Advanced Nuclear Energy

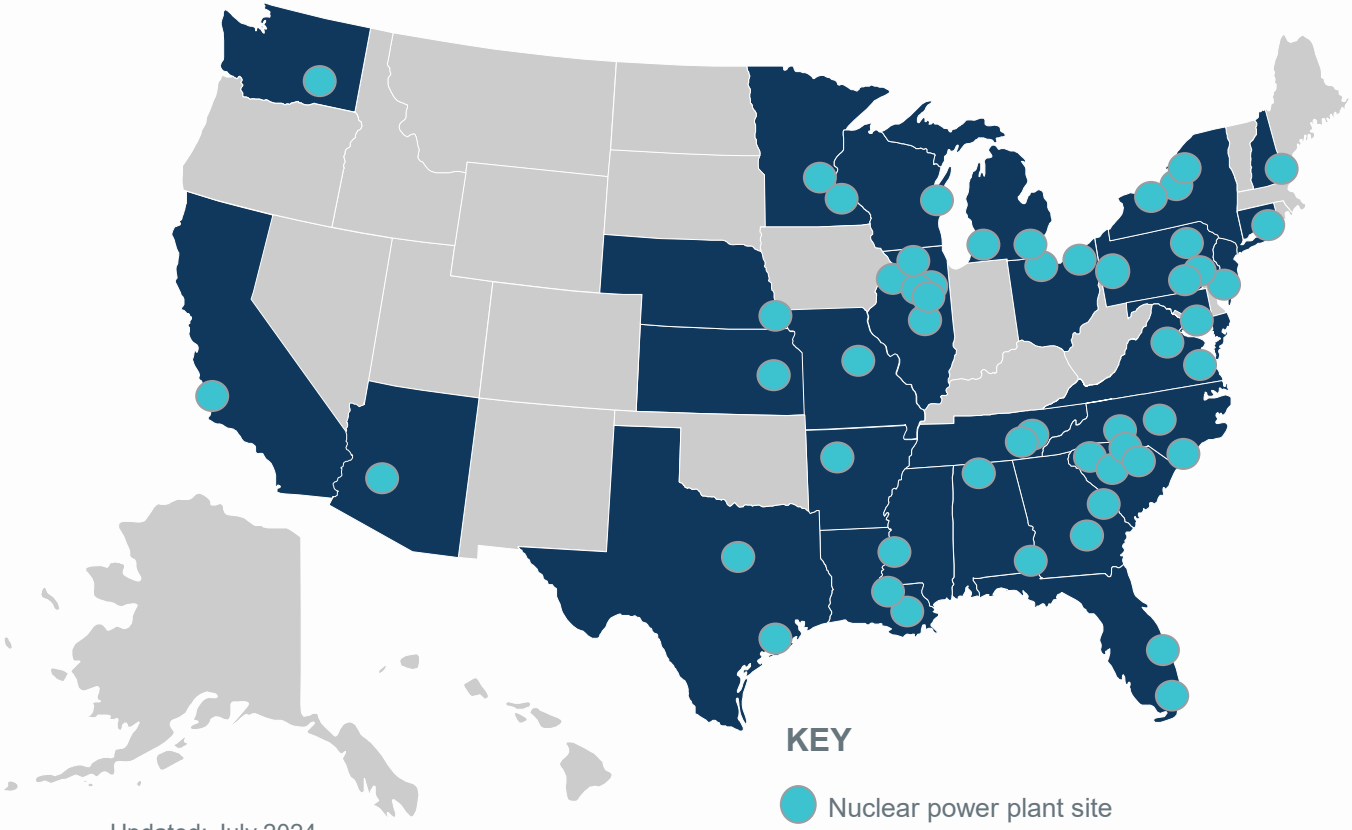
Oregon Senate Energy and Environment Committee

March 3, 2025

Kati Austgen
Director, Public Engagement
& New Nuclear

NUCLEAR ENERGY INSTITUTE

Nuclear Provides Majority of Emissions Free Electricity



Updated: July 2024

U.S. Clean Generation (2023)

47.8% NUCLEAR

26.2% WIND

14.8% HYDRO

10.2% SOLAR

1% GEOTHERMAL

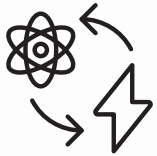
Recent Survey of NEI's U.S. Utilities

Nuclear power's potential role in meeting their company's decarbonization goals:

SLR

>90% of fleet expects to operate to at least **80 years**

GW



100 GWe of new nuclear opportunity by **2050s**

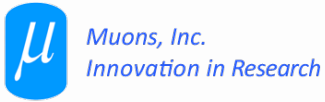
SMRs

Translates to roughly **300 SMR-scale plants**

NEI utility member companies produce nearly half of all US electricity.

