Trends in State-Level Energy Markets and Policy

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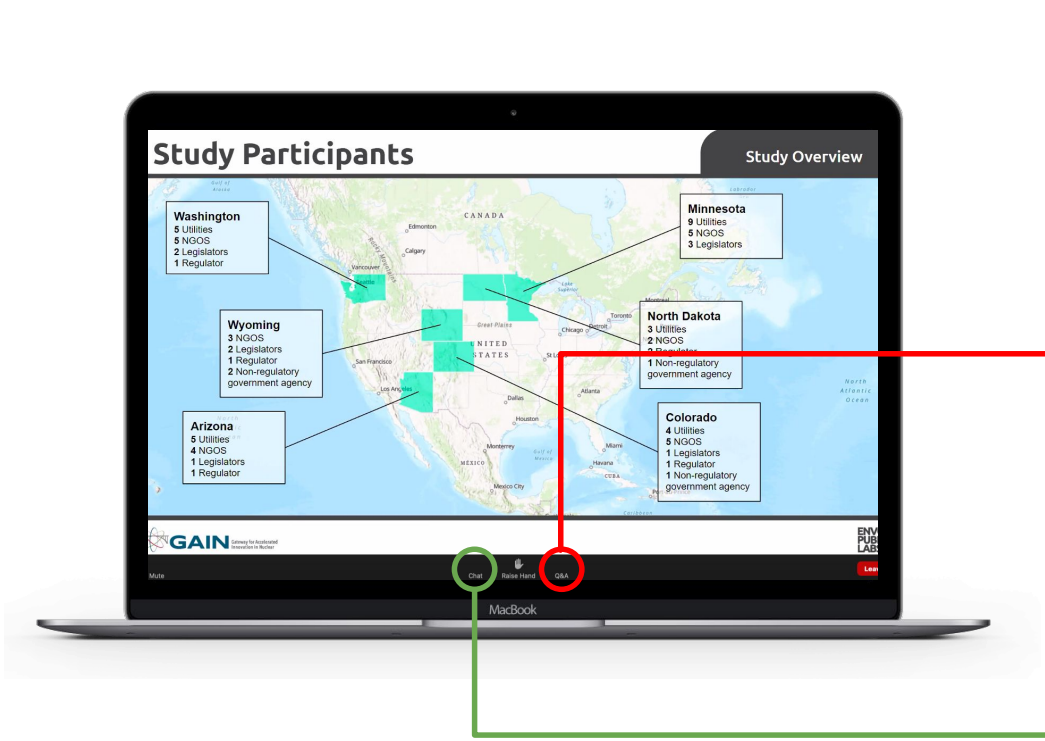
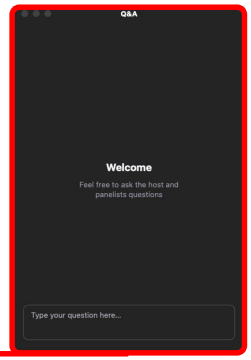
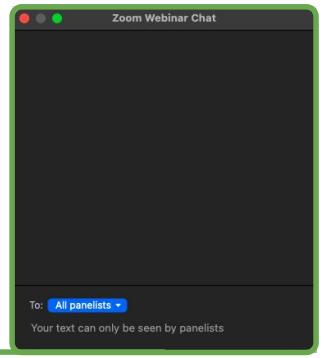
Topics







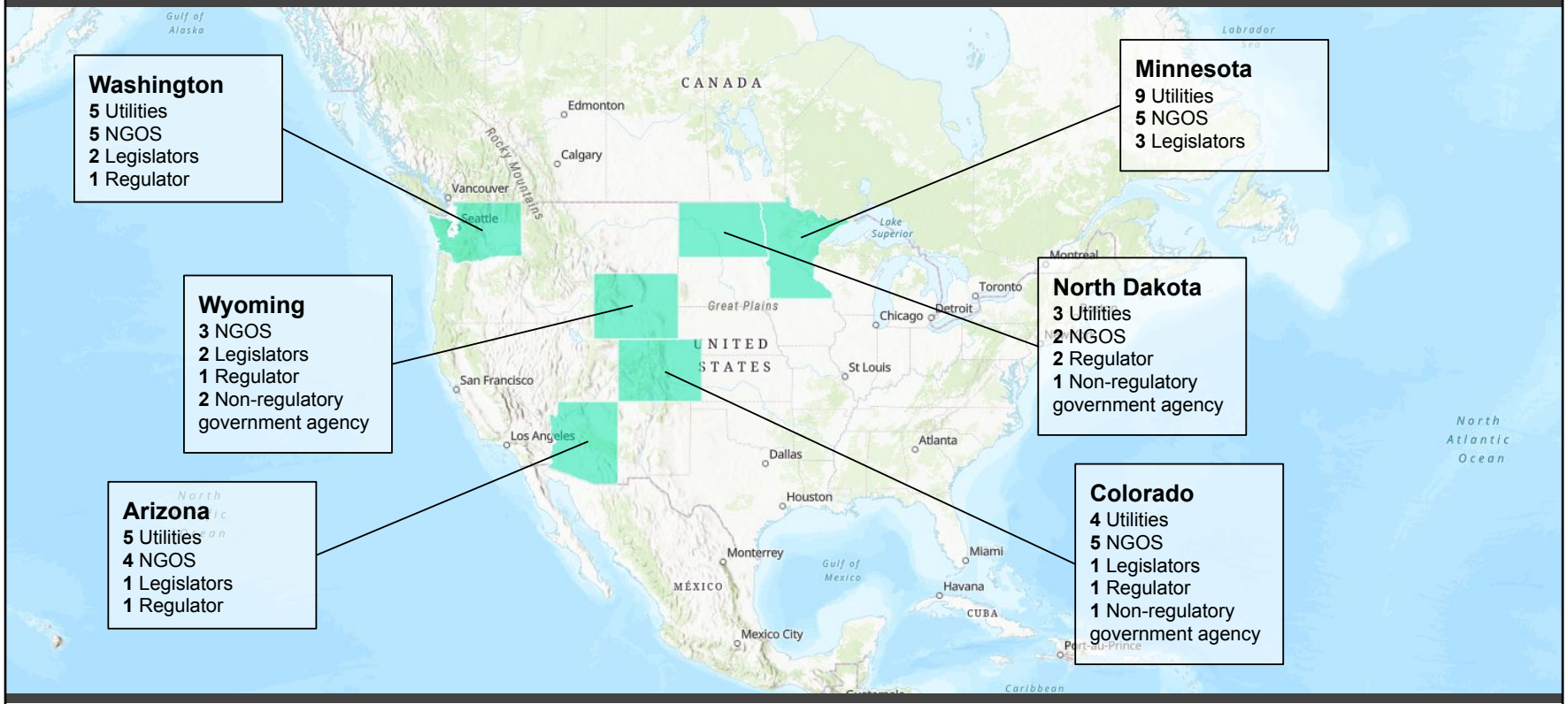
Question & Answer:
Submit questions which we will address during or after each section

Chat:
Comment or share information with the whole group

Topics

1. Study Overview & Key Takeaways
2. Carbon Dependent States
3. Rapidly Decarbonizing States
4. Tipping Point States

Study Participants



Washington
5 Utilities
5 NGOS
2 Legislators
1 Regulator

Minnesota
9 Utilities
5 NGOS
3 Legislators

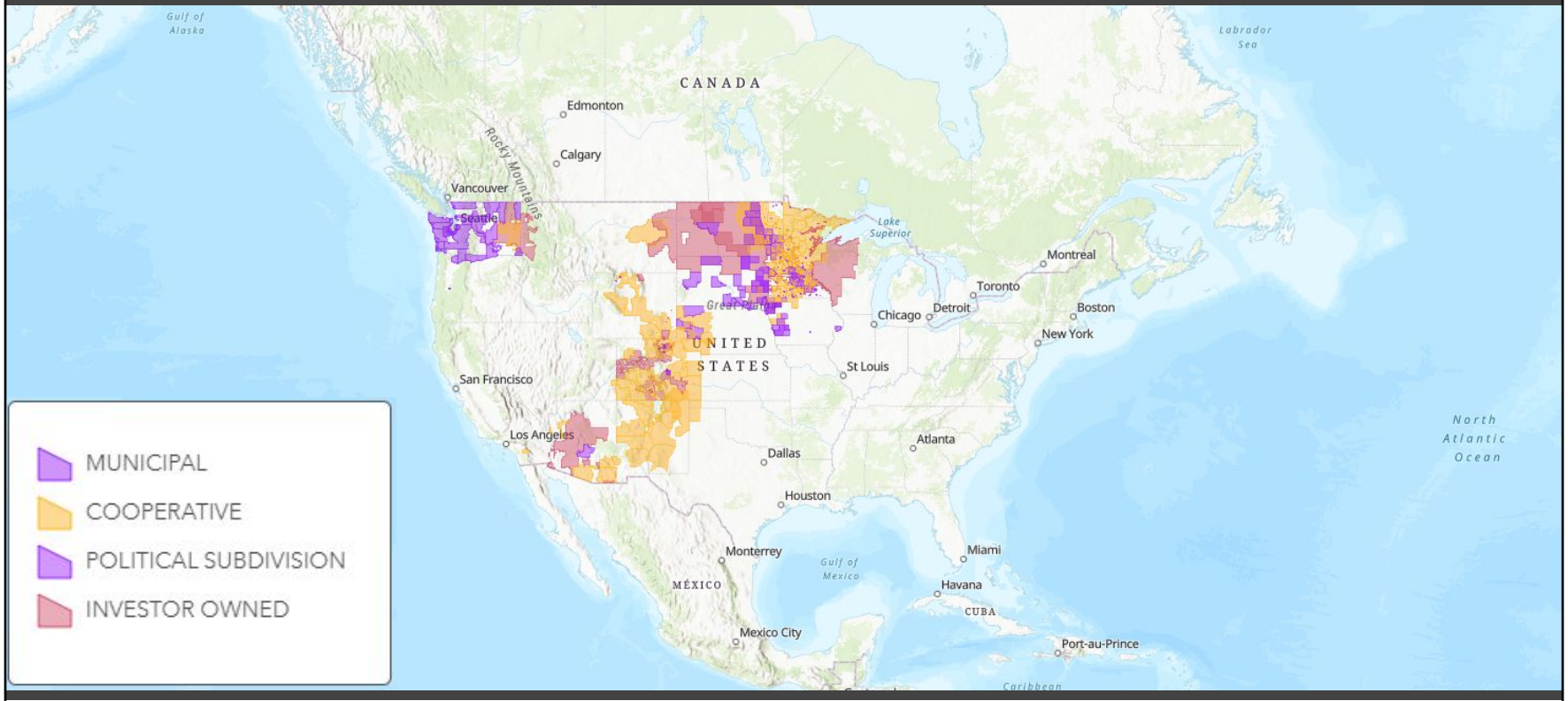
Wyoming
3 NGOS
2 Legislators
1 Regulator
2 Non-regulatory government agency

