

# The Texas Grid Failure: Any Lessons for Wyoming?

Prof. Kyri Baker  
University of Colorado Boulder

Presentation to the Wyoming State Bar

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## The importance of electric power

The US National Academy of Engineering ranks electric power networks as **the number 1 greatest engineering achievement of the 20th century.**

(ranked by how much an achievement improved quality of life)

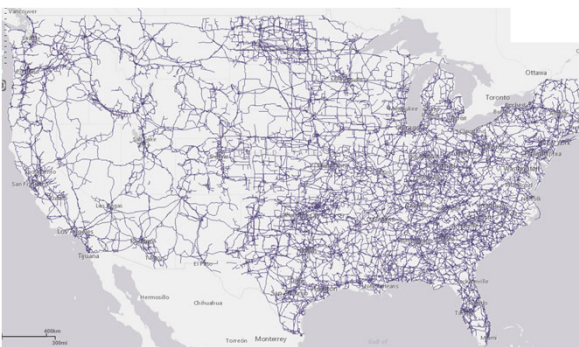


FIGURE 1: TRANSMISSION WIRES 138,000 VOLTS AND ABOVE

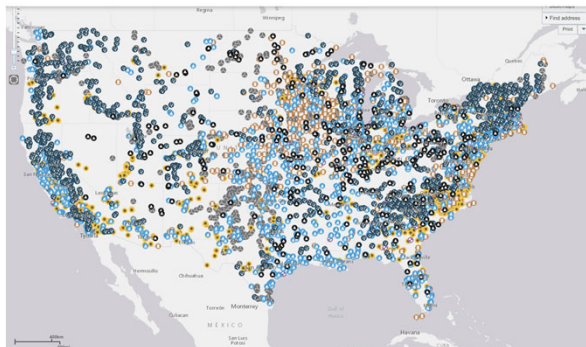
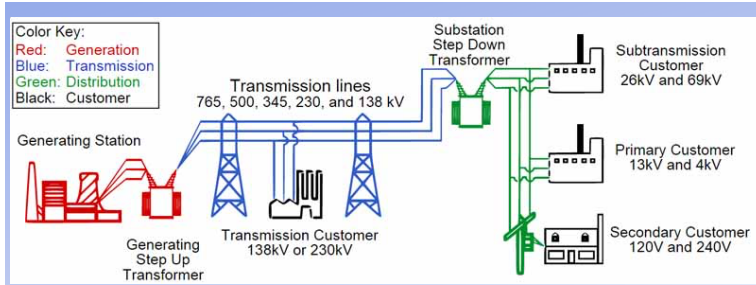


FIGURE 2: POWER GENERATORS (NON-RENEWABLE & RENEWABLE).

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## A complex, synchronized system...

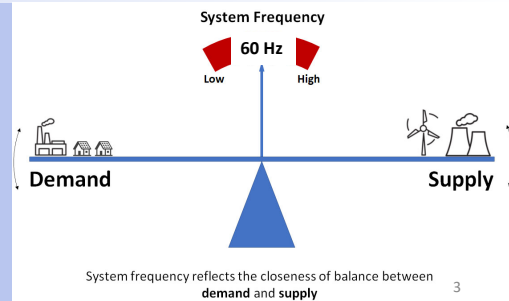


**International, interstate power exchanges**

**Hundreds of miles of infrastructure**

**Millions of participants**

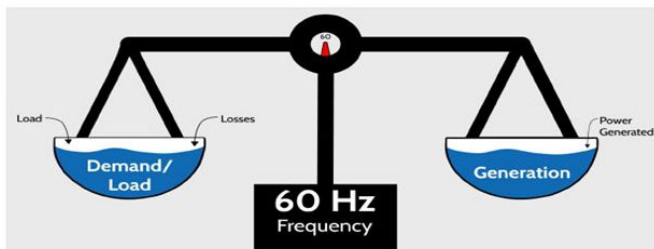
**Supply and demand must be balanced at all times in order to keep the grid stable**



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## Grid Frequency

In each of the AC grids, supply and demand must be balanced to maintain power at a frequency of 60 Hz (in the US).

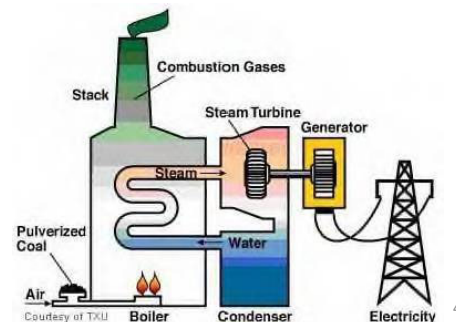


**Too much generation?** Frequency goes up.

**Too much demand?** Frequency dips.

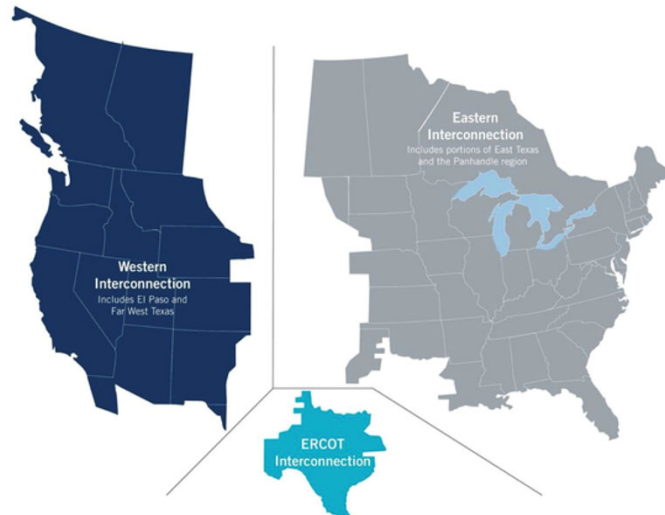
Balancing authorities (hence the name) try to match supply and demand to keep the frequency at 60 Hz.

