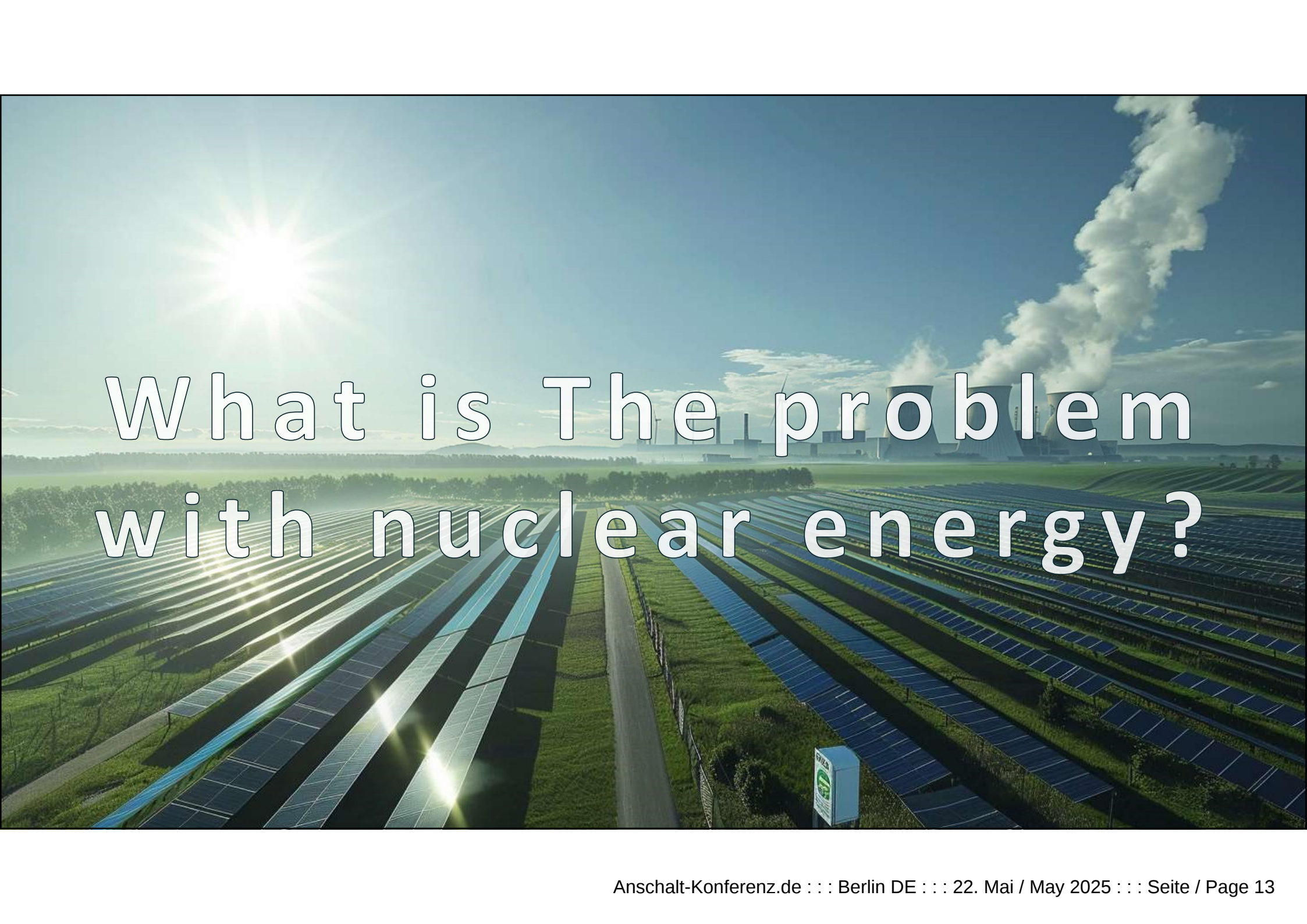


Anschalt
KONFERENZ

Speaker

Tomás Pueyo
Uncharted Territories

The image is a composite background. The foreground is dominated by a vast solar farm with rows of photovoltaic panels stretching into the distance. A paved road runs alongside the panels. In the background, a nuclear power plant with several large cooling towers is visible, with thick white steam rising from them. The sky is blue with a bright sun in the upper left corner, creating a lens flare effect. The text 'What is The problem with nuclear energy?' is overlaid in the center in a white, outlined font.

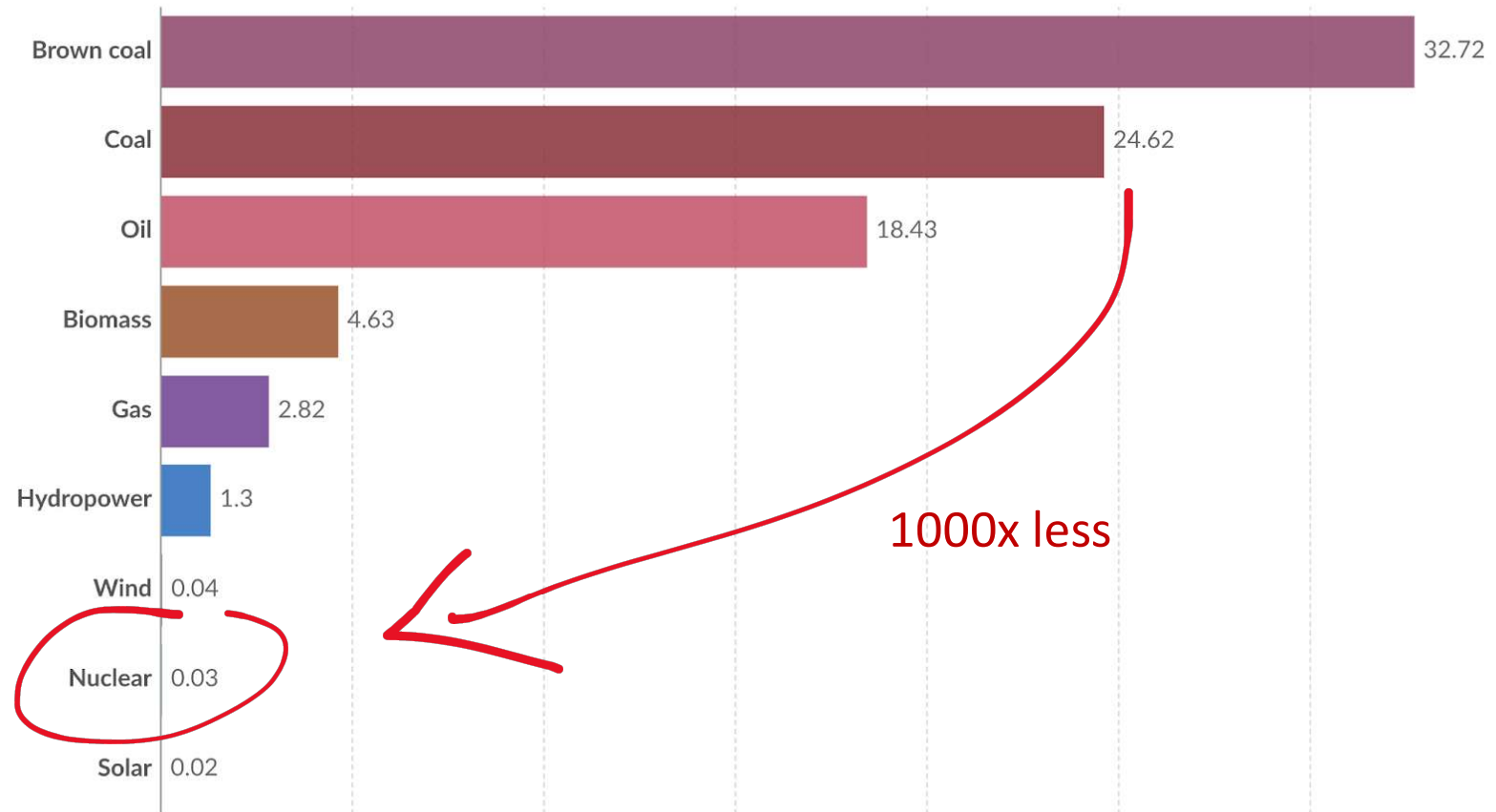
What is The problem with nuclear energy?

1. SAFEST

Death rates per unit of electricity production

Our World
in Data

Death rates are measured based on deaths from accidents and air pollution per terawatt-hour¹ of electricity.



Data source: Markandya & Wilkinson (2007); Sovacool et al. (2016); UNSCEAR (2008; & 2018)

OurWorldInData.org/energy | [CC BY](https://creativecommons.org/licenses/by/4.0/)

1. **Watt-hour:** A watt-hour is the energy delivered by one watt of power for one hour. Since one watt is equivalent to one Joule per second, a watt-hour is equivalent to 3600 Joules of energy. Metric prefixes are used for multiples of the unit, usually: - kilowatt-hours (kWh), or a thousand watt-hours. - Megawatt-hours (MWh), or a million watt-hours. - Gigawatt-hours (GWh), or a billion watt-hours. - Terawatt-hours (TWh), or a trillion watt-hours.

1. SAFEST



1. SAFEST
2. CLEANEST

Lifecycle Greenhouse Gas Emissions

in grams of CO₂ equivalent per kWh in 2020

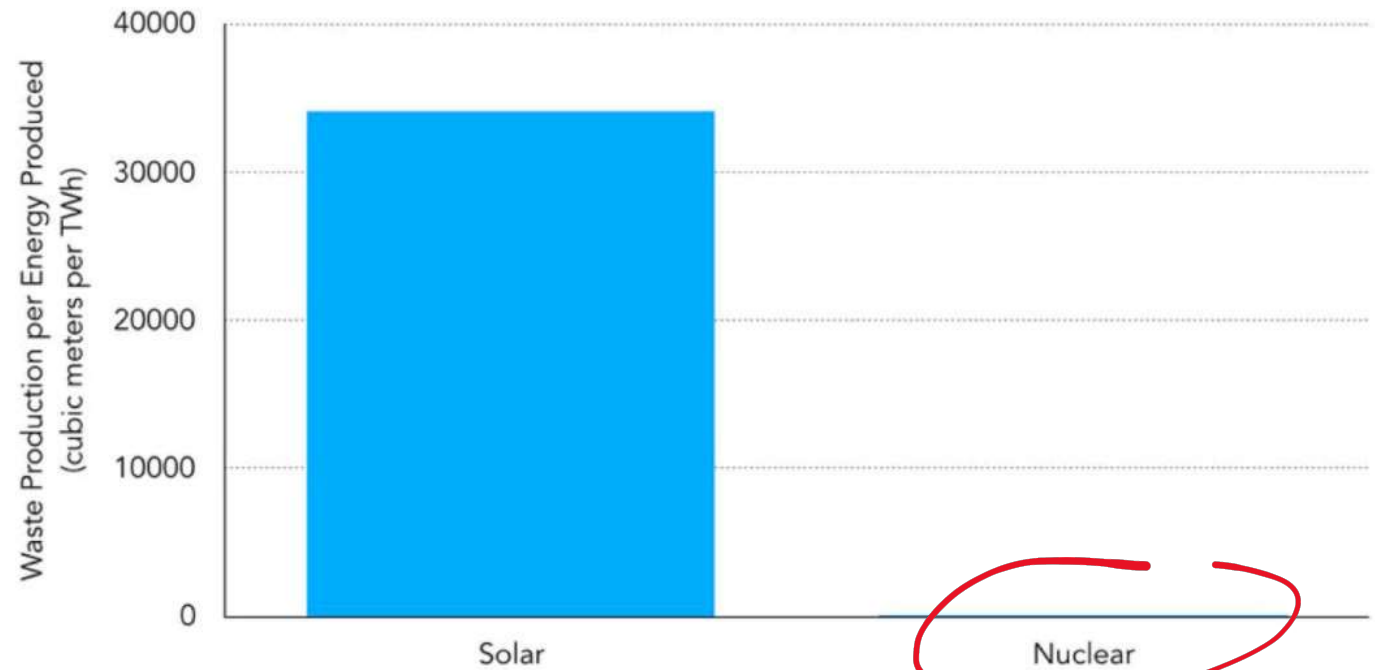


Source: Life Cycle Assessment of Electricity Generation Options, UN Economic Commission for Europe, 2021, https://unece.org/sites/default/files/2021-11/LCA_final.pdf
For Solar, I used the latest update from Seaver Wang: https://twitter.com/wang_seaver/status/1683694741219872769

