



Stationary Energy

The Biggest Source of CO₂

- Coal, Oil & Gas – the main drivers
- A Gas Led Recovery Versus Electrification
- Renewables Versus Nuclear

Werner Theinert
0427 955 188
wersula@gmail.com

Sector by sector: where do global greenhouse gas emissions come from?

Globally, we emit around 50 billion tonnes of greenhouse gases yearly. Where do these emissions come from? We take a look, sector-by-sector.

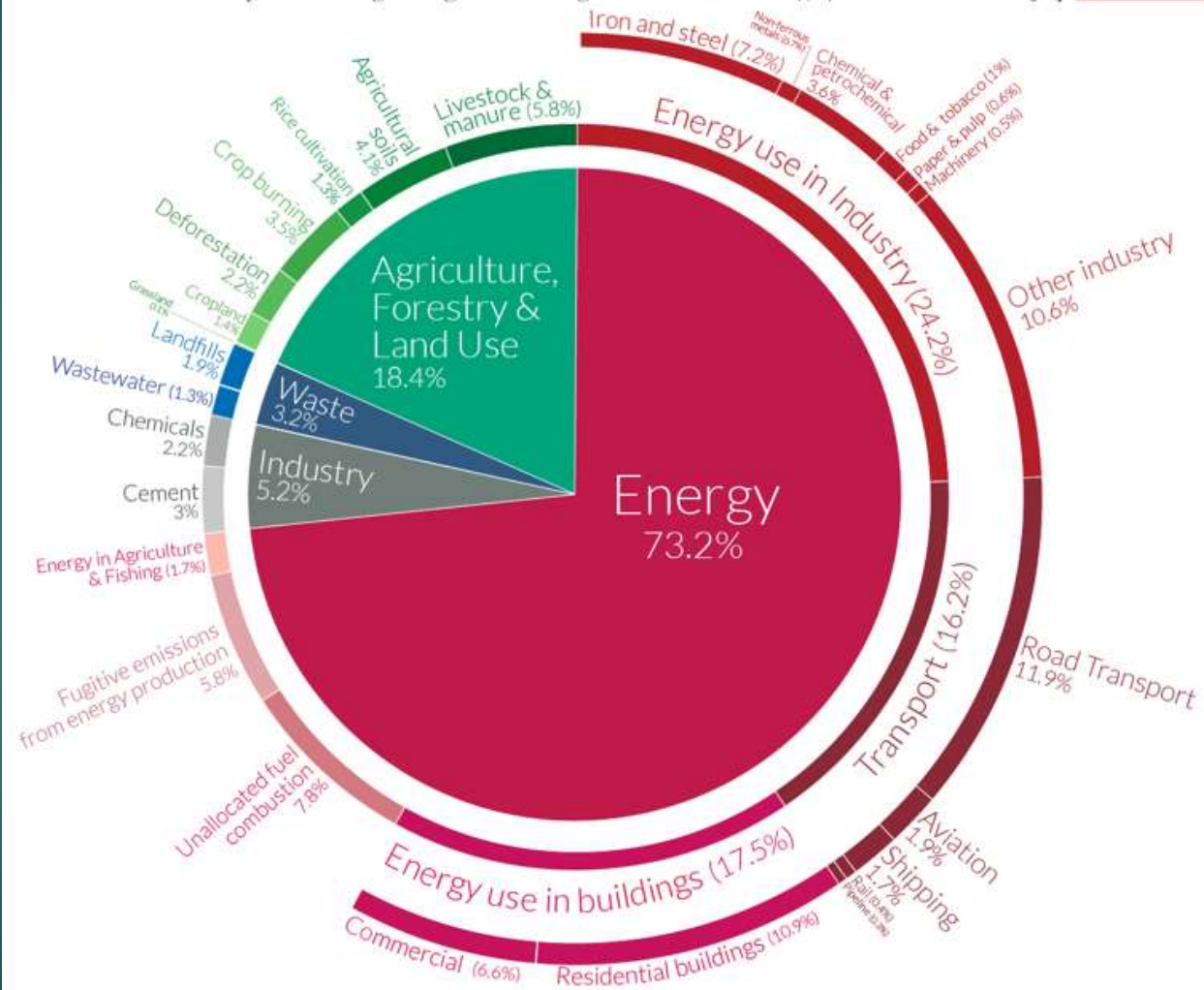
By: Hannah Ritchie
September 18, 2020

<https://ourworldindata.org/ghg-emissions-by-sector>

Global greenhouse gas emissions by sector

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO₂eq.

Our World
in Data



OurWorldinData.org – Research and data to make progress against the world's largest problems.

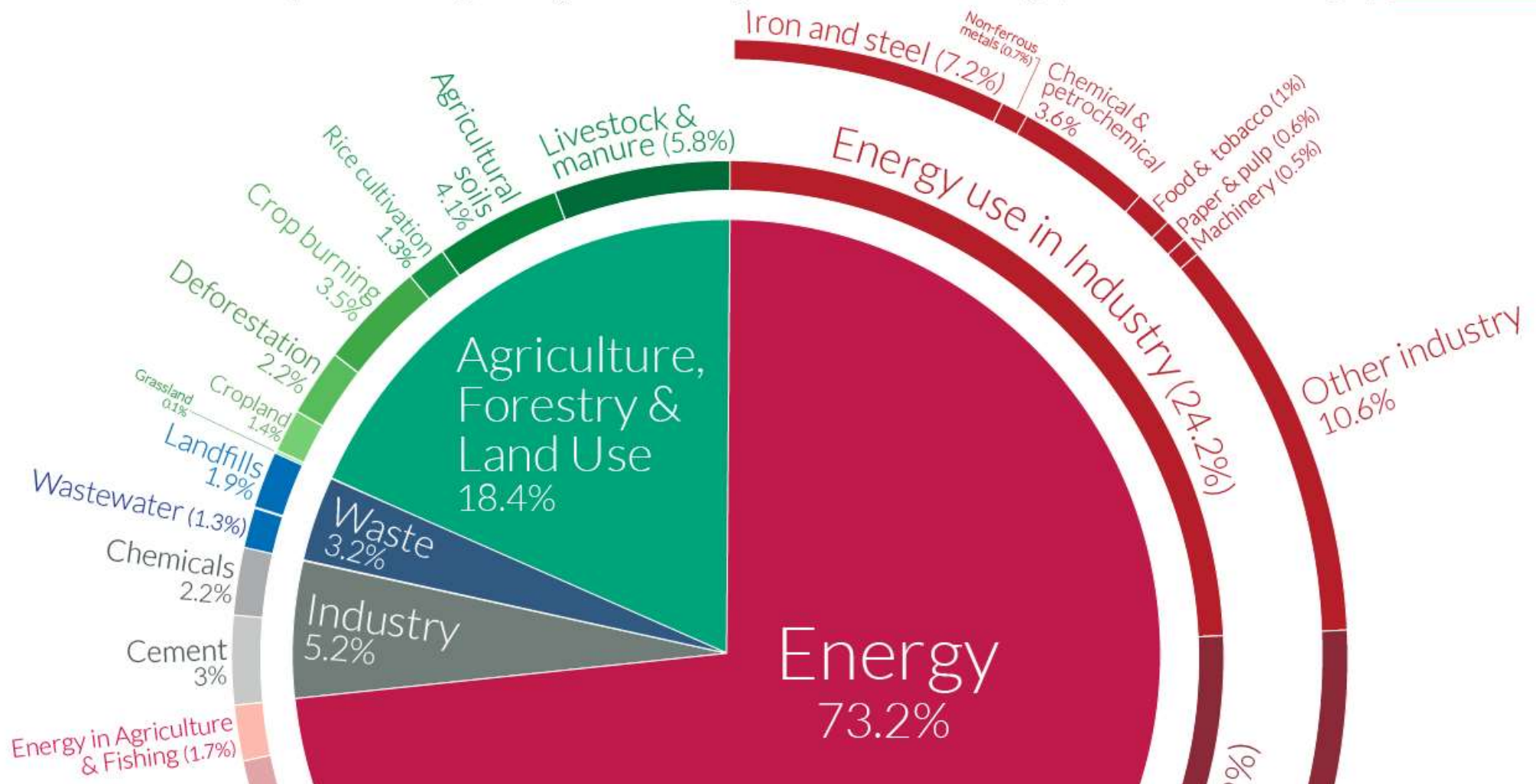
Source: Climate Watch, the World Resources Institute (2020).

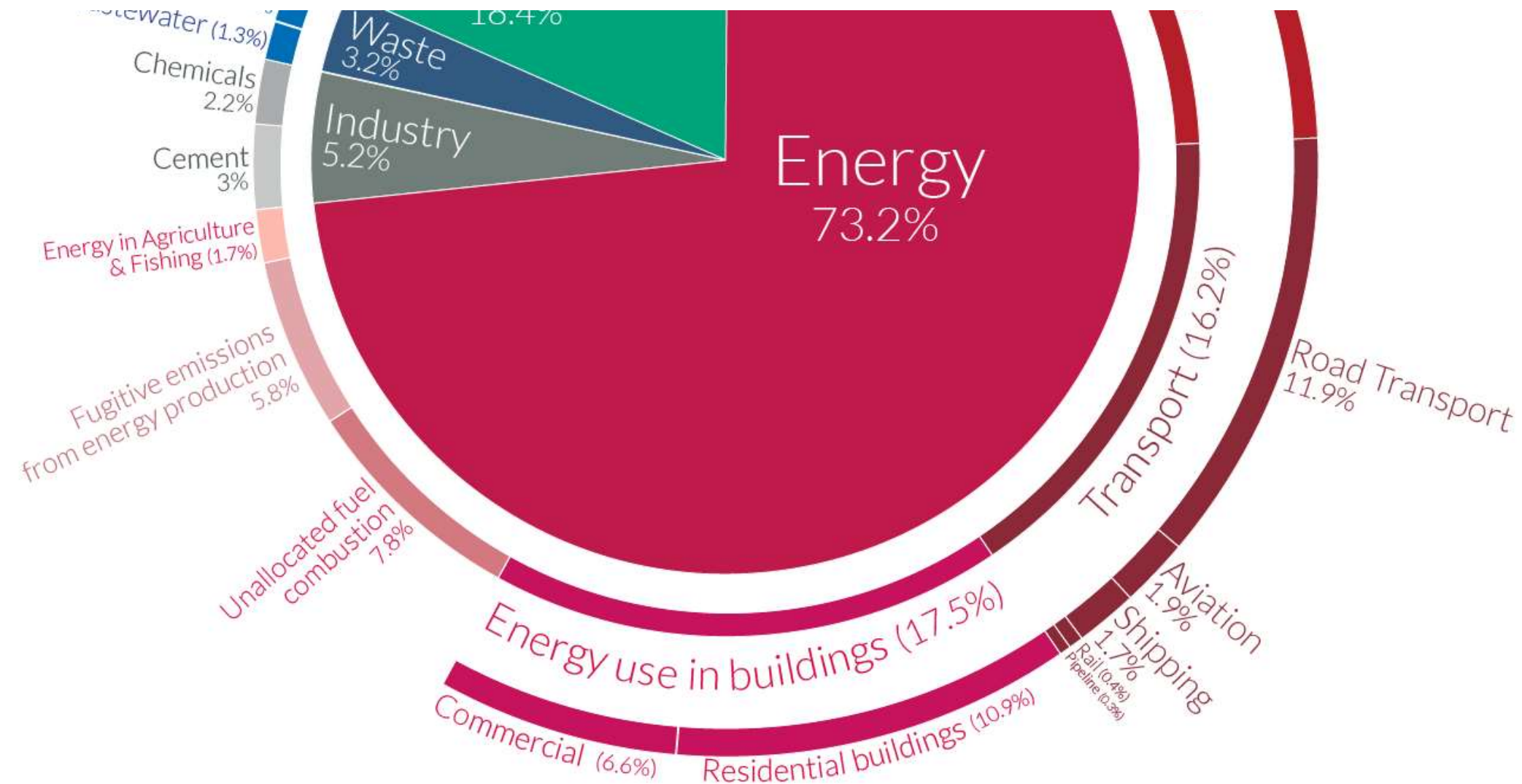
Licensed under CC-BY by the author Hannah Ritchie (2020).

