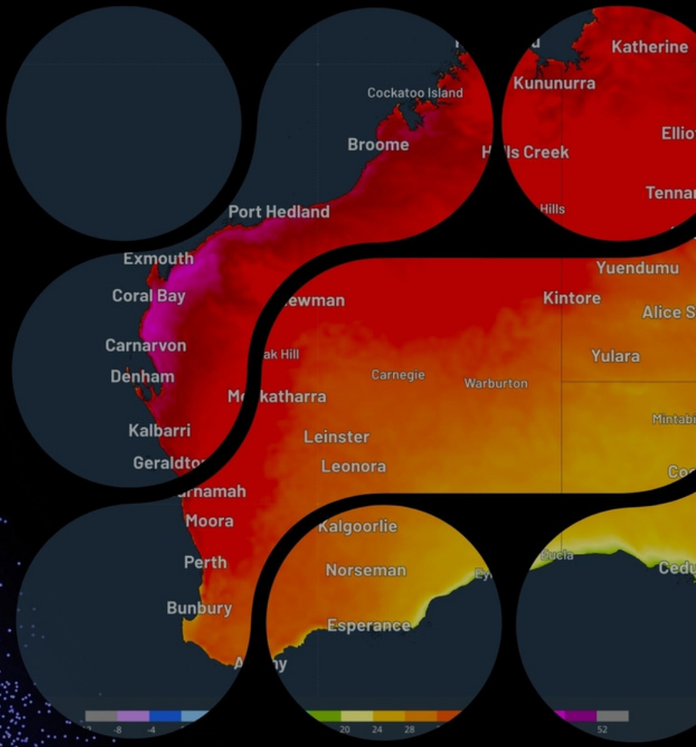
Simon Holmes à Court

OPPORTUNITIES & CHALLENGES IN THE CLEAN ENERGY TRANSITION

Lighter Footprints – February 2024

WHY ARE WE HERE?



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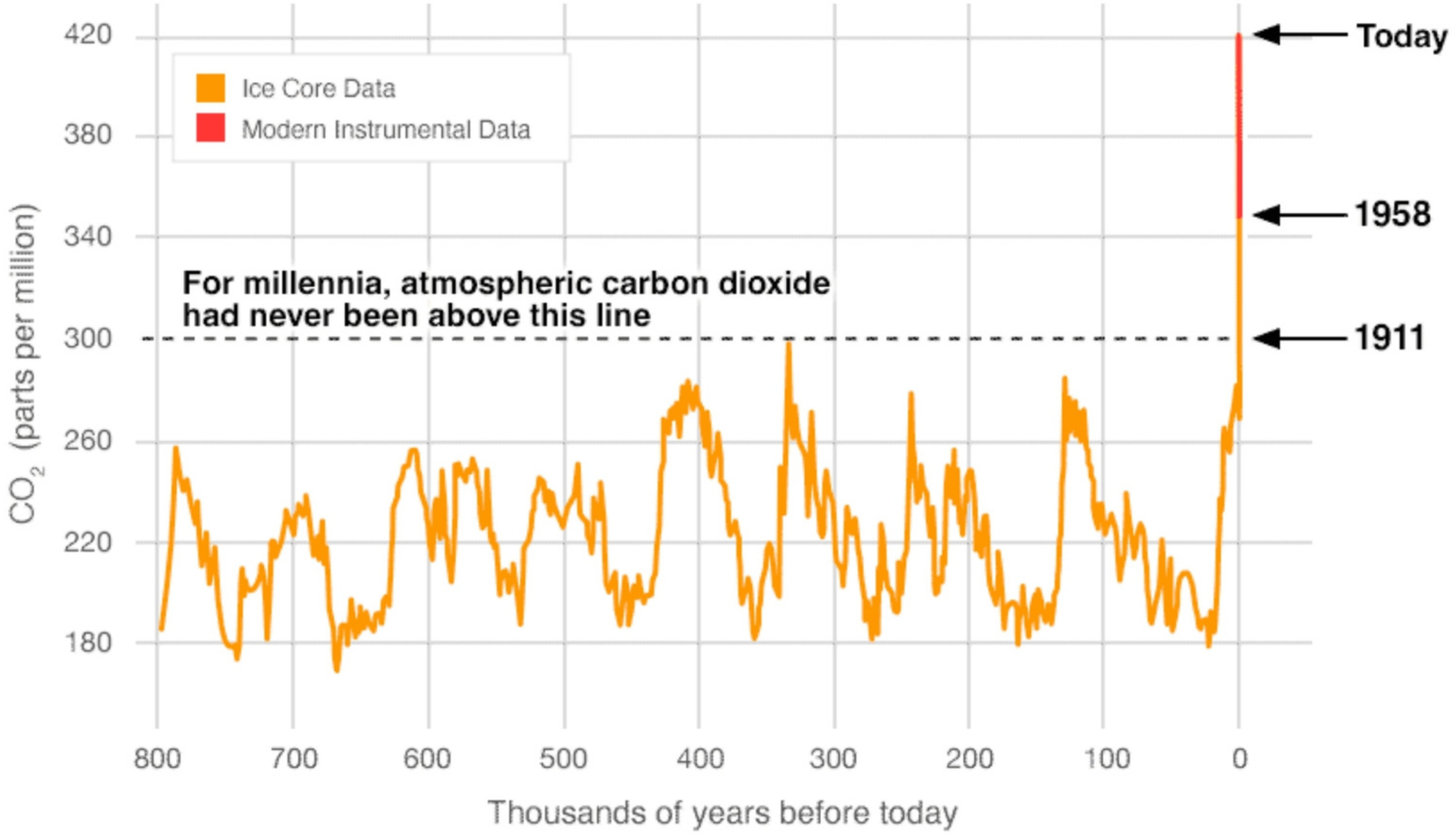
CO_2 levels the highest in human history

Currently 423ppm, ~50% increase in less than 200 years

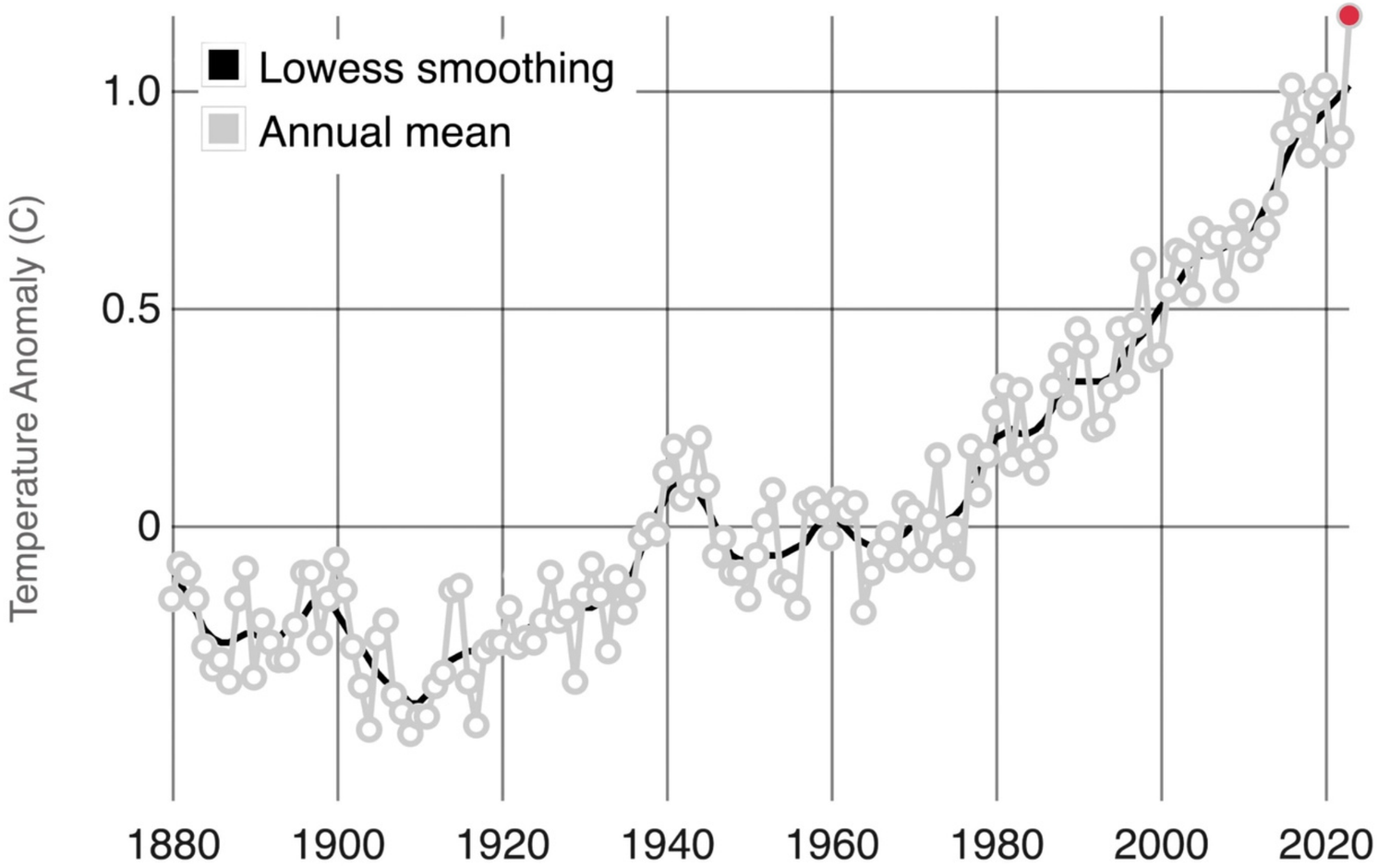


Source
NASA
Vital Signs of the Planet

Simon Holmes à Court

Hottest year on record

1.17ºC above the 20th Century average



Source
NASA
Vital Signs of the Planet

Note
1900 - 2000
reference period

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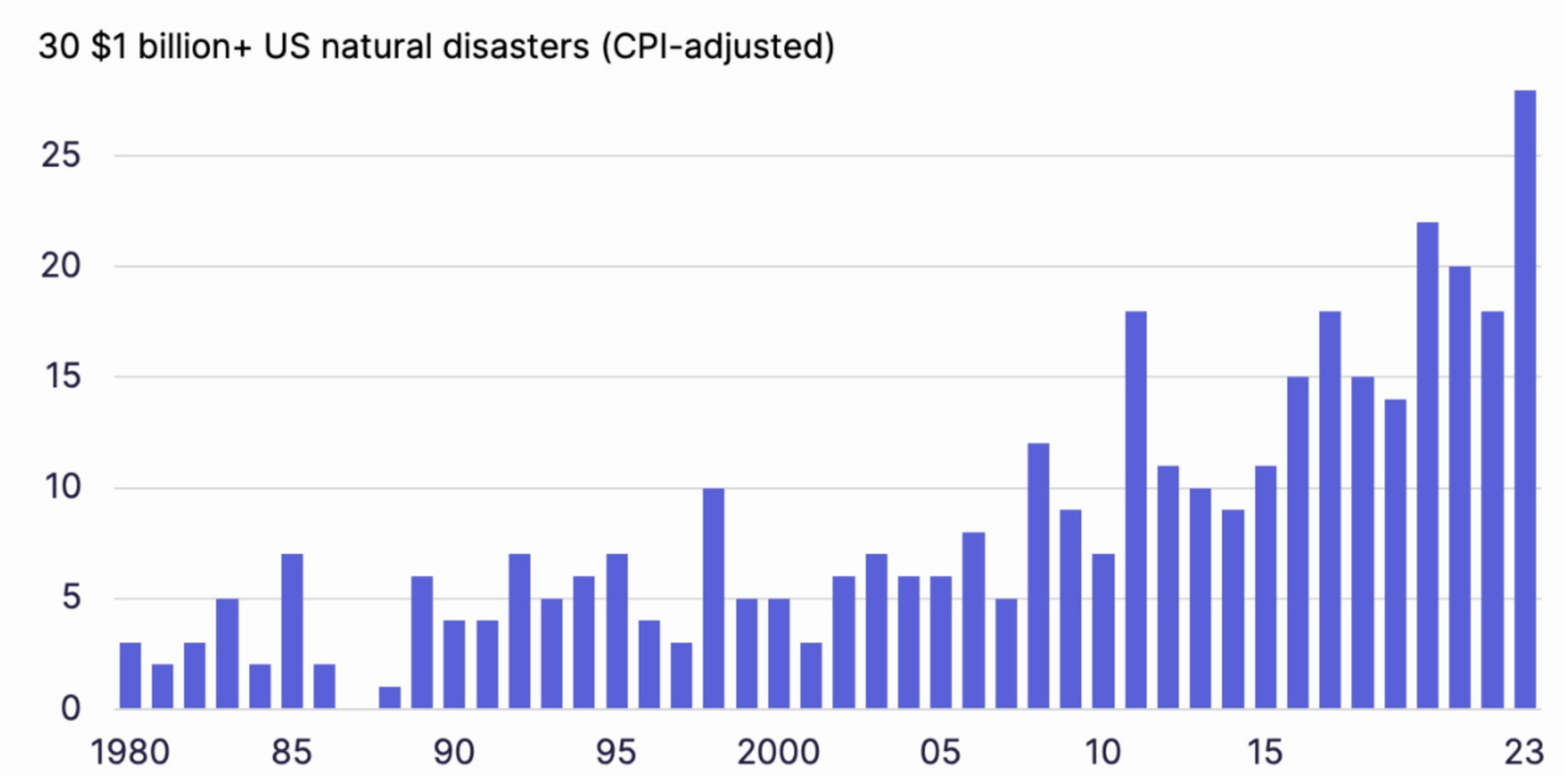
More disasters

The US experienced a record number of $1bn weather-related disasters in 2023



Source
National Centres for Environmental Information

via **Nat Bullard**

Simon Holmes à Court

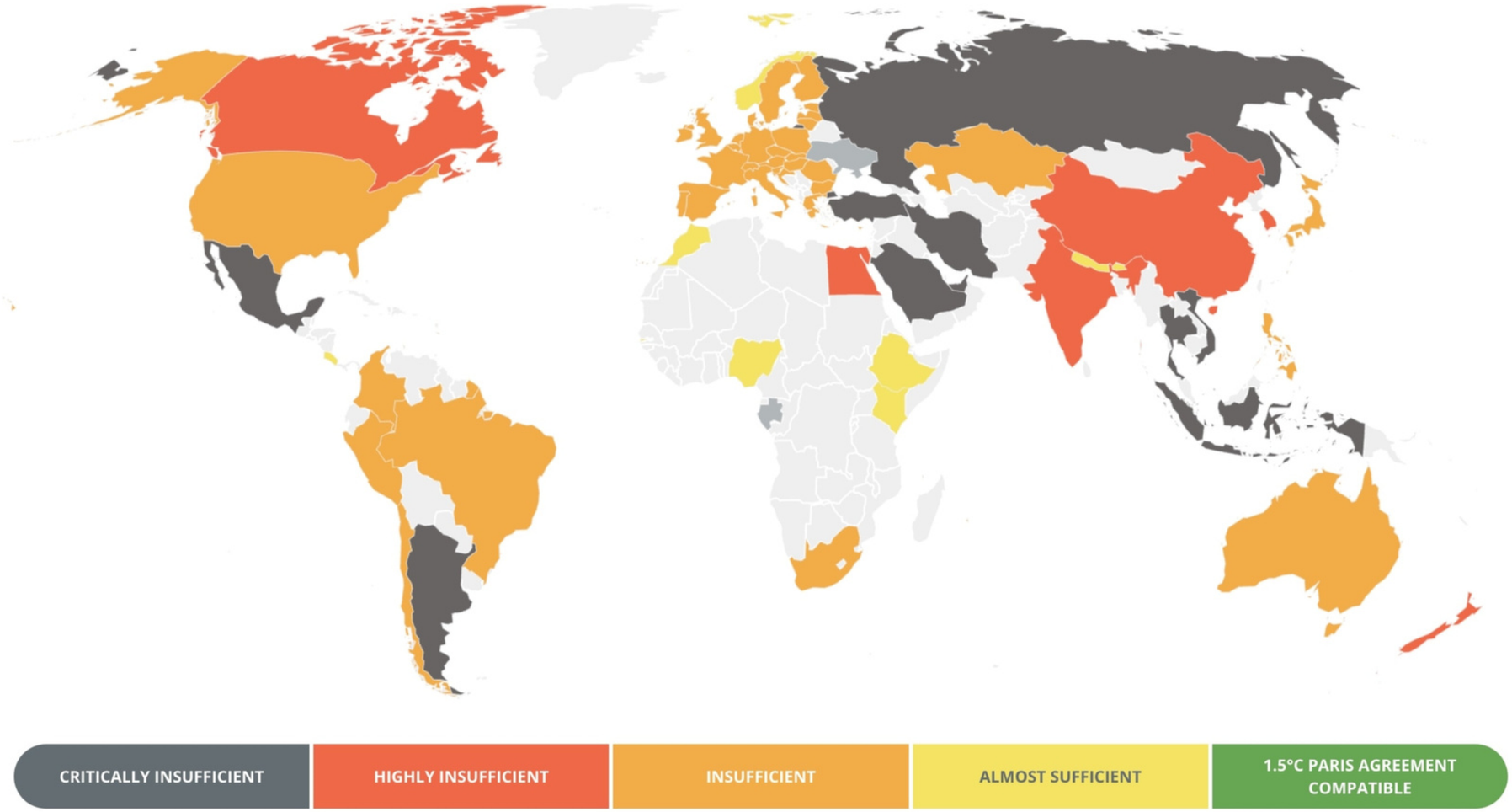
So what do we do?

