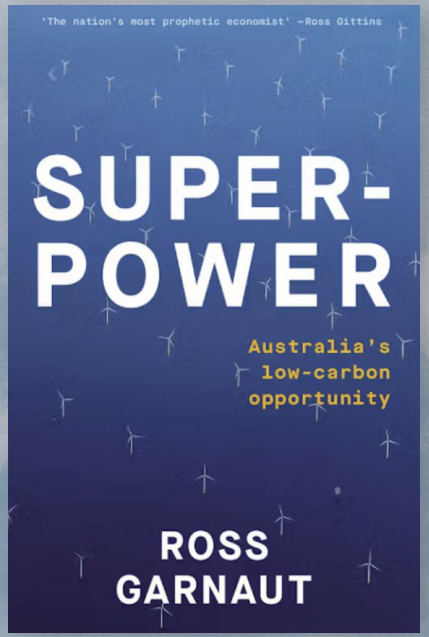
Report Launch

The New Energy Trade

Monday November 18, 2024
Hosted by Senator the Hon Tim Ayres

The Superpower Institute

The Superpower Thesis



The Superpower Thesis

1. Most major economies will lack enough **cheap** clean energy to meet their future needs. This will drive a trade in clean energy.

Tokyo city

The Superpower Thesis

1. Most major economies will lack enough cheap clean energy to meet their future needs. This will drive a trade in clean energy.

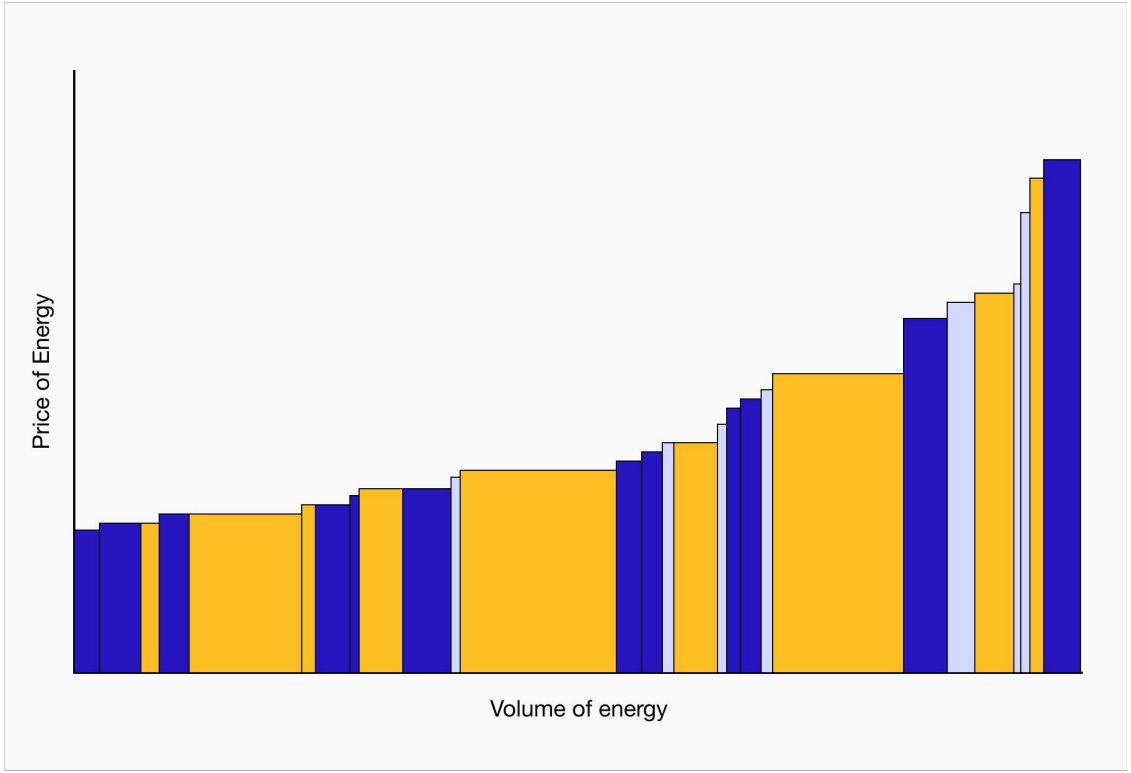
2. The world will mainly trade embedded clean energy—that is, energy embodied in energy-intensive goods, aka the ‘superpower industries’.

The Superpower Thesis

1. Most major economies will lack enough cheap clean energy to meet their future needs. This will drive a trade in clean energy.

2. The world will mainly trade embedded clean energy—that is, energy embodied in energy-intensive goods, aka the ‘superpower industries’.

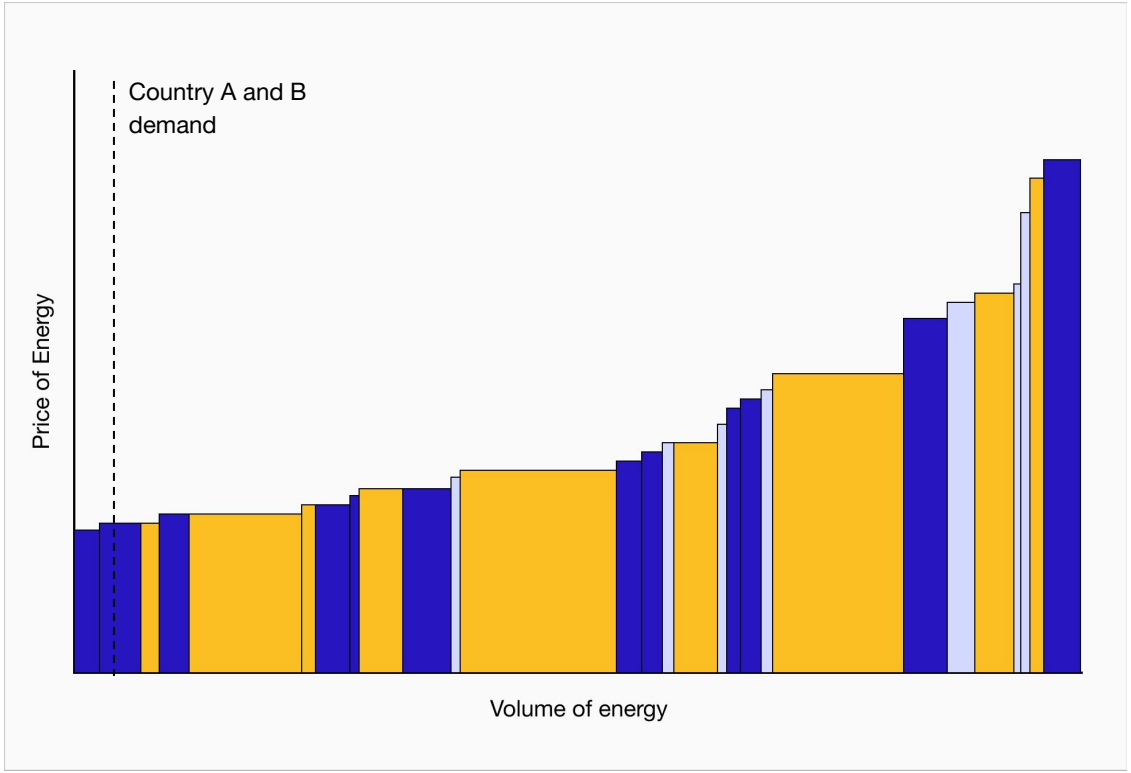
3. Australia, with a large comparative advantage in clean energy production, can take a large share of this trade.



