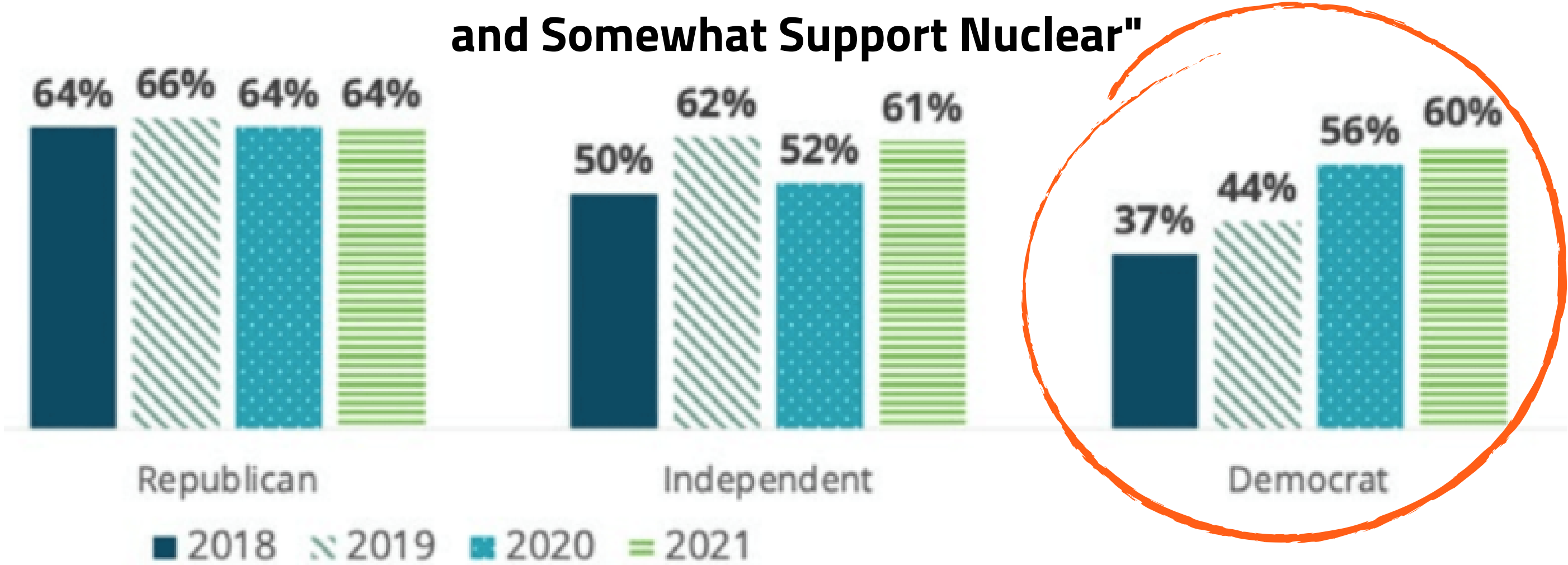


SUPPORT FOR NUCLEAR POWER HAS GROWN AMONG DEMOCRATS.

Survey Question: America's traditional nuclear power plants produce around 20% of our electricity. Which is closest to your opinion? "Strongly and Somewhat Support Nuclear"



<https://ecoamerica.org/american-climate-perspectives-survey-2021-vol-v/>

© ecoAmerica 2021

WHY IS THAT?

THEY'RE REALIZING THAT...

Nuclear energy jobs pay \$42/hour,

Wind and solar pay \$25/hour

Nuclear power plants have **triple the unionization rates** of
wind and solar industries

Components for nuclear plants are largely made domestically.

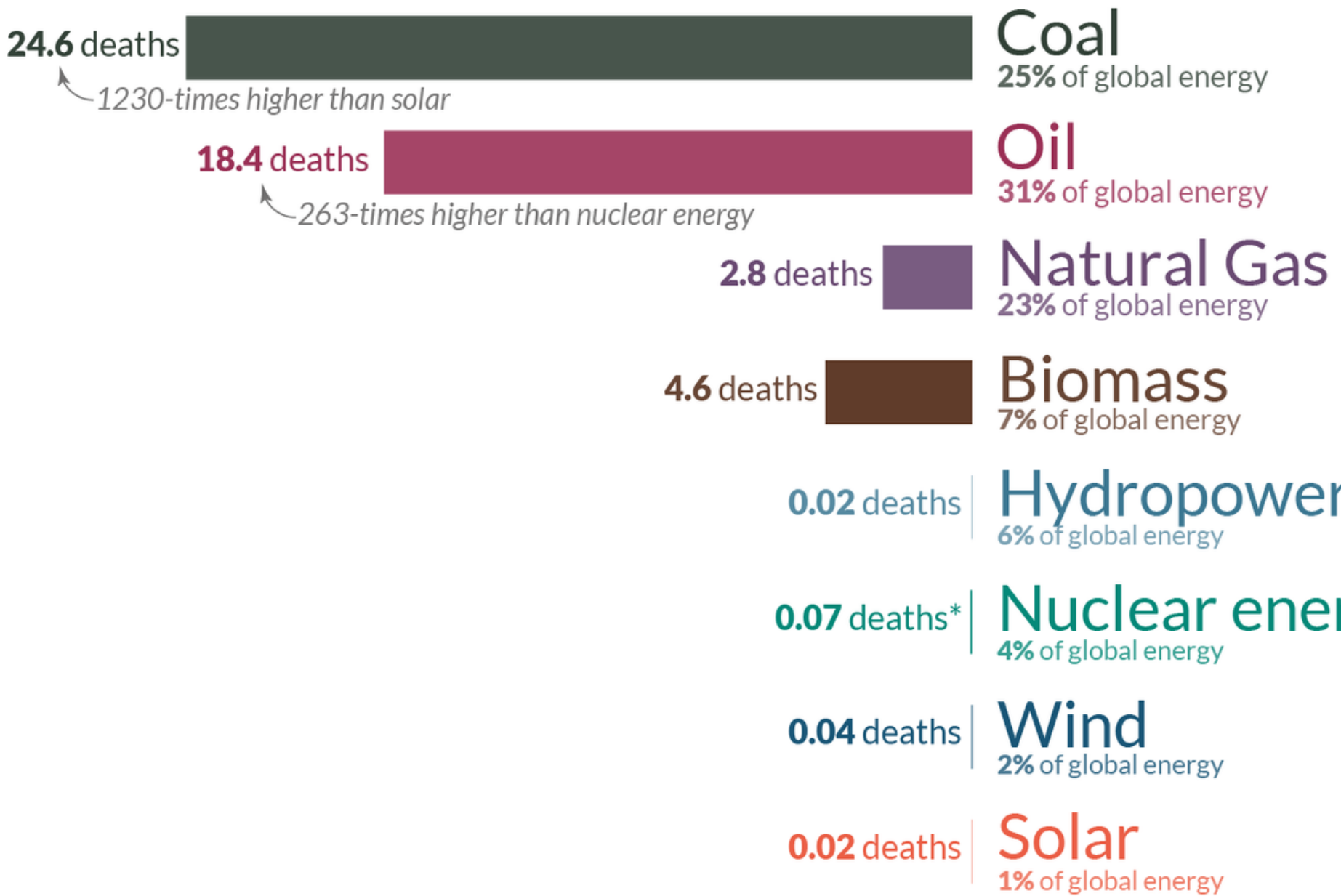
Wind and solar are largely imported.