Replace fossil fuels

Electrify everything
‘green’ electrons wherever possible

‘Green’ molecules elsewhere
Green hydrogen & derivatives

How are we travelling?

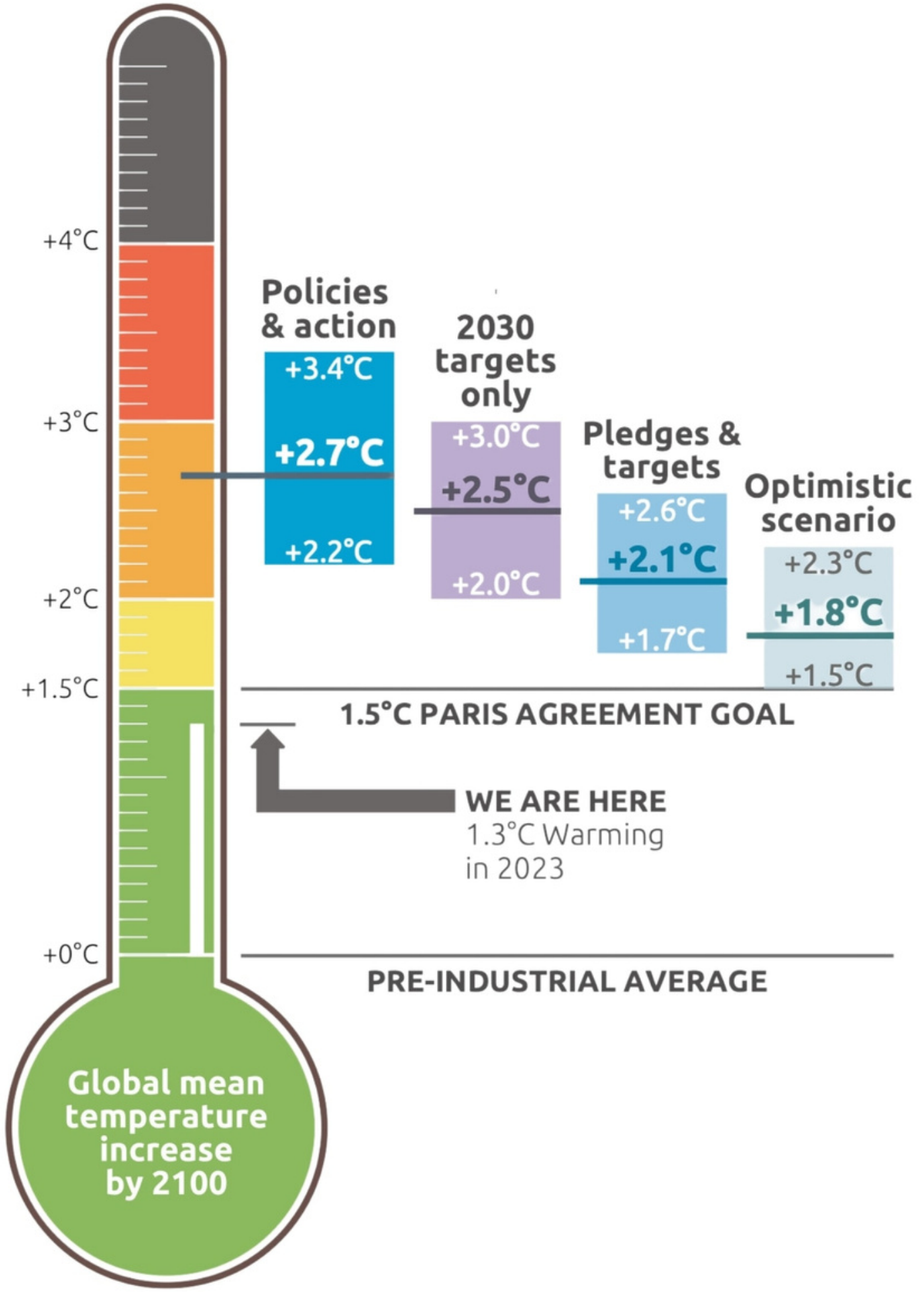


Source
Climate Action Tracker

December 2023 Update

Simon Holmes à Court

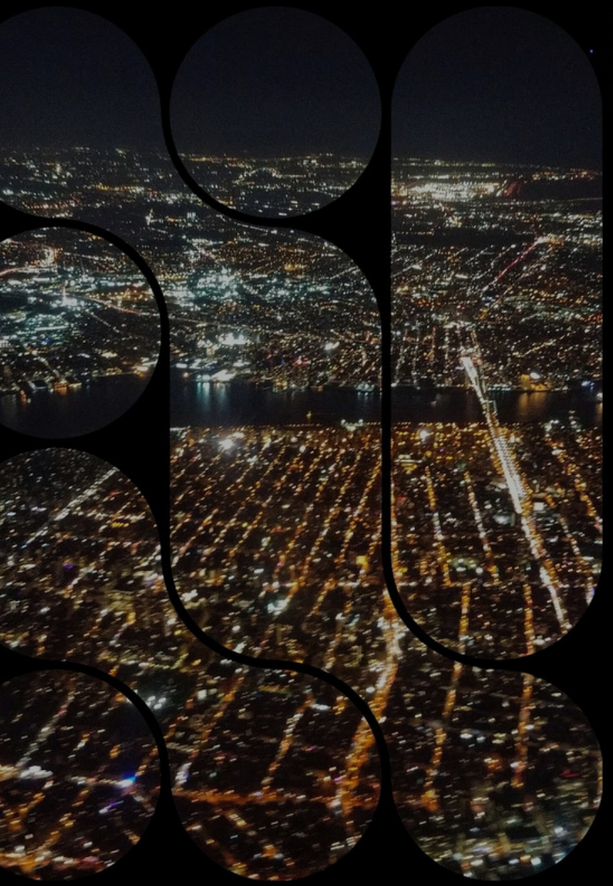
How are we travelling?



Source
Climate Action Tracker

December 2023 Update

Simon Holmes à Court



GRID

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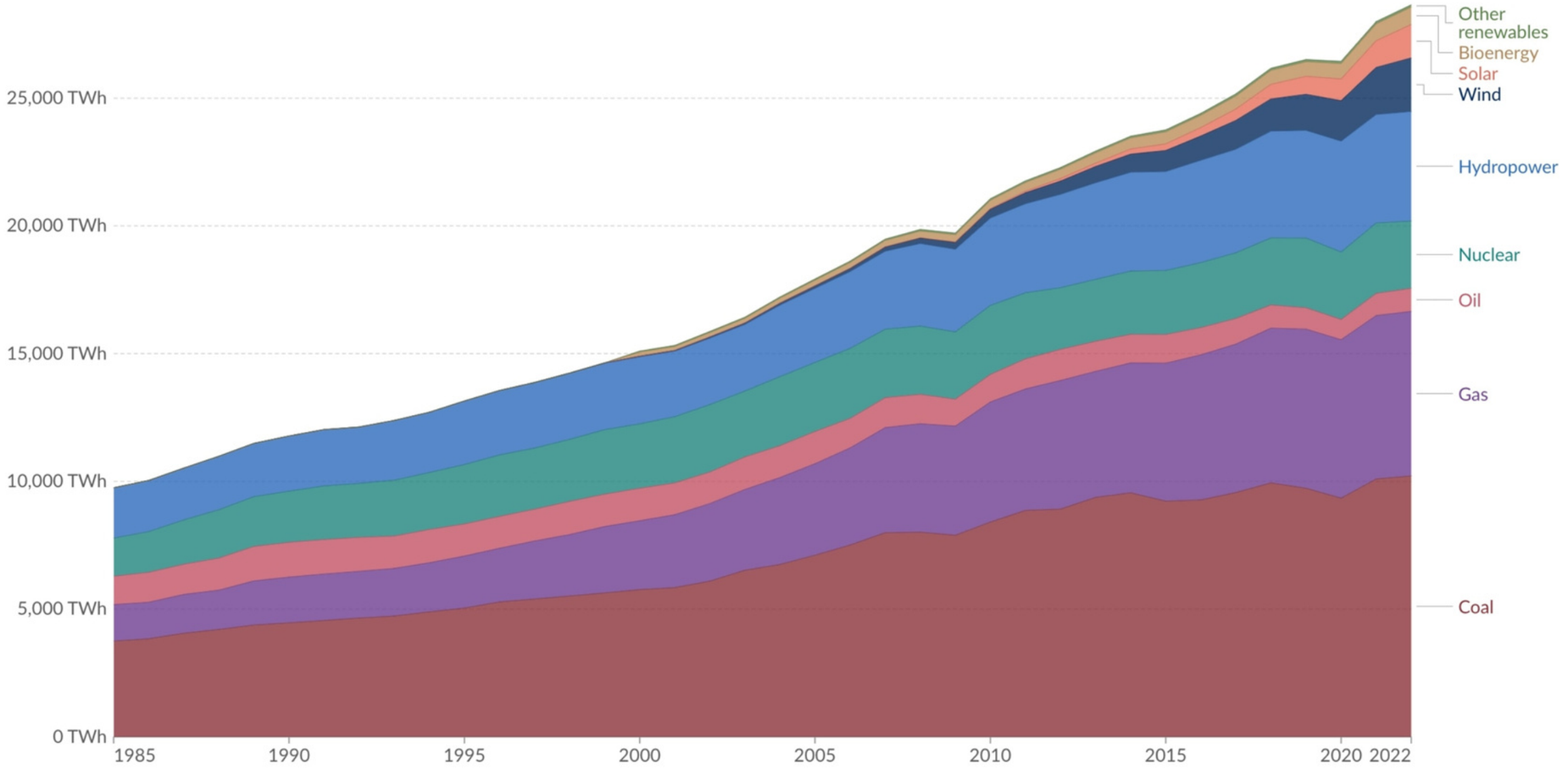
Holmes
à Court

A long way to go...

Global electricity production by source, TWh



Source
Ember
Yearly Electricity Data (2023)

Ember
European Electricity Review (2022)

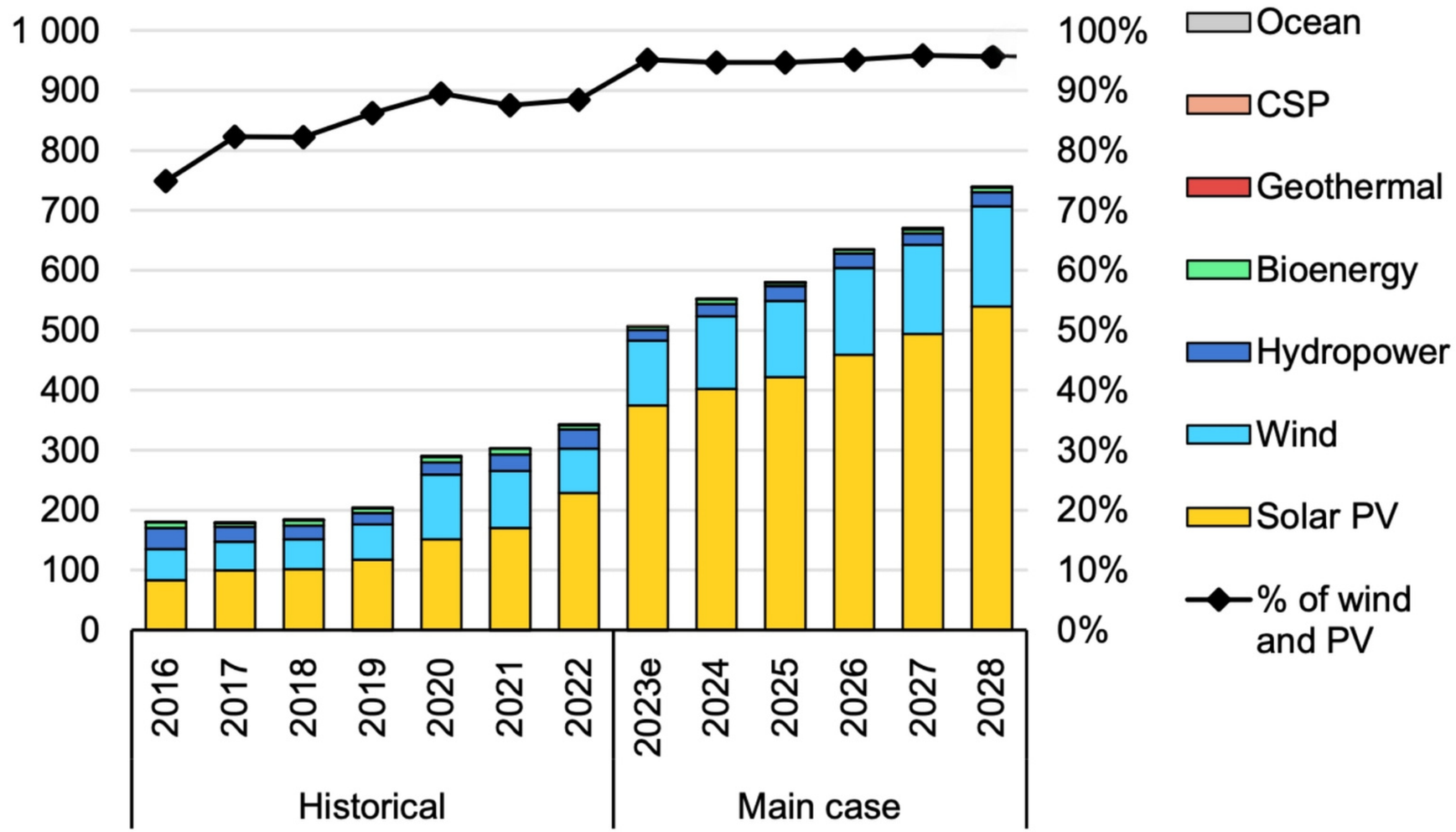
Energy Institute
Statistical Review of World Energy (2023)