North Dakota
3 Utilities
2 NGOS
2 Regulator
1 Non-regulatory government agency

Arizona
5 Utilities
4 NGOS
1 Legislators
1 Regulator

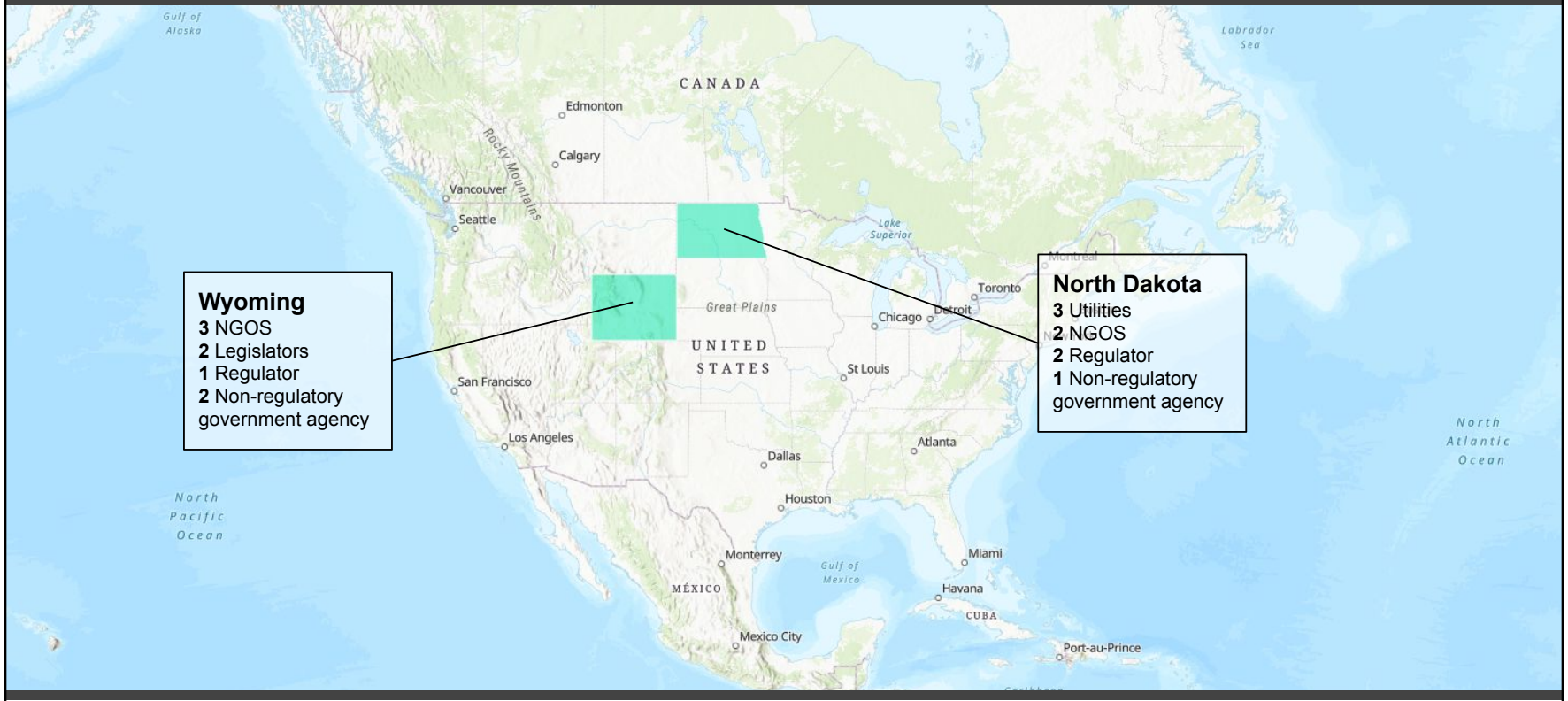
Colorado
4 Utilities
5 NGOS
1 Legislators
1 Regulator
1 Non-regulatory government agency

Participating Utilities



Fossil Dependent States: ND & WY

Fossil Dependent



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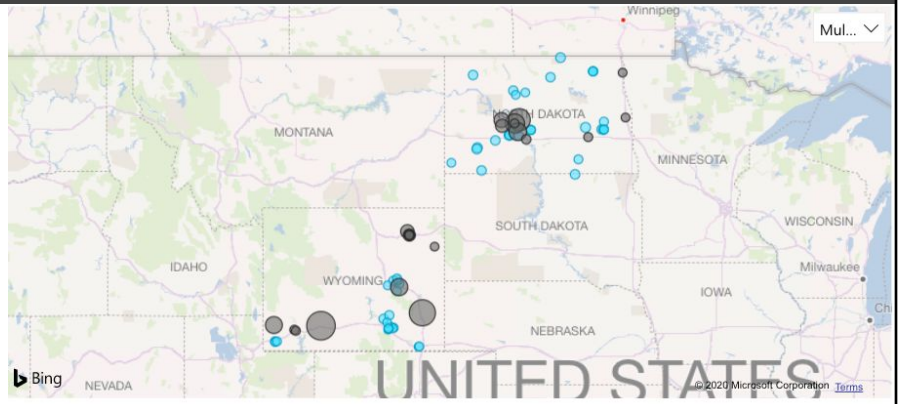
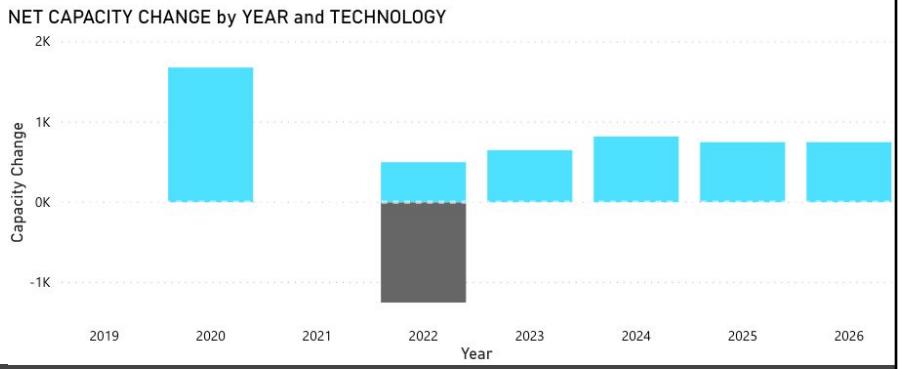
Key Takeaways: Policy

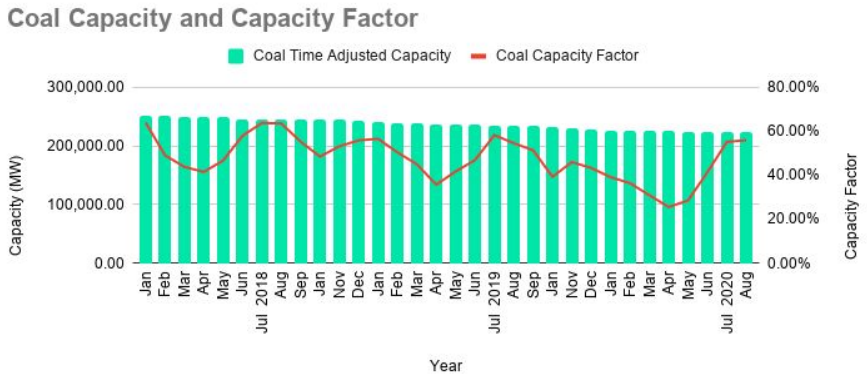
Aggressive carbon policies in decarbonizing states are driving market changes in more conservative states with fossil-dependent economies. Coal-reliant economies like Wyoming and North Dakota are having their status as energy exporters challenged by decarbonizing states like Washington, Colorado, California, and Minnesota and share utility service areas. **Out-of-state policies are forcing fossil-dependent states to radically reimagine their economy, and consider policy measures designed to promote emerging energy technology.**

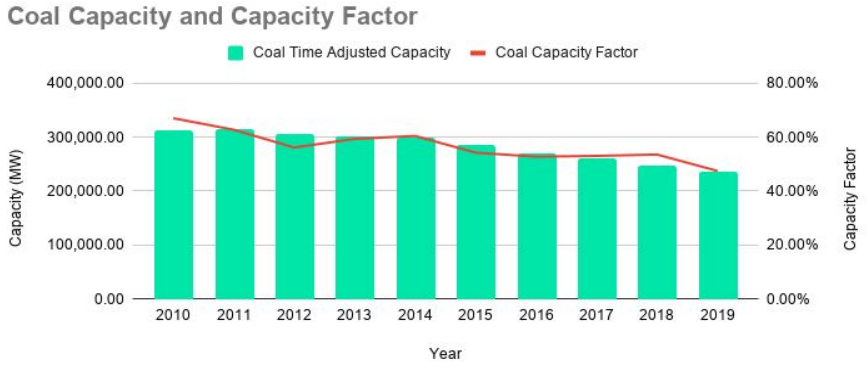




Key Takeaways: Market

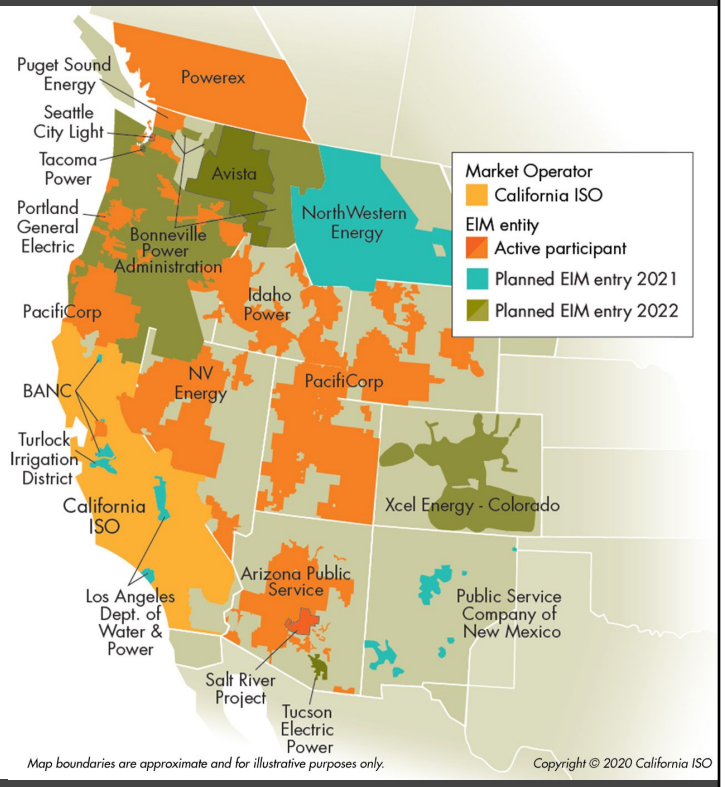
A one-to-one replacement of retiring coal assets that serve the baseload is unlikely to be a viable strategy for bringing small modular reactors to market. Currently, generation from these existing coal assets is on the decline, capacity factors are decreasing for individual plants, and the retirement of coal from the nation's energy mix has accelerated over the past decade. By the time advanced reactor designs are ready for commercial deployment in the late 2020s and early 2030s, most remaining coal units will likely operate as intermediate or peaking units. Developers of advanced-nuclear technology who hope to realize capital cost savings using existing infrastructure from decommissioned coal plants should consider that energy decision makers are demanding more than carbon-free baseload power.