Generators are spinning at 60 cycles per second

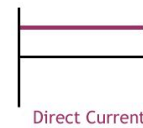


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## The US AC Grids



AC (Alternating Current) Grids in the US are connected via HVDC (high voltage DC) lines and synchronized to 60 Hz



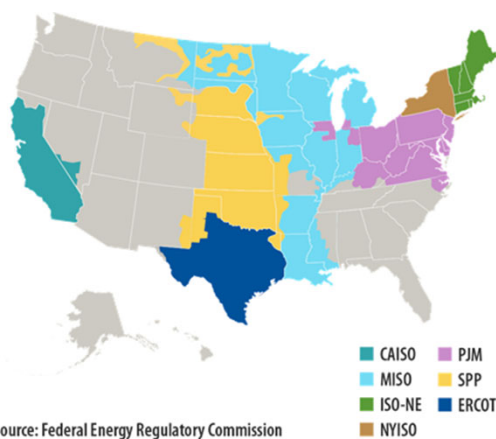
Source: ERCOT

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## Independent System Operators (ISOs)

### Wholesale Electric Power Markets



Source: Federal Energy Regulatory Commission

Some areas of the US have **vertically integrated** utilities (not competitive) and some have **wholesale markets** (deregulated) called Independent System Operators (ISOs) or Regional Transmission Operators (RTOs)

Market participants within the colored regions can buy and sell to each other within that region

**ERCOT** is an ISO and has a competitive wholesale electricity market

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## ISOs/RTOs

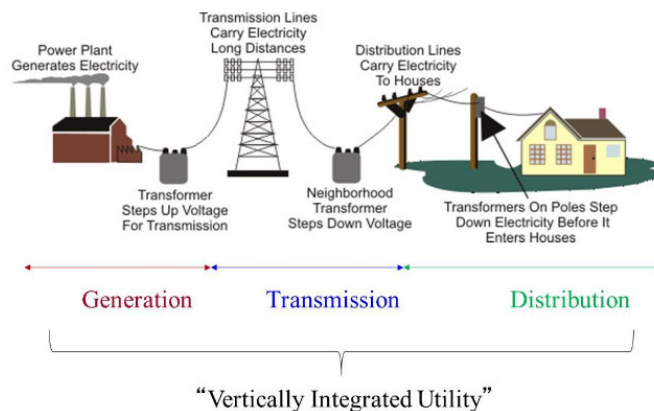
- Non-profit entities responsible for maintaining the reliability of the system
- Some actually control generation, some just oversee operation
- Schedule coordination between buyers and sellers in competitive markets
- System operators also monitor grid conditions to ensure safety
- System operators are responsible for maintaining and requiring **reserves**, or resources that can help if something goes wrong or unexpectedly



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## Non-competitive: Vertically Integrated

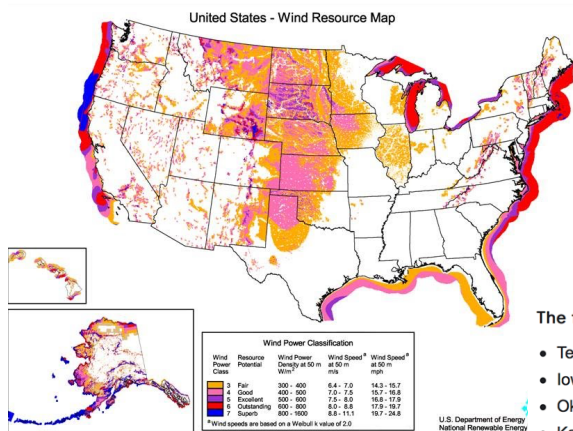
- Outside of those colored regions, there is no competition or market; the utilities are vertically integrated
- This means one company owns the generation, power lines, bills the customers, etc...



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## ERCOT : A unique ISO



Why does Texas have so much wind?

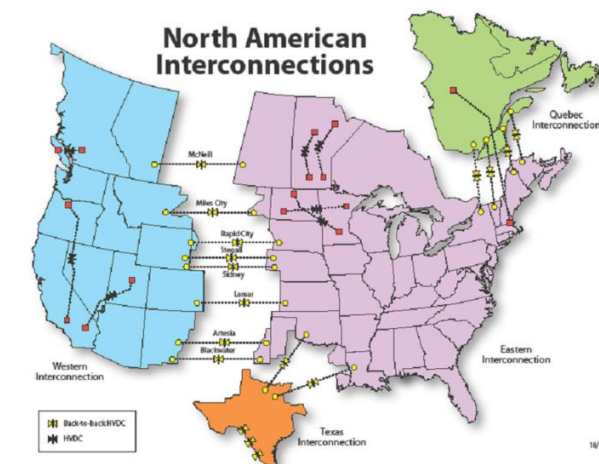
The five states with the most wind capacity installed at the end of 2020 were:

- Texas (33,133 MW)
- Iowa (11,660 MW)
- Oklahoma (9,048 MW)
- Kansas (7,016 MW)
- Illinois (6,409 MW)

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## A couple of reasons, but mainly: Independence and Competition



Texas' power grid is overseen by state regulators, not by FERC – they could build more power lines to transmit wind from windy areas to population centers

### FERC: Federal Energy Regulatory Commission

The federal agency that regulates the transmission and wholesale sale of electricity and natural gas in interstate commerce

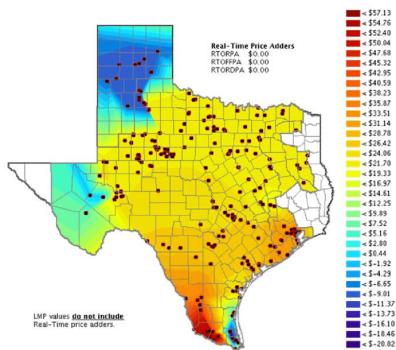
The federal government regulates electricity flowing across state lines under the commerce clause

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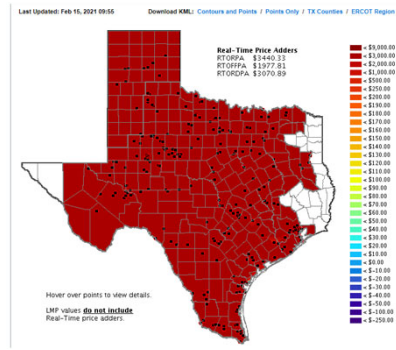
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## What makes ERCOT different from other ISOs?