via **Our World in Data**

Simon Holmes à Court

We’re adding clean capacity fast…

renewable generation capacity added GW



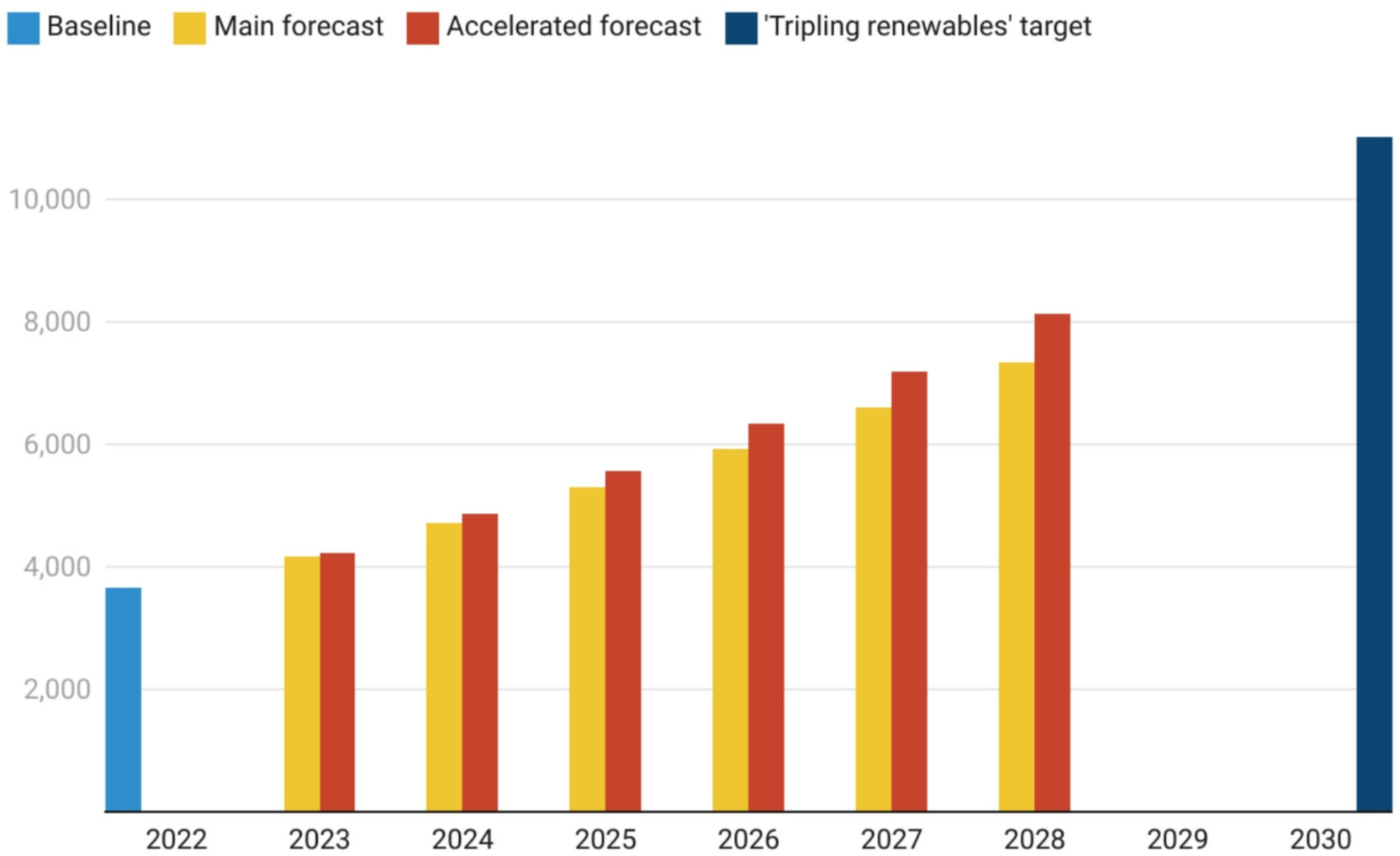
Source
IEA

Renewables 2023

Simon Holmes à Court

Putting audacious goals within reach

The IEA says ‘accelerating’ policies would put the world on track to tripling renewables capacity (GW) by 2030.



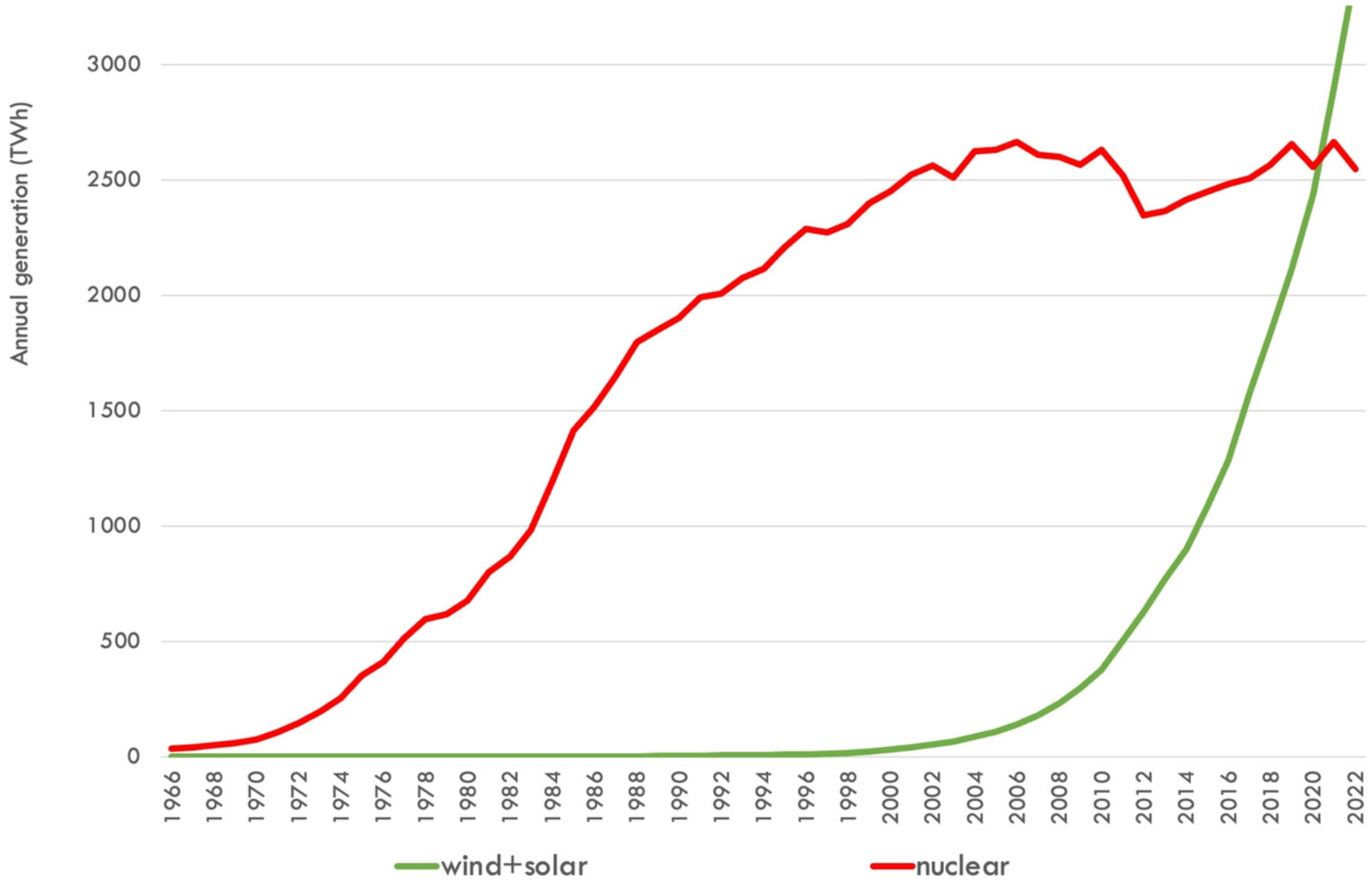
Source
IEA

via **CarbonBrief**

Simon Holmes à Court

Renewables the hero

Countries at high lattitudes or with land constraints may need nuclear to get moving.



Source
Energy Institute

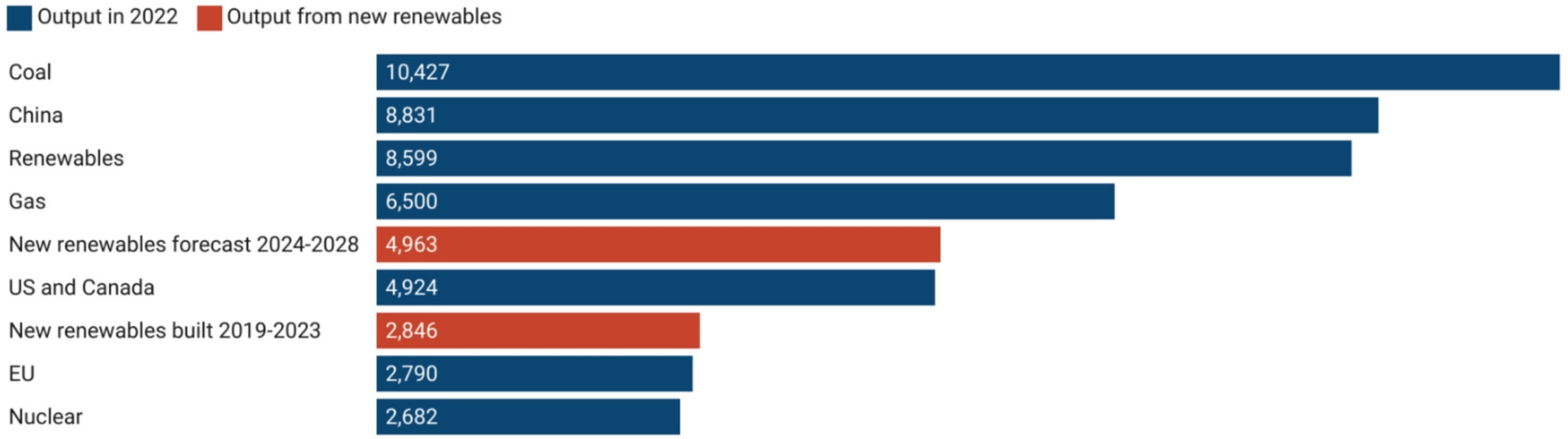
Statistical Review
of World Energy

(my analysis)

Simon
Holmes
à Court

Renewables now at impressive scale

Electricity generation TWh



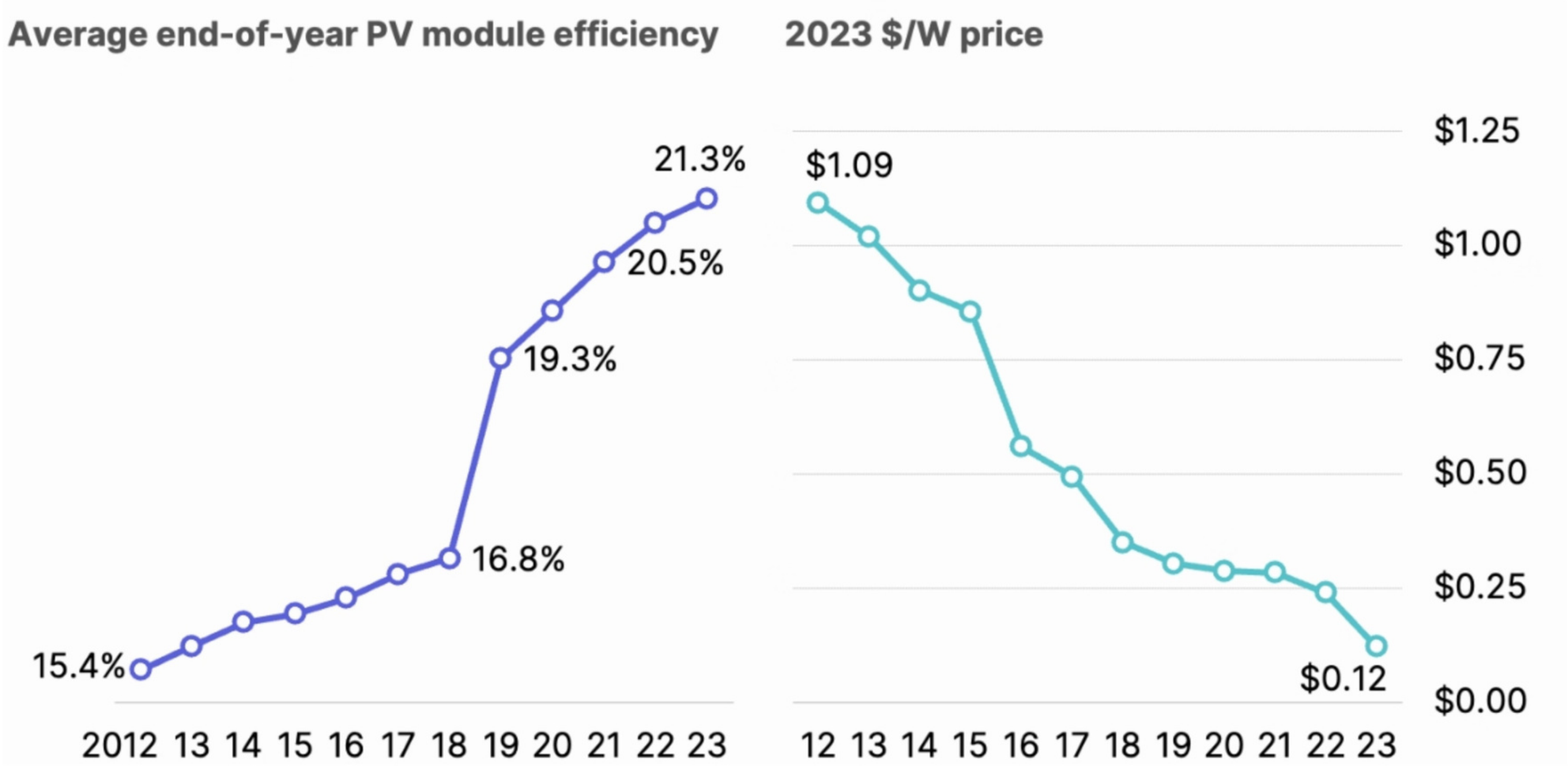
Source
IEA, Ember

via **CarbonBrief**

Simon Holmes à Court

Solar’s amazing journey

increasing supply + increasing efficiency → reducing price



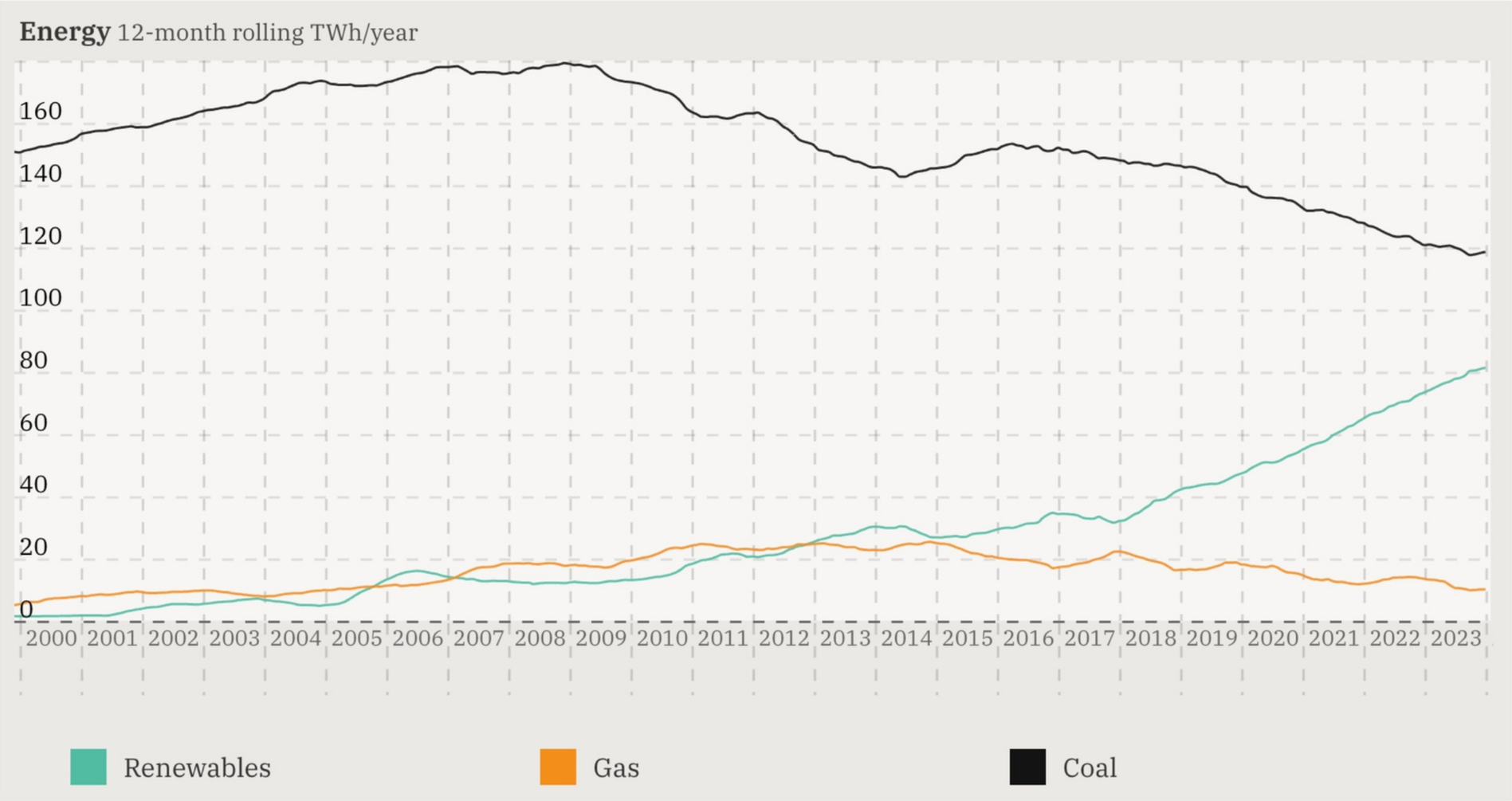
Source
BloombergNEF

via **Nat Bullard**

Simon Holmes à Court

At home, renewables sneaking up on coal

Crossover in ~2026?