Nuclear and renewables working together will give us our best
chance at a just transition to clean power

What are the **safest** and **cleanest** sources of energy?

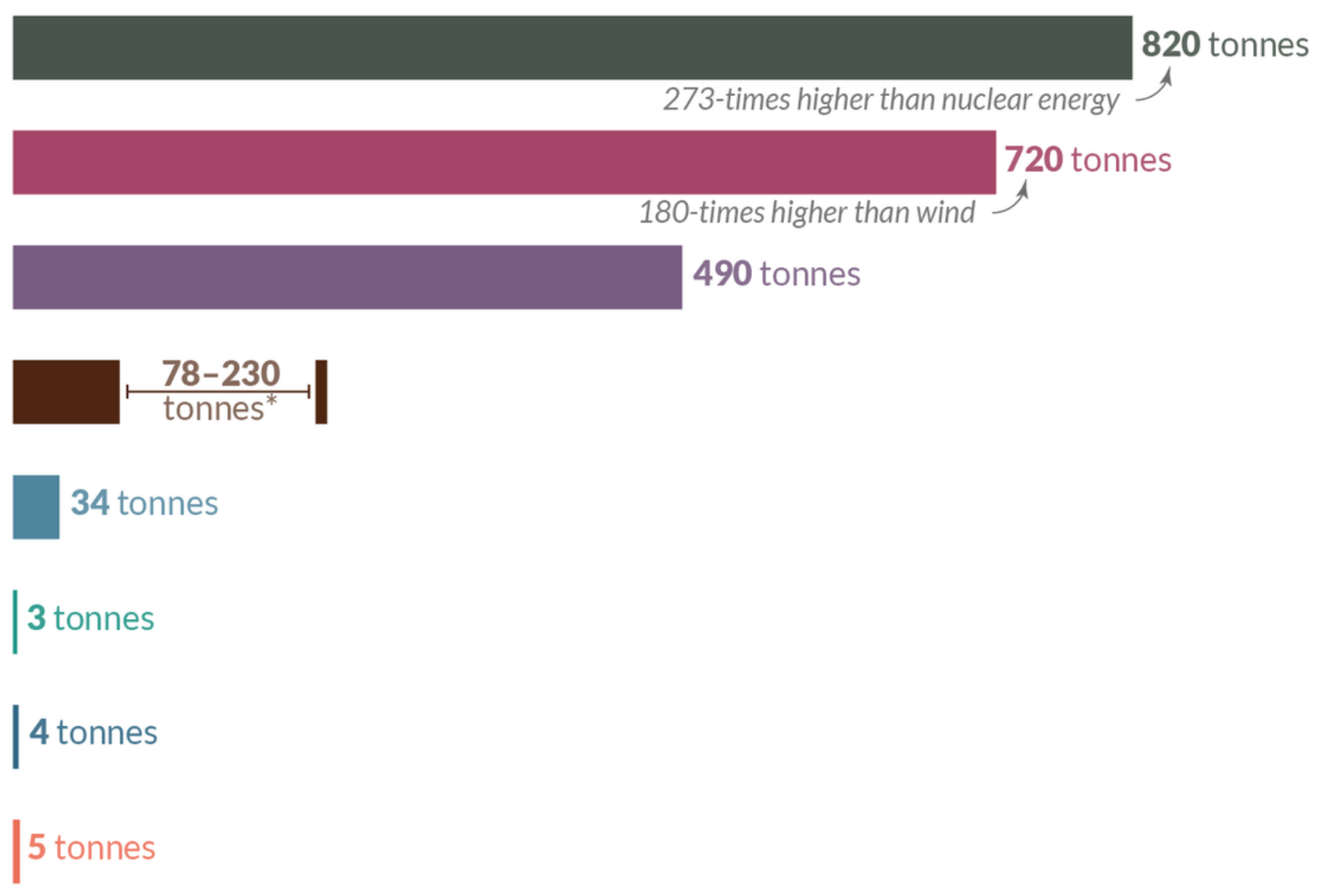
Death rate from accidents and air pollution

Measured as deaths per terawatt-hour of energy production.
1 terawatt-hour is the annual energy consumption of 27,000 people in the EU.



Greenhouse gas emissions

Measured in emissions of CO₂-equivalents per gigawatt-hour of electricity over the lifecycle of the power plant.
1 gigawatt-hour is the annual electricity consumption of 160 people in the EU.



*Life-cycle emissions from biomass vary significantly depending on fuel (e.g. crop residues vs. forestry) and the treatment of biogenic sources.
 *The death rate for nuclear energy includes deaths from the Fukushima and Chernobyl disasters as well as the deaths from occupational accidents (largely mining and milling).
 Energy shares refer to 2019 and are shown in primary energy substitution equivalents to correct for inefficiencies of fossil fuel combustion. Traditional biomass is taken into account.
Data sources: Death rates from Markandya & Wilkinson (2007) in *The Lancet*, and Sovacool et al. (2016) in *Journal of Cleaner Production*;
 Greenhouse gas emission factors from IPCC AR5 (2014) and Pehl et al. (2017) in *Nature*; Energy shares from BP (2019) and Smil (2017).
 OurWorldinData.org – Research and data to make progress against the world’s largest problems. Licensed under CC-BY by the authors Hannah Ritchie and Max Roser.

Right now it is illegal to build new nuclear plants in Minnesota.

The DFL is opposed to nuclear energy (the national Democrats are not.)

This ban is related to there not being a long-term storage plan for the spent fuel.
Right now the fuel is stored in casks like these:

