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January 7, 2021

MEMORANDUM

TO: Council Members

FROM: Gillian Charles, Senior Policy Analyst

SUBJECT: Update on annual greenhouse gas emissions (2019) from the power sector

BACKGROUND:

Presenter: Gillian Charles

Summary: Staff will present the latest annual (2019) regional and national carbon dioxide emissions from the generation of electricity.

While regional emissions had been relatively steady the previous three years (2016-2018), emissions increased in 2019 by about 16% from ~48.5 million metric tons in 2018 to ~56.6 million metric tons in 2019. In the Pacific Northwest, the power system's carbon emissions are directly connected to the hydro system. In a good hydro year (average, or above average output), emissions are lower as less natural gas and coal are dispatched. In poor hydro years, emissions tend to be higher as fossil fuel resources are dispatched at a greater frequency and duration to meet demand. In 2019, the region experienced its worst hydro year since 2005, thus leading to a fairly dramatic increase in fossil fuel output over the previous year.

As coal units begin to retire in the region (and nationwide), and existing natural gas generation continues to displace the dispatch of coal generation (natural gas is less carbon intensive, releasing roughly half the emissions of coal), emissions will begin to trend more deliberately

downward in the coming years. The extent of the trend depends largely on replacement resources, however with state renewable portfolio standards and state/city/utility clean energy policies in place, it is likely the region will see an increase in zero-carbon resources such as energy efficiency, renewables, and energy storage.

Workplan: B.4. Generation Resources – track/update generating resource datasets (including emissions)

Update on Annual GHG Emissions from the Power Sector – 2019 Emissions

Council Meeting, January 13, 2021

Gillian Charles



**THE 2021
NORTHWEST
POWER PLAN**

FOR A SECURE & AFFORDABLE
ENERGY FUTURE

Overview of today's presentation

Regional Emissions

- 2019 Annual CO₂ emissions
- Trends - generation, dispatch, additions and retirements

National Emissions

- 2019 Annual CO₂ emissions
- Trends - generation, dispatch, additions and retirements

2020 Sneak Peak

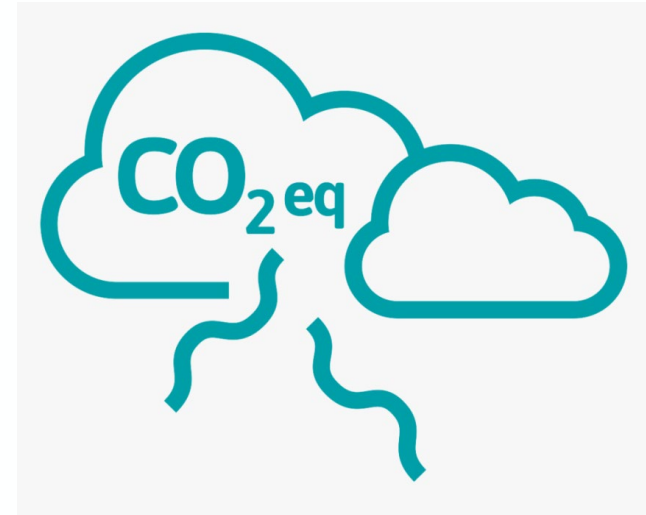
- Look at likely 2020 emission trends



Global warming potential of GHGs

GWP is a metric to compare the atmospheric impacts of GHGs over varying timescales

- CO₂ serves as the reference
- The higher the GWP, the more potent the gas
- Gases with shorter lifespans will have a higher GWP at 20yrs than 100yrs
- GWP is expressed in terms of CO₂e



	Avg lifetime in Earth's atmosphere	GWP (20 years)	GWP (100 years)
Carbon Dioxide (CO ₂)	Thousands of years	1	1
Methane (CH ₄)	12 years	86	34
Nitrous Oxide (N ₂ O)	121 years	268	298

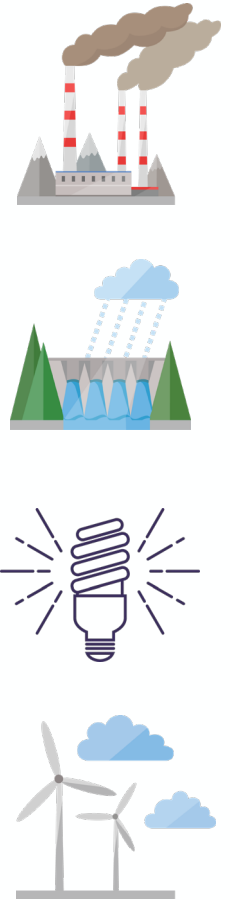
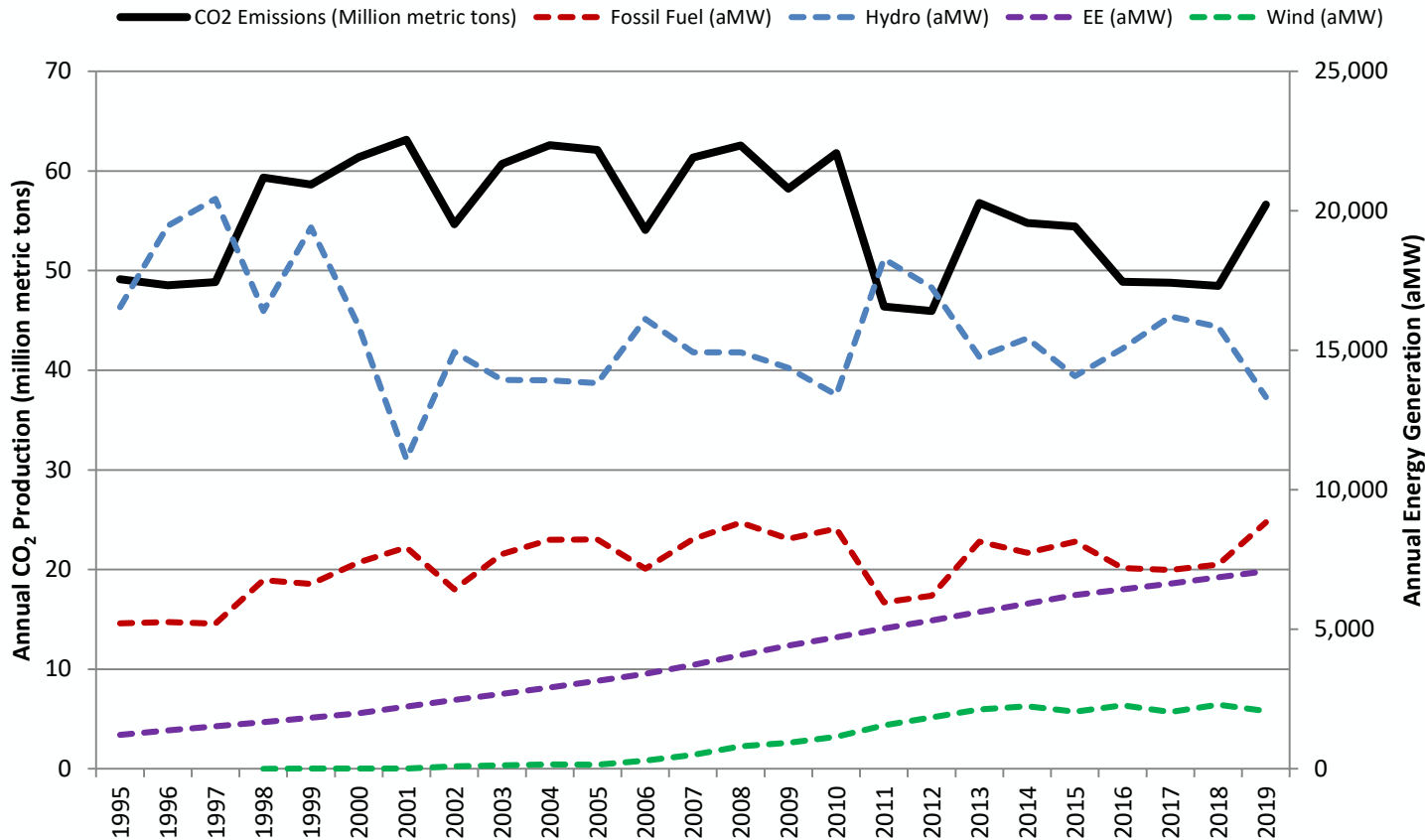




Regional Emissions

And the factors that influence them – resource mix, generation dispatch, resource additions and retirements, and policies