Global greenhouse gas emissions by sector

Our World
in Data

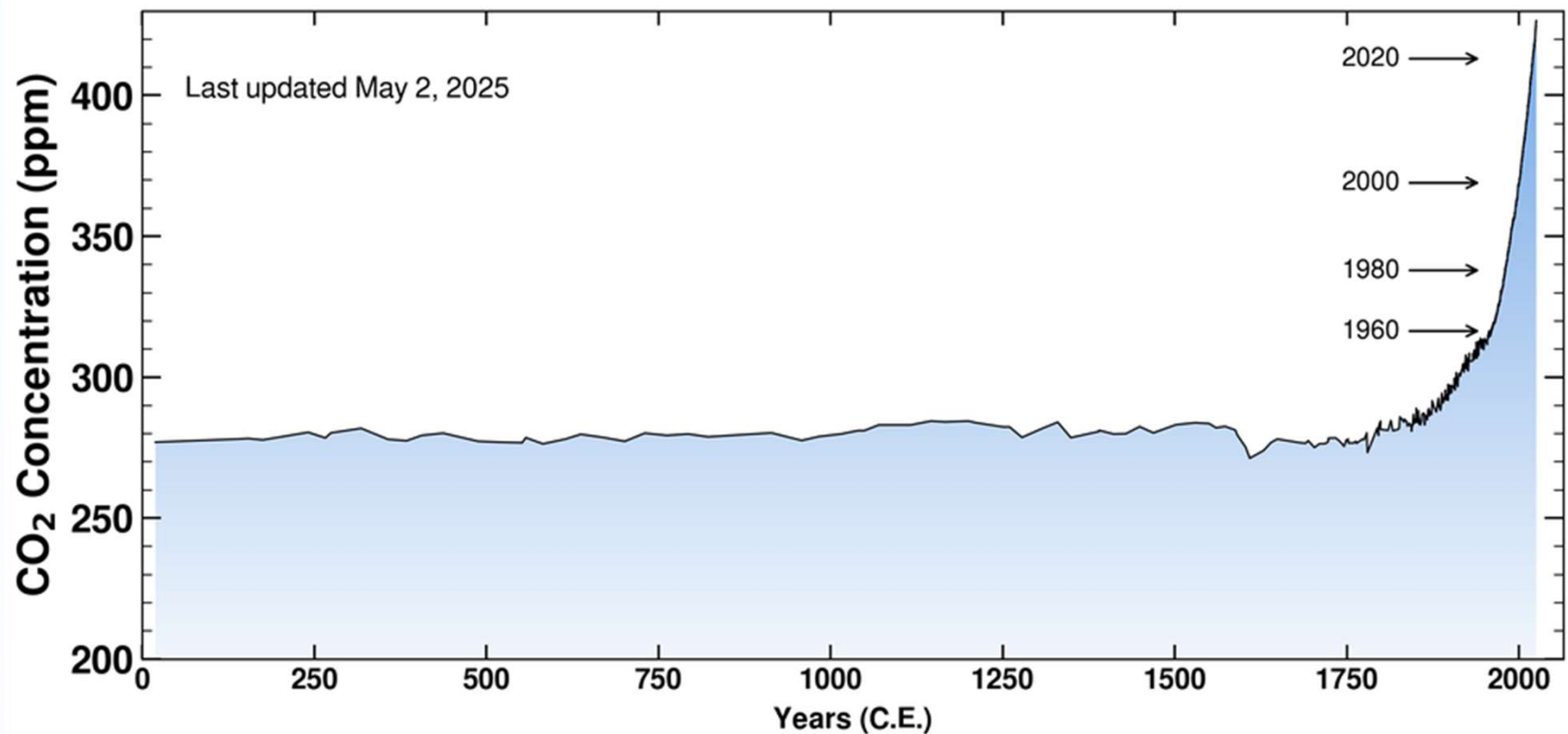
This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO₂eq.





We have technologies that can make –

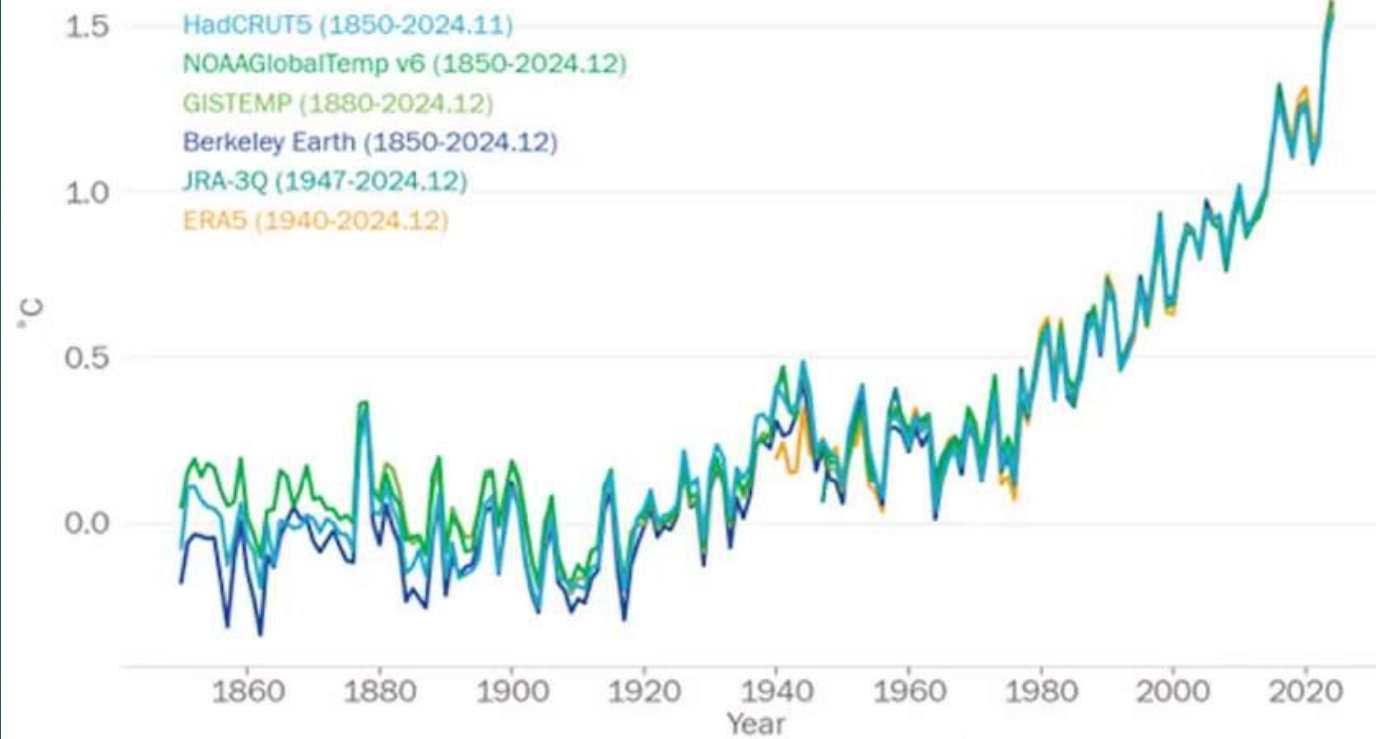
- Green Electricity
- Green Steel
- Green Alumina & Aluminium
- Green Cement
- Green Hydrogen
 - Green Fertilisers
- Green Transport
 - Cars
 - Trucks
 - Buses
 - Trains
 - Fortescue Mining Plant