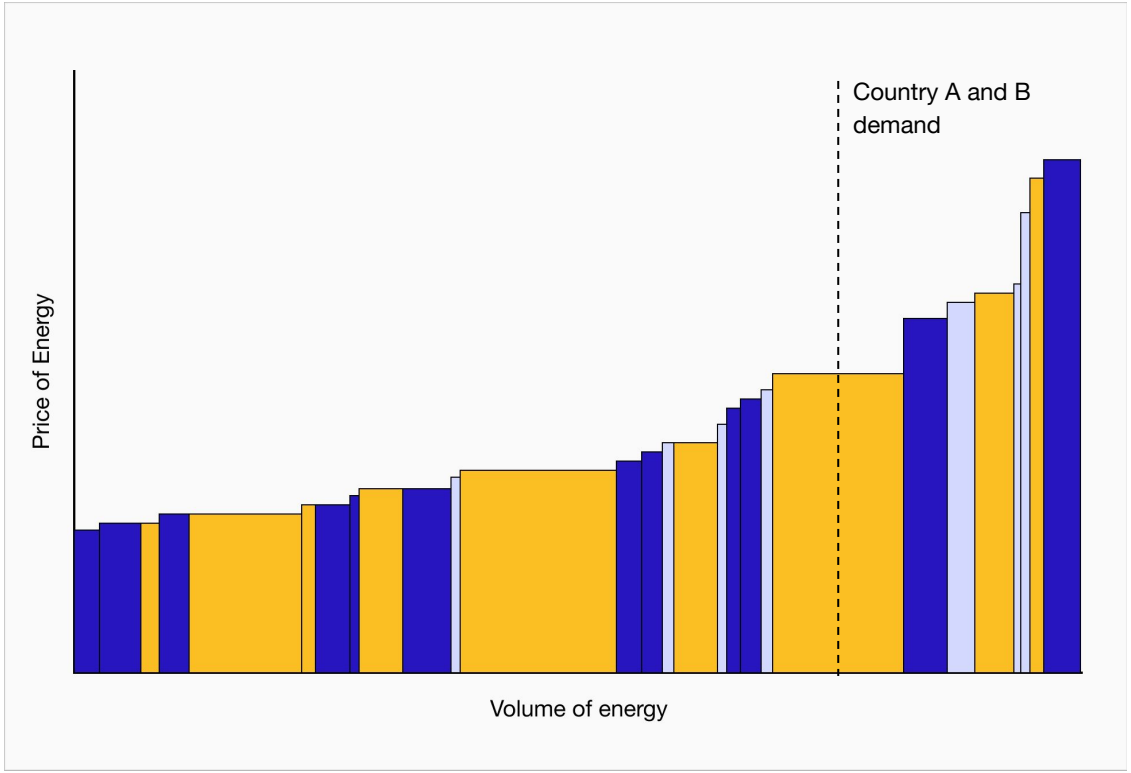
Country A
has the cheapest resource

Country B
is poorly endowed

Country C
has the largest resources at relatively low price



When **demand is low,**
Country A has the advantage.



When **demand is low,**
Country A has the advantage.

When **demand is high**,
Country C has the advantage.

Both Countries A and B will import large amounts of energy from Country C.

Why will the New Energy Trade be a trade in embedded energy?

Fossil age

- Transporting energy is cheap.
- Economies with minimal domestic energy resources (Japan, Korea, Taiwan), can compete in energy intensive industries.

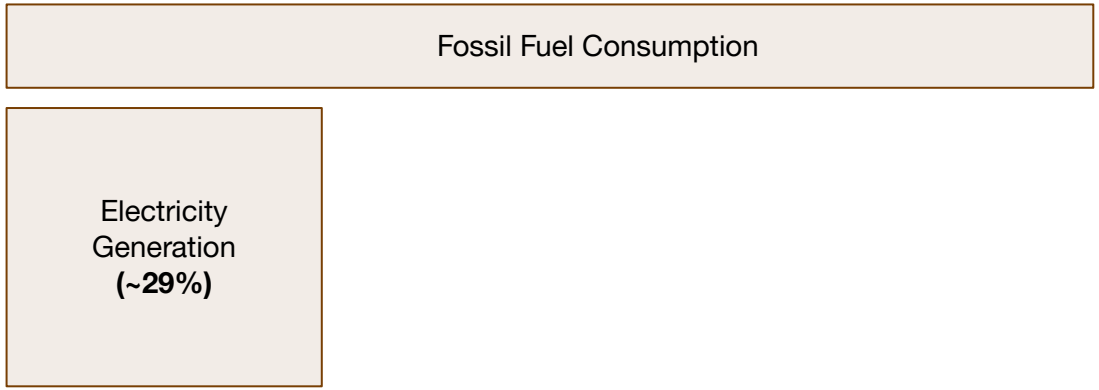
Fossil age

- Transporting energy is cheap.
- Economies with minimal domestic energy resources (Japan, Korea, Taiwan), can compete in energy intensive industries.

Net zero age

- Transporting energy is prohibitively costly.
- Conversion to intermediaries results in 66-80% efficiency losses, and is at minimum 3-5 times more expensive.
- **Transporting embedded energy (iron, aluminium, etc.) will remain cheap.**

Modelling electricity demand in the five countries

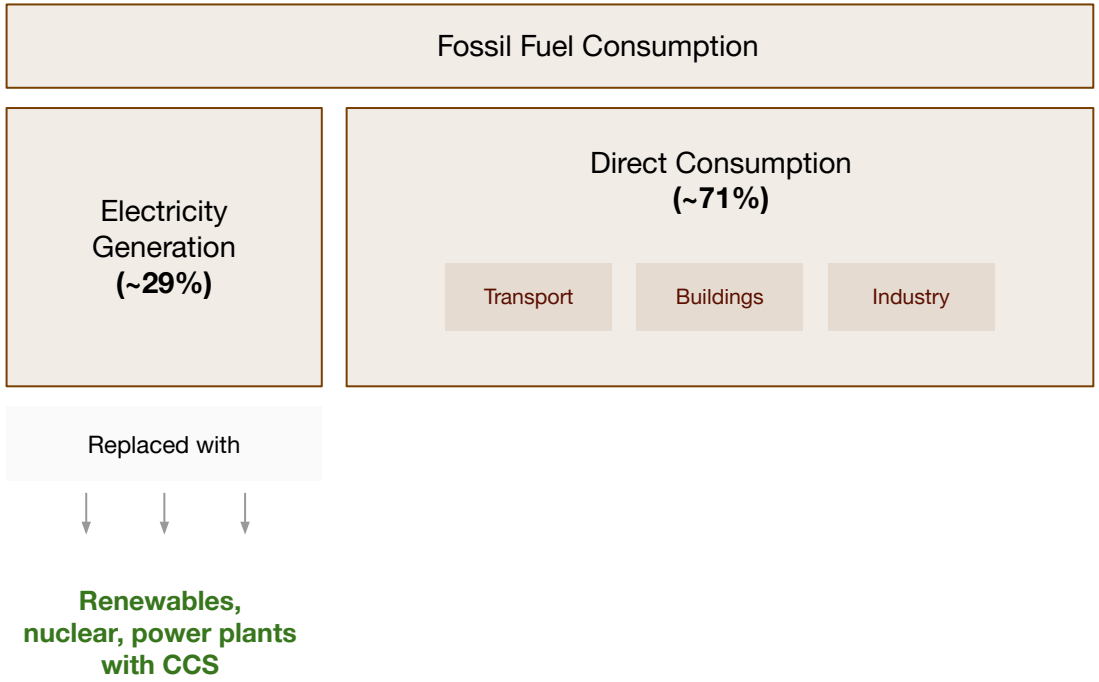

Fossil Fuel Consumption
Electricity Generation
(~29%)