Key Takeaways: Market

Western utilities are increasingly opting to participate in organized electricity markets, or their precursors. Respondents nearly unanimously agree that participation in these markets has increased liquidity and decreased costs for utilities, and any hesitancy to commit by utilities is based solely on disagreements over governance and a resistance to relinquishing local control. **A vertically integrated, rate-based power system is unlikely to exist longterm in the Western US; advanced reactors must be competitive with the whole array of generation and storage technologies in order to secure market share in this new paradigm.**



Key Takeaways: Legacy Nuclear

Overwhelmingly, the main concern of decision makers regarding nuclear projects is cost and capital requirements, rather than environmental or safety concerns. Colorado and Washington both have high-profile, nuclear-related environmental disasters in the state, as well as financially disastrous commercial nuclear projects. Respondents overwhelmingly indicate that cost overruns, long delivery times, and inflexible capital outlays would be the chief concerns associated with a potential advanced nuclear project in both states.

The Washington Post

SUNDAY, DECEMBER 2, 1984

WHOOPS

DARKNESS TO DAWN

An Ambitious Nuclear Empire Goes Awry

First of four articles

By Chip Brown

Washington Post Staff Writer

OKANOGAN, Wash.—Nick Cain has been growing apples for 32 years in a blossom-scented valley south of here in the shadow of the North Cascades. Each spring he takes out a loan to be repaid come fall when the apples are boxed. The paperwork is the sort of formality big men in small towns suffer lightly. Cain had

BY RAY LUSTIG—THE WASHINGTON POST

A containment building dome at Project 4 on the Hanford Reservation cost

ities known as Whoops tried to construct five all at once. It let contracts, cleared forests, cut roads, hired armies of craftsmen and printed more than $8 billion in tax-exempt bonds, more municipal bonds than any private or public corporation in American history.

Of the five reactors, Whoops finished one. Two were mothballed. Two others known as Projects 4 and 5 were abandoned, and last year Whoops defaulted on $2.25 billion in bonds held by

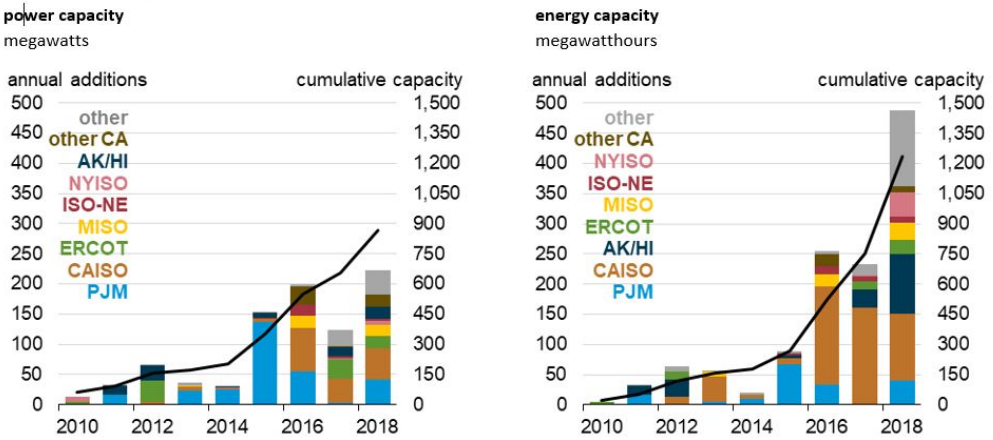
Key Takeaways: Legacy Nuclear

State and local level-leadership is critical to sustainable outcomes in nuclear projects and should be fostered by advanced nuclear stakeholders. **Technology developers and the federal government must appreciate the role of federalism in US policymaking and should foster state-level leadership as critical to robust financial, public relation, and policy outcomes.** Historical examples of unilateral federal action have led to negative consequences. Transparent cooperation between federal, state, and local stakeholders enables trust and prevents failures which could negatively impact nuclear prospects for decades.

Key Takeaways: Case Studies

Opportunities for commercial deployment in domestic markets exist, but customer discovery will require active customer discovery by advanced nuclear developers. Utility planners and policymakers are not incentivized to address resource adequacy concerns in any concrete fashion until grid resiliency is tangibly threatened. As variable sources are increasingly incorporated into resource plans, decision makers are betting heavily on the technological advancement of grid scale storage, with no guarantee that this technology will be available to economically balance the grid. **Publicly announced plans that rely on a revolutionary adoption of storage technologies should be regarded as a business development opportunity for advanced nuclear developers, and resources should be dedicated to these opportunities.**

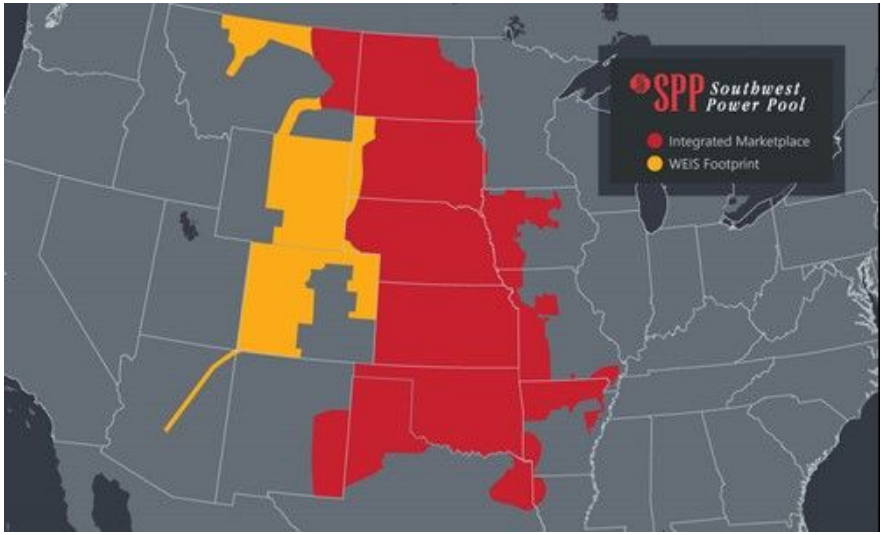
Figure ES1. Large-scale battery storage capacity by region (2010–2018)



Sources: U.S. Energy Information Administration, Form EIA-860M, *Preliminary Monthly Electric Generator Inventory*; U.S. Energy Information Administration, Form EIA-860, *Annual Electric Generator Report*

Key Takeaways: Case Studies

Opportunities for advanced nuclear development under the current nuclear business model of rate-based cost recovery are highly uncertain due to industry disruption and the early adoption of wholesale market mechanisms in Colorado. In addition, very strong renewable energy and decarbonization policies have made the state a clean energy leader. These trends are likely to expand into other states in the Western US, and **an active nuclear presence will be required to shape favorable policy and incorporate changes in market structure into new, innovative business models.** With newly empowered municipal utilities, electric cooperatives looking to own generation for the first time, incumbent utilities, and the rise of decentralized grids, business model innovation may be necessary for broad adoption of advanced reactors in a landscape of smaller, less capitalized power producers.

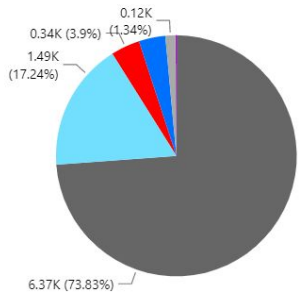


Wyoming Overview

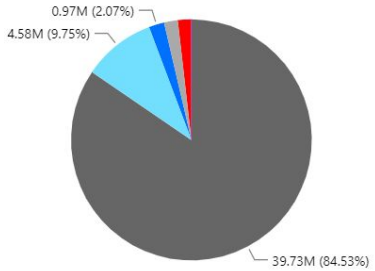
Fossil Dependent

Batteries
Nuclear
Biomass
Other
Coal
Petroleum
Geothermal
Solar
Hydroelectric
Wind
Natural Gas

SUMMER CAPACITY (MW) by Primary Fuel

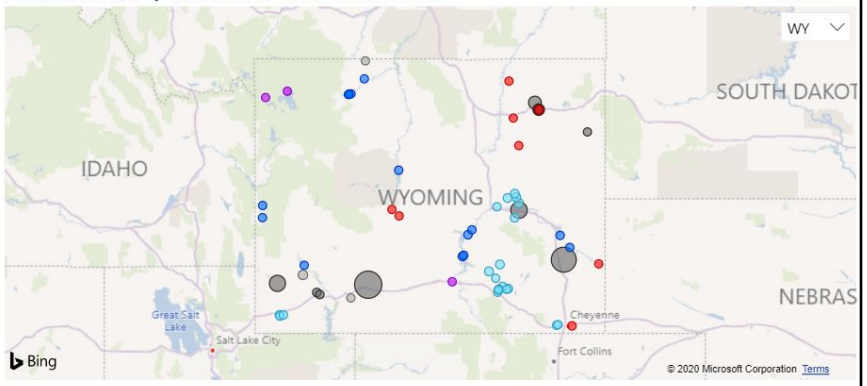


NET GEN (MWH) by Primary Fuel

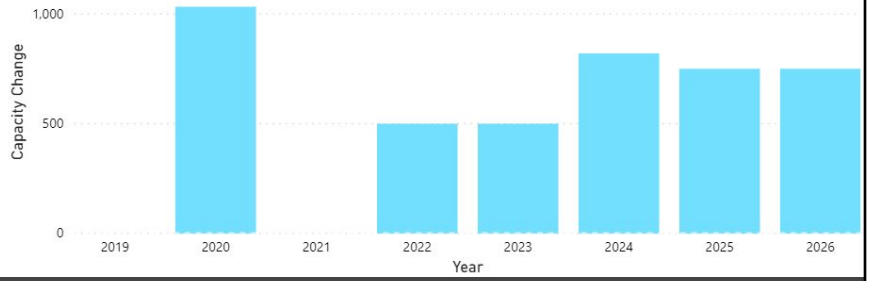


POWER PLANTS by GENERATION and PRIMARY FUEL

STATE



NET CAPACITY CHANGE by YEAR and TECHNOLOGY



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North Dakota Overview

Fossil Dependent

Batteries
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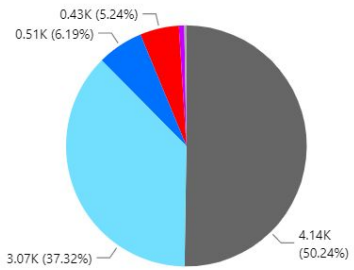
Wind

