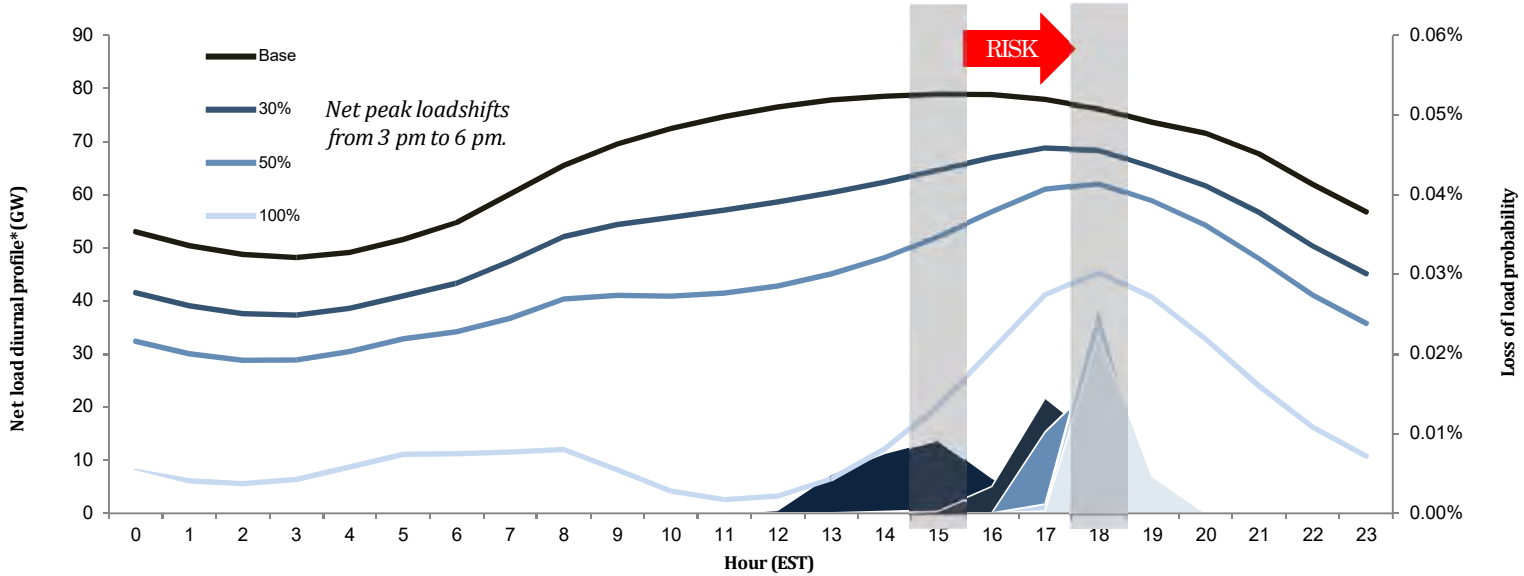


# MISO's Renewable Integration Impact Assessment (RIIA) indicates integration complexity increasing sharply beyond 30% renewable penetration