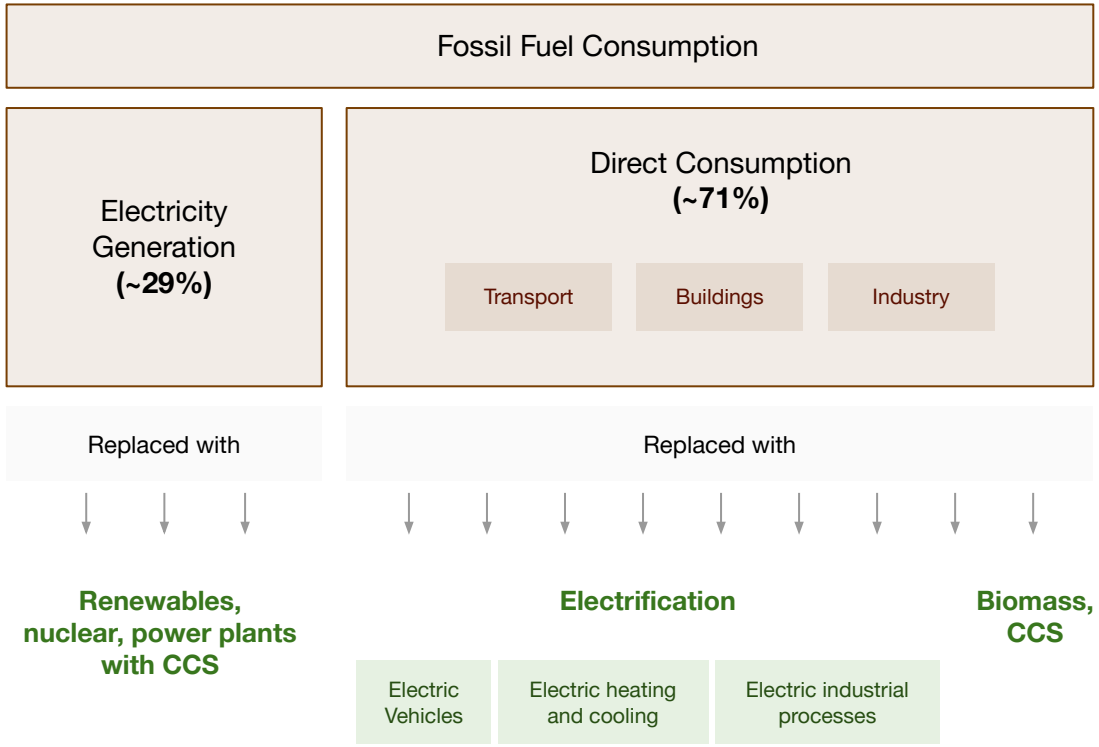
Fossil Fuel Consumption

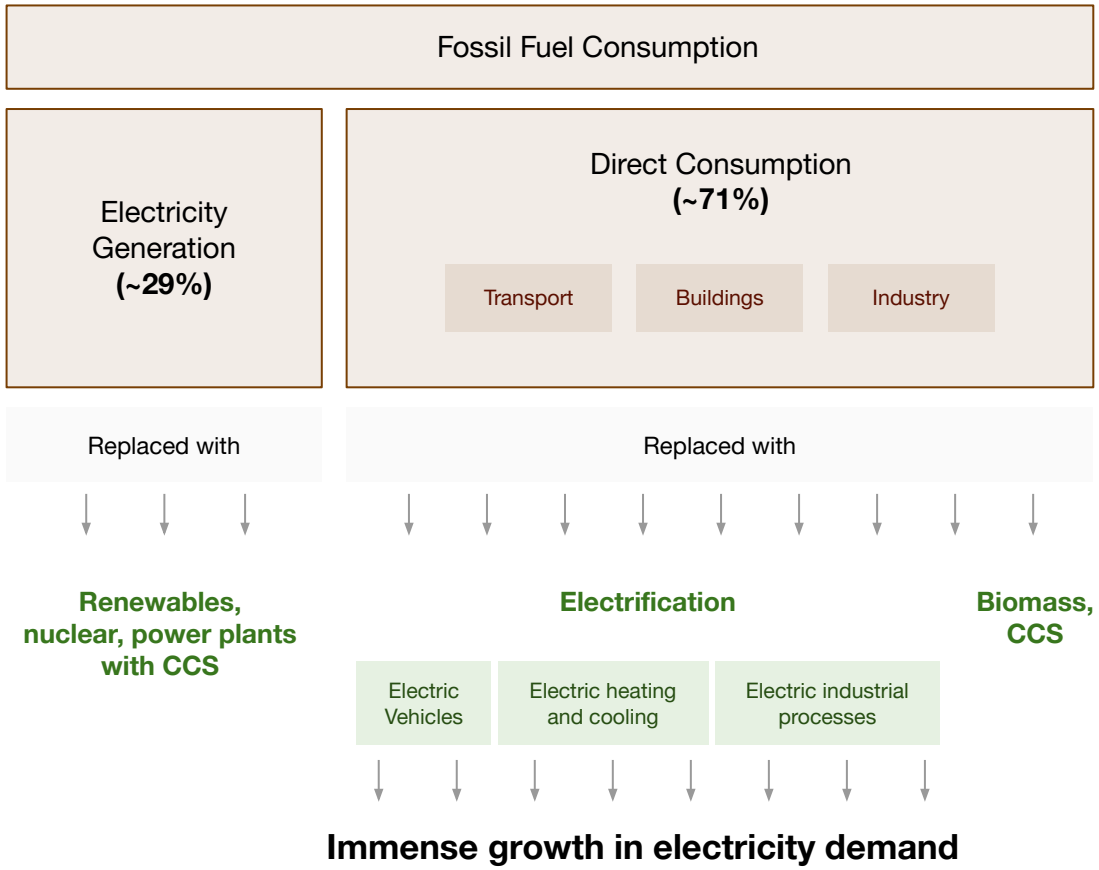
Electricity Generation **(~29%)**

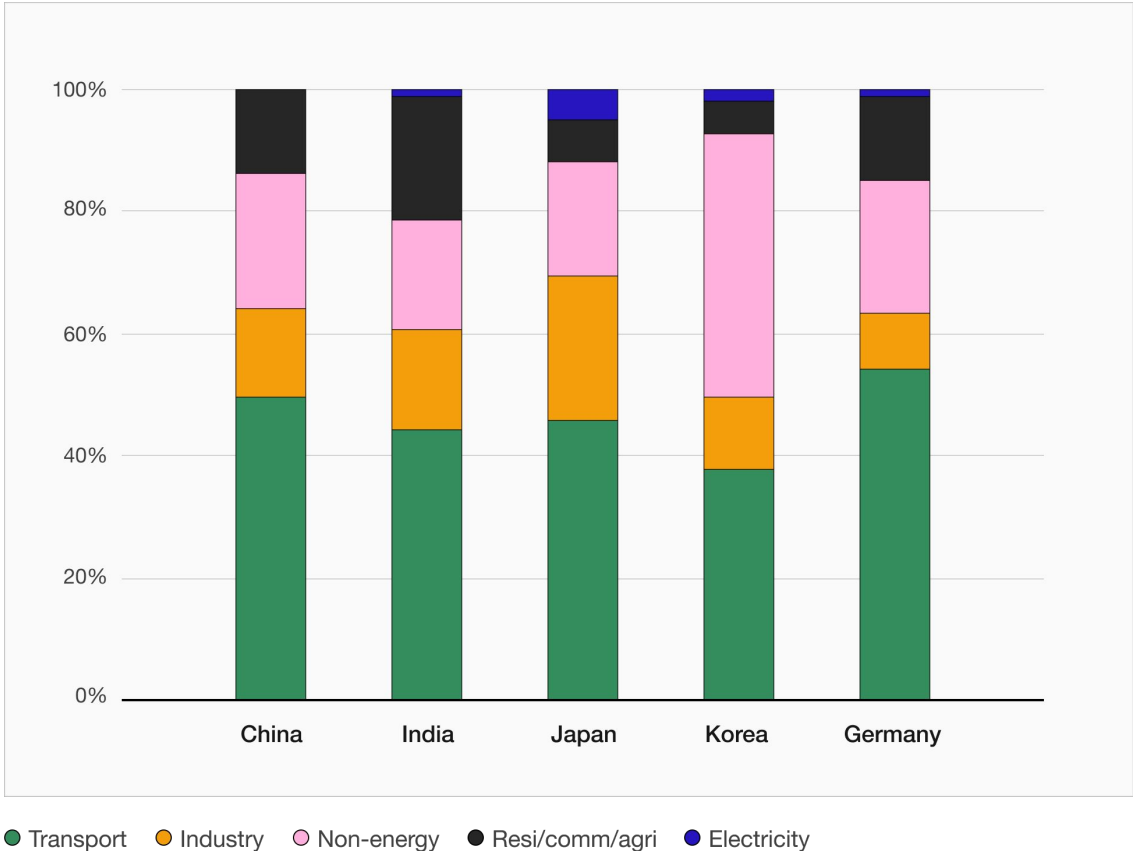
Replaced with

Renewables, nuclear, power plants with CCS

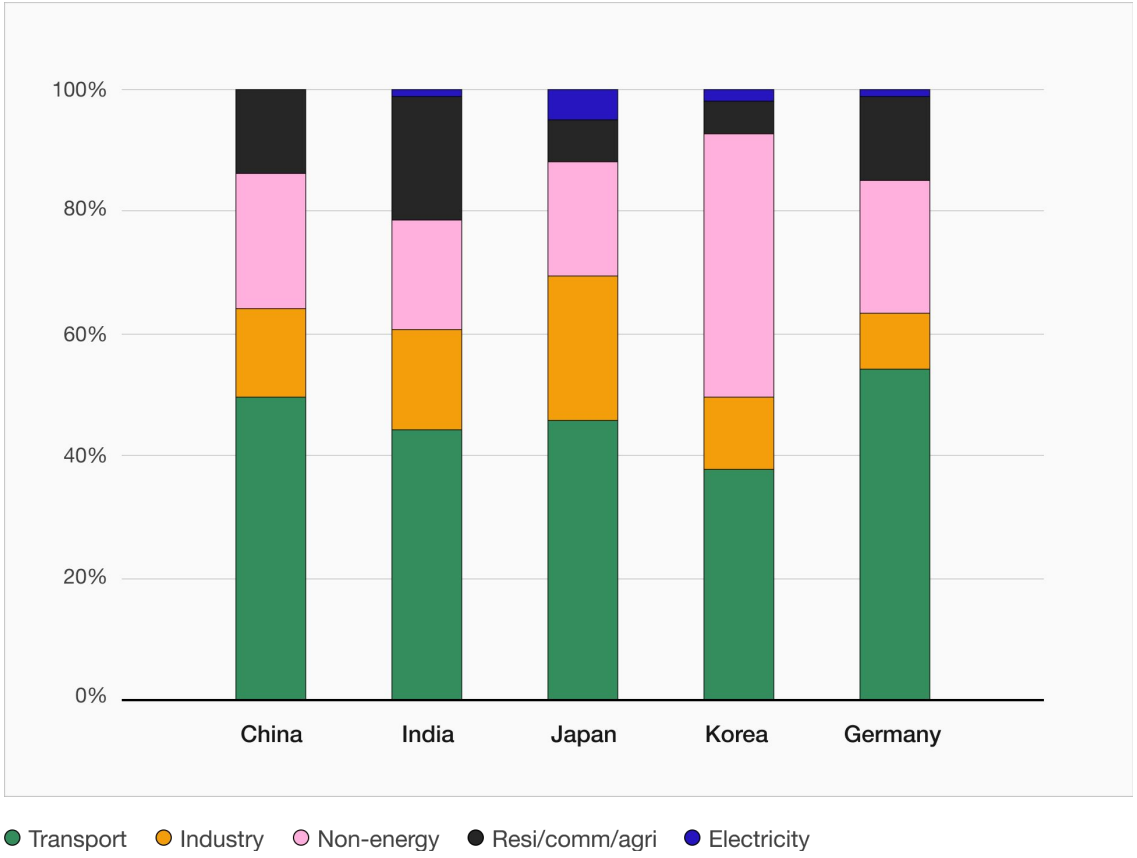

Fossil Fuel Consumption
Electricity Generation (~29%)
Direct Consumption (~71%)
Transport
Buildings
Industry
Replaced with
Renewables, nuclear, power plants with CCS


Fossil Fuel Consumption
Electricity Generation (~29%)
Direct Consumption (~71%)
Transport
Buildings
Industry
Replaced with
Replaced with
Renewables, nuclear, power plants with CCS
Electrification
Biomass, CCS
Electric Vehicles
Electric heating and cooling
Electric industrial processes


Fossil Fuel Consumption
Electricity Generation (~29%)
Direct Consumption (~71%)
Transport
Buildings
Industry
Replaced with
Replaced with
Renewables, nuclear, power plants with CCS
Electrification
Biomass, CCS
Electric Vehicles
Electric heating and cooling
Electric industrial processes
Immense growth in electricity demand