Annual carbon emissions from the generation of electricity in the NW

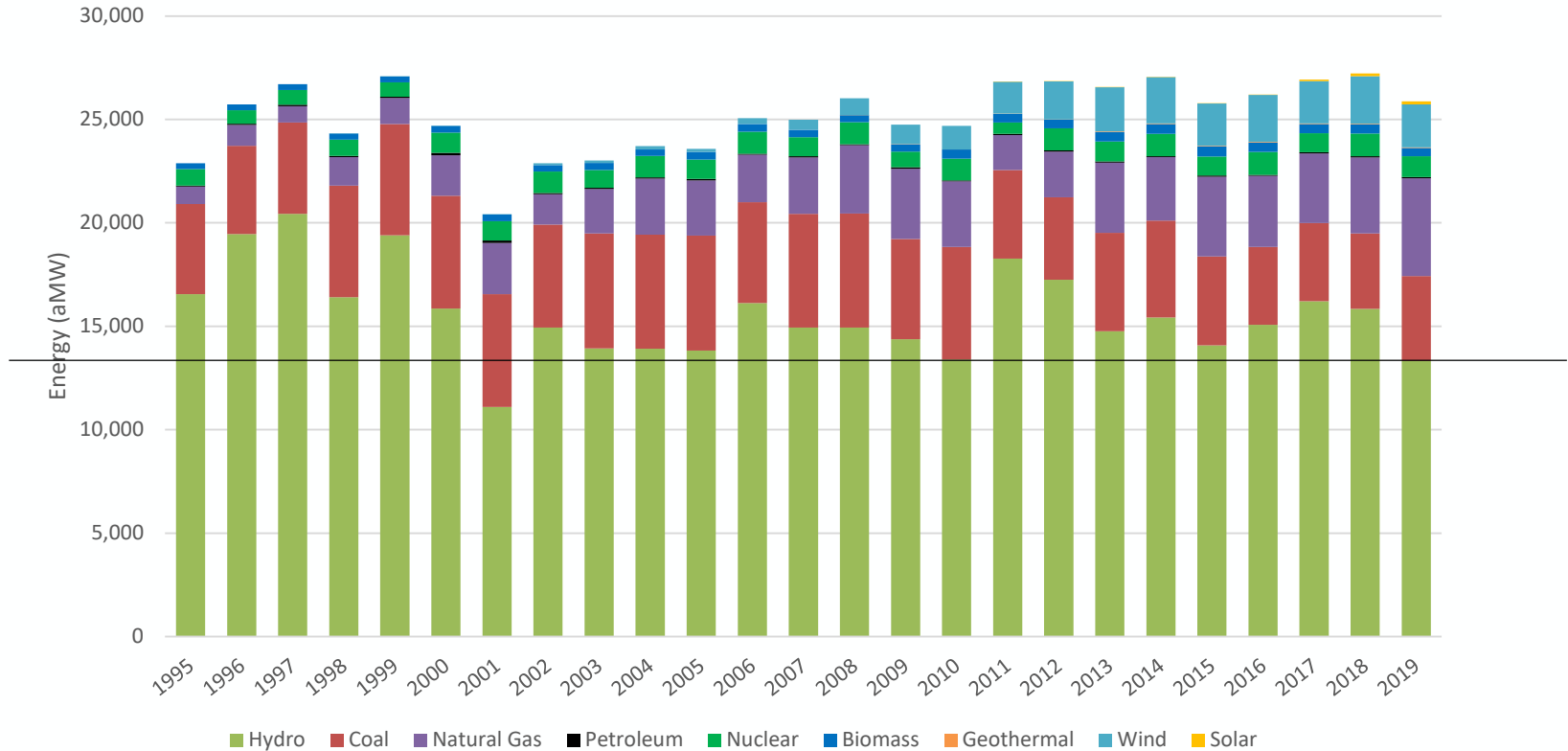


Following three years of stable emissions, emissions increased from ~49 million metric tons in 2018 to ~56.6 million metric tons in 2019



Regional generation by resource type

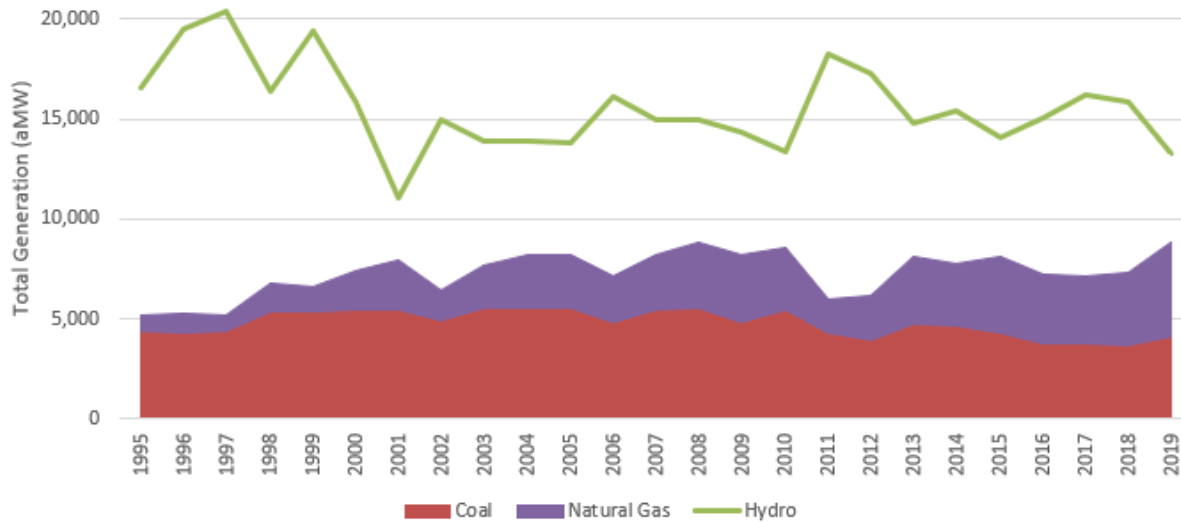
Historical Energy Production in the Northwest (aMW)



2019 was one of the worst hydro years since 2001 (2010 and 2005 were very close)



Regional Generation by Resource Type

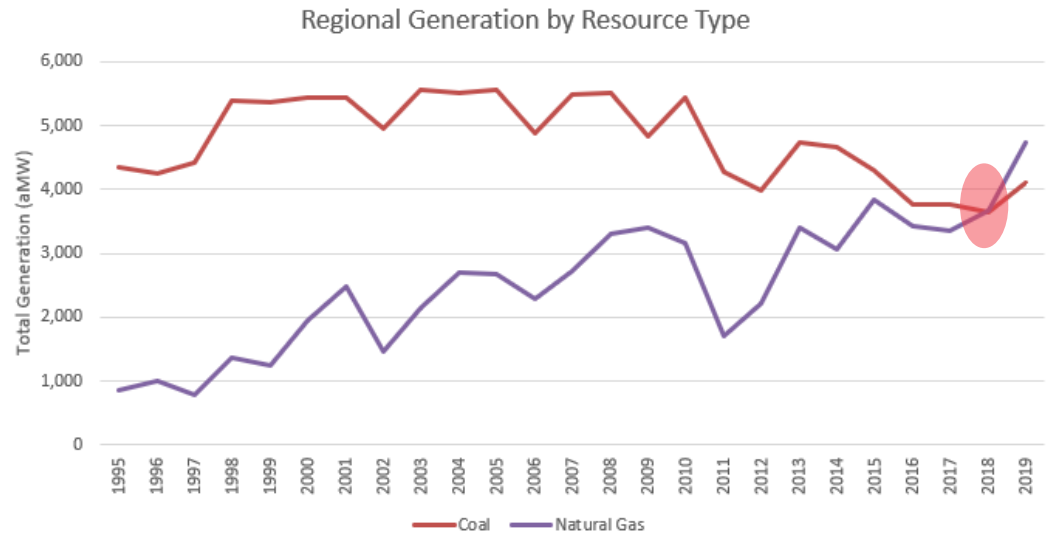


While fossil fuel (coal + natural gas) generation dispatches based on hydro production, overall fossil fuel generation has increased

(Coal + Nat Gas stacked area chart; Hydro is line chart)

On average, coal generation has been declining while natural gas generation has been increasing...