- Due to being an isolated AC grid, ERCOT is not subject to some FERC regulations that other ISOs are
- ERCOT has an “energy-only” market, which means plants are only paid if they generate electricity
- ERCOT encourages investment in new generation through **scarcity pricing** (other ISOs like PJM have capacity markets).



Normal locational marginal prices (LMPs): ~\$50/MWh



LMPs during the Feb 2021 Grid Event: \$9000/MWh<sup>11</sup>

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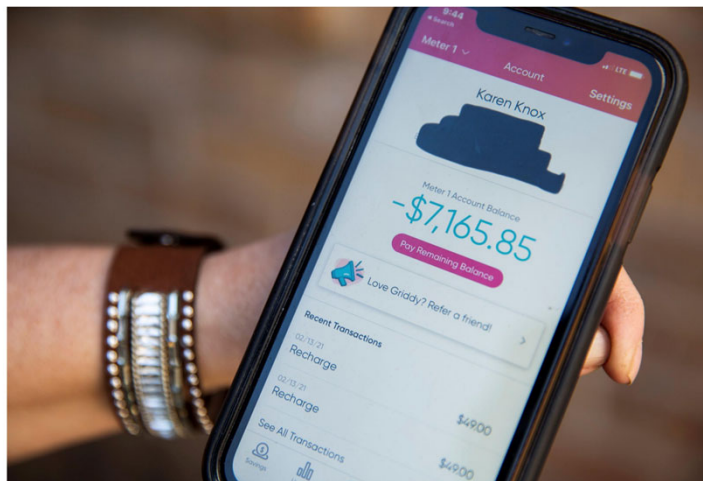
## Price implications for consumers

Typically, the volatility of wholesale market prices does not flow all the way down to residential consumers.

**Griddy** was an energy retailer (now shut down) that allowed Texas customers to interface directly with real-time wholesale electricity prices.

In general, this had the potential of improving economic efficiency but cutting out “middle man” costs with purchasing power.

But it also exposed retail customers to the volatility of extreme events.

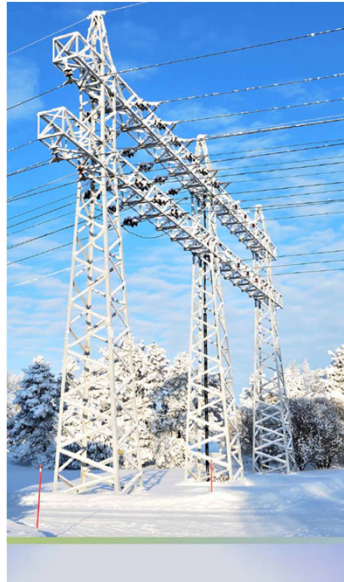


Karen Knox, a special education teacher at L.D. Bell High School in Hurst, received a bill of over \$7K from Griddy for less than a week of electricity during the winter storm. © Shelby Tauber for The Texas Tribune

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## 2021 Winter Texas Blackout

- More than 10 million Texans without power at one point
- Economic losses from lost output and damage ~ **\$130 billion in TX alone**
- **Despite warning from FERC and NERC** from the 2011 blackouts, ERCOT did not properly winterize plants and gas infrastructure
- 2021 winter freeze was even colder and blackouts were worse



### REPORT ON OUTAGES AND CURTAILMENTS DURING THE SOUTHWEST COLD WEATHER EVENT OF FEBRUARY 1-5, 2011

#### Causes and Recommendations

Prepared by the Staffs of the  
Federal Energy Regulatory Commission  
and the  
North American Electric  
Reliability Corporation

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## Primary culprit: Natural Gas

- ~40% of natural gas production was not available during the crisis.
- Gas, electricity, and water systems are linked so failures in one of them can lead to cascading failures in others



**Table 1**

Comparison of Fuel Sources: Expected Capacity and Actual Generation, February 15–19th.

Fuel Source	Expected capacity (GW)	Extreme Scenario Capacity (GW)	Actual Average Generation (GW)	Deficit (GW)	% Deficit [From Expected Capacity]
<i>Gas</i>	48.4	38.4	30.3	-18.1	-37%
<i>Coal</i>	13.6	10.8	7.8	-5.8	-43%
<i>Wind</i>	7.1	1.8	3.8	-3.3	-46%
<i>Nuclear</i>	5.2	4.1	4.1	-1.1	-21%
<i>Solar</i>	0.3	0.3	0.77	0.47	157%

Source: ERCOT data compiled by Blake Shaffer.

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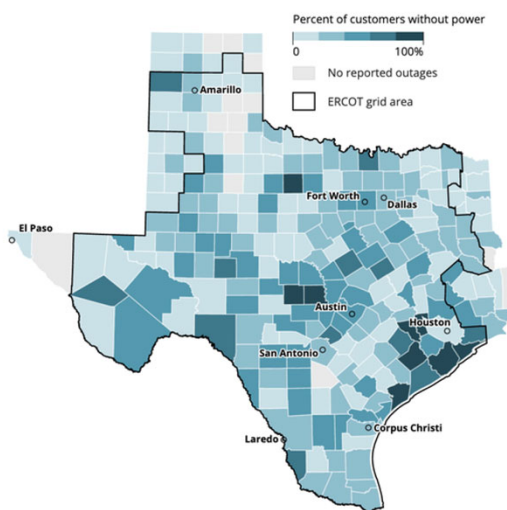
## What actually froze?