# As renewable penetration increases, the risk of losing load shifts and compresses to a smaller number of hours

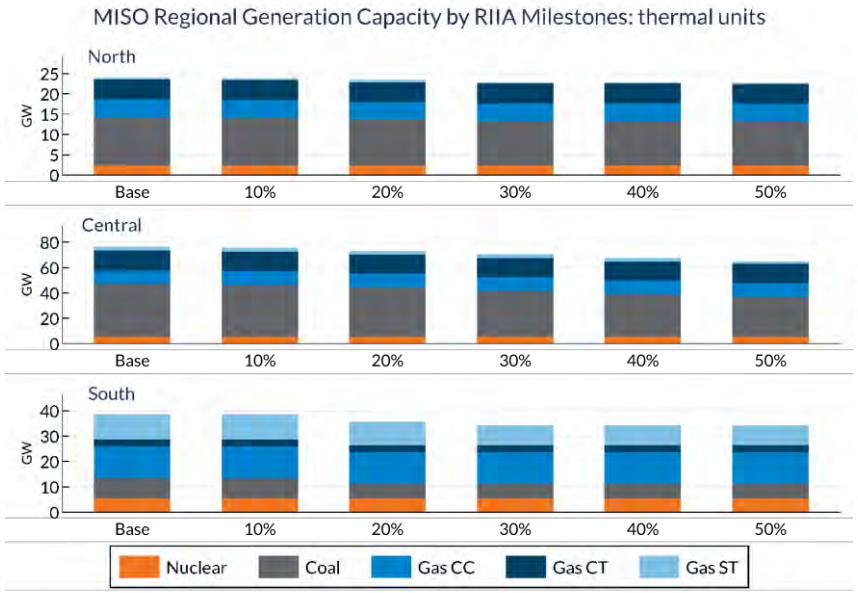


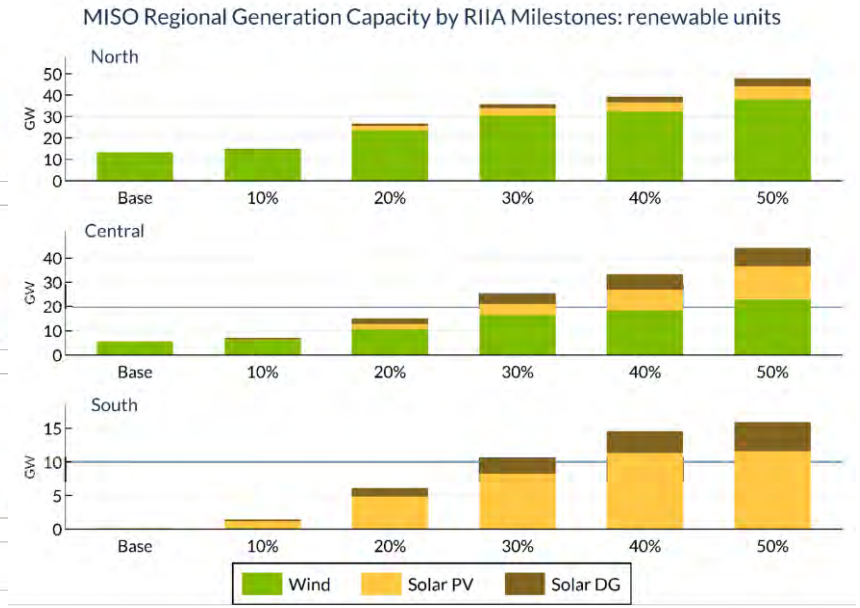

- Probability of losing load is targeted at one day in ten years over all penetration levels.
- While aggregate risk remains constant, the risk in specific hours increases.

LOLE = Loss of Load Expectation

**Profile shapes represent hourly averages across all days of the 6 study years.*

## From Base to 50% Milestone, the majority of the thermal fleet remains available to maintain adequacy: ~17GW retired; ~100GW of renewable capacity added.



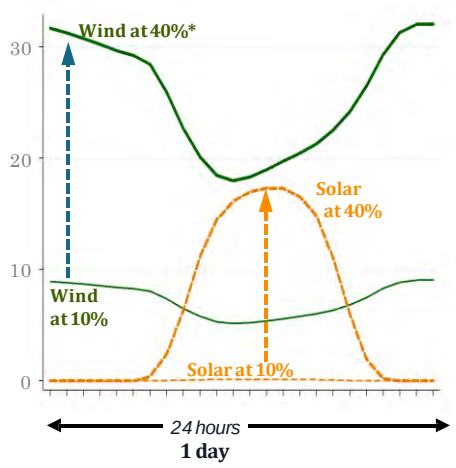




*Different Y-axis scales.

# Increasing variability due to renewable generation will require generators to perform differently than today

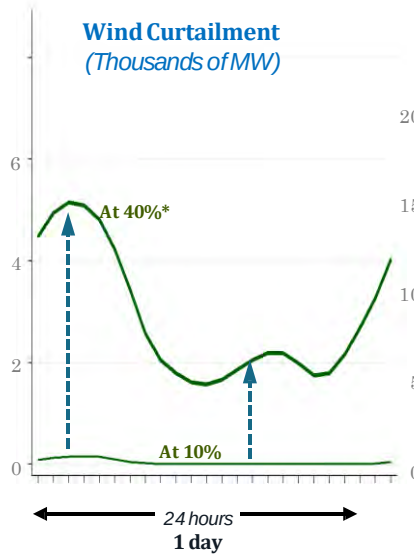
**More hourly variability from renewables…**