CO₂ Concentration Levels in our Atmosphere in Parts Per Million

Global mean temperature 1850-2024

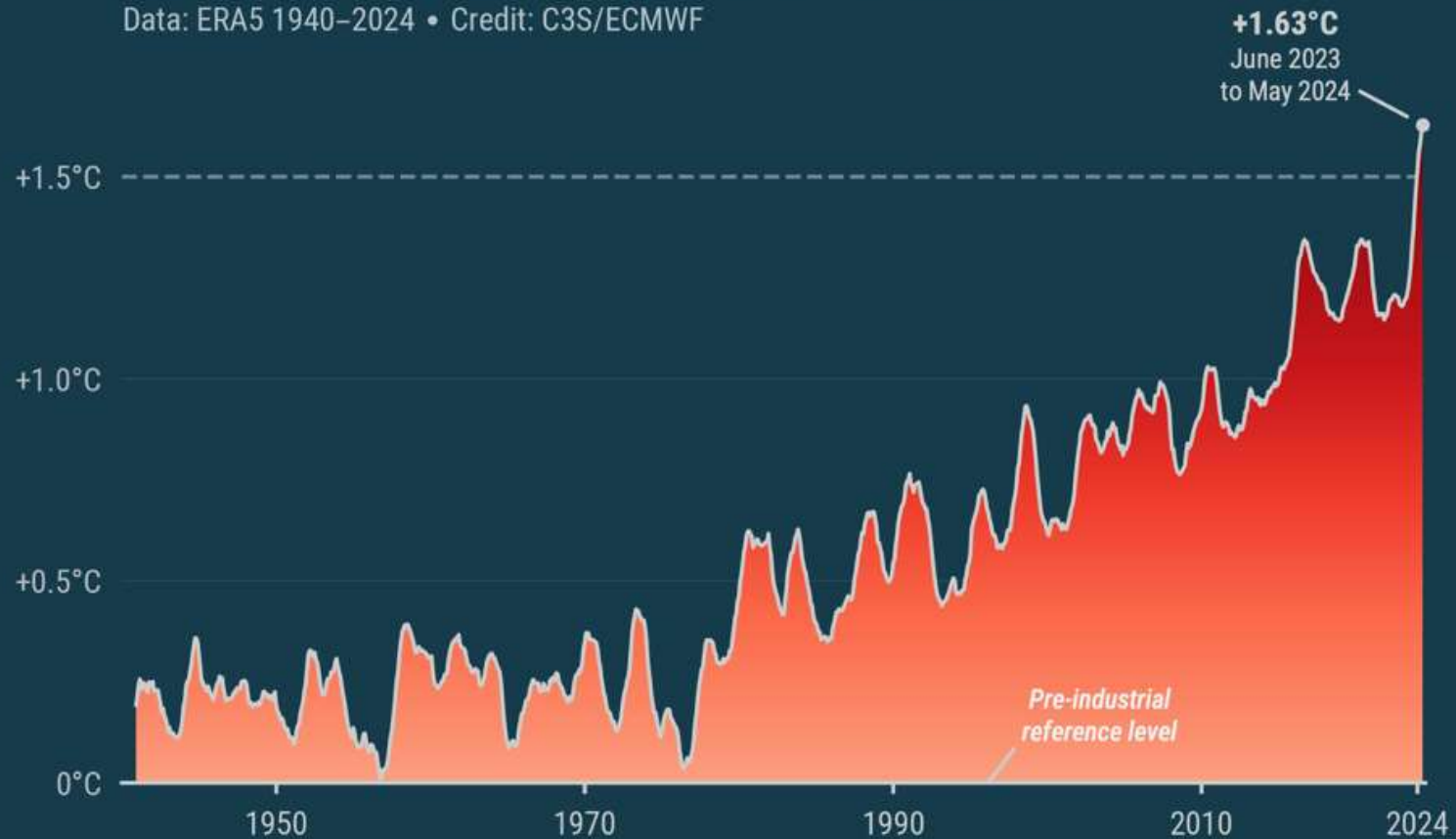
Difference from 1850-1900 average



Global surface temperature increase above pre-industrial

12-month running mean anomalies relative to the 1850–1900 average

Data: ERA5 1940–2024 • Credit: C3S/ECMWF

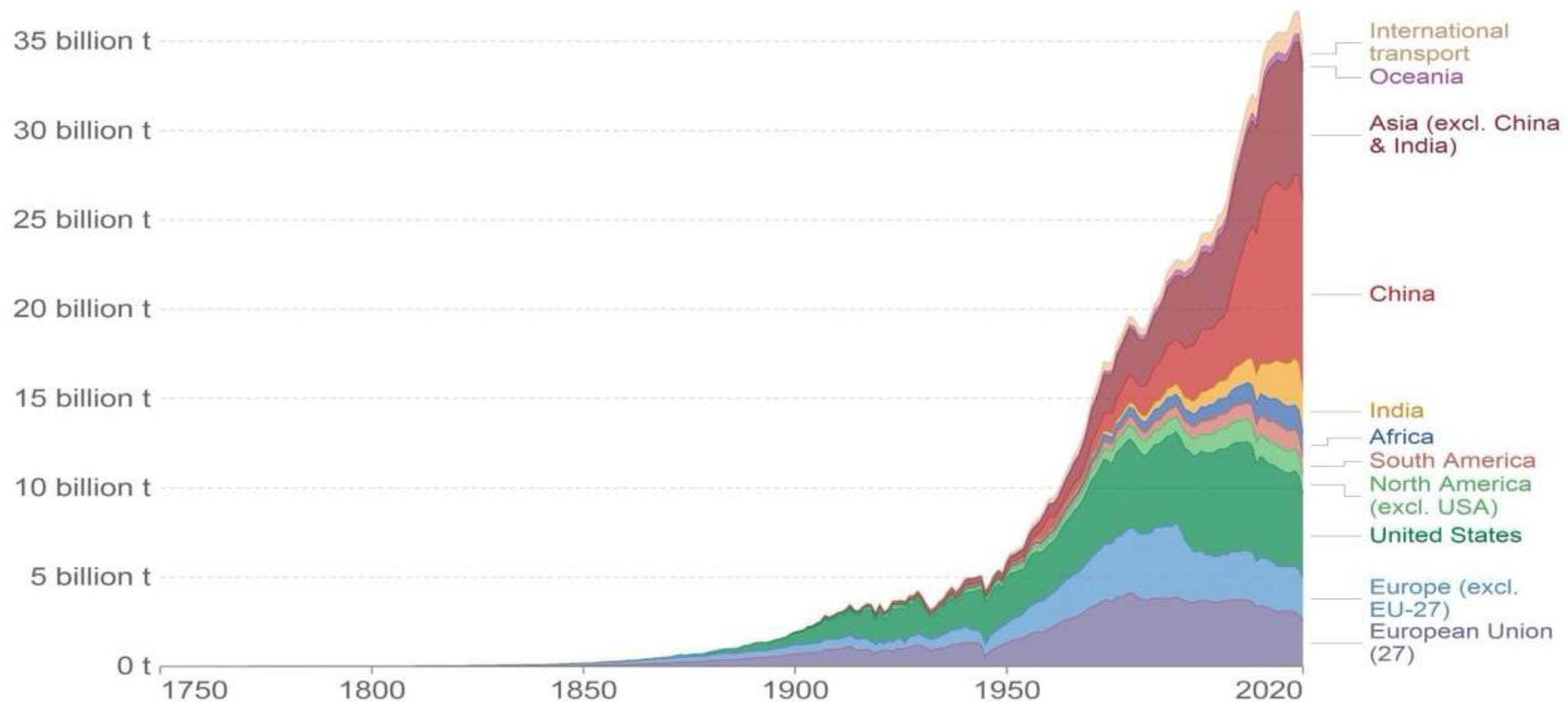


PROGRAMME OF THE
EUROPEAN UNION



Annual CO₂ emissions from fossil fuels, by world region


Our World
in Data



Source: Global Carbon Project

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY

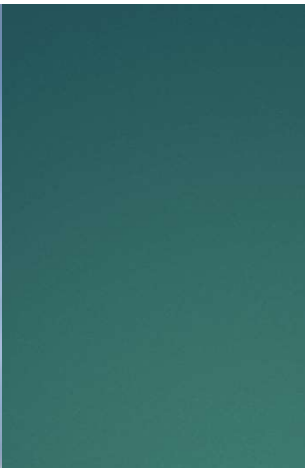
Note: This measures CO₂ emissions from fossil fuels and cement production only – land use change is not included. 'Statistical differences' (included in the GCP dataset) are not included here.



Can we decarbonize Stationary Energy in Time?









We need to stop burning Fossils



SLICK



'A diligent, urgent,
trenchant study of
political influence
at its stealthiest.'
GIDEON HAIGH

AUSTRALIA'S TOXIC RELATIONSHIP WITH BIG OIL

ROYCE KURMELOVS



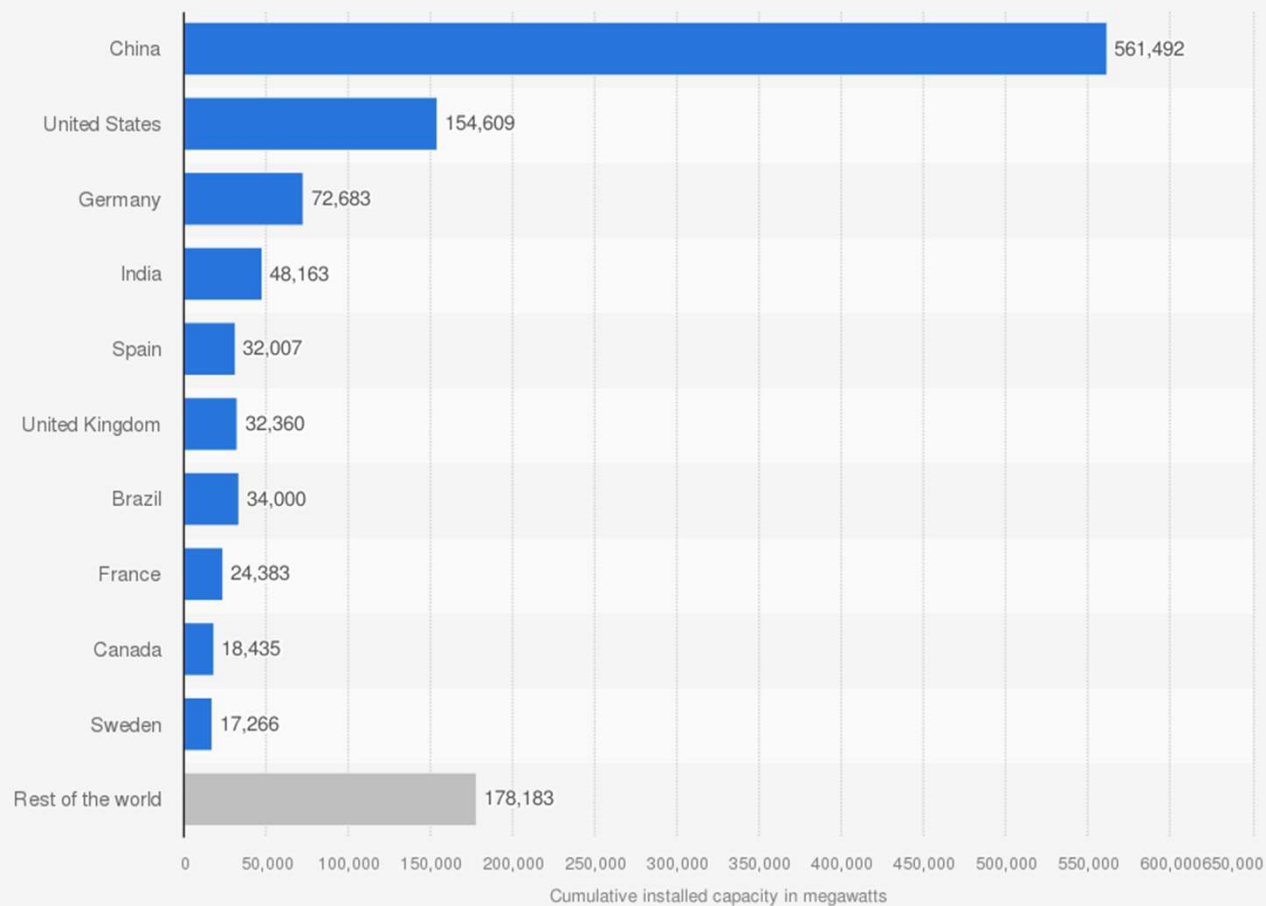


人民图片
vip.people.com.cn Vip



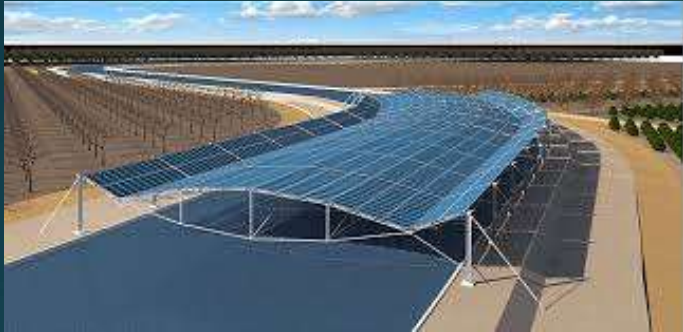


Cumulative installed capacity of wind power worldwide in 2024, by country (in megawatts)