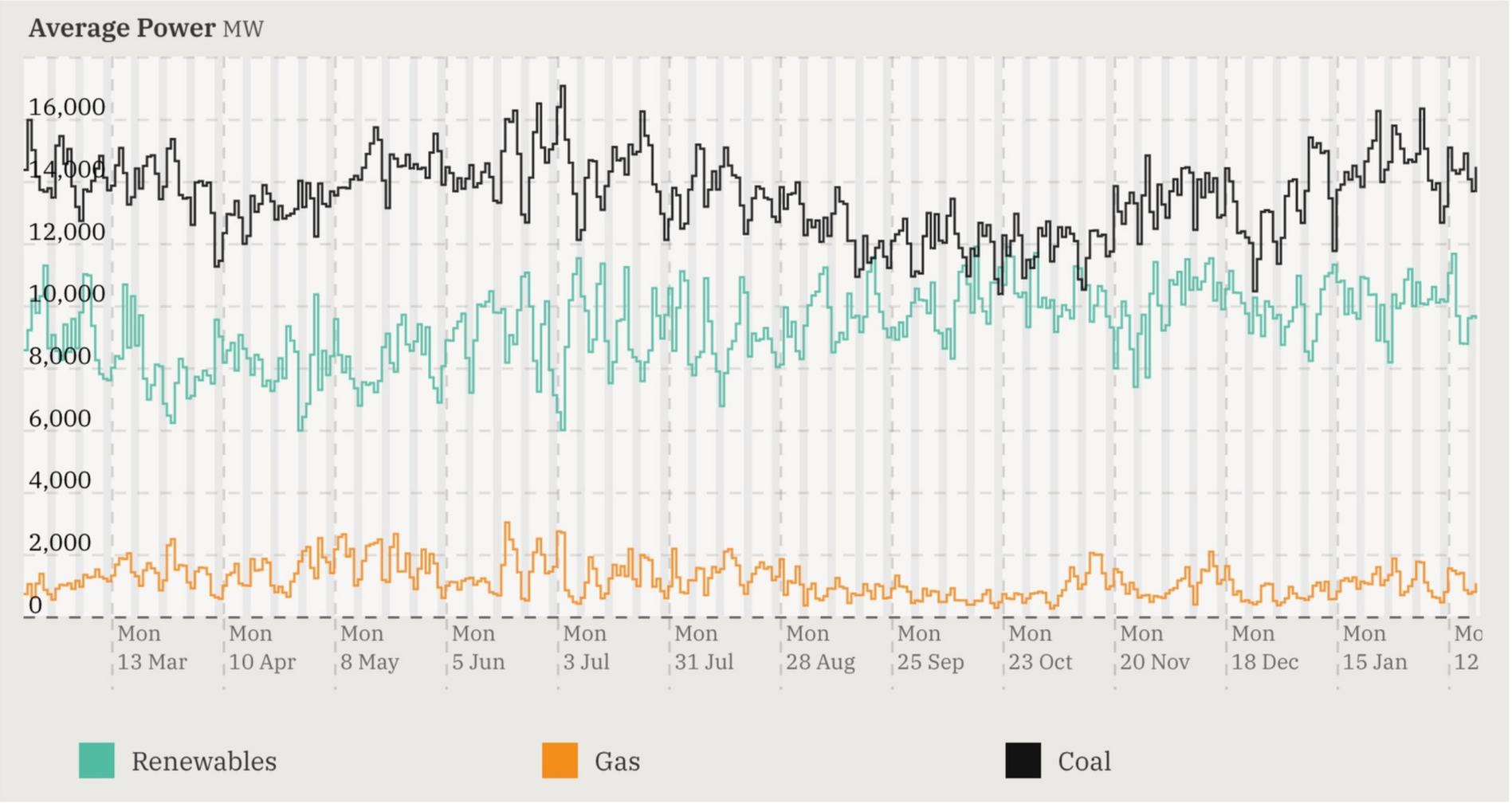
Source
The Superpower Institute

OpenNEM

Simon Holmes à Court

Crossovers increasingly common

Renewables generated more energy than coal for 8 days last year.



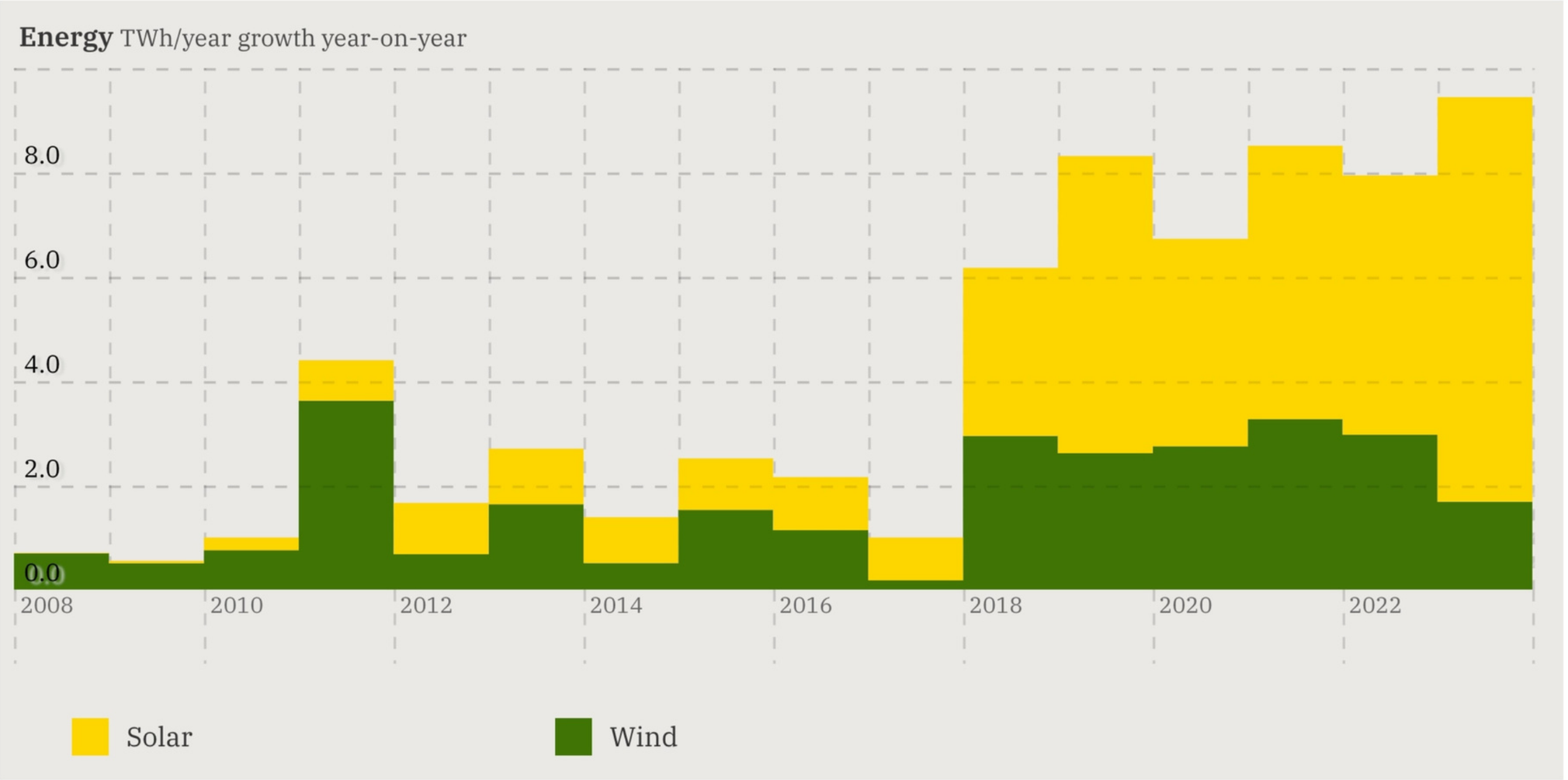
Source
The Superpower Institute

OpenNEM

Simon Holmes à Court

Renewables growing

Wind and solar generation growing each year, and the growth is growing.



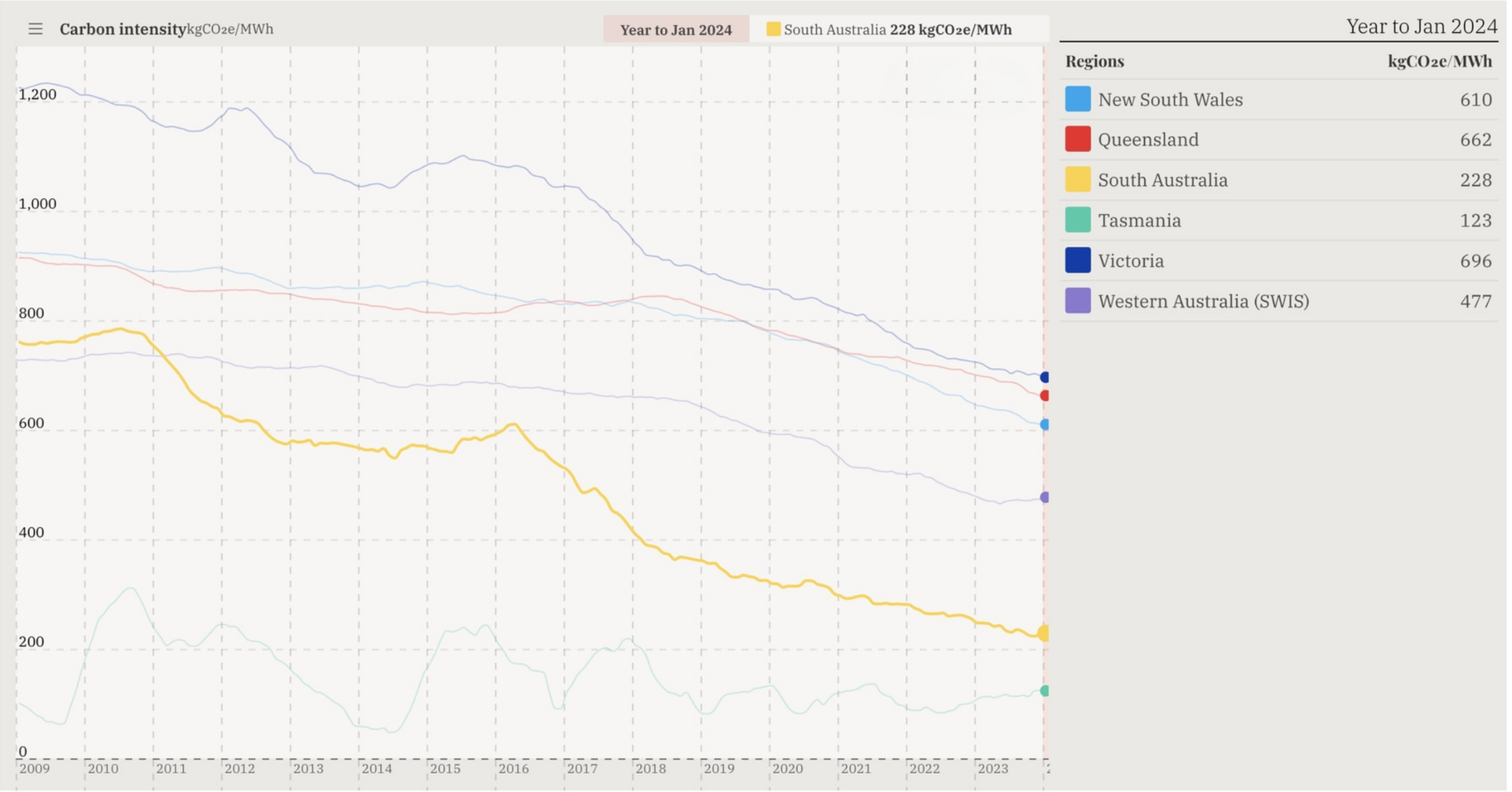
Source
The Superpower Institute

OpenNEM

Simon Holmes à Court

Grid emissions falling

South Australia falls from ~800 to ~228 $kgCO_2e/MWh$ in 15 years.



Source
The Superpower Institute

OpenNEM

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SCENARIOS

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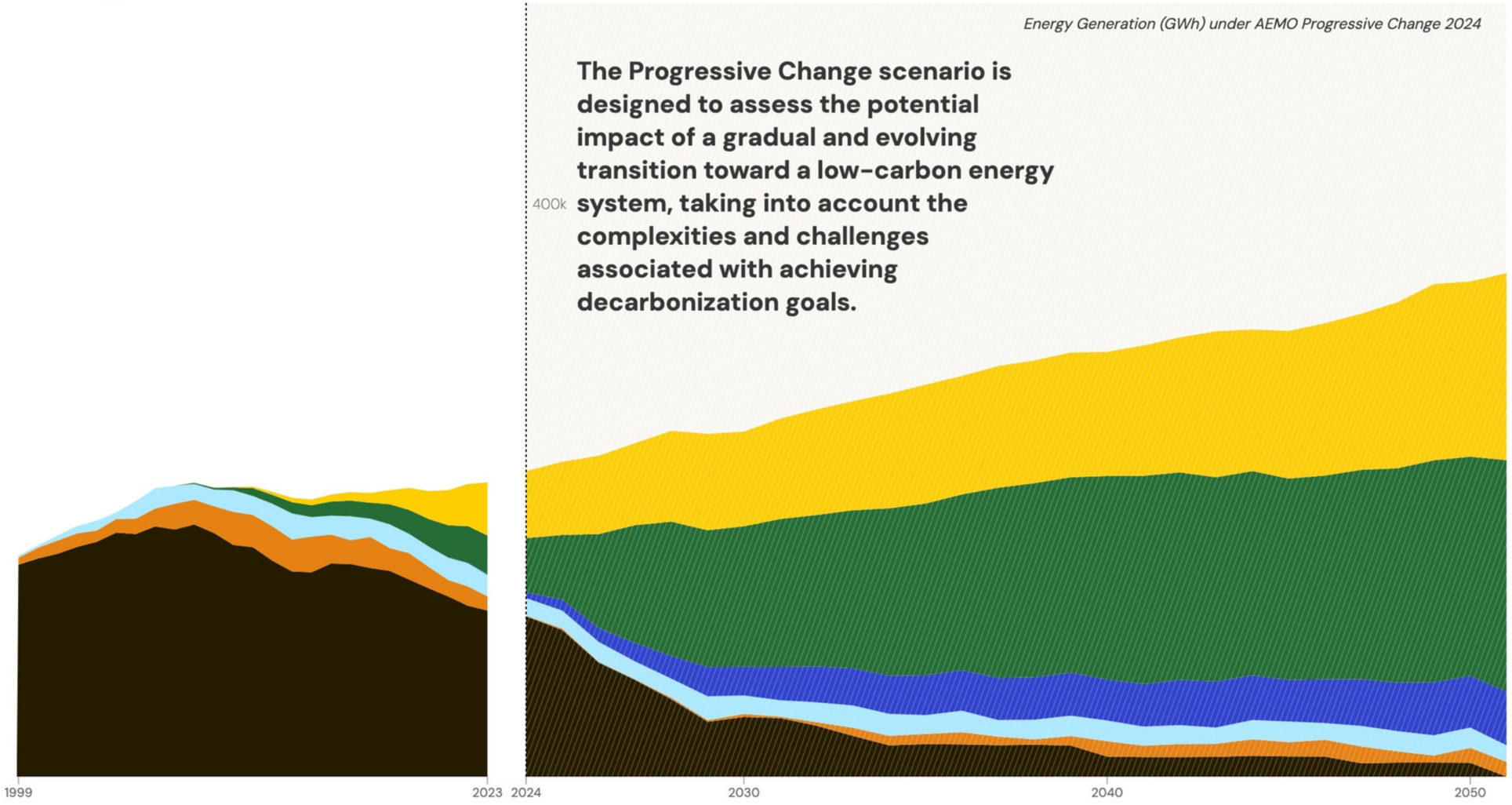
Holmes
à Court

