



**CHRISTY CARDENAS**

MARCH 2025

# THE NUCLEAR OPTION

## THE SHORT STORY

Power demand is on the rise  
Nuclear has a fair enough share  
It's a bit pricey ...  
... and not without incident ...  
... driving decades of regulatory red tape

Now, a nuclear renaissance is underway  
AI is power hungry  
AI infrastructure is attracting investment  
Big tech has already gone nuclear  
Global powers are doubling down

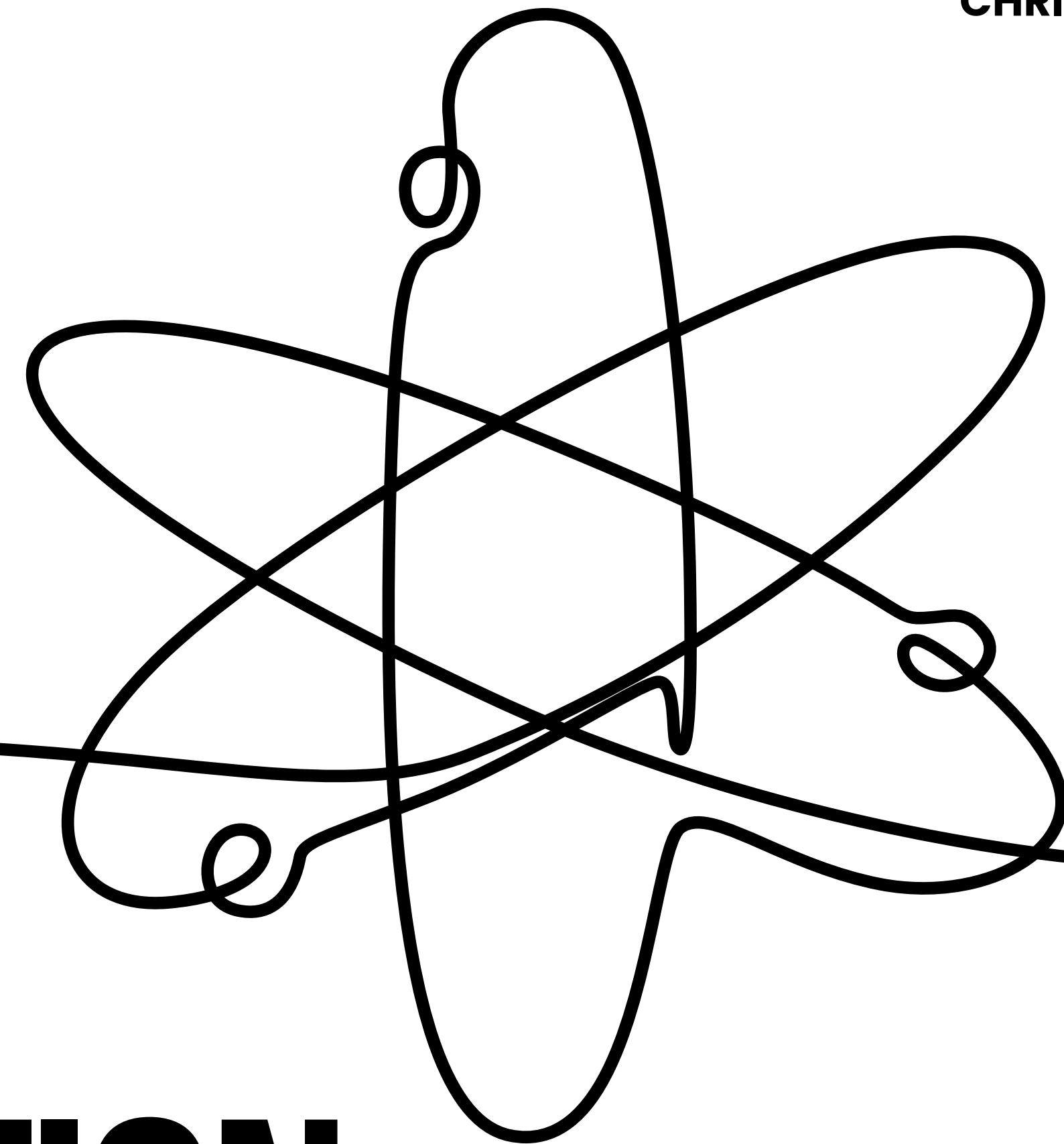
Big long term challenge  
Big long term opportunity

## THE NUCLEAR OPTION



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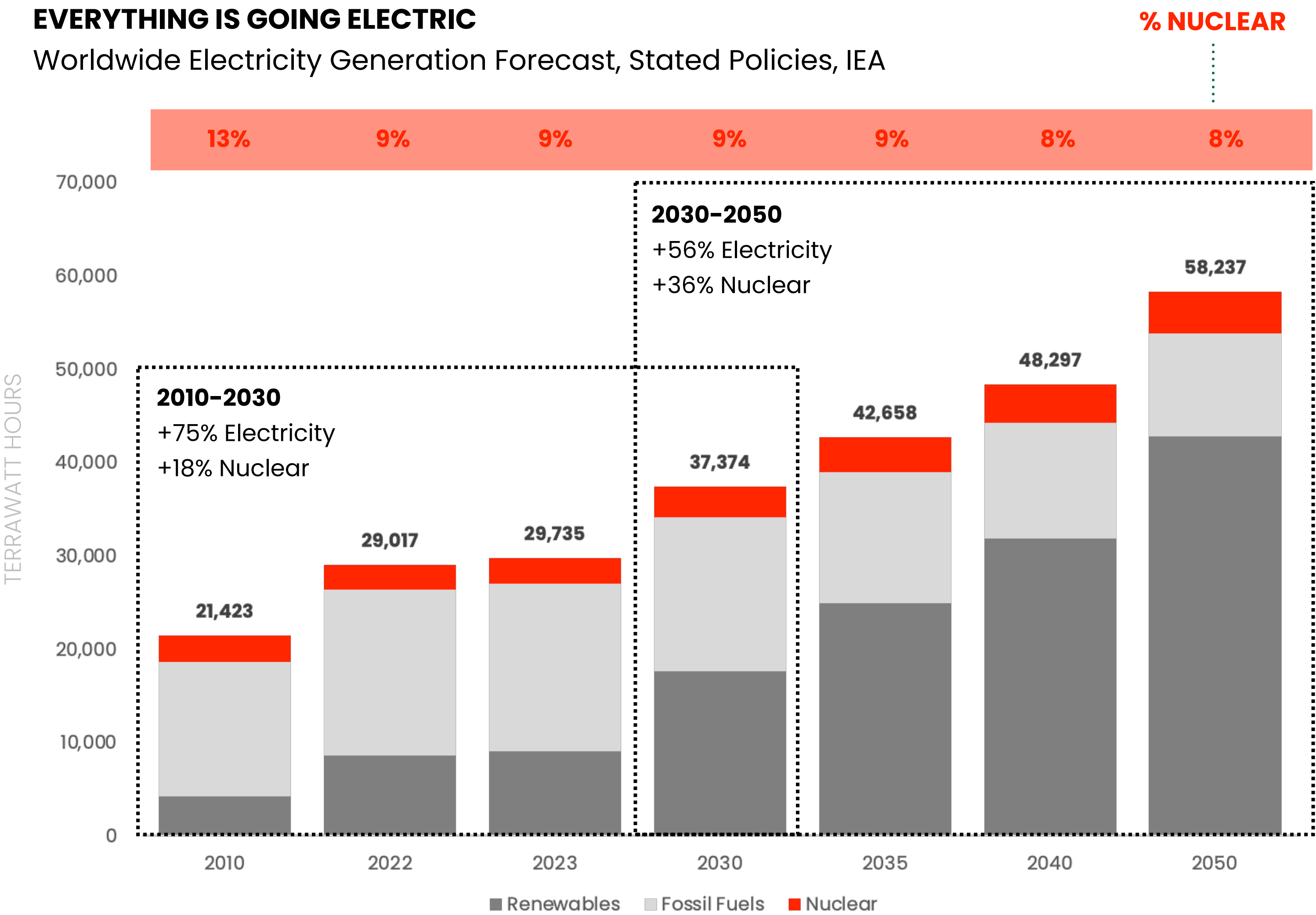


# THE NUCLEAR OPTION

# Power demand is on the rise

## EVERYTHING IS GOING ELECTRIC

Worldwide Electricity Generation Forecast, Stated Policies, IEA



### KEY DEMAND DRIVERS:

- ✓ **ECONOMY**  
Improving global outlook
- ✓ **INDUSTRIALIZATION**  
Global emerging economies
- ✓ **ELECTRIC VEHICLES**  
Increasing penetration, globally
- ✓ **CLIMATE CHANGE**  
Building heating and cooling
- ✓ **ARTIFICIAL INTELLIGENCE**  
Growing digitalization worldwide