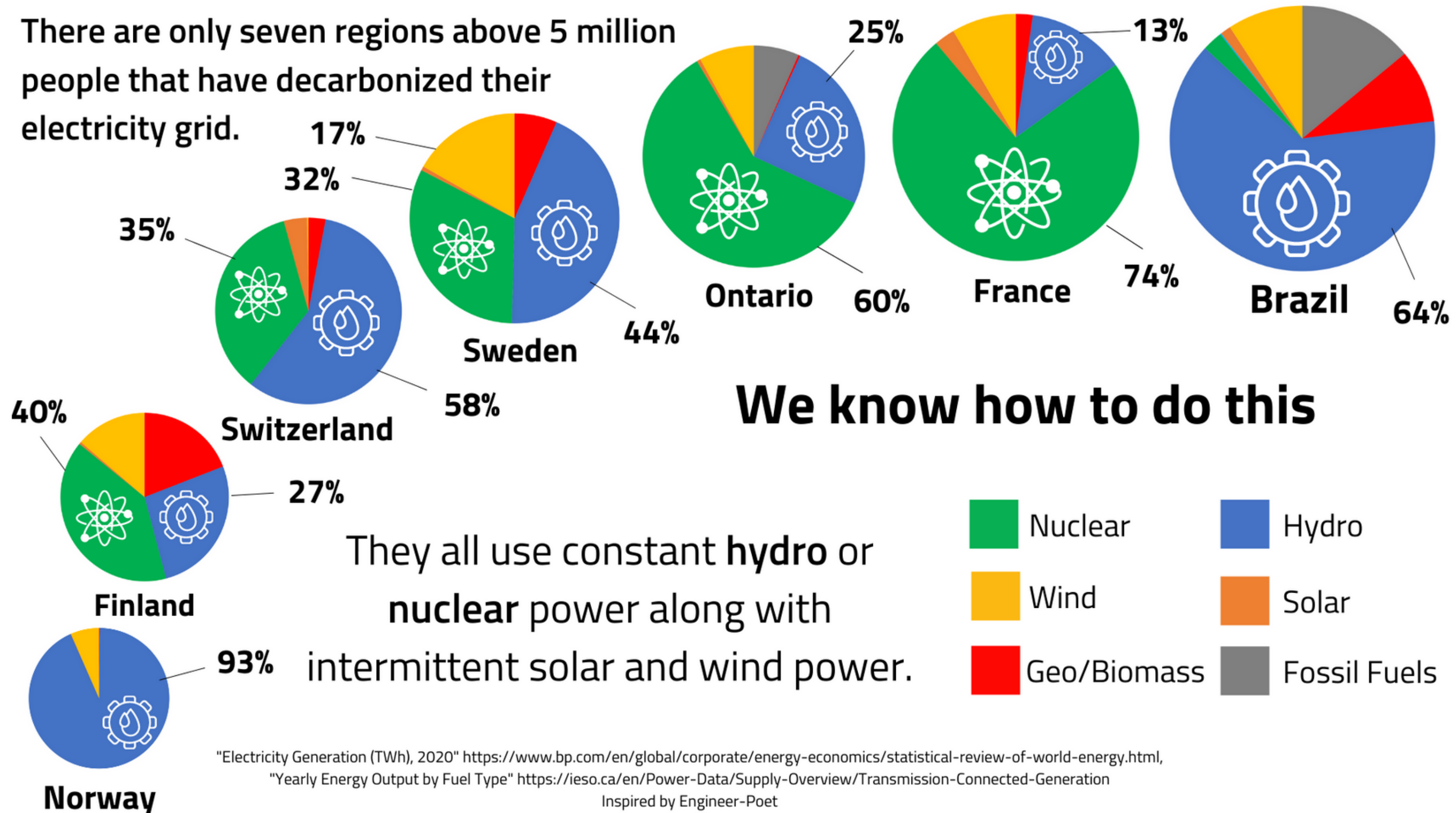


While this needs to be addressed, in our view it isn't as urgent as the threat of climate change. We also fear that a renewables-only future will require more mining, create fewer union jobs, and drive a significant increase in electricity rates (as has been seen elsewhere in the world.)

In the last few years, four other states have lifted restrictions on new nuclear (WV, KY, WI, and MT).
In 39 states, there is no legislative prohibition on nuclear power.
These states are able to more deeply assess a just transition from fossil fuels to nuclear energy.

We can look to the success of other countries and regions.

There are only seven regions above 5 million people that have decarbonized their electricity grid.



We know how to do this

They all use constant **hydro** or **nuclear** power along with intermittent solar and wind power.

"Electricity Generation (TWh), 2020" <https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html>,

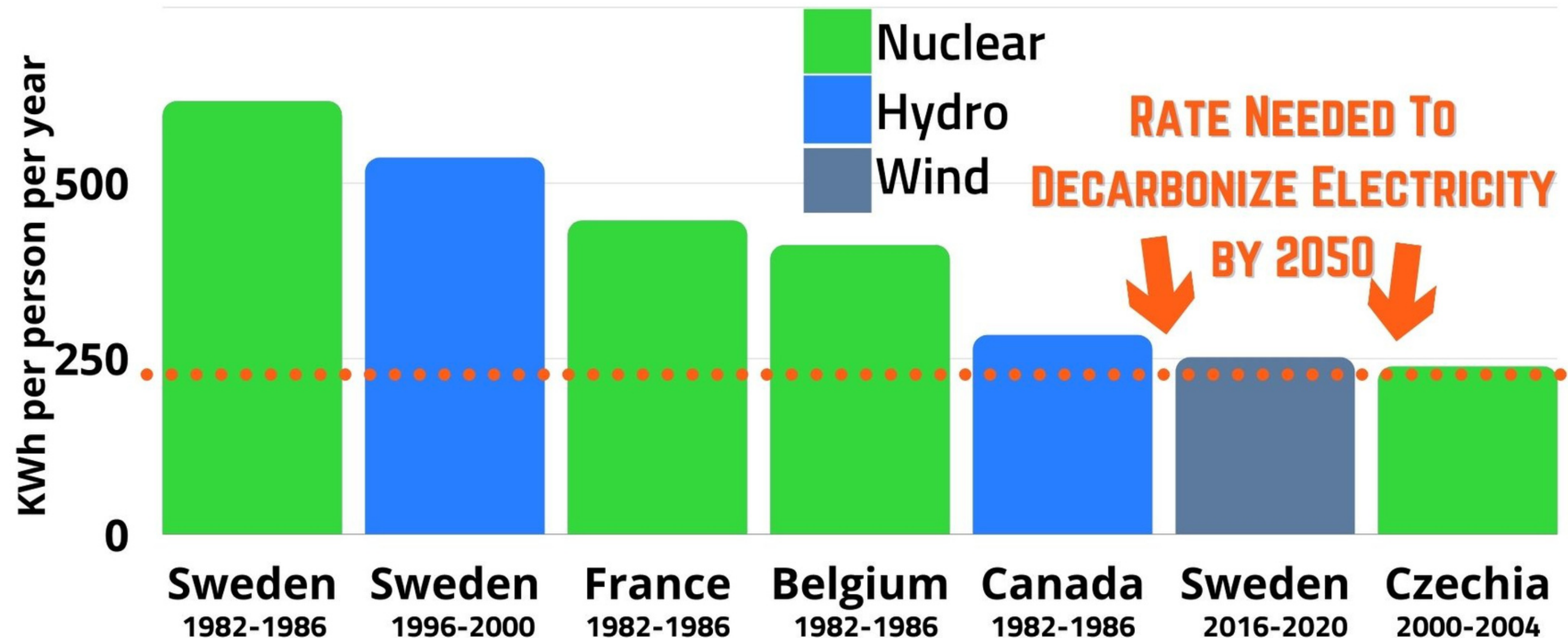
"Yearly Energy Output by Fuel Type" <https://ieso.ca/en/Power-Data/Supply-Overview/Transmission-Connected-Generation>

Inspired by Engineer-Poet

**Doesn't it take too long to
build nuclear power plants?**

We've only ever added clean energy fast enough a few times in history to meet our timetable for deep decarbonization.