SUMMER CAPACITY (MW) by Primary Fuel



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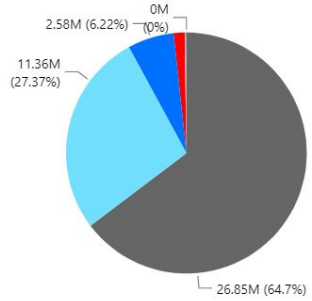
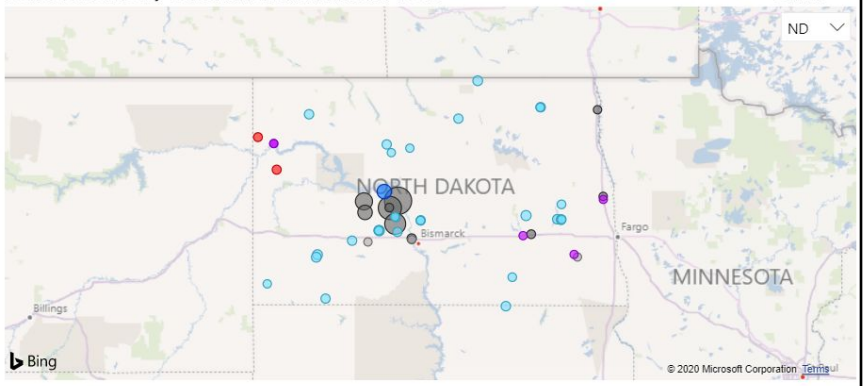


POWER PLANTS by GENERATION and PRIMARY FUEL

STATE ND



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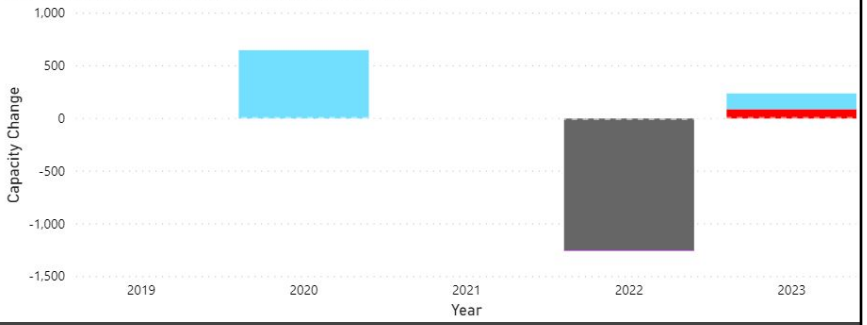

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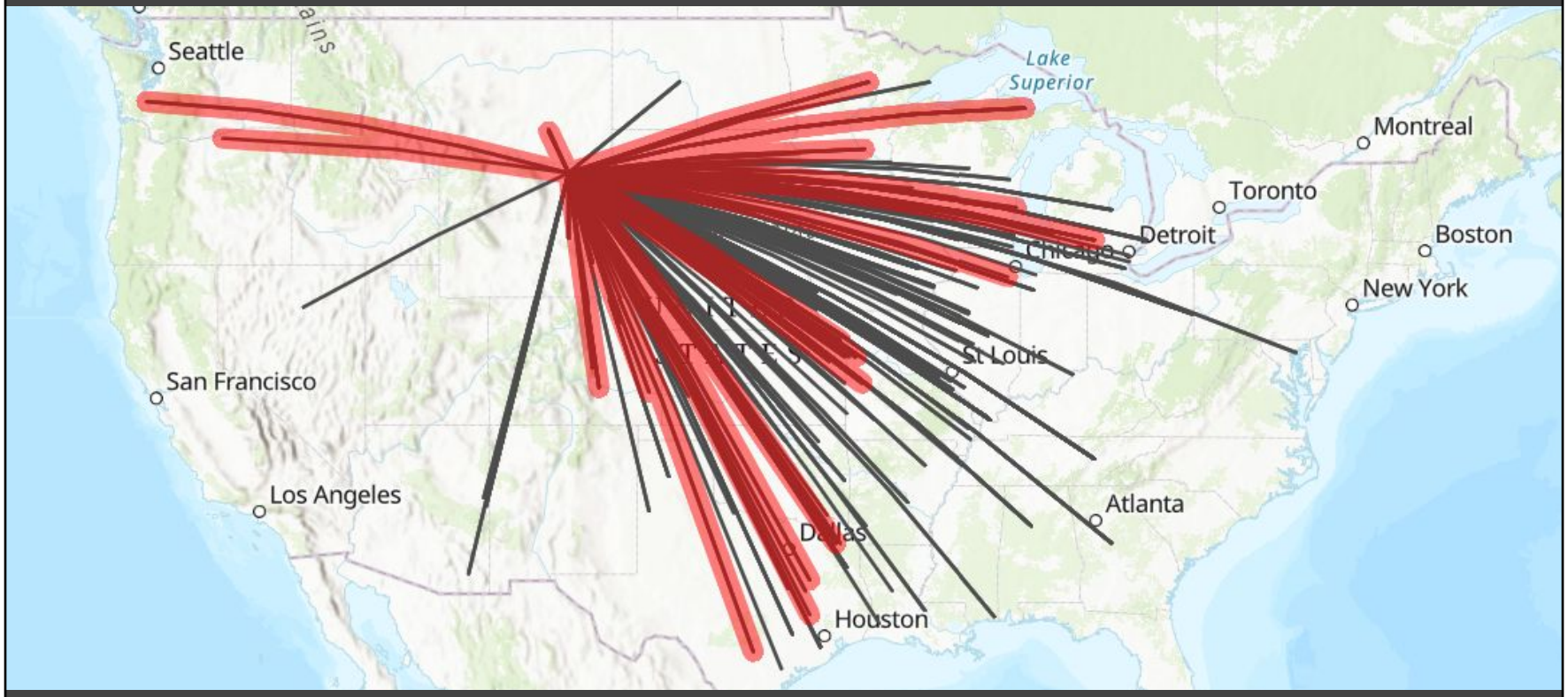
Wyoming's Coal Economy

Fossil Dependent



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North Dakota Coal Economy

Fossil Dependent

Source: *The Bismarck Tribune*

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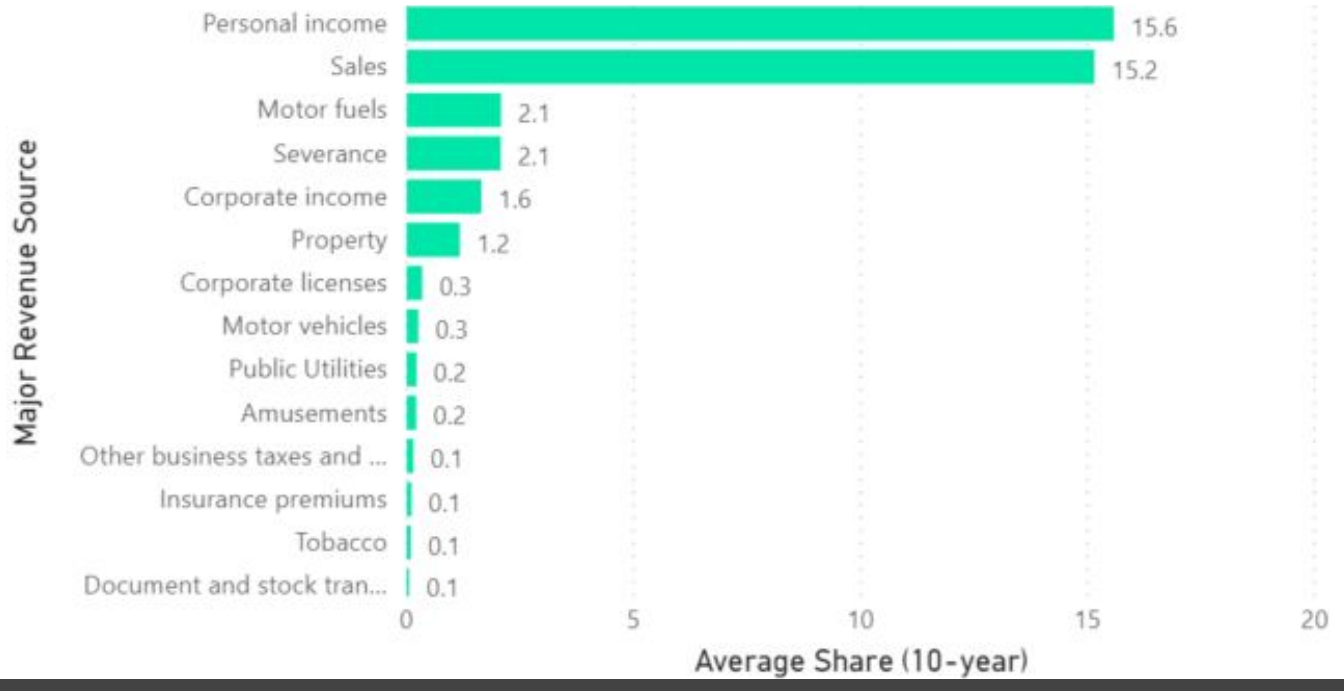
Typical Tax Revenue Sources

Fossil Dependent

Average State Tax Revenue Share (10-year) by Major Revenue Source, Nationwide



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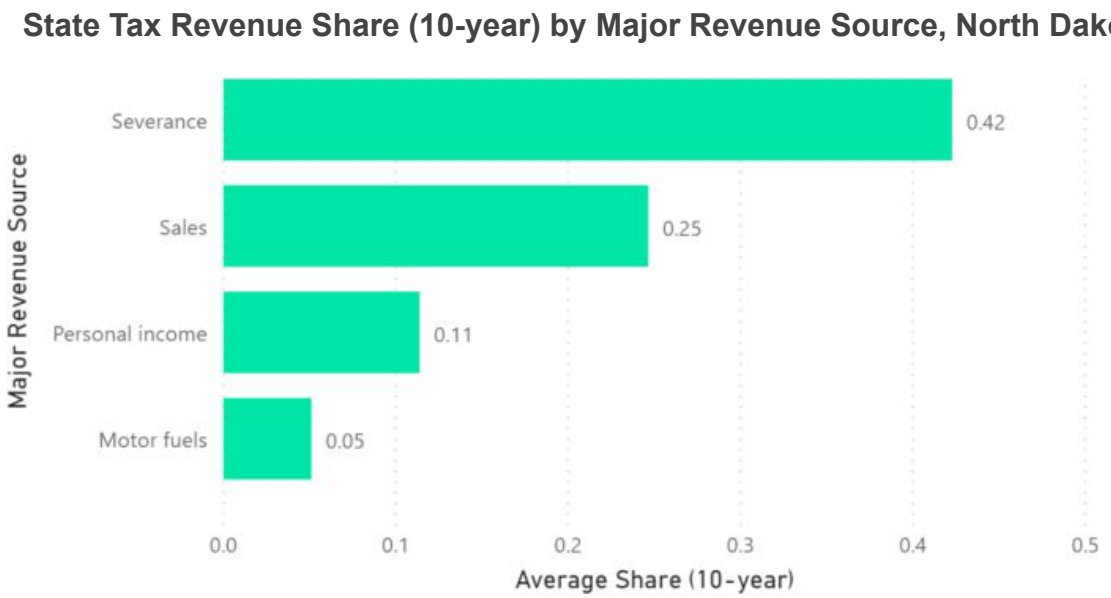
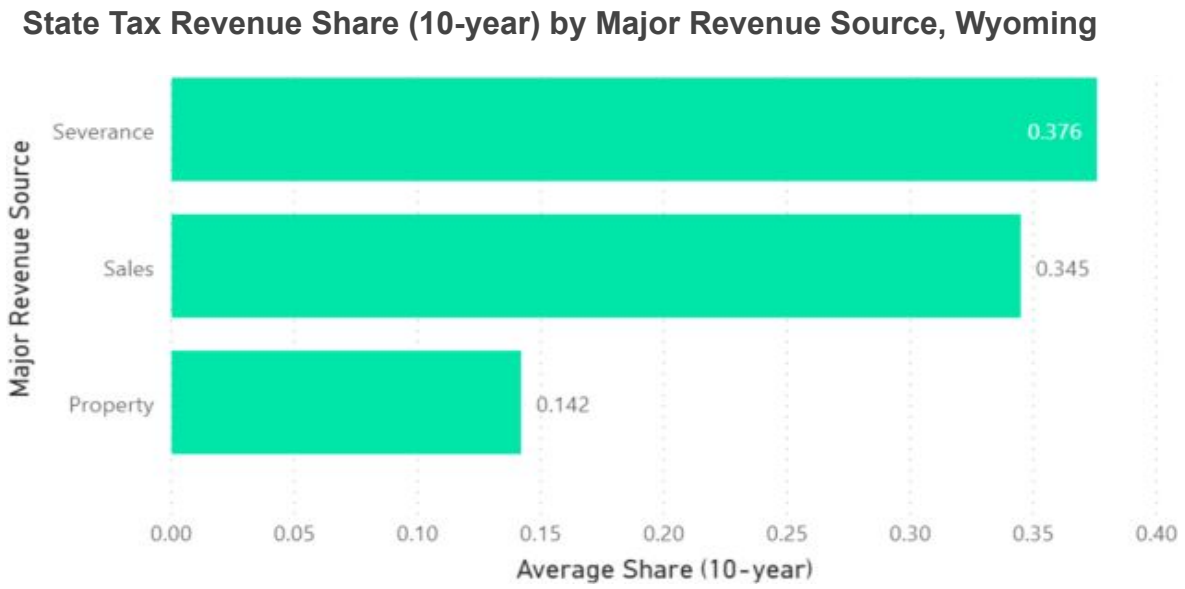
North Dakota Tax Revenue

