Entering the Era of Energy Disruption

GERARD REID

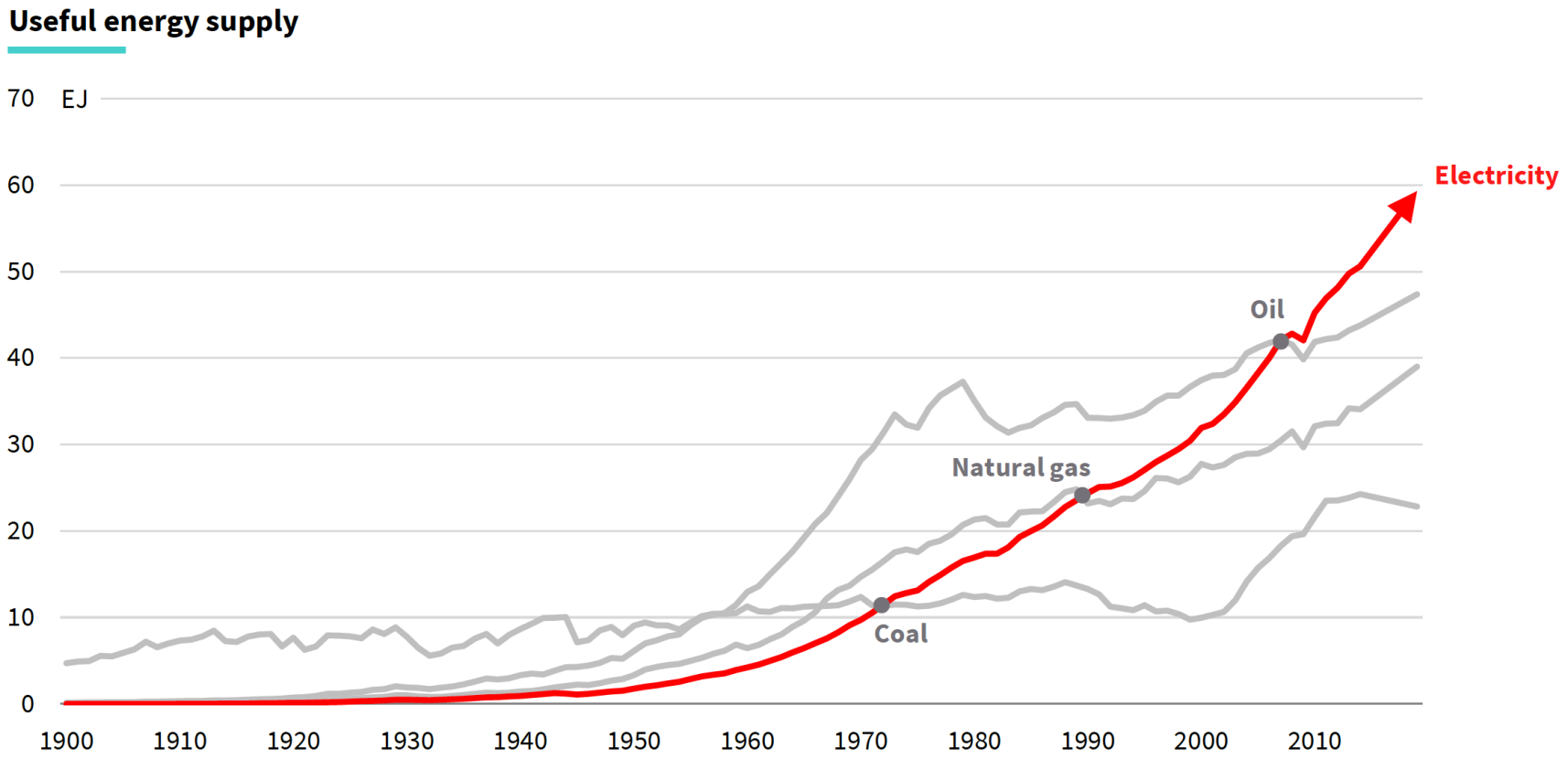
MAY 2025

The Energy Big Picture

Change Drivers

Implications

The World is Electrifying Everything!!



Source: RMI

Driver #1: All our digital devices need electricity and nearly everything is controlled through an electrical controller

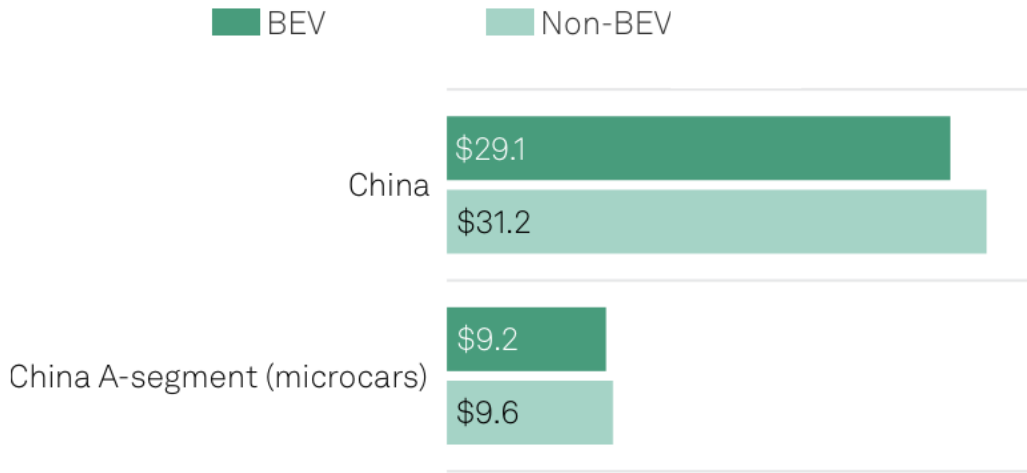
Driver #2: Electricity is more cost effective than burning fossil fuels

In Texas EVs are more than 60% cheaper to fuel than ICES

Vehicle	Energy/Fuel Efficiency	Fuel/Electricity Cost	Cost per 10,000
Tesla Model Y	15 kWh / 100 km	$0.13 / kWh (home rate)	**$195**
BMW 1 Series (Petrol)	~7.5 L / 100 km (~31 mpg US)	$3.50 / gallon (Texas avg)	**$692**

Vs.

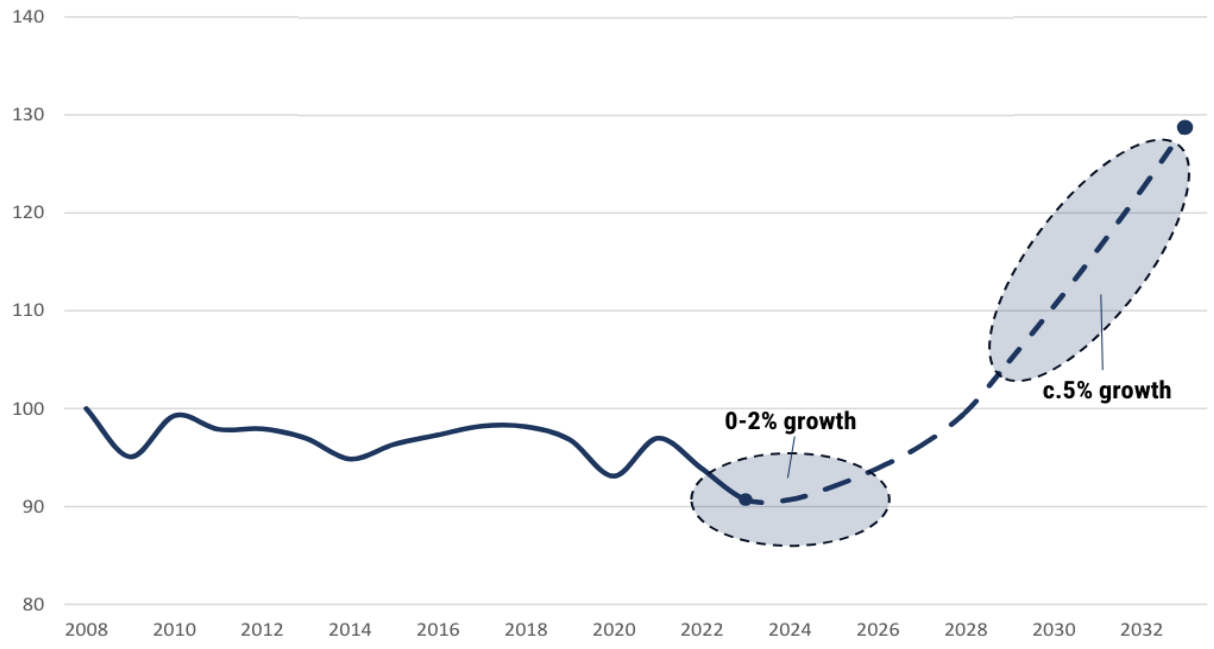
In China we have EV-ICE Cost Parity



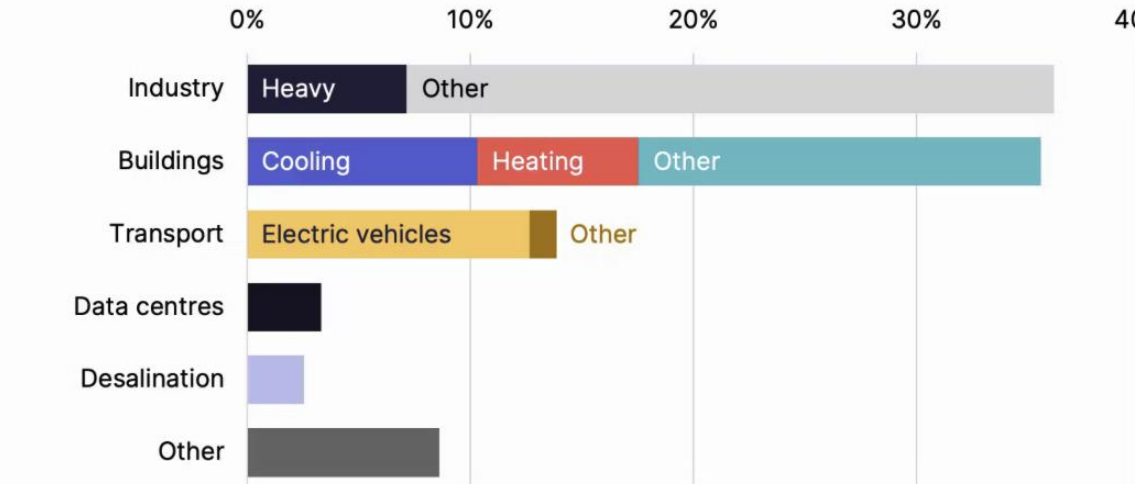
Source: Bloomberg NEF

Driver #3: Electrification of Industry and Buildings

EU-27 power demand (rebased, 2008=100)



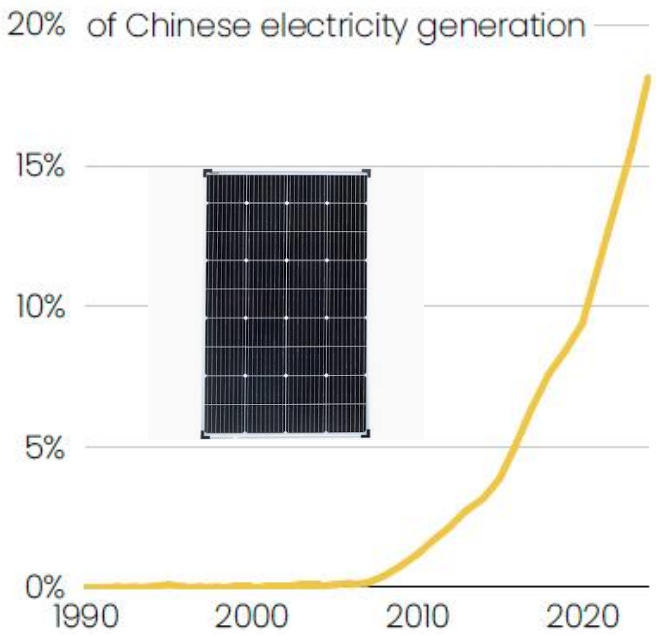
Share of Growth in Global Energy Demand till 2030



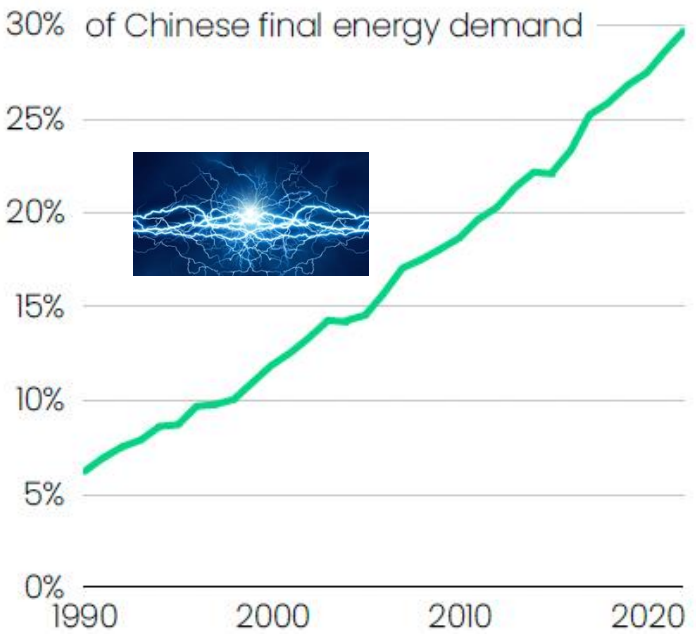
Source: Goldman Sachs IEA

Driver #4: Move to energy independence

1. Localise energy production via solar and wind



2. Convert end uses to electricity



Curb growing import dependency

$440b

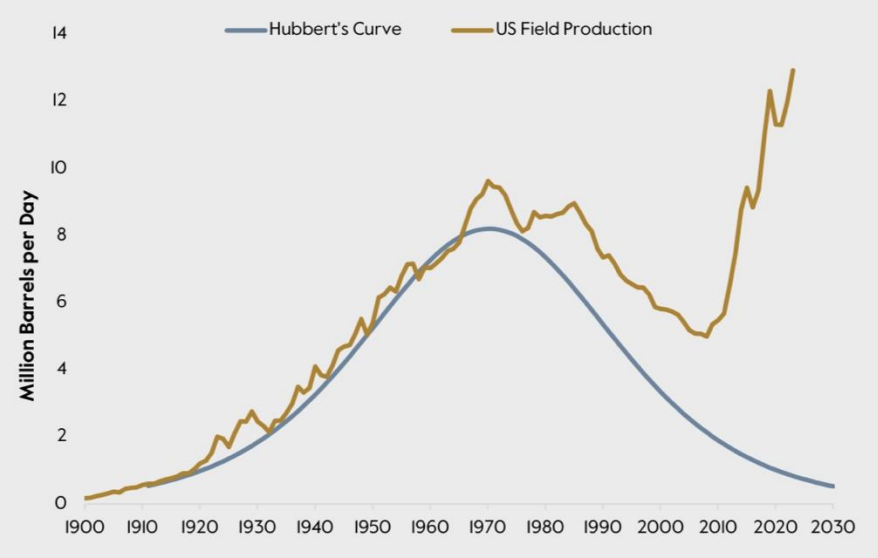
per year spent on fossil fuel imports by China

Source: Ember

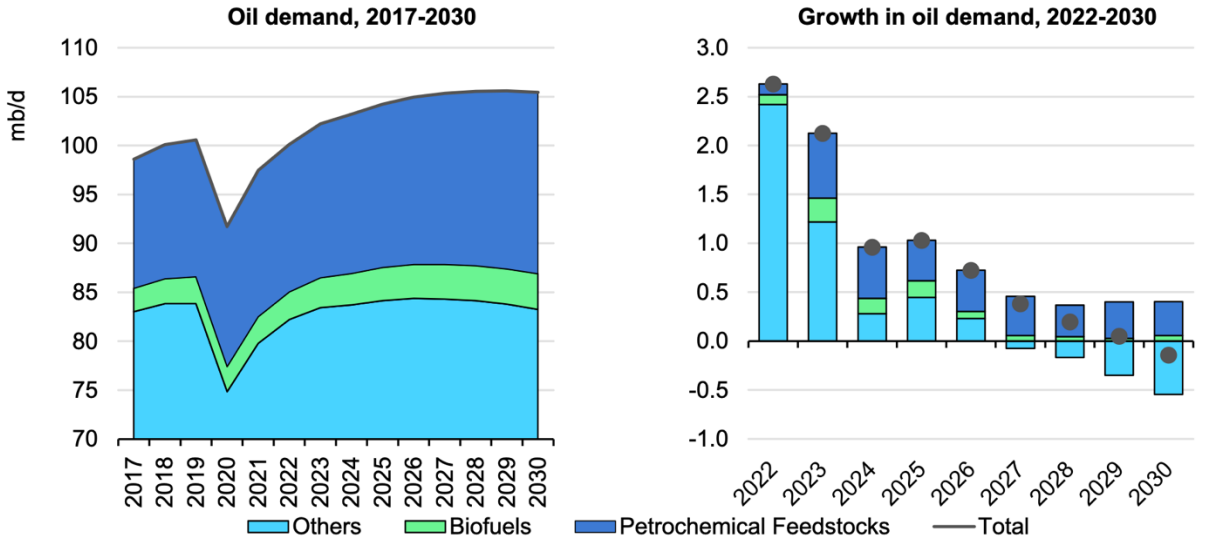
We are moving to an age of abundant energy

Starting with oil

So Much for Peak Oil Supply!