**Renewable Output**
*(Thousands of MW)*

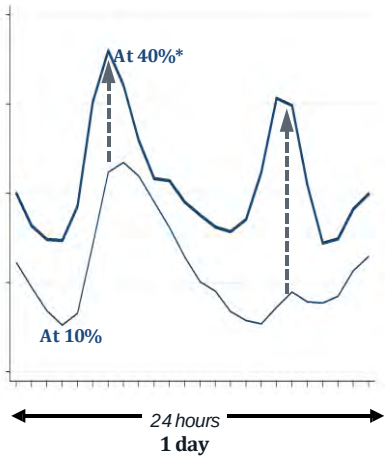



**…requires increased flexibility (curtailments and ramp capability)**

**Wind Curtailment**
*(Thousands of MW)*

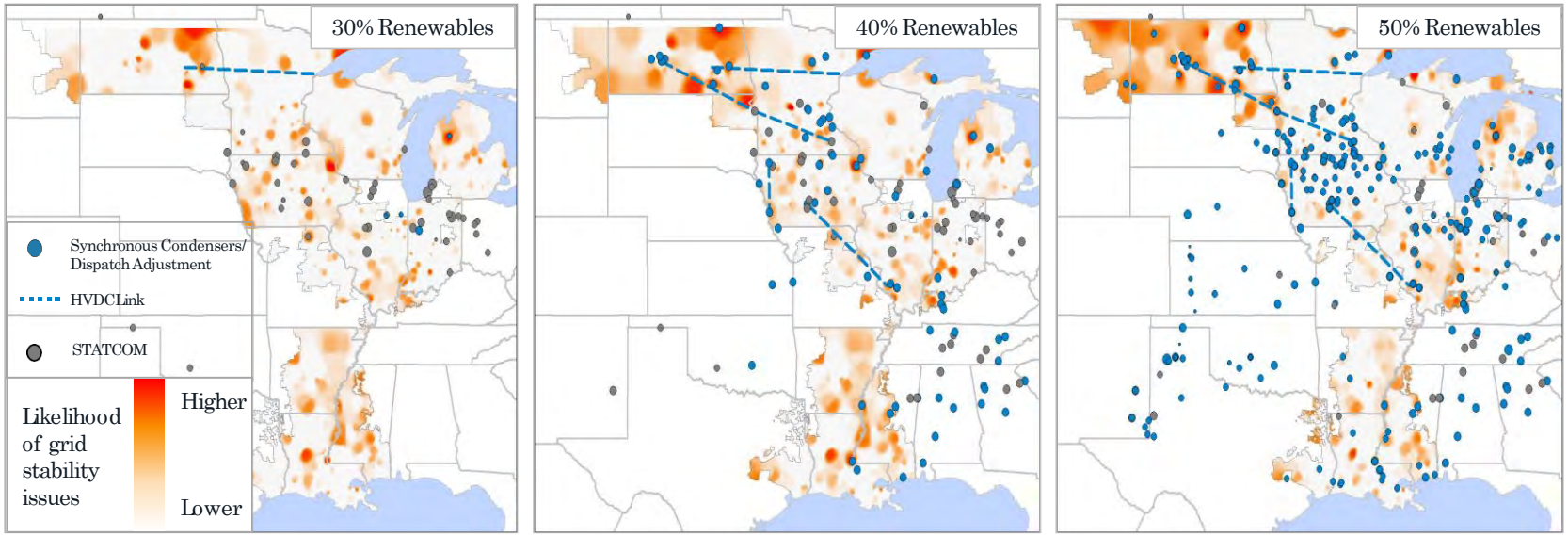



**Coal and Gas Ramp**
*(% of capacity)*



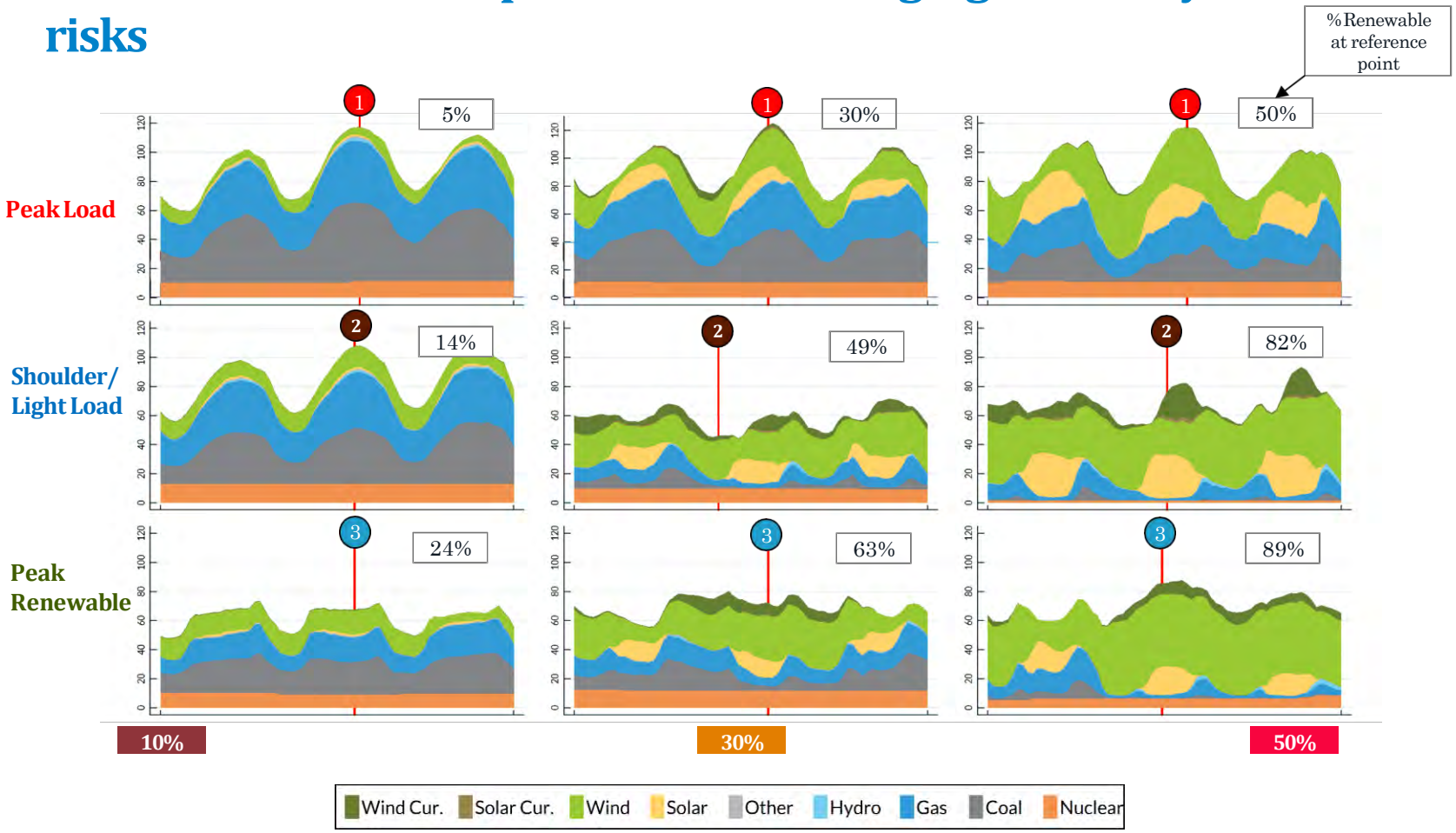

* All %'s in labels refer to MISO-wide renewable penetrations levels

# System-wide voltage stability is the main driver of dynamic complexity starting at 