- Natural gas itself did not freeze. Underground pipelines did not freeze (temperatures are expected to be colder underground, and these pipelines are ~3 ft underground).
- Other components froze like wellheads.
- Processing plants for natural gas were unable to receive electricity, so they were unable to supply power plants with enough gas = cascading effects



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## Some areas had 100% customers without power



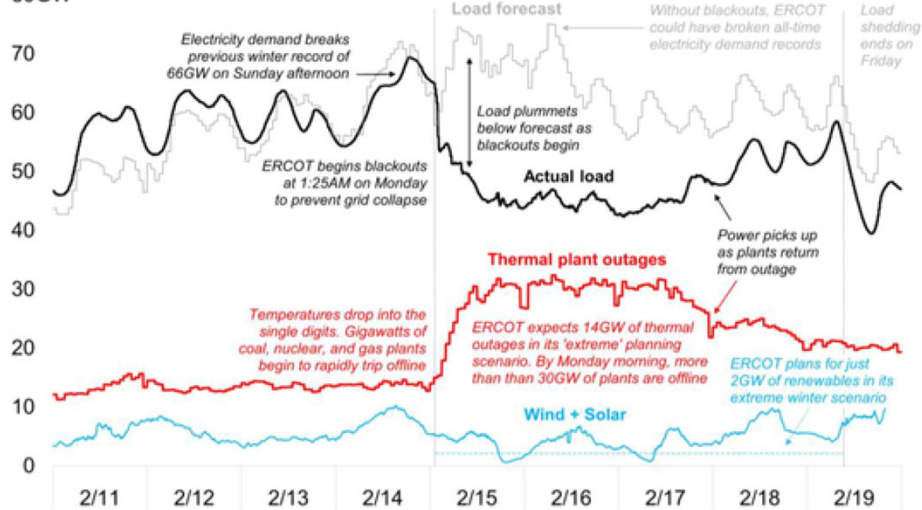
Outage map on Feb. 16, 2021

Source: The Texas Tribune and ProPublica

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## 2021 Blackouts: Sequence of Events

ERCOT electric load, load forecasts, thermal plant outages, and renewables  
80GW



Source: Brian Bartholomew

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## Possible recommendations

**Winterization:** FERC suggested most winterization measures "would not be unduly expensive."

→ For gas-fired units, the capital costs of equipment like insulation and heat tracing could range from \$50,000 to \$500,000.

→ For gas producers, they estimated well winterization costs to range from \$2,800 to \$30,000.

→ Statewide, winterizing 50,000 to 200,000 wells could cost a few billion dollars (far less than the disaster itself).

**Increasing Interconnections:** Increased DC ties to the other interconnections could help. Pattern Energy has a 2 GW project that is intended to link ERCOT to MISO through a HVDC that the company claims will not affect ERCOT's independent status. FERC approved the line in 2014 but it hasn't been built yet.

**Better demand response:** more intelligent power cuts could help keep customers warm by cycling power outages at a more granular scale (rather than cutting power to entire substations at once)

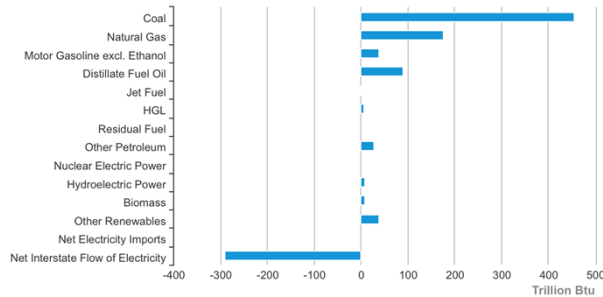
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## Wyoming's energy mix

Coal plants = 80% of WY's generation (2020). 15% of generation from renewables (mostly wind)

Wyoming Energy Consumption Estimates, 2018

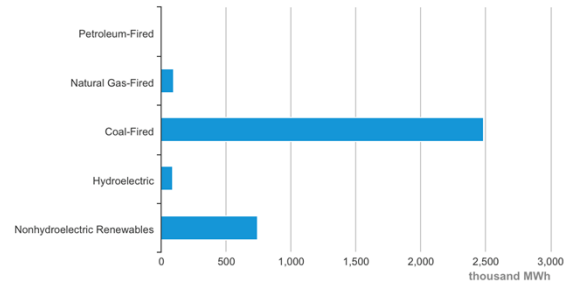
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Source: Energy Information Administration, State Energy Data System

Wyoming Net Electricity Generation by Source, Feb. 2021

DOWNLOAD

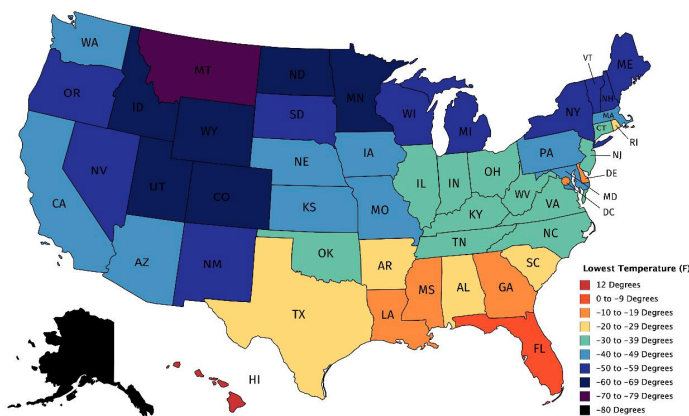


Source: Energy Information Administration, Electric Power Monthly

Wyoming is a net exporter of electricity – the state generates more than they consume  
Sends > 50% of the electricity generated out of state  
(<https://www.eia.gov/state/analysis.php?sid=WY>)

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## Wyoming's preparation for a similar events



WY is used to extremely cold temperatures and power producers know the value of winterizing infrastructure.