FASTEST CLEAN ENERGY BUILDS IN HISTORY*



Sources: BP World Energy Review, 2021.

*Countries of more than ten million people.

Assuming all existing generation is retired by 2050.

Data: <https://bit.ly/energygrowthrate>. Analysis by volunteer engineers.

Nuclear energy has been one of the fastest ways we've ever added clean energy.

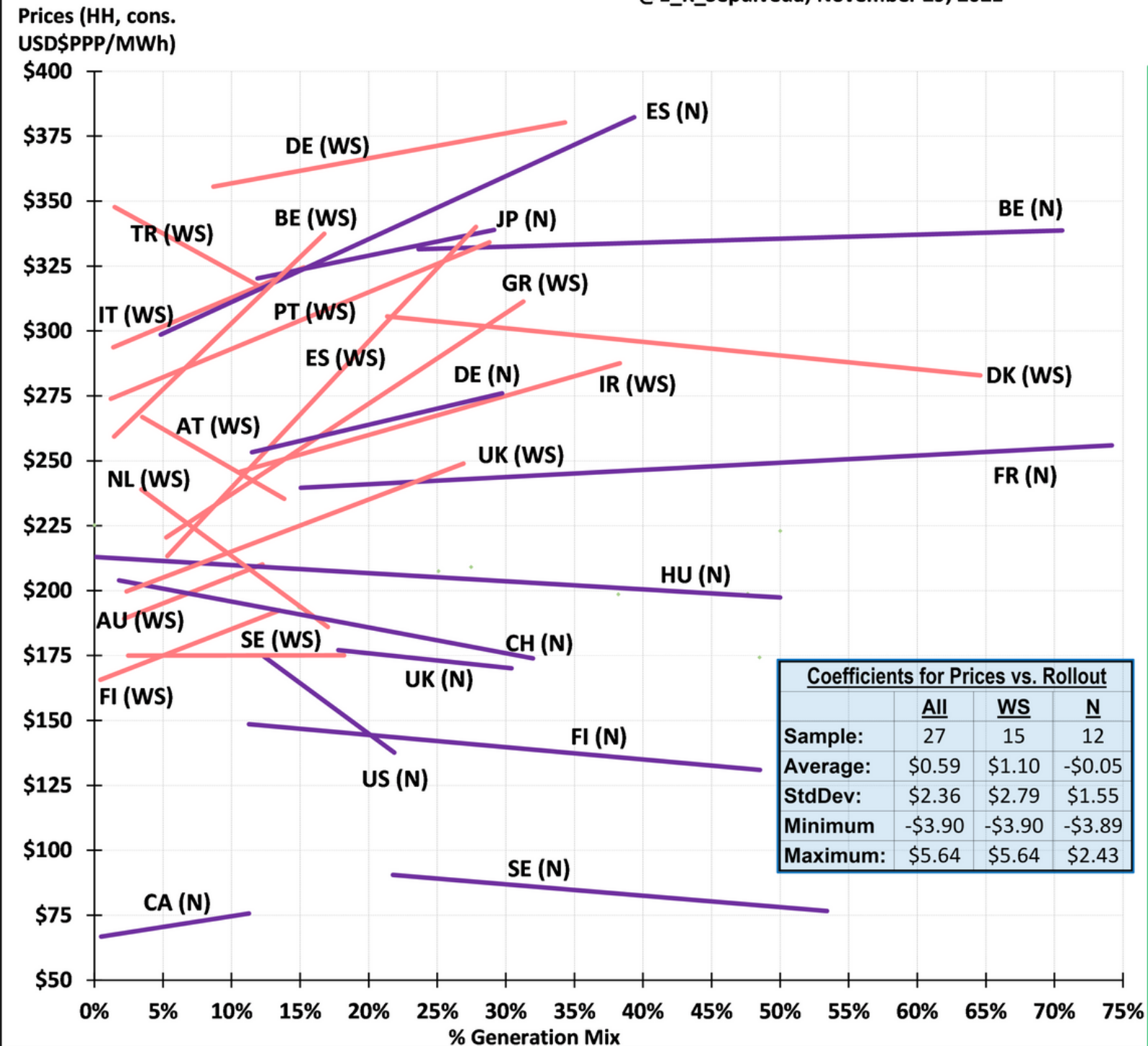
What about the cost?

Isn't nuclear too expensive?

"Levelized costs of electricity" don't tell the full story.

Prices vs. Nuclear (N) and Wind & Solar (WS) rollouts

@E_R_Sepulveda; November 29, 2021



Comment: This graphic shows the trendlines representing the statistical association between peak rollout of N and WS and real household prices. The average slope of these linear bivariate regressions suggests a 1%-point increase in generation % mix in N has ≈ 0 association with prices; but for WS it is associated with a price increase of $\approx \$1/\text{MWh}$.

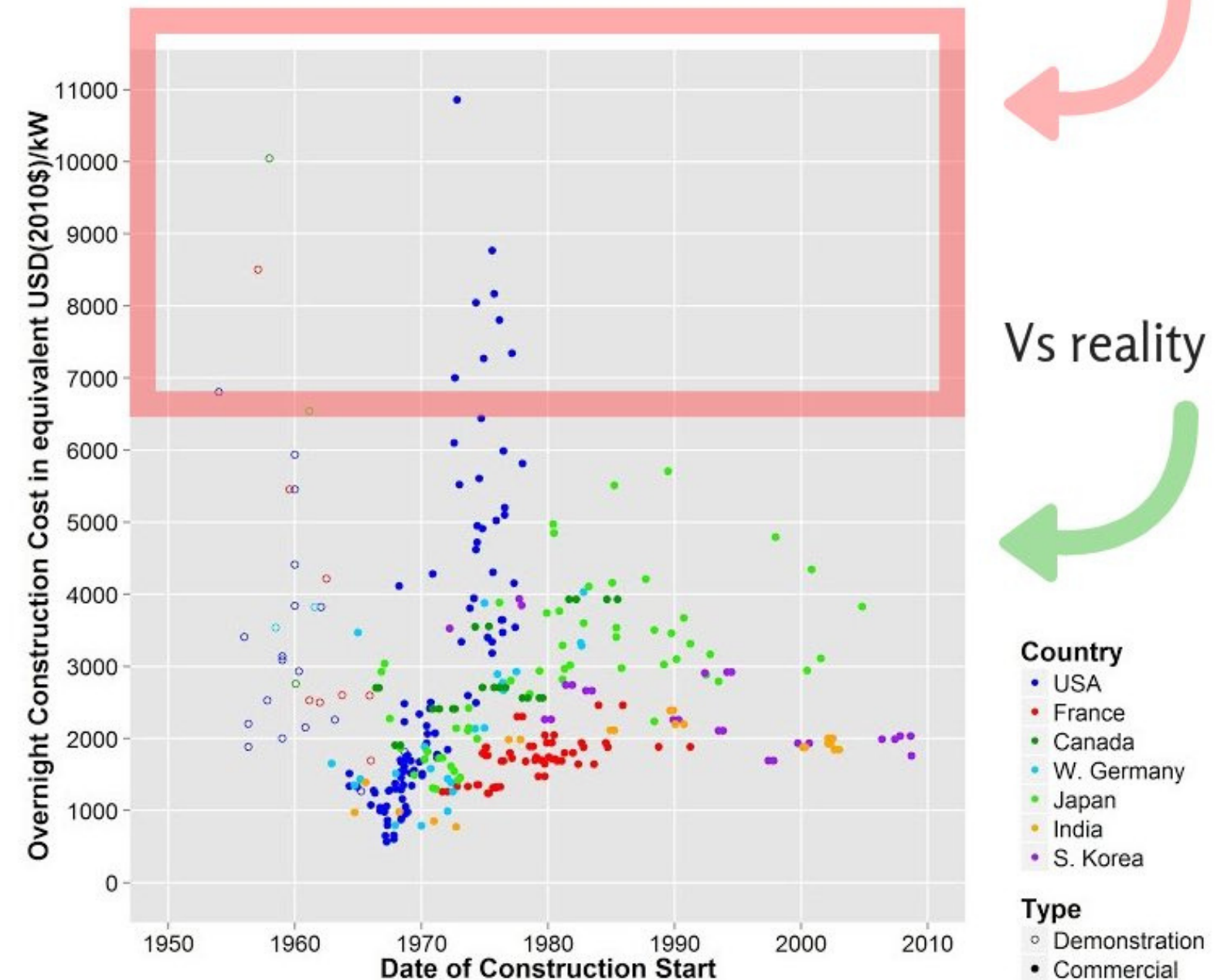
Context: This is part of an ongoing project analysing the emission and price performance of the electricity sectors in 24 OECD countries over the 1960-2020 period (edecarb.org).