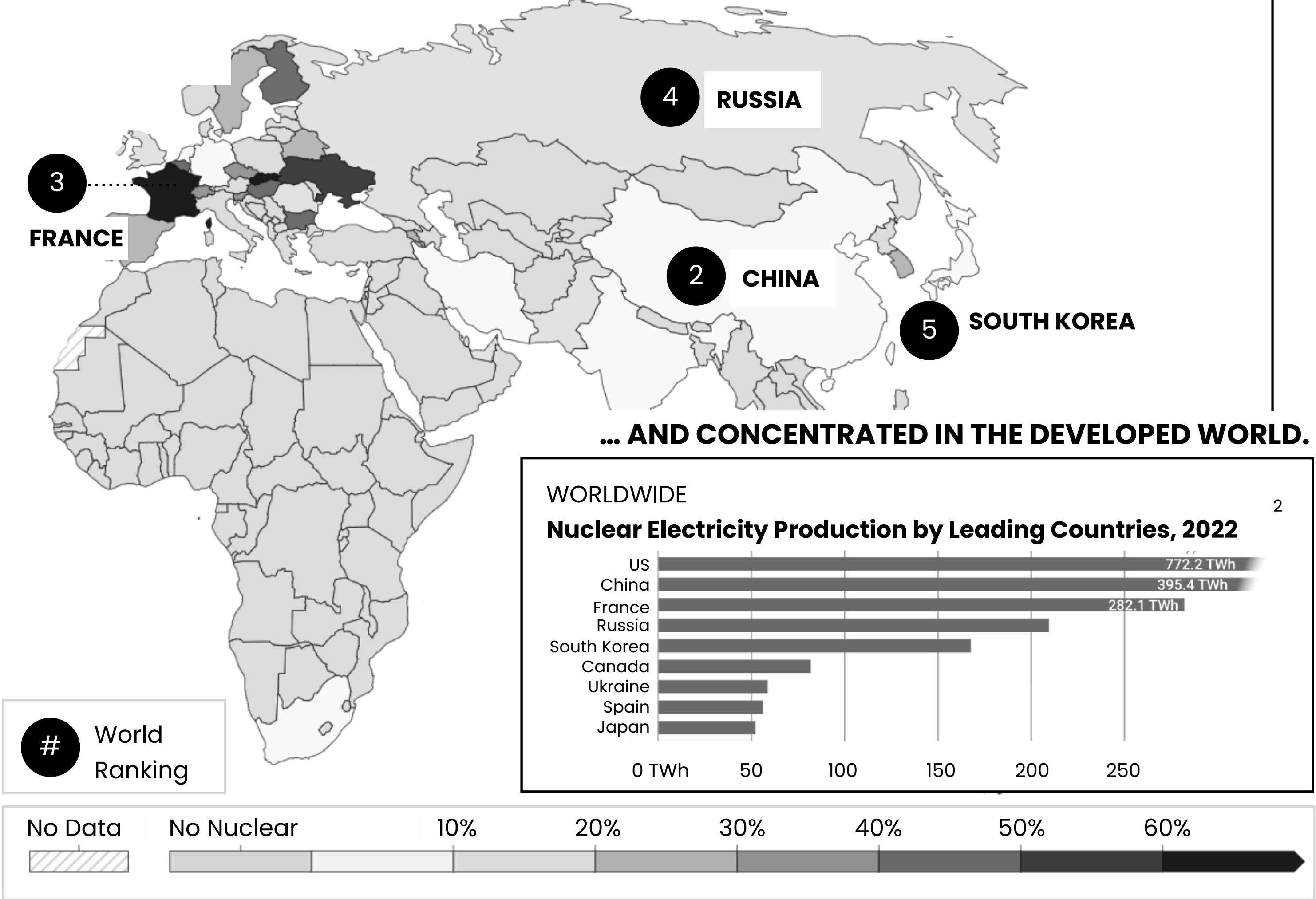
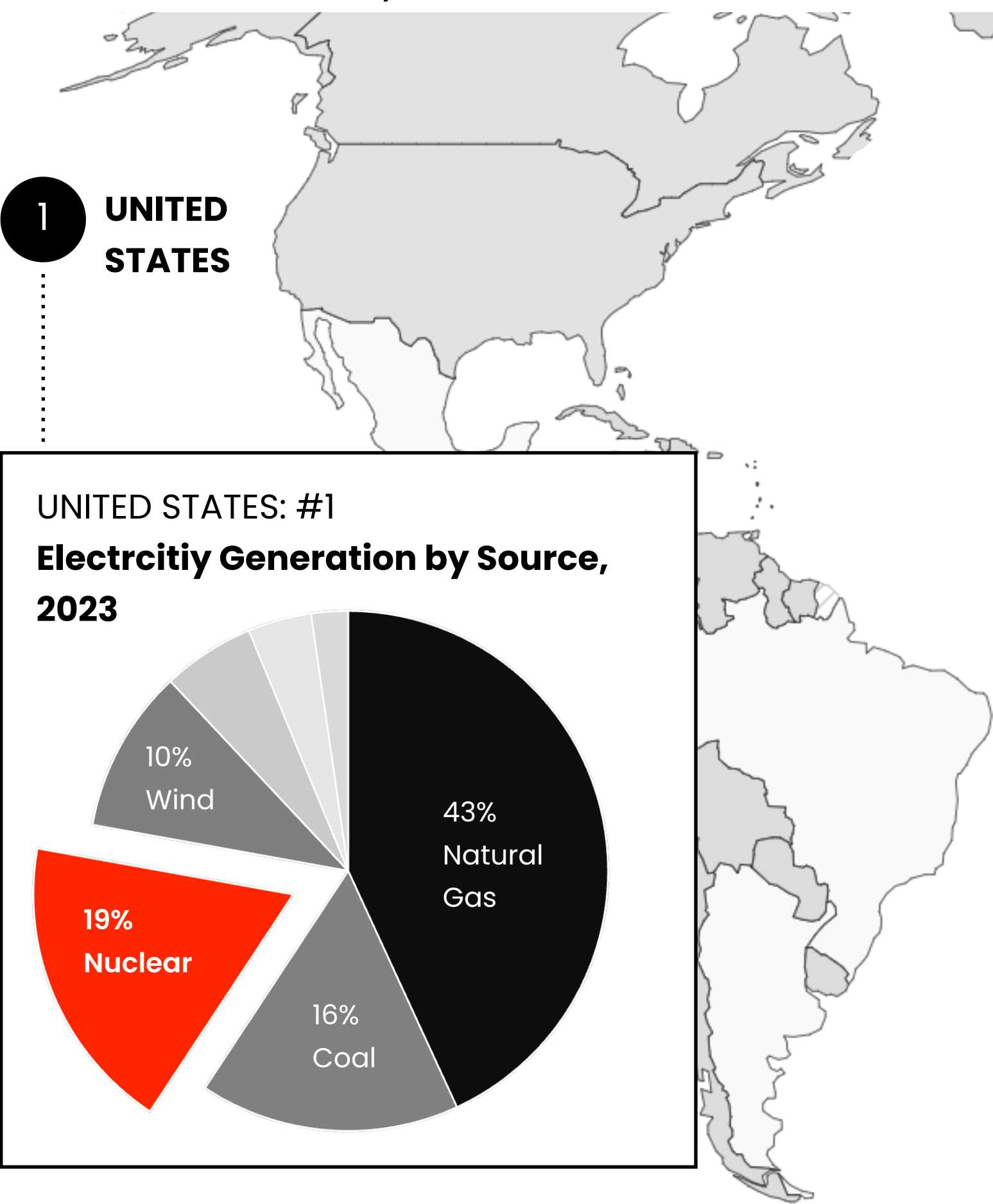
**ELECTRIFICATION  
WILL CONTINUE TO  
DRIVE DEMAND UP**



# Nuclear has a fair enough share

What's more — nuclear generation is set to hit an all-time high in 2025.