Uses of oil across the five key countries

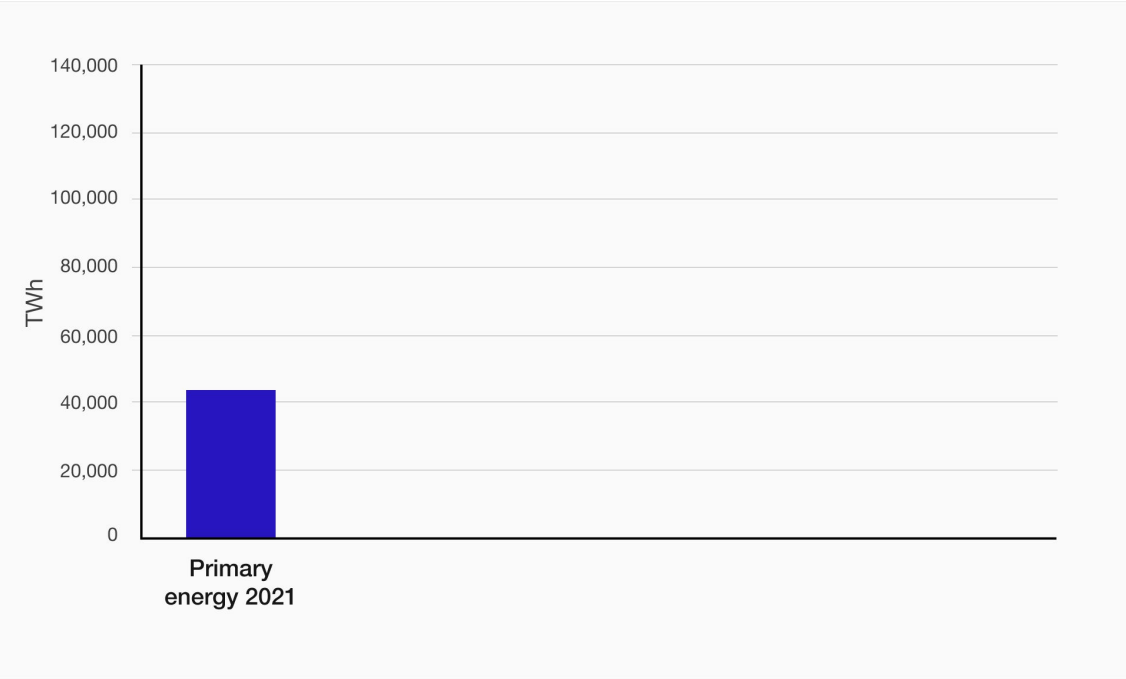


Uses of oil across
the five key countries

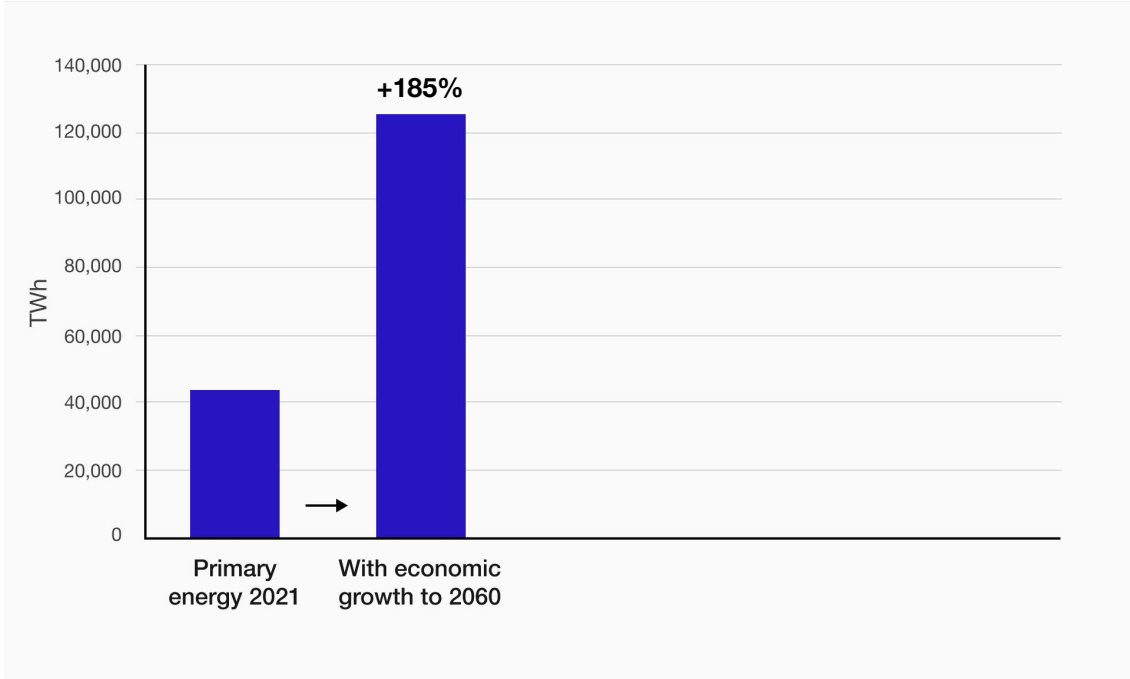
1. **What share of direct fuel uses are electrificable?**
2. **What is the efficiency of electrification?**

What is the projected electricity demand around *mid-century*?