This will include future inference testing (by multivariate regression analysis) to see whether the prelim. bivariate results presented here are statistically significant.

Sources/Methodology: Generation Mix (IEA, Public Gross Generation); Prices (Constant, 2015 national CPI deflated; 2015 USD/PPP conversion for whole period; IEA 1978-2020).

Peak rollout based on 8-12 year periods with largest increase in gen%mix; only include results with average gen%mix $\geq 1\%$ /year.

Lazard's assumption of capital cost of nuclear



Source: Lovering et al 2016: *Historical construction costs of global nuclear power reactors*

Levelized Full System Costs of Electricity

Robert Idel

Rice University's Baker Institute for Public Policy, 6100 Main Street MS-40, Houston, 77005, TX, United States

R. Idel

Energy 259 (2022) 124905

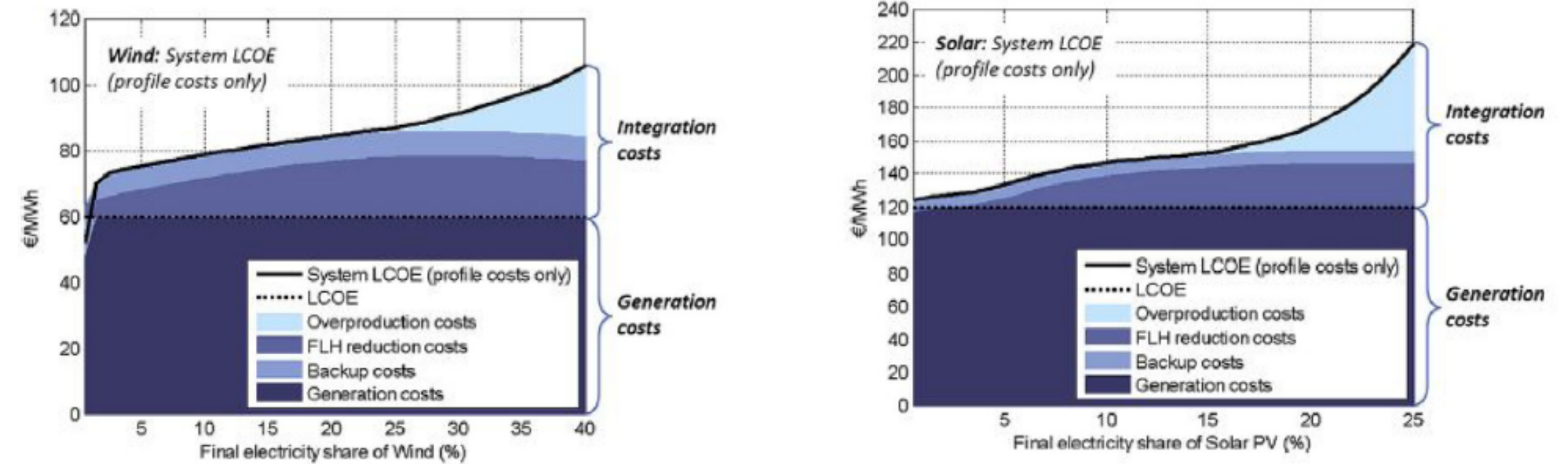


Fig. 2. System LCOE for Wind (left) and Solar (right) in Germany. Graphs are taken from Ueckerdt et al., page 72, Figure 10 - [4].