**NUCLEAR PENETRATION HAS BEEN SLOW ...**  
 Share of Electricity Production from Nuclear, 2023 <sup>1</sup>

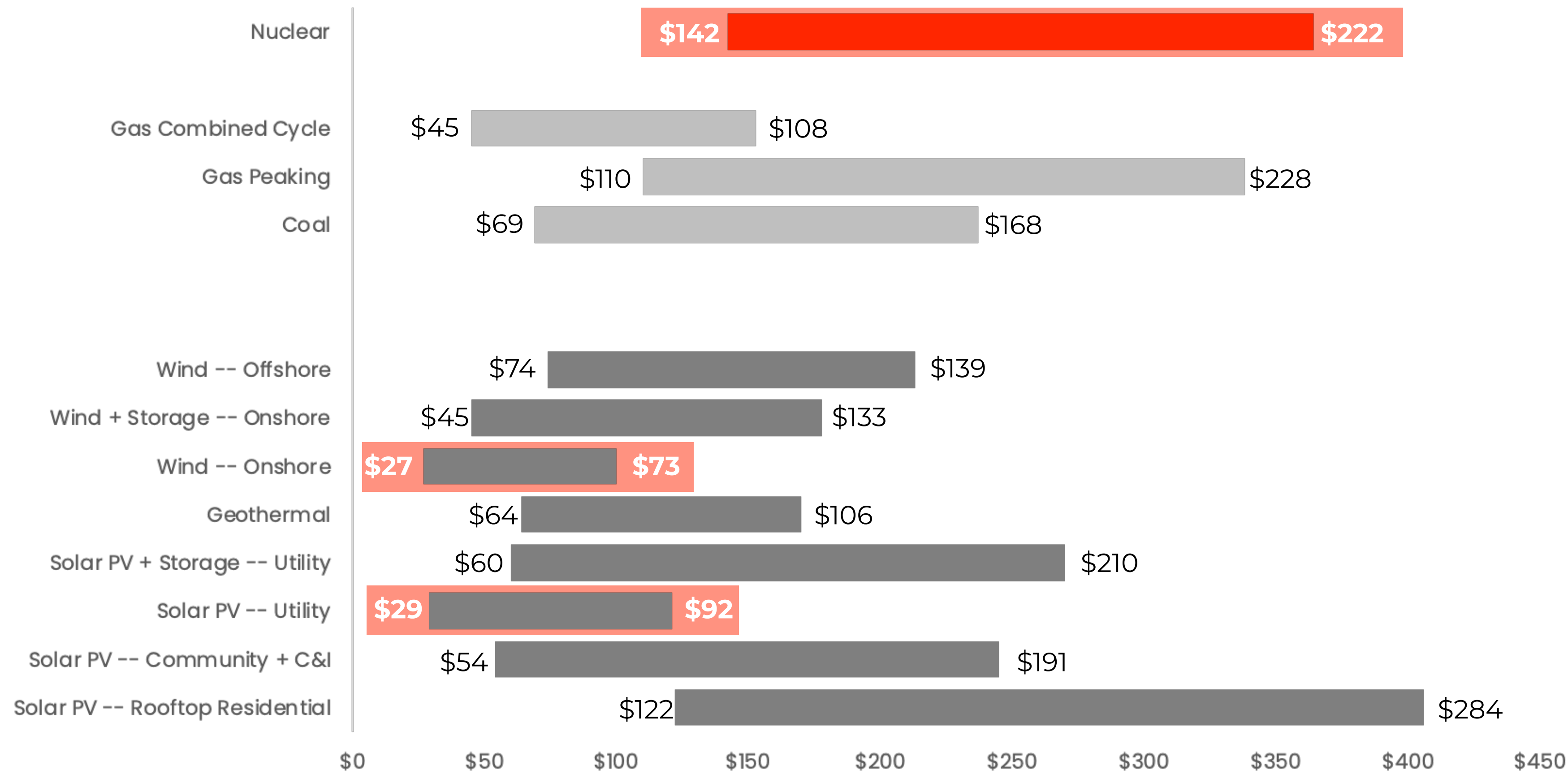


<sup>1</sup> Ember (2024), and Energy Institute – Statistical Review of World Energy (2024), as depicted by [Our World in Data](#).  
<sup>2</sup> International Energy Agency, as reported by [World Nuclear Association](#).

# It's a bit pricey ...

## NUCLEAR POWER IS EXPENSIVE

Levelized Cost of Energy Comparison by Generation Technology (\$/MWh)



### HIGH UPFRONT COSTS

Nuclear power in the US has been stymied by major cost overruns, up to 3x and amounting in the billions.

A few notable examples:

**Vogtle Units 3 + 4 (2024).** Reactor construction Georgia came in \$21B or 150% over budget and 7 years delayed.

**San Onofre Nuclear Station (1984).** Final cost of \$4.3B, a 550%+ cost overrun. The plant is in decommissioning.

**Shoreham Nuclear Plant (1984).** The Project incurred \$5B+ in cost overruns, and was decommissioned in 1989.

**Olkiluoto 3 (2023).** The Finnish plant had a final cost of EUR 11B, a 250%+ overrun.



# ... and not without incident ...

## THREE MILE ISLAND

1979



**\$1B clean up effort**  
**Unclear health impacts**

## CHERNOBYL

1986



**Est. \$235B in damages**  
**46 reported deaths**

## FUKISHIMA

2011



**164,000 residents displaced**  
**1 suspected radiation death**

### ONE MORE TIME

Three Mile Island was restarted in 1985, and then retired in 2019 due to operating losses. Constellation Energy has now entered into a deal to restart the facility to fuel Microsoft data centers, pursuant to a 20-year \$100/MWh power agreement (2x local power rates).

### THE NUCLEAR SAFETY RECORD

These represent all reported incidents related to nuclear power. For context, gas-fired power generation reports an average of 120 safety incidents a year, in a mix of fatalities, injuries and property damage.

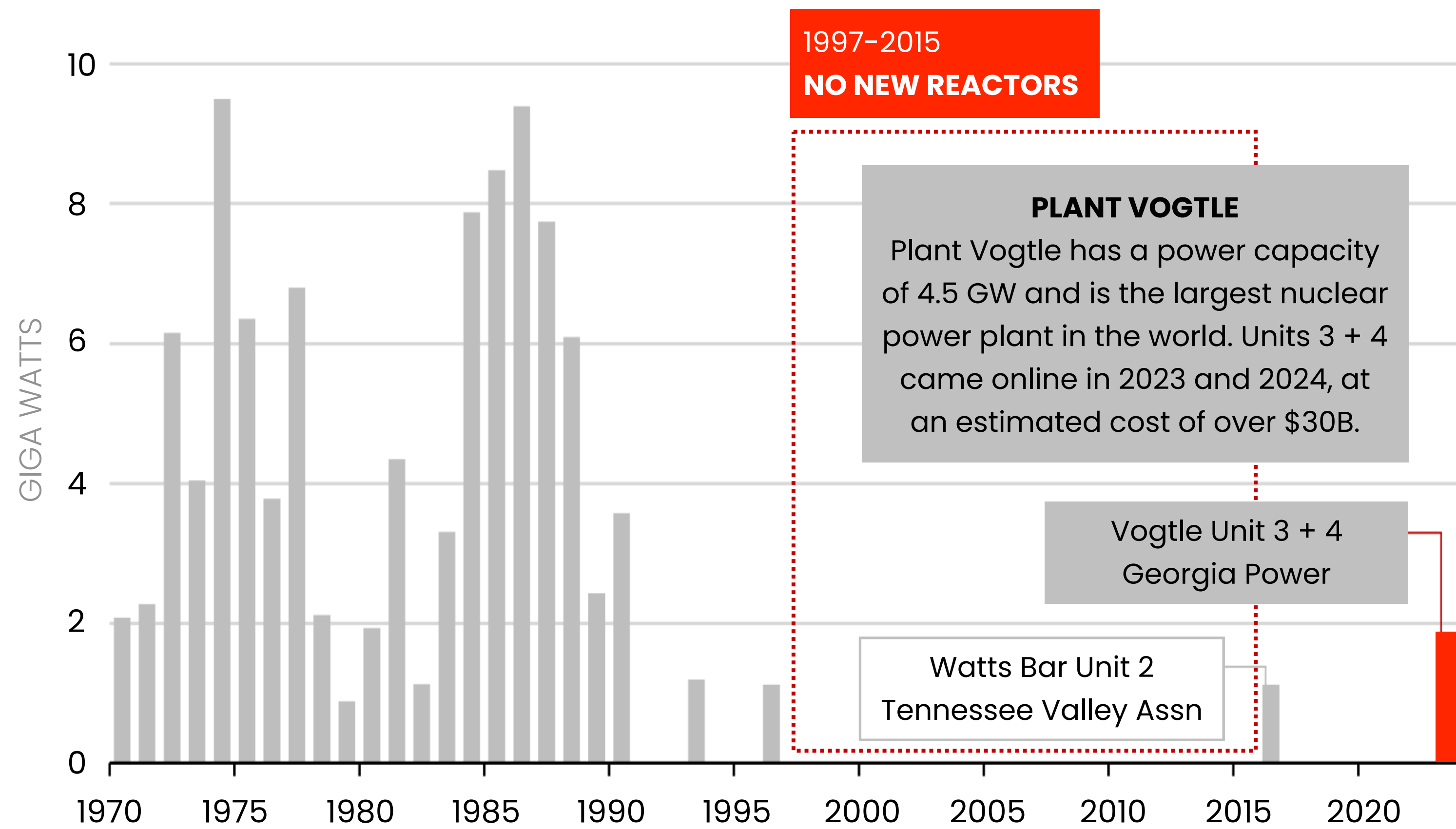
**Nuclear energy results in 99.9% fewer deaths than brown coal, 99.8% fewer than coal, 99.7% fewer than oil, and 97.6% fewer than gas. Wind and solar are just as safe.**