This coupled with the abundance of generation (more than double what the state consumes itself) and the interconnections with other grids make these grid events unlikely in the near term

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## Future outlook

→ Even though we are better prepared, it doesn't mean that we are **perfectly** prepared

### Frozen wind turbines could cause power outages in Grand

#### MPE urging energy conservation

News [FOLLOW NEWS](#) | February 14, 2021



**McKenna Harford** [FOLLOW](#)  
mharford@skyhnews.com

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**Update 4 p.m.:** Mountain Parks Electric reports the affected wind turbines are now fully operational after being frozen earlier in the day.

With the turbines now running at full capacity, the risk of a power outage is highly reduced.

The affected wind turbines were located in Wyoming and Colorado.

"If you are able to conserve energy immediately – by washing clothes and dishes later, turning down thermostats a couple of degrees, using a microwave oven instead of an electric range, turning off space heaters, etc. – please do so," the notice to customers read.

It's unclear how long the turbines will be down.

An MPE spokesperson said this is the first time the coop has had turbines freeze.

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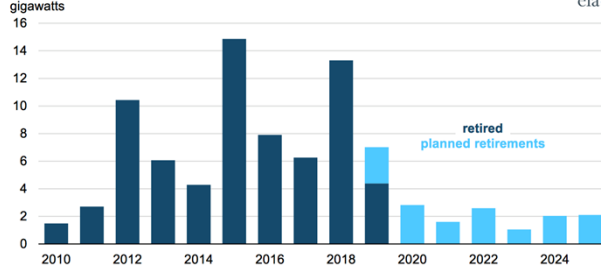
## Future outlook

→ Trends of coal plant retirements may mean less generation capacity in-state

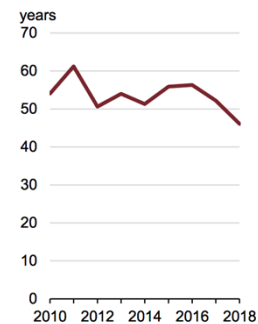
→ WY has excellent wind and solar resources that can help with this loss

→ Investment in winterization is a no-brainer in this region

Total net summer capacity of retired and retiring coal units (2010-2025)



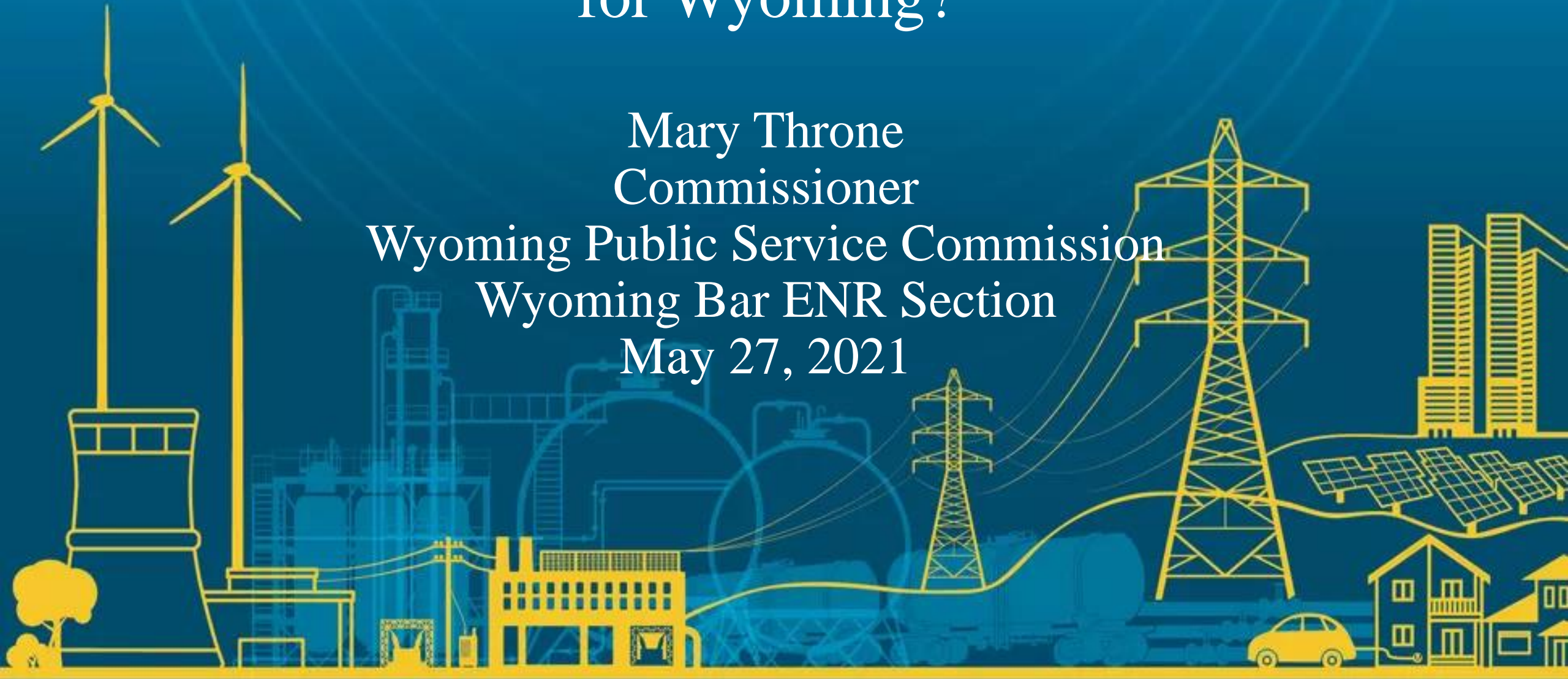
Average age of retired coal-fired units (2010-18)



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# The Texas Grid Failure: Any Lessons for Wyoming?