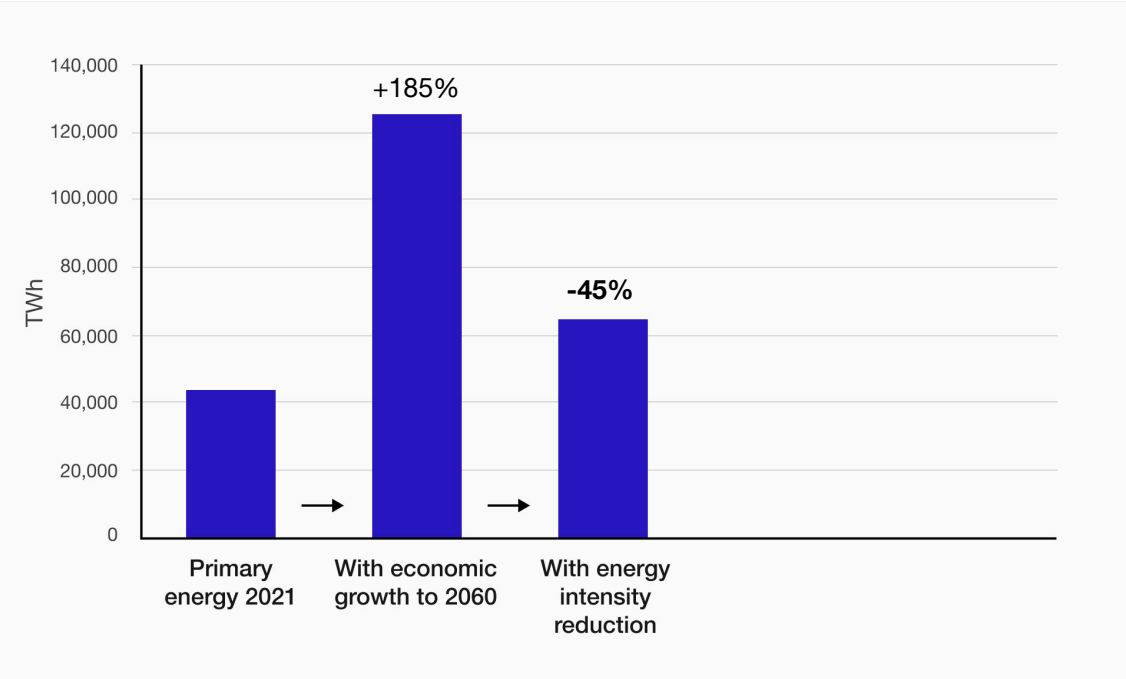
Stepwise analysis for China



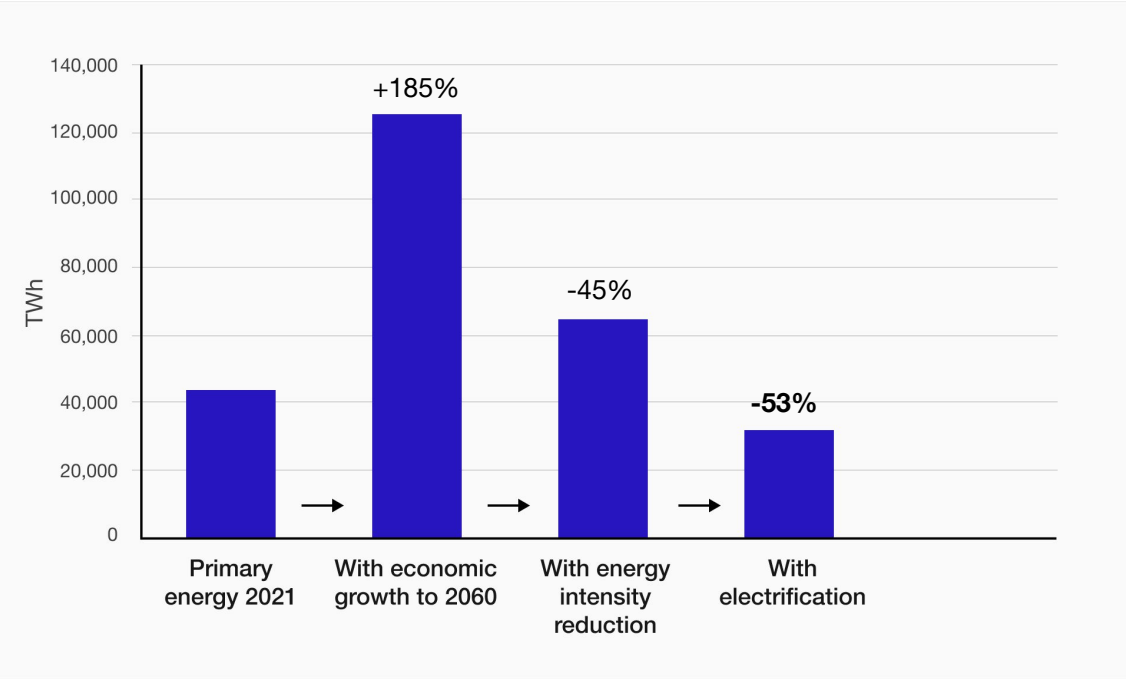
Stepwise analysis for China



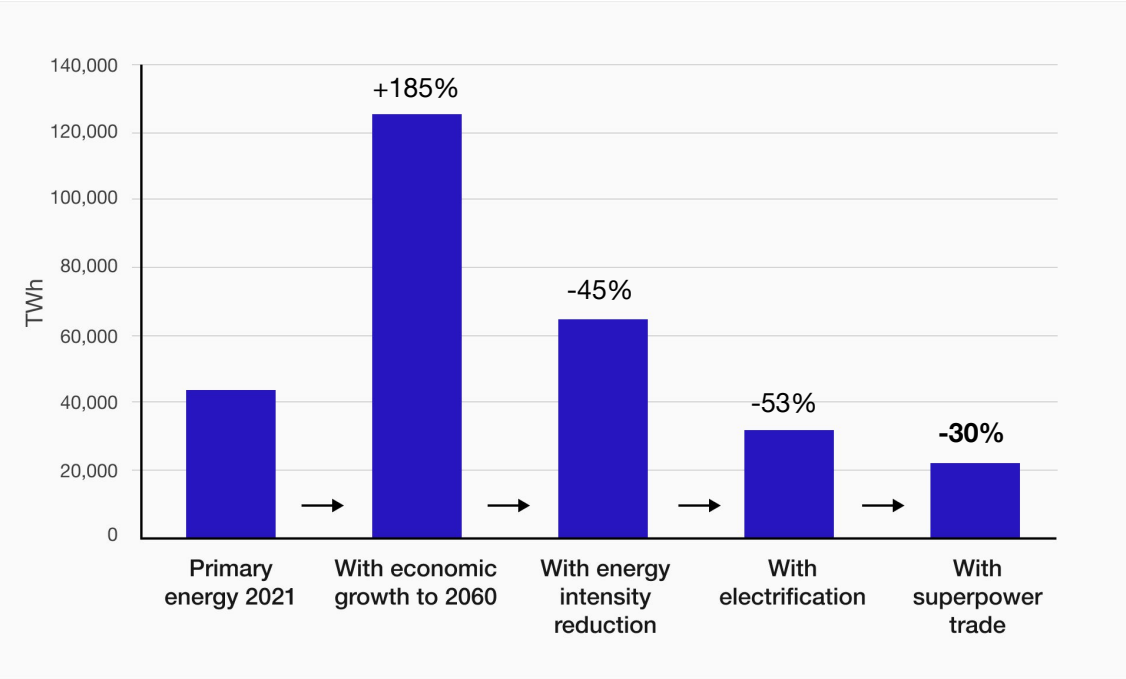
Stepwise analysis for China



Stepwise analysis for China



Stepwise analysis for China



Growth in electricity demand to net zero

	Electricity demand at net zero (TWh)	**Growth in demand** (%)
China	31,550	**290%**
India	21,600	**1170%**
Japan	2,550	**170%**
Korea	1,650	**180%**
Germany	1,800	**220%**

Satisfying demand:
Relative technology costs

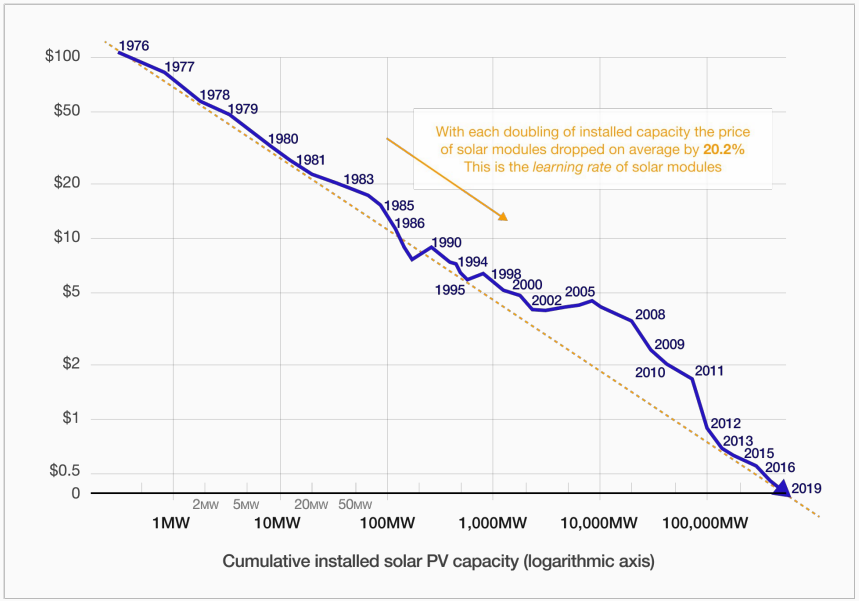
Technology:

Nuclear

- $300-440/MWh for recent plants (3-5x cost of Australian renewables with firming)
- Costs have grown over time

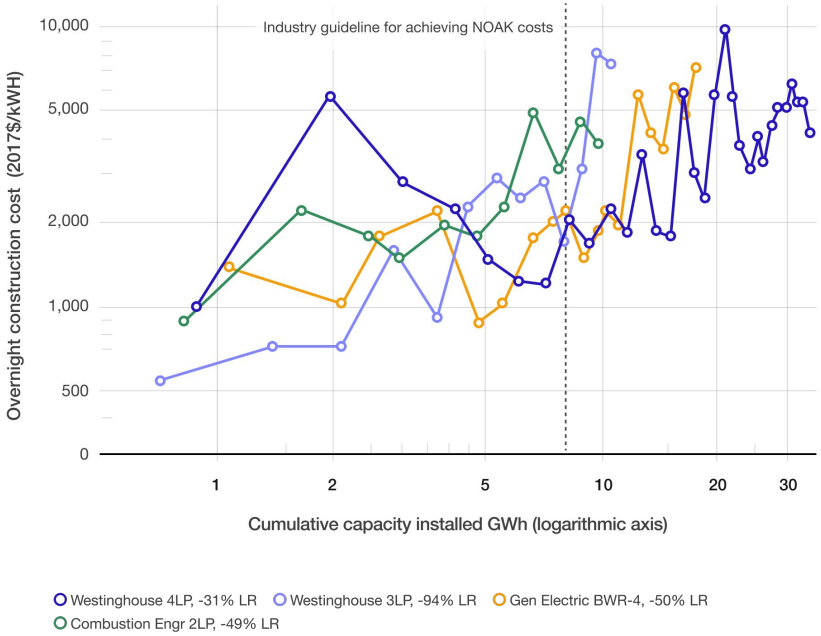
The falling cost of solar:
A 99.6% reduction in the price per watt since 1976.