# ... driving decades of regulatory red tape

## THE NEW NUCLEAR DROUGHT CONTINUES

US Nuclear Power Capacity Additions by Initial Year of Operation (1970-2024)



## THE REGULATORY CHALLENGE:

- ✗ COMPLEX LICENSING  
Expensive and length (10Y+)
- ✗ WASTE DISPOSAL  
Lack of a repository for spent fuel
- ✗ SAFETY REGULATIONS  
Drives complexity in construction
- ✗ PUBLIC PERCEPTION  
Concerns given Fukushima, et al
- ✗ OUTDATED REGULATIONS  
Not relevant to new designs

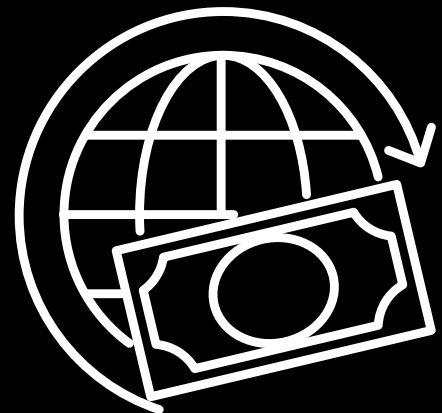
The average age of the US nuclear fleet is ~42 years, making it **one of the oldest fleets in the world.**

NOW:

# A nuclear renaissance is underway

1

## GLOBAL INVESTMENT



Investment in nuclear energy has risen by 50% since 2020, to a whopping \$60B per year. Experts expect further increase given climate ambitions and energy security requirements.

2

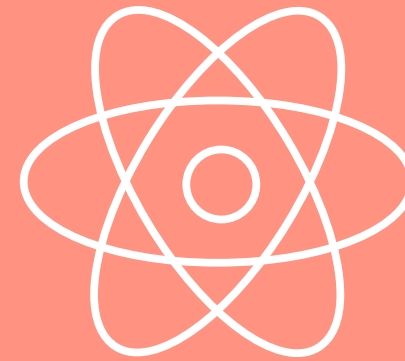
## CAPACITY EXPANSION



Global capacity is up to 2,600 TWh of electricity, and both developed and developing countries like China, India, and France have hundreds of GW in nuclear capacity goals.

3

## INNOVATION



Large venture capital investments in small modular nuclear fission reactors and nuclear fusion companies demonstrate economic appetite for these solutions.

4

## CORPORATE INVESTMENT



Major technology companies, including Amazon, Google, and Microsoft, have entered agreements to utilize nuclear power, particularly SMRs, to meet the energy demands of AI data centers.

5

## REGULATORY TAILWINDS



Government commitments and international collaborations highlight the global competition for energy security and safe, clean and reliable energy production at scale.

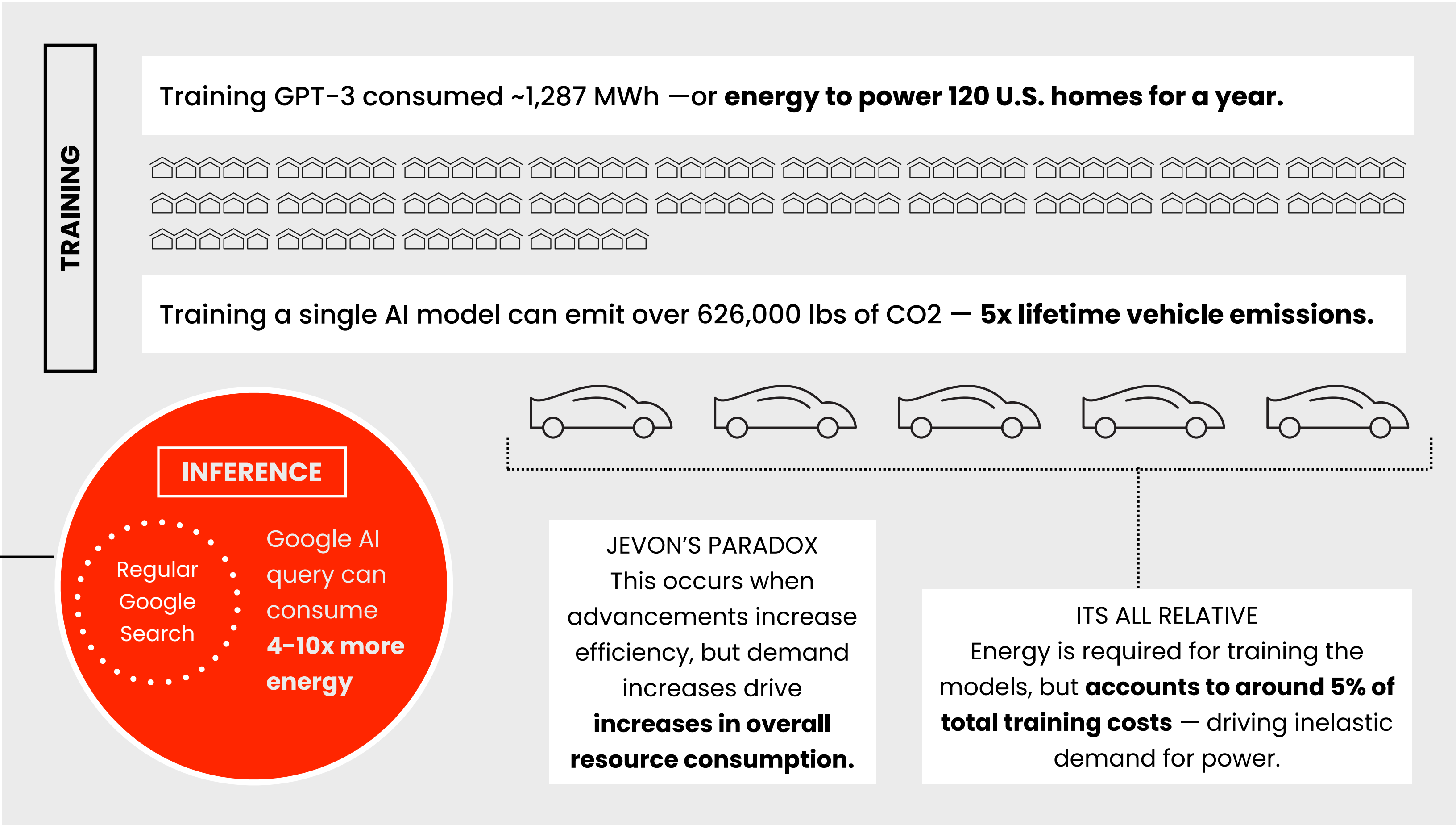


# AI is power hungry

The data quantities being consumed in AI operations is enormous. Data has increased 100x over the last 15 years, and more data has been created in the last three years than in all of history, as we know it.

As AI continues to penetrate the economy, data will continue to increase, as well as the intensity of the data being processed. As pricing drops, the consumer adoption of generative AI will drive increase in the frequency of iteration.