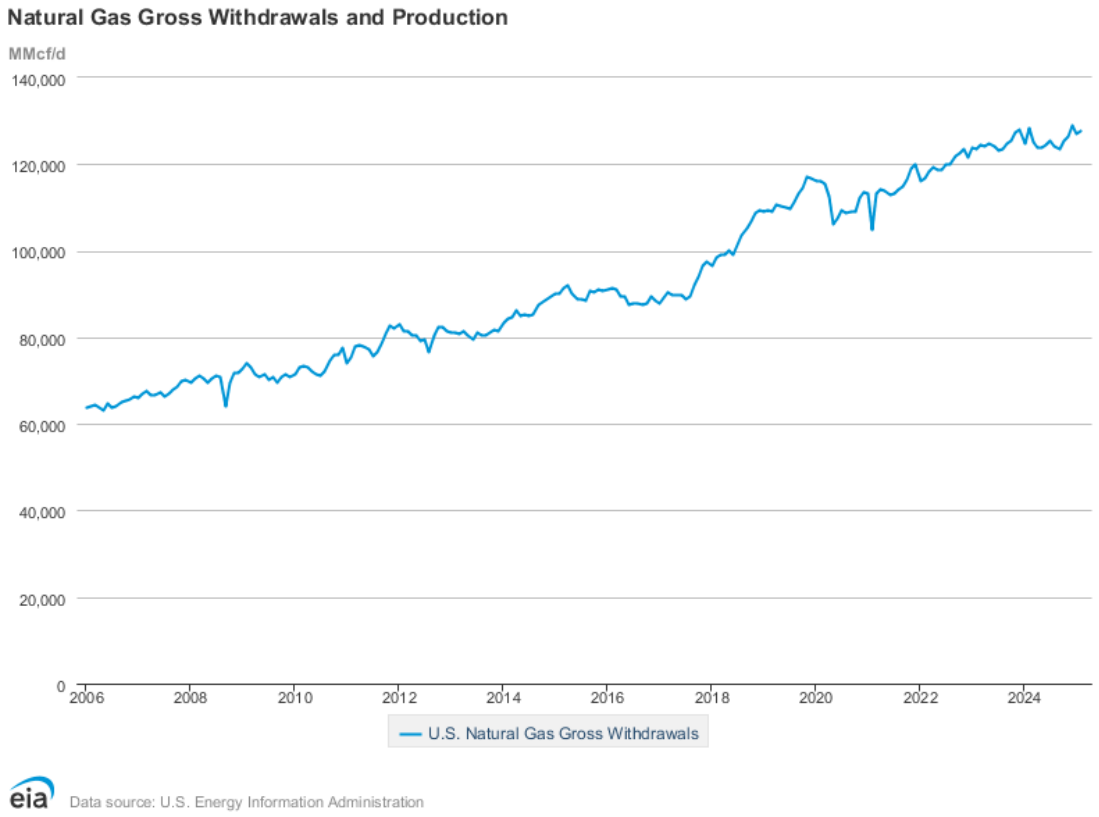
Global Demand for Oil is Close to Peaking



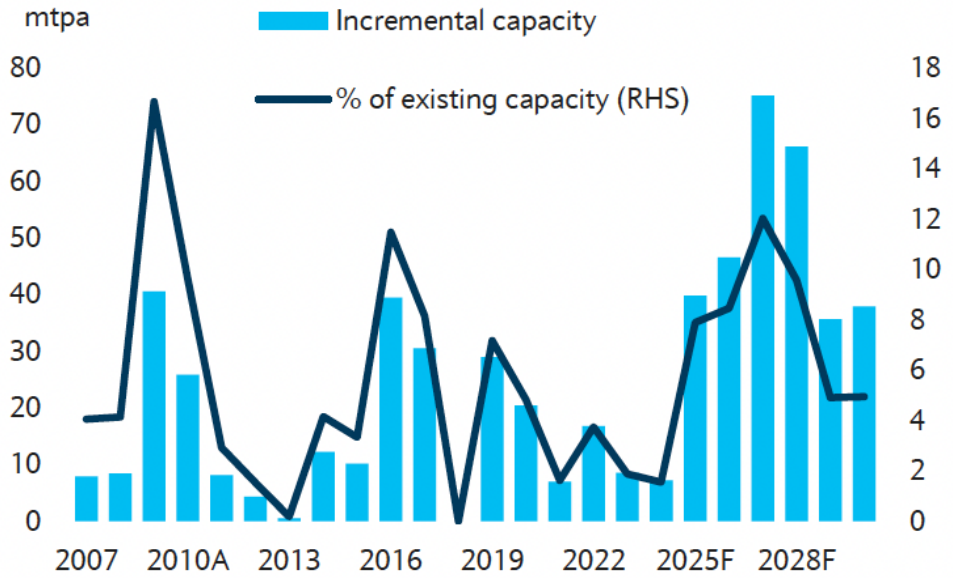
Source: IEA, Statistical Review of World Energy

We are moving to an age of abundant energy

Huge amounts of Natural Gas with lots of LNG capacity coming online



Massive amounts of LNG Capacity is Coming Online



Source: EIA, Barclays

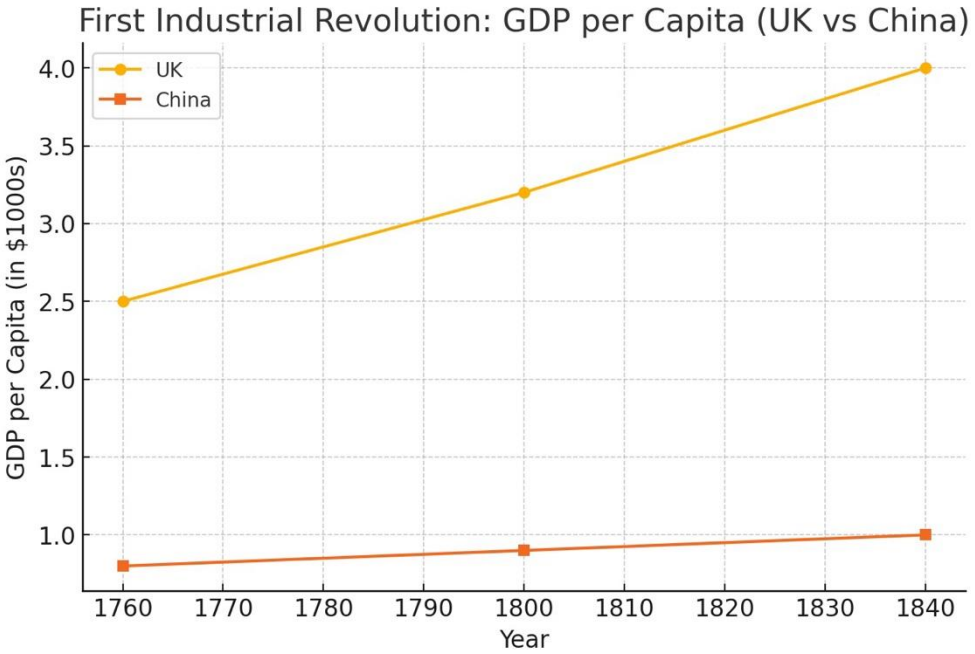
We are moving to an age of abundant energy

Increasingly we have too much power in the system

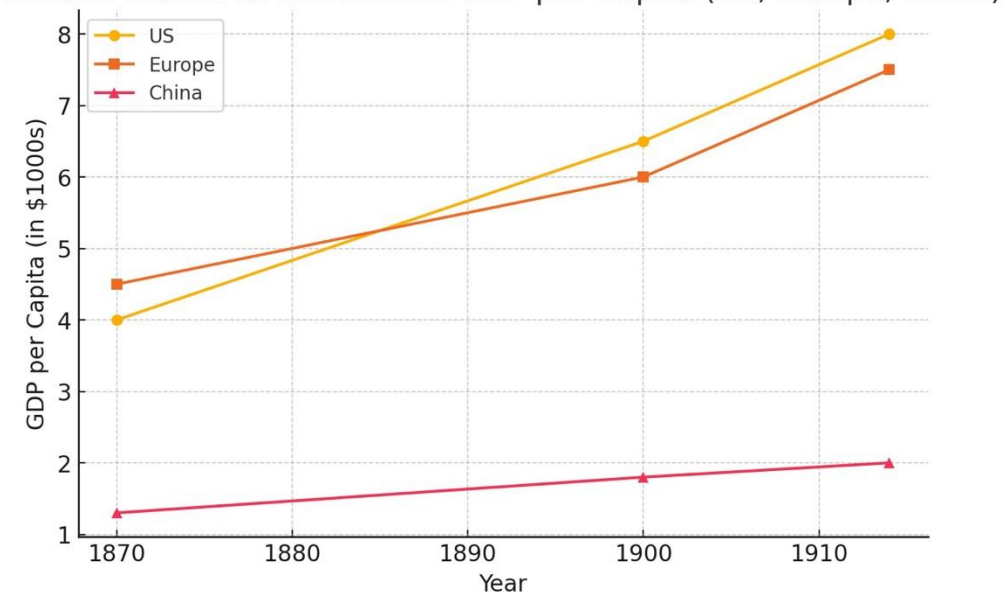
Source: Nordpool

We are at the start of a new Industrial Revolution which will radically reshape our world

And past ones have done…

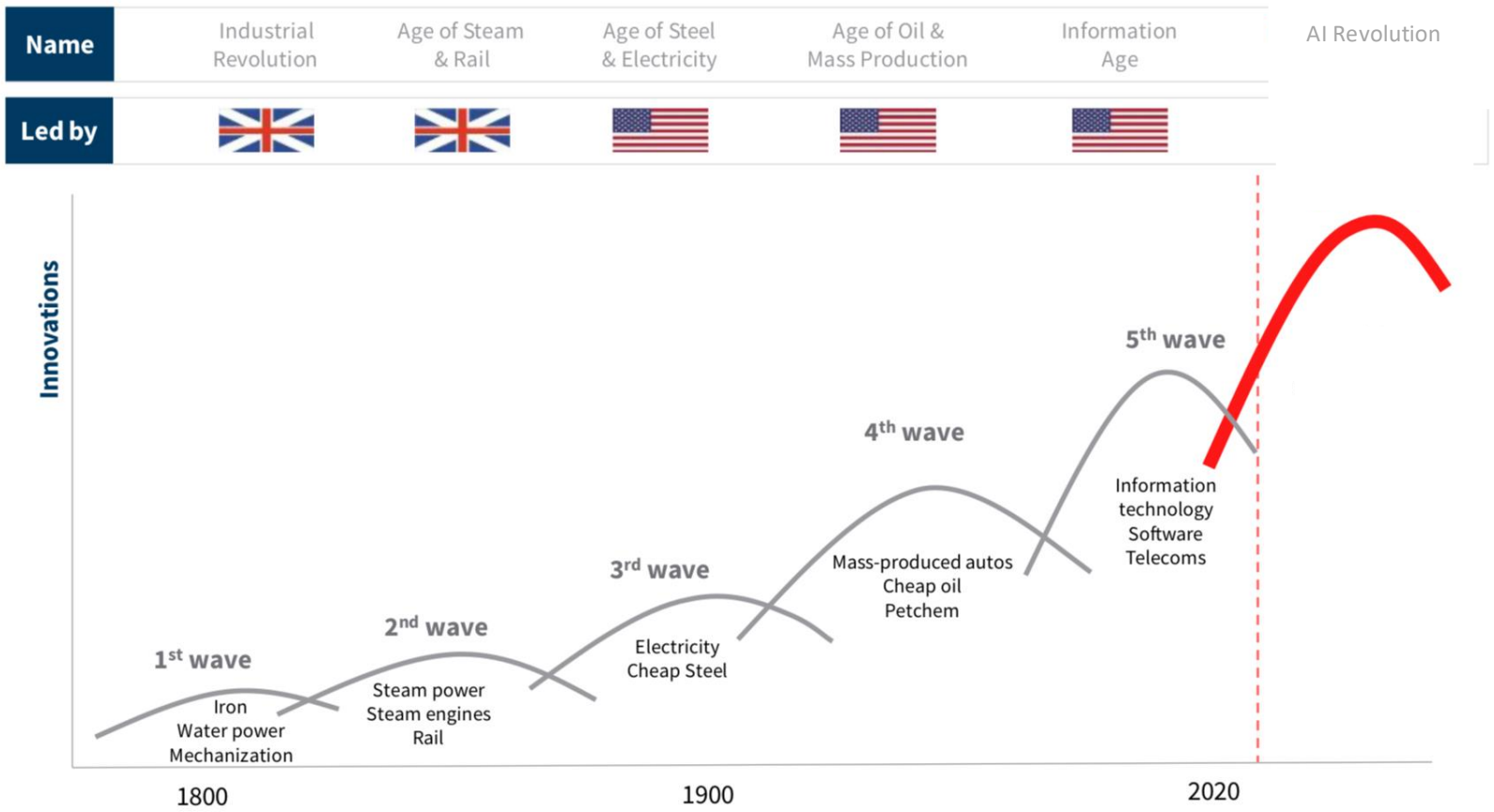


Source: Gerard Reid



Change Drivers

The Electrical Intelligence revolution is a technology driven revolution with AI & Electrification at its core



AI

IoT & Semis

Electrification

Renewables

#1 AI: will completely revolutionize our lives

With 4 big user cases for the next years

White Collar Work

Expect exponential productivity gains, especially in government, finance, HR, and legal