More than half have more interest than in 2022 (prior survey year)

Advanced Nuclear Designer Members



Types of Advanced Reactors

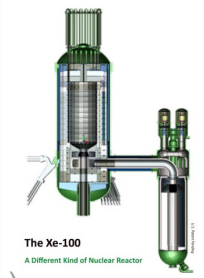
Range of sizes and features to meet diverse market needs

Water Cooled | Non-Water Cooled | Both

Westinghouse AP1000® (shown)
GE ABWR
GE ESBWR

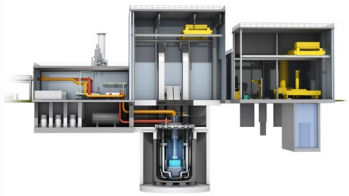
GEH BWRX-300 (shown)
NuScale
Holtec SMR-300
Westinghouse AP300

High Temp Gas Reactors



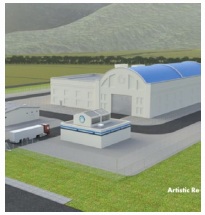
X-energy (shown)

Liquid Metal Reactors



TerraPower Natrium™ (shown)

Molten Salt Reactors



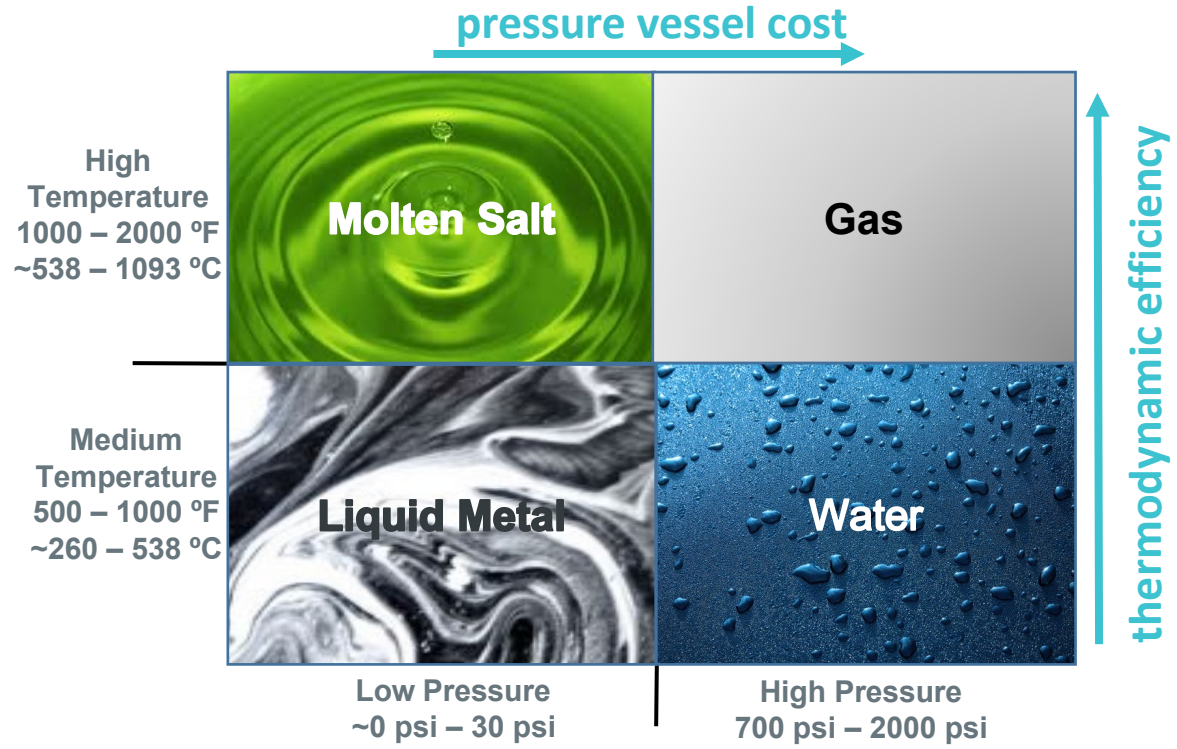
Kairos Hermes (shown)
Natura Resources

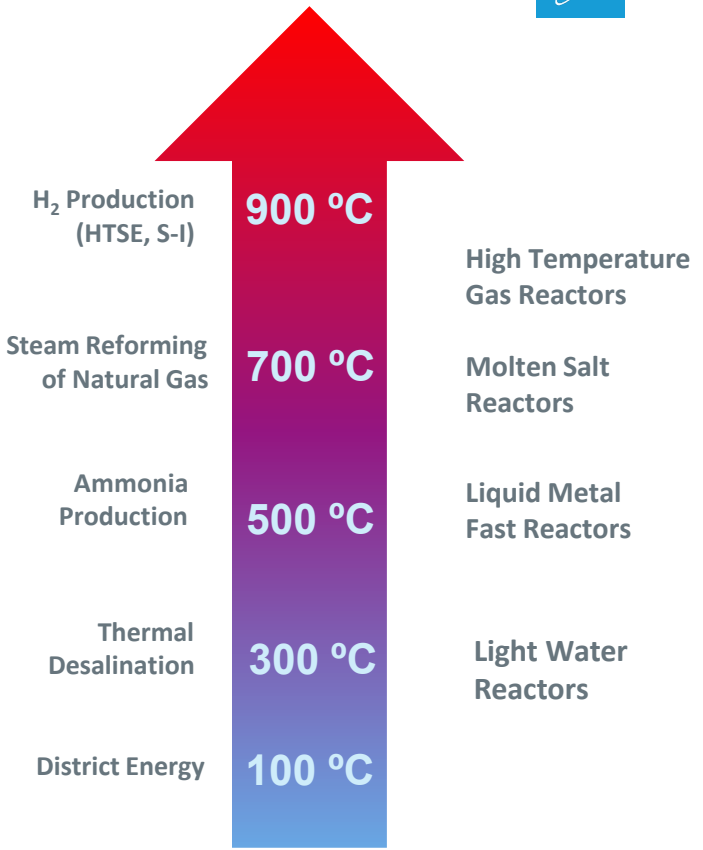
Oklo (shown)
Last Energy
Radiant
Westinghouse eVinci™

Large ~1000 MWe | Small Modular Reactors < 300 MWe | Micro < 50 MWe

Learn more about innovative technologies with the Nuclear Innovation Alliance.

Technology and Temperature





Advanced Nuclear Versatility

Spectrum of Sizes and Options

Micro

Small

Large

Variety of Outputs

Electricity

Isotopes

Hydrogen

Process Heat

Multitude of *New* Customers

Energy Transitions

Data Centers

Military Bases

Petrochemical

Cement

Steel

Oil & Gas

District Energy

Space

Pulp & Paper

Block Chain Mining

Transportation

Rail

Aviation

Maritime

Mining

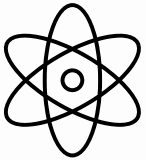
Agriculture

Fashion

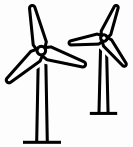