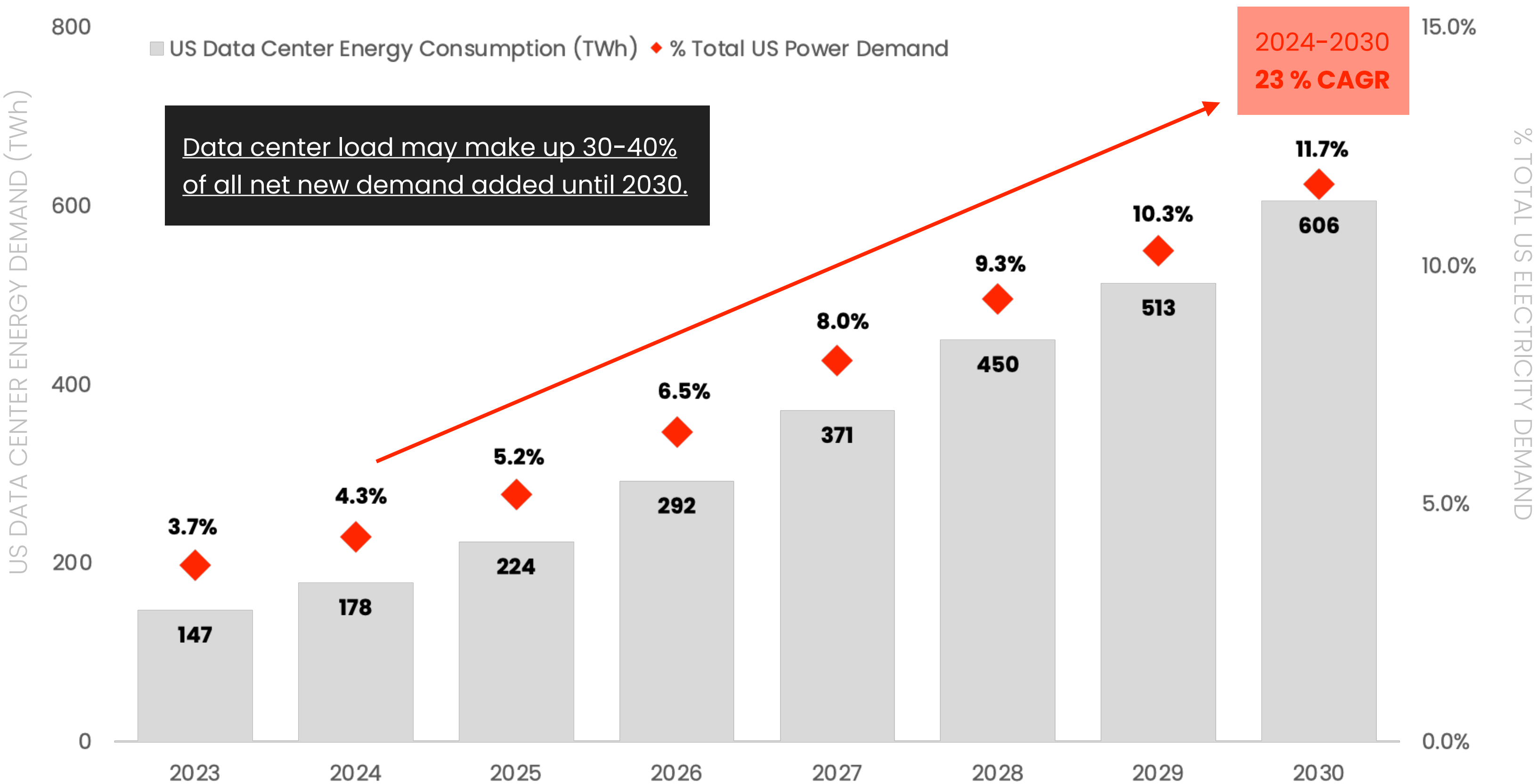
For this, we will require infrastructure. Data Center infrastructure to compute, process and store, and energy infrastructure to power.



# AI infrastructure is attracting investment

## DATA CENTER POWER DEMAND IN THE US WILL RISE, SIGNIFICANTLY

US Data Center Electricity Demand (Terrawatt Hours, Twh) <sup>1</sup>

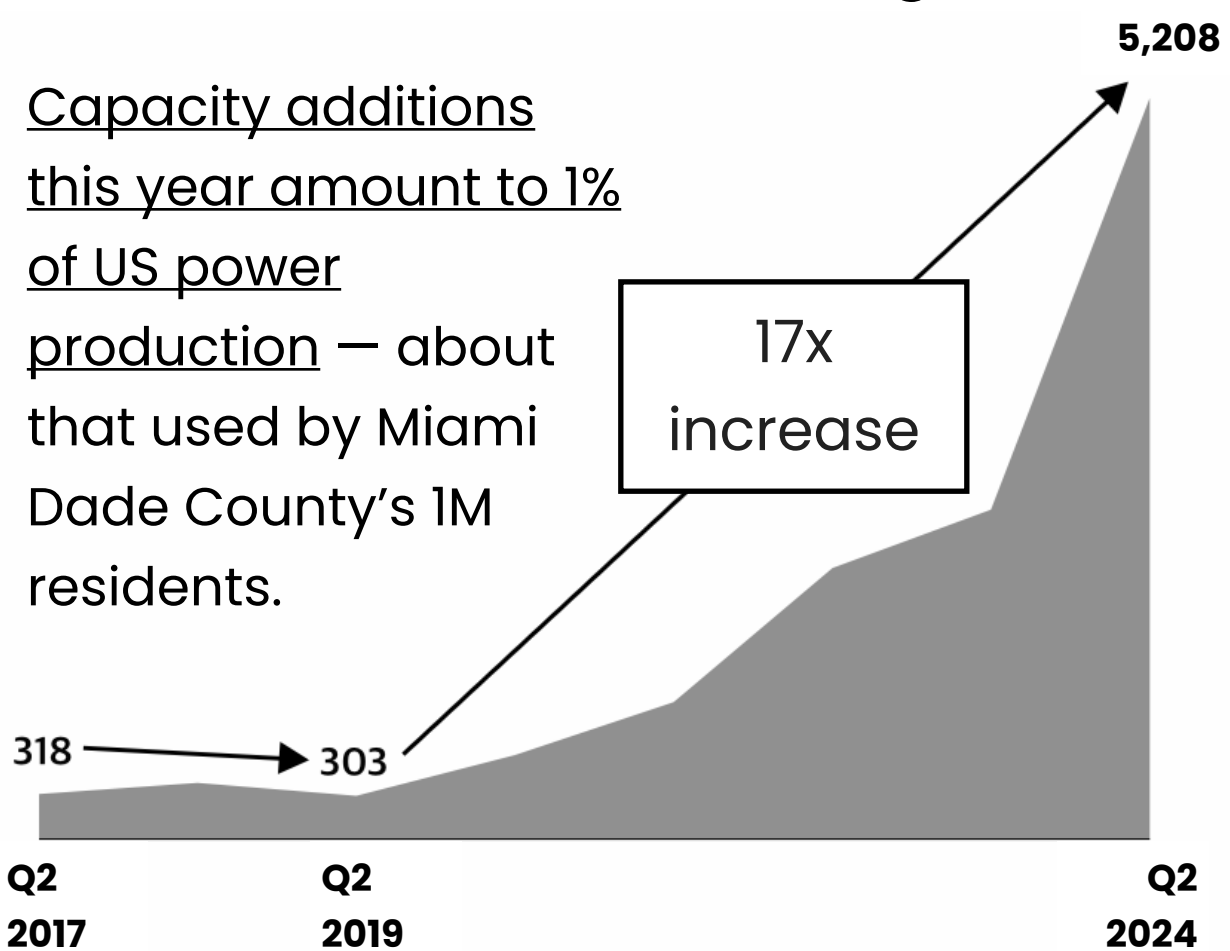


## EXPECTATIONS: <sup>2</sup>

- \$1T invested in US over 5Y
- \$2T invested in world in 5Y
- Doubled grid capacity in 12Y
- Localized grid constraints
- Localized investment required

## US New Data Center Leasing (MW) <sup>2</sup>

Capacity additions this year amount to 1% of US power production — about that used by Miami Dade County's 1M residents.



<sup>1</sup> McKinsey & Company, [How data centers and the energy sector can satiate AI's hunger for power](#), September 17 2024.

<sup>2</sup> Blackstone, [The Convergence of Data Centers and Power: A Generational Investment Opportunity](#), October 31 2024.

# Big tech has already gone nuclear

BIG TECH POWER REQUIREMENTS:

CLEAN

SAFE

RELIABLE

SCALABLE

... at (almost) any price.

SOLUTION: NUCLEAR POWER




Microsoft entered into a \$100B deal with BlackRock, GIP, and MGX to invest in data centers and power infrastructure

Microsoft recently signed a 20 year contract to restart Three Mile Island Nuclear Facility

Microsoft is developing an AI tool to streamline the permitting process for nuclear power plants



Amazon led a \$500M round in X Energy, a small modular reactor nuclear co.