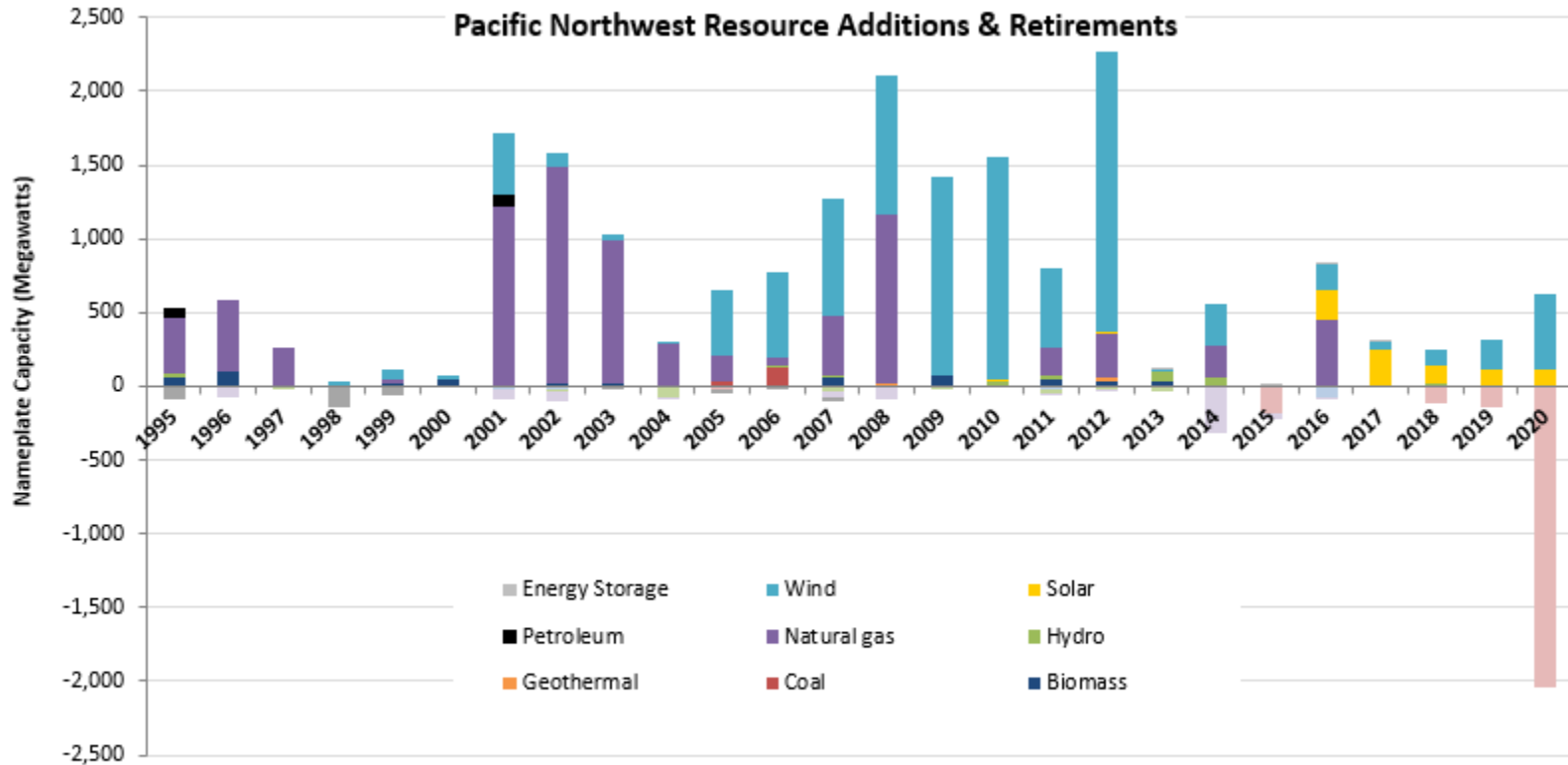
In 2018, gas surpassed coal generation for the first time



Fuel Type	CO ₂ Emissions (lbs CO ₂ /MMBtu)
Coal	205 - 228
Petroleum/Oil	161
Natural Gas	117



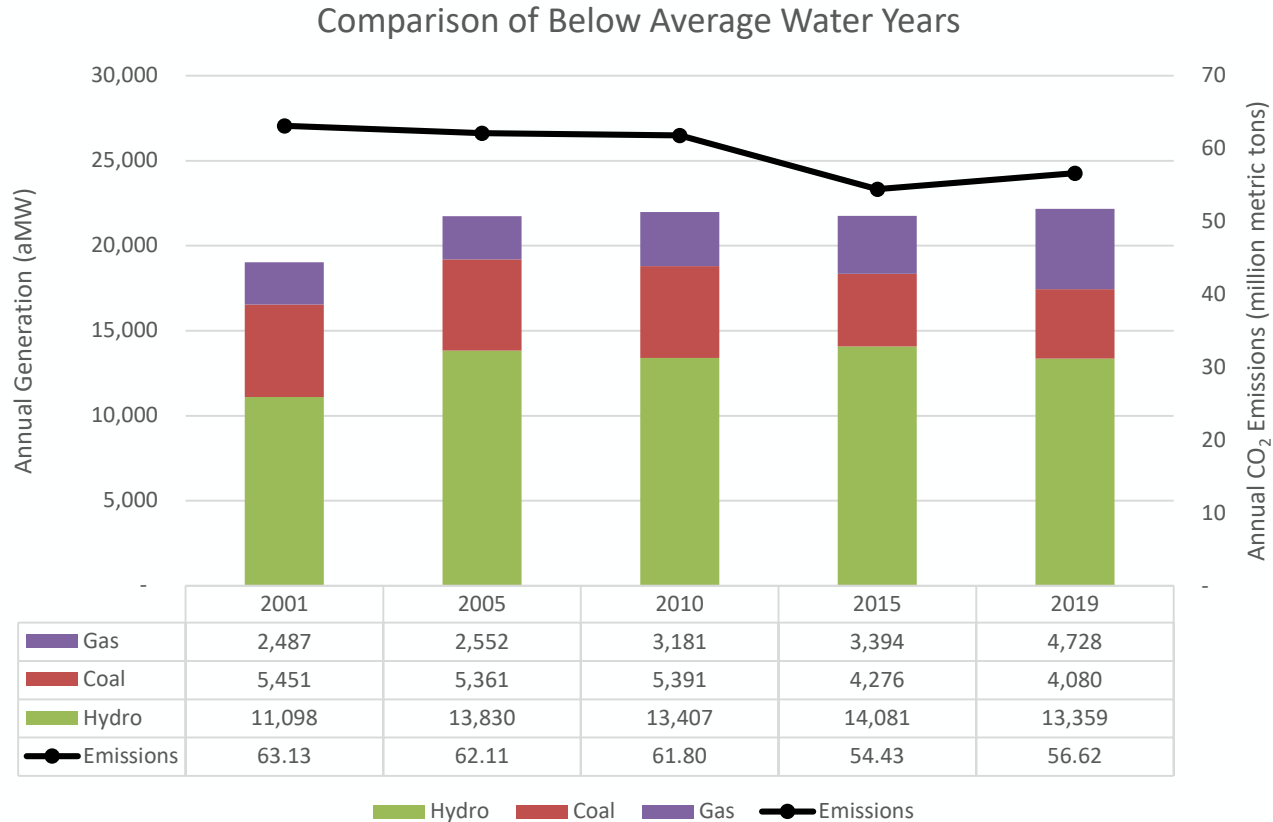
New resources and retirements in the Pacific Northwest