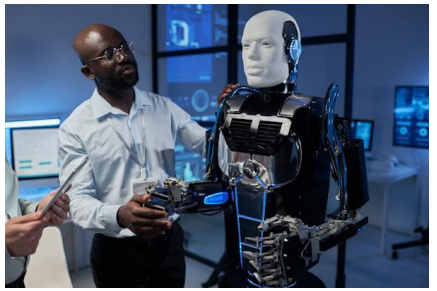
Autonomous Vehicles

A *game-changer for mobility, but the rollout will be uneven and city-specific*

Power Grid

Essential. Without AI, 100% renewable grids aren't feasible

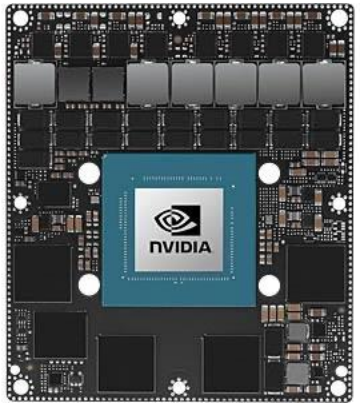
Humanoid Robotics



It's a total paradigm shift

#2 Semis, Sensors & IOT: are the enablers of change…

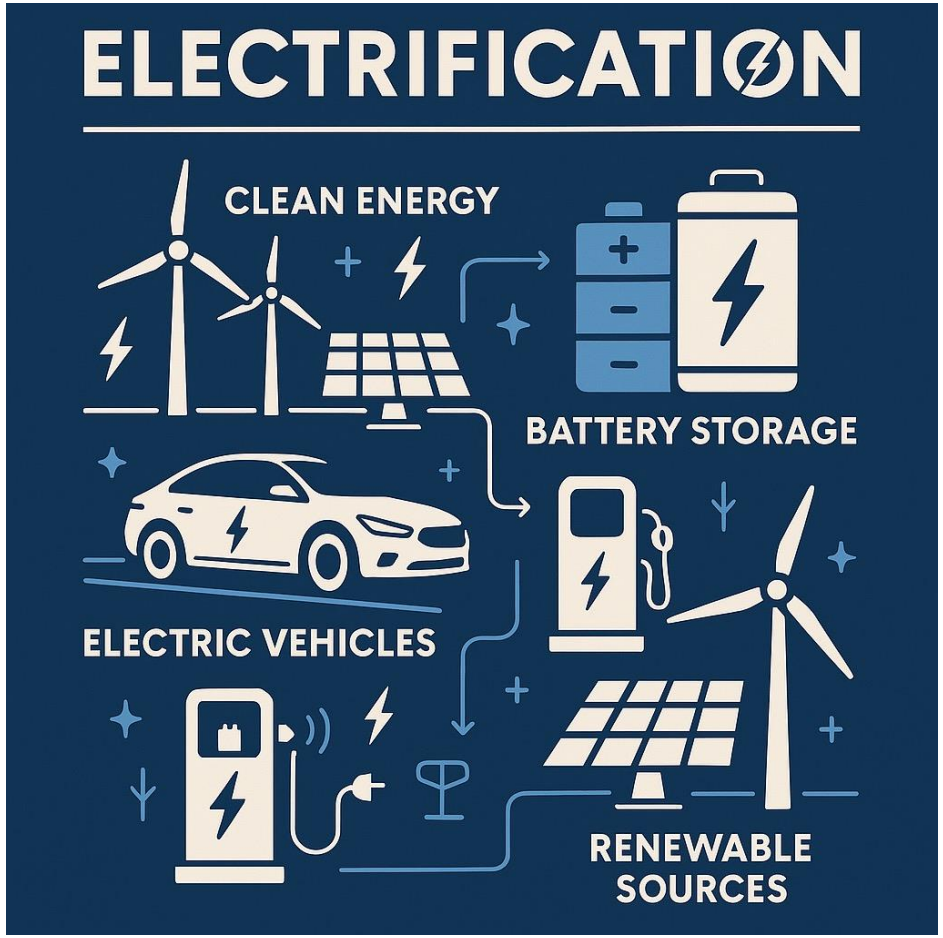
Semiconductors: The Brains of Everything



Sensors: The Eyes and Ears of Machines

IoT: The Nervous System of the Digital Age

#3 Electrification: We are seeing a massive innovation in electrification

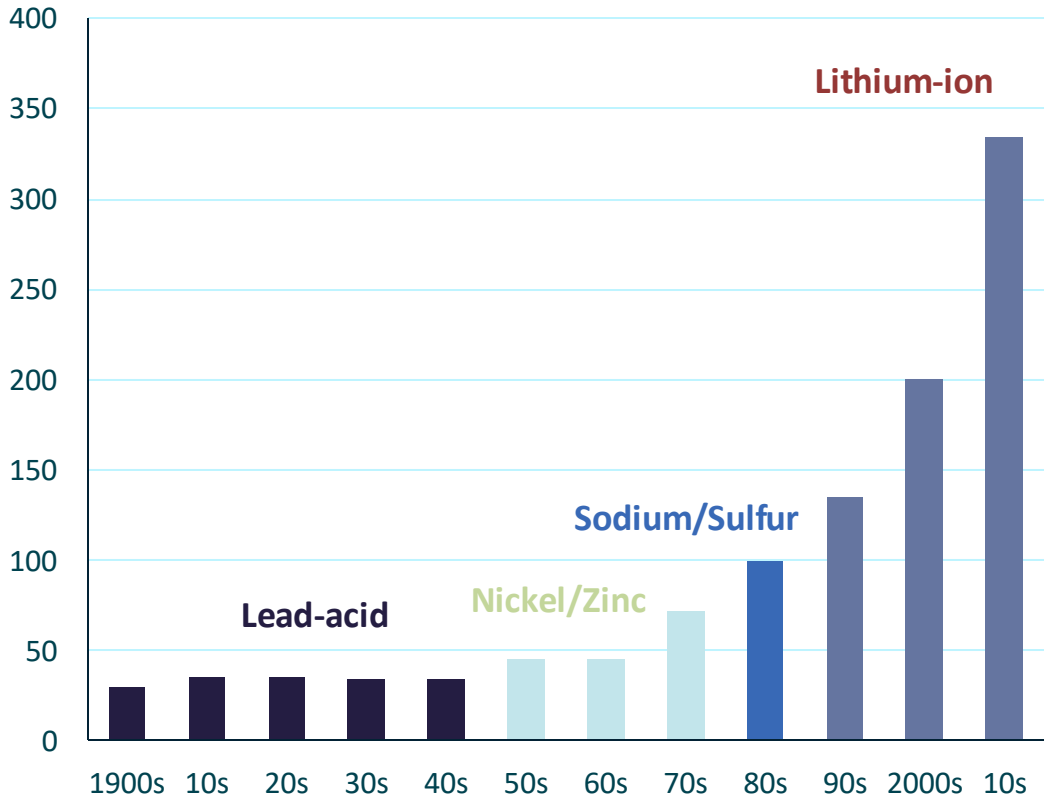


Source: Alexa Capital

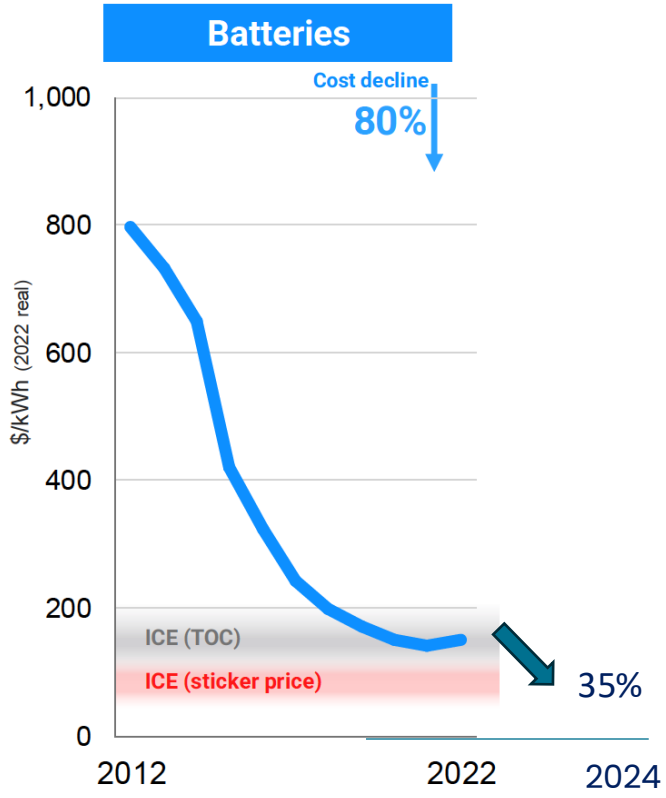
The innovation in batteries is a game changer

Nothing happened in batteries till the dawn of the 21st century

Battery Cell Energy Density (Wh/kg)



Lithium-ion battery pack prices ($/KWh)

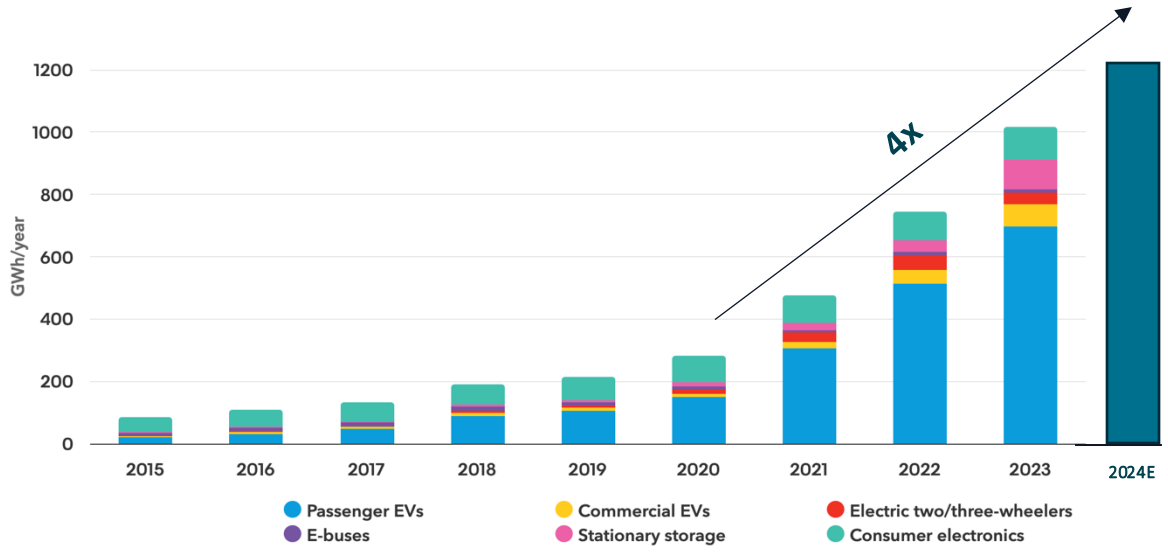


Source: Alexa Capital

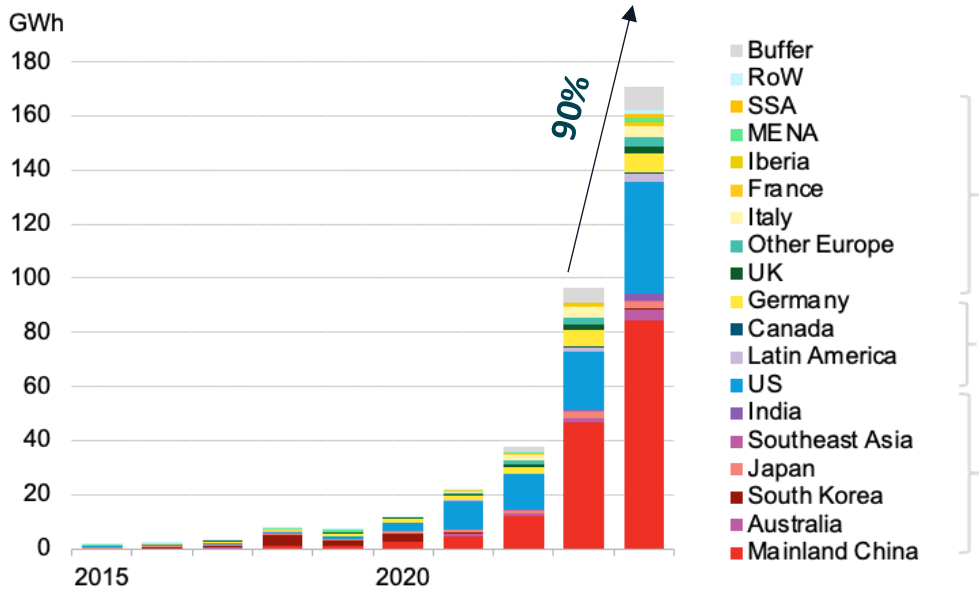
And the lithium-ion market is booming

With the big driver being EVs and storage for grid and buildings

Global Lithium-ion Demand



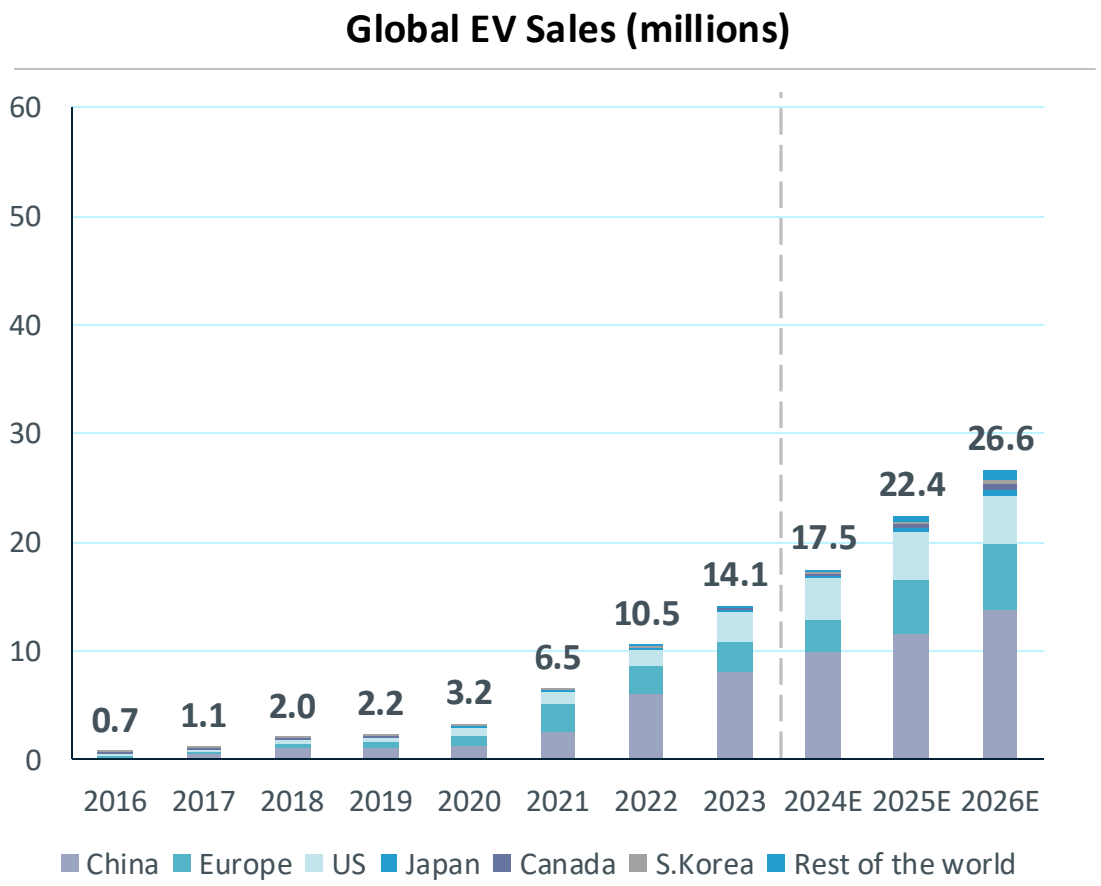
Global Lithium-ion Stationary Storage Demand