Progressive Change

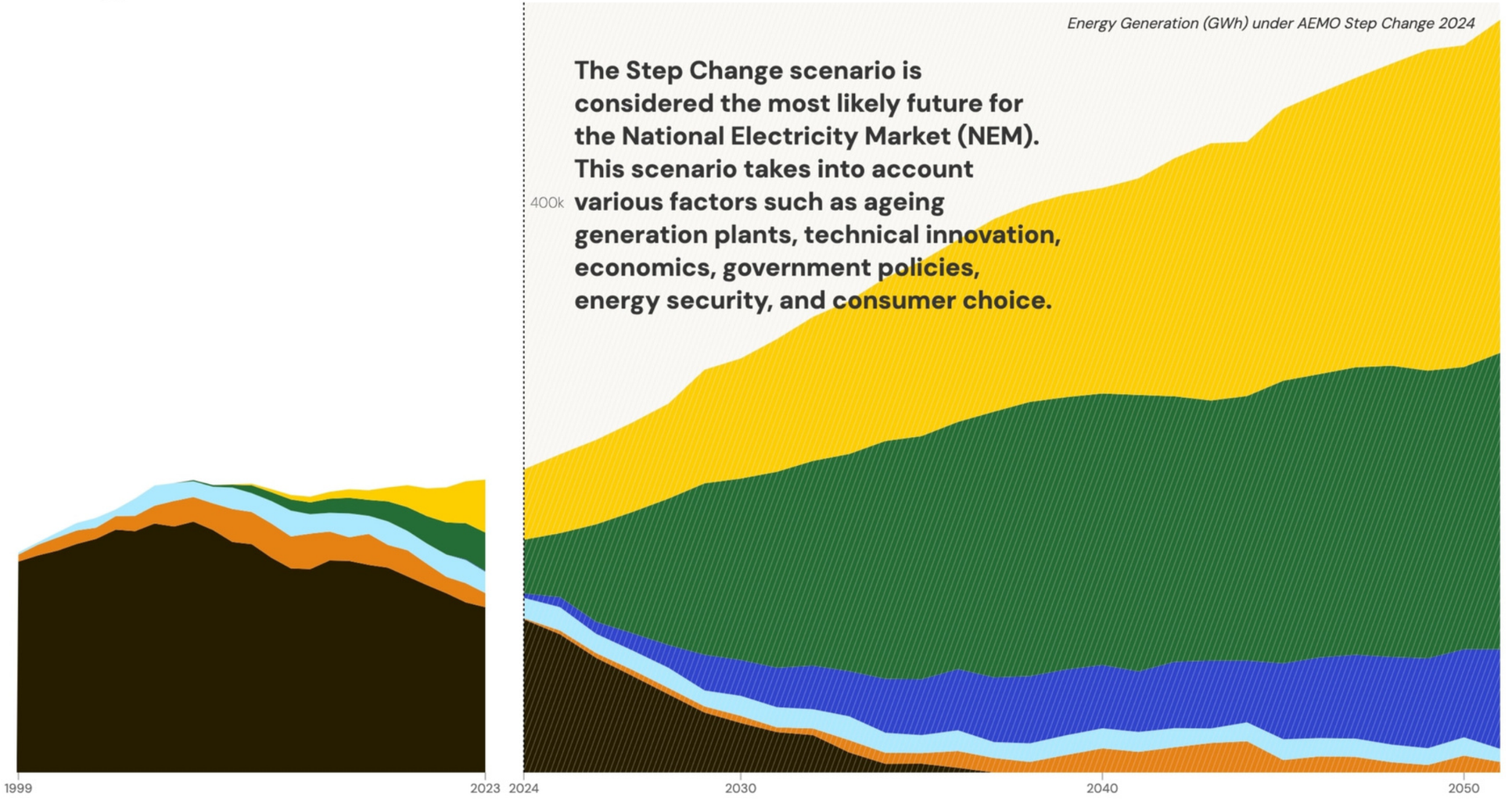


Source
AEMO 2024 Draft Integrated System Plan

via
The Superpower Institute

Simon Holmes à Court

Step Change

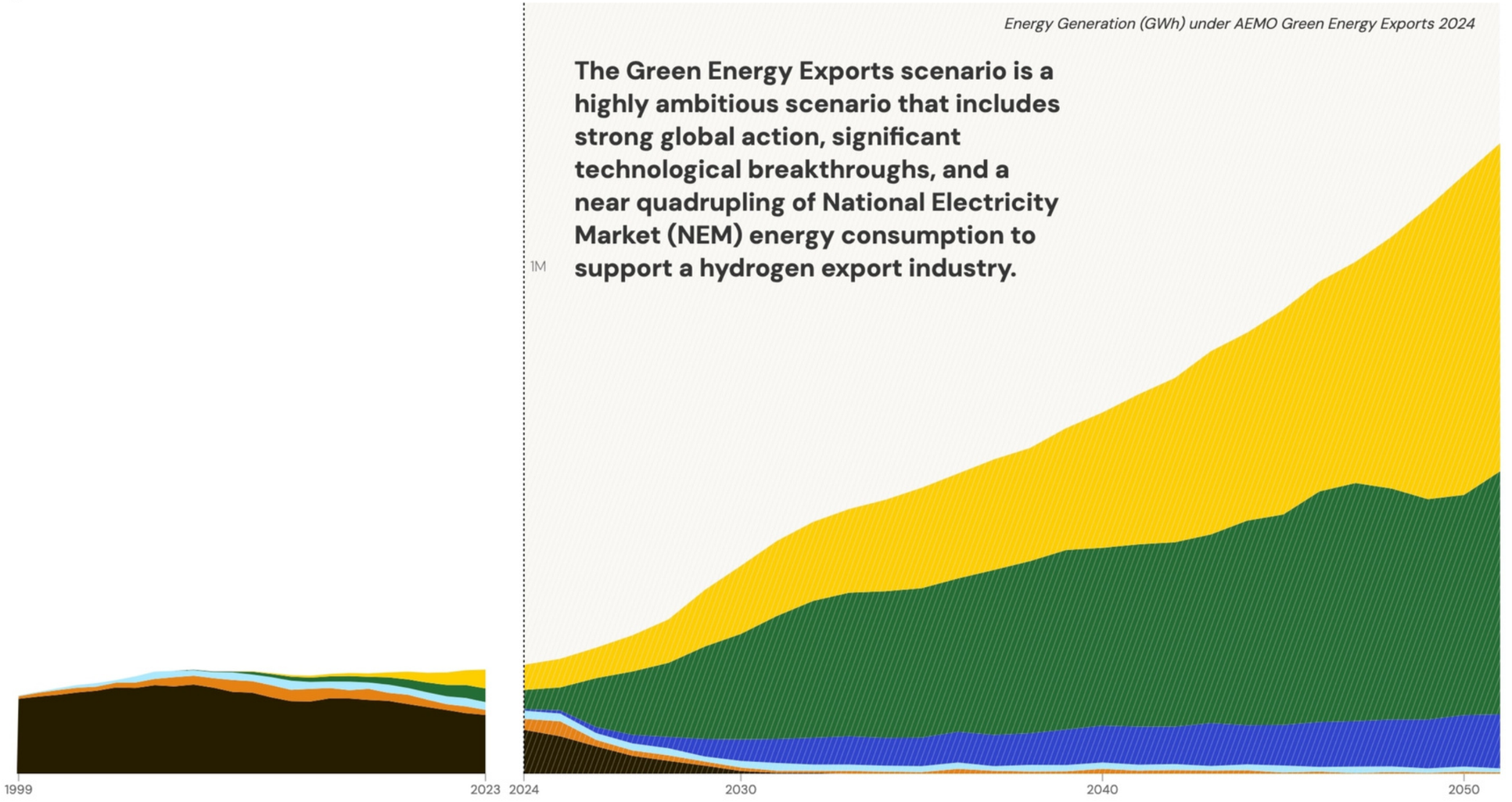


Source
AEMO 2024 Draft Integrated System Plan

via
The Superpower Institute

Simon Holmes à Court

Green Energy Exports



Source
AEMO 2024 Draft Integrated System Plan

via
The Superpower Institute

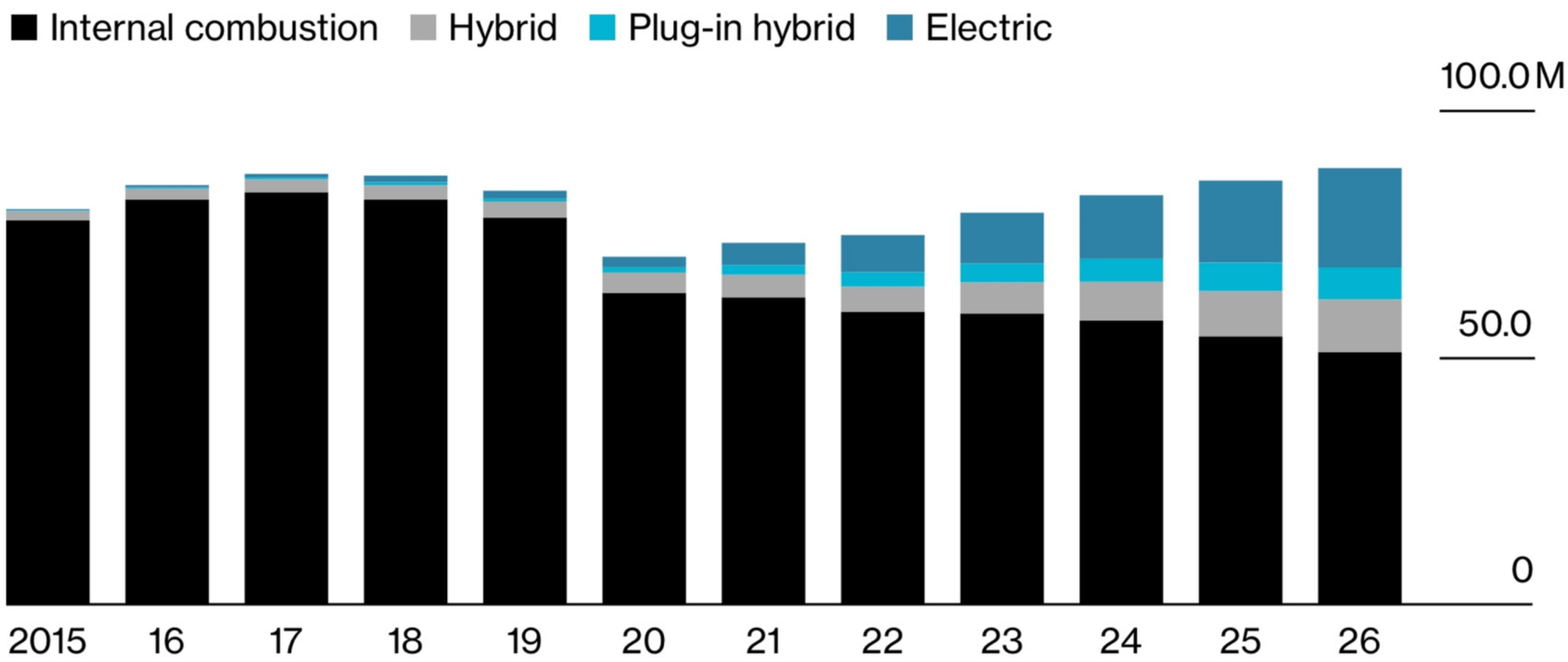
Simon Holmes à Court

CARS

Simon
Holmes
à Court

World hit peak petrol vehicle sales in 2017

Electric vehicles and hybrids are rapidly taking market share.



Source
BloombergNEF

Long-term
Electric Vehicle
Outlook 2023

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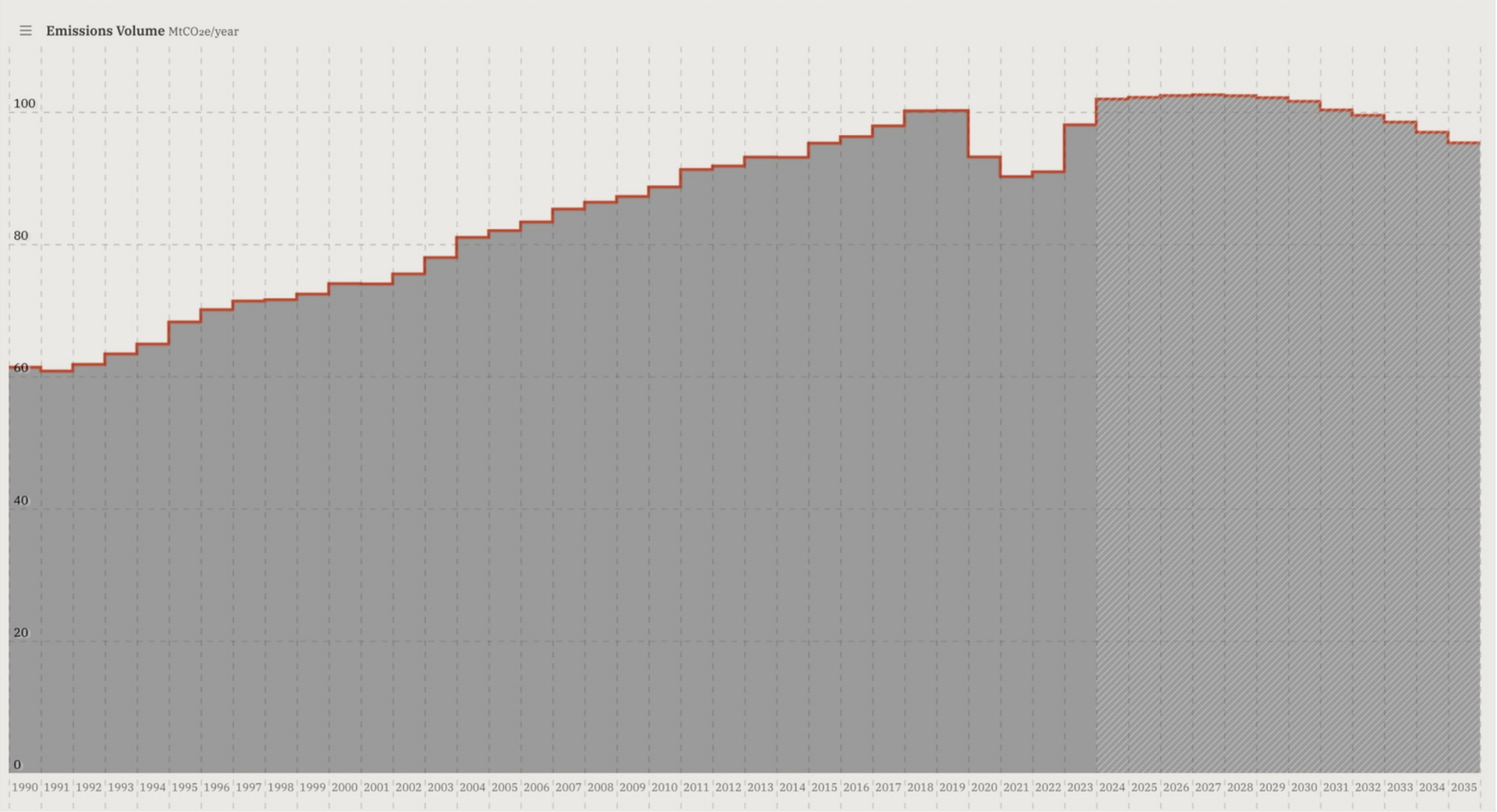
Holmes
à Court

Transport emissons about to flatten?