Mary Throne  
Commissioner  
Wyoming Public Service Commission  
Wyoming Bar ENR Section  
May 27, 2021



# Overview

- Utilities have an obligation to provide safe, adequate and reliable service at just and reasonable rates, under Wyoming law and as part of the regulatory compact, which governs utilities across the country
- There is both an intrastate and interstate or regional reliability component. Transmission and wholesale markets are FERC regulated; however the Wyoming PSC has the responsibility to ensure Wyoming customers have reliable service.
- Wyoming utility regulation both locally and regionally is not Texas; yet, there were impacts in Wyoming

# The Regulatory Compact

- Under the regulatory compact, the regulator grants a company a protected monopoly for the sale and distribution of services to customers in its defined service territory. In return, the company commits to supply the full quantities demanded by those customers at a price calculated to cover all prudent operating costs and an opportunity to earn a "reasonable" return on the capital invested in the enterprise.
- Wyoming Statute 37-2-112
  - The Commission shall have general and exclusive power to regulate and supervise every public utility within the state in accordance with the provisions of this act.

# Texas is not Wyoming-Resource Adequacy and Reliability in the West

- No RTO-but a system of regional cooperation and regulation.
- FERC--National Energy Regulatory Corporation (NERC)-Western Electric Coordinating Council (WECC)
  - Section 215 of the Energy Policy Act of 2005 called for enforceable reliability standards for all users and operators of the Bulk Power System developed by an Energy Reliability Organization (ERO). NERC is the ERO and its authority in the West is delegated to WECC
  - May 26, 2021 Summer of 2021 Reliability Assessment “warns that parts of North America are at elevated or high risk of energy shortfalls this summer during above-normal peak temperatures.”
- RCWest and SPP Reliability Services
- NWPP
- EIM

# Not Texas-But

## CAISO 2020 Summer Event

- On August 14-15, 2020, an extreme heat wave forced CAISO (California Independent System Operator) to initiate rolling blackouts, as discussed in organization's final root cause analysis-[Final-Root-Cause-Analysis-Mid-August-2020-Extreme-Heat-Wave.pdf \(caiso.com\)](https://www.caiso.com/Documents/Final-Root-Cause-Analysis-Mid-August-2020-Extreme-Heat-Wave.pdf) these were two of the key findings:
  - The climate change-induced extreme heat wave across the western United States resulted in demand for electricity exceeding existing electricity resource adequacy (RA) and planning targets.
  - In transitioning to a reliable, clean, and affordable resource mix, resource planning targets have not kept pace to ensure sufficient resources that can be relied upon to meet demand in the early evening hours. This made balancing demand and supply more challenging during the extreme heat wave. (no. 3 omitted)
- CAISO's Summer 2021 Assessment <http://www.caiso.com/Documents/2021-Summer-Loads-and-Resources-Assessment>

The ISO anticipates supply conditions in 2021 to be better than 2020, but continues to see potential challenges in meeting demand during extreme heat wave.

# WECC

<https://www.wecc.org/Pages/home.aspx>

- The Western Electricity Coordinating Council (WECC) is a non-profit corporation that exists to assure a reliable Bulk Electric System in the geographic area known as the Western Interconnection. WECC has been approved by the Federal Energy Regulatory Commission (FERC) as the Regional Entity for the Western Interconnection. The North American Electric Reliability Corporation (NERC) delegated some of its authority to create, monitor, and enforce reliability standards to WECC through a Delegation Agreement.
- WECC promotes bulk power system reliability and security in the Western Interconnection. WECC is the Regional Entity responsible for compliance monitoring and enforcement and oversees reliability planning and assessments.
- WECC-December 18, 2020 Western Assessment of Resource Adequacy-Over a 10 year planning horizon shows increasing demand in all sub-regions and risk of unserved demand under various scenarios. (Over-simplification and I encourage a full reading)

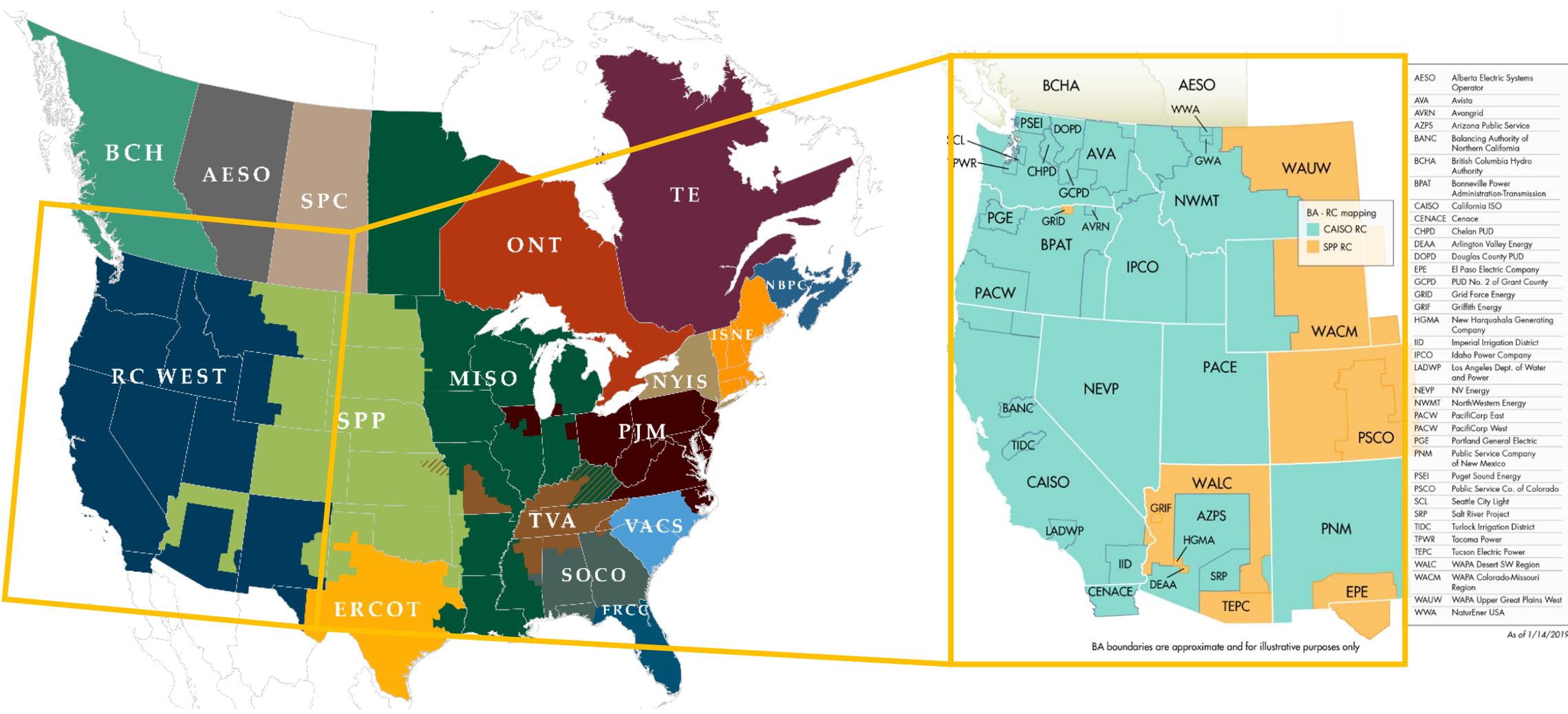
# SPP and RC West Are Regional Reliability Coordinators