Jan 2021



Historical Emissions in Low Water Years

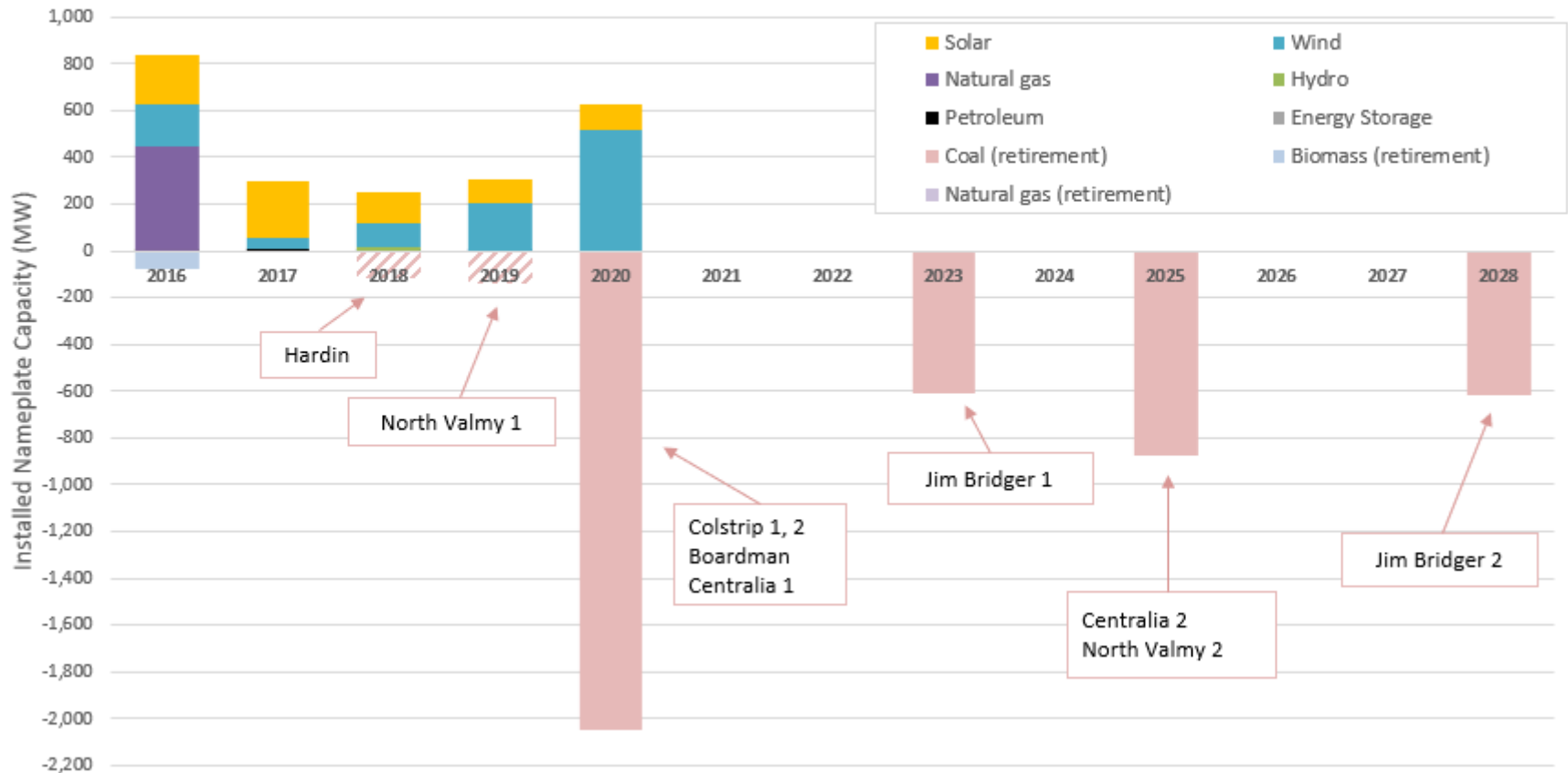


2019, 2010, and 2005 were very similar water years, and yet...

- Emissions are ~9% less in 2019
- Overall fossil fuel generation is greater in 2019, but less coal is generated

In general, emissions have been decreasing over time across similar hydro years primarily due to the dynamic between coal and natural gas generation

Additions and Retirements since the Seventh Power Plan (incl. announced planned retirements)

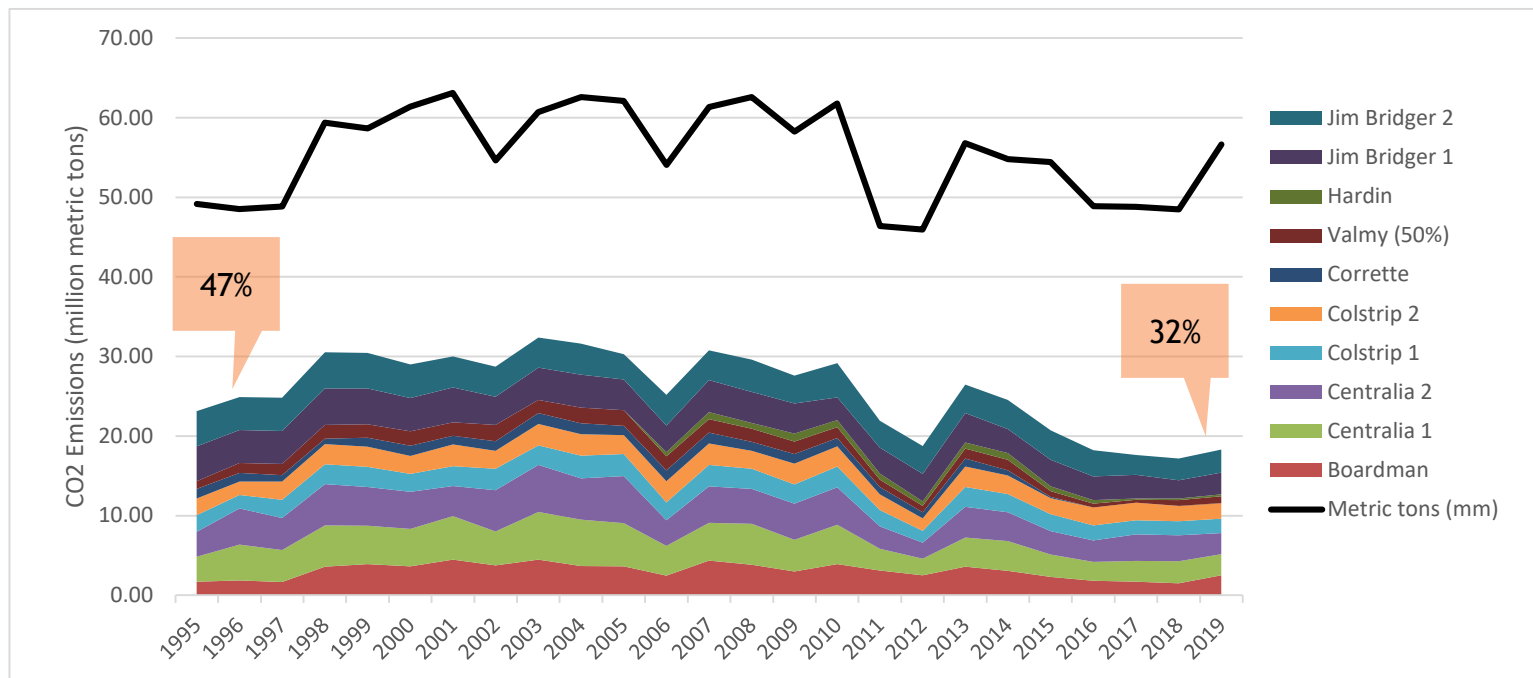


Updated Jan 2021

Planned retirements based on agreements, announcements, IRPs; subject to change
 Hardin Generating Station was sold to an out-of-region cryptocurrency company; therefore no longer “counts” towards the region
 Idaho Power ended its participation in North Valmy 1 in Dec 2019; unit will likely retire in 2021 (NV Energy)
 Uncertainty remains over timing of Jim Bridger 1,2 potential accelerated retirements
 Uncertainty remains over Idaho Power’s participation in North Valmy 2; may divest ownership in 2022, with unit retiring in 2025
 Colstrip 3,4 owners have discussed potential retirement dates, but nothing official announced



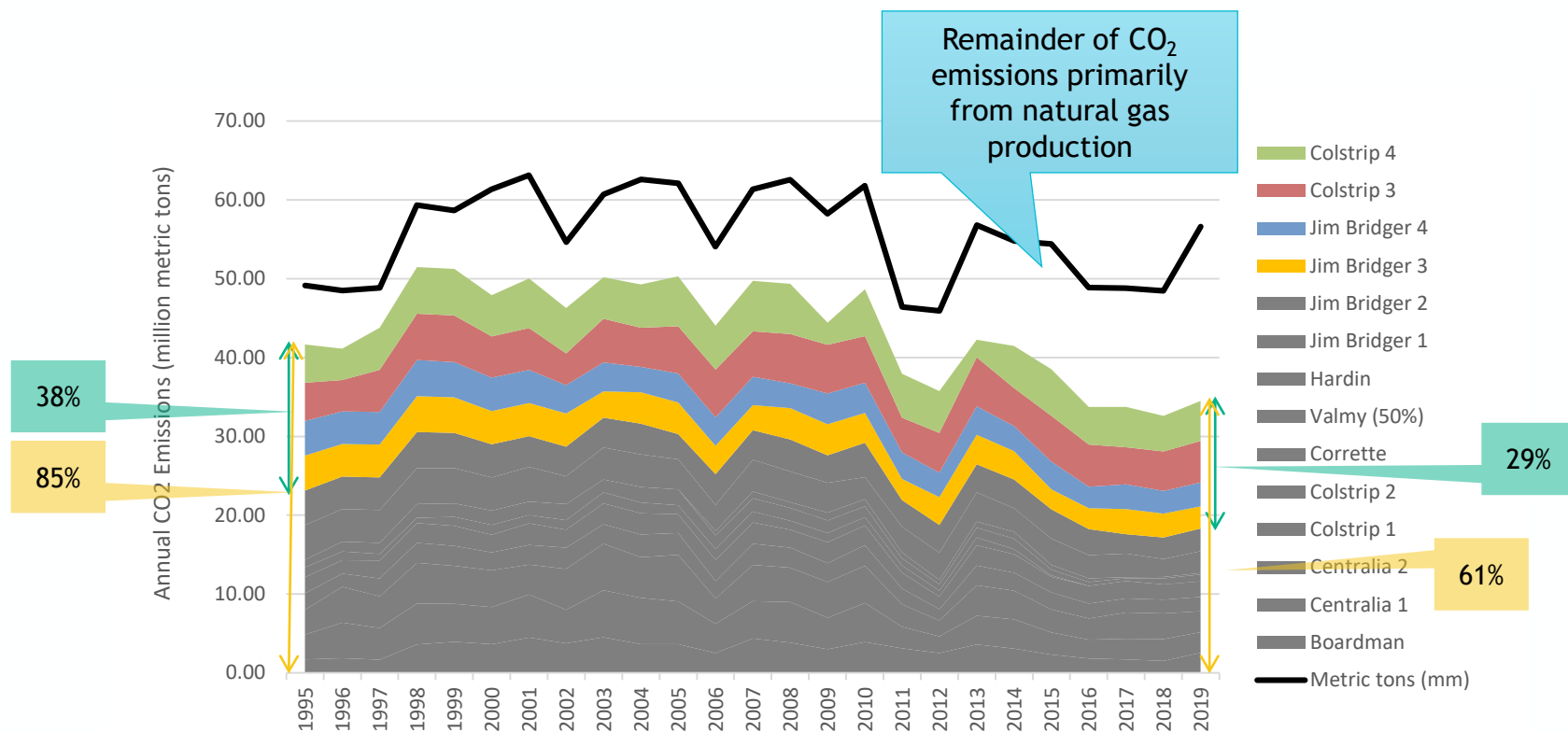
Retiring* coal plants account for about 46% of historical emissions since 2000



HOWEVER, actual future emissions depend on the **replacement resources!**



What about the remaining coal units?