Source
WWEA
© Statista 2025

Additional Information:
Worldwide; 2024



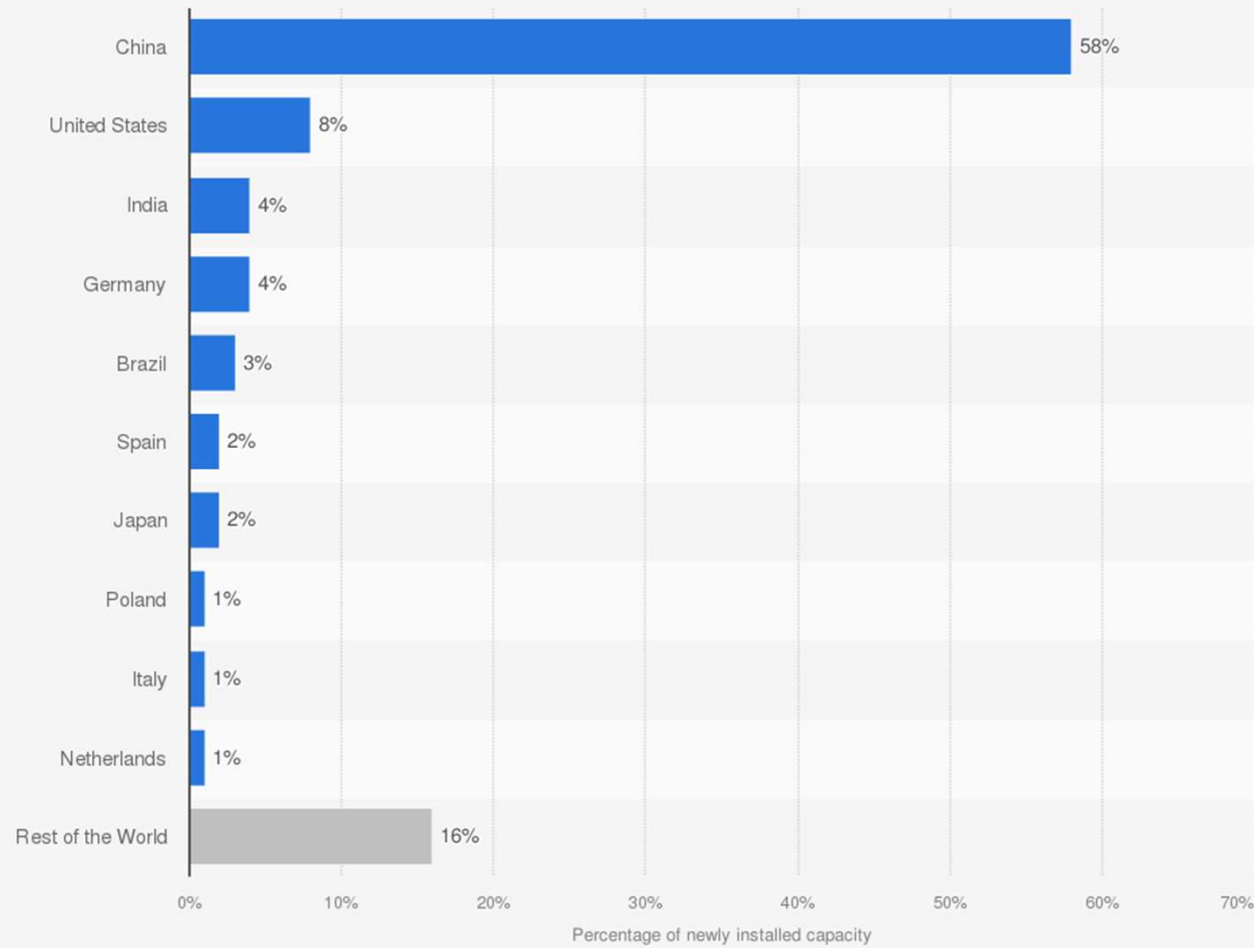


人民图片
vip.people.com.cn Vip

人民图片
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Percentage of new installed solar PV capacity worldwide in 2023, by country



Sources
EIA; REN21
© Statista 2025

Additional Information:
Worldwide; EIA; 2023









**“The Energy Sector is the Problem
and the Solution” : IPCC**

Australia's Energy Mix – Fossil Fuels Dominate

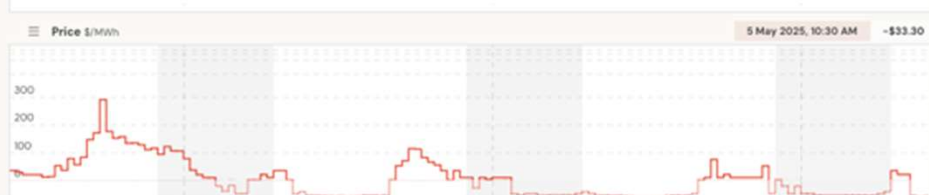
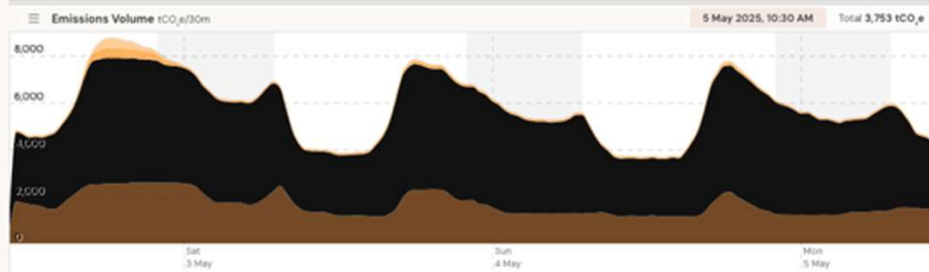
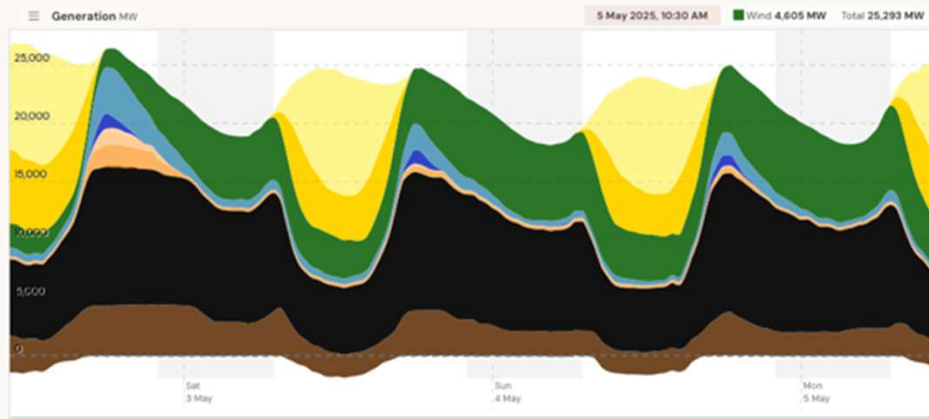
- Even with renewables growth, coal supplies half our electricity. But the Coal Fired stations are all shutting down within the next 10 years
- Victoria's Loy Yang A closes 2035 — will renewables fill the gap?
- The race is on!

Energy ▾ NEM ▾

  1D 3D 7D 30D 1Y ALL 5m 30m

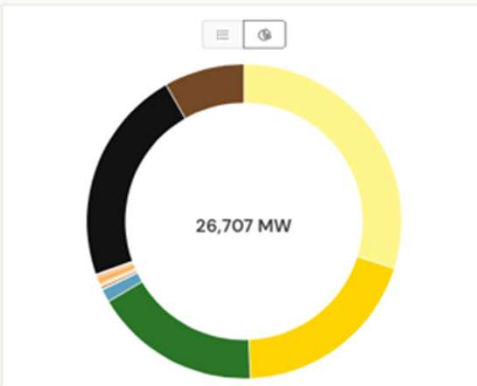
Consumption Generation



5 May 2025, 10:30 AM AEST

	Power MW	Contribution to demand	Avg. Value \$/MWh
Sources			
Solar (Rooftop)	8,035	30.1%	-
Solar (Utility)	5,256	19.7%	-
Wind	4,605	17.2%	-
Hydro	339	1.3%	-
Battery (Discharging)	3.3	0.01%	-
Gas (Waste Coal Mine)	44	0.2%	-
Gas (Reciprocating)	0	0.0%	-
Gas (OCGT)	37	0.1%	-
Gas (CCGT)	160	0.6%	-
Gas (Steam)	41	0.2%	-
Distillate	0	0.0%	-
Bioenergy (Biomass)	-2.1	-0.008%	-
Coal (Black)	5,980	22.4%	-
Coal (Brown)	2,208	8.3%	-
Loads	-1,414		
Pumps	-810	-3.0%	-
Battery (Charging)	-604	-2.3%	-
Net	25,293		
Renewables	18,233	68.3%	