## What is a Reliability Coordinator?

- Established by NERC with the following responsibilities:
  - Highest level of authority responsible for the reliable operation of the Bulk Electric System (BES).
  - Authority to prevent or mitigate emergencies in day-ahead and real-time.
  - Maintain Wide Area view of BES (situational awareness)
    - Act like an air traffic controller and independent overseer of the grid



# North American Reliability Coordinators



# Reliability Coordinator History in the West (WIRAB)

Date	Description	# of RCs in West
1995	NERC establishes "Security Centers"; Four centers established in the West (Covering CA, NW, DSW, RM)	4
1996	Series of blackouts in western North America	4
1999	Consolidated DSW and RM Security Coordinator Centers	3
2001	Name changed from Security Coordinators to Reliability Coordinators	3
2003	August 14, 2003 Northeast Blackout	3
2005	Energy Policy Act of 2005 passed in the U.S.; Established the Electric Reliability Organization and Mandatory Reliability Standards	3
2007	Mandatory Reliability Standards become effective; WECC designated the Regional Entity for the Western Interconnection	3
2009	Three RCs in the West consolidated into one RC under the WECC-RC	1
2011	September 8, 2011 Southwest Blackout	1
2014	WECC bifurcates and creates Peak RC as an independent and standalone RC for the West	1
2015	Peak establishes Alternative Funding Agreement; Alberta Electric System Operator (AESO) does not join Funding Agreement and provide its own RC Service	2
2018	CAISO submits withdrawal notice from Peak Funding Agreement to pursue option to provide its own RC Services and offers RC Services to other entities in the West; SPP offers to provide RC Services in the West; All Peak Funding Parties submit notices to Peak to leave the Peak Funding Agreement.	2
2019	CAISO RC West, SPP, and BCHydro all apply for RC Certification; AESO maintains its RC Area; Peak terminates operation Dec 3, 2019	4

# Northwest Power Pool (NWPP)

- Northwest Power Pool is a membership organization of multiple utilities which works to “keep the lights on by ensuring Northwest Power Pool member organizations achieve maximum benefits of coordinated operations.” <https://www.nwpp.org/>
- And from NWPP’s Resource Adequacy Page: <https://www.nwpp.org/about/workgroups/12>

Given the recent trend in decommissioning coal plants and increasing renewable integration, the Resource Adequacy group is working to coordinate activities related to a comprehensive review of resource adequacy in the NWPP region, and the development and implementation of a Resource Adequacy Program (RAP).

# CAISO Energy Imbalance Market

Western Energy Imbalance Market <https://www.westerneim.com/Pages/About/default.aspx> :

The ISO's Energy Imbalance Market (EIM) is a real-time energy market, the first of its kind in the western United States.