Desalination

Lowest System Cost Achieved by Enabling Large Scale New Nuclear Deployment

Lowest Cost System

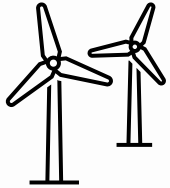


Nuclear is 43% of generation (>300 GW of new nuclear)

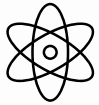


Wind and solar are 50%

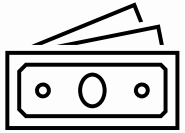
Energy System with Nuclear Constrained



Wind and Solar are 77% of generation



Nuclear is 13% (>60 GW of new nuclear)



Increased cost to customers of $449 Billion

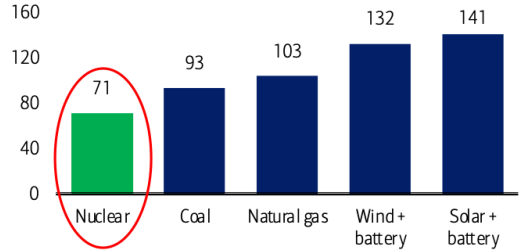
Both scenarios are successful in reducing electricity grid GHG emissions by over 95% by 2050 and reducing the economy-wide GHG emissions by over 60%

Scan to view the complete study.

Nuclear Energy is Affordable

"Nuclear appears to be the cheapest scalable, clean energy source by far."

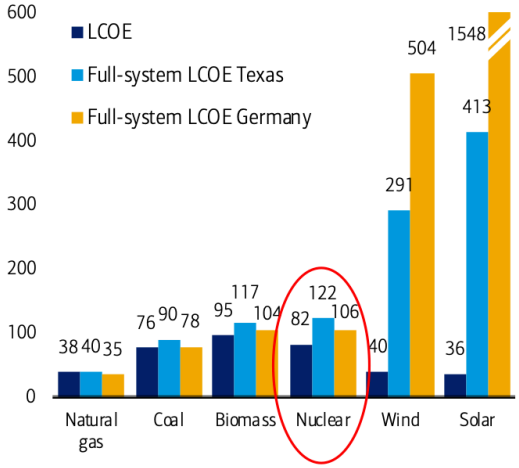
Exhibit 20: Nuclear is cost-effective…
Cost of generation, different sources ($/MWh)



Source: BofA Research Investment Committee, Lazard, Entler, et al. (2018). Note: nuclear, coal, and natural gas price estimates from Entler, et al. Wind and solar cost estimates are from Lazard's 2023 Levelized Cost of Energy+ report. Wind + battery and solar + battery use estimates from California's Independent System Operator (CAISO) and assume a 4-hour lithium-ion battery storage system to account for firming costs. All cost estimates show unsubsidized costs.