40% and worsens at 50%, which requires transmission technologies equipped with dynamic-support capabilities

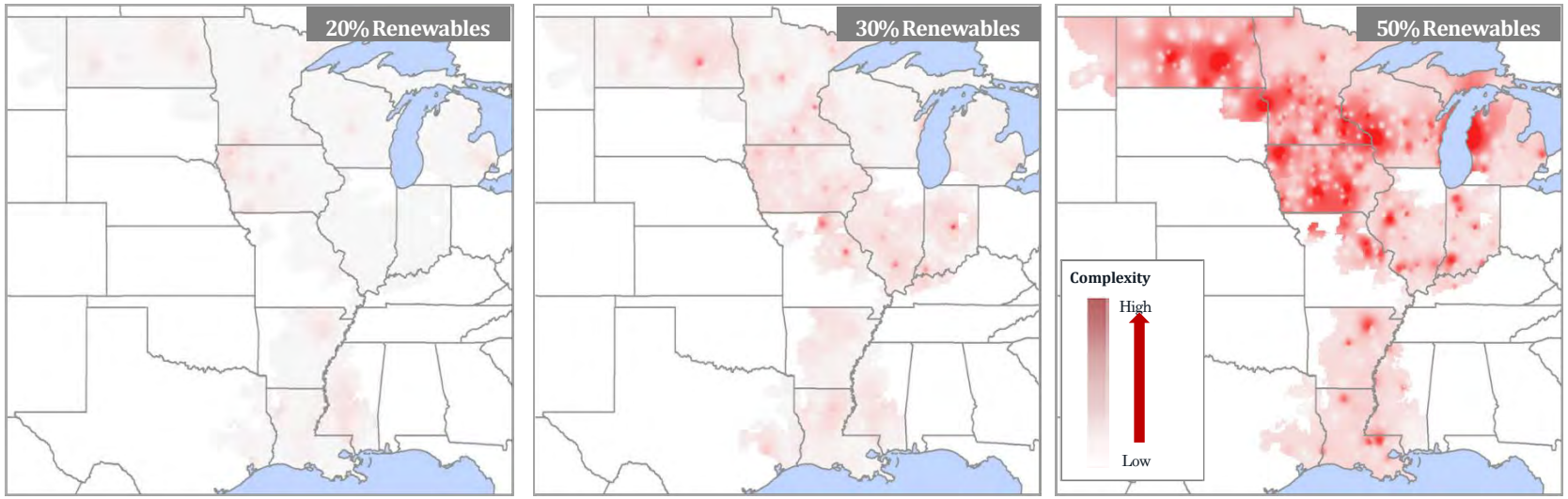



*Maps reflect cumulative issues/solutions across milestones

# As renewable penetration increases, the change in fuel mix at select snapshots drives changing reliability risks



# Renewable integration complexity increases sharply beyond 30%, illustrating need for expansion of longer, higher kV, higher capacity transmission