1. SAFEST

2. CLEANEST

Solar panels produce ~300x more waste than nuclear reactors when providing the same amount of energy.



Sources and Notes:

US GAO, http://www.gao.gov/key_issues/disposal_of_highlevel_nuclear_waste/issue_summary

World Nuclear Association, <http://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-wastes/radioactive-waste-management.aspx>

<http://www.world-nuclear.org/information-library/facts-and-figures/world-nuclear-power-reactors-archive/reactor-archive-december-2015.aspx>

IAEA, <https://www.iaea.org/PRIS/home.aspx>

BP, <http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html>

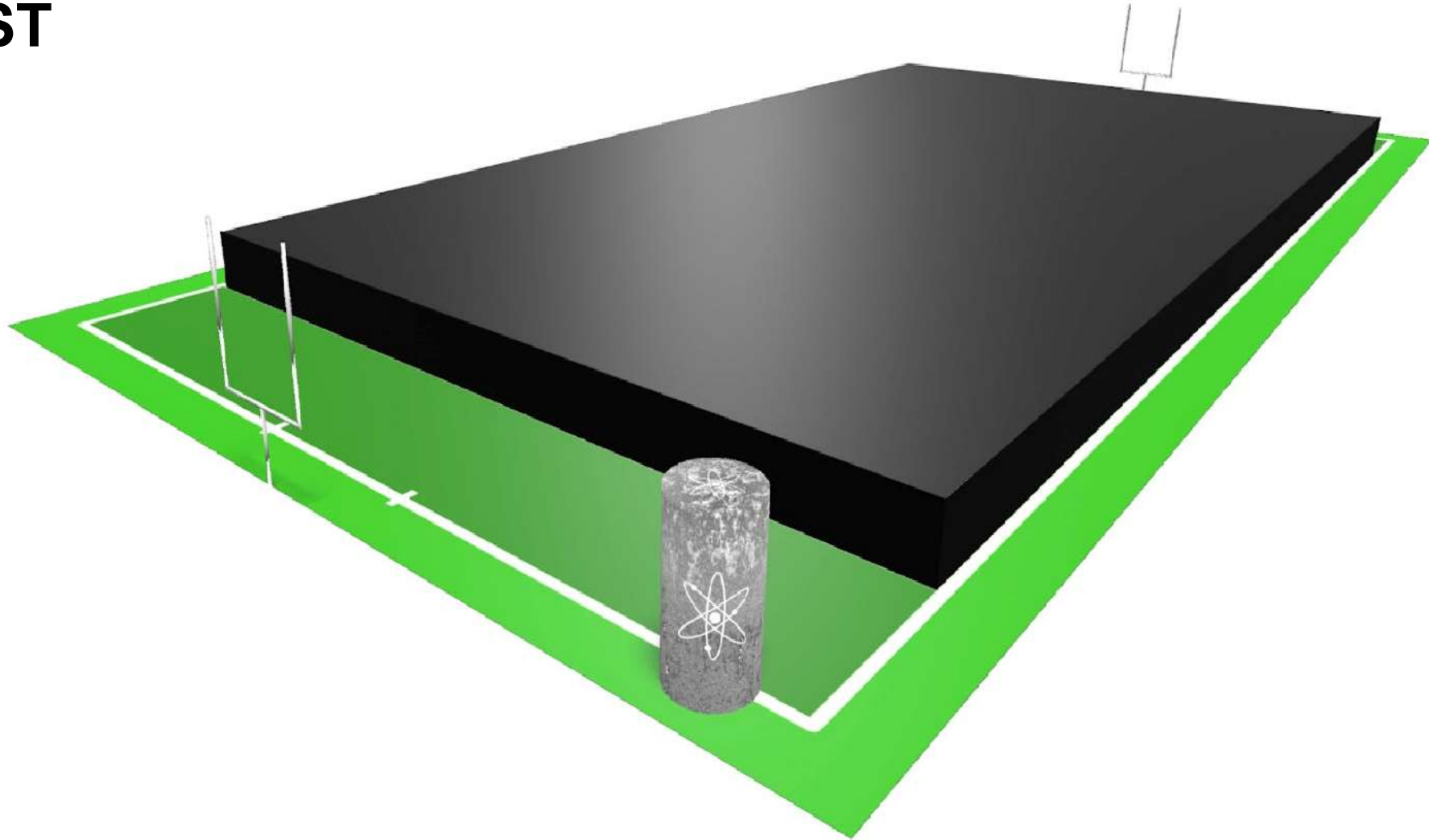
Solar panels specifications vary. Panel specifications were standardized according to TrinaSolar's Duomax Dual Glass 60-Cell Module:

http://static.trinasolar.com/sites/default/files/PS-M-0474%20A%20Datasheet_Duomax_PEG5_XX_US_Feb_2017_A.pdf