Fossil Dependent



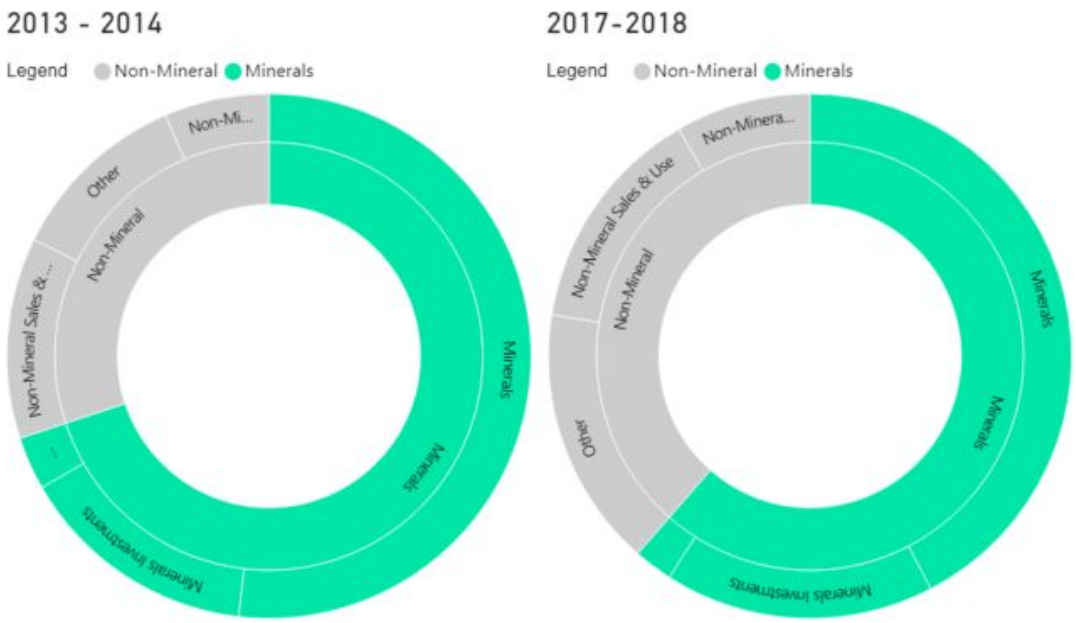
Wyoming Tax Revenue

Fossil Dependent



Wyoming Revenue Breakdown

Fossil Dependent



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WY HB200 (Carbon Capture)

Fossil Dependent

"...the public service commission shall establish by rule energy portfolio standards that will maximize the use of dispatchable and reliable low-carbon electricity" no later than July 1, 2030.

*"'Low-carbon' means electricity that is generated while using (CCS)…"***

****Does not include nuclear or hydropower**

"...the rates charged by an electric public utility shall not include any recovery of or earnings on the capital costs associated with new electric generation facilities built, in whole or in part, to replace the electricity generated from one (1) or more coal fired electric generation facilities located in Wyoming and retired on or after January 1, 2024…"

"No carbon is low carbon."

Rep. Mike Yin, (D) HD 16

Source: *Wyoming Legislature*

Source: *NRECA*

WY HB74 (Small Modular Reactors)

Fossil Dependent

“Any public utility or person that currently owns a plant, property or facility for the generation of electricity that currently uses coal or natural gas may apply to replace the coal or natural gas generation with generation using small modular nuclear reactors…”

**Any SMR replacement would also be under an extra $5/MWh taxation.

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Carbon Capture in North Dakota

Fossil Dependent

Source: *Project Tundra*

SB 2344 (2019):

"...it is in the public interest to promote the use of carbon dioxide to benefit the state, to help ensure the viability of the state's coal and power industries, and to benefit the state economy."

SB 2133 (2017):

"...a coal conversion facility that achieves a twenty percent capture of carbon dioxide emissions during a taxable period is entitled to a twenty percent reduction in the state general fund share."

Balances listed below as of October 31, 2020.

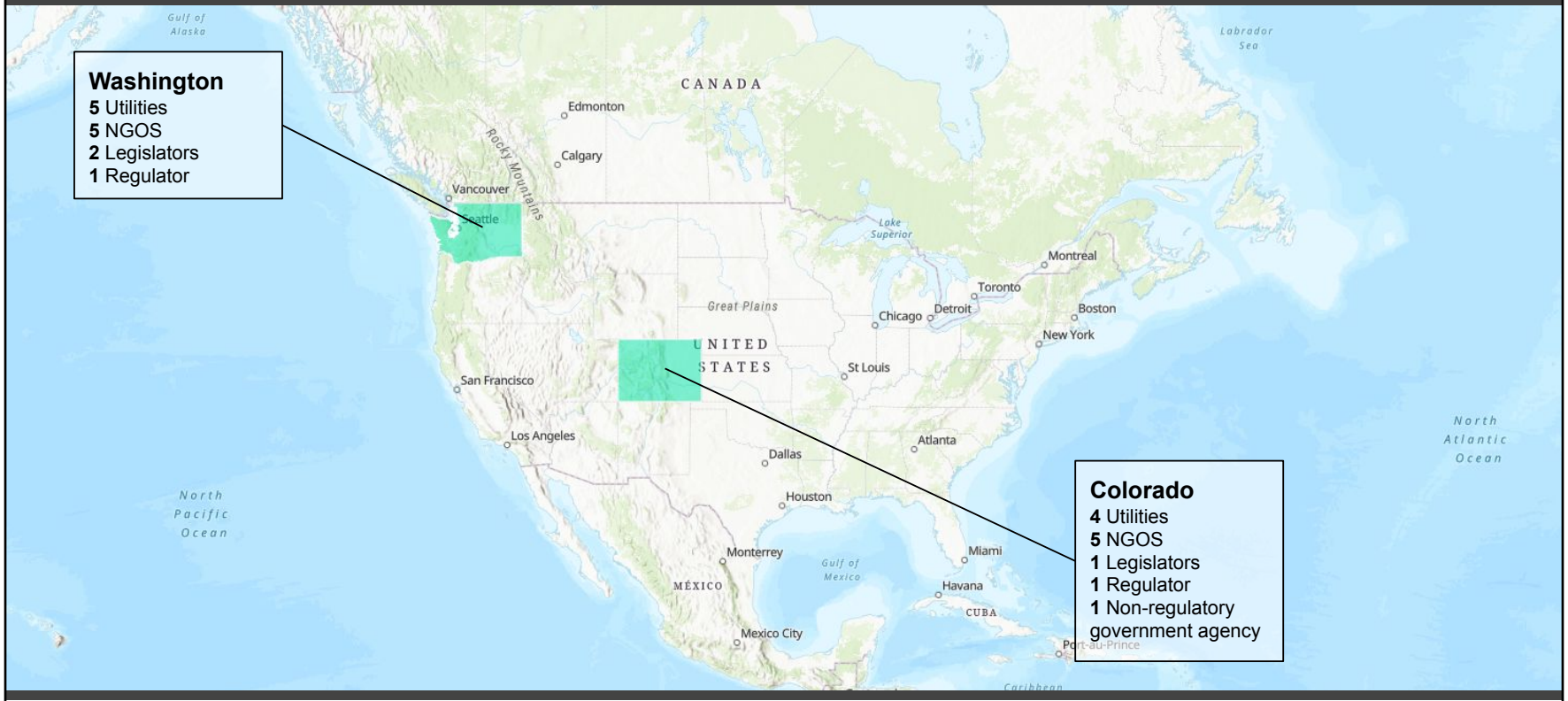
FUND VALUE	INCEPTION-TO-DATE NET INCOME	PRINCIPAL BALANCE
$7,341,670,166	$1,949,980,433	$6,283,792,621

CURRENT BIENNIUM-TO-DATE EARNINGS (as defined by NDCC 21-10-12)	EARNINGS TRANSFERRED TO GENERAL FUND	
$445,540,765	2017-19 Biennium	$455,263,216

Source: *North Dakota Retirement & Investment Office*

Rapidly Decarbonizing States: CO and WA

Rapidly Decarbonizing



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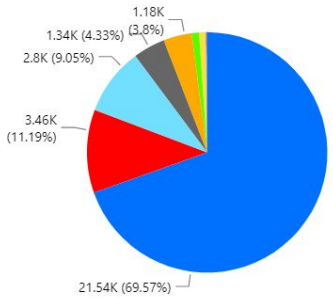