Source: Bloomberg NEF

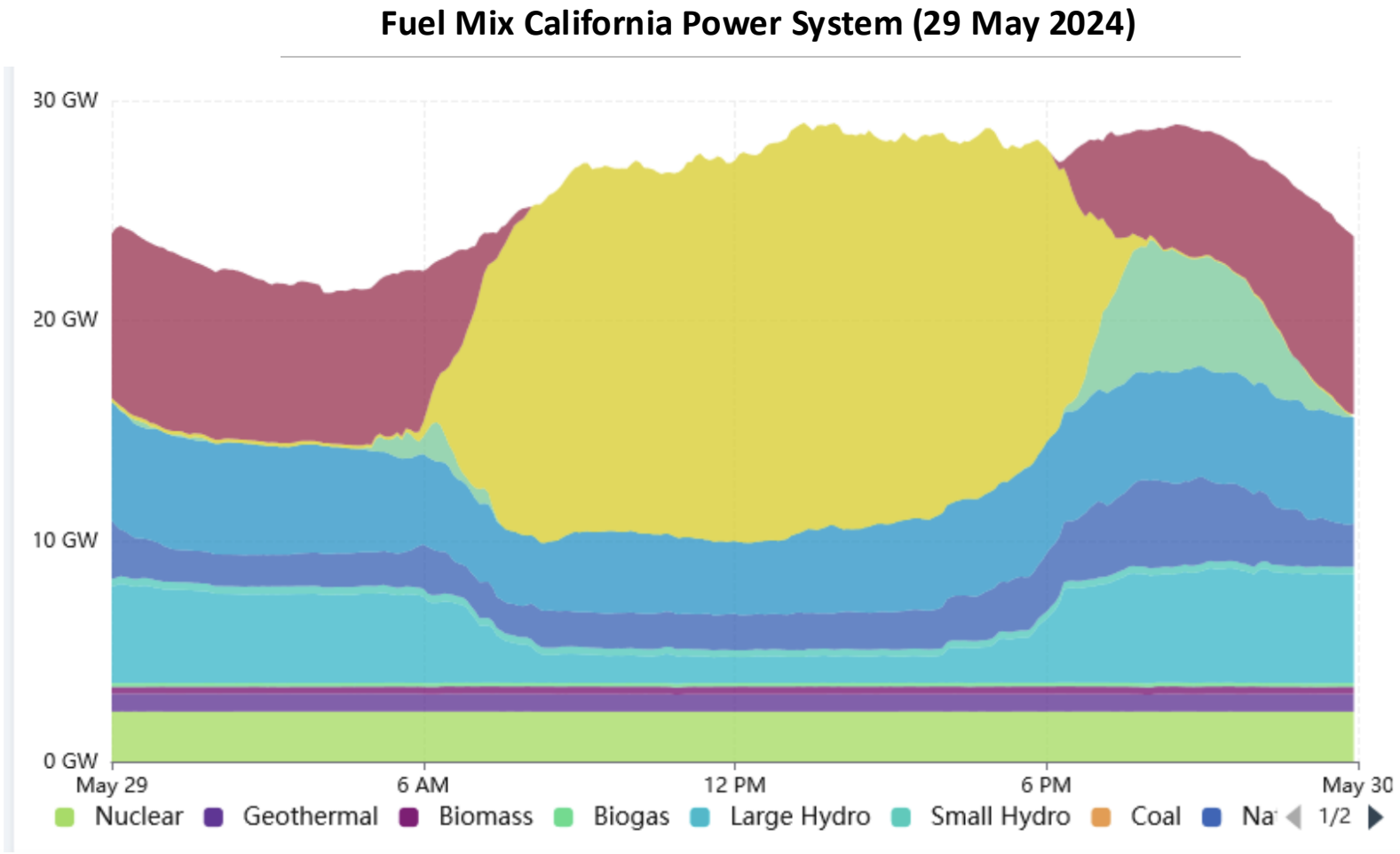
Lithium-ion batteries are enabling our digital world

Lithium-ion batteries are revolutionizing the automobile



Source: Bloomberg NEF, RMI

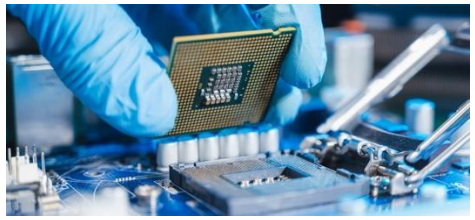
Lithium-ion batteries are solarizing the world of electricity



Source: CAISO

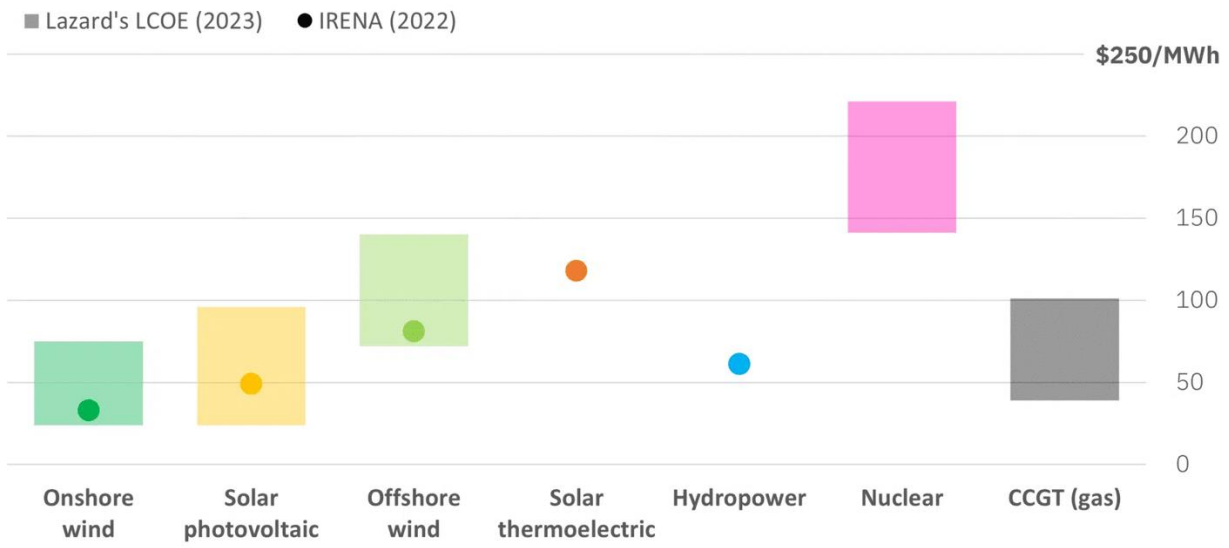
Innovation in power electronics, which is all about controlling power flows, is incredible…

Innovation Area	Key Benefit	Application Example
SiC / GaN	High efficiency, smaller size	EVs, chargers, solar inverters
Bidirectional Flow	Grid interaction, resilience	V2G, grid-forming inverters
High-Frequency Topologies	Compact & efficient hardware	Aerospace, robotics, EV converters
AI-based Control	Optimization & predictive maintenance	Smart converters and microgrids
Embedded Power	Integration into form factor	e-axles, solar panels, aircraft systems



#3 Renewables: The cheapest and quickest way to generate electricity

Levelized Cost of Energy (LCOE)



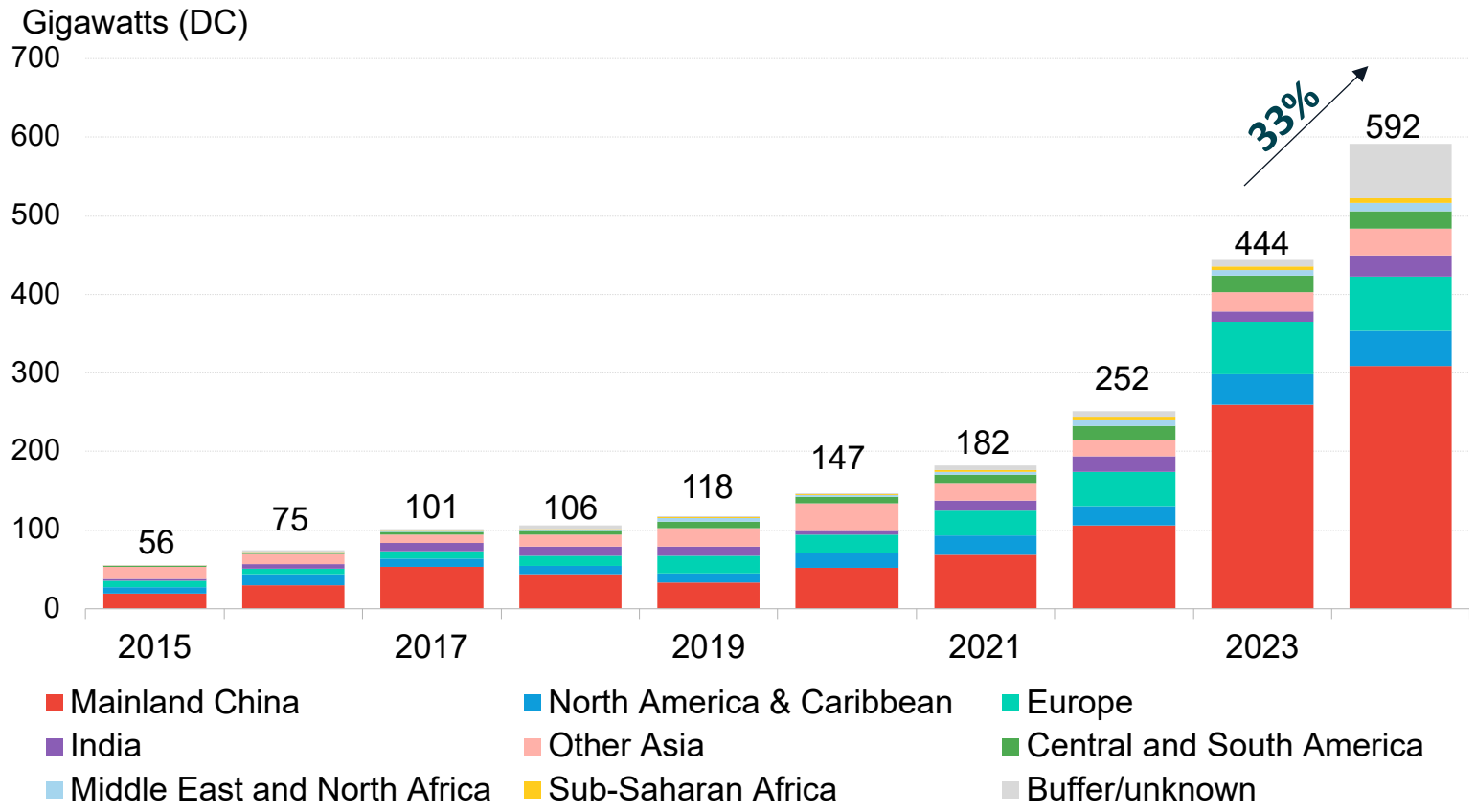
Speed to Deliver 1GW of Power

Technology	Typical Build Time (U.S.)
Solar PV	2–3 years
Wind (onshore)	3–4 years
Natural Gas	4–6 years
Nuclear	10–20 years

Sources: AleaSoft

Solar is the major driver going forward given its speed to deploy and flexibility

Enough installed last year to power Japan for a year



Source: Bloomberg NEF

With further technology improvements and cost reduction coming making cost of locally producing electricity cheaper than wholesale power…

Rooftop solar installation costs of €1.50 per watt!!

Balcony solar installation costs of €0.50 per watt!!

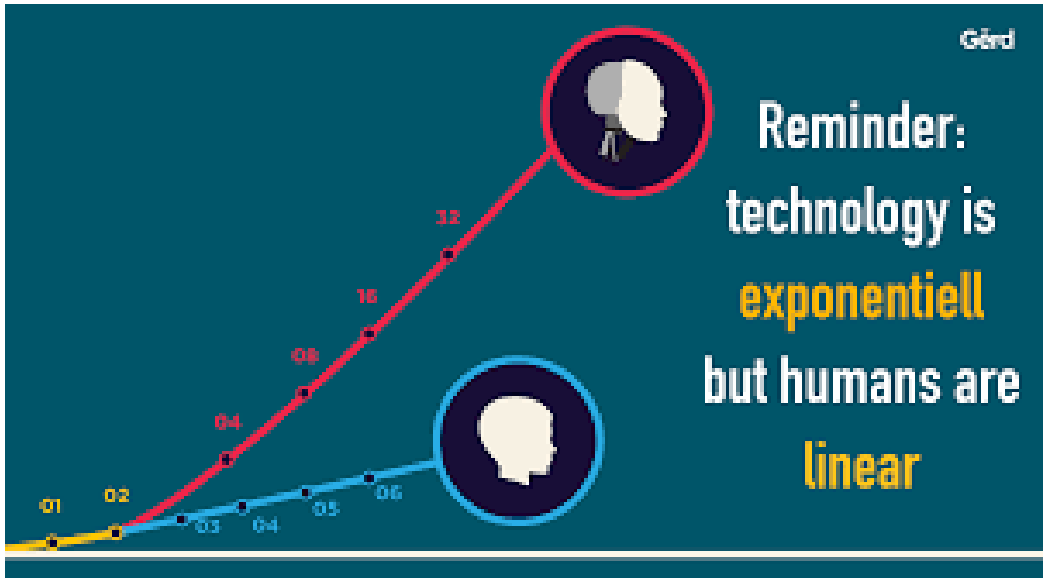
LCOE €10 cents per kWh

LCOE €4 cents per kWh

Source: Gerard Reid

All of these are exponential technologies….

Which means they scale globally and much quicker than we think…



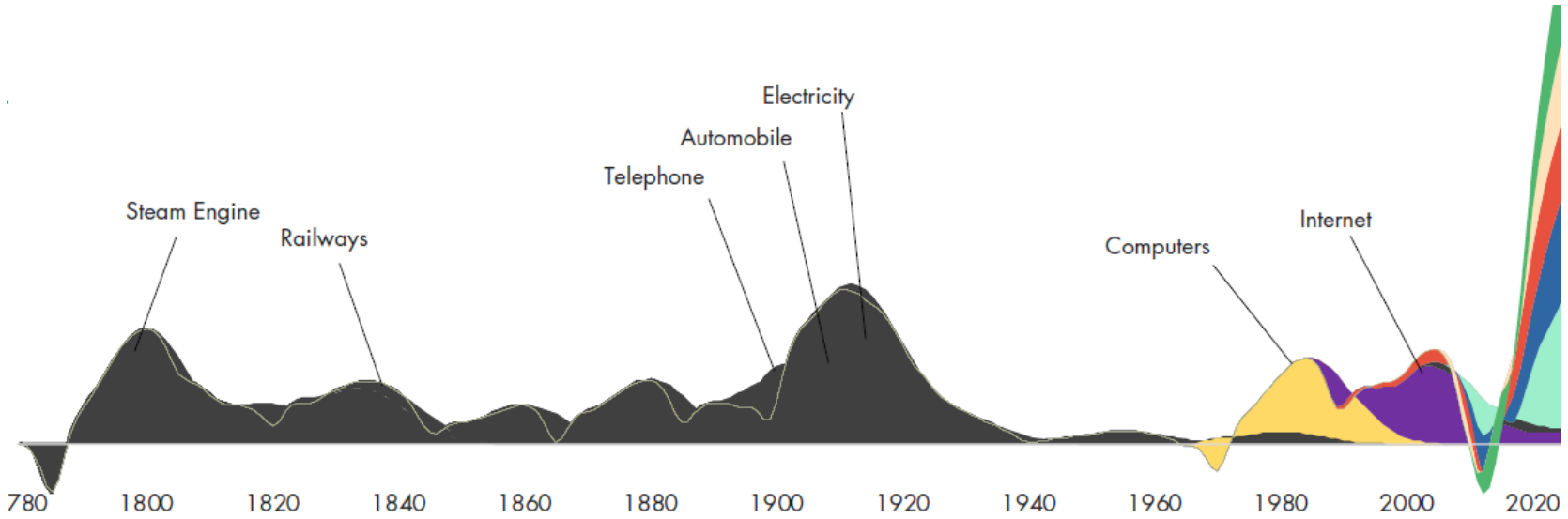
Technologies

Characteristics

Technologies	Cost Decline	Performance Gains	Manufacturing Scale	Convergence Role
AI	Significant — compute cost per task falling fast	Breakthroughs in reasoning, vision, and language	Cloud and chip infrastructure scaling rapidly	Central to everything from mobility to health
Solar PV	~90% drop in cost since 2010	Steady gains in efficiency and durability	High — modular, fast to deploy	Key pillar of clean electrification
Batteries	>80% cost reduction in a decade	Energy density, charging speed improving	EV and stationary storage gigafactories scaling	Enables EVs, storage, and off-grid power
Power Electronics	Costs falling as SiC/GaN scale	Faster switching, higher efficiency	Broad adoption across EVs, solar, industry	Crucial enabler for modern grids and mobility
Semiconductors	Moore's Law still holding in AI and niche chips	Specialized chips outperform general-purpose silicon	Global fabs scaling across nodes	Backbone of all digital systems
Sensors	Massive price drop in MEMS, optics, etc.	Higher precision, miniaturization	Embedded everywhere from phones to turbines	Foundation for smart environments and devices