Prices are adjusted for inflation and in 2019 US$ (Source: Roser, 2020).



The rising costs of nuclear over time:

(Source: Eash-Gates et al. 2020.)



Technology:

Nuclear

- $300-440/MWh (3-5x cost of Australian renewables with firming)
- Costs have grown over time
- Korea and China are reported exceptions, but opaque and heavily subsidised
- China built 1.4 GW of nuclear in 2023 vs 290 GW of solar and wind
- On track for a 3.5% nuclear contribution to China’s energy supply in 2060

Technology:

Carbon Capture & Storage

- Costly everywhere

Initial/temporary Uses

- Enhanced oil recovery (sometimes competitive, raises emissions)
- Rescuing stranded assets (sometimes competitive, depends on the assets)

Future Uses

- New build CCS (likely uncompetitive)
- Non-electrifiable industries (sometimes competitive)

Technology:

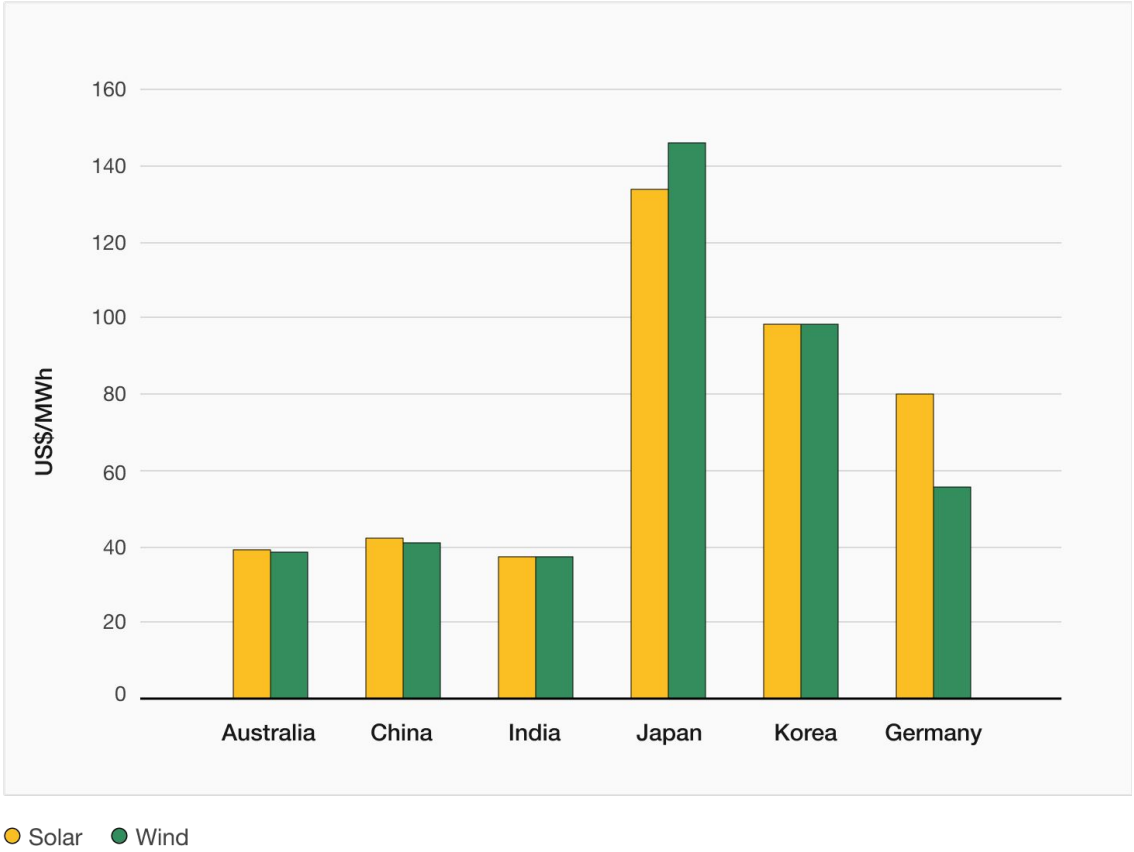
Biomass

- In China, biomass power costs are double that of coal
- Near zero biomass in Japan, Korea, and Germany; India little compared to demand
- By 2060, superpower industries will need over 2 billion tonnes for carbon content
- This will push the world far up the biomass supply curve, raising marginal prices

Technology:

Solar & Wind

- The world’s main source of electricity
- The world’s cheapest electricity



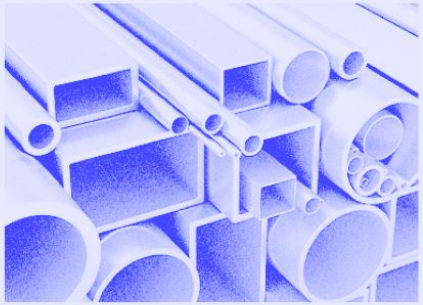
Solar and wind:

Average of 2020/2023 prices in US$.

Especially at scale, Australia's wind and solar resources are greatly superior to those of China, India, Japan, Korea, and Germany

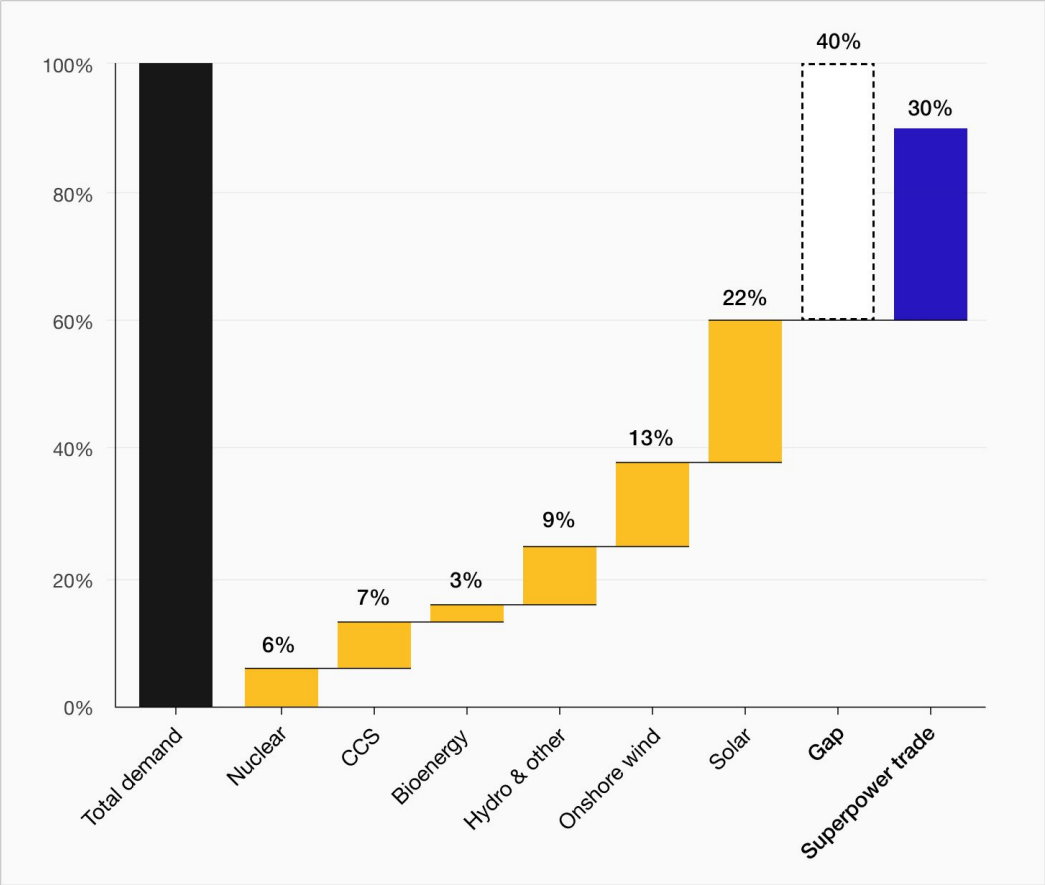
	Solar capacity factor	Seasonality	Wind capacity factor	Seasonality
Australia	**26%**	Low to moderate	**30-35%** onshore at multi-TW	Low to moderate
China	**17%**	Moderate to high	**<25%** in north at multi-TW, **<20%** elsewhere	High to very high
India	**18%**	High	**<14%** onshore at multi-TW	Very high to extreme
Japan	**13%**	Low	**<20%** onshore at multi-GW	Moderate to high
Korea	**14%**	Low to moderate	**<20%** onshore at multi-GW	High to very high
Germany	**11%**	Very high	**<20%** onshore at multi-GW	Moderate to high