Cars and light commercial vehicles make up ~62% of Australia's transport emissions.



Source
DCCEEW

National
Greenhouse Gas
Inventory
Quarterly updates

via **OpenNEM**

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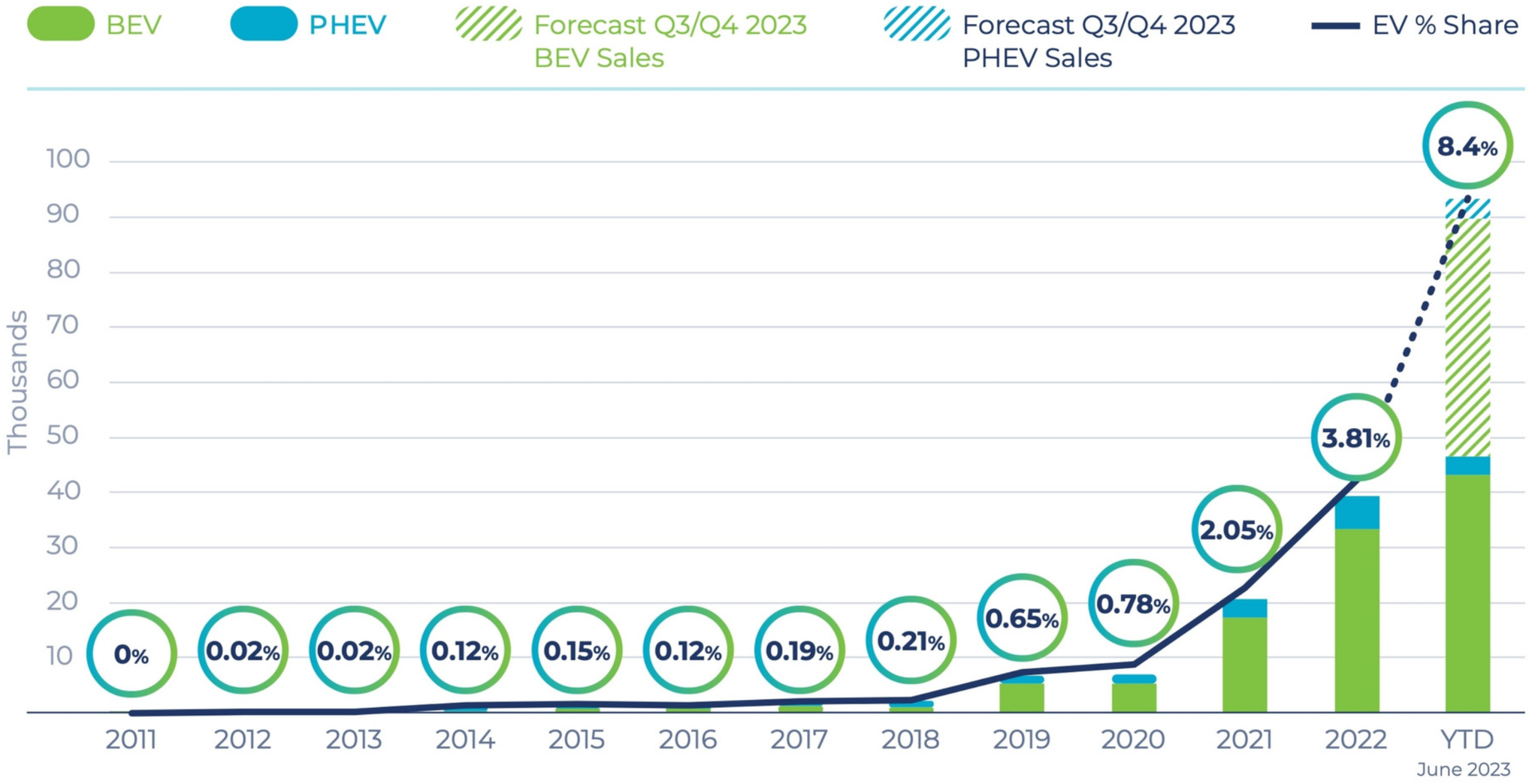
Holmes
à Court

Behind but tracking well

Australia is seeing strong EV demand growth.



Source
Electric Vehicle Council

State of Electric Vehicles July 2023

Simon Holmes à Court

We need a New Vehicle Efficiency Standard

Consultation now open on a standard for new vehicles.

Currently

New cars in Australia use **20%** more fuel than those in the US

Transport emissions
will become the largest source of greenhouse gas emissions by 2030, if we do nothing

The Australian Government's New Vehicle Efficiency Standard design will mean

In 2028, you could save around

$1,000
per year in fuel and
$17,000
over the life of the vehicle

$5 billion
in health benefits from reduction in air pollution by 2050

By 2050, a reduction of

369 million tonnes
of carbon emissions

Source
Department of Infrastructure, Transport, Regional Development, Communications and the Arts

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A choice between useless, ok and pretty good

	Option A	Option B	Option C
Total costs	$0.41 billion	$46.49 billion	$58.75 billion
Total benefits	$0.58 billion	$142.95 billion	$173.65 billion
Net benefits	**$0.17 billion**	**$96 billion**	**$115 billion**
Benefit to cost ratio	1.42	3.08	2.96
Abatement to 2050	**0.97 Mt**	**369 Mt**	**443 Mt**

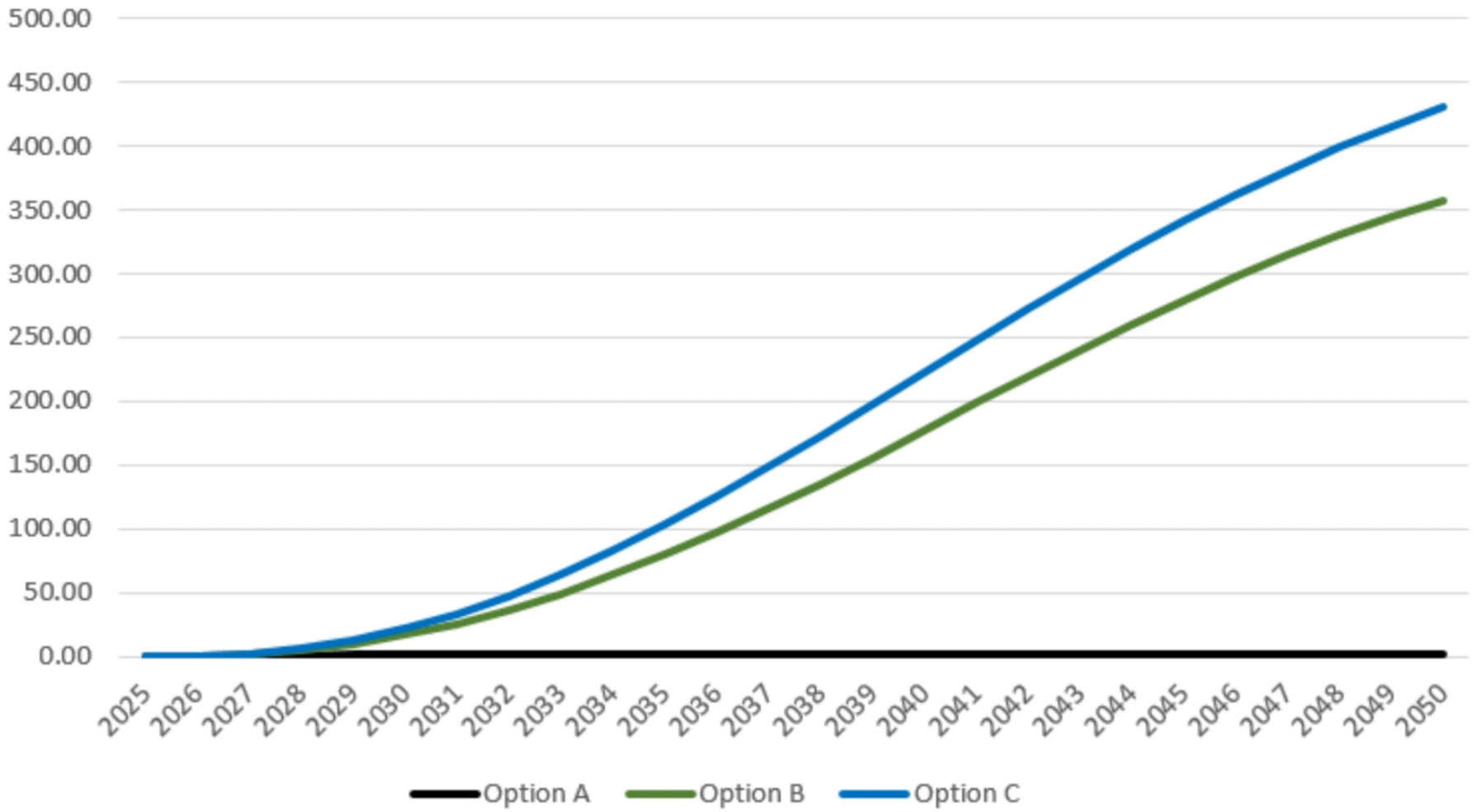
Source
Department of Infrastructure, Transport, Regional Development, Communications and the Arts

NVES Consultation Impact Analysis

Simon Holmes à Court

Guess which option the petrol car companies wanted.

abatement $MtCO_2e$



Source
Department of Infrastructure, Transport, Regional Development, Communications and the Arts

NVES Consultation Impact Analysis

Simon Holmes à Court

BATTERIES

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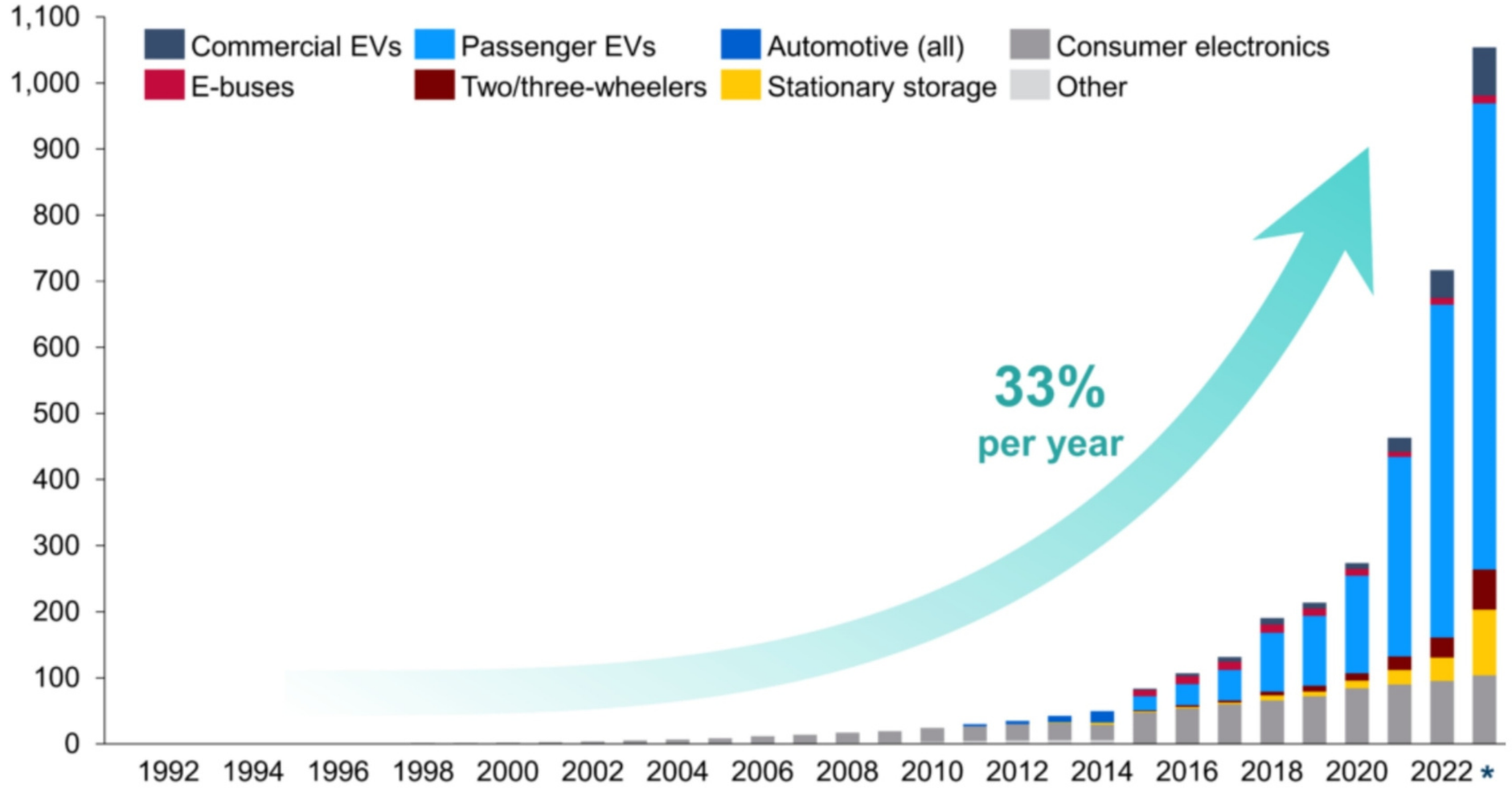
Holmes
à Court

Global battery sales

GWh capacity sold per year



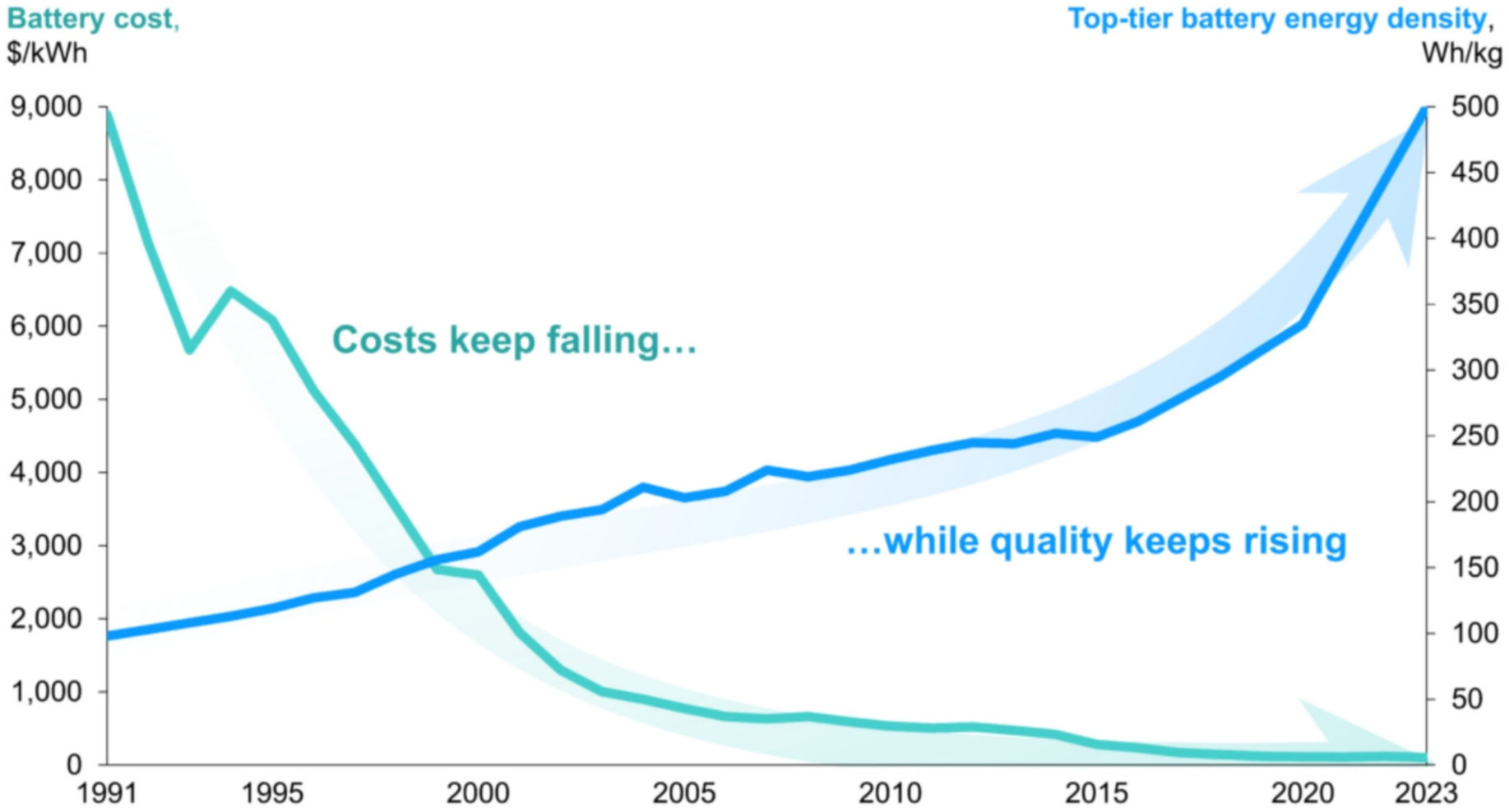
Source
RMI

The Rise of Batteries in Six Charts and Not Too Many Numbers

Simon Holmes à Court

Batteries following same path as solar

Cost falls as performance improves.