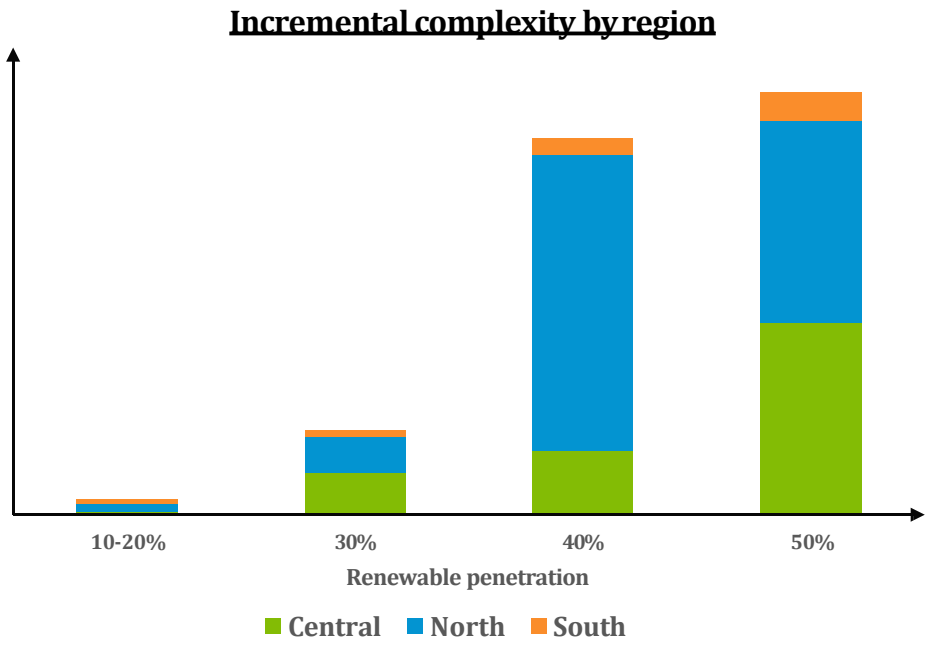

*Maps reflect cumulative issues/solutions across milestones

| Incremental Transmission Mitigation at 10-20% | | | |
|---|---|---|---|
| kV | 161 and Below | 230 | 345 & above |
| Ckt*Mile | 1,500 | 200 | 400 |

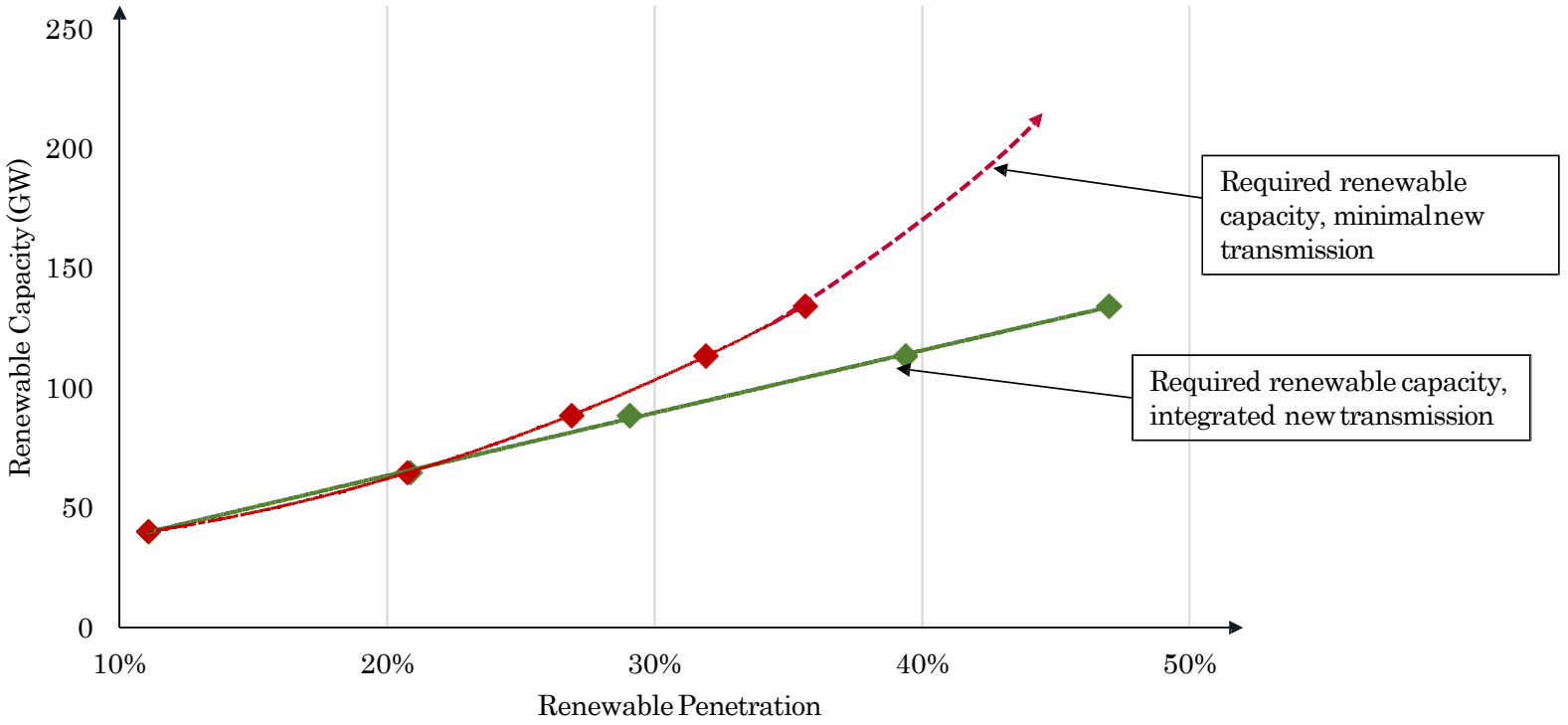
| Incremental Transmission Mitigation at 30% | | | | |
|---|---|---|---|---|
| kV | 161 & Below | 230 | 345 & above | HVDC |
| Ckt*Mile | 1,600 | 200 | 500 | 400 |