BofA GLOBAL RESEARCH

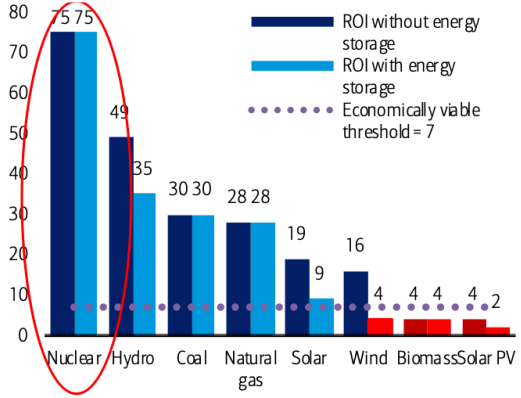
Exhibit 21: …especially on an "all-in basis"…
LCOE & LFSCOE calculations by energy source



Source: BofA Research Investment Committee, Idel 2022

BofA GLOBAL RESEARCH

Exhibit 22: …and has the highest energy ROI
Energy returned on energy invested, by source



Source: BofA Research Investment Committee, D. Weißbach, G. Ruprecht, A. Huke, K. Czerski, S. Gottlie, A. Hussein; Red signals EROI below economically viable threshold

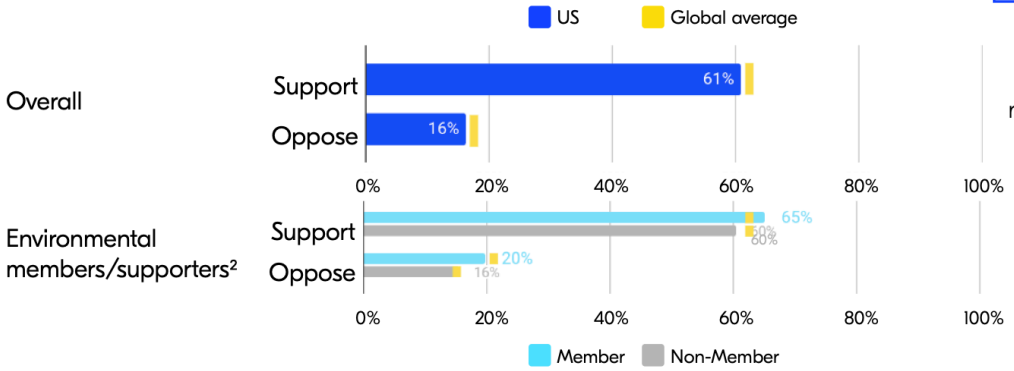
BofA GLOBAL RESEARCH

Bank of America Analyst Report: https://advisoranalyst.com/wp-content/uploads/2023/05/bofa-the-ric-report-the-nuclear-necessity-20230509.pdf

Strong Public Support for Nuclear Energy

US

Support vs. opposition[1]



n=4,250

Support by...

Gender

Men	73%
Women	50%

Age

18-34	58%
35-54	62%
55+	62%

Income

Low income (under 50k USD)	52%
Medium income (50k-100k USD)	60%
High income (100k+ USD)	70%

Political Affiliation

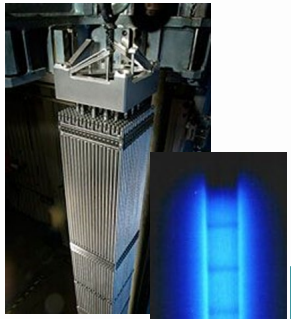
Democrat	61%
Independent	60%
Republican	66%

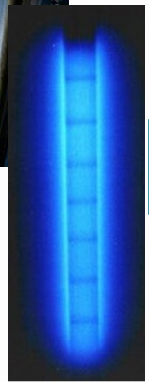
Top 5 nuclear sentiments[3]
(% agree)

We need a way to produce more and more energy for our economy to keep growing	76%
We need to be building capacity for more energy, not just trying to use less	63%
We need nuclear energy in the mix, along with renewables, if we are to meet our climate goals	60%
Leaving nuclear waste behind is just wrong, however safe it is	59%
We should use advanced nuclear energy to reduce our dependence on other countries	58%

Source: Potential Energy, 2023, https://potentialenergycoalition.org/wp-content/uploads/NewNuclear_Report_May2023.pdf

Current (& Future) Fuel Cycle – Back End





Reactor

Pool

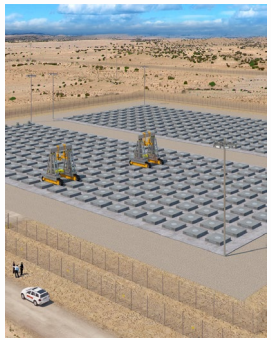
Dry Cask

Geologic Repository

(Option for future) Recycle

Geologic Repository or Final Disposal

- Nations making progress on used nuclear fuel disposal
  - Sweden, Finland, – repository approved/licensed, under construction
  - France, Canada – site identified, in public consultation toward pilot phase/geologic investigations under way
  - Switzerland – geologic investigations supporting siting process underway
  - U.S. – Yucca Mountain designated by law, alternatives being considered
- Consolidated Interim Storage
  - France, Sweden, Switzerland have deployed CIS
  - U.S. companies pursuing CIS solutions