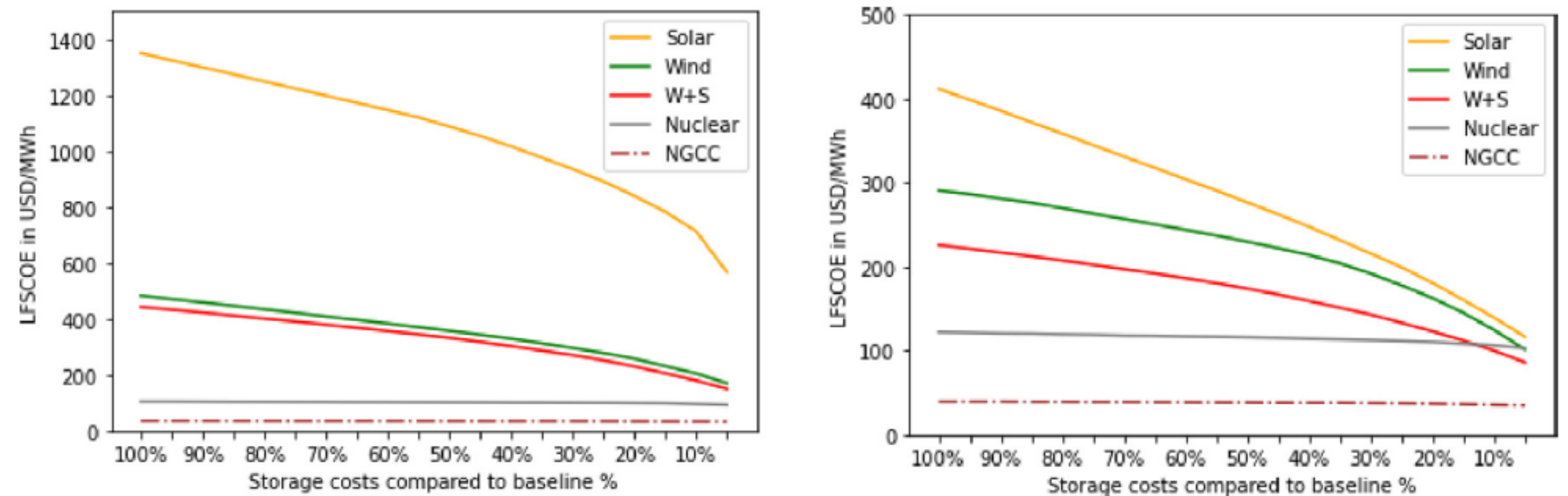
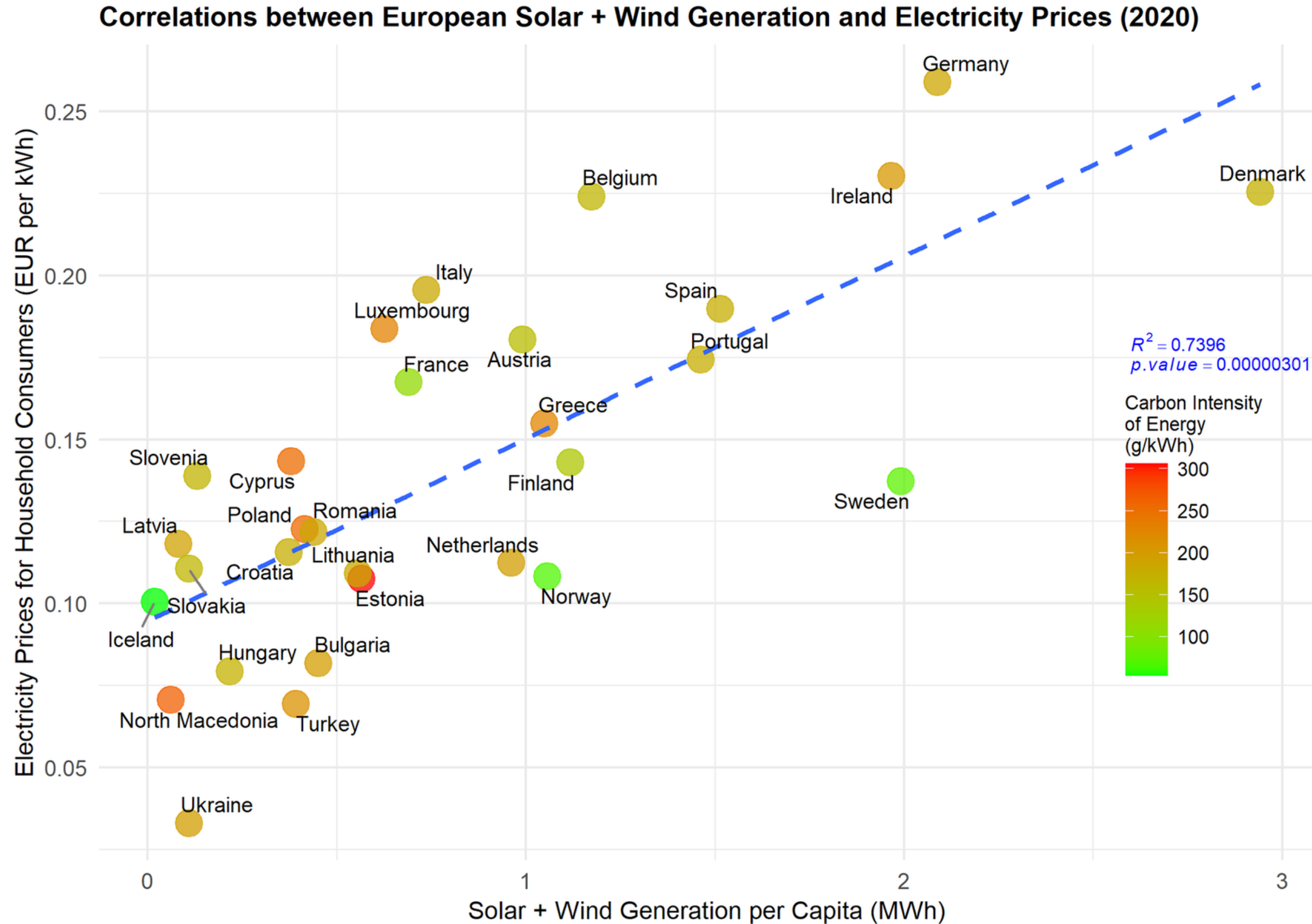


Fig. 3. LFSCOPE with decreasing capacity costs for storage. Development of LFSCOPE if storage costs decrease significantly for the market in Germany (left) and Texas (right).

While wind and solar are cheap-- shaping, storing, and transmitting the variable power gets more expensive the more you add.



Source: @GrantChalmers | Eurostat | BP Statistical Review of World Energy June 2020 | World Bank

Expensive electricity is a regressive cost and sends manufacturing jobs to other states.

Why are the reactors in Georgia so expensive?

We haven't built nuclear in the US for so long, experienced construction crews retired and supply chains atrophied.