1. SAFEST

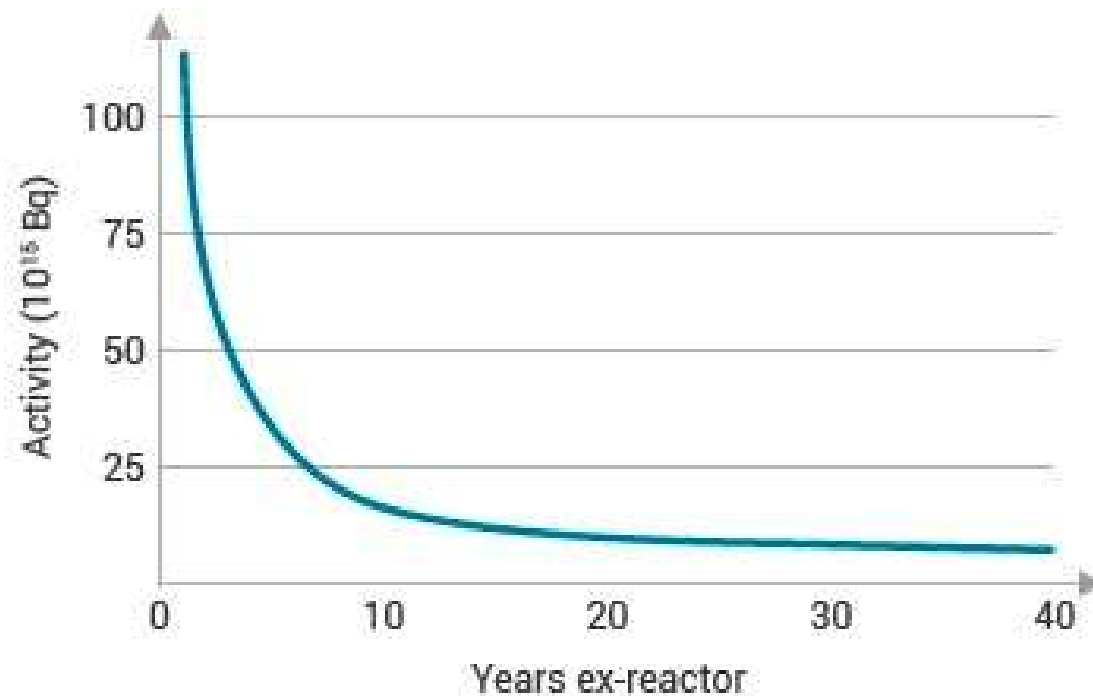
2. CLEANEST



1. SAFEST

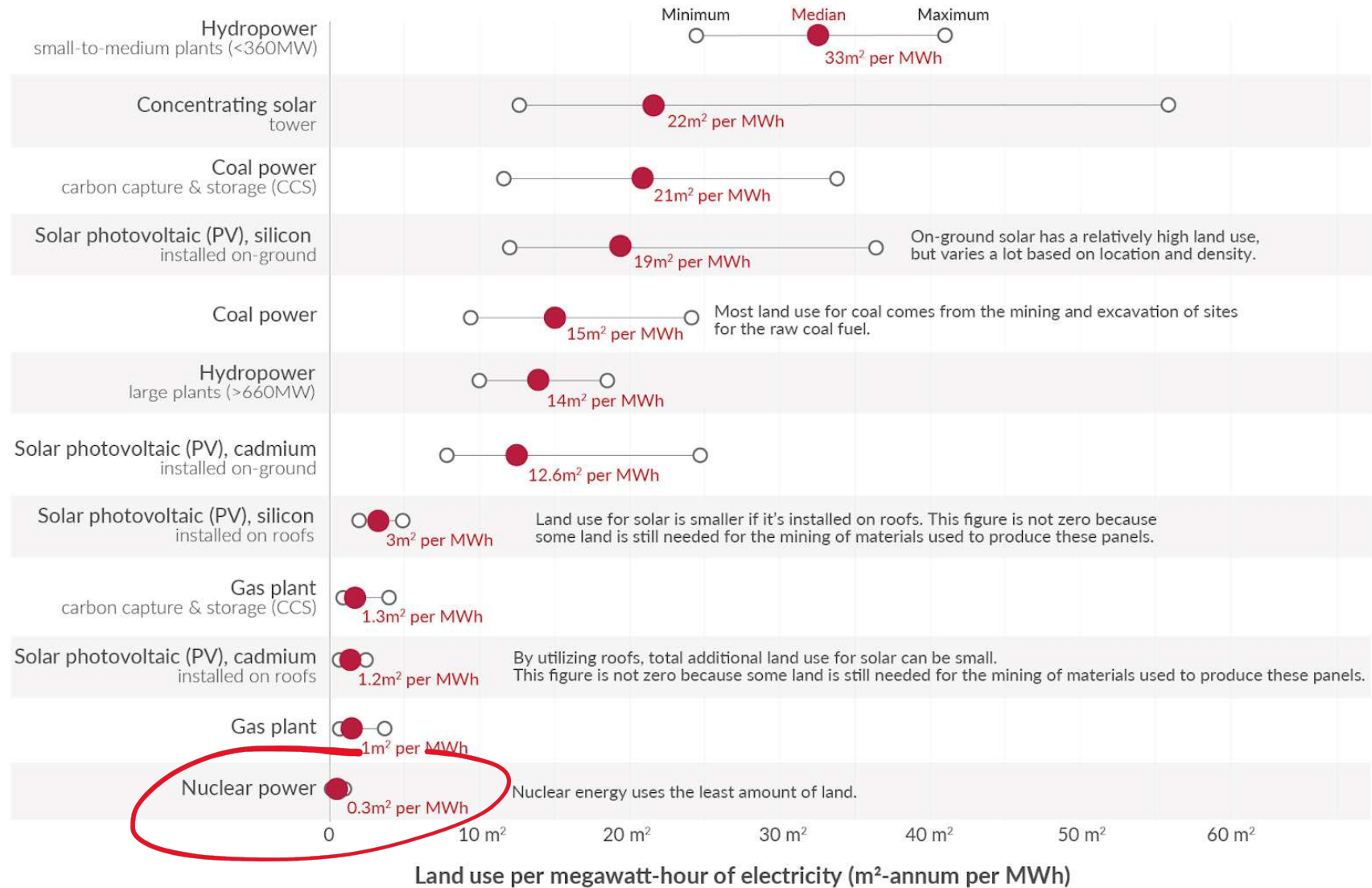
2. CLEANEST

-99% radioactivity in 40-50 years



Land use of energy sources per unit of electricity

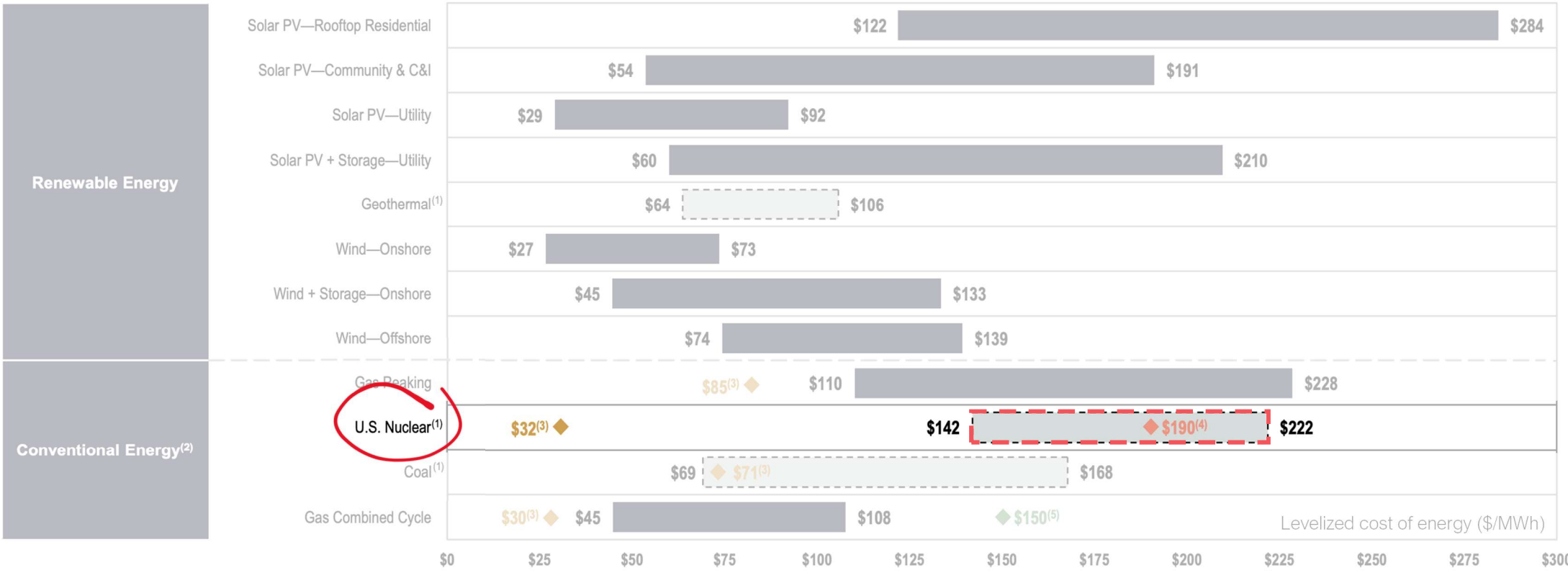
Land use is based on life-cycle assessment; this means it does not only account for the land of the energy plant itself but also land used for the mining of materials used for its construction, fuel inputs, decommissioning, and the handling of waste.