Colstrip 3 & 4 and Bridger 3 & 4 are the largest coal units currently operating in the region. They account for on average 32% of historical emissions since 1995.

Since 1995, coal has accounted for ~80% of the region's overall power plant CO₂ emissions, although that percentage has been decreasing. In 2019, coal accounted for ~60% of the annual emissions.

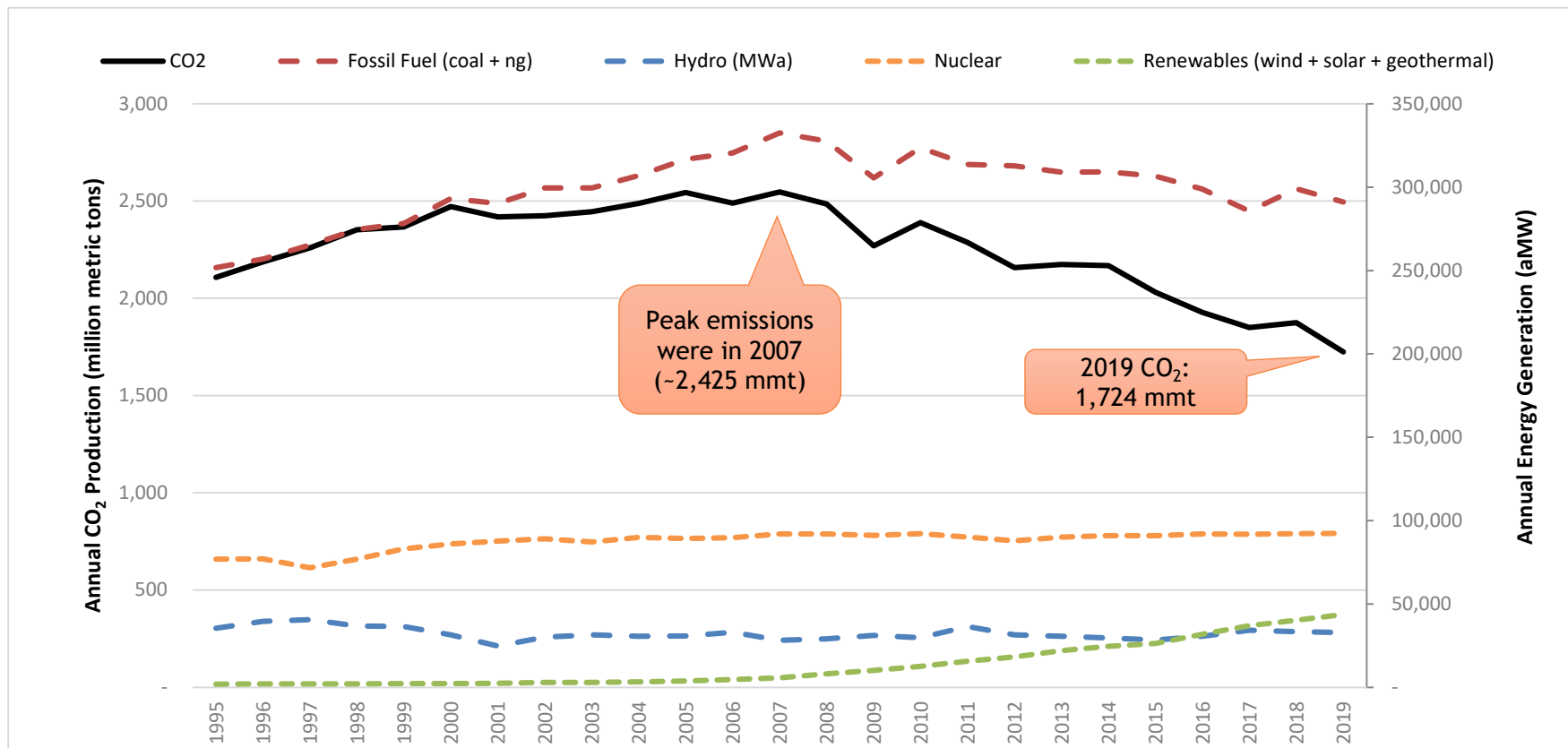




National Emissions

Factors behind the trends, comparison between region and United States

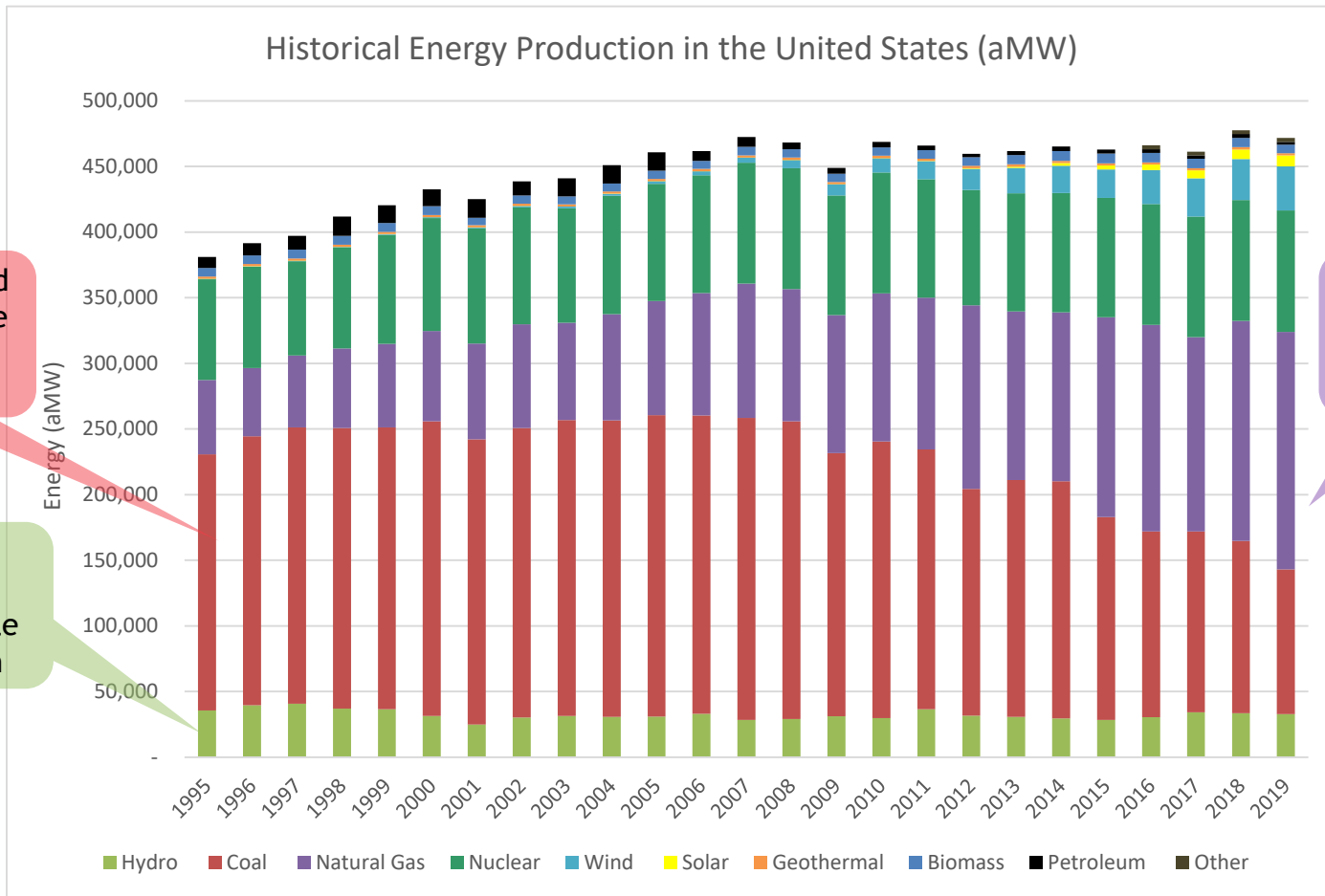
Annual carbon emissions from the generation of electricity: U.S.