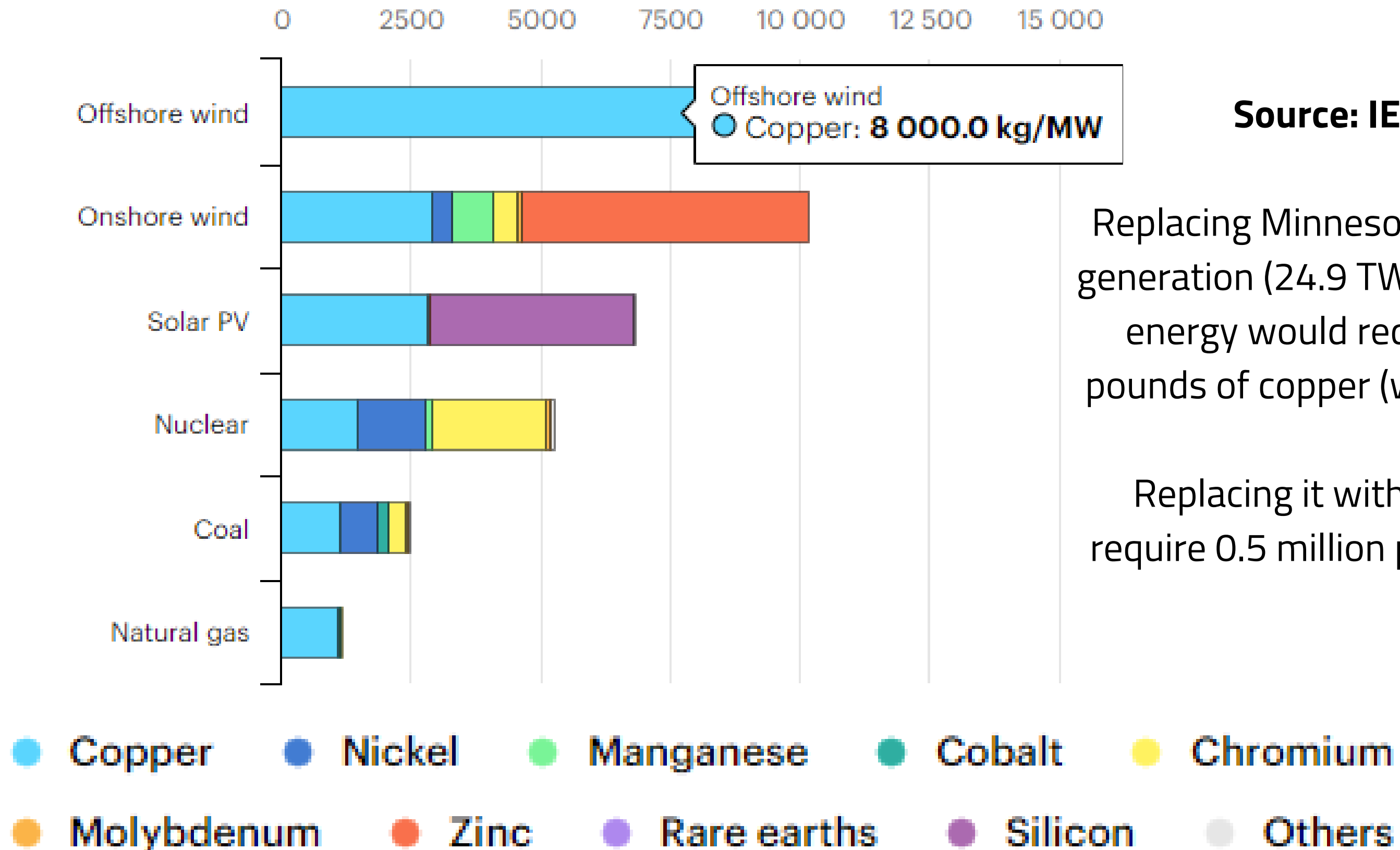
Next generation reactors, which are to be built primarily in shipyards and factories, should help address this re-learning curve.



**How does nuclear energy
affect the environment?**

Using an energy dense fuel like uranium means less mining overall

Critical minerals needed for various energy sources:



HOW MUCH RAW MATERIAL IS REQUIRED TO MAKE CLEAN ENERGY?

- Concrete
- Steel
- Glass
- Polymers & Plastics
- Uranium
- Copper
- Aluminum

kg per MWh

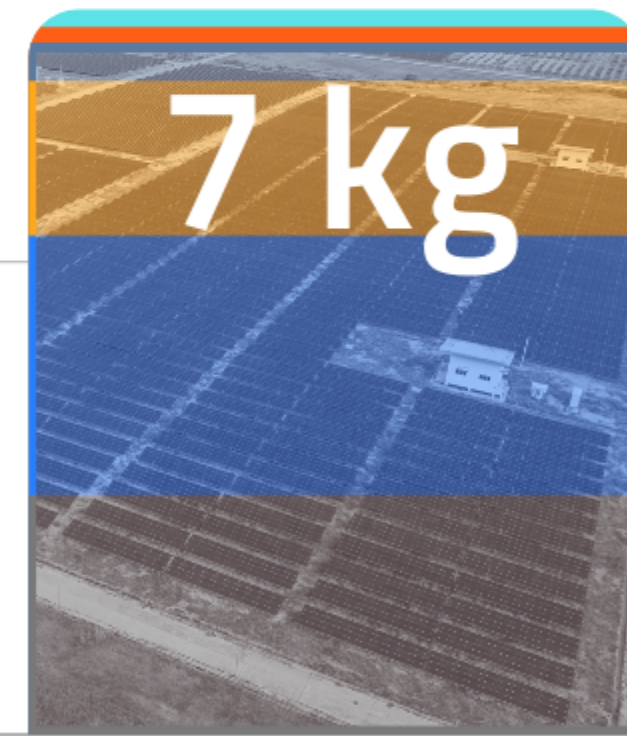
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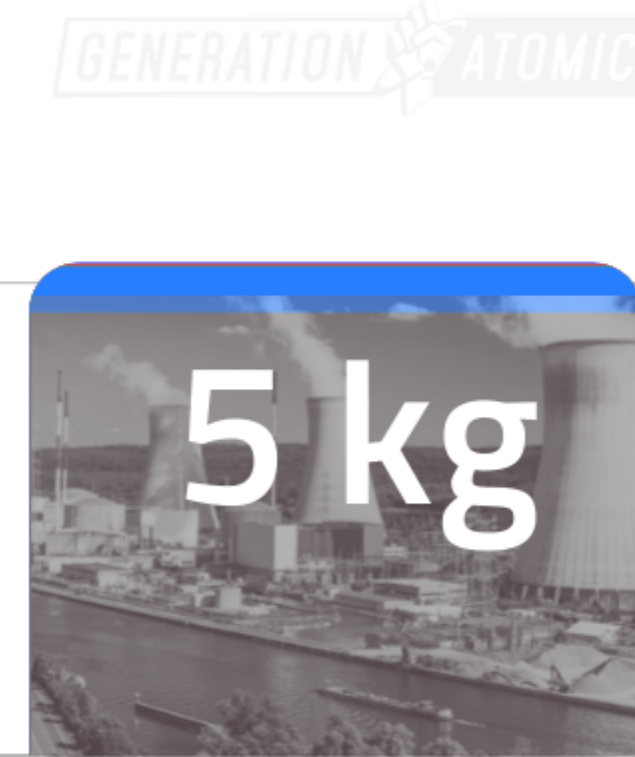
Hydro



Wind



Solar



Nuclear

What is a megawatt hour (MWh)?
 A megawatt hour is enough power to support the electricity use of 1300 people for an hour (at European consumption levels.)