1. SAFEST
2. CLEANEST
3. DENSEST

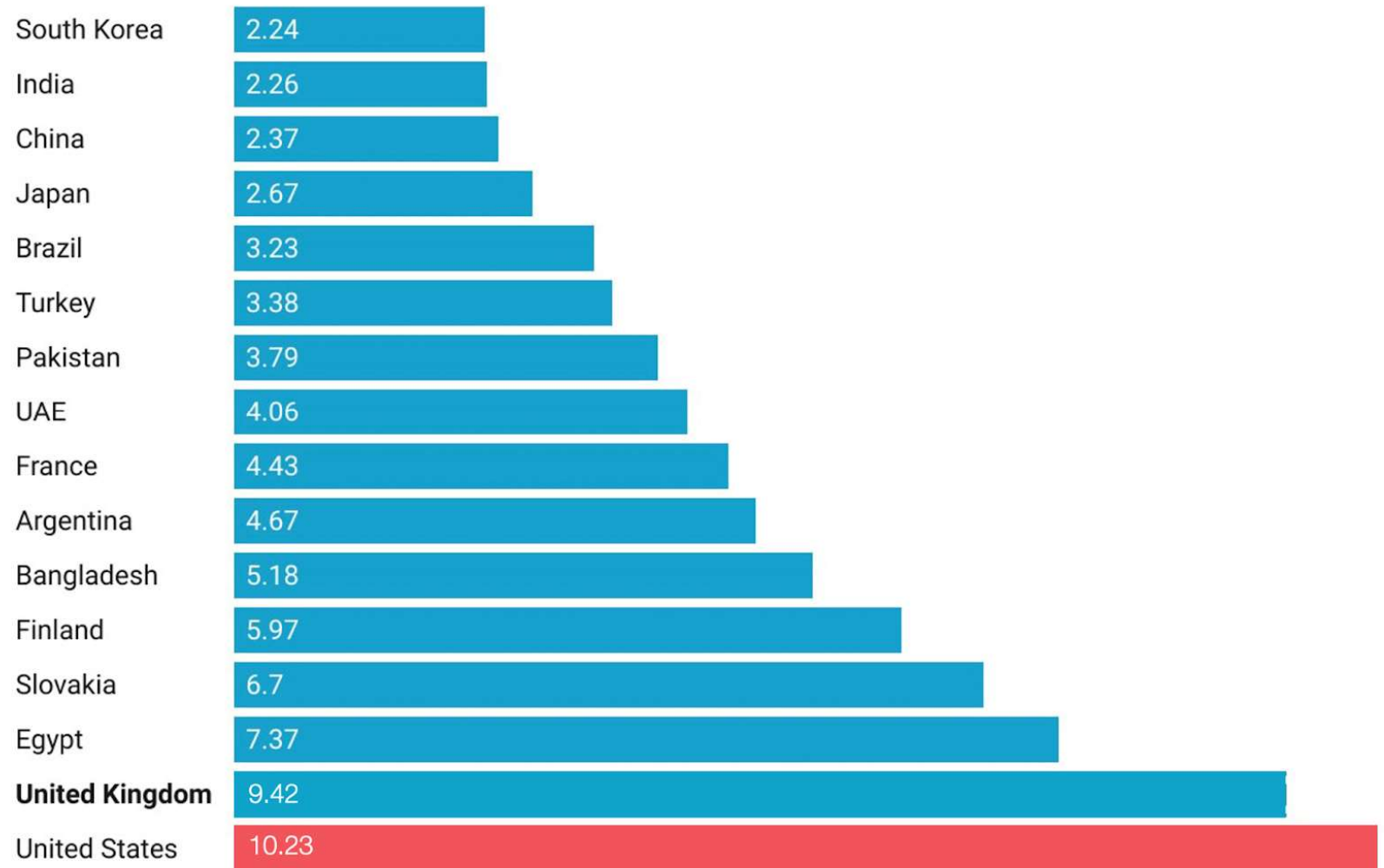


- 1. SAFEST
- 2. CLEANEST
- 3. DENSEST
- 4. CHEAP*



1. SAFEST
2. CLEANEST
3. DENSEST
4. CHEAP*

Average Construction Cost of Nuclear Power Plants Across Different Countries



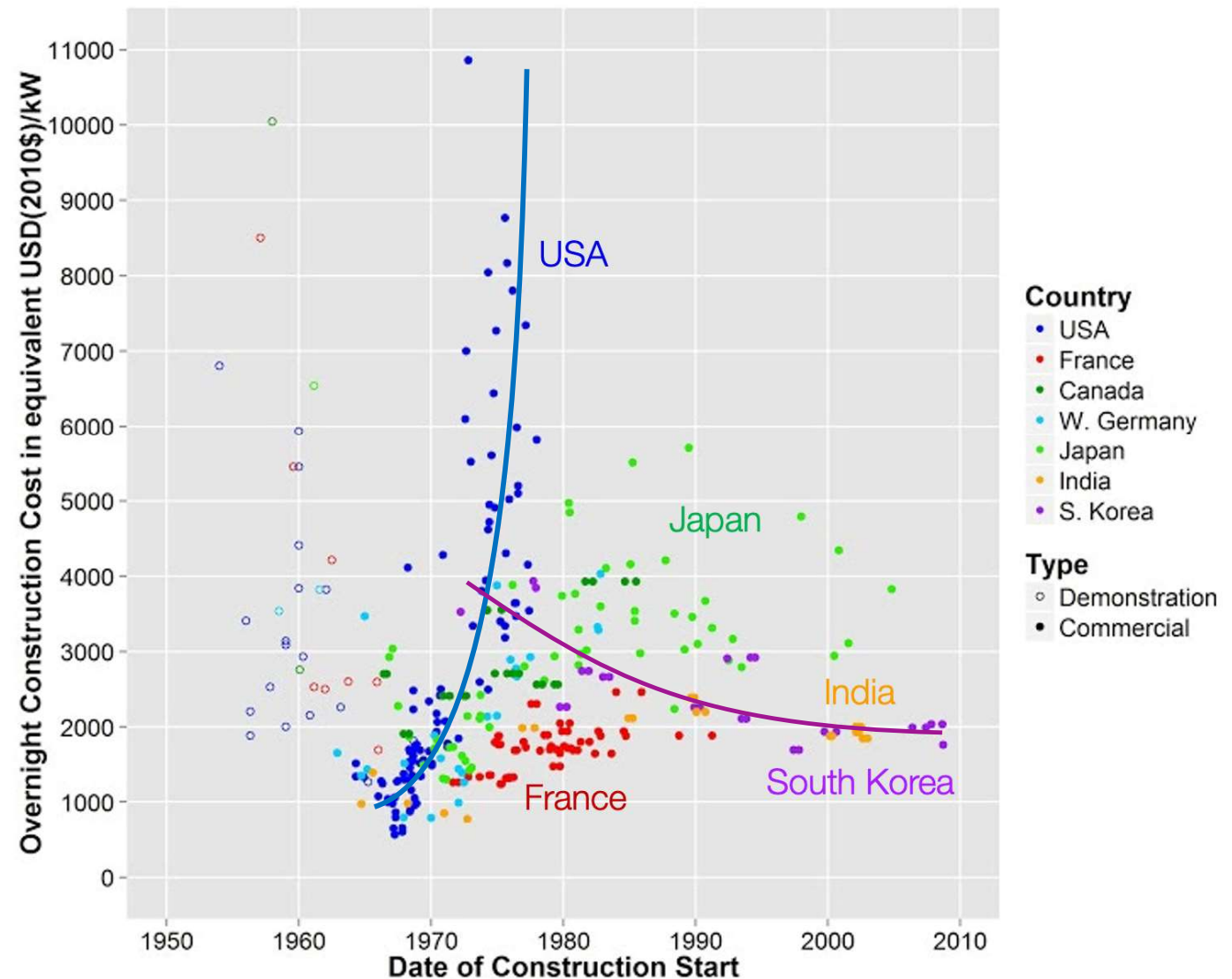
Average construction cost (inflation adjusted GBP) per MW for all plants with reliable cost data built since 2000

Chart: Britain Remade • Created with Datawrapper

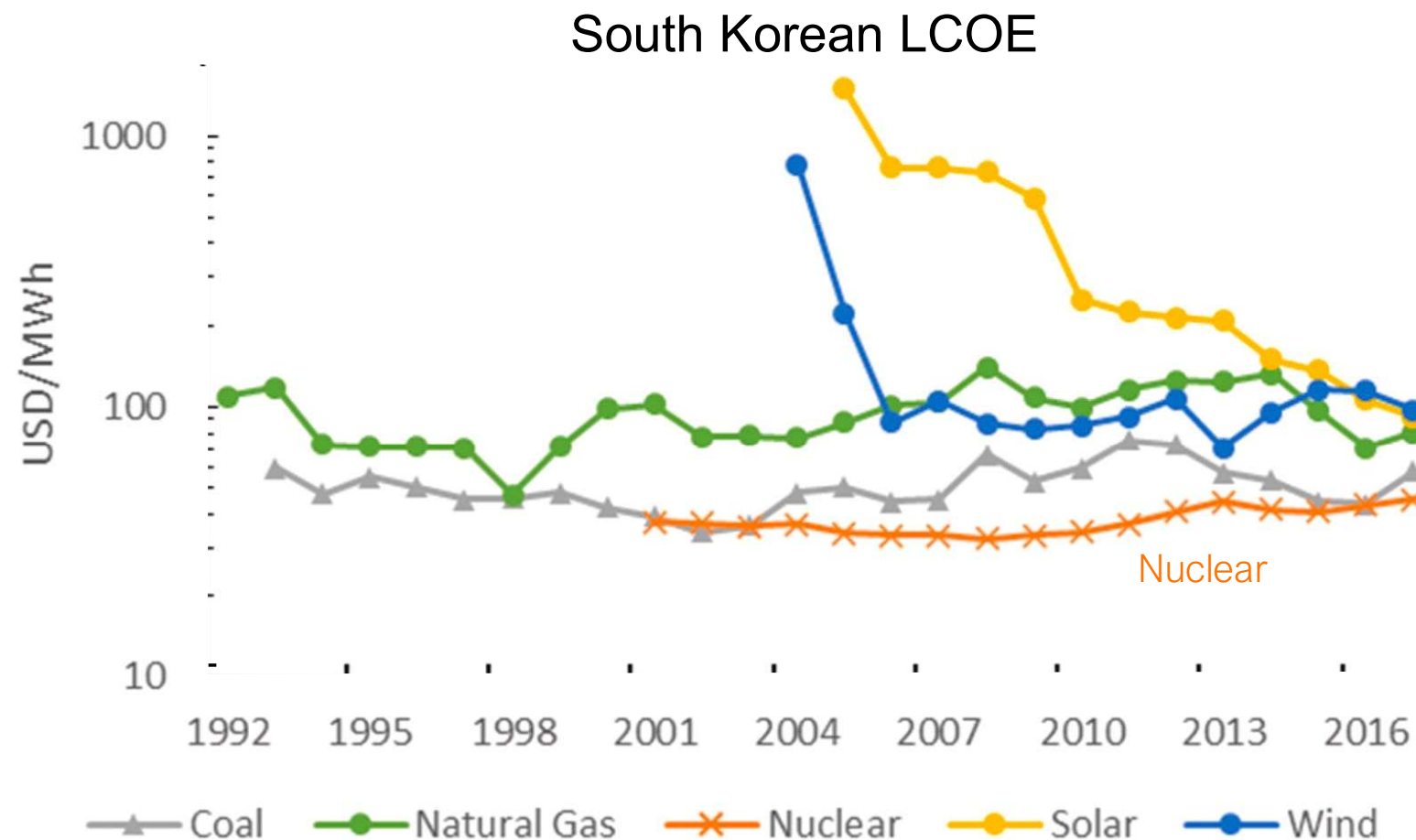
1. SAFEST
2. CLEANEST
3. DENSEST
4. CHEAP*

Overnight Cost of Nuclear

across Countries and over Time



1. SAFEST
2. CLEANEST
3. DENSEST
4. CHEAP*



1. SAFEST
2. CLEANEST
3. DENSEST
4. CHEAP*

Addressing Root Causes of AP1000 Construction Delays Leads to Rapid Speed Up in Construction Time

Average Number of Days from Start of Nuclear Construction to Module Placement ("Big 6" Nuclear Island Modules).