Amazon has also entered into several agreements for small modular reactor development


Amazon is already the largest corporate consumer of renewable power



OpenAI recently announced Project Stargate, a \$500B AI infrastructure commitment backed by Softbank



Helion, a small modular reactor company, investors include Sam Altman, Sotbank and Mithril Capital





In December, Meta announced a search for 1-4 GW of nuclear power generation capacity

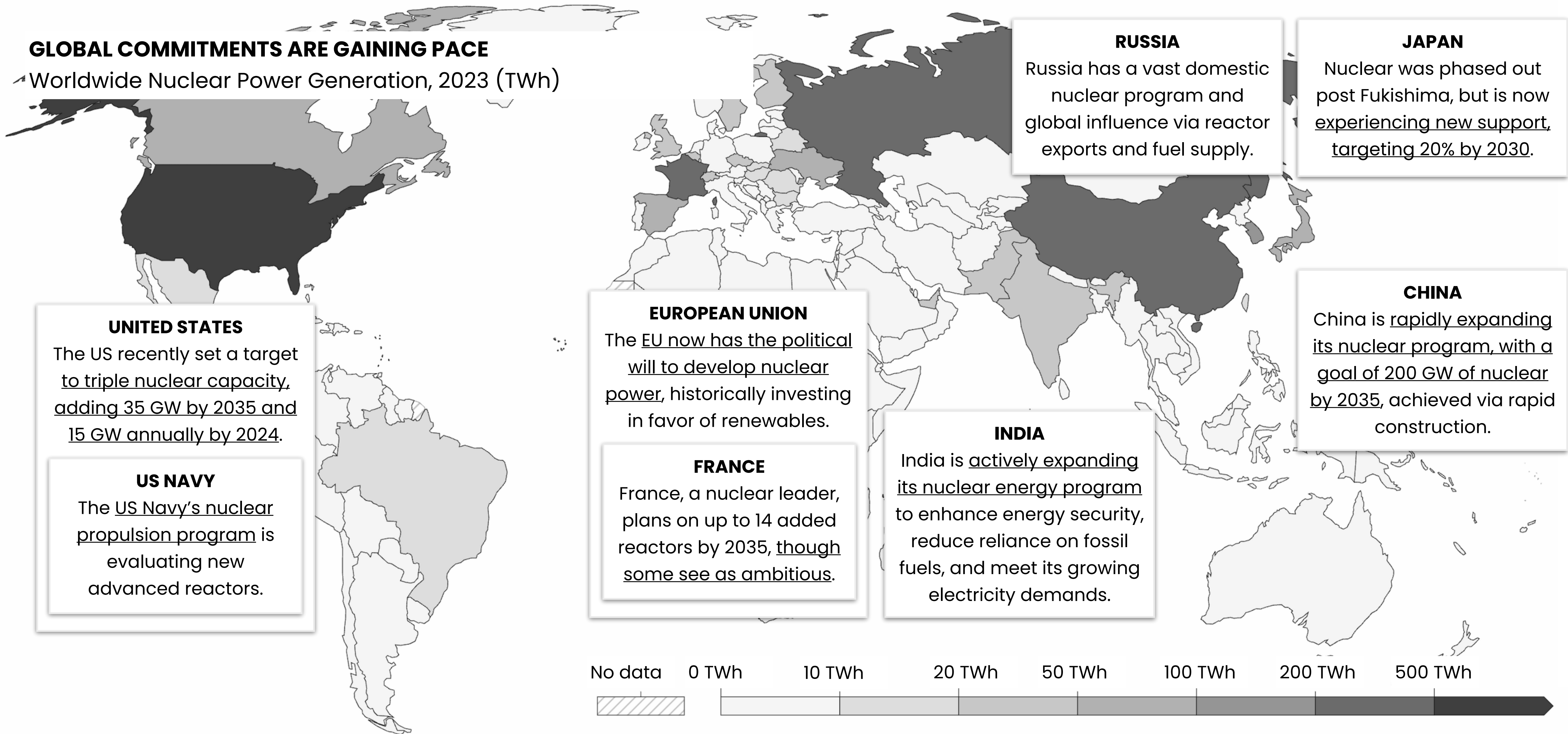


Google has entered into a PPA with Kairos Power, an SMR developer, for 500 MW





# World powers are doubling down



# Big long term challenges



## DEMAND

Increasing power demand given ongoing electrification, climate change and emerging AI demands will drive a need for reliable, scalable power and energy infrastructure.



## CLIMATE

Climate change is wreaking economic havoc on the world, as we battle increasing weather volatility, increasing catastrophic storms, and evolving sea levels.



## SECURITY

In the wake of the COVID, the Ukraine War, the European Energy Crisis, and increasing AI energy needs, energy security is a critical and increasingly salient priority.



## RELIABILITY

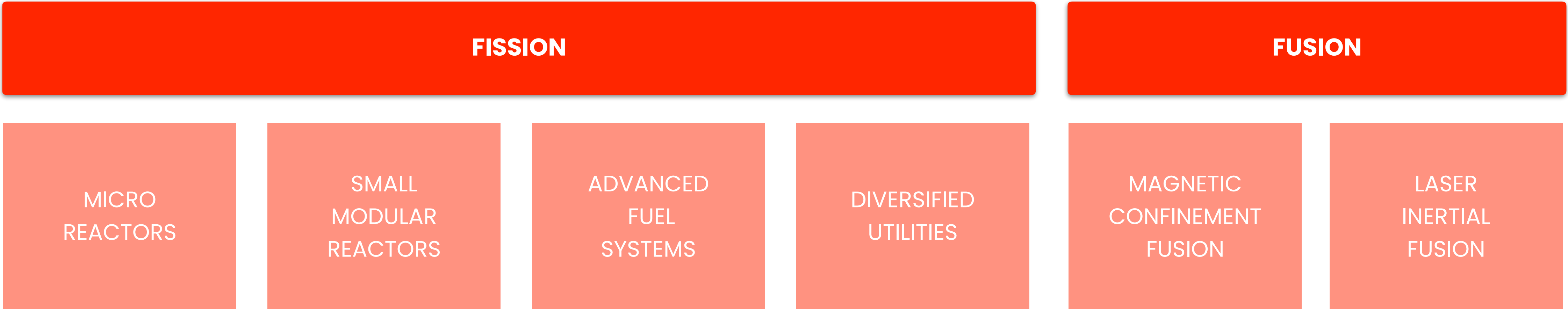
Electricity production that can be trusted throughout weather events, intermittent resources, and maintenance cycles is mission critical given the constancy of new needs.





















## EFFICIENCY

The for efficient utilization of resources, time and capital is a top priority, as we advance strategic technologies, with great economic and industrial benefit.

# Big long term opportunity





14 Note: Helion is pursuing a magneto-inertial fusion technology combining aspects of magnetic and inertial confinement fusion.