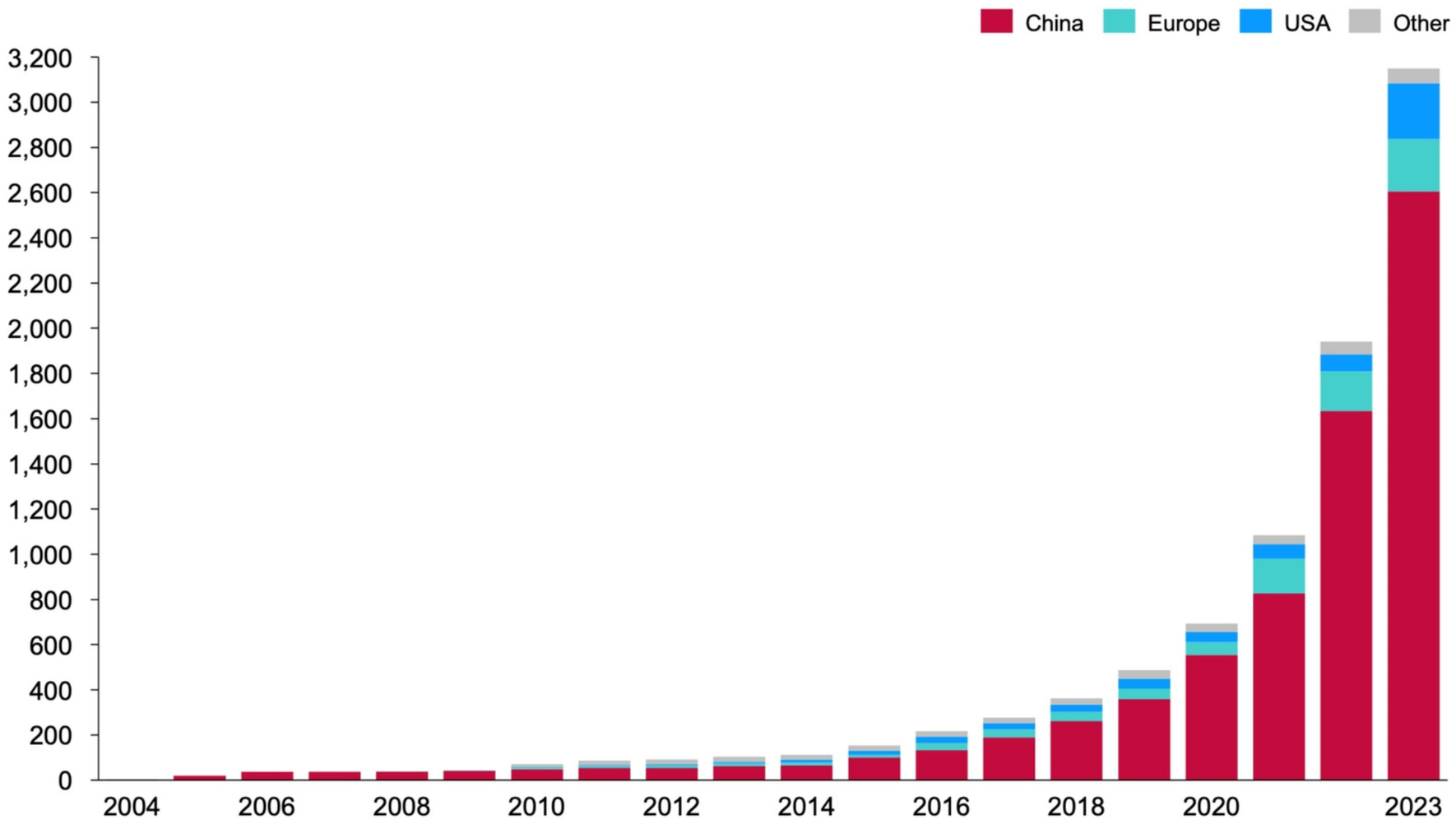
Source
Ziegler and Trancik, BNEF Long-Term Electric Vehicle Outlook (2023), BNEF Lithium-Ion Battery Price Survey (2023)

via **RMI**

Simon Holmes à Court

Installed battery manufacturing capacity

manufacturing capacity GWh/y



Source
RMI

X-Change:
Batteries
The Battery
Domino Effect

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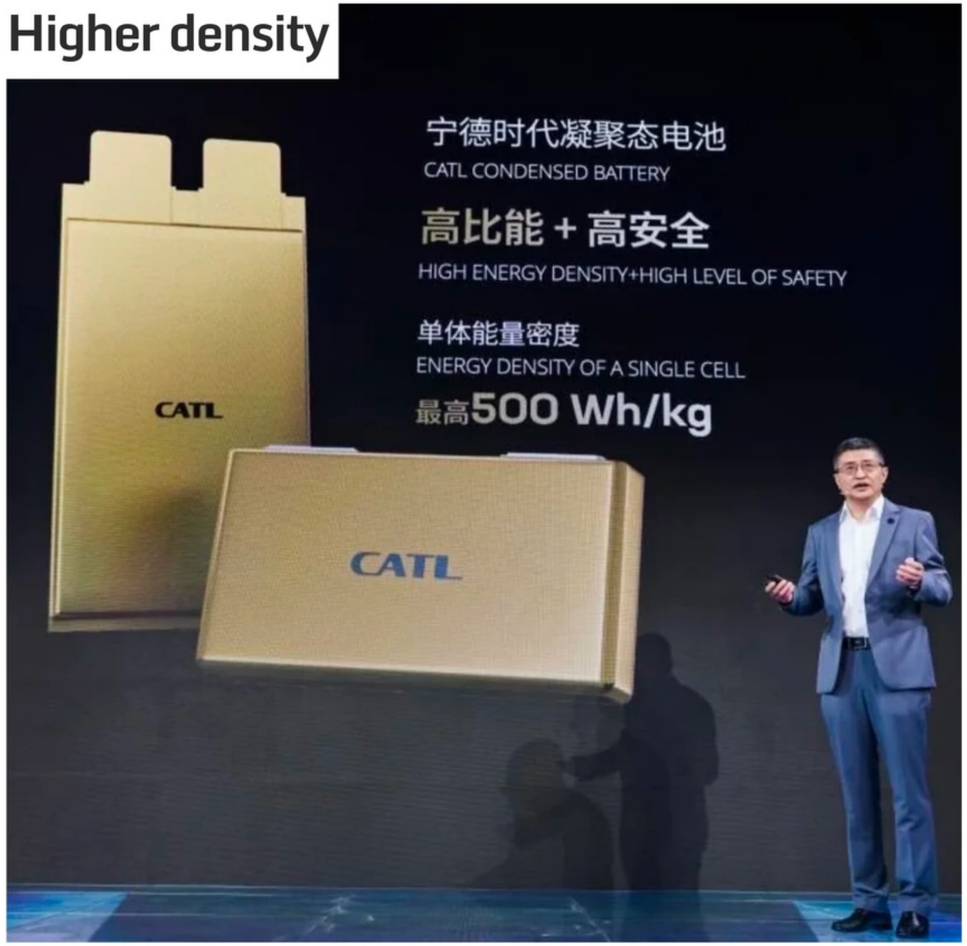
à Court

Innovations

Sodium ion

Higher density



Simon Holmes à Court

EXPORTS

Australian thermal coal exports

million tonnes

Source
Office of the Chief Economist

Resources and Energy Quarterly

December 2023

Simon Holmes à Court

Australian LNG exports

million tonnes

Source
Office of the Chief Economist

Resources and Energy Quarterly

December 2023

Simon Holmes à Court

Australian lithium exports

Spodumene kilotonnes

Source
Office of the Chief Economist

Resources and Energy Quarterly

December 2023

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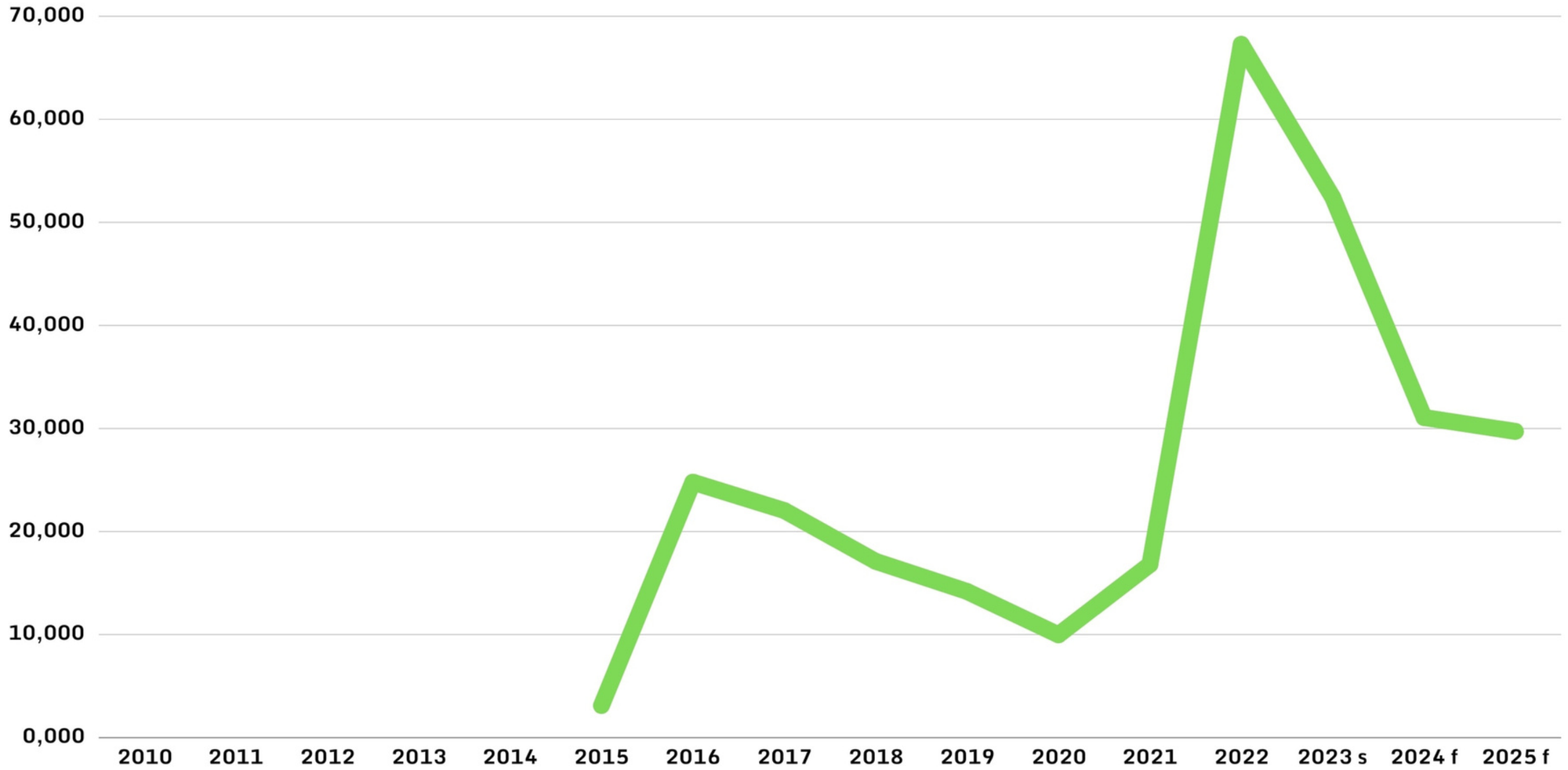
World lithium price

Lithium hydroxide price US$/t



Source
Office of the Chief Economist

Resources and Energy Quarterly

December 2023

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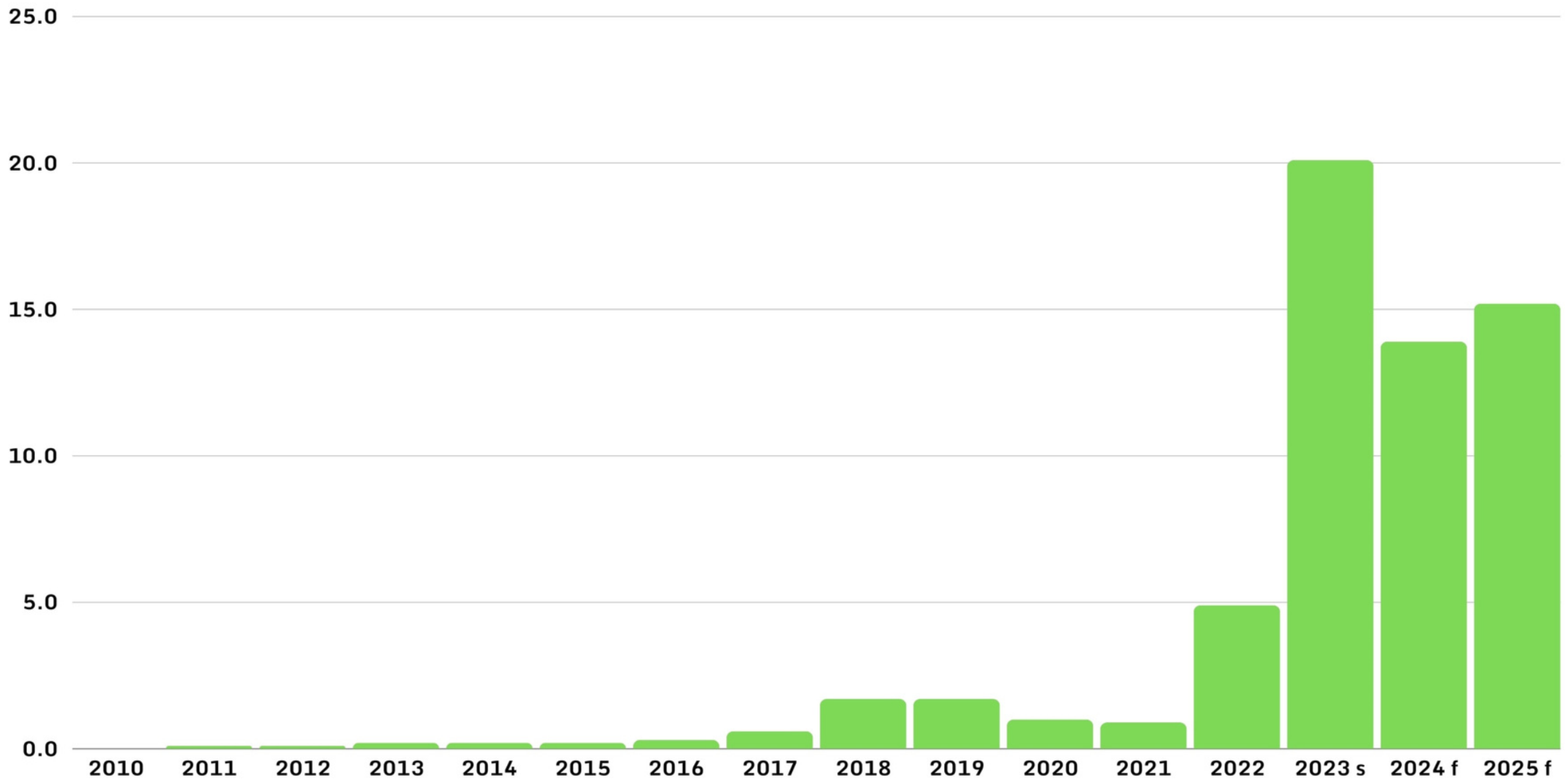
Australian Lithium Export Value