- 2019 emissions decreased overall (after a slight increase in 2018), part of an ongoing downward trend
- Since peak in 2007, emissions have fallen ~32%



Trends in historical energy generation in the United States



Coal accounted for ~half of the nation's generation

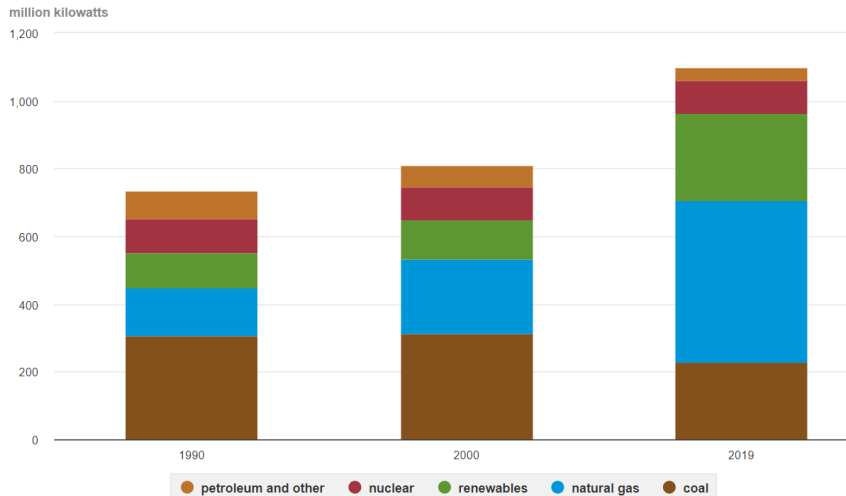
Hydro consistently plays small role in generation

Natural gas increasing in capacity and generation



Nationwide increase in natural gas development and dispatch

U.S. electricity generation capacity by major energy source, 1990, 2000, and 2019

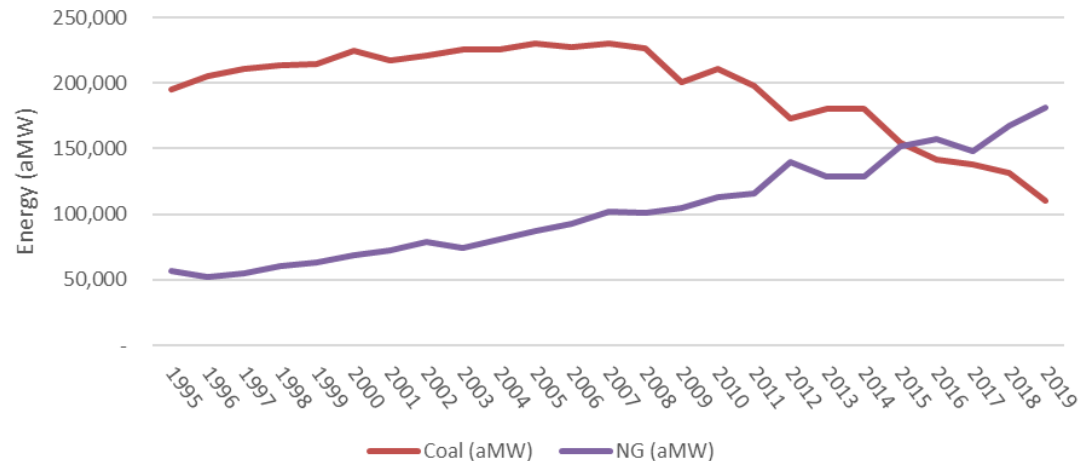


In 2016, gas generation overtook coal generation for the first time (on an annual basis) – and was the leading generating resource supplying 34% of US generation compared to coal’s 30%

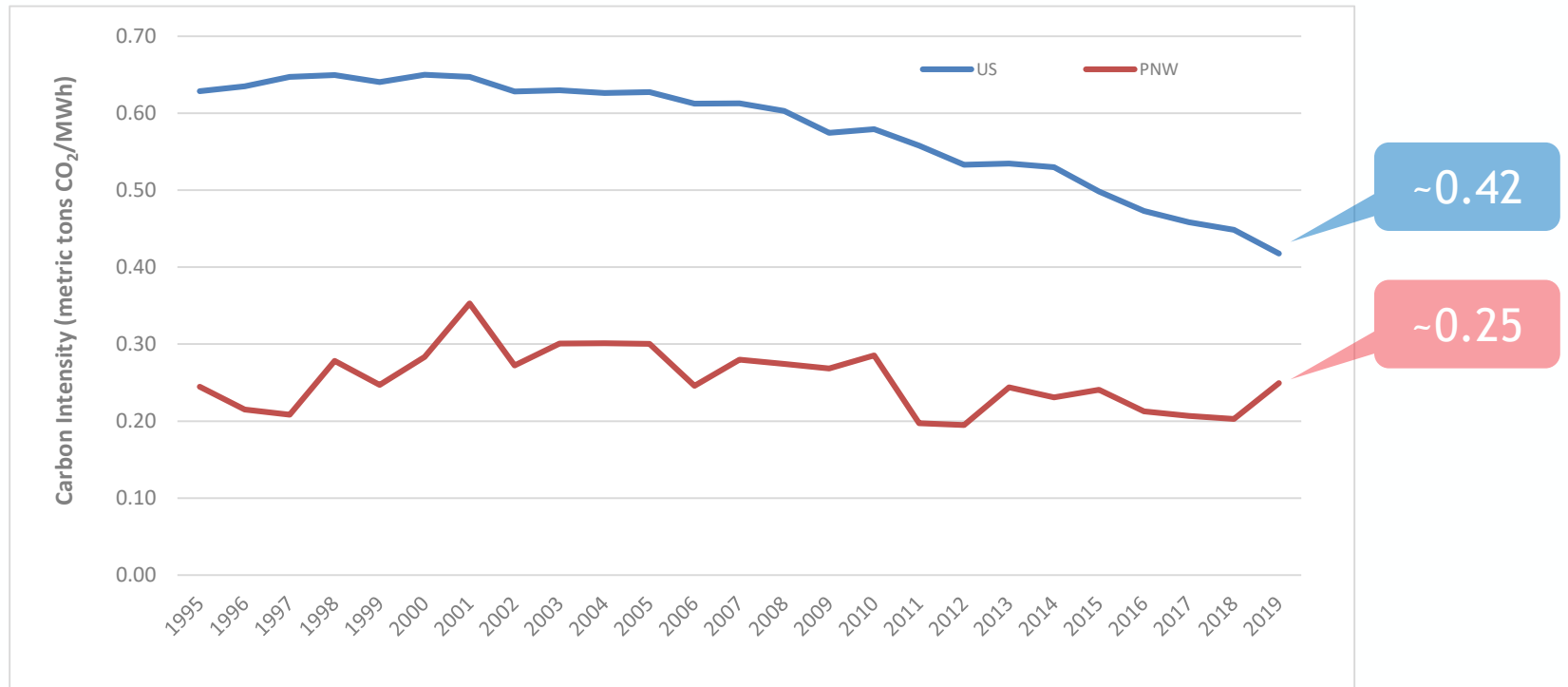
eia Note: Net summer capacity of utility-scale generators. Hydro includes conventional and pumped-storage hydro. Source: U.S. Energy Information Administration, Annual Energy Review 2011 and Electric Power Monthly, February 2020

In 2019, gas generation supplied 38% compared to coal’s 23%

Historical Fossil Fuel Generation in the US (aMW)