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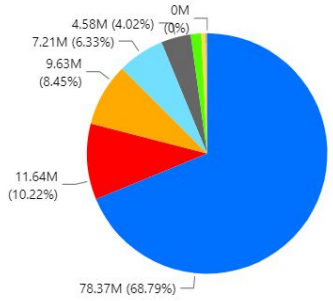
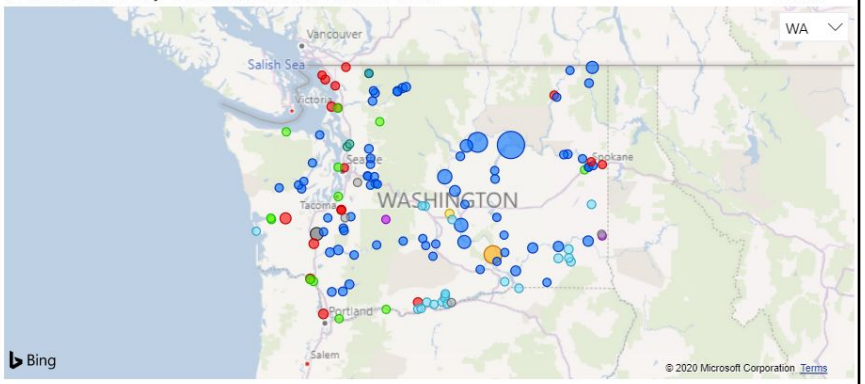
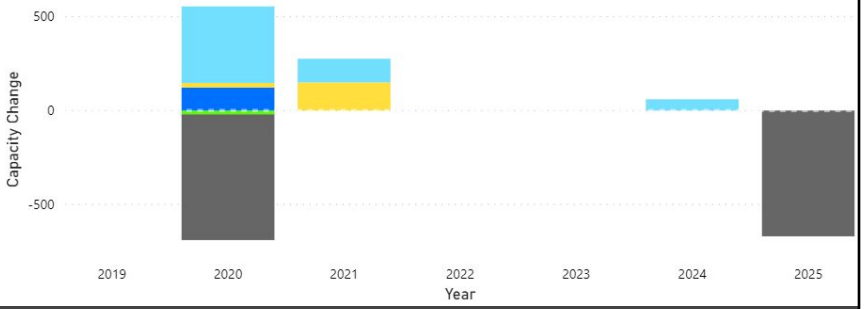


POWER PLANTS by GENERATION and PRIMARY FUEL

STATE



NET CAPACITY CHANGE by YEAR and TECHNOLOGY



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Colorado Overview

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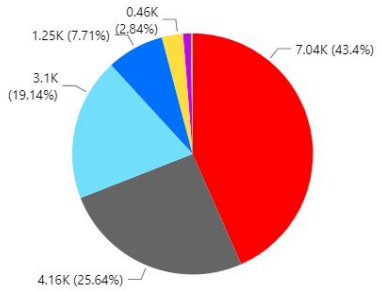

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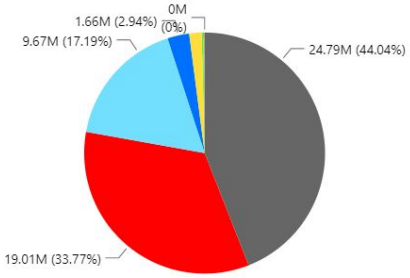

POWER PLANTS by GENERATION and PRIMARY FUEL

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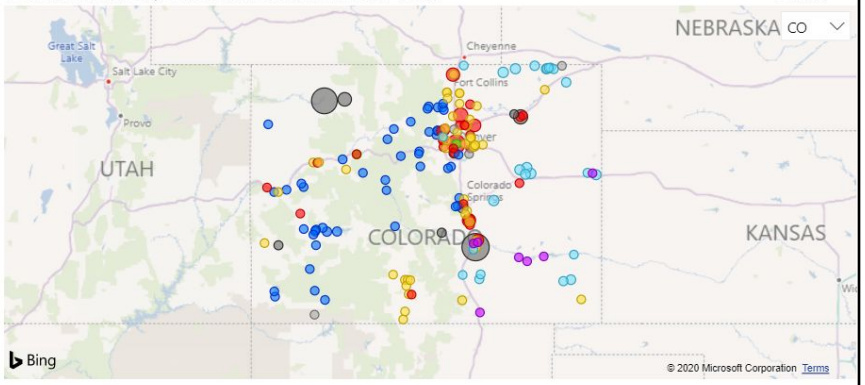

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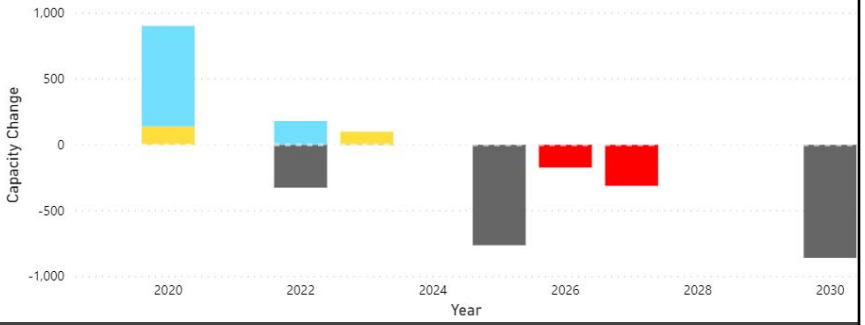

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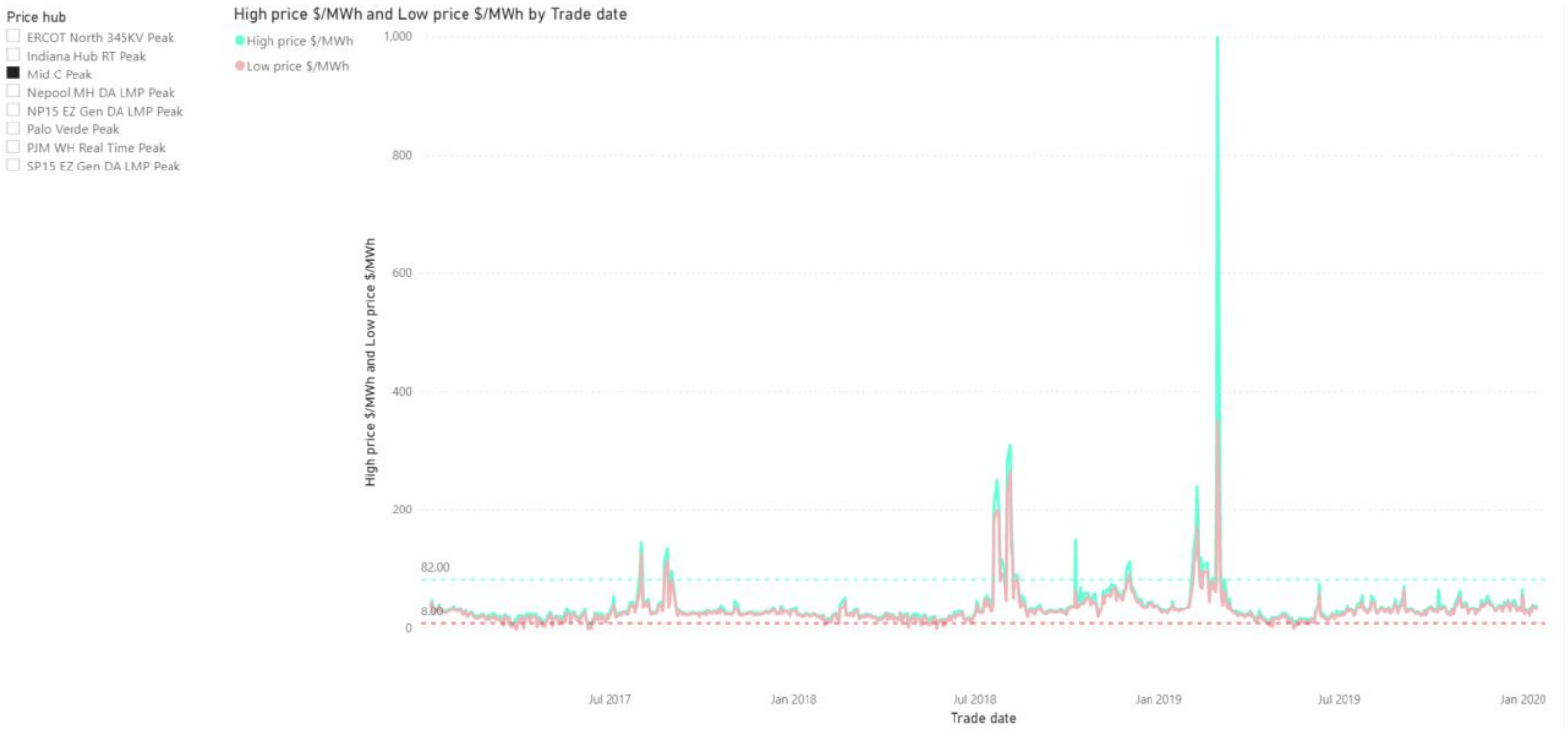
Washington Resource Adequacy

Rapidly Decarbonizing



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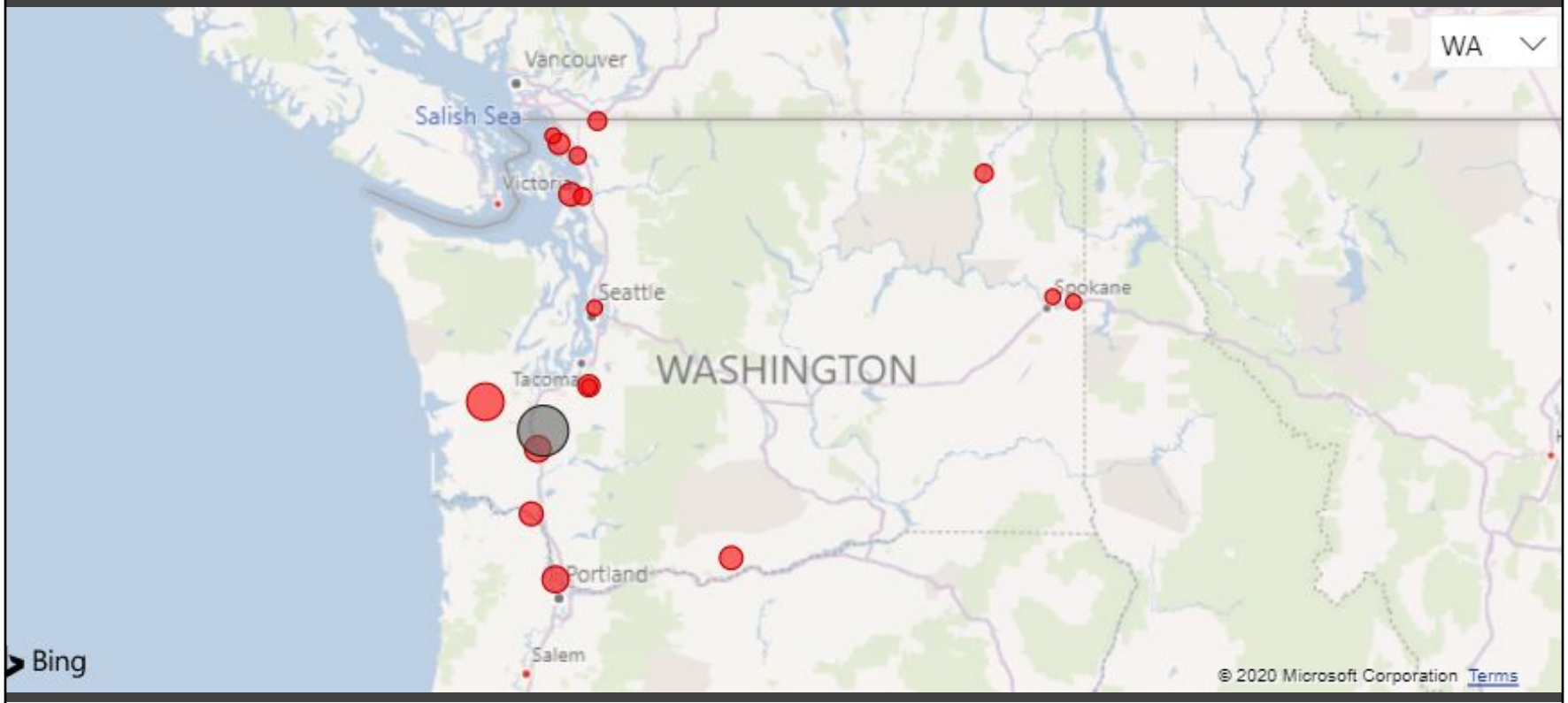