Implications

#1: We are in an Industrial Revolution which is a huge opportunity and threat for all of us



Renewables

Electrification

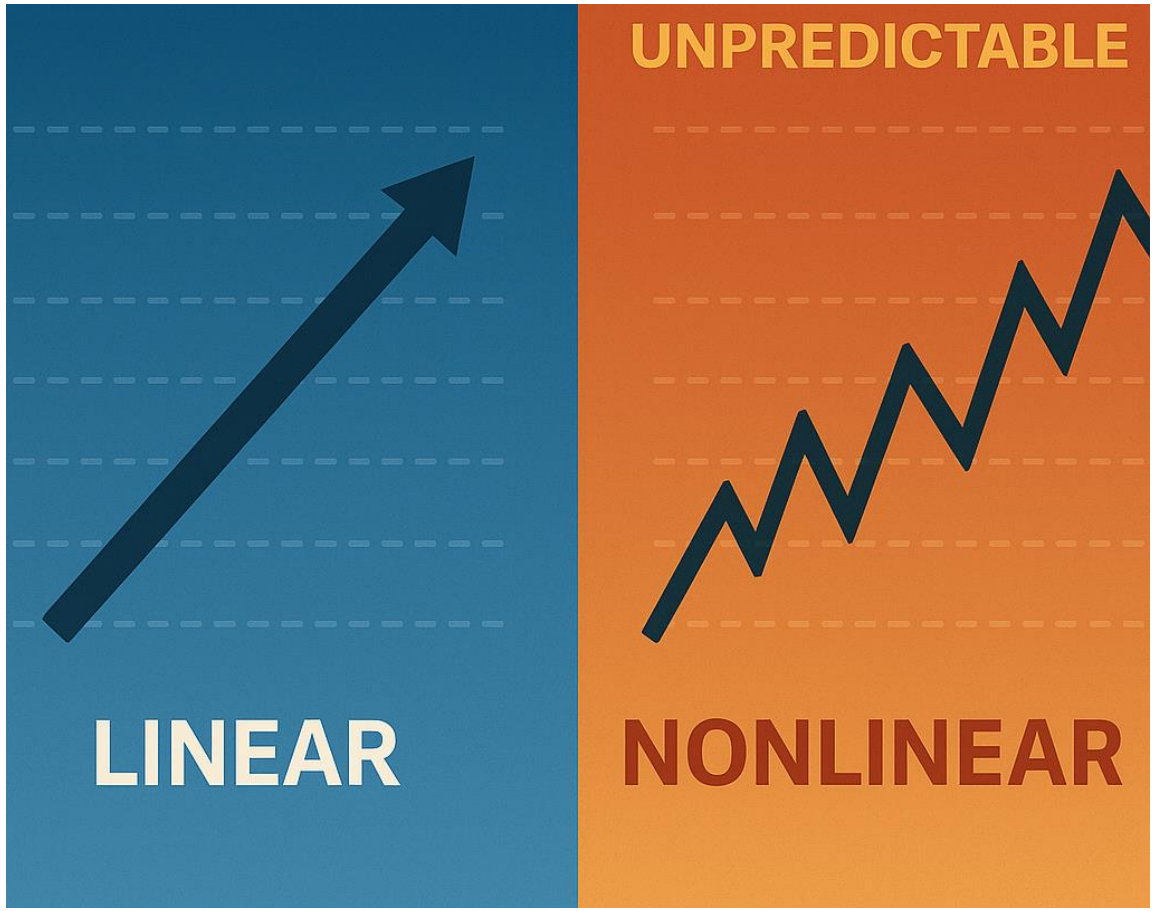
IoT

AI

#2: We are moving from a linear to a non-linear world with the speed of change accelerating…

Innovation

Climate

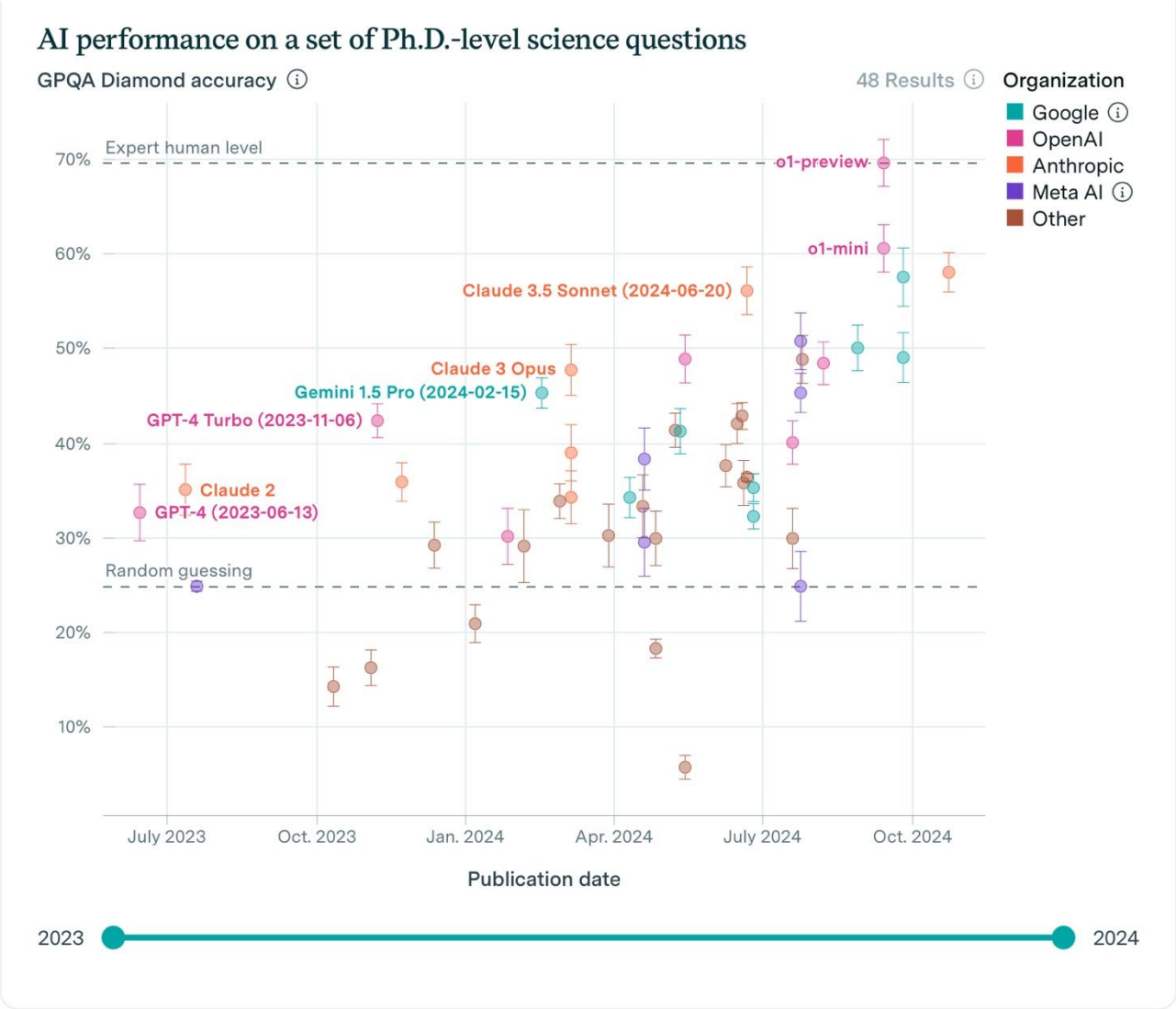


Geopolitics

Energy Security

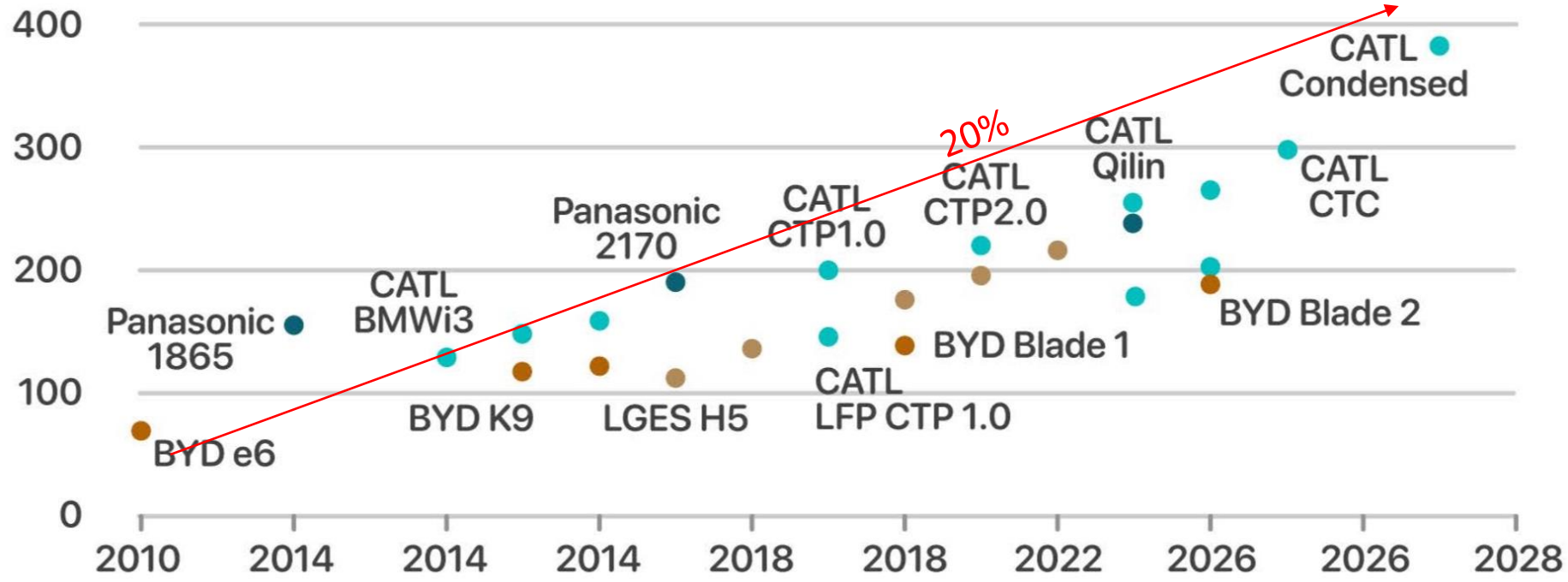
The speed of innovation with AI is unbelievable

AI has gone in one year from failing science tests to outperforming PhD students



Battery performance is improving every year

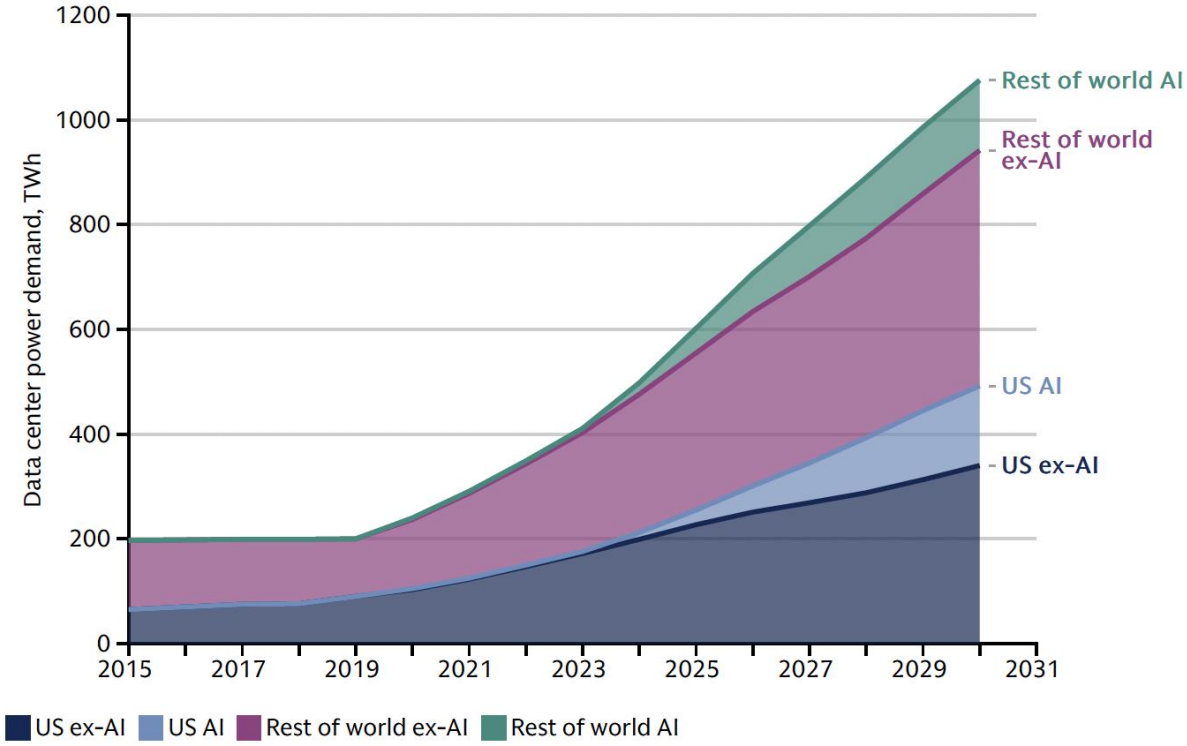
Opening up new markets



Source: Morgan Stanley Research

#3: AI needs massive amounts of electricity, but we are not sure how much…

China's Deepseek uses 90% less energy than Chat-GPT and is self-learning…



Source: Masanet et al. (2020), Cisco, IEA, Goldman Sachs Research
Figures for 2024-2030 are estimates

Goldman Sachs

deepseek

4. Tokens per Dollar per Watt (Estimated)

Let's calculate an **approximate comparison** using the above estimates:

ChatGPT (GPT-4):

- Tokens: 1,000
- Cost: $0.03
- Energy: 0.3 kWh
- **Tokens per Dollar per Watt**:

$$\frac{1,000}{0.03 \times 300} \approx 111.11$$

DeepSeek (Hypothetical 1B Model):