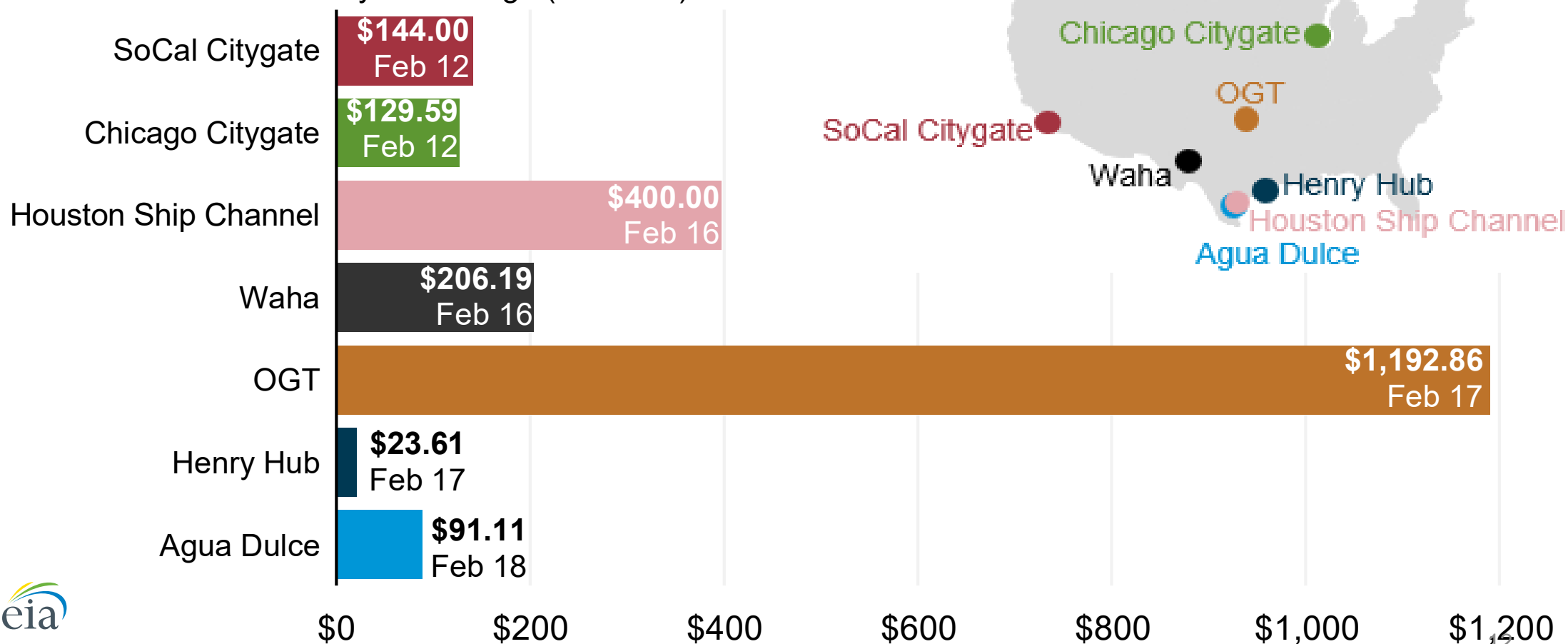
The EIM's advanced market system automatically finds low-cost energy to serve real-time consumer demand across the west. Since its launch in 2014, the EIM has enhanced grid reliability and generated cost savings for its participants. Besides its economic advantages, the EIM improves the integration of renewable energy, which leads to a cleaner, greener grid.

# How Did Texas Affect WY: Natural Gas Price Disruption

## Natural gas price ranges at selected trading hubs (Feb 2021)

dollars per million British thermal units

daily record high (\$/MMBtu)





# Wyoming Response to Texas Event

- Wyoming Utilities experienced commodity price spikes and are seeking recovery
- Solutions And Impacts Unique to Each Utility
  - Rocky Mountain Power-May 25 report to PSC: “Mid-C heavy load prices indexed \$191/MWh, Palo-Verde prices \$375.00/MWh and Rockies cash gas \$140 MMBtu.”
- Commission Investigation, Docket No. 90000-63-XI-21 (Record No. 15794): In the Matter of the Commission's Investigation to Examine the Adequacy of Natural Gas Supply Acquisition Strategies, Including Hedging Arrangements, Employed by Public Utilities Providing Natural Gas Distribution Services, Operating Natural Gas Fired Electric Generation Facilities or Depending on such Facilities for the Provision of Safe, Adequate and Reliable Service at Just and Reasonable Rates

# Commission Pass On Rule

Pursuant to Commission Rule Chapter 3, Section 26(a), a public utility may file an application to pass on to its customers in rates, known or projected commodity or commodity-related cost increases or decreases if the application complies with the substantive and procedural requirements of the Commission's Rules and the Commission determines:

- a. The evidence shows recovery of the costs is in the public interest and the pass-on includes only prudent commodity or commodity-related cost increases or decreases not under the Commission's jurisdiction.
- b. The costs included in the application are the most reasonable option available to the utility for safe, adequate and reliable service.
- c. The pass-on allocates increases or decreases to all retail rate classes and contract customers on an equal or proportionate basis. The Commission may consider a special proportionate class allocation if requested.
- d. The application contains supporting documentation as required by the Commission's Rules.

# Reliability in Wyoming

- Traditional Commission Authority
  - 2019 RMP Integrated Resource Plan (IRP) Investigation, Docket No. 90000-144-XI-19 (Record No. 15280)-The Commission identified a number of concerns, but specifically found the reliability analysis deficient.
  - RMP Cholla Unit 4 Closure, Docket No. 20000-578-ER-20 (Record No. 15464). Approved closure of Cholla Unit 4 in AZ, following review of reliability and consistent with results of IRP investigation requires more vigorous reliability assessment in future closures.
  - 2021 RMP IRP expected in September
- Legislation
  - HB200 (2020)-Requires the Commission to establish low carbon energy reliability standards for each utility to meet no later than 2030 through deployment of carbon capture
  - HB 166 (2021)-Establishes a rebuttable presumption against closure of natural gas or coal generation facilities, unless the utility can demonstrate the closure “will not result in an insufficient amount of reliable and dispatchable capacity,” and no adverse impact on reliability, as well as economic benefits.
  - 2021 Interim-Utilities with a focus on reliability is the 3<sup>rd</sup> priority for the Minerals Committee

# Texas Grid Failure: Any Lessons for Wyoming? The Answer

- The February 2017 grid failure is a cautionary tale for Wyoming and the West
- Despite the different system and the “independence” of ERCOT, Wyoming was not immune
- Wyoming and the Region cannot ignore the lessons of Texas or the West’s 2020 Summer Event
  - Resource adequacy, reliability, and resilience will be the watch words regionally and in Wyoming for the foreseeable future
  - Increased electricity demand and a changing resource mix with coal retirements and increasing renewable generating present planning and transmission challenges

# Questions?

Phone: 307.777.7427

Email: [mary.throne@wyo.gov](mailto:mary.throne@wyo.gov)

Website: <https://psc.wyo.gov/>

Twitter: @WyoPSC