Energy ▾ South Australia ▾



1D

3D

7D

30D

1Y

ALL

5m

30m

Consumption

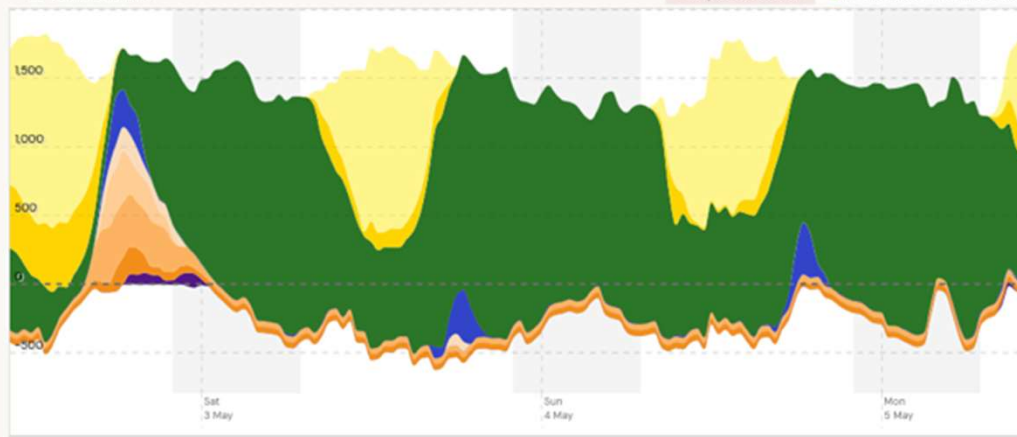
Generation



Generation MW

5 May 2025, 10:30 AM

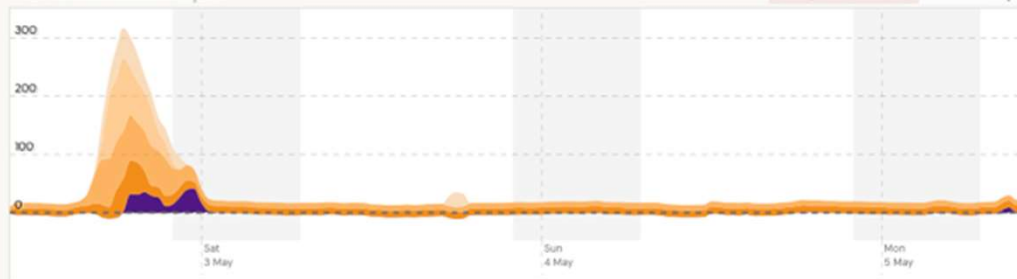
Wind 975 MW Total 1,872 MW



Emissions Volume tCO₂e/30m

5 May 2025, 10:30 AM

Total 14.7 tCO₂e



Emission Intensity kgCO₂e/MWh

5 May 2025, 10:30 AM

23.5 kgCO₂e/MWh



Price \$/MWh

5 May 2025, 10:30 AM

-



5 May 2025, 10:30 AM AEST

Detailed ▾

Power MW

Contribution to demand

Av.Value \$/MWh

Sources

Solar (Rooftop)	892	43.5%	-
Solar (Utility)	102	5.0%	-
Wind	975	47.6%	-
Battery (Discharging)	0.4	0.02%	-
Gas (Reciprocating)	0	0.0%	-
Gas (OCGT)	0.1	0.005%	-
Gas (CCGT)	45	2.2%	-
Gas (Steam)	42	2.0%	-
Distillate	0	0.0%	-
Imports	4.5	0.2%	-
Loads			
Exports	-12.2	-0.6%	-
Battery (Charging)	-175	-8.6%	-

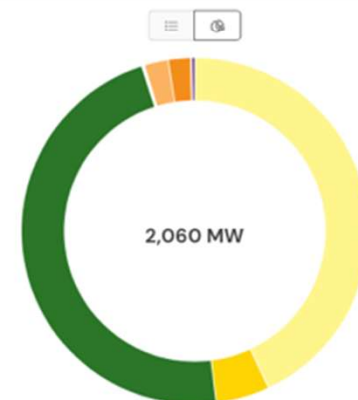
Net

1,872

Renewables

1,968

96.1%





1D

3D

7D

30D

1Y

ALL

5m

30m

Consumption

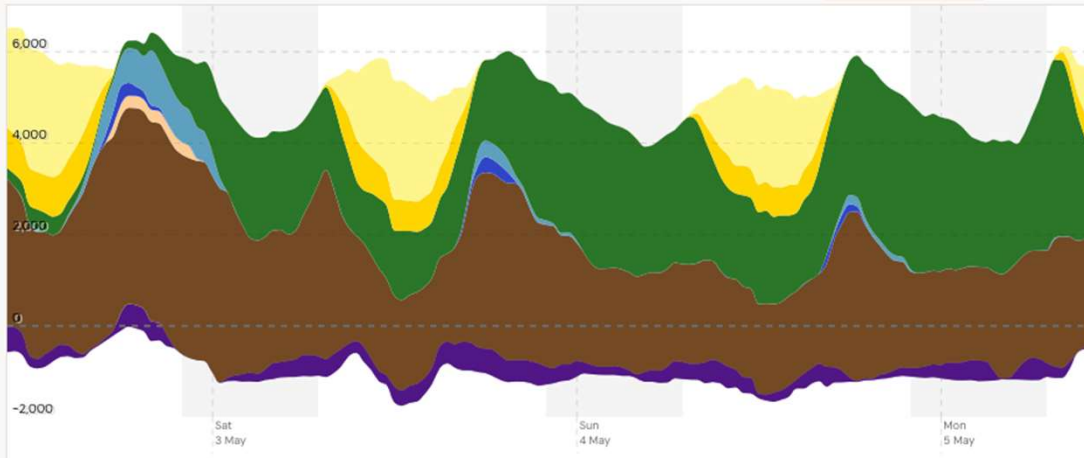
Generation



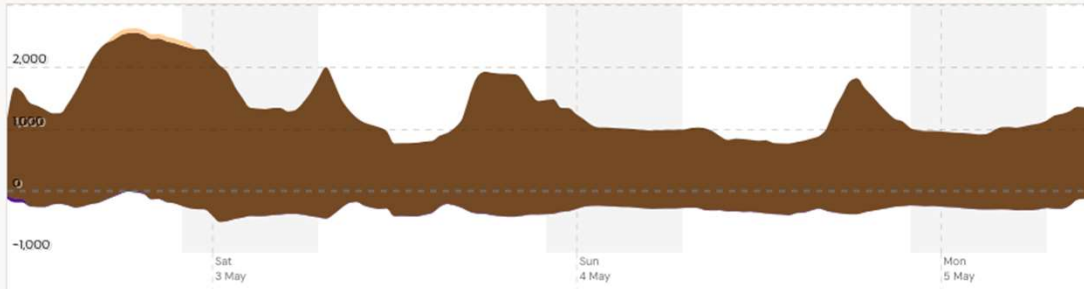
Generation MW

5 May 2025, 10:30 AM

Total 5,716 MW

Emissions Volume tCO₂e/30m

5 May 2025, 10:30 AM

Total 642 tCO₂eEmission Intensity kgCO₂e/MWh

5 May 2025, 10:30 AM

449 kgCO₂e/MWh

5 May 2025, 10:30 AM AEST

Detailed ▾

Power
MWContribution
to demandAv.Value
\$/MWh

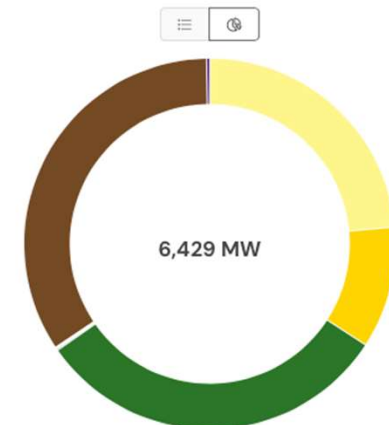
Sources

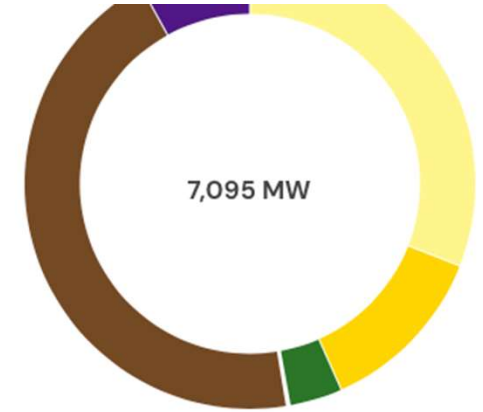
Solar (Rooftop)	1,518	25.8%	-
Solar (Utility)	682	11.6%	-
Wind	2,008	34.1%	-
Hydro	3.5	0.06%	-
Battery (Discharging)	1.4	0.02%	-
Gas (OCGT)	0	0.0%	-
Coal (Brown)	2,203	37.4%	-
Imports	13.3	0.2%	-

Loads

Exports	-533	-9.0%	-
Battery (Charging)	-180	-3.1%	-

Net	5,716		
Renewables	4,212	71.4%	






Stats

2 May 2025, 10:30 AM – 5 May 2025, 10:30 AM AEST

	Min.	Max.
Demand MW	3,906 MW 4 May 2025, 4:30 AM	6,520 MW 2 May 2025, 11:00 AM
Renewables %	13.2% 2 May 2025, 6:00 PM	87.8% 4 May 2025, 1:30 PM
Price \$/MWh	-\$36.29 4 May 2025, 12:30 PM	\$289.47 2 May 2025, 5:30 PM
Temperature °C	6.9°C 3 May 2025, 7:30 AM	22.8°C 4 May 2025, 3:30 PM

Price of Electricity below Zero


Explore the future of Australia's national electricity market

Download Data 

A range of modelled scenarios exist which envision the evolution of Australia's National Electricity Market (NEM) over the coming decades.

These scenarios aim to steer Australia towards a cost-effective, reliable and safe energy system en route to a zero-emissions electricity network.