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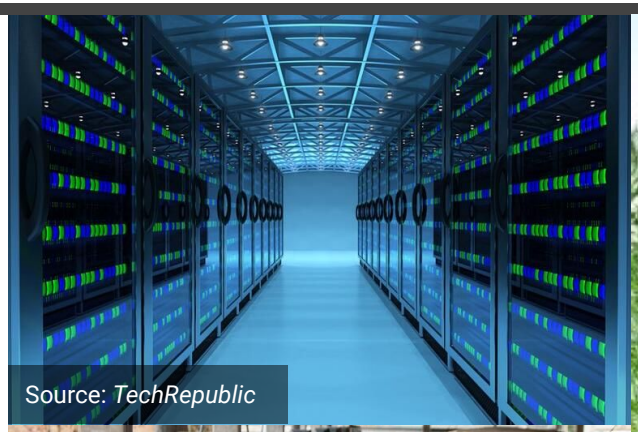
Washington Opportunities

Rapidly Decarbonizing

Data Centers

Electric Vehicles

Agriculture



Source: *TechRepublic*

Source: *Greentech Media*

Source: *Successful Farming*

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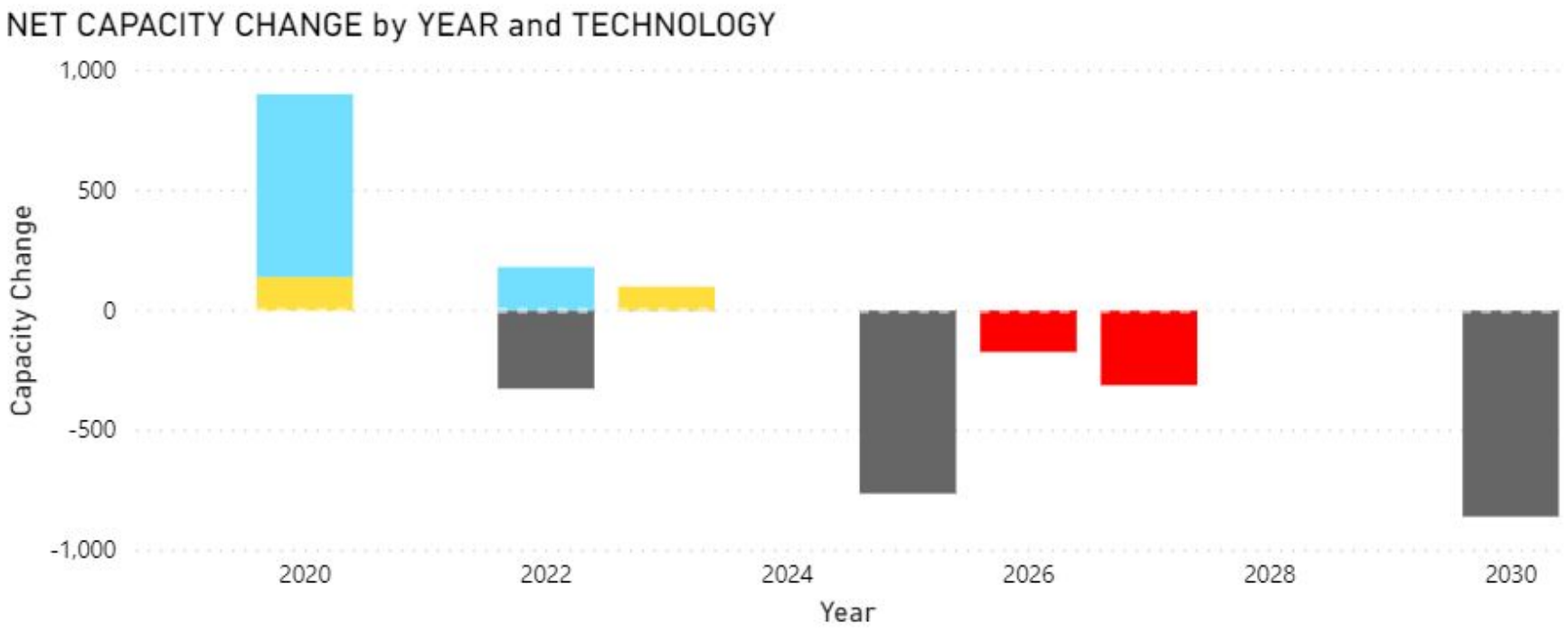
Colorado Market Opportunities

Rapidly Decarbonizing



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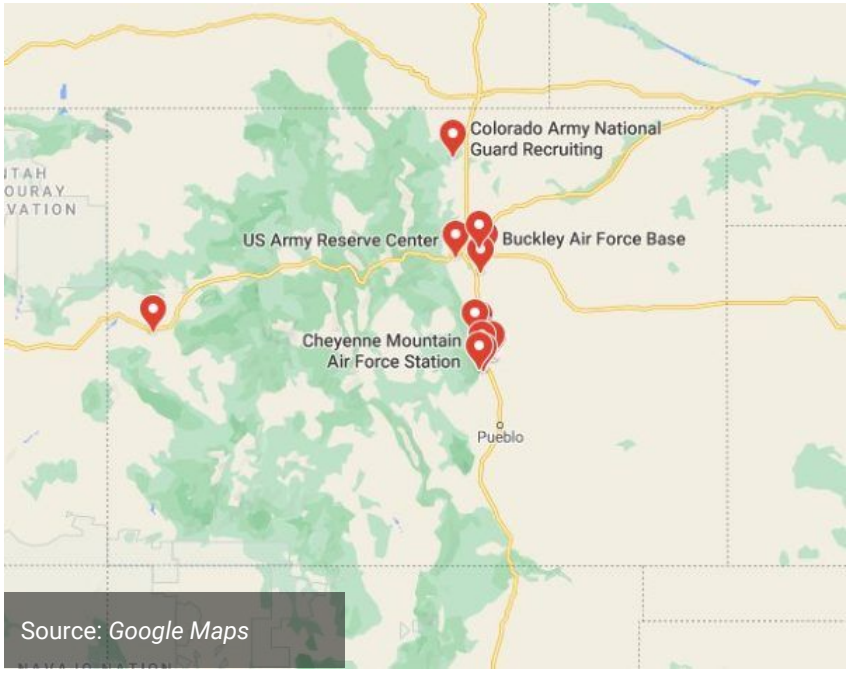
Colorado Opportunities

Rapidly Decarbonizing



Source: *Google Maps*

CETA vs. CAP

Rapidly Decarbonizing

Source: *The Seattle Times*

Source: *Grist*

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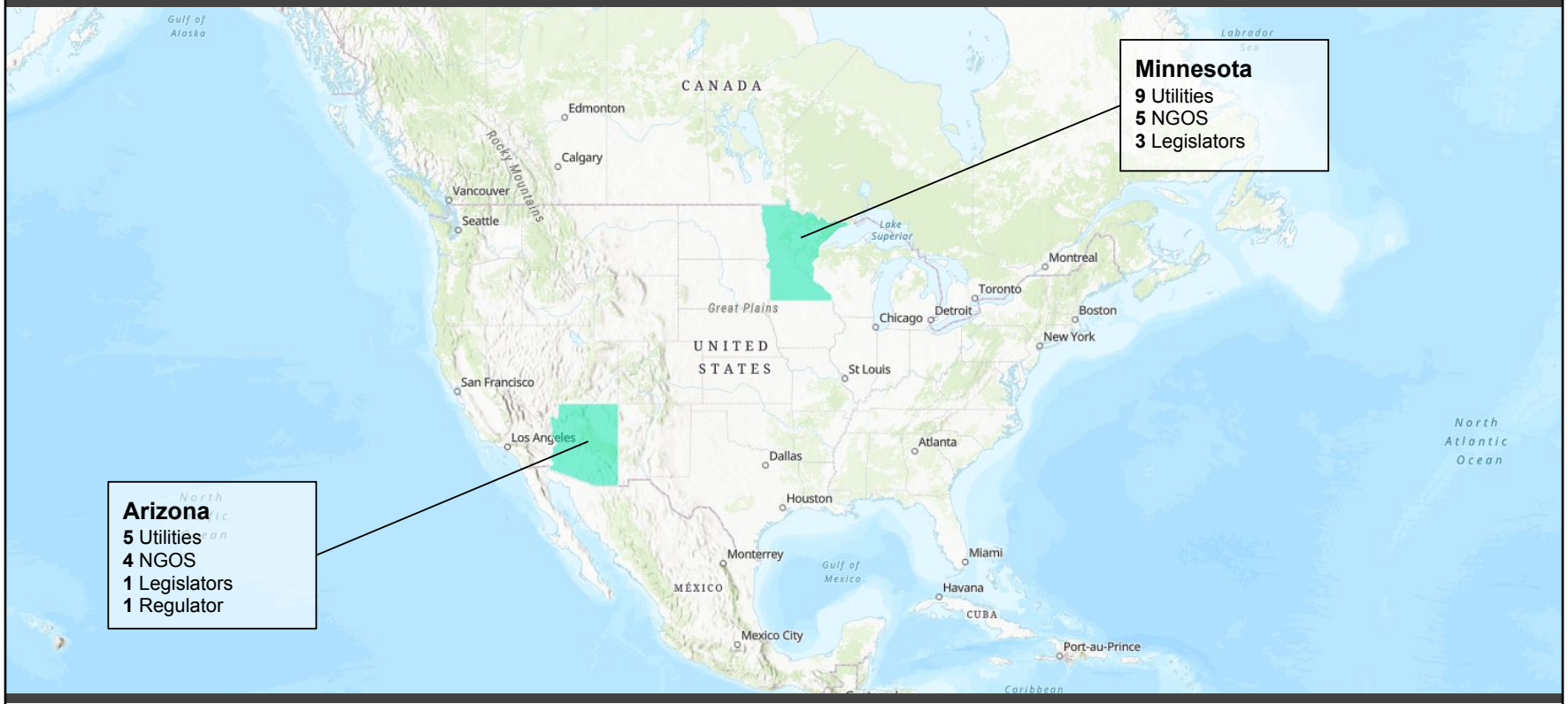
Tipping Point States: AZ and MN

Tipping Points



Minnesota
9 Utilities
5 NGOS
3 Legislators

Arizona
5 Utilities
4 NGOS
1 Legislators
1 Regulator

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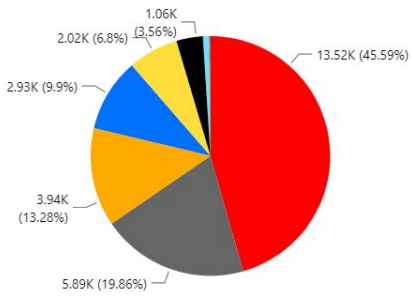
Arizona Overview