States Taking Action for Nuclear

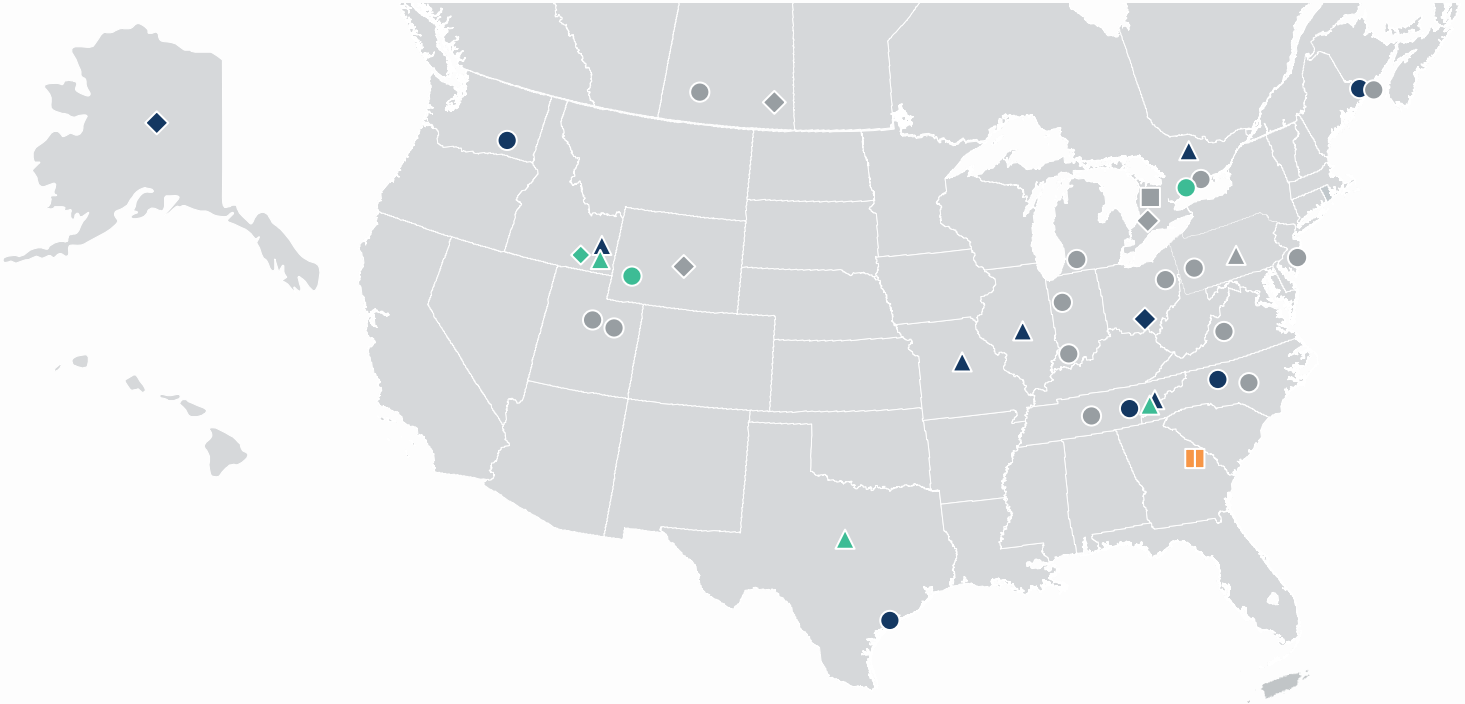
Exploring Nuclear Technology with Studies, Working Groups, Commissions and Task Forces	Connecticut, Florida, Indiana, Kentucky, Louisiana, Maryland, Michigan, Montana, Nebraska, New Hampshire, Ohio, Pennsylvania, Tennessee, and Texas
Recognizing Nuclear as a Clean Energy Resource	Idaho, Michigan, Minnesota, North Carolina, Tennessee, Utah, and Virginia
Removing Barriers and Signaling Support	Repealing Nuclear Moratoriums: Connecticut, Illinois, Kentucky, Montana, West Virginia, and Wisconsin Signaling Regulatory Support: Indiana, Mississippi, North Carolina, and South Dakota
Incentivizing Nuclear Technology and Supply Chain	Kentucky, Michigan, Tennessee, Virginia, Washington, and Wyoming

Current State Policies: https://www.nei.org/resources/reports-briefs/state-legislation-and-regulations
State Policy Options: https://www.nei.org/resources/reports-briefs/policy-options-for-states-to-support-new-nuclear