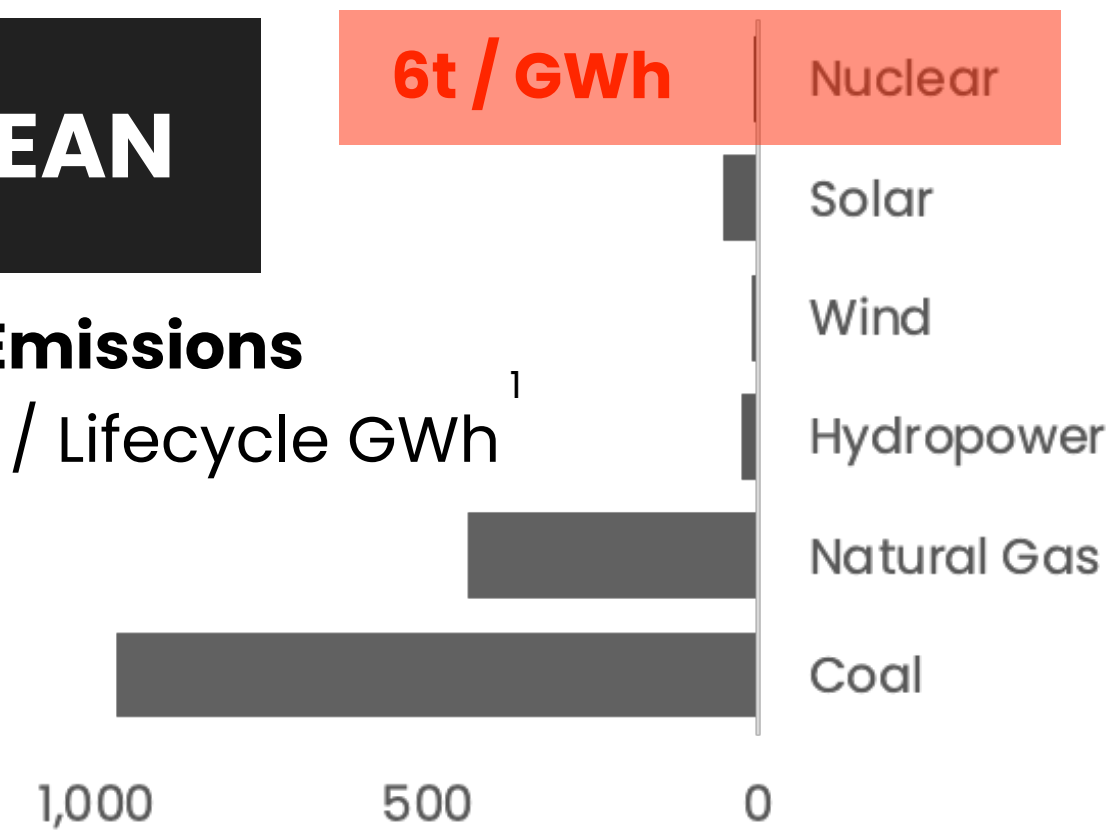


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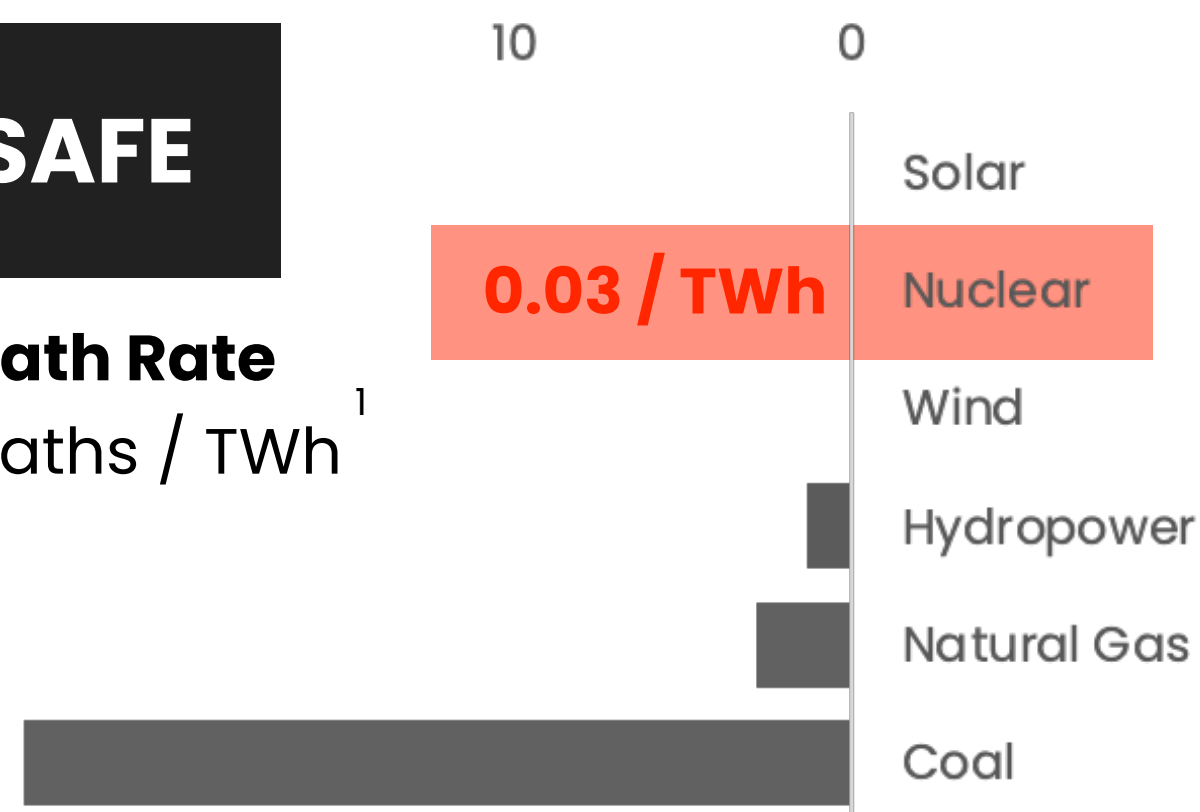
## CLEAN