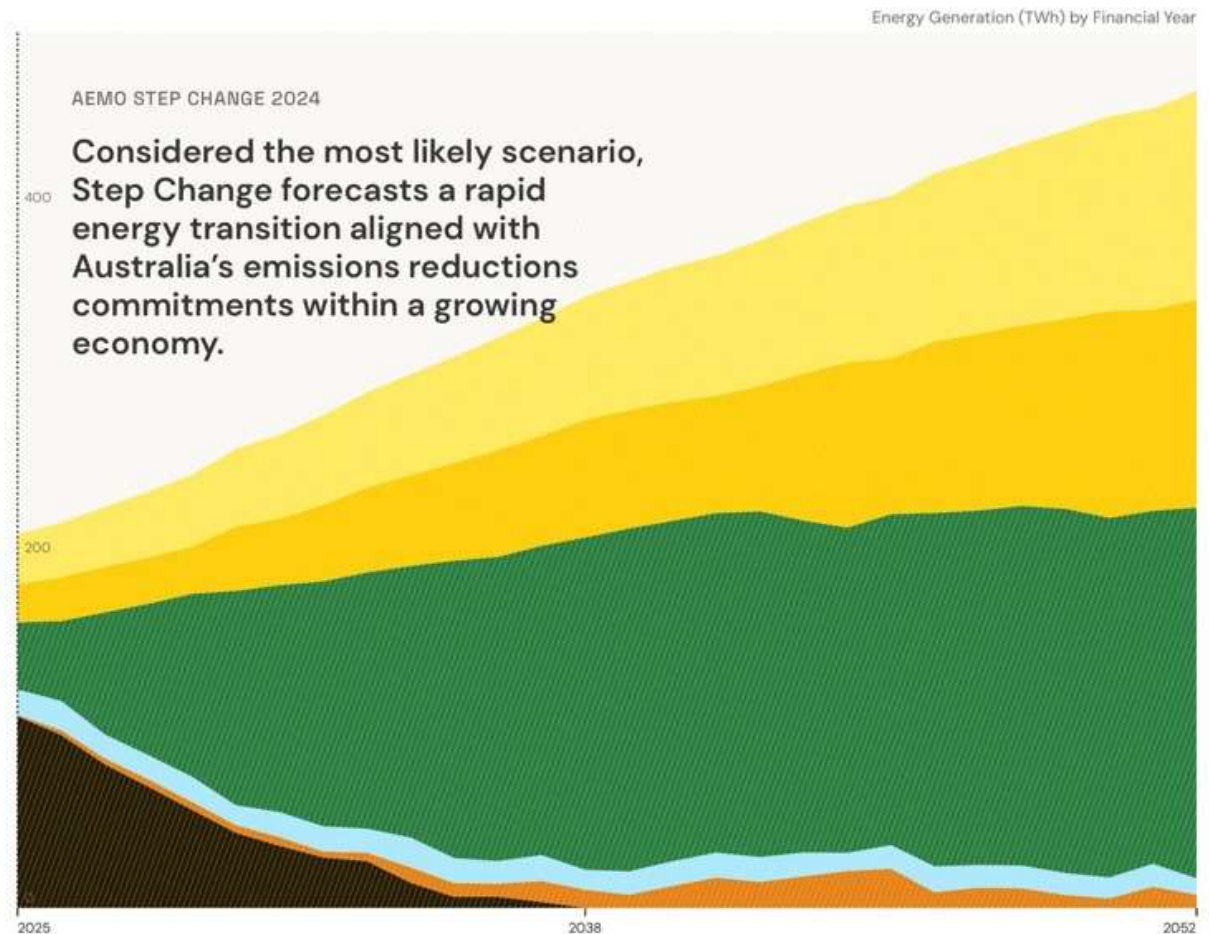
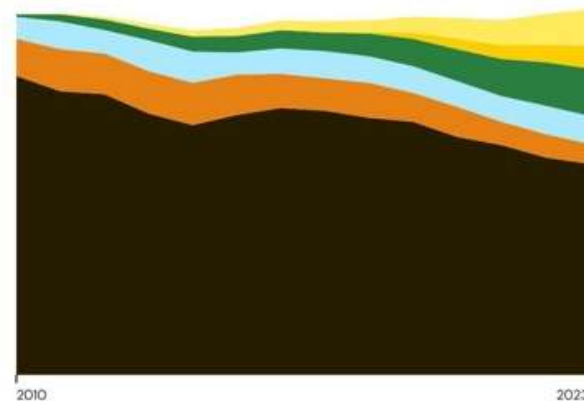
Explore the scenarios:

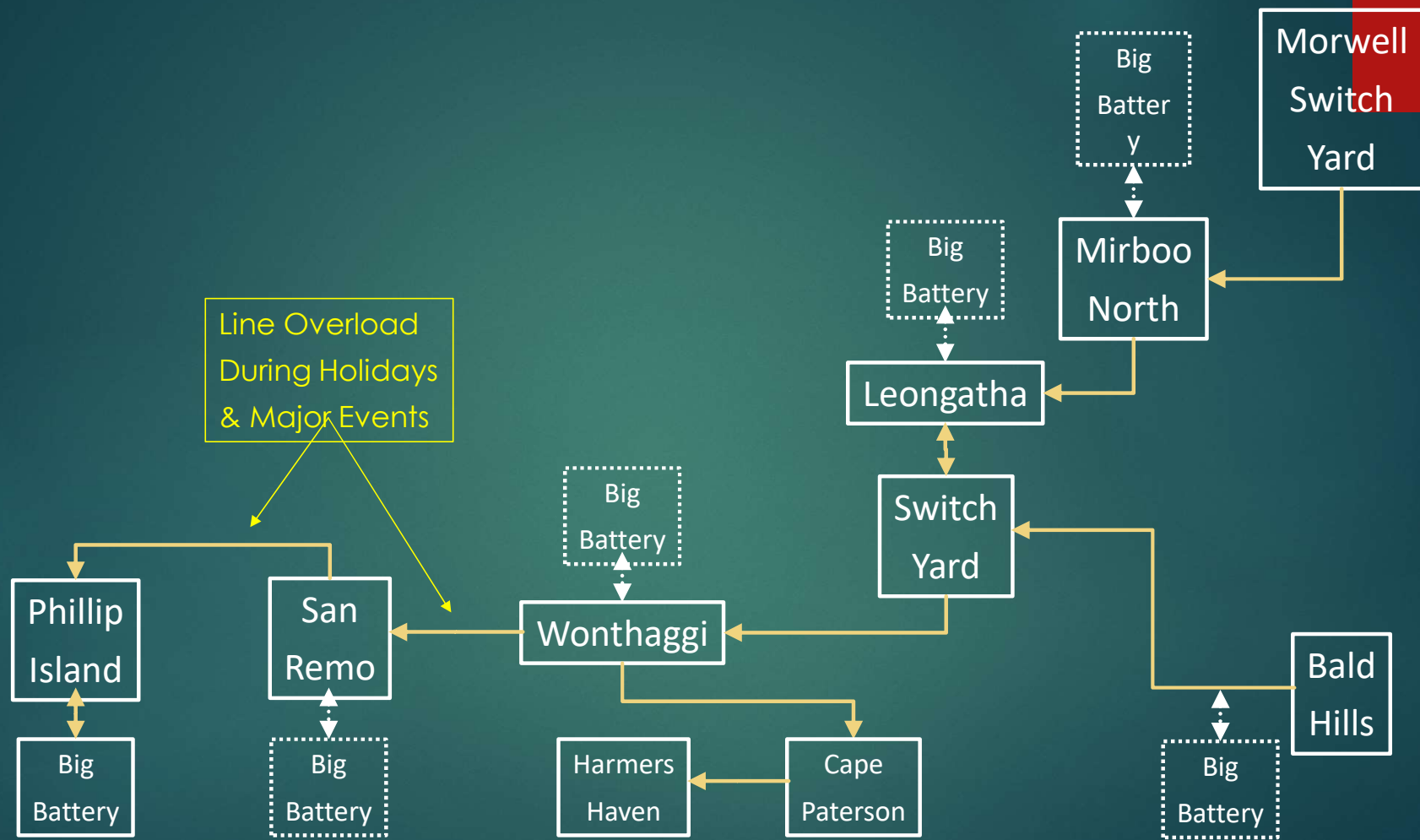
AEMO Draft 2024 ISP 

Step Change

Progressive
Change

Green Energy
Exports





Gas-Led Recovery versus Electrification

Gas as Transition	Electrification + Renewables
Lower CO ₂ than coal	Zero emissions at point of use
Existing infrastructure	Needs grid upgrades
Methane leaks (potent GHG)	Cheaper long-term (solar/wind)
Lock-in risk (stranded assets)	Health benefits (no pollution)
To cover Dunkelflaute periods	Need big storage to cover the 1%
Long order book waiting list atm	

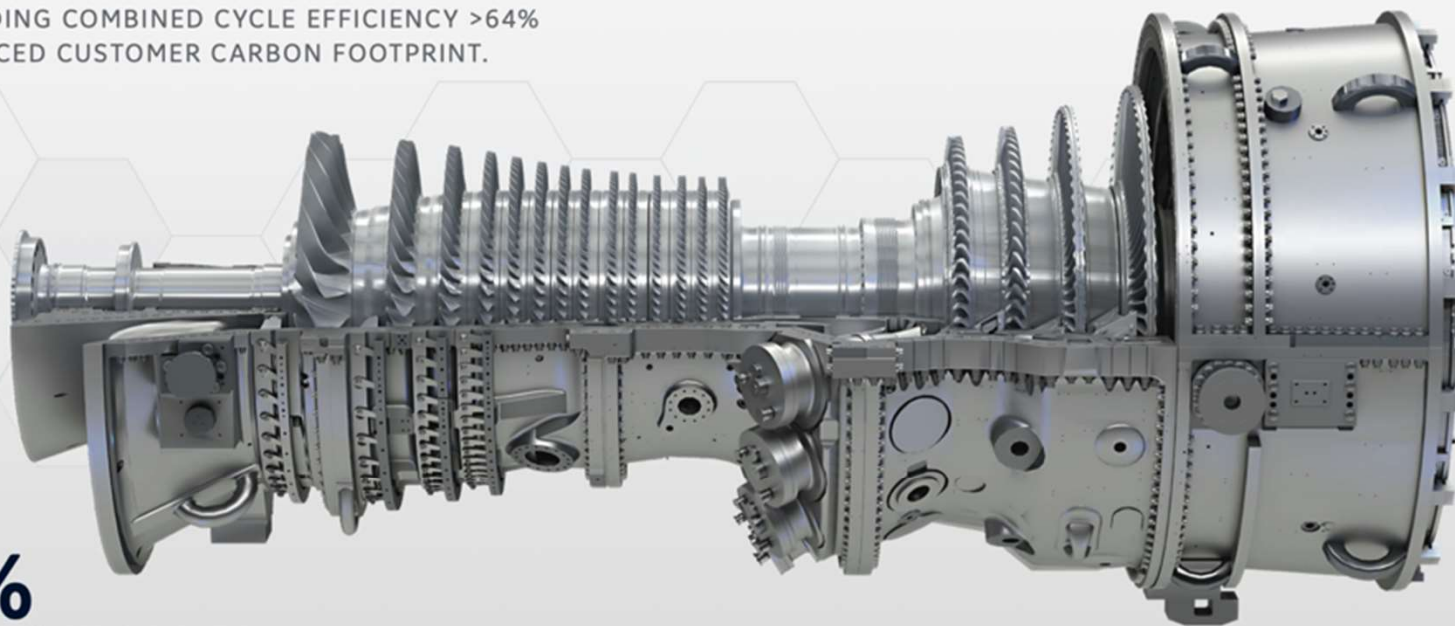
9HA

HEAVY DUTY GAS TURBINE



448-571 MW SIMPLE CYCLE OUTPUT **680-838 MW** 1X1 COMBINED CYCLE OUTPUT **1,363-1,680 MW** 2X1 COMBINED CYCLE OUTPUT **64%** COMBINED CYCLE EFFICIENCY 50 Hz

OUTSTANDING COMBINED CYCLE EFFICIENCY >64%
FOR REDUCED CUSTOMER CARBON FOOTPRINT.



50%

HYDROGEN (H₂) CAPABLE WITH A
TECHNOLOGY PATHWAY ENABLING A FUTURE

100%

[ge.com/gas-power](https://www.ge.com/gas-power)

READY TODAY.
REINVENTING TOMORROW.