Advanced Nuclear Deployment Plans

Projects that may be in operation by early 2030s

Updated 01/17/2025



Legend

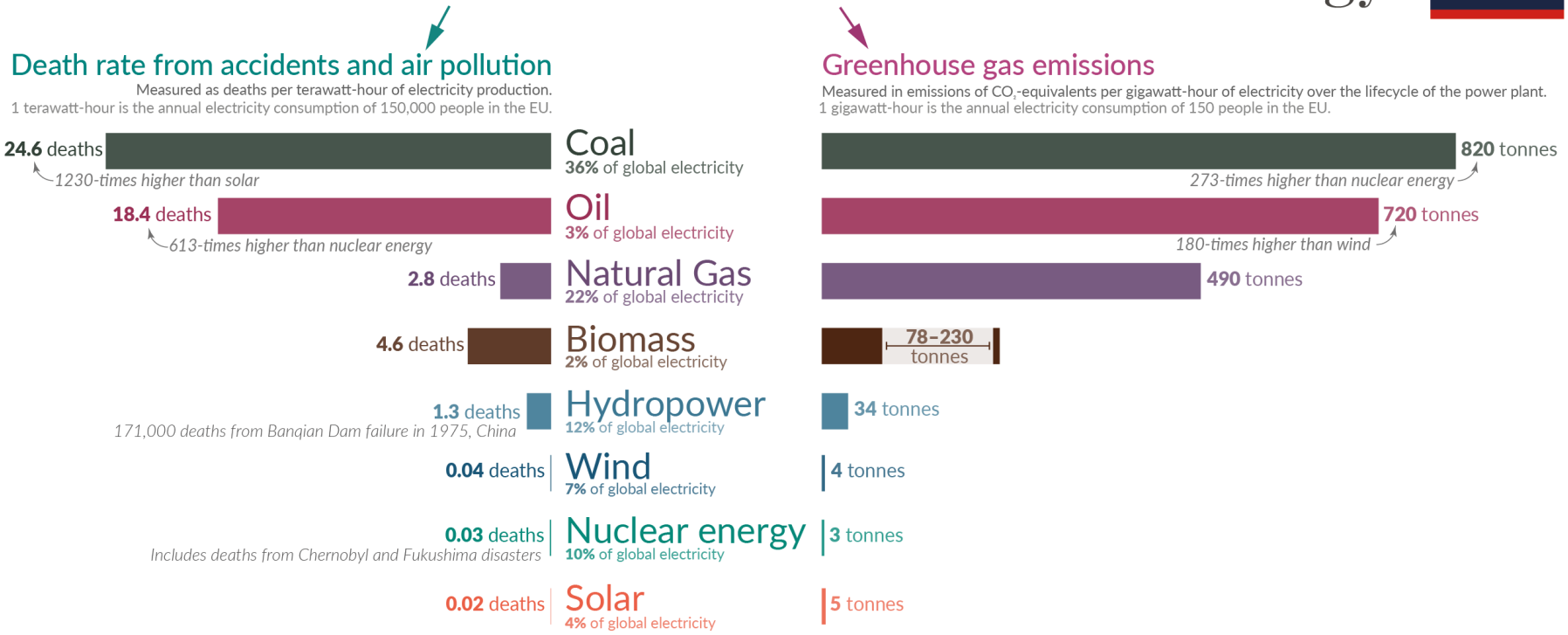
- Considered project
- Planned project
- Under construction
- Operating
- Large (1,000 MWe)
- Small (<300 MWe)
- Micro-reactor (<50 MWe)
- University / Research / Test

QUESTIONS?

By Third Way, GENSLER

What are the safest and cleanest sources of energy?