Assumptions

Energy Type	Plant Lifetime	Capacity Factor
Wind	20	43.0%
Hydro	93.6	35.2%
Solar	25	18.3%
Nuclear	60	92.5%

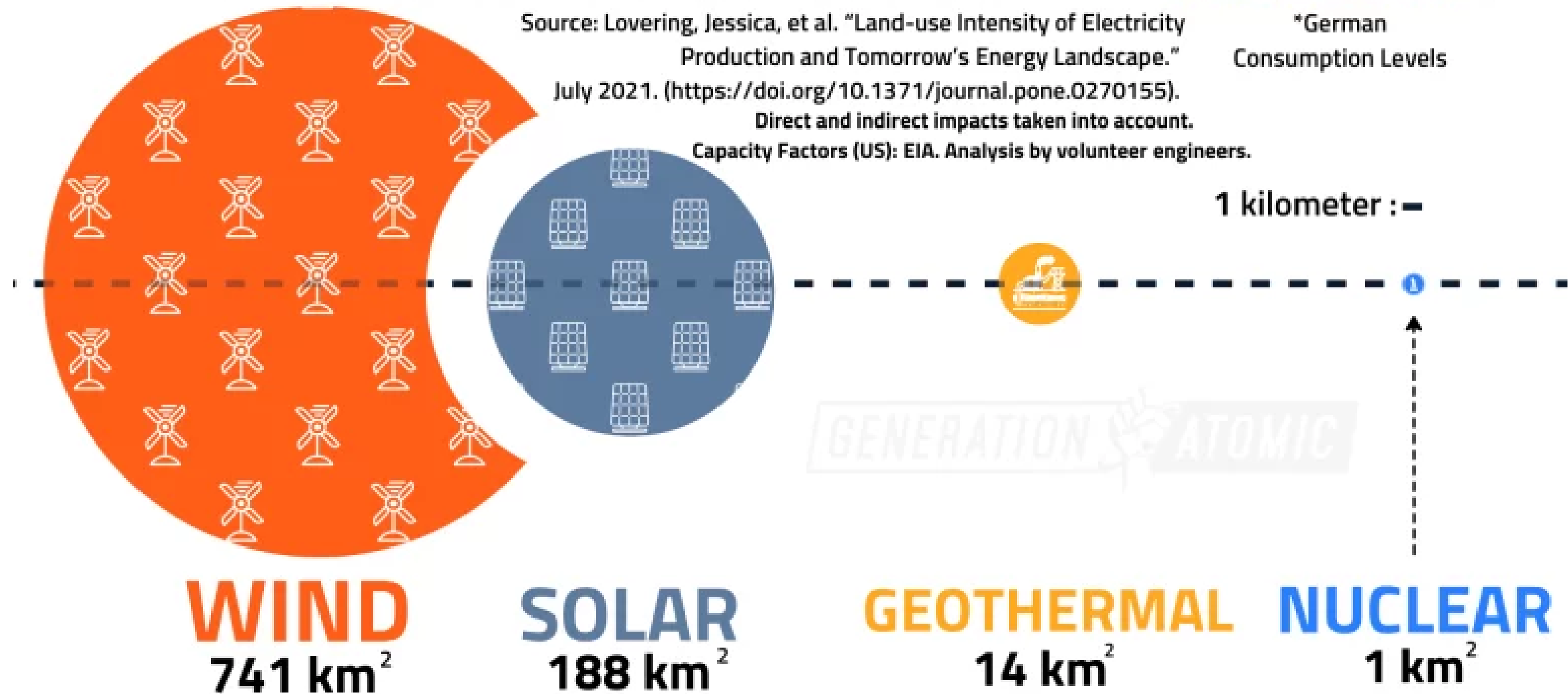
Sources: Geothermal: Karlsdóttir LCA (2015); Wind: Vattenfall EPD (2019); Hydro: QER (2015); Au-Shönenberg EPD (2017); Solar: European Commission (2019), IRENA (2020); Nuclear: Vattenfall EPD (2019), Sizewell EPD (2009), Beznau EPD (2007,2011). Capacity Factors (US): NREL, IRENA (2018, 2019). Levelized plant lifetimes. Data: bit.ly/energyminingandland. Analysis by volunteer engineers.

Using less land for energy production means more land for farming and habitat.

HOW MUCH LAND DOES IT TAKE TO POWER A CITY OF 1 MILLION*?

Source: Lovering, Jessica, et al. "Land-use Intensity of Electricity Production and Tomorrow's Energy Landscape." July 2021. (<https://doi.org/10.1371/journal.pone.0270155>).
Direct and indirect impacts taken into account.
Capacity Factors (US): EIA. Analysis by volunteer engineers.

*German Consumption Levels



Why is now a good time to look at lifting the moratorium?

Bill Gates Would Like to Build All of the Nuclear Reactors

West Virginia seems like a good spot for his new one.

BY DARREN DEF PUBLISHED: JAN 11, 2023



Jamal Cousins // Getty Images

- [Bill Gates, the founder of TerraPower, thinks existing energy infrastructure in West Virginia could be a good fit for his Sodium nuclear reactor.](#)
- [Gates is currently trying to transform a coal-fired power plant in Wyoming into a nuclear one.](#)
- [Wyoming and West Virginia are the highest coal-powered energy producers in the U.S.](#)

Office of Nuclear Energy

DOE Report Finds Hundreds of Retiring Coal Plant Sites Could Convert to Nuclear

SEPTEMBER 13, 2022

Office of Nuclear Energy »

DOE Report Finds Hundreds of Retiring Coal Plant Sites Could Convert to Nuclear

WASHINGTON, D.C.— The U.S. Department of Energy (DOE) today released a [report](#) showing that hundreds of U.S. coal power plant sites could convert to nuclear power plant sites, adding new jobs, increasing economic benefit, and significantly improving environmental conditions. This coal-to-nuclear transition could add a substantial amount of clean electricity to the grid, helping the U.S. reach its net-zero emissions goals by 2050.

The study investigated the benefits and challenges of converting retiring coal plant sites into nuclear plant sites. After screening recently retired and active coal plant sites, the study team identified 157 retired coal plant sites and 237 operating coal plant sites as potential candidates for a coal-to-nuclear transition. Of these sites, the team found that 80% are good candidates to host advanced reactors smaller than the gigawatt scale.

U.S. & WORLD ENVIRONMENT POLITICS

The role of the 'Inflation Reduction Act' in the nuclear power industry

The legislation contains incentives and tax credits for electric vehicles, as well as renewable energy and nuclear power

By Gitanjali Poonia | gpoonia@deseretnews.com | Aug 9, 2022, 11:38am CST

This bill includes “includes \$369 billion in climate and energy provisions,” aiming to “reduce greenhouse gases by 40% below 2005 levels by 2030,” according to [Politico](#).

This entails nearly \$30 billion in tax credits over a 10-year-period for nuclear power plants, according to the [Congressional Budget Office](#).

“If the bill is signed into law, nuclear plants would automatically be eligible for a credit of 0.3 cents per kilowatt-hour, a measure of electricity production, the Congressional Research Service [reports](#), but plants that pay wages similar to or higher than the surrounding area could get 1.5 cents per kWh, five times more,” according to [Forbes](#).

Additionally, the act also includes \$700 million in funding for high-assay low-enriched uranium, or HALEU production.

It's not just us saying this...

"I don't see how we can do this without the help of nuclear power."

-- Dr. James Hansen

"I was on the other side of it then, but given the challenge we face today,
and the progress of fourth generation nuclear, go for it.

No other alternative."

-- John Kerry

"I'm a yes on this."

-Ranking DFL Sen. Frentz and DFL Sen. Newton on 3-24-22,
on partially lifting the moratorium for small reactors

"If we're serious about solving climate change, and quite frankly we have to be, the first thing we should do is keep safe reactors operating. Even then, just maintaining that status quo is not enough. We need more nuclear power to zero out emissions in America and to prevent a climate disaster."

-- Bill Gates