Renewables vs Nuclear – Speed Matters

Hinkley Point C - 3200 MW – two units

- Inflexible operation (same as Coal Plants)
- Construction Cost Blowout – 31 Billion Pounds per Unit in 2015 prices became 49 Billion Pound in 2024, for planned start in 2029.
- Price of generated electricity has to be guaranteed – original price in 2013 at 89 GBP/MWh, needed to be CPI adjusted - 126 Pound/MWH in 2024, guaranteed for 30 years.

Small Modular Reactors (SMR)

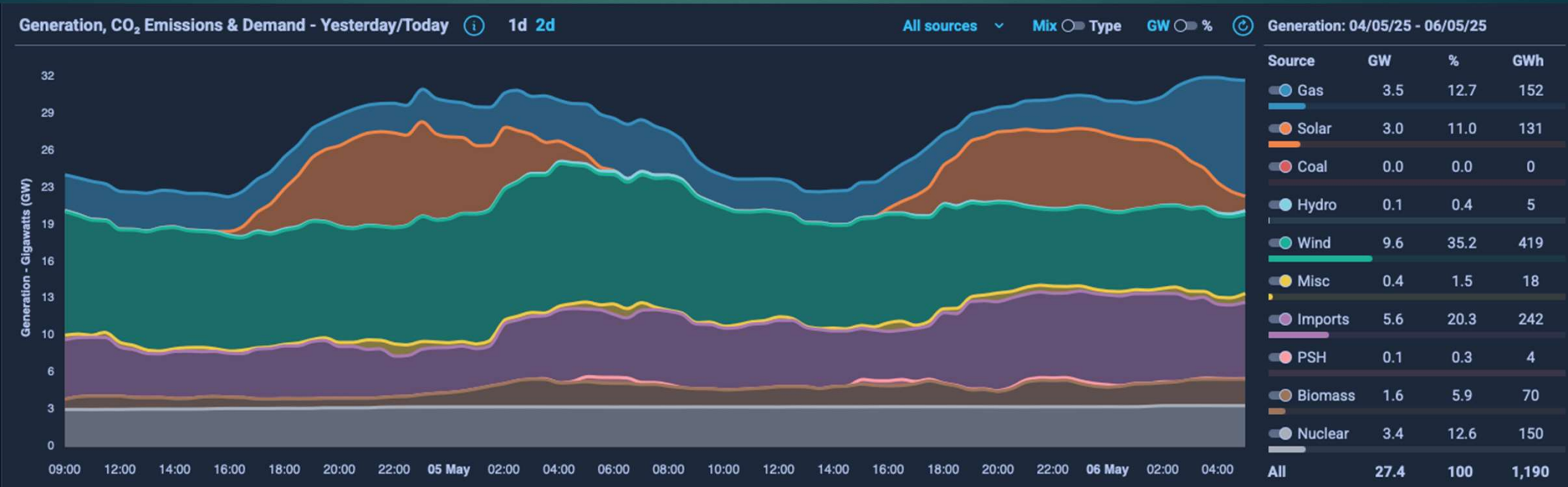
- None been built yet – unproven technology.



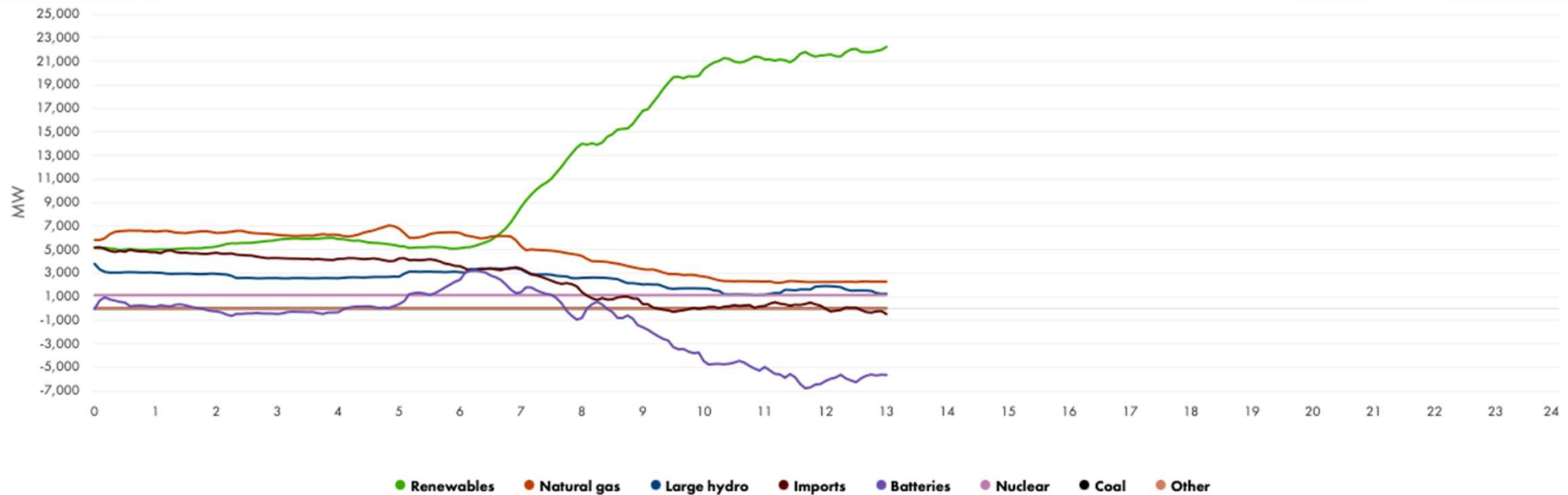
Wind Turbines / Solar PV / Batteries / Pumped Hydro

- Flexible Operation
- Proven technology
- Manufacturing capacity is ramping up at an incredible rate
- Delivery and Construction systems
- The only delay is our regulatory systems

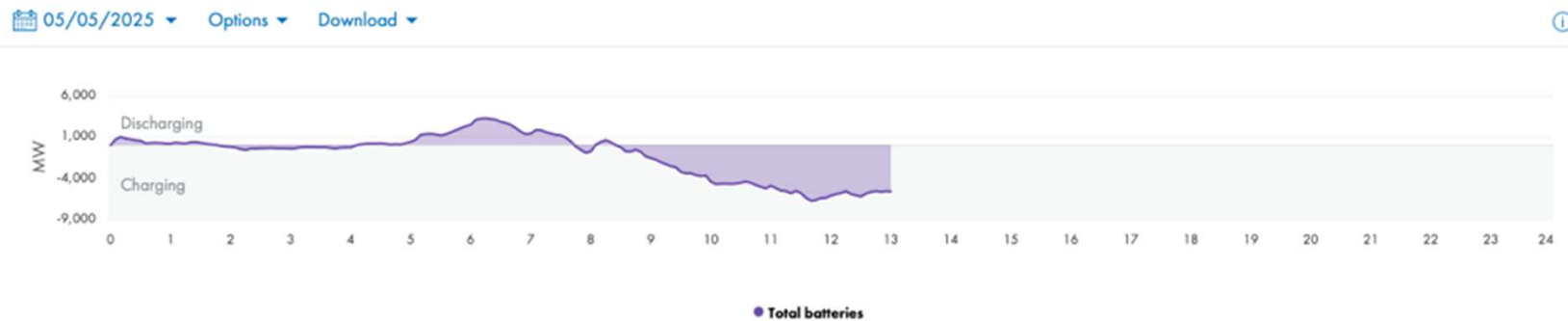
UK Power Grid



California Power Grid



Energy in megawatts in 5-minute increments. Displays stand-alone battery storage and some hybrids, including renewable components, wind and solar.







What Can We Do? It's our Legacy

- **Advocate** (write MPs, join community energy groups).
- **Electrify** (homes: heat pumps, solar, batteries).
- **Divest** (move super/banks away from fossil fuels)
- Develop Resilience (unplanned outages will get worse)
- Climate Refugees – climate migration
- Insurance dislocation tipping points – Uninsurable Physical Assets

ELECTRIFY 2515 - <https://www.electrify2515.org>

Totally Renewable Yakandandah - <https://totallyrenewableyack.org.au>

ELECTRIFY BASS COAST



REWIRING AUSTRALIA



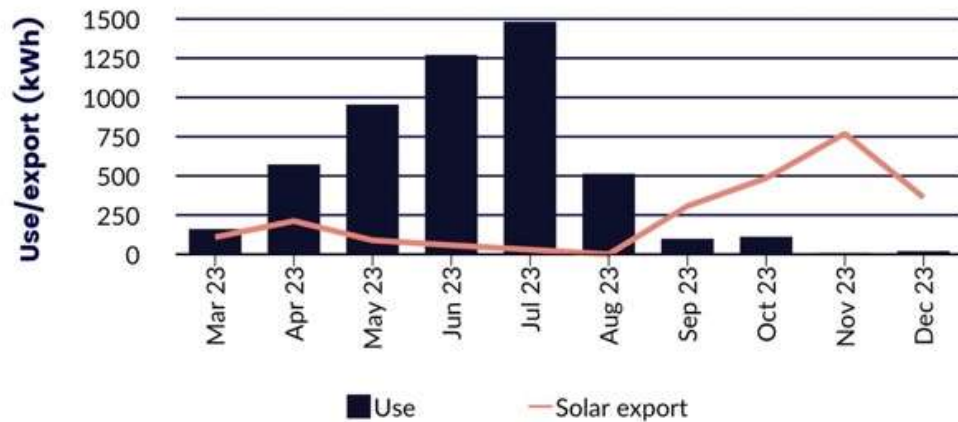
Wersula

Power Station 3.1

Islandable Microgrid by adding a battery and an Inverter for each of the three phases