Carbon intensity: Region vs. United States



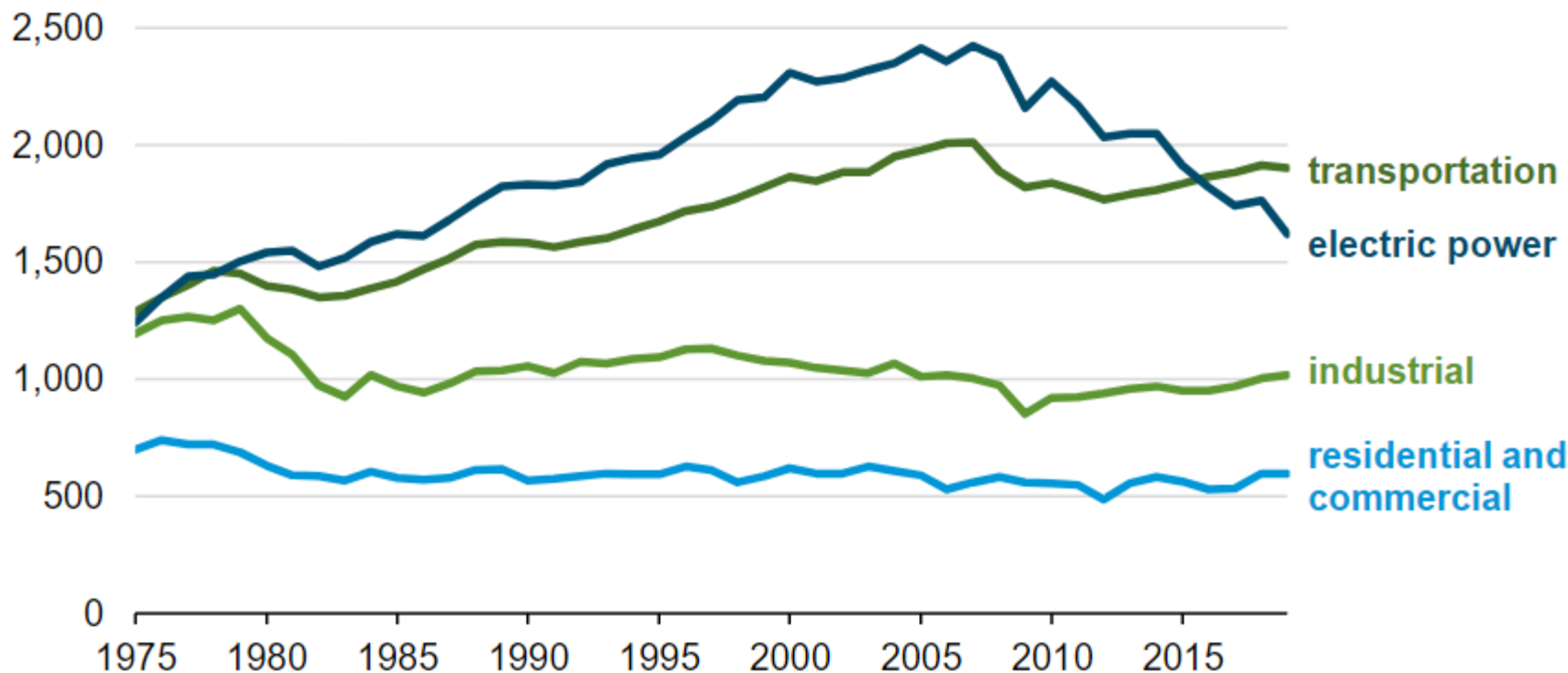
Carbon intensity of electricity is the amount of carbon emitted per unit of energy generated; in this case, million metric tons of CO₂ per megawatt hour



Significant decrease in US electric power emissions; flat or increasing in other sectors

U.S. energy-related carbon dioxide (CO₂) emissions by sector (1975-2019)

million metric tons



Source: U.S. Energy Information Administration, *Monthly Energy Review*

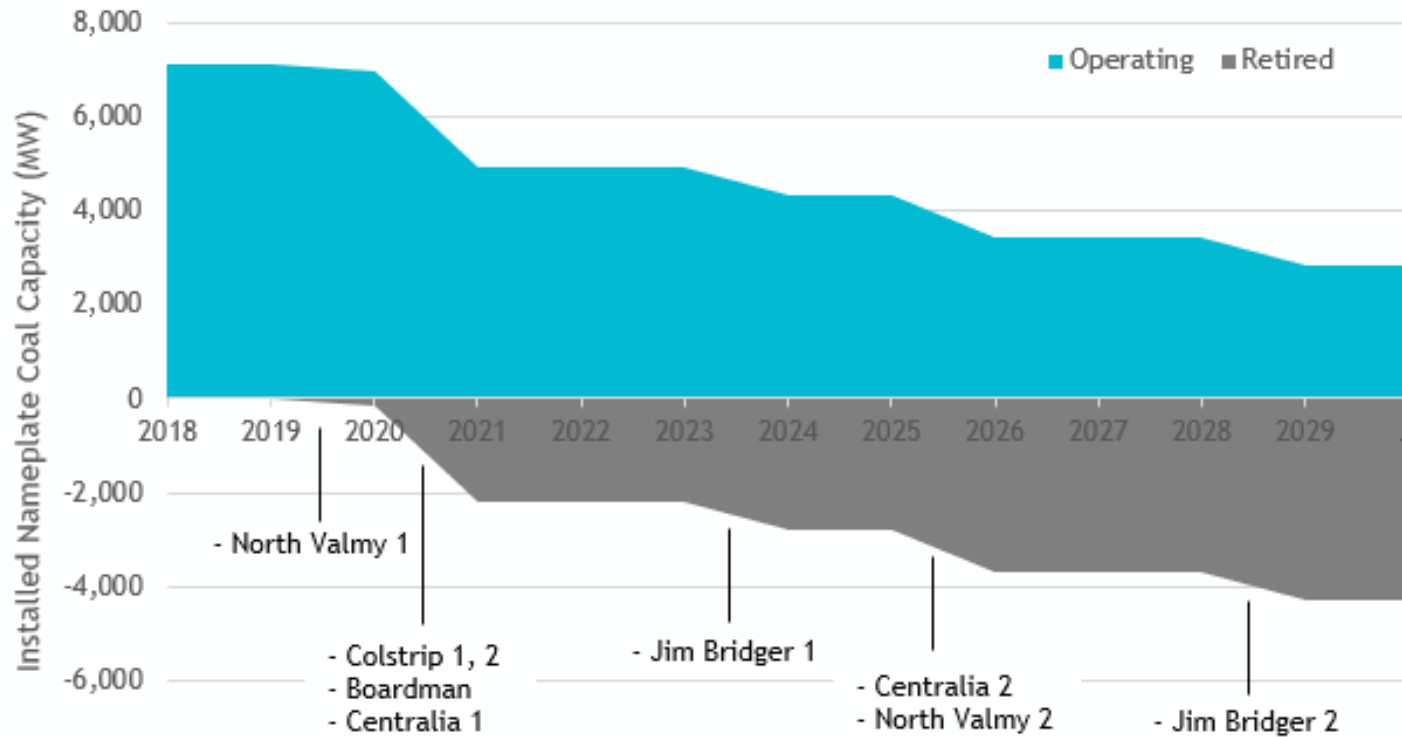


An abstract graphic featuring several overlapping geometric shapes. On the left, a teal shape with a white outline is partially visible. To its right is a light blue shape, also with a white outline. Further right is a large light green shape. The shapes are layered, with the teal and light blue shapes appearing to be in front of the light green one. The overall composition is clean and modern.

Looking ahead...

What do we expect future emissions to look like?

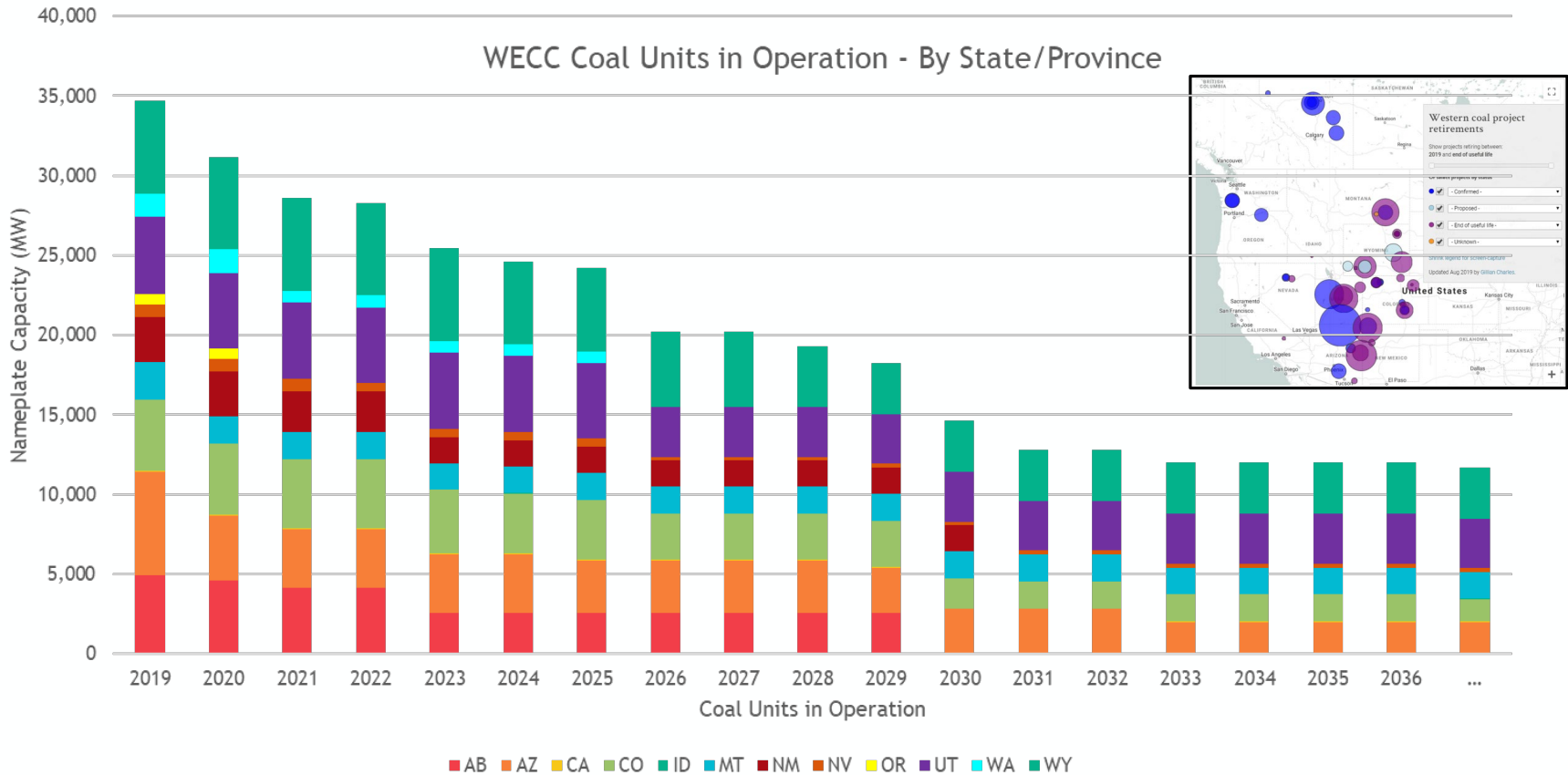
Regional coal retirements planned over the next decade