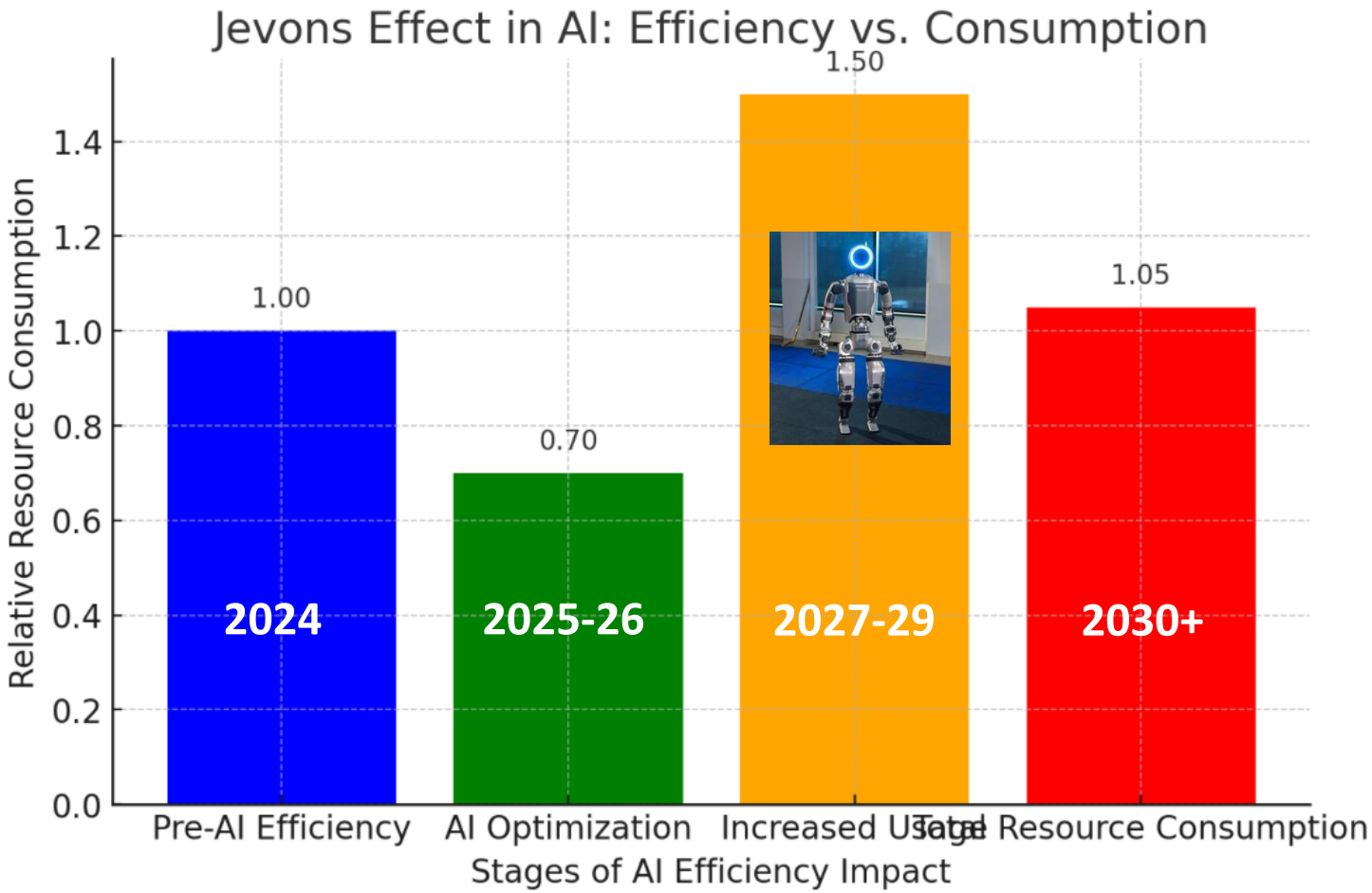
- Tokens: 1,000
- Cost: $0.001
- Energy: 0.02 kWh
- **Tokens per Dollar per Watt**:

$$\frac{1,000}{0.001 \times 20} \approx 50,000$$

Message DeepSeek

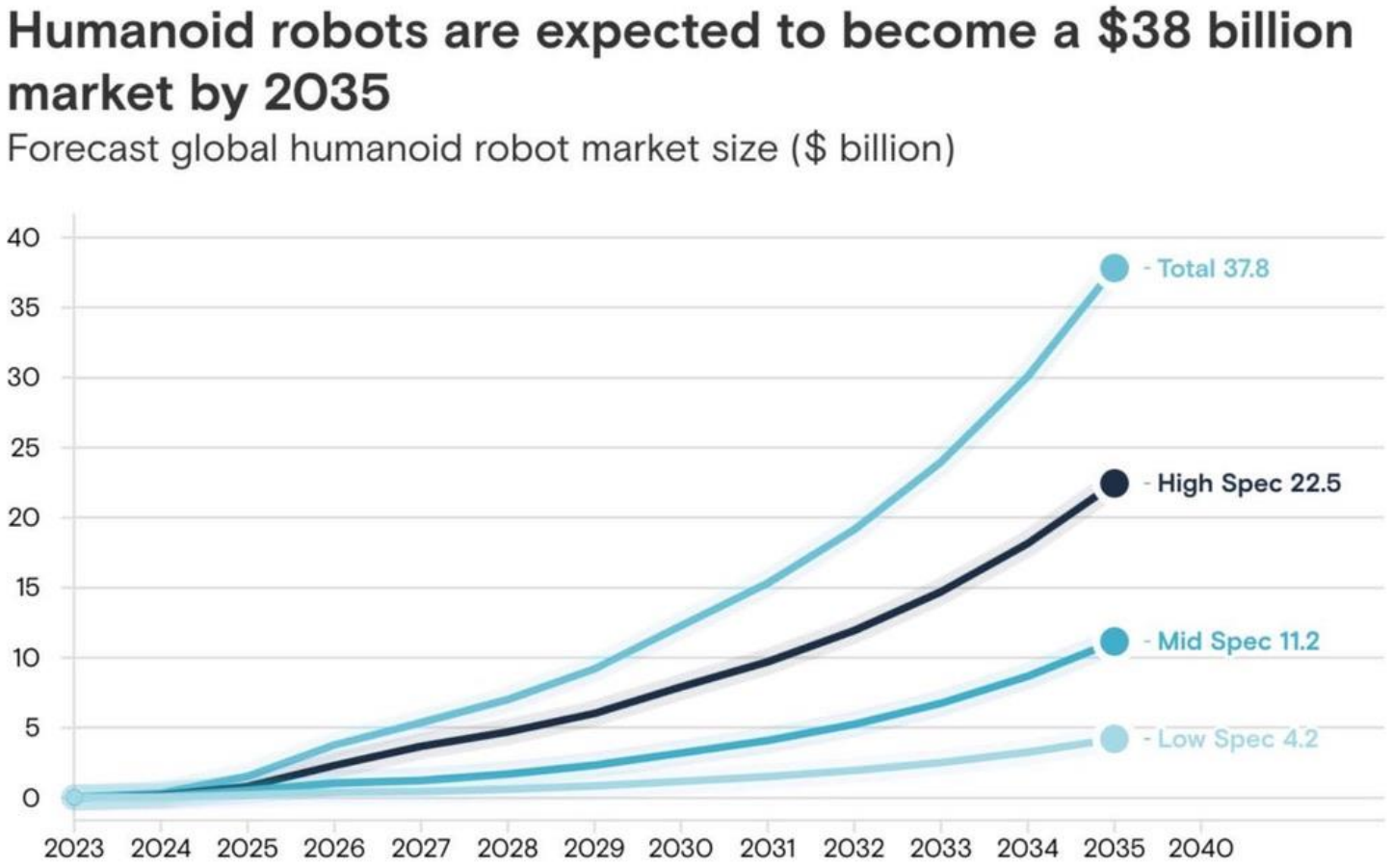
What it makes complicated is the Jevons Effect…

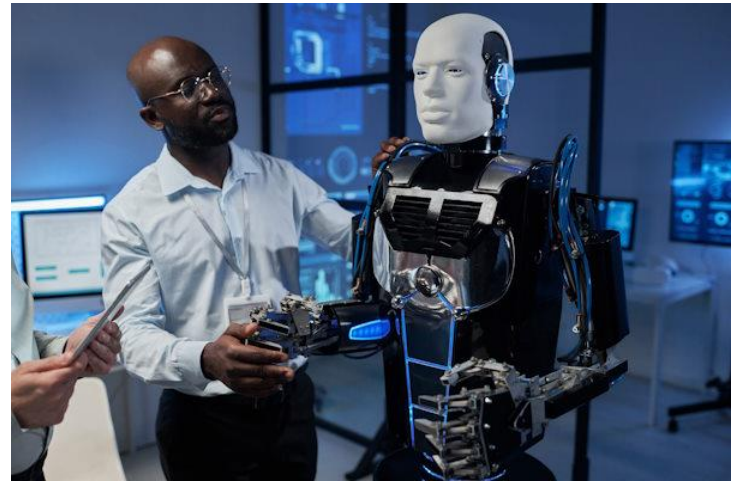
The cheaper AI becomes the quicker new applications come to market



#4: AI will create new industries such as humanoid robots

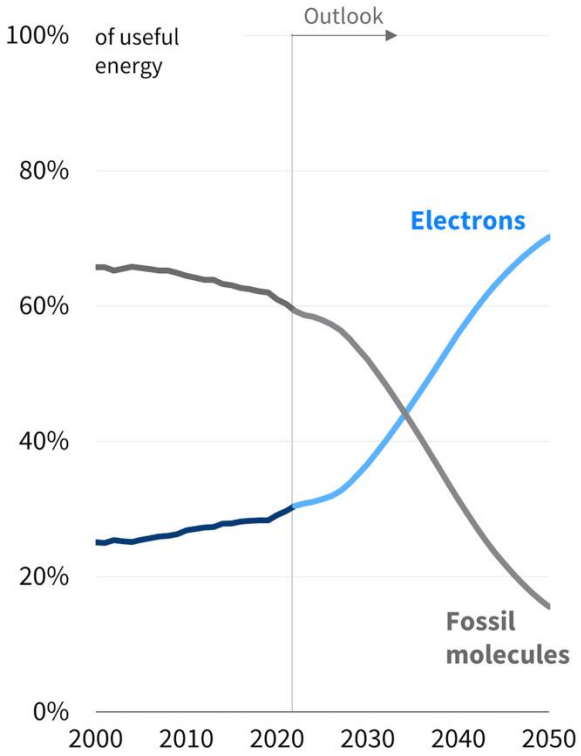
And will speed up innovation and change the laws of science…

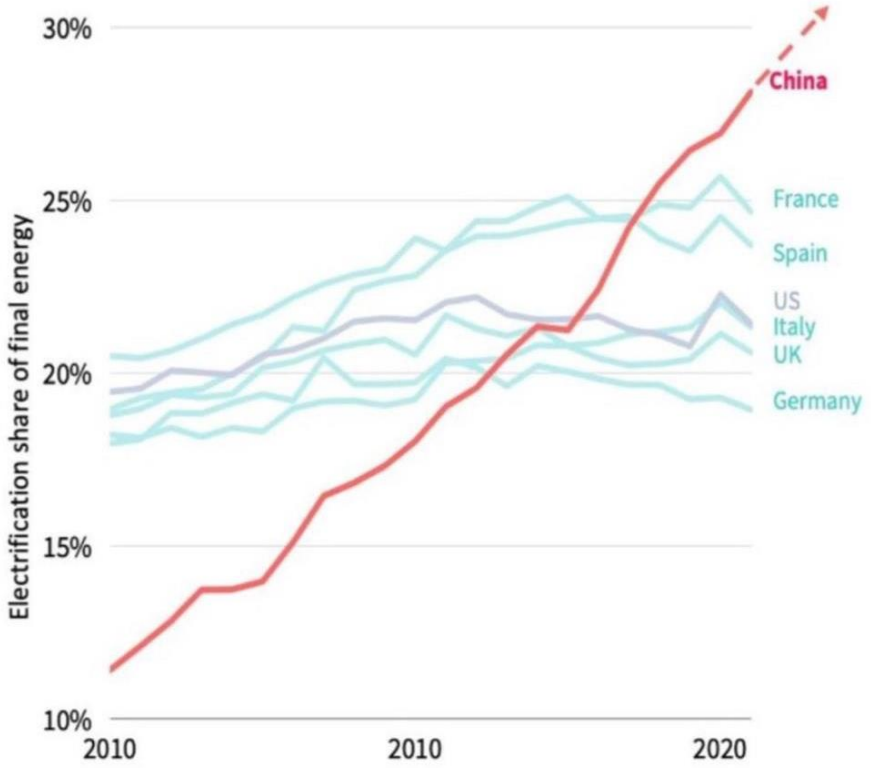




Source: Goldman Sachs

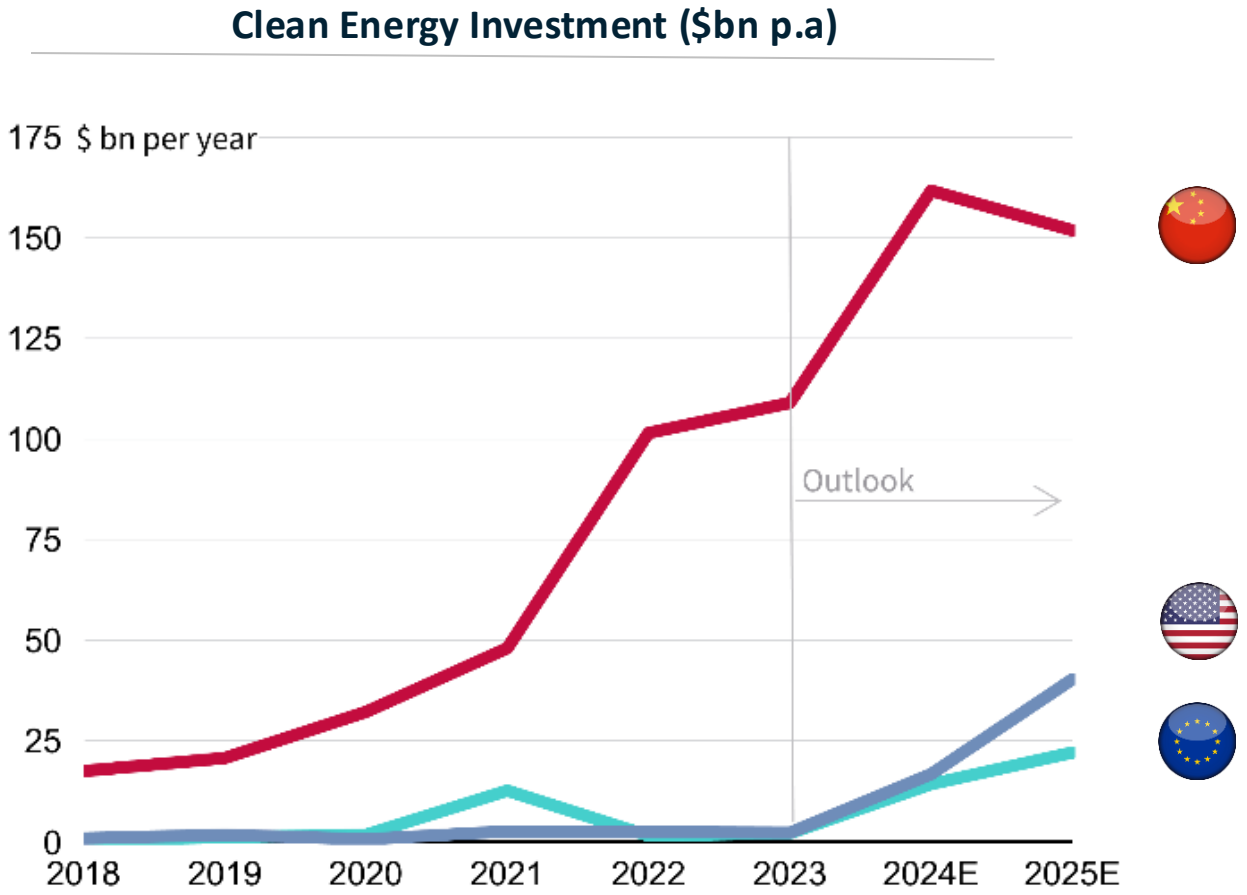
#5: China has been much more strategic in driving the Electrical Intelligence Revolution