First Generation Second Generation

CA20



CA01



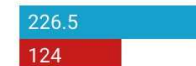
CA02



CA03



CA04

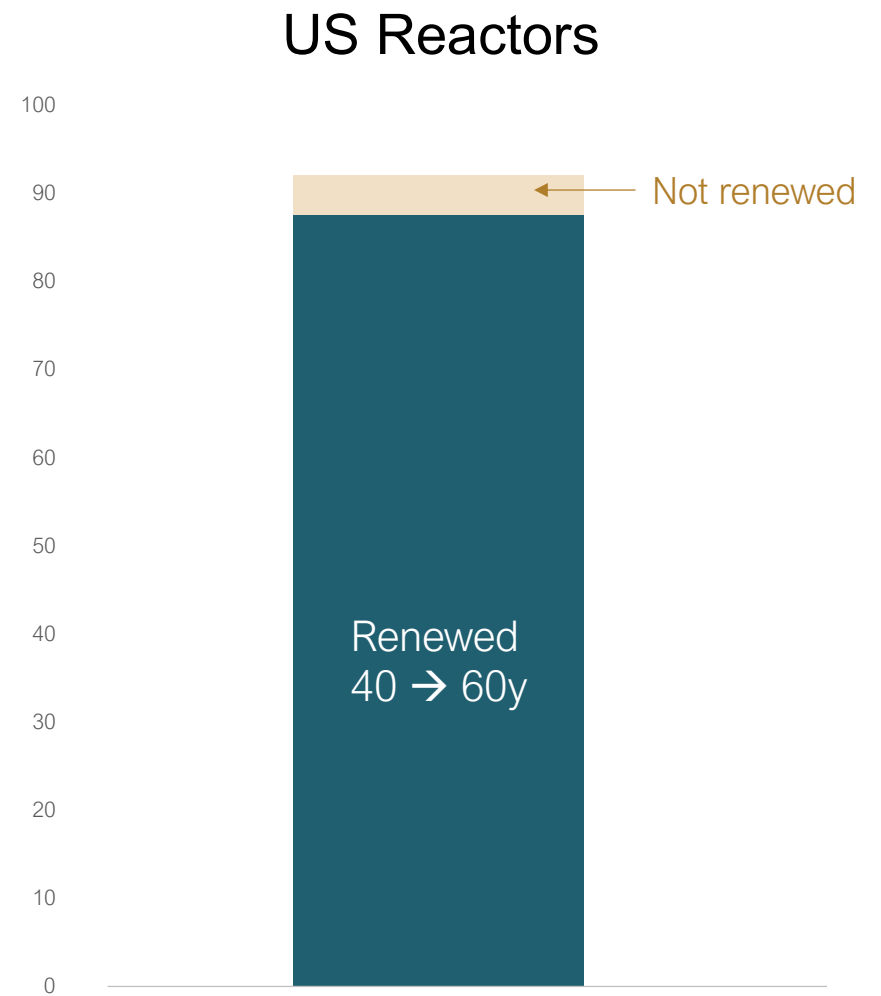


CA05



Chart: James Krellenstein • Source: Alva Energy LLC • Created with Datawrapper

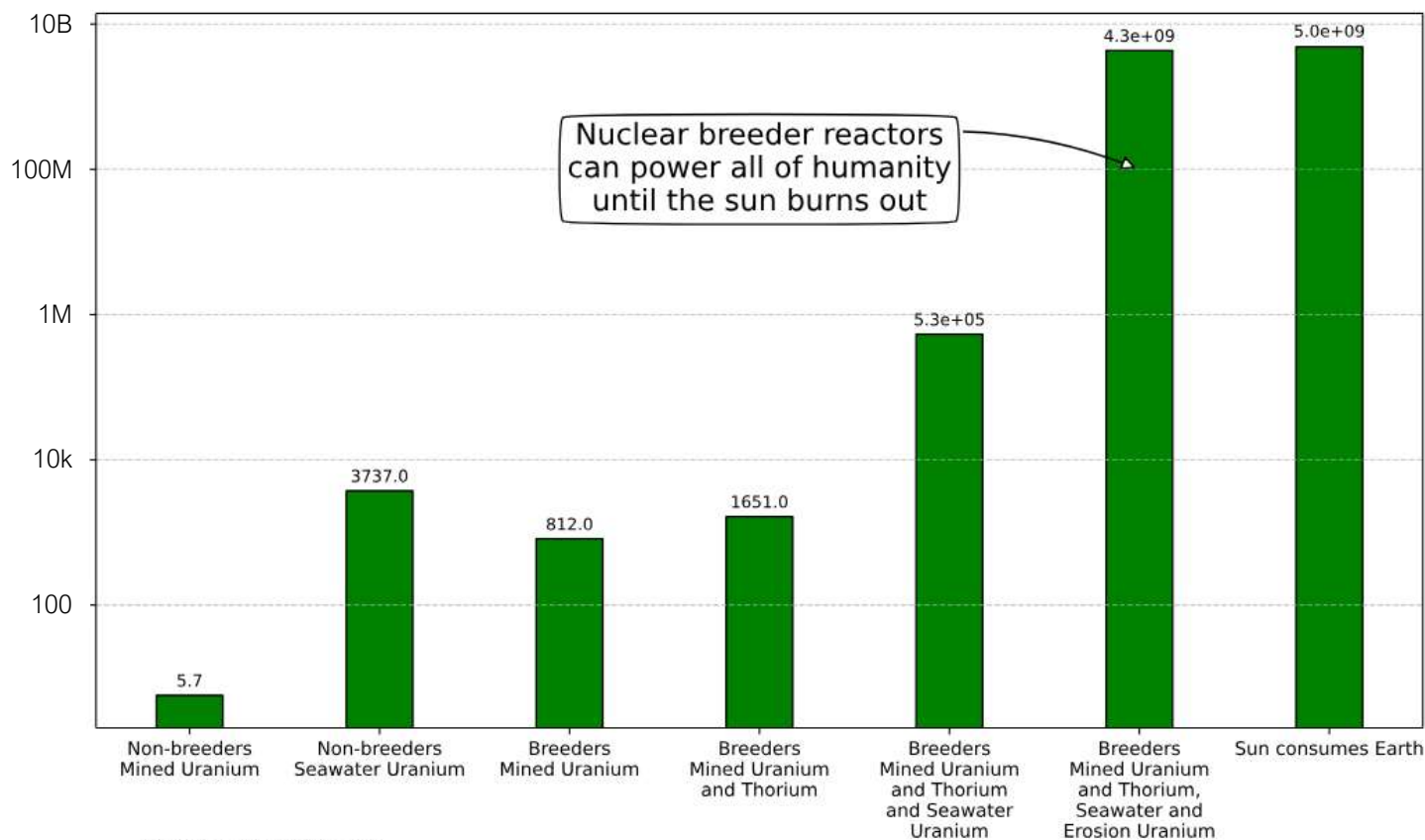
1. SAFEST
2. CLEANEST
3. DENSEST
4. **CHEAP***



1. SAFEST
 2. CLEANEST
 3. DENSEST
- MOST**
4. SUSTAINABLE

How long can nuclear fission power the world?

Years providing 100%
of primary energy



CC-BY-NC by whatisnuclear.com

1. SAFEST
2. CLEANEST
3. DENSEST
- MOST**
4. SUSTAINABLE
- 5. GEO STABLE**

Identified recoverable conventional uranium resources

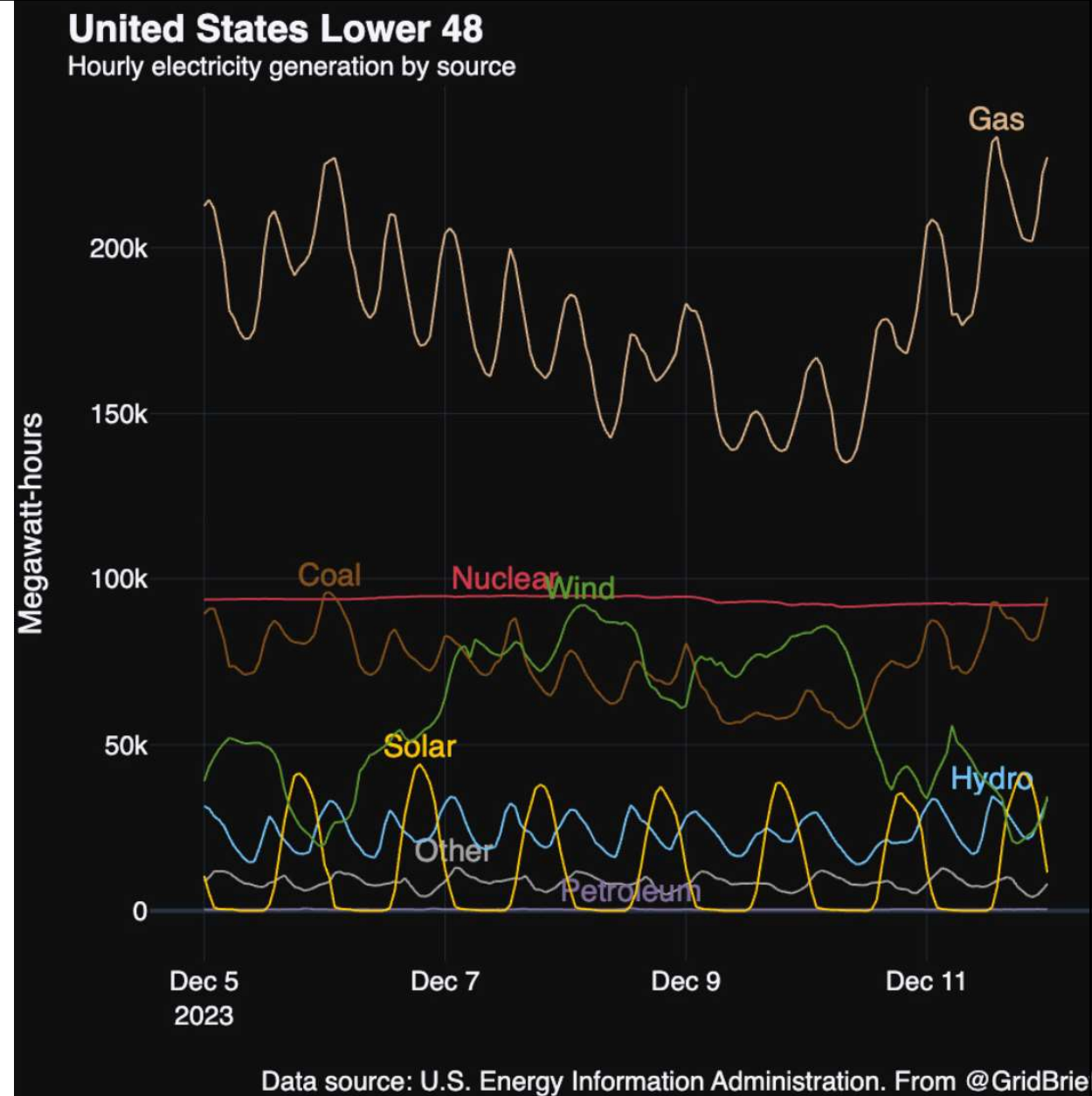
(<USD 130/kgU as of 1 January 2021)



* Secretariat estimate or partial estimate.

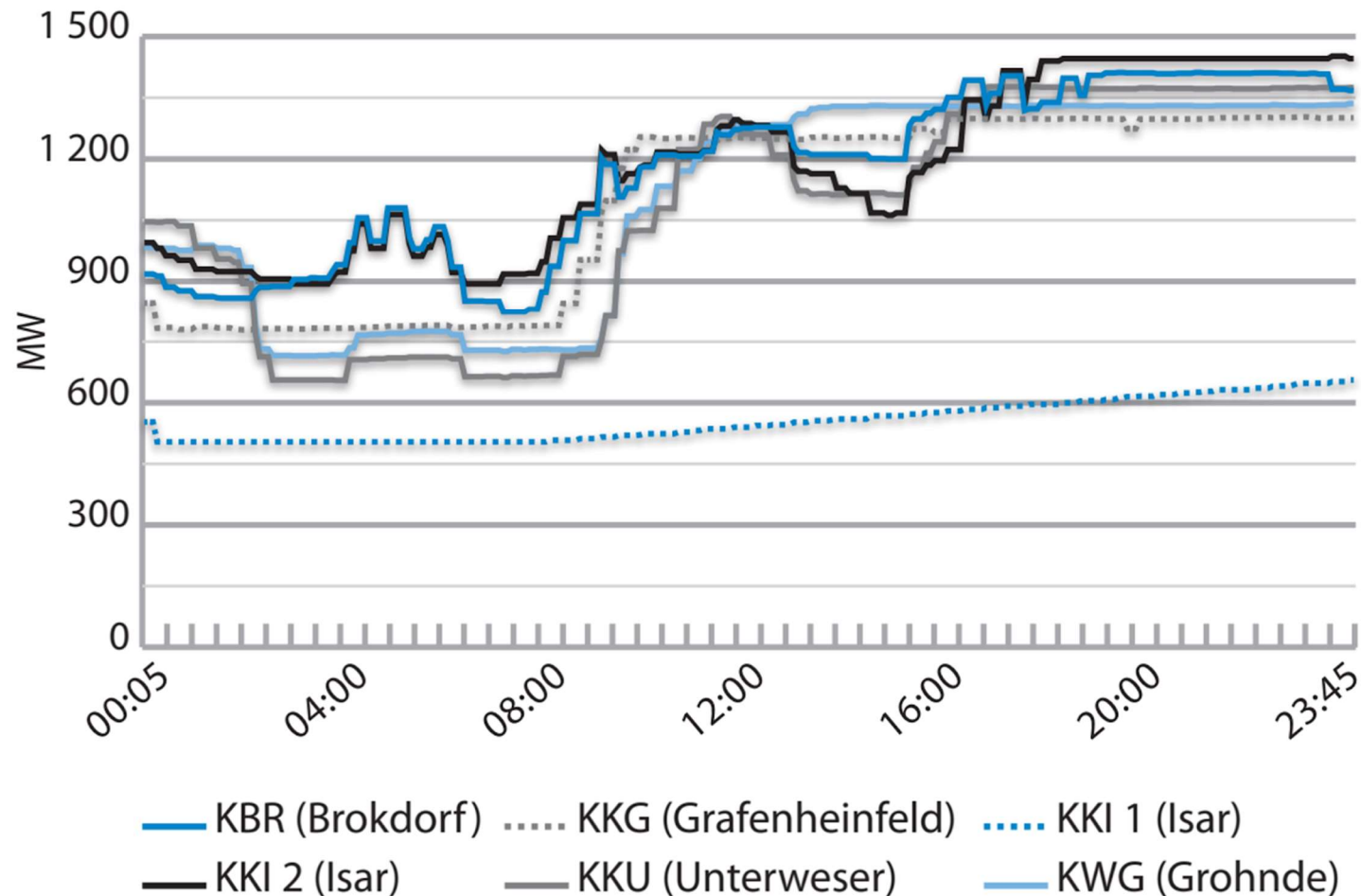
The global distribution of identified recoverable conventional uranium resources in the <USD 130/kgU cost category among 15 countries, which are either major uranium producers or have significant plans for growth of nuclear generating capacity, illustrates the widespread distribution of these resources. Together, these 15 countries are endowed with 95% of the global resource base as specified above (the remaining 5% are distributed among another 24 countries). The widespread distribution of uranium resources is an important geographic aspect of nuclear energy in light of security of energy supply.