A$billions



Source
Office of the Chief Economist

Resources and Energy Quarterly

December 2023

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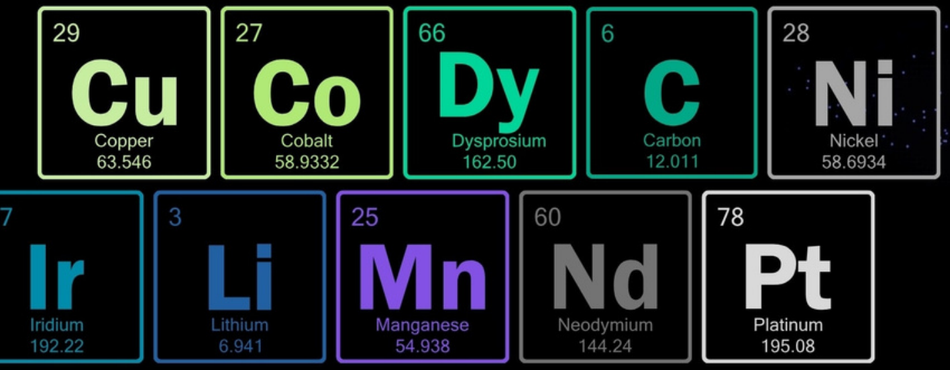
SUPERPOWER

Australia can directly remove over 8% of global emissions.

RESOURCE	REDUCTIONS
Iron Ore & Aluminium	3–4%
Ammonia Hydrogen & Renewable Energy	
Energy Transition Minerals	
Biomass for Industry & Land	

Australia is the **only country** with **all critical** battery minerals.



Australia is source of **80**% of **Tesla's lithium** and **40**% of its **nickel** and **copper**.

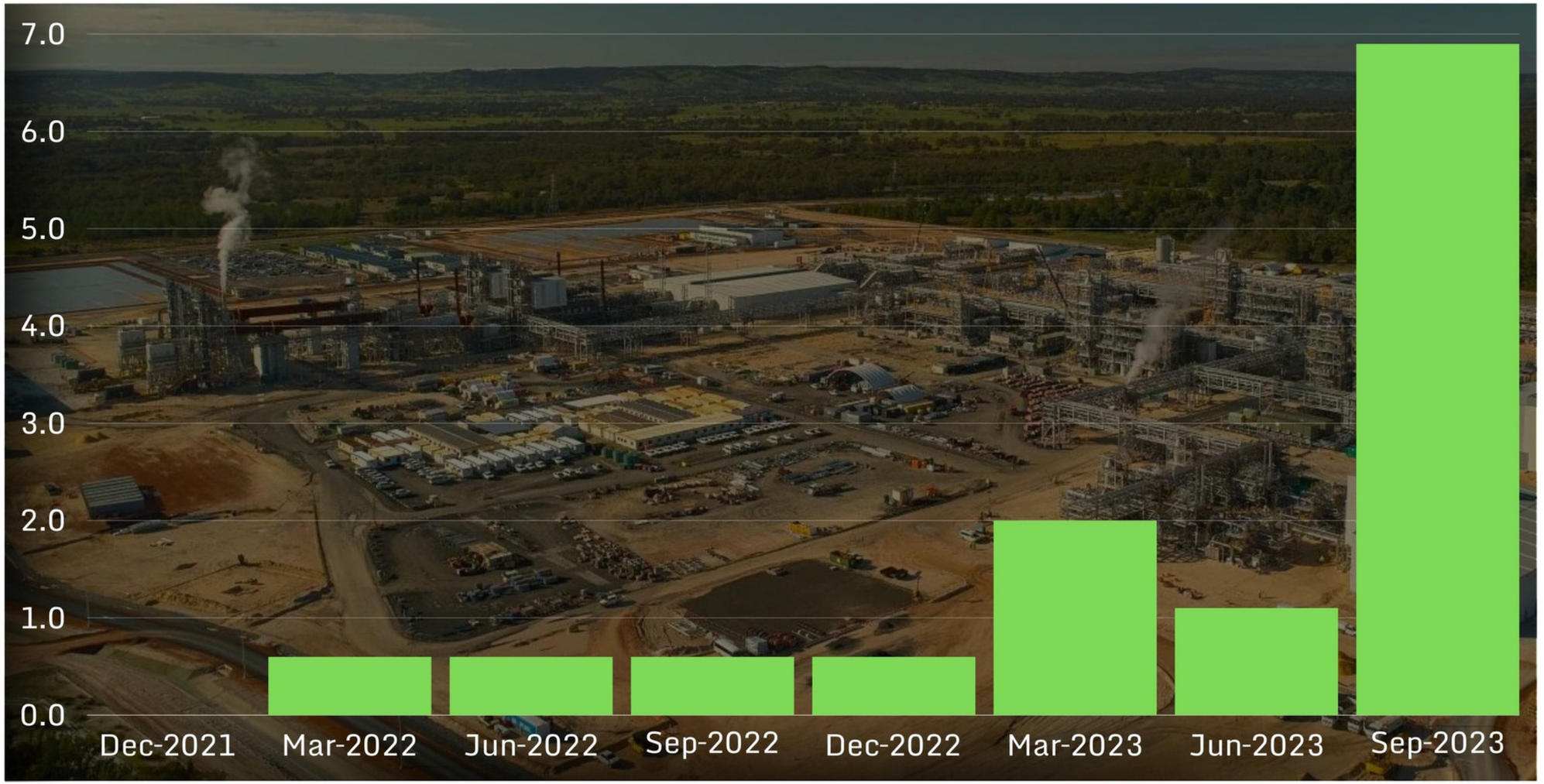
Australia is the world's largest producer of lithium, the third largest producer of cobalt and fourth largest producer of rare earths.

Australia produces large quantities of aluminium, nickel and copper ores.

Australia has the world's largest resources of wind and solar energy, needed to produce the 'green' commodities of the transition.

Local lithium processing gets going

lithium hydroxide kilotonnes



Source
Office of the Chief Economist

Resources and Energy Quarterly

December 2023

Local polysilicon manufacturing proposed

pv magazine

Subscriptions

Quinbrook announces green polysilicon manufacturing plant in North Queensland

Renewables investor Quinbrook Infrastructure Partners has announced plans to develop a green polysilicon manufacturing plant in North Queensland's Lansdown Eco-Industrial Precinct. Quinbrook has been conditionally allocated a 200-hectare at the site, and is looking for an operational parter to complete the vertical play.

OCTOBER 31, 2023 BELLA PEACOCK

PROPOSED

Artists impression of Lansdown Eco-Industrial Precinct

Image: Queensland government

Early days for local green steel

FINANCIAL REVIEW

Newsfeed

Companies Mining Carbon challenge

Push to save iron ore golden goose

Angela Macdonald-Smith and Brad Thompson

Updated Feb 9, 2024 – 11.20am, first published at 9.51am

The risk that Australia's most lucrative export industry could be hit by the clean energy transition has prompted mining rivals Rio Tinto and BHP into a collaboration to prove local iron ore can be used to make green steel.

The project with steelmaker BlueScope at Port Kembla, south of Sydney, is aimed at fast-tracking the path to nearly carbon-free steel production and protecting a golden goose expected to generate $131 billion in 2023-24, according to official government forecasts.

Under the initiative, the three companies aim to develop a pilot plant that will prove production of molten iron from West Australian ores is feasible using renewable power in direct reduced iron process technology, and in doing so, future-proof the Pilbara.

Sweden isn’t mucking about

World’s first commercial scale plant is now under construction.

Location: Boden, Sweden

Company: H_2 Green Steel

Finance secured: €6.5bn

Electrolysers: 1 GW

Emissions: 40-50 vs 1800-1900 kg CO_2e/t

Construction: underway

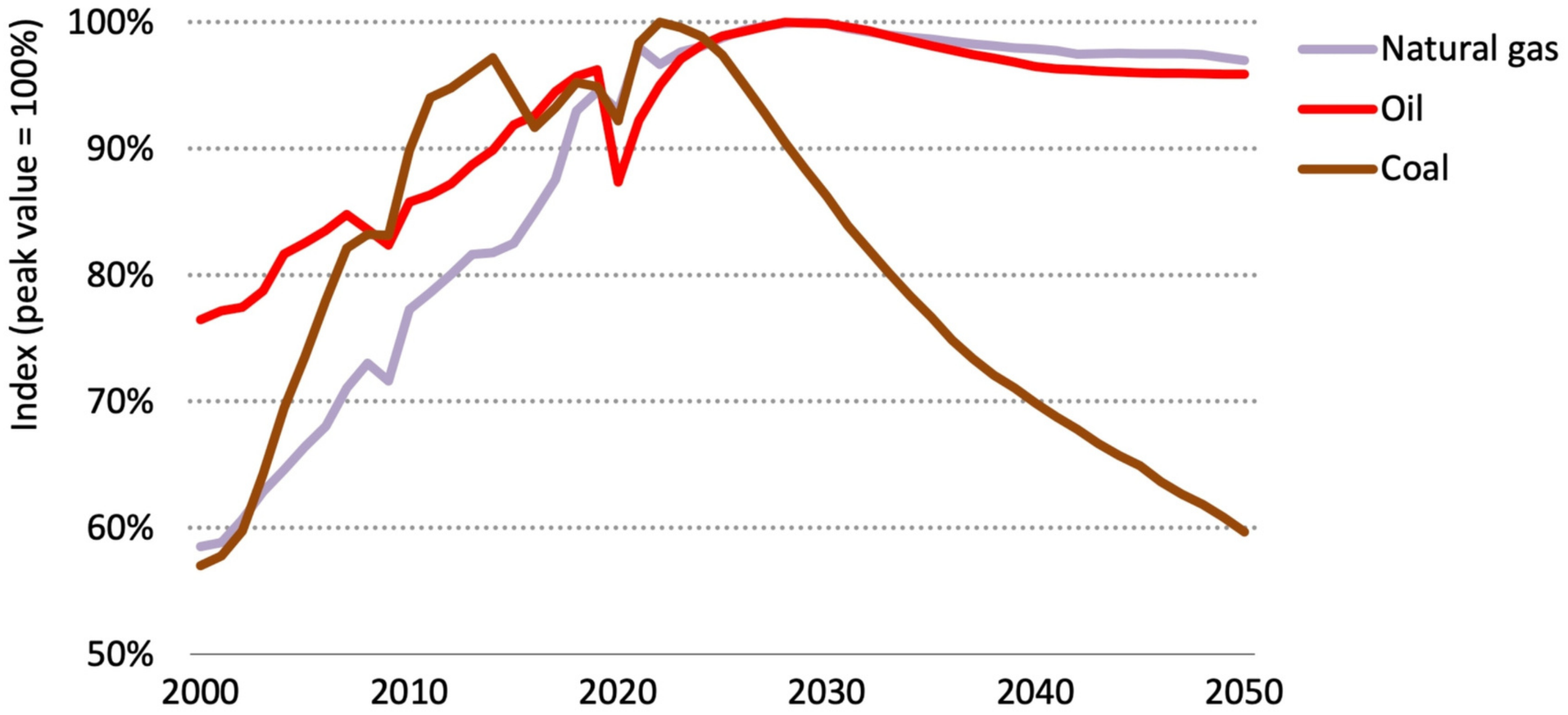
Phase 1 production: 2.5 Mt/y

First output: 2027

Sales: Mercedes-Benz, Porsche, Scania, ZF and Cargill

Some good news...

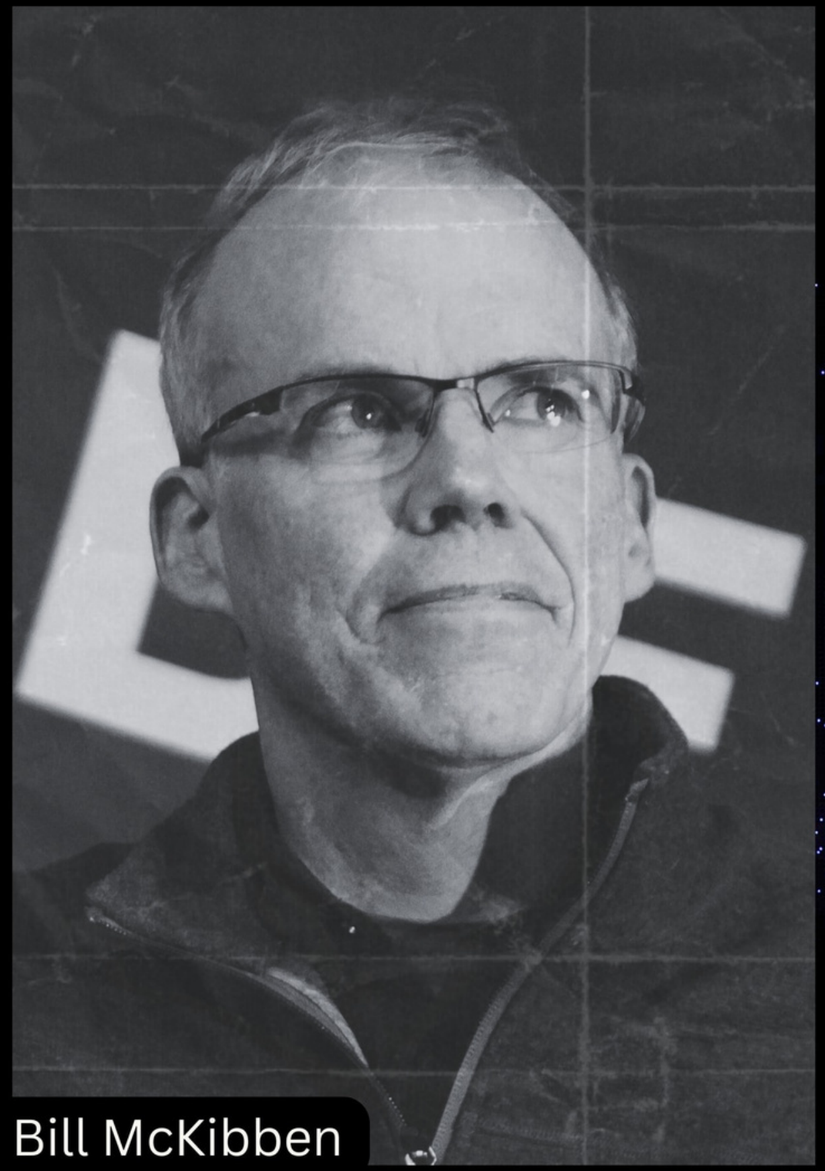
IEA calculates that under stated policies, coal, gas and oil will peak this decade.



Source
IEA

World Energy Outlook 2023

Simon Holmes à Court



Bill McKibben

Winning *slowly* is the same as *losing.*