Planned retirements based on agreements, announcements, IRPs; subject to change
 Hardin Generating Station was sold to an out-of-region cryptocurrency company; therefore no longer “counts” towards the region
 Idaho Power ended its participation in North Valmy 1 in Dec 2019; unit will likely retire in 2021 (NV Energy)
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WECC Coal Units in Operation, Decreasing over Next 15 Years



Overall, coal operating in the WECC falls from about ~34GW in 2019, to ~15GW in 2030 and ~12.5GW in 2036



RPS and Clean Policies: WECC-wide (US only)

- Renewable portfolio standards and clean energy policies (and goals) establish a framework for existing resources and future resource development
- Legislation aimed at preserving coal units – eg. Wyoming Senate File 159

Washington Clean Energy Transformation Act (CETA, 2019)

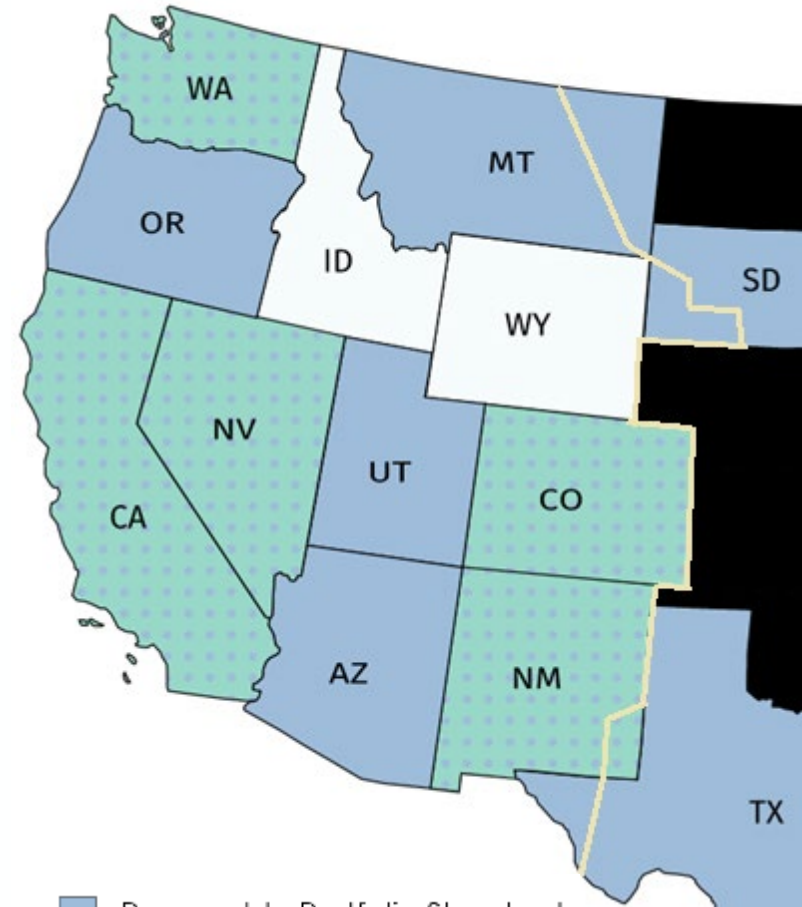
- No coal by EOY 2025; 2030 - 80% non-emitting; 2040 - 100% non-emitting (w/ 15% RPS still in effect)

Oregon Clean Electricity and Coal Transition Act (2016)

- No coal by EOY 2029; 2040 - 50% RPS

Montana Renewable Power Production and Rural Economic Development Act

- 2015 - 15% RPS



■ Renewable Portfolio Standard (or goal)

■ Clean Energy Standard (or goal)



2020 Outlook: Regional Emissions

Final data will not be available until late Fall 2021, however

- 2020 water year was above normal (remember, 2019 was well *below* normal!)
- Covid-19 may have suppressed demand
- Coal retirements:
 - Idaho Power ceased participation and divested its 50% ownership of North Valmy at EOY 2019
 - Colstrip 1, 2 – retired early January 2020
 - Boardman – retired October 2020
 - Centralia 1 – retired December 2020

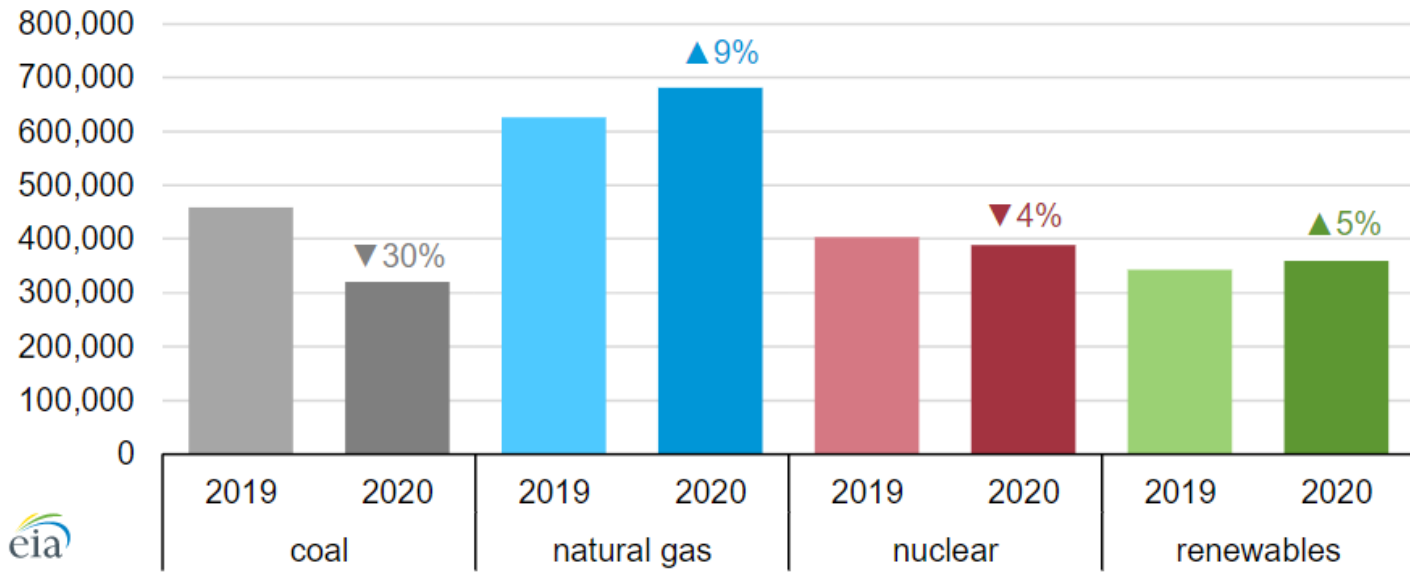
Accounted for
~17% of 2019
emissions

❖ 2020 emissions will likely decrease due to the improved hydro year; it will also be the first year we see the effect of some of the region's major coal unit retirements



2020 Outlook: US Emissions

Lower 48 states power generation by source (Jan–Jun, 2019–2020)
gigawatthours



Source: U.S. Energy Information Administration, *Hourly Electric Grid Monitor*

❖ Emissions will likely continue to decrease nationwide as trends continue to show increase in national gas use and decrease in coal dispatch and retirements



A photograph of a mountainous landscape shrouded in mist. In the foreground, a dark lake is visible. The mountains are covered in green and brown vegetation. A white, geometric, multi-sided shape is overlaid on the right side of the image, resembling a stylized house or a modern architectural element. The word "Questions?" is written in a large, black, sans-serif font on the left side of the image.

Questions?