| Incremental Transmission Mitigation at 50% | | | | |
|---|---|---|---|---|
| kV | 161 & Below | 230 | 345 & above | HVDC |
| Ckt*Mile | 500 | 700 | 5000 | 600 |

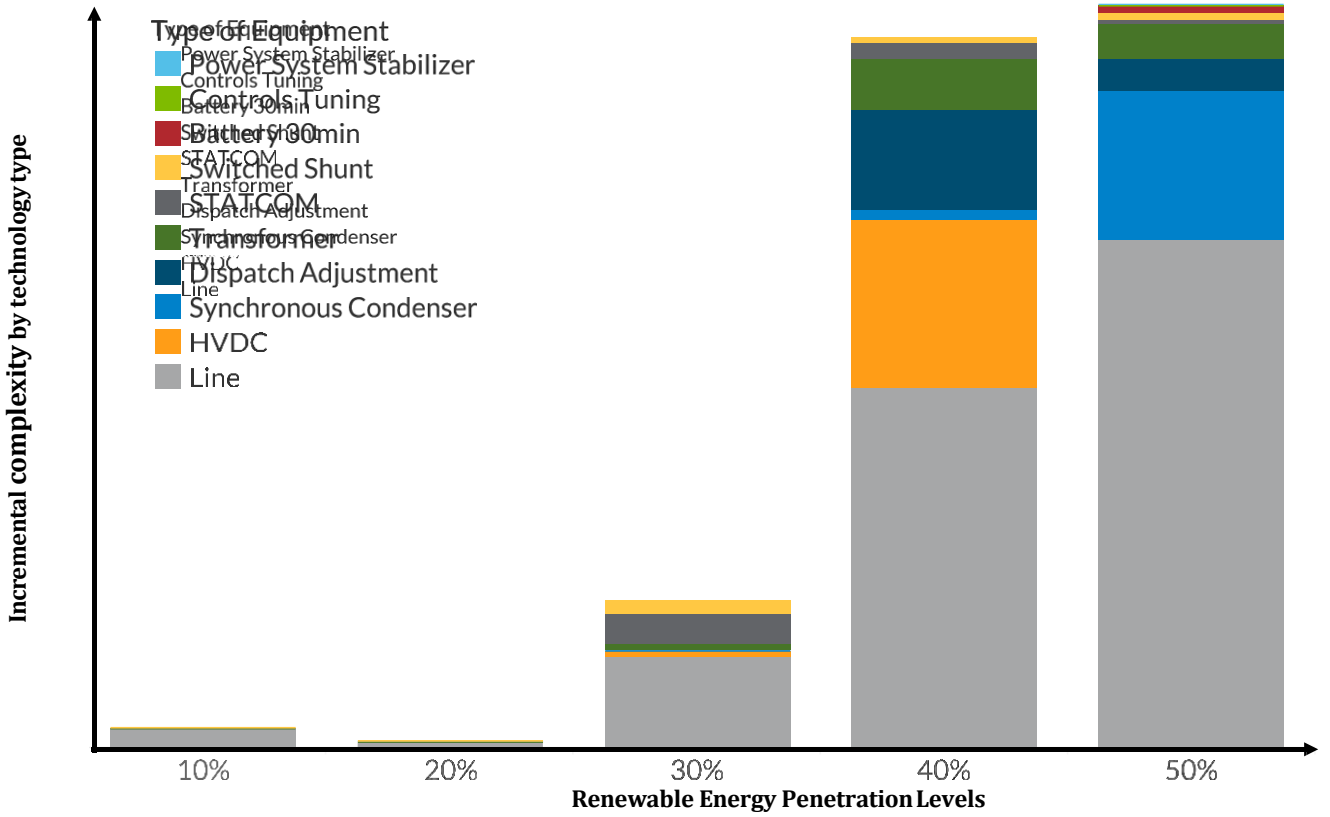
# Assuming historical renewable growth trends by location and technology, the incremental complexity by region changes with renewable penetration