1. SAFEST
2. CLEANEST
3. DENSEST
- MOST**
4. SUSTAINABLE
5. GEO STABLE
- 6. PREDICTABLE**



1. SAFEST
2. CLEANEST
3. DENSEST
- MOST**
4. SUSTAINABLE
5. GEO STABLE
6. PREDICTABLE
- 7. DISPATCHABLE**

Example of load-following during 24 hours at some German nuclear power plants

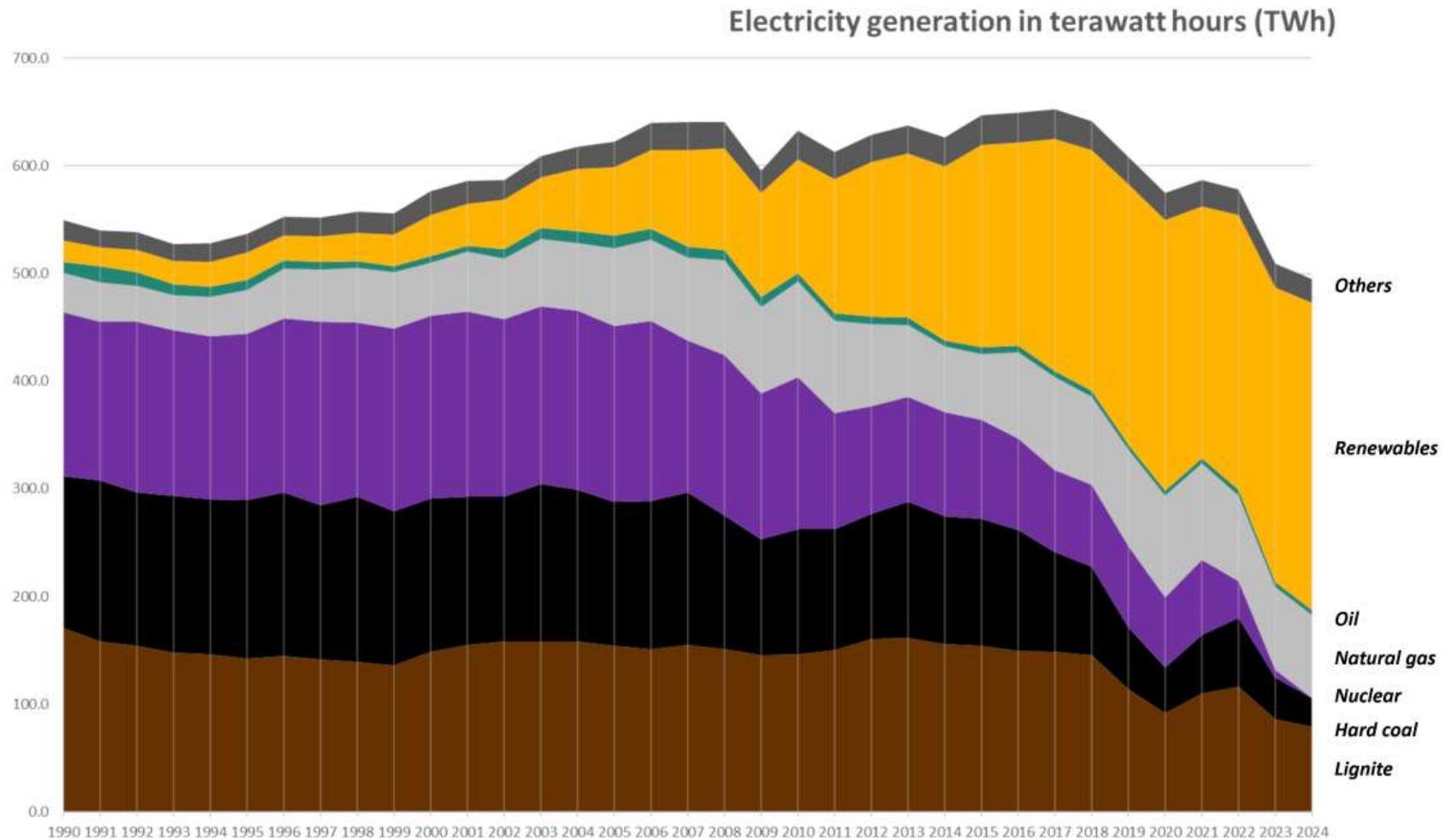


Courtesy of E.ON Kernkraft.

W H Y D O E S
T H I S
M A T T E R ?

Gross electricity production in Germany 1990 - 2024, by source.

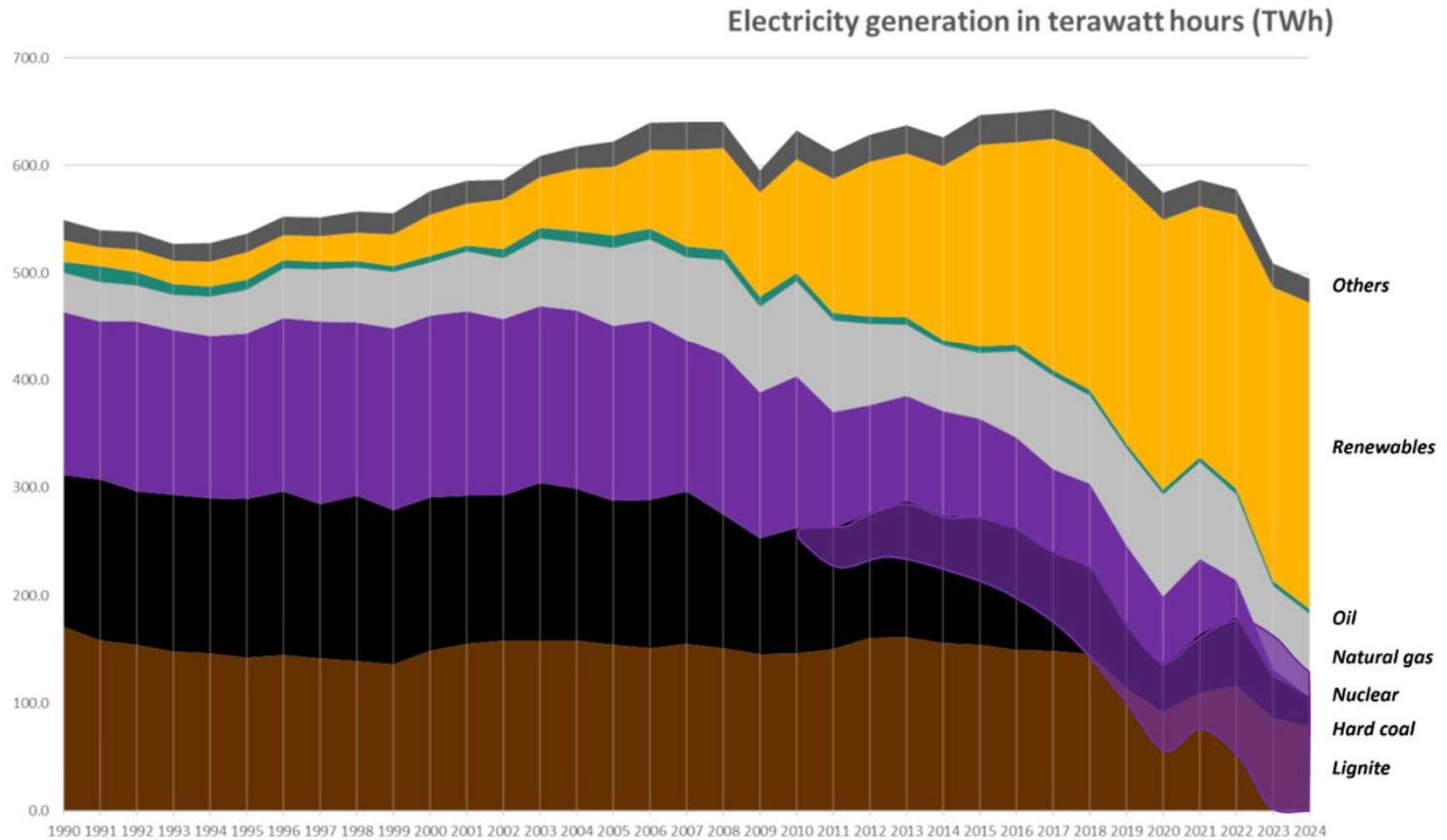
Data: AGEB 2024.



CC BY SA 4.0

Gross electricity production in Germany 1990 - 2024, by source.

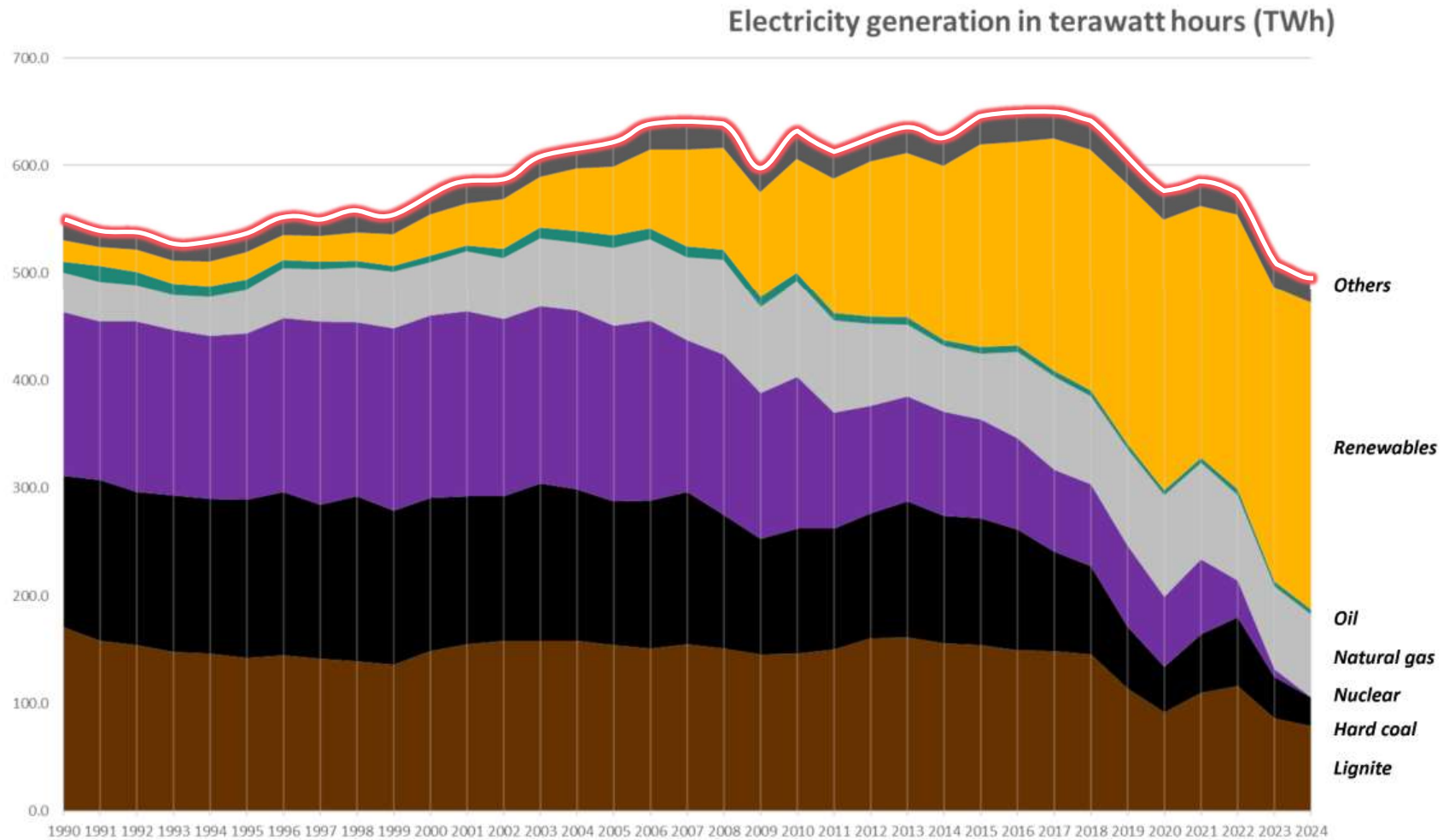
Data: AGEB 2024.