Our World in Data



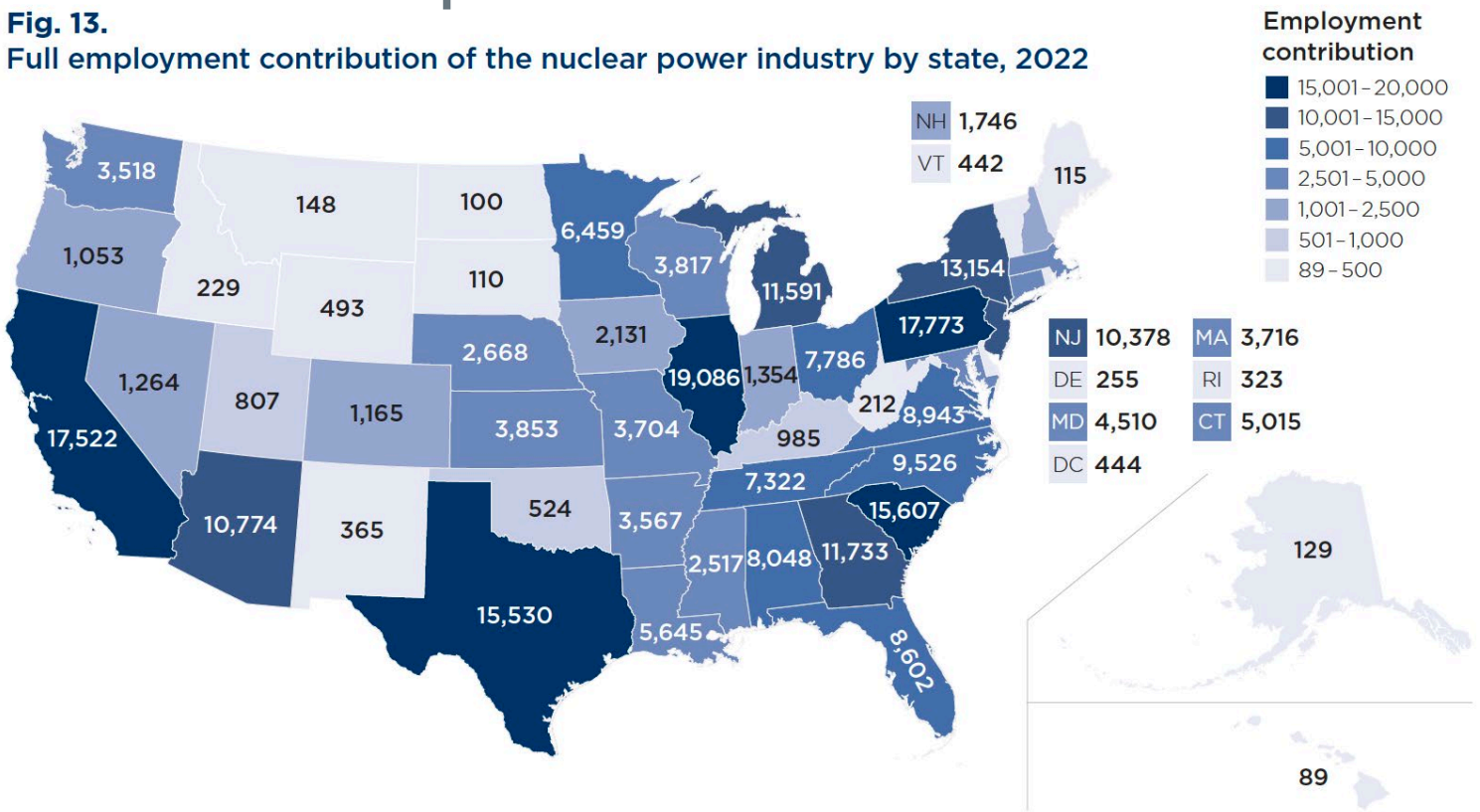
Death rates from fossil fuels and biomass are based on state-of-the art plants with pollution controls in Europe, and are based on older models of the impacts of air pollution on health. This means these death rates are likely to be very conservative. For further discussion, see our article: OurWorldinData.org/safest-sources-of-energy. Electricity shares are given for 2021.

Data sources: Markandya & Wilkinson (2007); UNSCEAR (2008; 2018); Sovacool et al. (2016); IPCC AR5 (2014); Pehl et al. (2017); Ember Energy (2021).

Source: https://ourworldindata.org/safest-sources-of-energy

Economic Impacts of Nuclear in the U.S.