**GHG Emissions**  
t CO<sub>2</sub> / Lifecycle GWh<sup>1</sup>



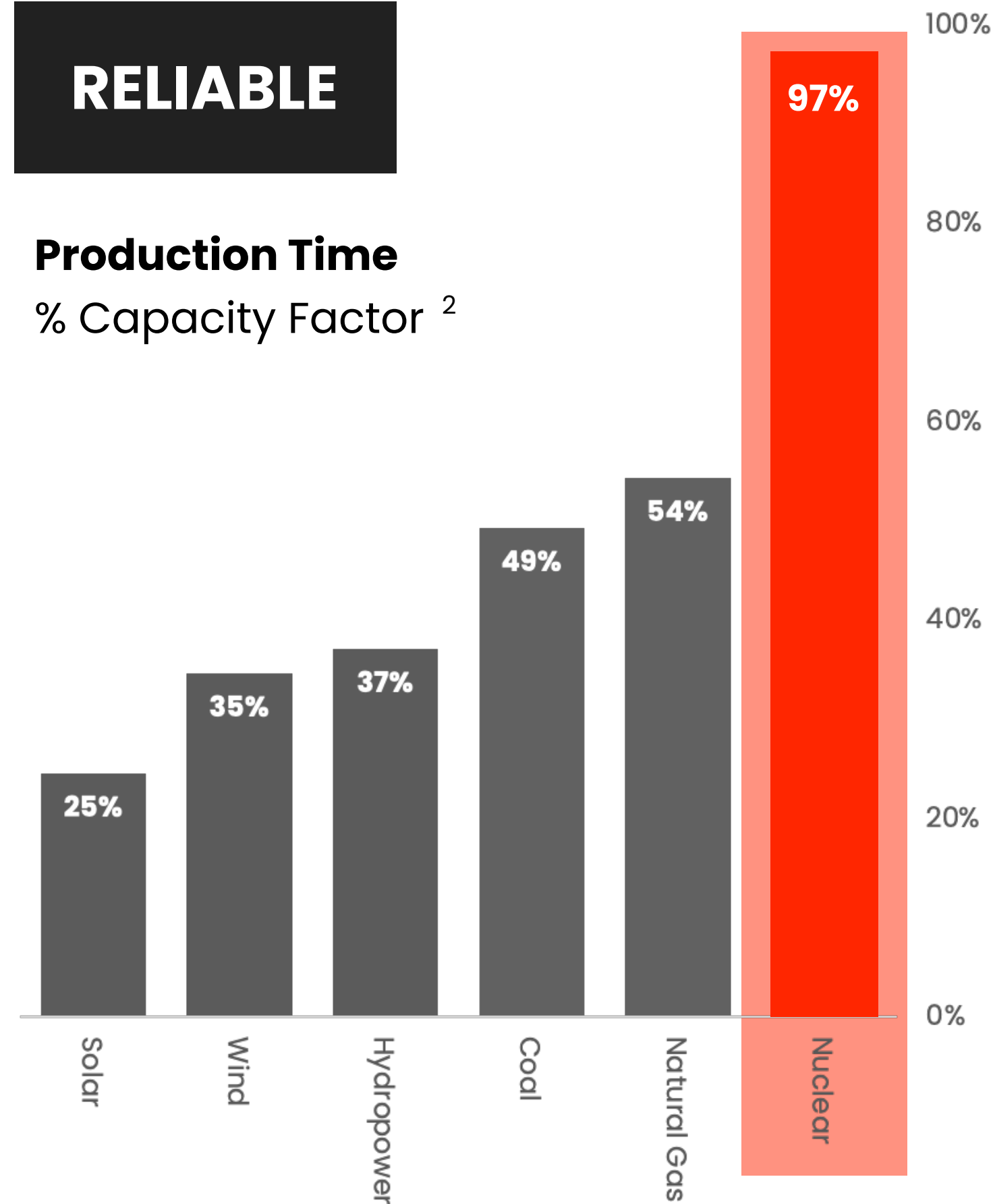
## SAFE

**Death Rate**  
Deaths / TWh<sup>1</sup>

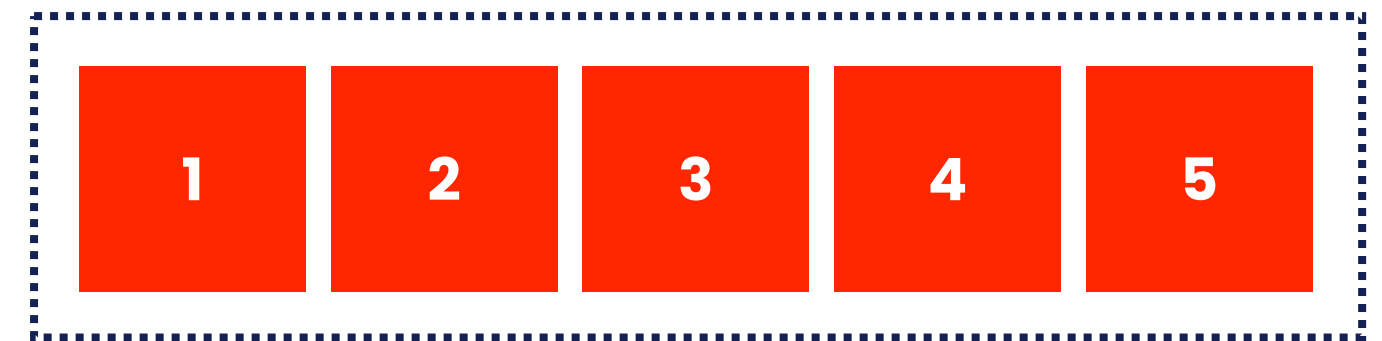


## RELIABLE

**Production Time**  
% Capacity Factor<sup>2</sup>



## ENERGY AT SCALE



**5 Nuclear Plants** is energy equivalent to:

**16 Natural Gas Plants**

400 MW combine cycle facilities

**7,600 Wind Turbines**

1.5 MW wind turbines

**3.5M Solar PV Rooftops**

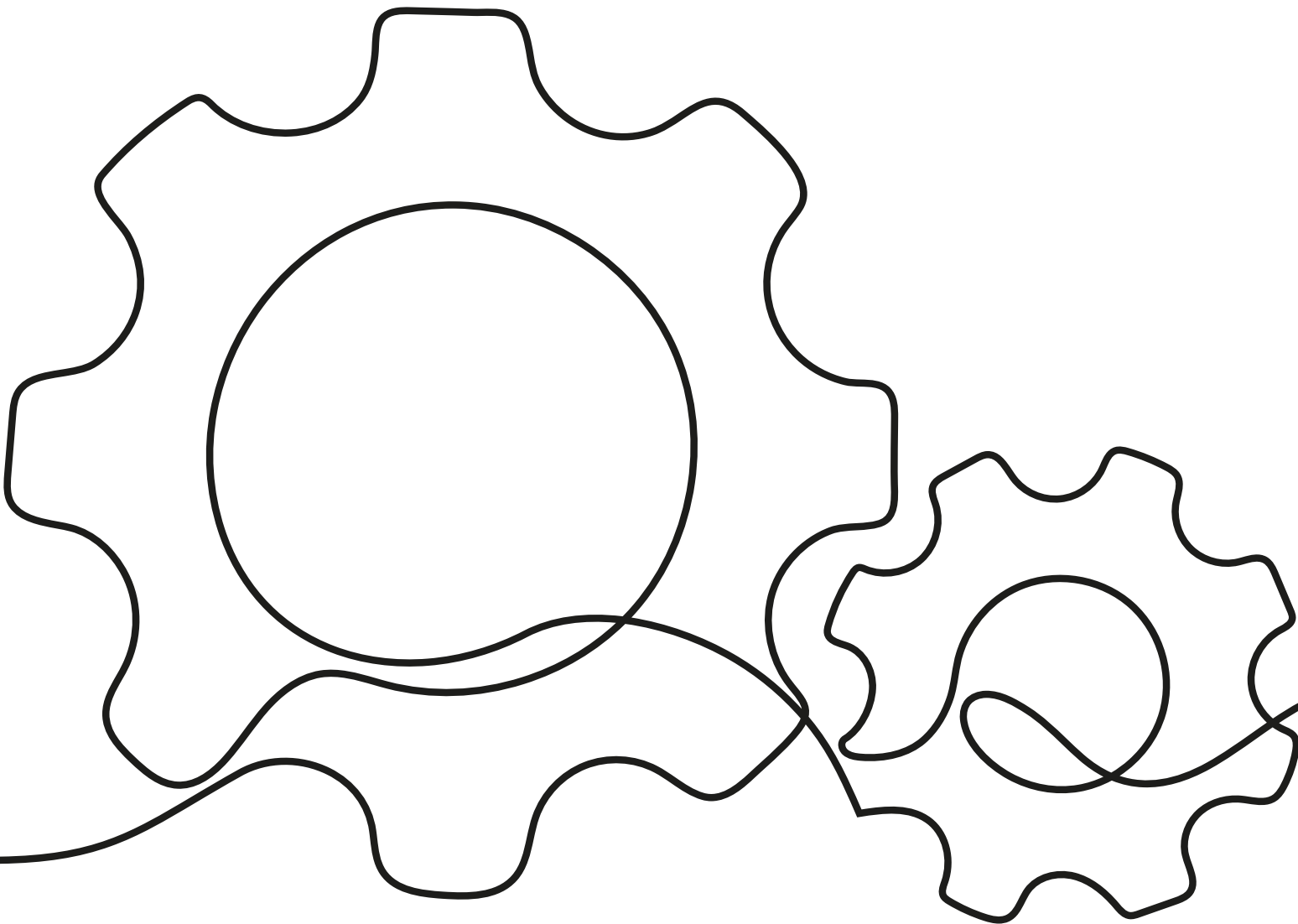
5 kW solar PV rooftops

<sup>1</sup> Our World in Data, [What are the safest and cleanest sources of energy?](#), February 10, 2020.

<sup>2</sup> US Department of Energy, [What is Generation Capacity?](#), May 1, 2020.

THESIS

# CLEAN MACHINE



The intelligent automation of our world continues. The required advancements, already occurring, will require a real-world infrastructure across energy, robotics, advanced manufacturing, space and more. These machines must indeed be “clean”, as we strive toward a sustainable and comfortable existence. **Opportunity awaits.**

AI

- SUPER COMPUTERS
- QUANTUM COMPUTERS
- SEMICONDUCTORS
- DATA CENTERS
- FOUNDATION MODELS

ROBOTICS

- HUMANOID ROBOTICS
- VERTICAL ROBOTICS
- MICRO ROBOTICS
- ADV. MANUFACTURING
- MOTORS + ACTUATORS

ENERGY

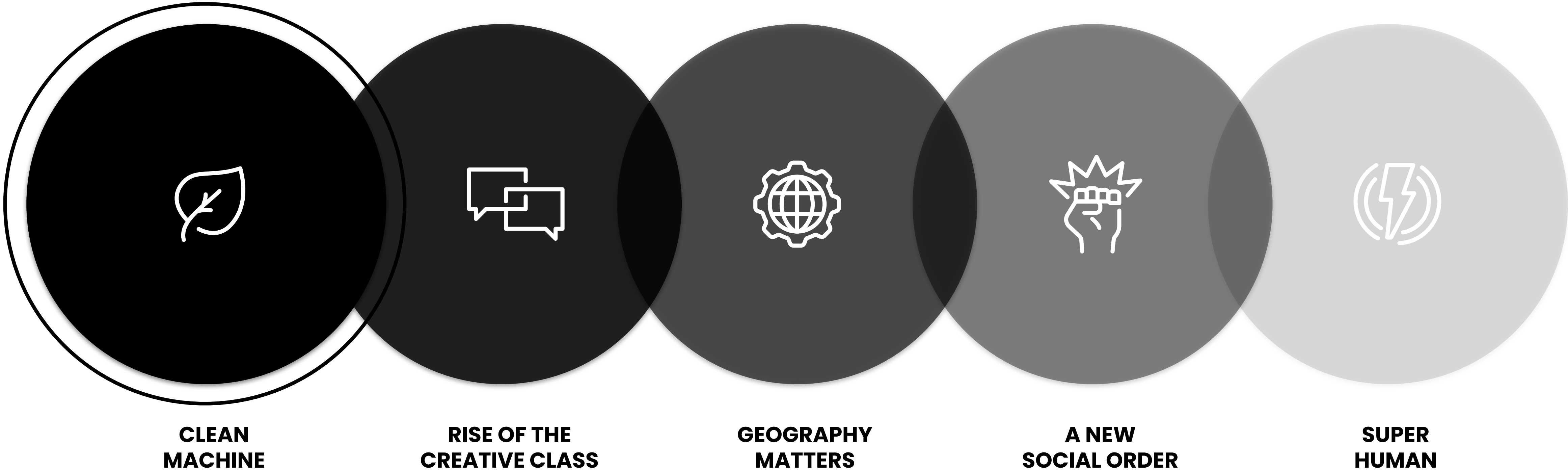
- RENEWABLE POWER
- GRID INFRASTRUCTURE
- ENERGY STORAGE
- ENERGY EFFICIENCY
- NUCLEAR POWER

SPACE

- ROCKETS
- SATELLITES
- PROPULSION
- ADV. MATERIALS
- FRONTIER ROBOTICS

MANIFESTO

# THE AGE OF ABUNDANCE



THE AGE OF ABUNDANCE is an Iris Invest Future Cast. We sit at the cusp of an unprecedented Age of Abundance, where human quality of life and collective consciousness will increase dramatically. Our thesis lays out areas for opportunity, collaboration and investment. We are manifesting the future.





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MARCH 2025

Christy Cardenas



**We believe in focus.**