CC BY SA 4.0

Gross electricity production in Germany 1990 - 2024, by source.

Data: AGEB 2024.

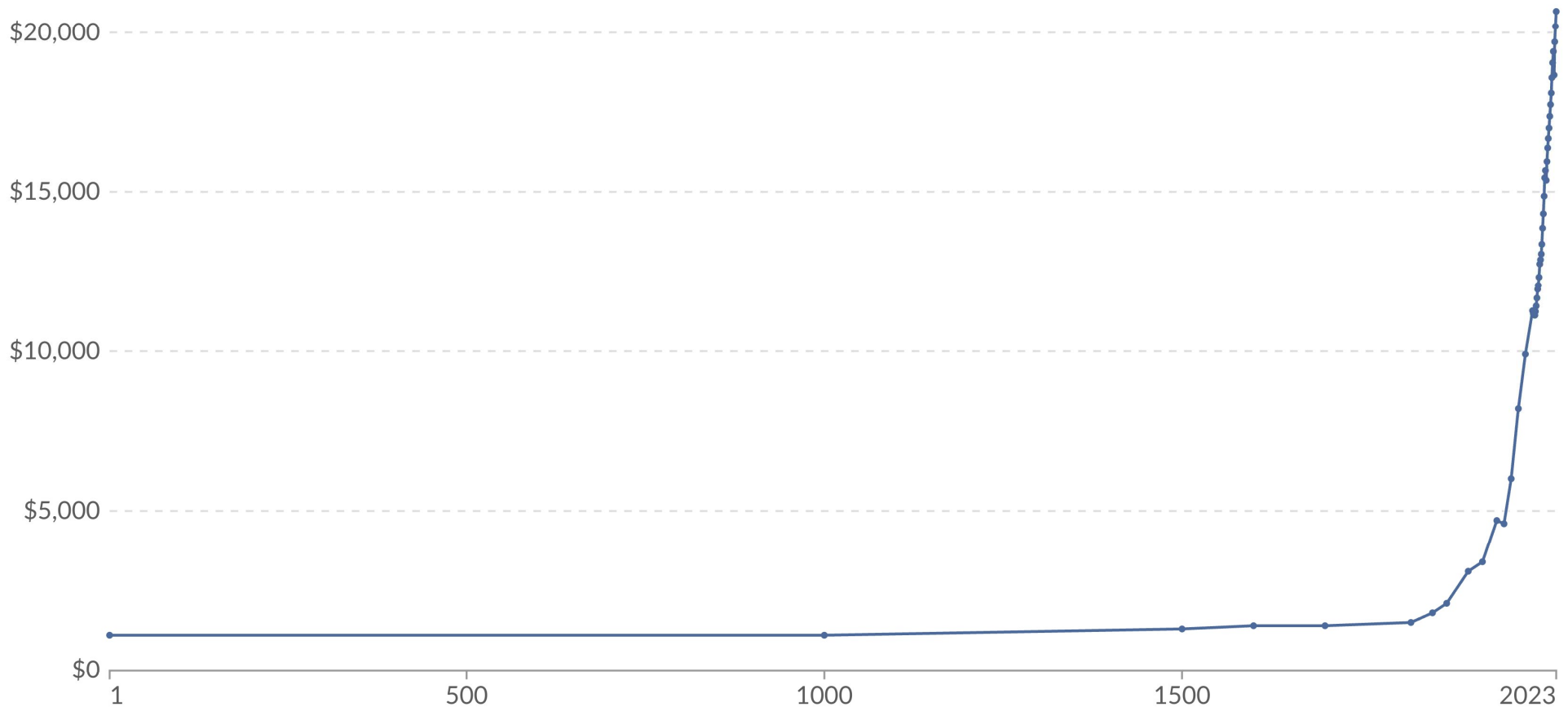


CC BY SA 4.0

Global average GDP per capita over the long run



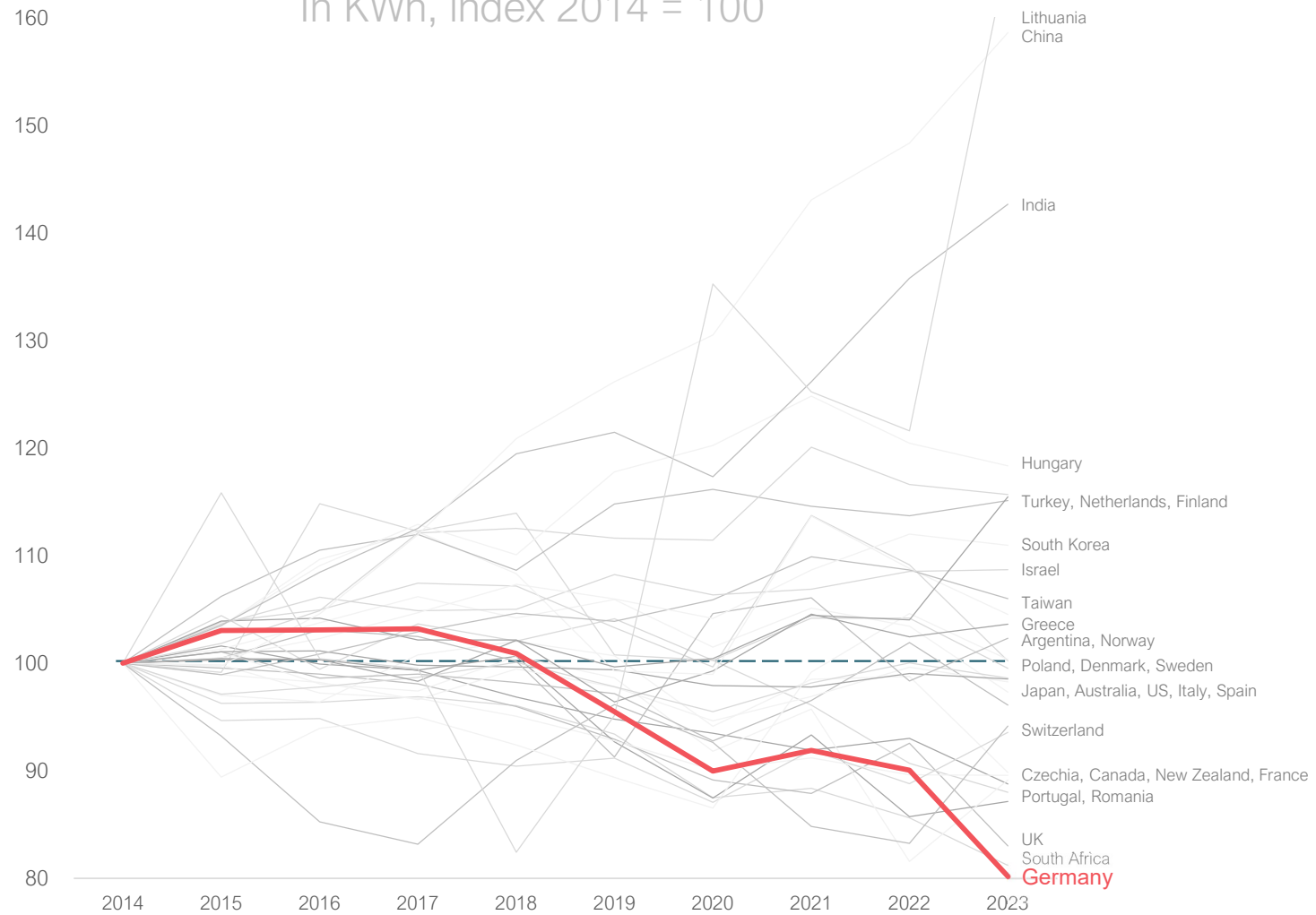
These historical estimates of GDP per capita are adjusted for inflation. We combine three sources to create this time series: the Maddison Database (before 1820), the Maddison Project Database (1820–1989), and the World Bank (1990 onward).