# Transmission solutions are more cost effective than over-building renewable generation to meet renewable penetration milestone



# Grid-technology-needs evolve as renewable penetration increases, leading to an increased need for integrated planning



# Questions?

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Renewable Integration Impact Assessment (RIIA)

All RIIA-related documents can be found on MISO's web page (MISOenergy.org)

**Home > Planning > Transmission Planning Studies and Reports > Renewable Integration Impact Assessmen**

# Minnesota Power Integrated Resource Plan Stakeholder Engagement

**Meeting 3: March 3rd, 2020, American Swedish Institute**

## National Energy System Trends (Rolf Nordstrom, GPI)

### Major Themes

- Consumer preferences are changing to favor renewable energy (RE)
- Renewable energy generation is becoming increasingly competitive
- The grid is changing to be more distributed and less centralize
- Electrification and interest in electrification is increasing
- CO2 is a potential liability and economic opportunity

### Questions and Discussion

- What are MN power green pricing options and participation rates?
  - Small premium for 100% RE, about +$7 monthly
  - Solar garden program
  - No participation rates on-hand but could provide that information. Will likely be different than a national survey, 30% of our base is low income with a higher price sensitivity
- How will corporations achieve RE goals? VPPA? Utility? Green tariff?
  - Planning ramifications for both corporations and utilities
  - How can utilities cement relationships so customers don't go somewhere else to achieve their goals?
- Why exactly are nuclear plants struggling to be competitive?
  - They don't compete on price when they're bidding into market. States are putting in place policy to help nuclear plants compete. Sometimes by states for jobs, sometimes for emissions
- What were the big takeaways from previous meetings in Chisolm?
- There wasn't a denial of the fact that climate is a real issues and trends need to be addressed
- Plea to utilities and regulators to leave communities as whole as possible. Not so much "hell no" and more so "if we have to go, let's do it as humanely as possible"
- Frustration with lack of support for mining

- EVs aren't going to cover the customer defection from renewable energy- we need to think about how utilities will be protected. Clean Energy First will kind of do that, but we should also think more broadly
- Communities are skeptical about legislative transition plans- we don't have the greatest history of protecting communities
  - It would take more than 100 target stores to replace Boswell
  - If we're talking about the issues of early retirements and we're not talking about community impacts, then we're not really addressing the issue
- What happened when the Ford plant was shut down? Do we have models/examples in the state of the best ways to do this?
  - we're looking at other states- in an area like northern Minnesota communities are so intertwined. Conversations are good.
  - Other than talking about the science, we really need to start bringing in economic development specialists to explain impacts and benefits
  - CEEE has a study on the economic impacts of retirements
- Carbon Capture
  - Rapid Electrification wouldn't necessarily reduce the need for carbon capture
  - If carbon capture is going to be cost-effective, it would definitely be cost effective at a mine-mouth plant like the one in project Tundra
- Republicans and democrats are both in favor of RE and carbon capture in many cases, some just don't want to talk about it in the context of climate.
  - For example, some companies can charge a premium for low carbon steel
  - Lots or corporations are thinking about green supply chains, it would be interesting to see what various industries are seeing from their corporate customers

## Transmission and Market Considerations (MISO)

### Major Themes

- Interconnection Queue is Saturated
- Renewable Integration Impact Assessment (RIIA) looks at challenges with integrating renewables on the transmission grid
- 40% RE integration sees a dramatic spike in complexity of integration