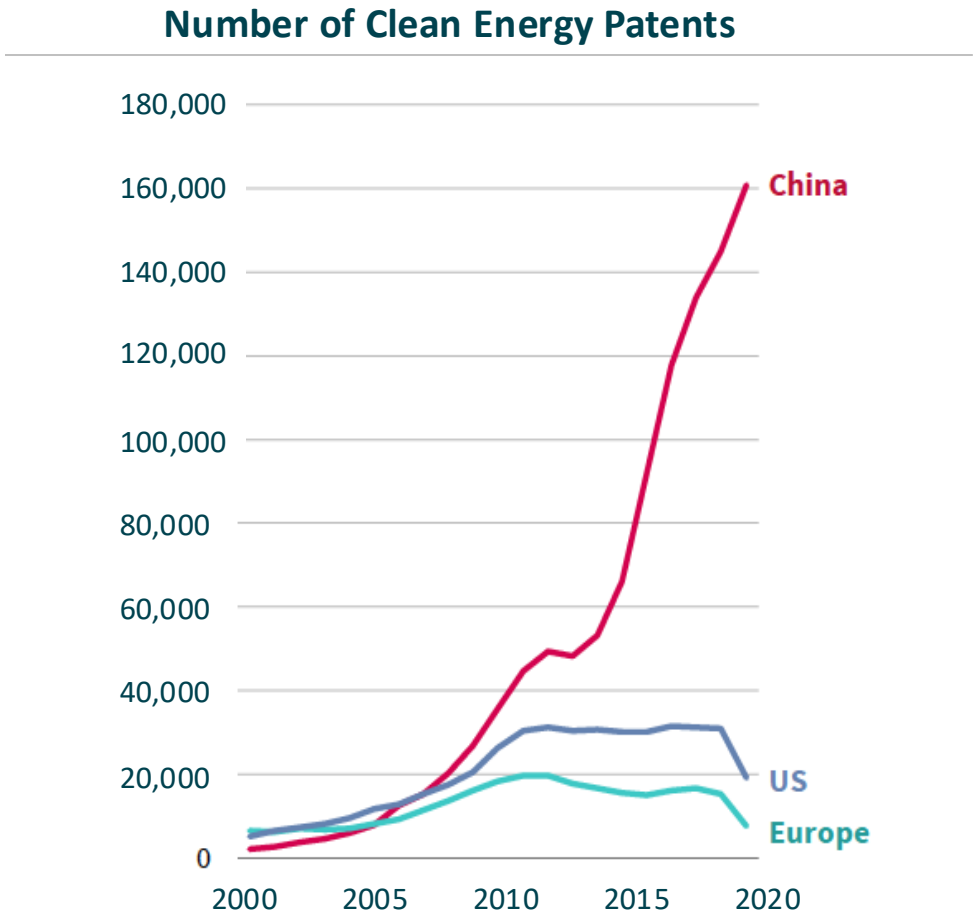
Source: RMI

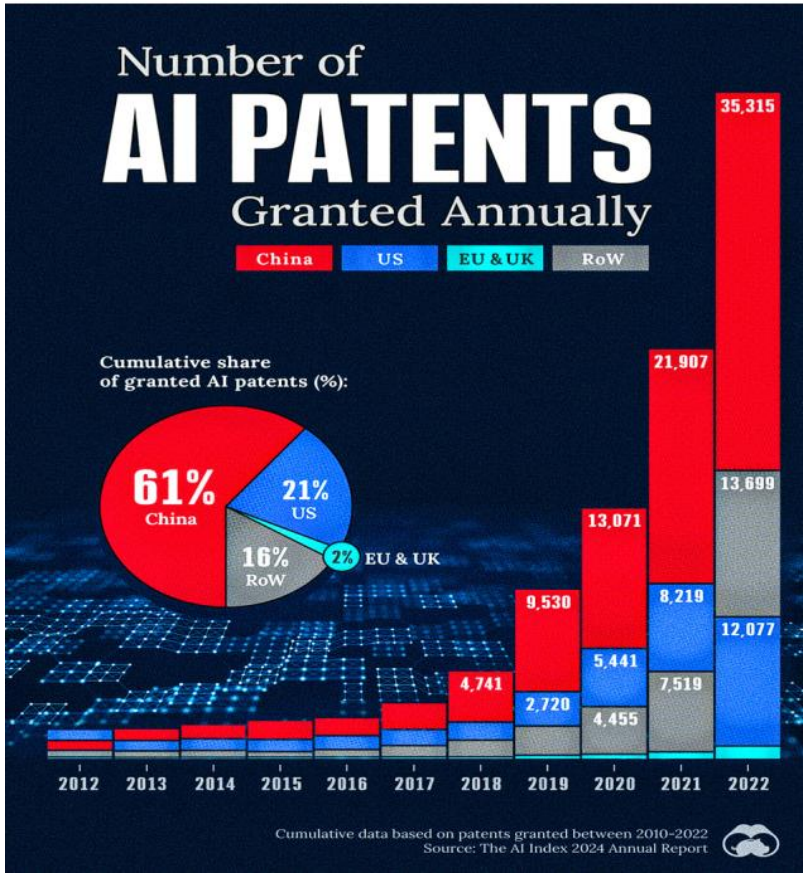
Nobody is investing in the energy transition like China



Source: RMI

China is also leading in terms of technology development





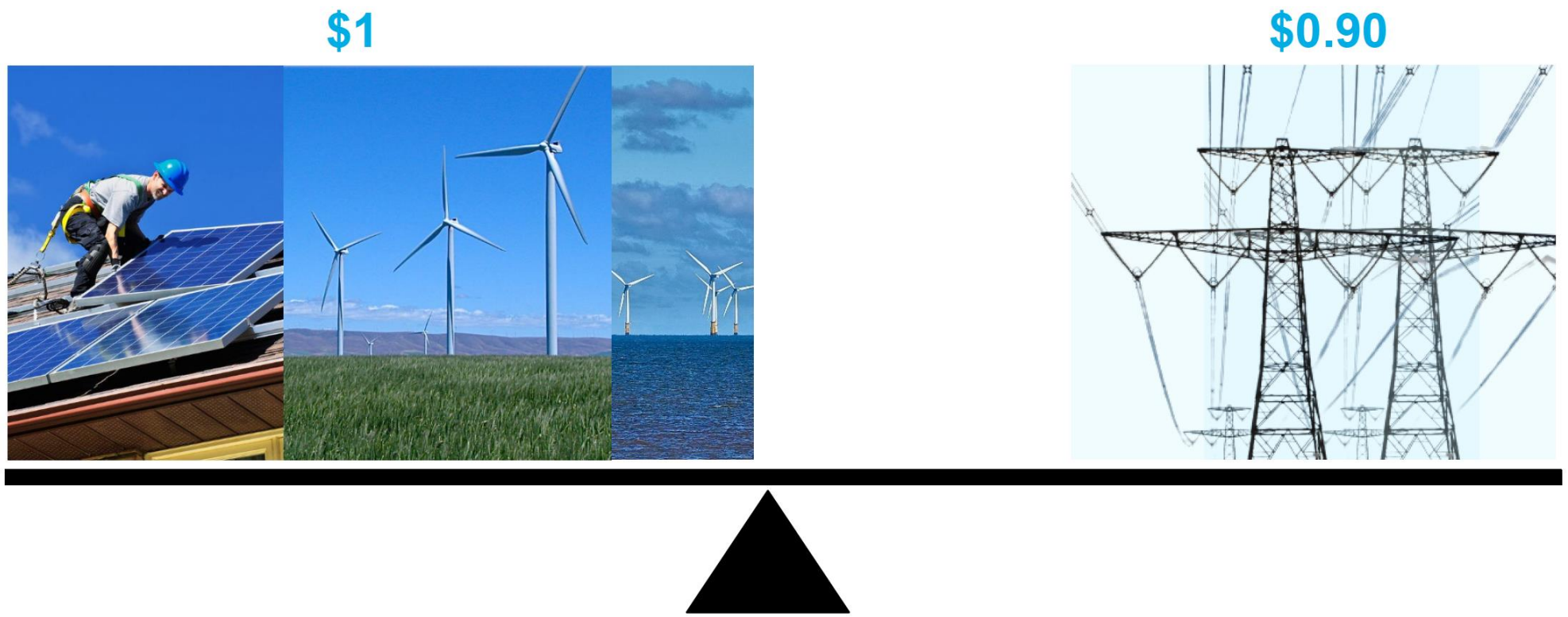
Source: Alexa Capital, IEA

#6: We are realizing that we cannot do without electricity

And the current system is not fit for the 21st century

We need to increase grid expenditures

To improve resilience and enable electrification



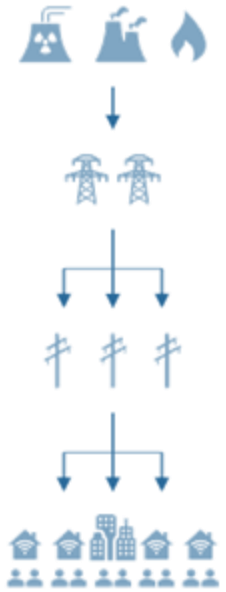
But they are at 0.4 across most of Europe and US…

Source: IEA, Bloomberg NEW

AI needs to be used to bind this complex world together…

It is too complex for the man in the control room…

Historical grid → **EI: Enablers** → **Distributed-centric system**



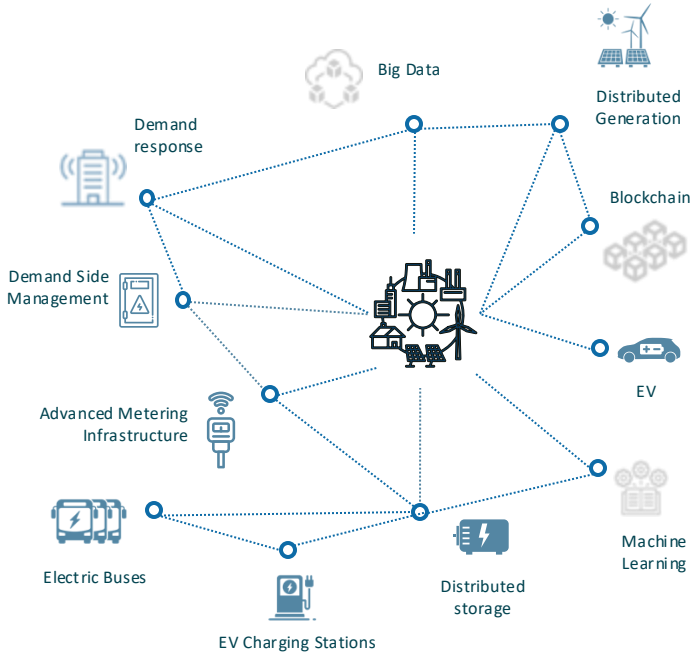
Connectivity

Power Electronics

AI

Software

Sensors

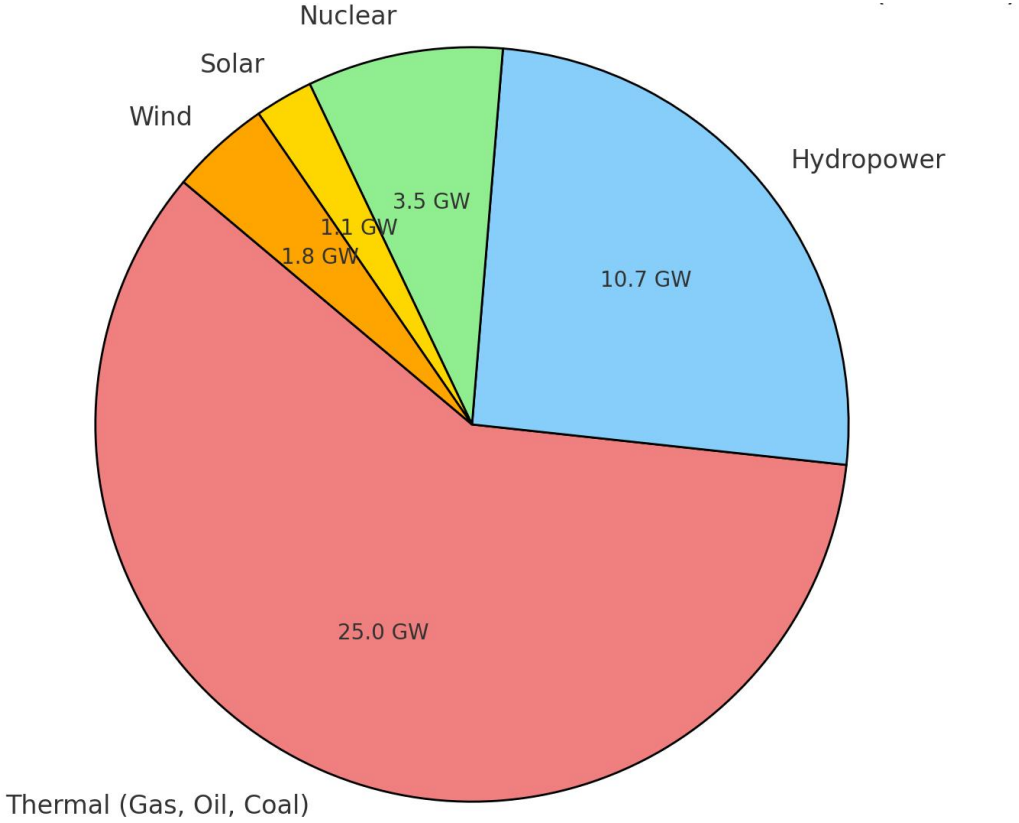


Source: Bourbaki

#7: We will build a global power system around renewables

Pakistan may have added 15GW of solar over the last 18 months, in a 30GW peak demand market

Pakistan's Installed Power Generation Capacity in 2023 (GWs)



Solar

- Pakistani's pay $23 cents per kWh when they buy from the grid
- Solar is much cheaper…

Source: RMI

The alternatives are too expensive and take too long to build

They are way too risky…

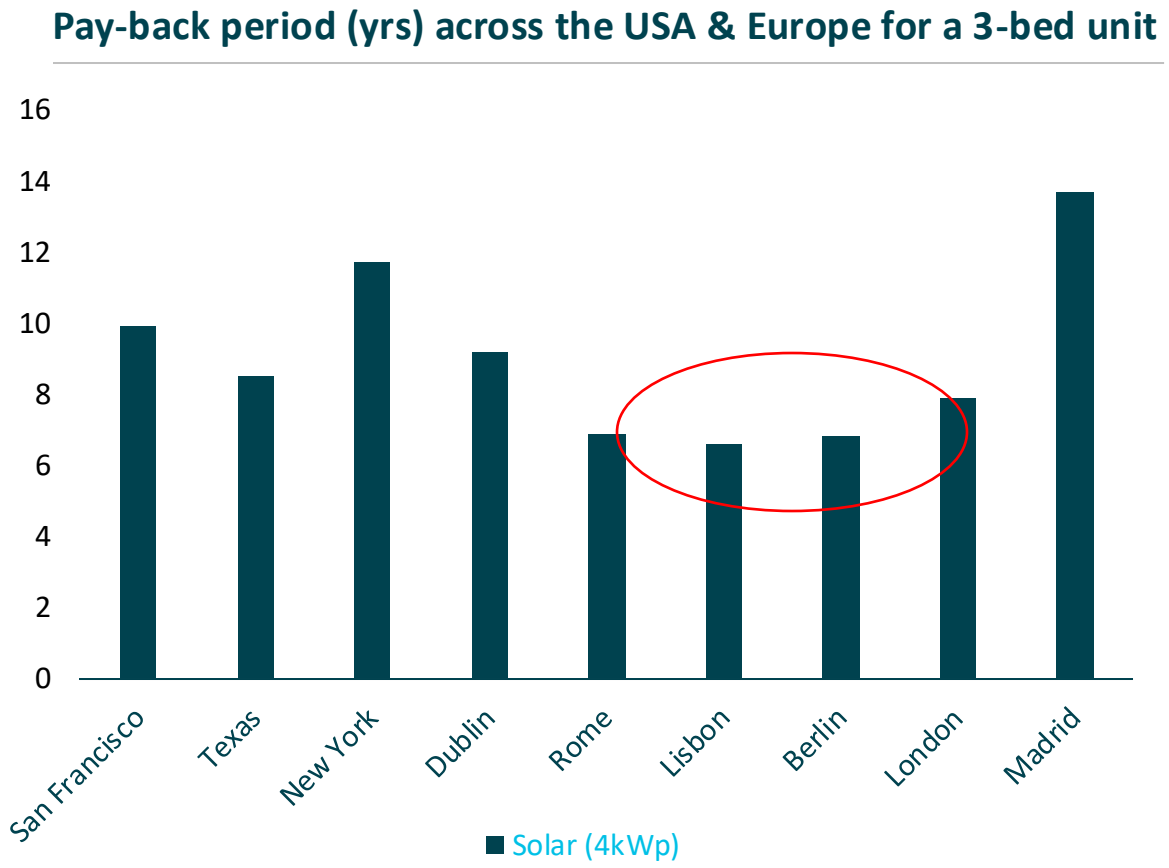
Hinkley Point C is likely to

- Become the **most expensive power plant ever built**, at nearly $60 billion
- And one of the **longest to build** at 14 years….