Data source: Data compiled from multiple sources by World Bank (2025); Bolt and van Zanden - Maddison Project Database 2023; Maddison Database 2010

Electricity Generation Per Capita

In KWh, index 2014 = 100



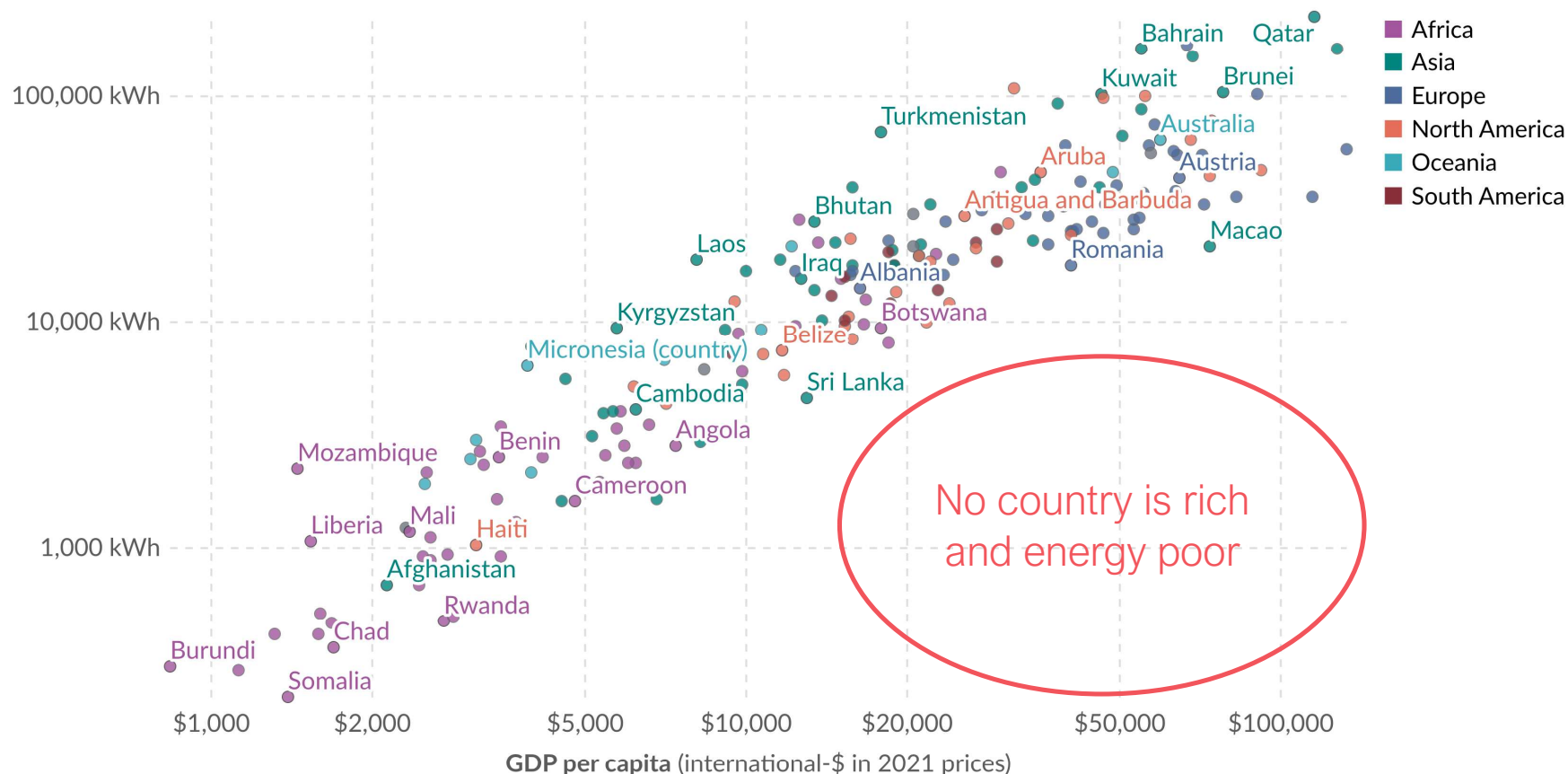
Source: Tomas Pueyo for Uncharted Territories, based on data from Our World in Data, which in turn comes from Ember (2024); Energy Institute - Statistical Review of World Energy (2024); Population based on various sources (2023)

Energy use per person vs. GDP per capita, 2023

Our World
in Data

Energy refers to primary energy¹, measured in kilowatt-hours² per person, using the substitution method³.
Gross domestic product (GDP) is adjusted for inflation and differences in living costs between countries.

Per capita energy consumption (kilowatt-hours)

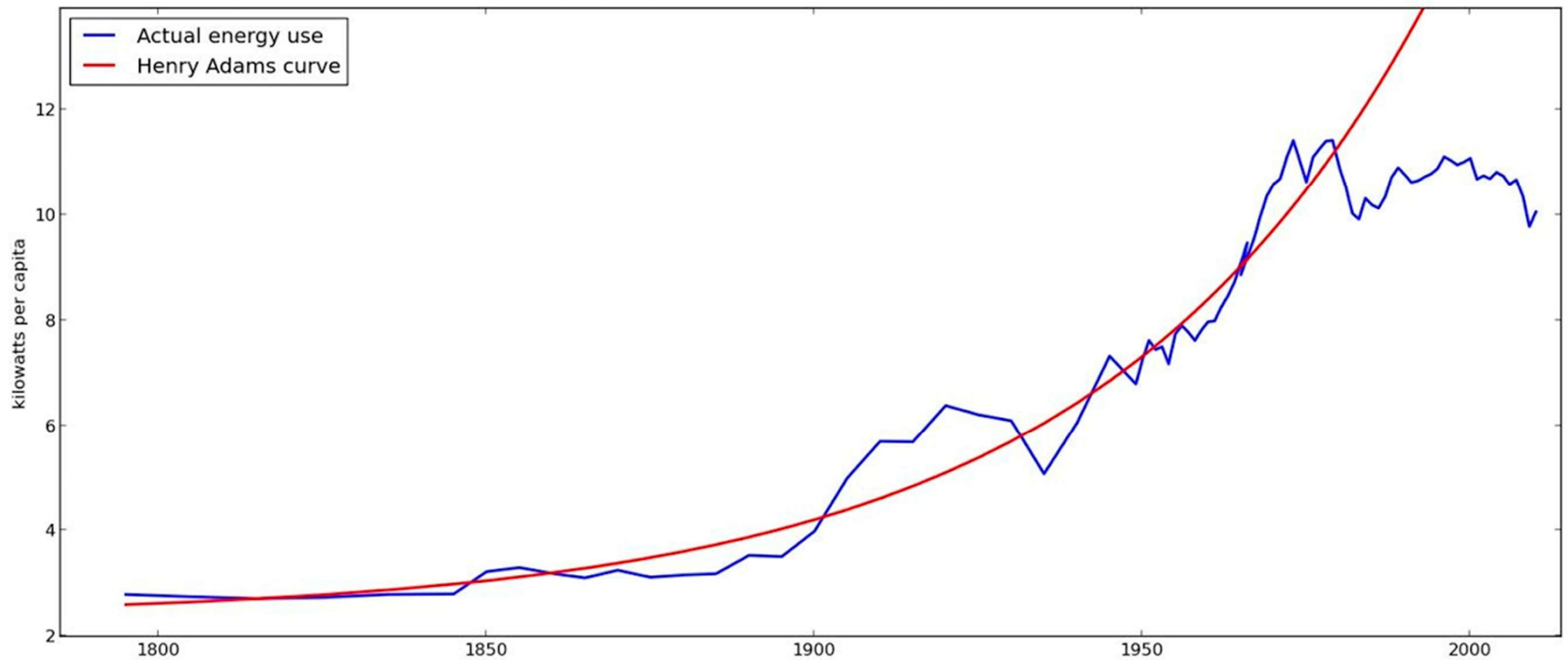


Data source: U.S. Energy Information Administration (2023) and other sources

OurWorldinData.org/energy | CC BY

Note: GDP data is expressed in international-\$⁴ at 2021 prices.

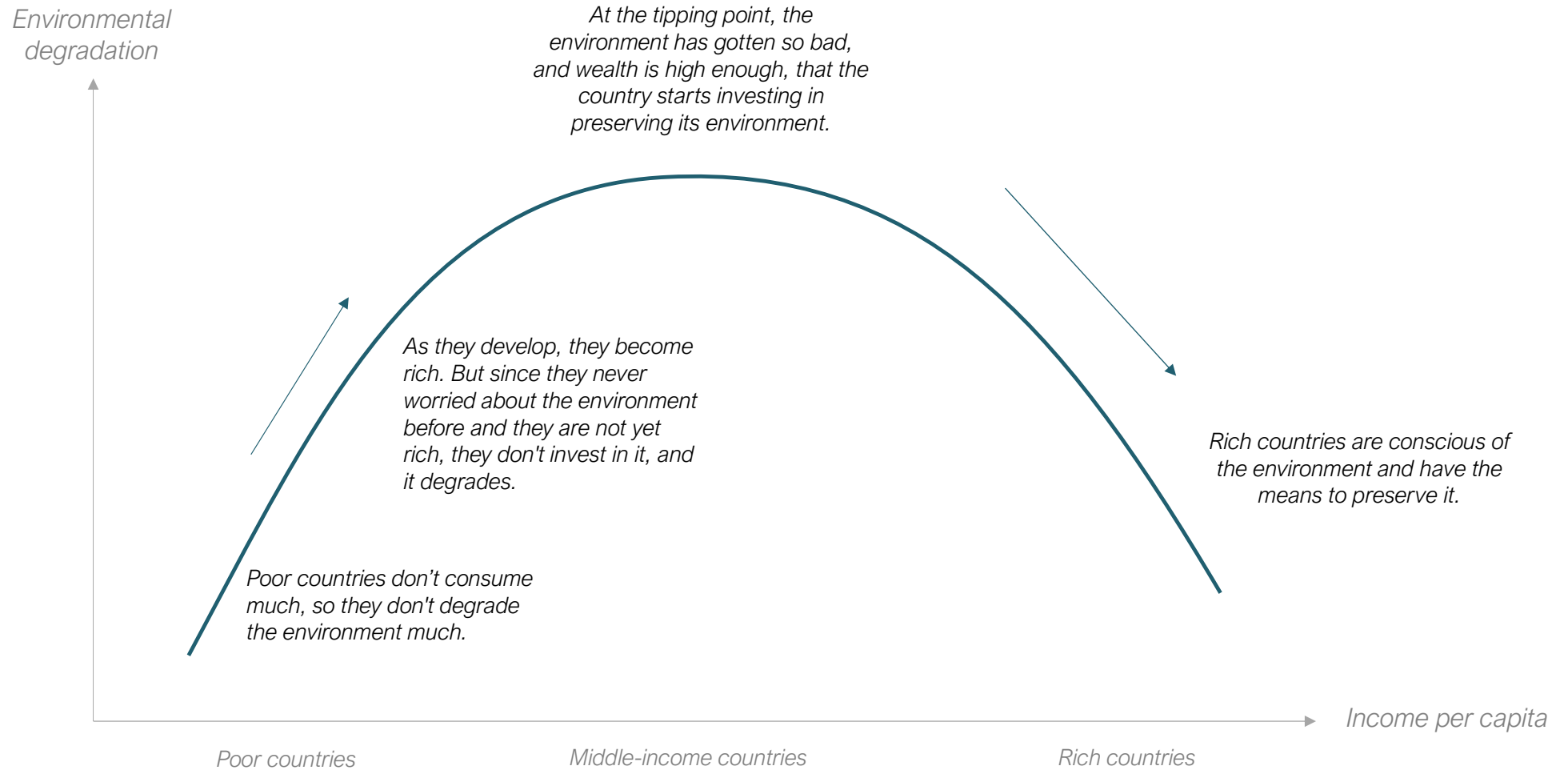
Adams Curve



Without the slow down of energy,
Germans would be 2-3x richer



Kuznets Curve



What is the problem with nuclear energy?

- ✓ Safest
- ✓ Cleanest
- ✓ Densest
- ✓ Sustainable
- ✓ Geopolitically stable
- ✓ Predictable
- ✓ Dispatchable
- ✓ Cheap... especially when reactors are already paid for!

T h a n k
y o u