### Questions and Discussion

Interconnection

- How many projects will actually interconnect?
  - Rule of thumb, 25%.
  - However, lately it has been much lower bc of grid saturation/upgrade costs
- Is there storage in the queue?
  - Yes. There are also storage as transmission only (SATOA) projects
- Is transmission the limiting factor on the queue?
  - Yes. That's why we had the large transmission "Multi-Value Projects" (MVPs) many years ago
  - The last queue cycle, almost 40,000 MW sought interconnection and about 200MW made it through
- Who paid for MVPs, and why can't we do them again?
  - Last time everyone received the bills for the project, they were large, and many don't think they can or want to shoulder another set of costs
  - Several states sued over MVP cost allocation, and it was found reasonable in DC circuit court. FERC said cost allocation needs and order of magnitude justice, not down to a penny
- What should MN Power doing about adding RE resources if they think MISO will stonewall them? Why look at RE if there's nowhere to put it?
  - IRPs are their process (-MISO)
- Planning for an IRP directly considers the cost of interconnection and where we could find lower interconnection costs- it's an absolutely key factor in planning.
  - You've state that RE would be economically viable, but if it's dependent on the extremely high costs of interconnection then it seems like more of a hypothetical argument.
- How do you turn interconnection constraints into modelling costs?
  - There are other technologies that could help that are quicker than a transmission build-out. We need to answer, "What do we need, and how quickly can we actually move?"
  - We can use all our tools, but we still need to resolve the congestion issue

Renewable Integration Impact Assessment (RIIA)

- Study Inputs
  - When you talk about % renewable penetration scenarios, we know the RE penetration ebbs and flows throughout the day. Do you mean all hours, or just the peak?
  - All hours of the year, overall
  - Are these scenarios forecasts for a specific year?

        - Not a specific year that we will for sure “hit” that % penetration. We assume the system as is today, add RE on top if that, and back out other generation MW by MW as necessary to make room for the RE
        - Does RE include hydro?
        - No, just wind and solar
    - How would you apply RIIA findings to a utility like us?
        - We don’t know yet, MISO will be coming out with more localized studies at the LRZ level
    - What does “grid instability” mean to an end user?
        - How well can we withstand an outage? If we can’t, it could mean dropping load/blackouts
    - Is there a strict relationship between complexity and cost?
        - Yes, complexity is basically a metric for cost
    - So, when you integrate RE, in additional to just HVDC lines, you also need all these fancy statcoms and synchronous generators to get grid strength back?
        - Yes. HVDC lines also play a dual role for stability- in modelling we found AC lines were not enough
    - What are the next steps on RIIA?
        - Sensitivity analysis and phase 3- where resource will go, fuel mix, fuel cost, role of storage, etc. aimed to finish by q 4 with updates every 2 months

## Boswell Environmental Impacts (Frank Kohlasch, MNPCA)

### Major Themes

- The climate and will adversely affect the Midwest
- Through various legislative levers, incentives, penalties, etc., Minnesota has been making progress towards reducing GHG emissions
- MN Power Emissions have been reduced in recent years

### Questions and Discussion

- When you (MNPCA) look at the impact of electricity imports, do you use the resource mix of the whole MISO footprint?
    - We use the emissions factors of the states surrounding us and make an overall emissions factor rate
    - Do we ever do this for other sectors?
    - One example is transportation- we pick up vehicle miles travelled from tourism in the state

- Why are agricultural emissions so volatile?
  - Crop emissions are pretty stable, but the way we capture forest storage is pretty volatile
- Retrofits on Plants
  - What's the timeline for cost recovery?
  - It's in our 2035-40 timeframe document
  - Is equipment tied to the plant?
    - Yes
  - Where does recovered mercury go?
  - It attached to the activated carbon, which then ends up in the coal ash
- Do people need to buy EVs in a very near time frame to have any real difference on decarbonization goals?
  - Yes- but right now we're trying to get people comfortable with the idea of electric vehicles and then let them get to decide where/when they want one
- How does Minnesota get recognition for being cleaner than surrounding states and doing it faster?
  - Can we value how quickly Minnesota has moved on decarbonization? Is there a net present valuation for the carbon that we've reduced?
  - We have the social cost of carbon, which is a way to deduce marginal economic benefits per unit of time
  - This is particularly relevant for biofuels; a lot of farmers can make revenue on this and want Minnesota to move as quickly as possible.

## Boswell Retirement (Julie Pierce, MN Power)

### Major Themes

- MN Power is a leader in renewable energy
- Boswell Retirement is a significant job loss (180)
- MN Power found new positions within the company for all but 5 of employees

### Questions and Discussion

- How do ratepayers pay for a retired unit?
  - Do ratepayers pay the same amount regardless of the year that the plant was retired?
    - Yes, but ratepayers also need to account for replacing the generation that is no longer coming from the plant
  - The PUC would look at whether it was cheaper to keep it running or if it would be cheaper to replace it with new generation