The Superpower Trade

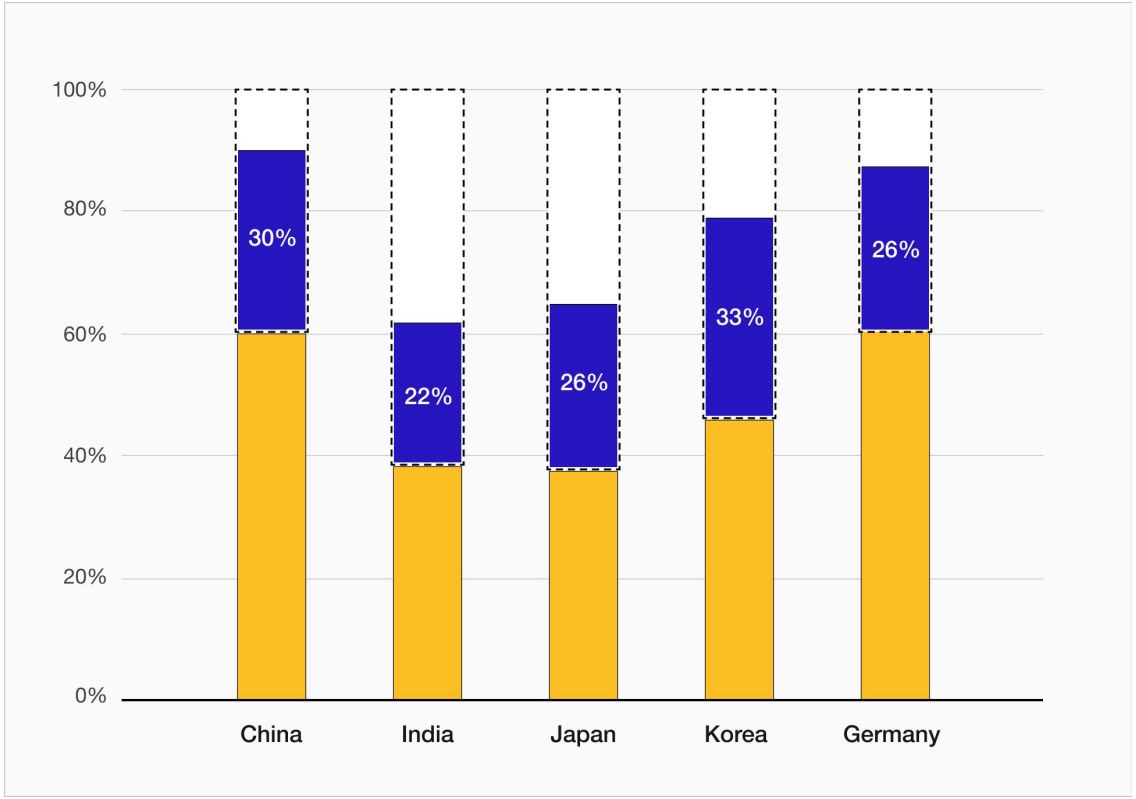


How much can the global superpower trade contribute to the five countries' decarbonisation?



Full realisation of the superpower trade would reduce Chinese electricity demand by **30 per cent**.

This could close **three-quarters** of the supply-demand gap.



Contribution of the superpower trade to bridging the supply-demand gap in five key countries.

How much would the Australian superpower trade contribute to global climate mitigation?

	Australia's potential market share
Iron / steel	40%
Aluminium	30%
Silicon & polysilicon	25%
Ammonia & urea	25%
Methanol (industrial)	25%
Shipping	25%
Aviation	25%
Road freight	15%
Total	

	Australia's potential market share	Today's mitigation contribution
Iron / steel	40%	4.0%
Aluminium	30%	0.7%
Silicon & polysilicon	25%	0.2%
Ammonia & urea	25%	0.5%
Methanol (industrial)	25%	0.2%
Shipping	25%	0.4%
Aviation	25%	0.6%
Road freight	15%	0.1%
Total		6.7%

Australia could cut global emissions by between 6.7% …

	Australia's potential market share	Today's mitigation contribution	Global industry growth to 2060	Mid-century mitigation contribution
Iron / steel	40%	4.0%	10%	4.4%
Aluminium	30%	0.7%	30.40%	0.9%
Silicon & polysilicon	25%	0.2%	100% (Si), 300%(PSi)	0.5%
Ammonia & urea	25%	0.5%	300%	1.5%
Methanol (industrial)	25%	0.2%	30%	0.3%
Shipping	25%	0.4%	0%	0.4%
Aviation	25%	0.6%	100%	1.1%
Road freight	15%	0.1%	180%	0.4%
Total		**6.7%**		**9.6%**

Australia could cut global emissions by between 6.7% and 9.6% of 2021 emissions**.**

What would be the scale of Australia's export income?

	Export Revenue, contemporary market size	Export revenue, 2060 market size
Iron / steel	$386 billion	$386 billion
Aluminium	$67 billion	$89 billion
Silicon & polysilicon	$11 billion	$36 billion
Ammonia & urea	$29 billion	$90 billion
Methanol (industrial)	$15 billion	$29 billion
Shipping	$43 billion	$43 billion
Aviation	$90 billion	$158 billion
Road freight	$54 billion	$156 billion
Total	**$693 billion**	**$987 billion**

Total superpower revenue would be around **$700 billion per annum** on today's level of production, or **$1 trillion** on forecast 2060 levels of production.

Potential trade revenues from superpower industries are together *6 to 8 times larger than typical combined coal and LNG export revenues.*

Grasping the opportunity

1.

Address market failures by pricing CO2, supporting innovation and investing in transport and energy infrastructure.

2.

Allow **market forces** to guide the most cost-effective investments.

3.

Maintain open trade to secure Australia's access to low-cost inputs and establish reliability as a source of critical materials.

4.

Manage debt and inflation to help restrain interest rates, which is essential for attracting necessary capital, including foreign investment.

5.

Accelerate green project approvals to stay competitive globally.

6.

Ensure policy certainty by building **bipartisan support** for reforms to provide investor confidence for long-term projects.

Q & A

The New Energy Trade

The Superpower Institute