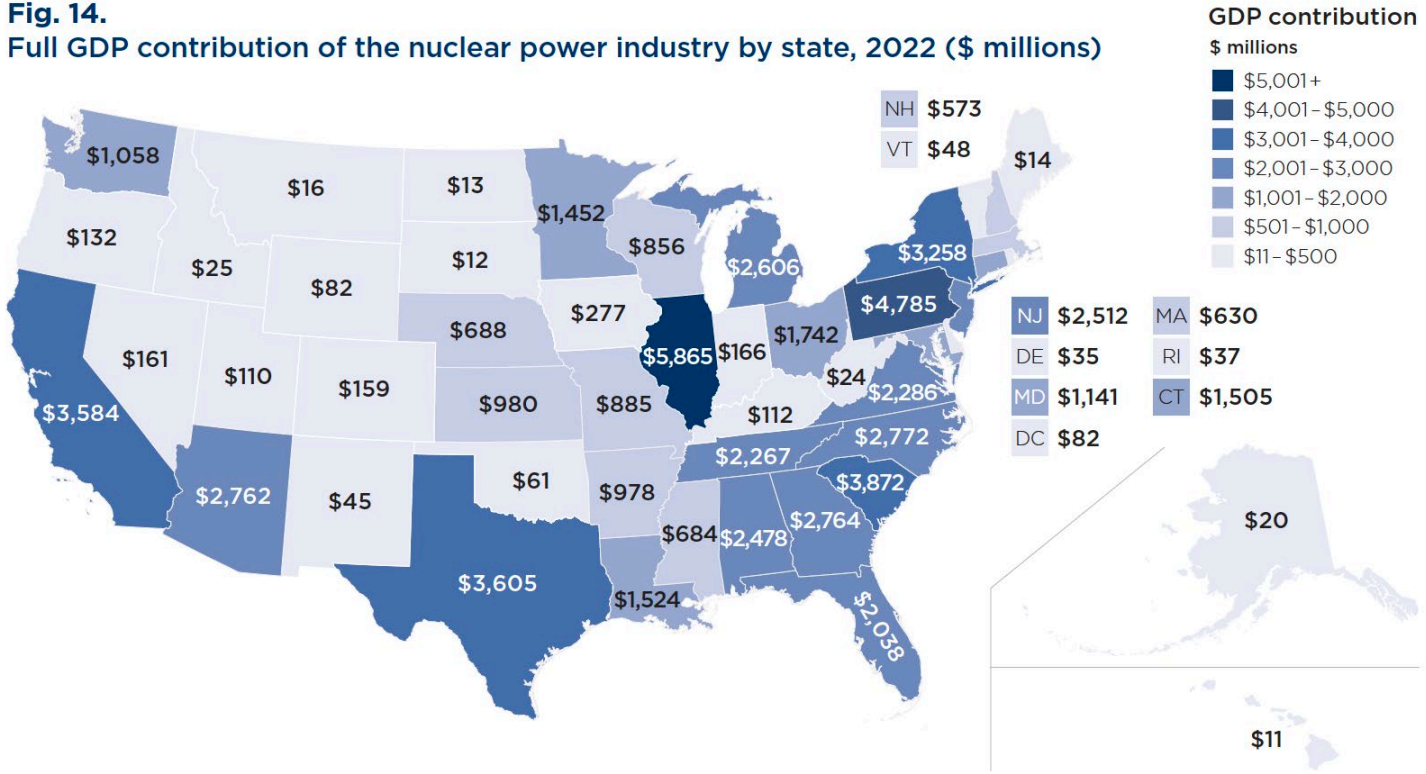
Fig. 13.
Full employment contribution of the nuclear power industry by state, 2022



Source: https://www.oxfordeconomics.com/resource/the-economic-contribution-of-the-us-nuclear-power-industry/

Economic Impacts of Nuclear in the U.S.

Fig. 14.
Full GDP contribution of the nuclear power industry by state, 2022 ($ millions)



Source: https://www.oxfordeconomics.com/resource/the-economic-contribution-of-the-us-nuclear-power-industry/

Growth Rates Increasing Almost Everywhere

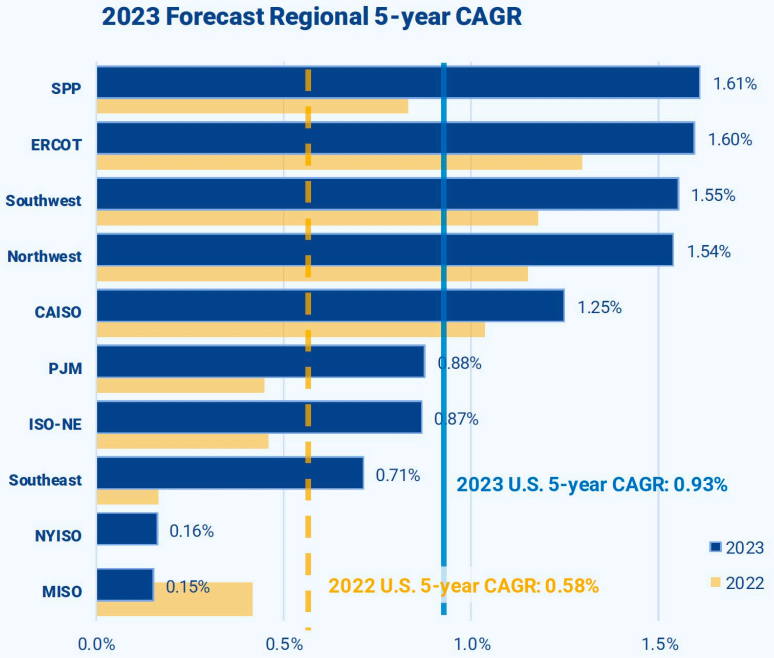
From 2022 to 2023, the 5-year national forecast for peak demand shot up by about 50% – from 0.63% annual growth to 0.93%.

Annual growth rates are measured using the Compound Annual Growth Rate (CAGR). The CAGR represents the rate at which the initial load forecast or current load needs to grow annually to match the forecasted load in the final year assuming an annually compounded growth rate.

CAGRs can be useful to compare forecasted load growth of different utilities regardless of the size of the utility.

The only region where the CAGR decreased in 2023 is MISO. However, as discussed in the MISO profile, expedited new load projects are flooding MISO's planning process and should drive an increase in future load forecasts.

NOTE | The "Southwest" region includes some utilities that might be characterized as central western.



Source: https://gridstrategiesllc.com/wp-content/uploads/2023/12/National-Load-Growth-Report-2023.pdf