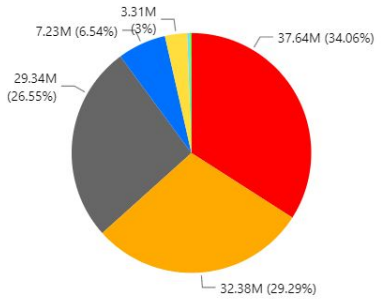
Tipping Points

Batteries
Nuclear
Biomass
Other
Coal
Petroleum
Geothermal
Solar
Hydroelectric
Wind
Natural Gas

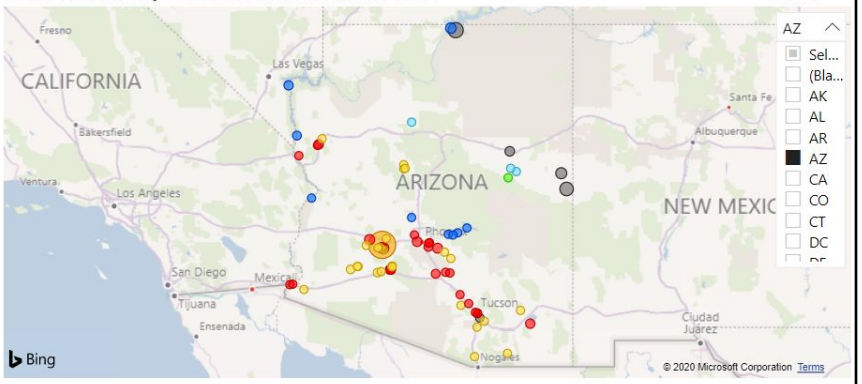
SUMMER CAPACITY (MW) by Primary Fuel



NET GEN (MWH) by Primary Fuel

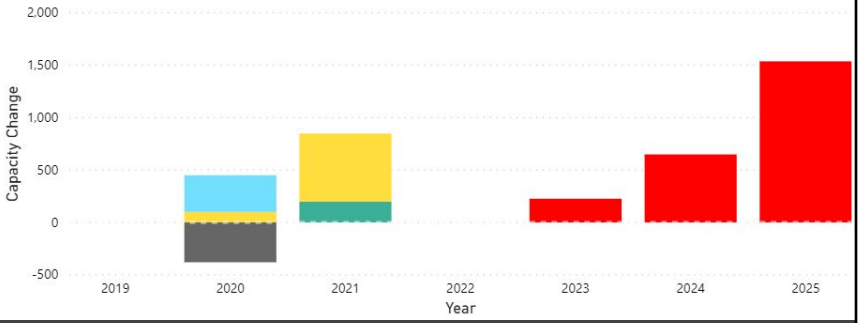


POWER PLANTS by GENERATION and PRIMARY FUEL



STATE

NET CAPACITY CHANGE by YEAR and TECHNOLOGY



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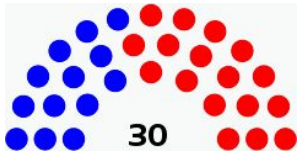
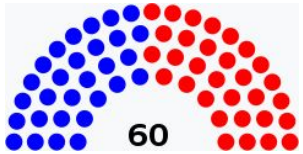
Arizona Corporation Commission

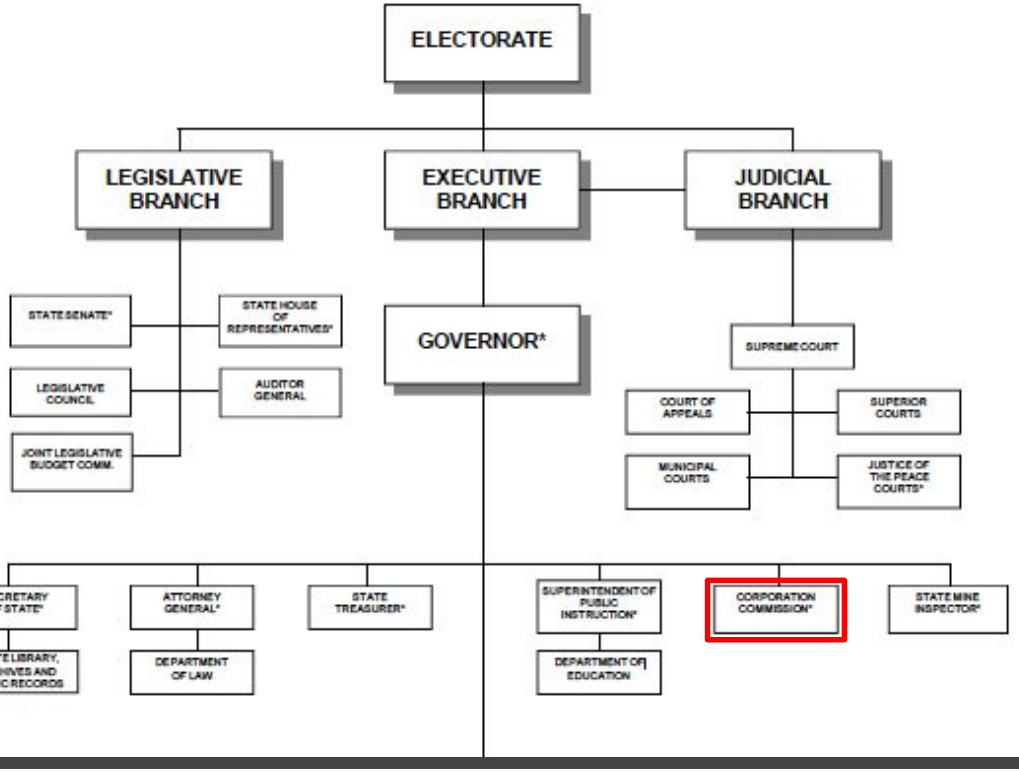
Tipping Points

Upper Chamber



Lower Chamber





Gov. Doug Ducey (R)
2015-2023
(term limited)

Arizona Corporation Commission
"Fourth Branch of Government"

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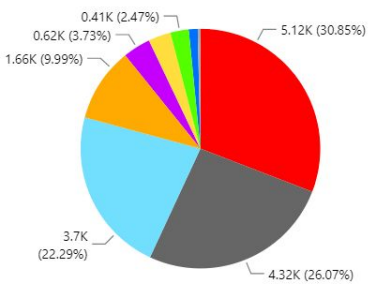
Minnesota Overview

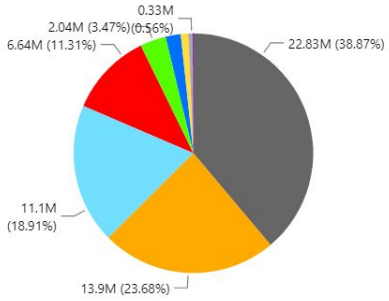
Tipping Points

Batteries
Nuclear
Biomass
Other
Coal
Petroleum
Geothermal
Solar
Hydroelectric
Wind
Natural Gas

SUMMER CAPACITY (MW) by Primary Fuel

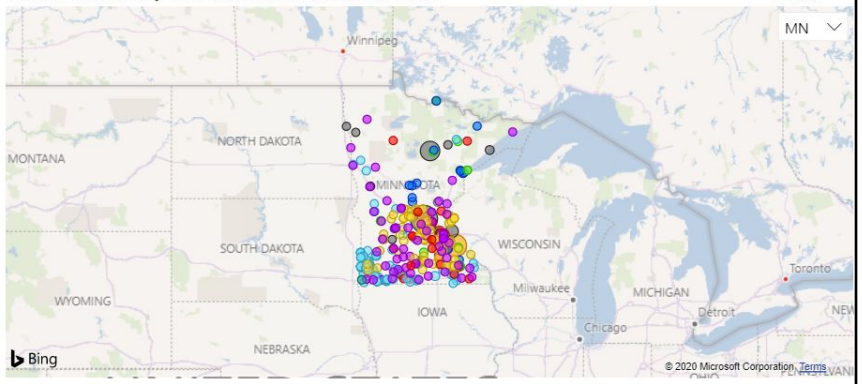


NET GEN (MWH) by Primary Fuel

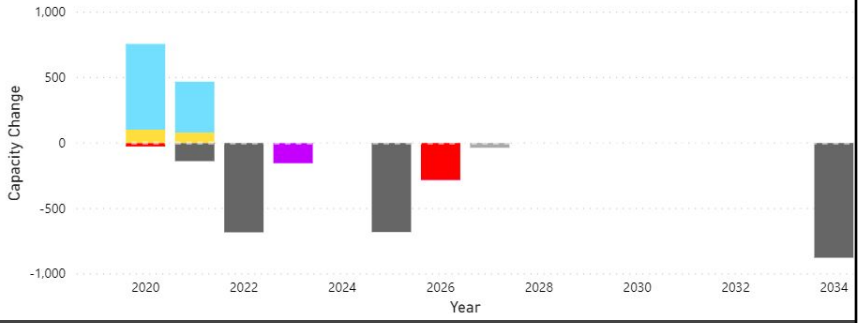


POWER PLANTS by GENERATION and PRIMARY FUEL

STATE



NET CAPACITY CHANGE by YEAR and TECHNOLOGY



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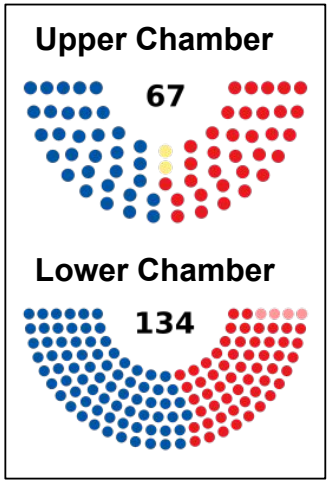
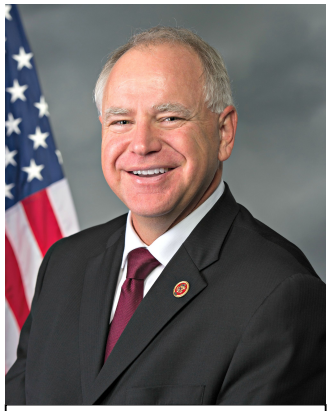
Minnesota Political Overview

Tipping Points





Gov. Tim Walz (DFL)
2019-2023
(likely to seek re-election)

Minnesota Policy Landscape

Tipping Points

Current RPS

- Passed in 2007, Sunsets in 2025
- 31.5% by 2020 for Xcel Energy (24% must come from wind by 2020)
- 26.5% by 2025 for other IOUs (1.5% must come from solar by 2020)
- 25% by 2025 for other utilities
- Statewide goal of 10% solar by 2030

Rep. Jamie Long (D) 61B
"Clean Energy First *Act*" (2019)
HF 1956

100% carbon free by 2050 for all utilities

Does not offer guidance on nuclear power plants other than replacing them with renewables when decommissioned

Sen. Dave Senjem (R) 25
"Clean Energy First" (2019)
SF 1456

Requires utilities to add clean energy to its system when it needs to increase or replace power, unless they bring unreasonable cost or threaten liability

Not technology dependent

Subnational Picture

Tipping Points