Sources: EDF

#8: We will increasingly put in own generation

Especially in markets with high power prices…



Source: Alexa Capital Markets

We will build industry/digital parks with their own renewable generation

Low cost and quick to build…

#9: Revolutions are tough places to invest in…

‘Huge losses’: Sweden fears for future of batterymaker Northvolt

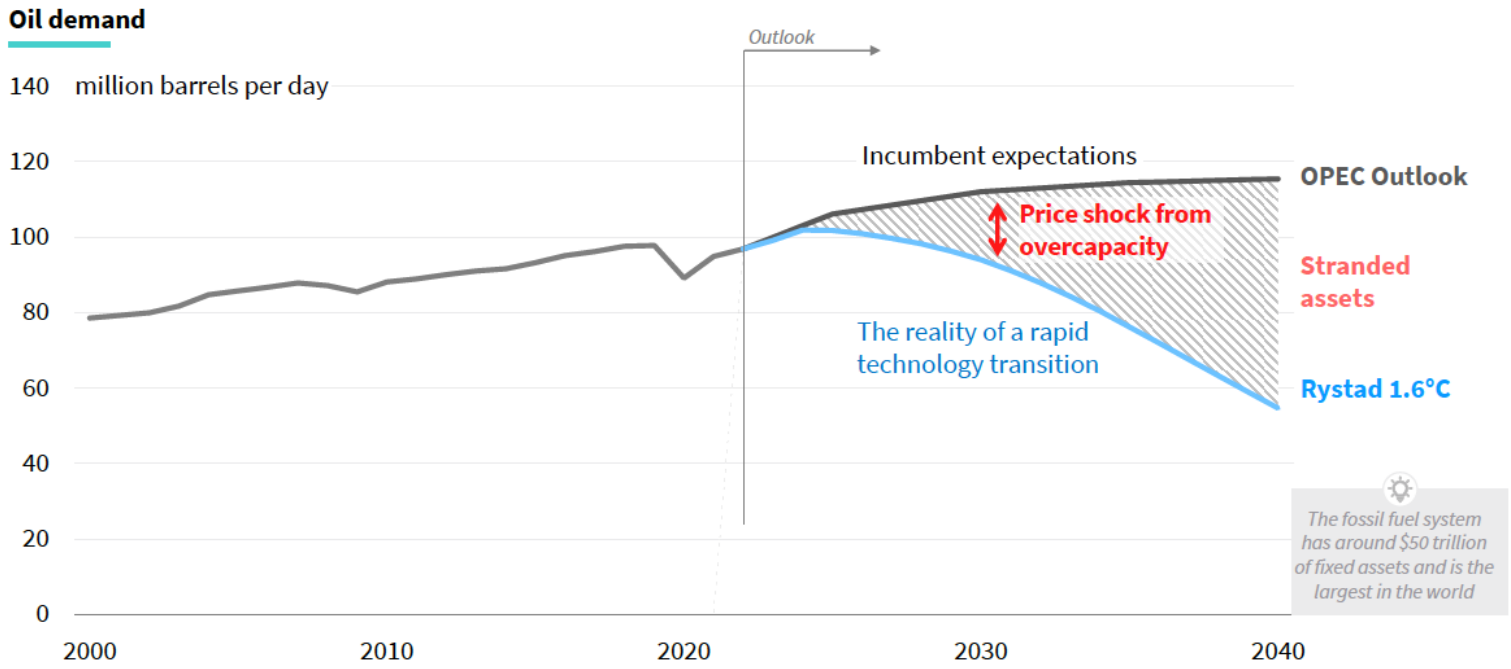
Government rules out bailout for key project in European green industrial transition as job cuts announced

Many global leaders, will not survive this revolution

European Cost	€46,335	€41,990
Gross Margin	20%	50%

Source: Bourbaki

Stranded assets are on the way which is why incumbents are blocking change and influencing the public and politics



Volkswagen, Germany's largest private employer, could cut over 15,000 jobs with plant closures—and there's no plan B, Jefferies says

BY PRARTHANA PRAKASH
September 17, 2024 at 12:18 PM GMT+2

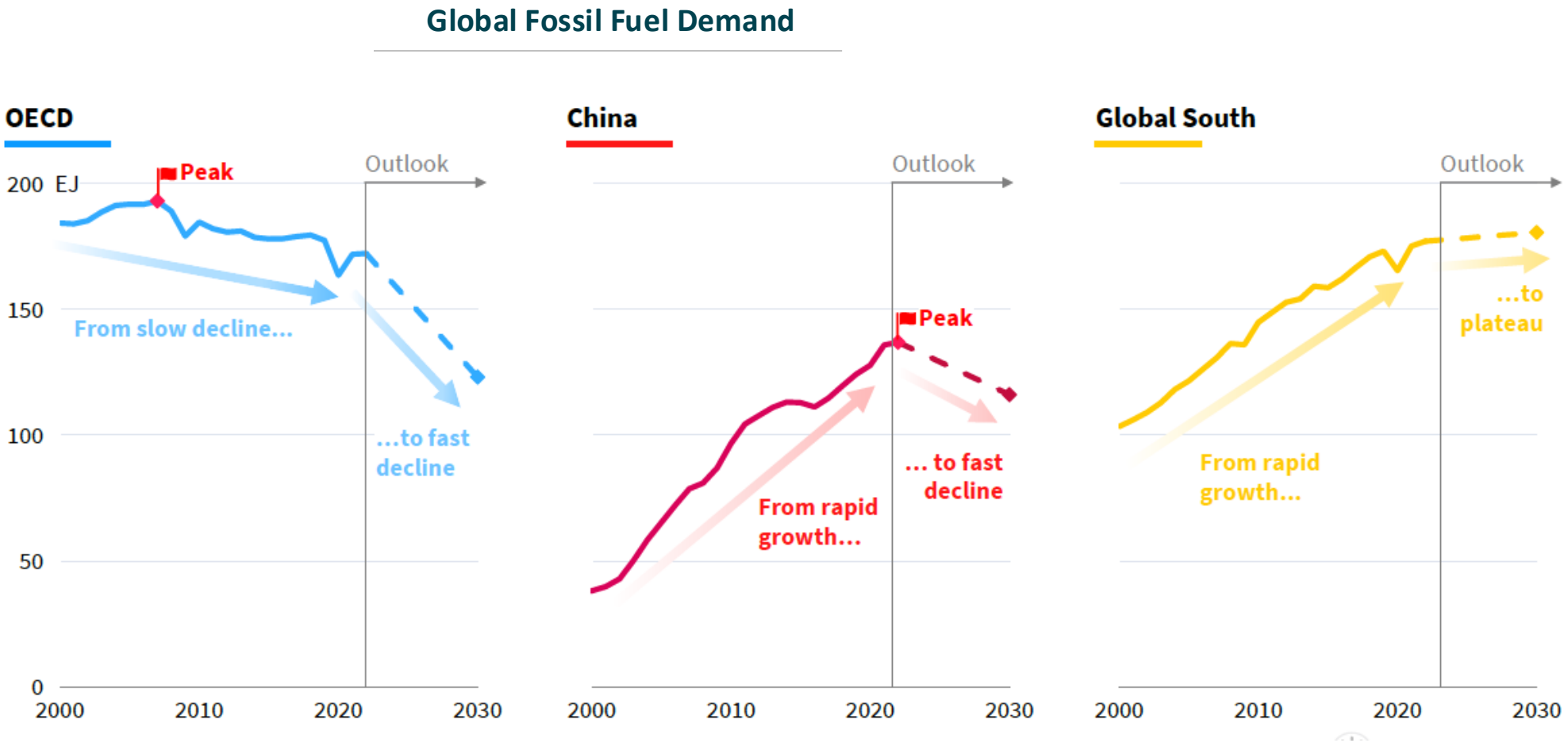
Mercedes Is Walking Back Its All-EV Future to Invest in 'High-Tech Combustion'

Just a few years after "switching from EV-first to EV-only," Merc says it's throwing its weight behind further ICE development.

Source: RMI

#10: The world is very close to peak carbon emissions

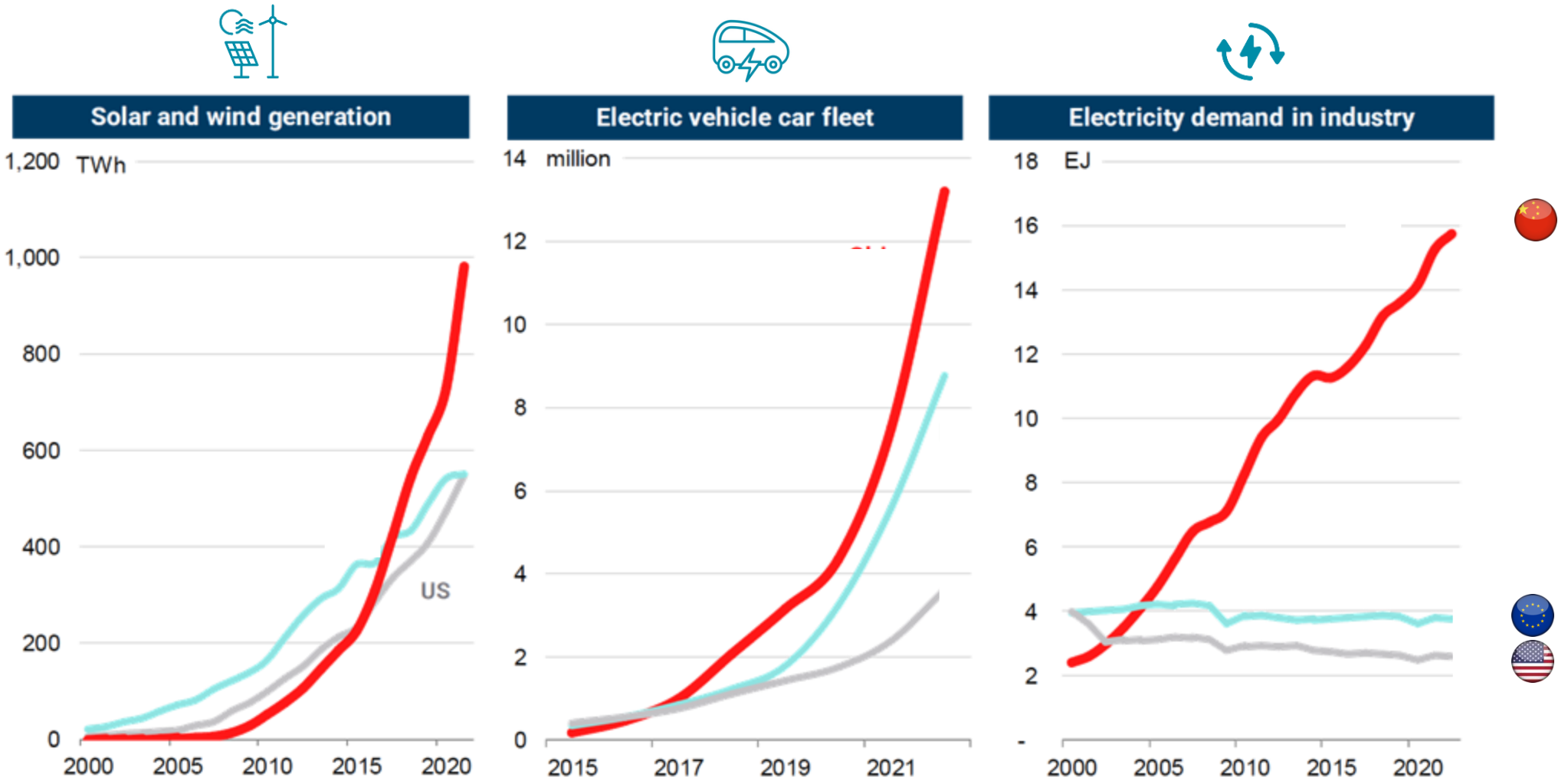
When China peaks so do global emissions



Source: RMI

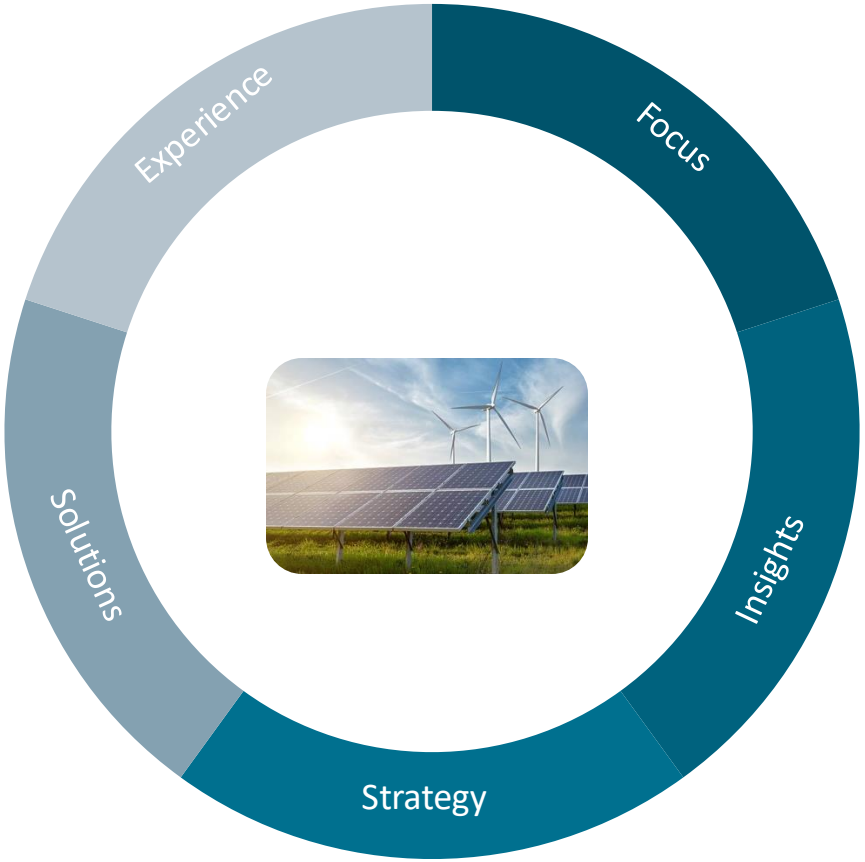
China could peak this year

Thanks to its massive green electrification push !



Source: Bloomberg

ANY QUESTIONS?



Gerard Reid – *Empowering Change in the Worlds of Energy and Mobility*

Over two decades of experience in energy investment banking research, fund management and corporate finance.