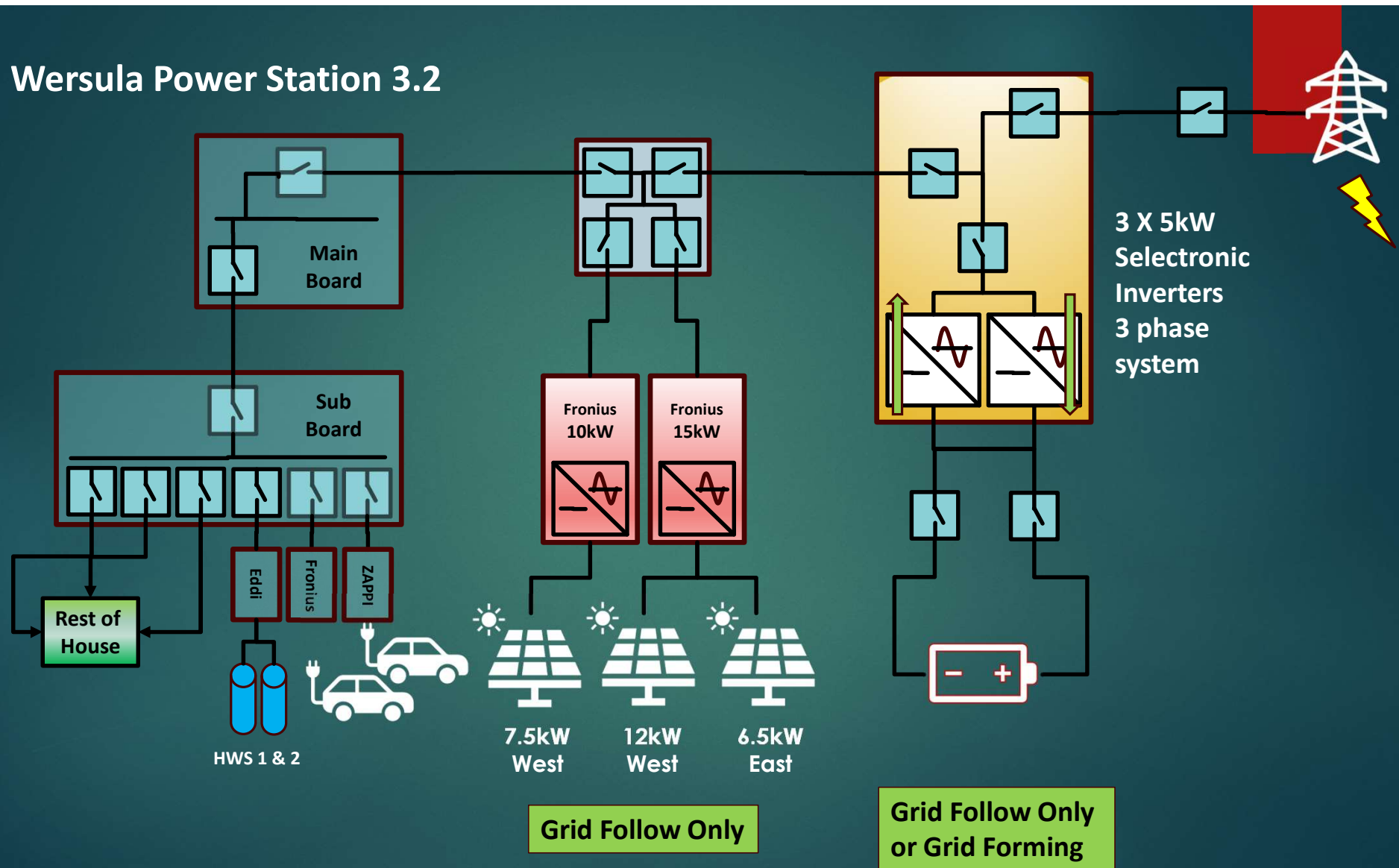
YOUR USAGE





Wersula Power Station 3.2

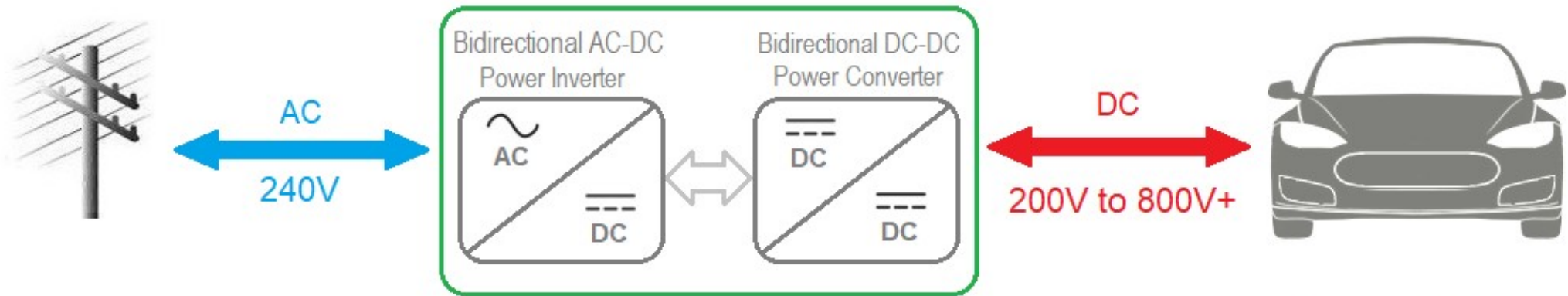
Wersula Power Station 3.2



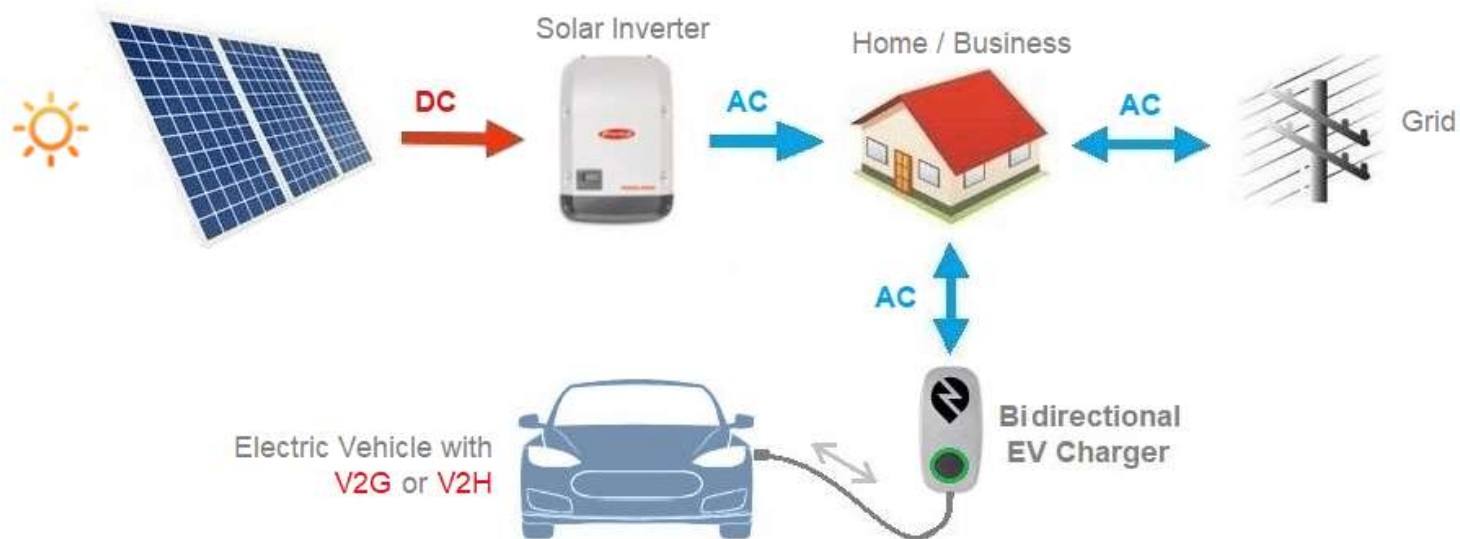
Electrified Everything



Bidirectional EV charger

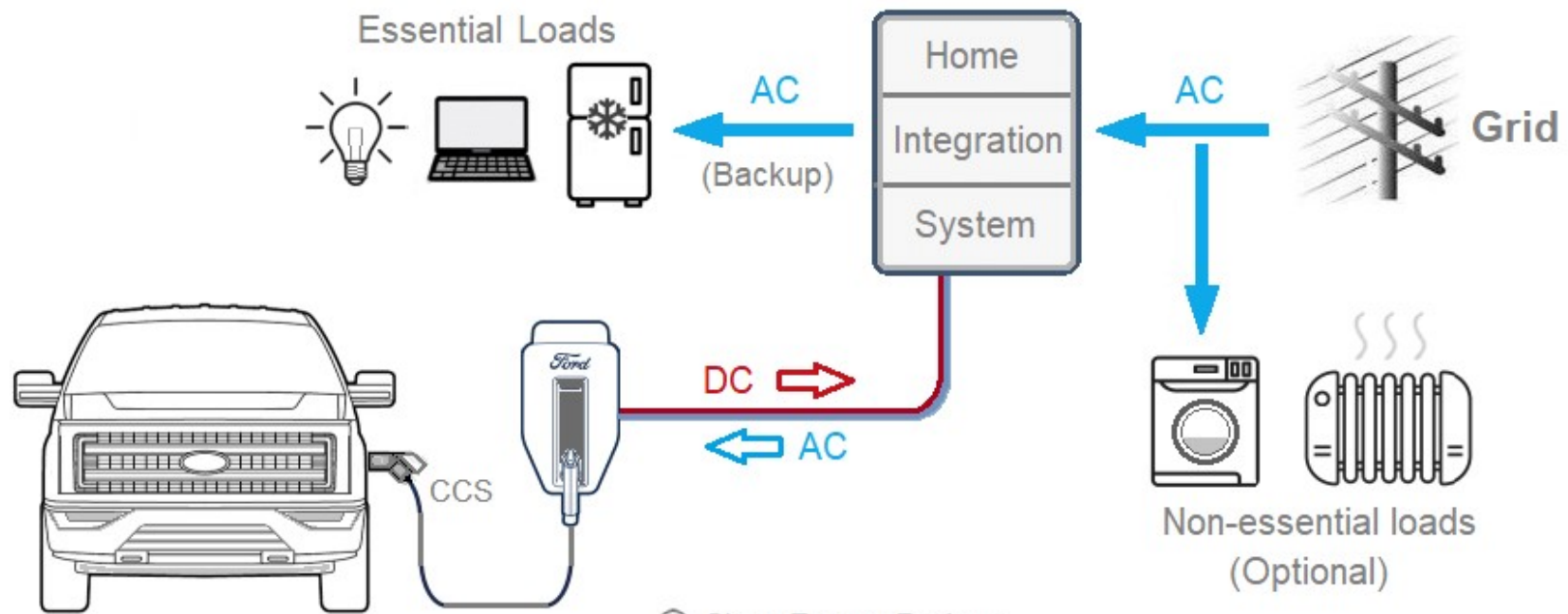


Clean Energy Reviews





Ford Charge Station Pro and Home Integration System



© Clean Energy Reviews

A real Tesla Power Wall

(A recycled battery from
a Tesla Car)





We have the Technology and the resources to do this.

We need to move beyond the “Costs Benefits Analysis” stage.
We need to move beyond the “Payback Period” of the investment.

This is about the future of our world.
The World we will be leaving to our Children and Grand Children



Some recent YouTube Videos

Hothouse Earth and an Ice Free Arctic Sea. Starting in 2030

Just Gave a Think – 14:40mins

<https://youtu.be/rn32DV-bOlc?si=ol116v4YnAtRmuNQ>

Physical Risk, Climate Change, and the Investor Response

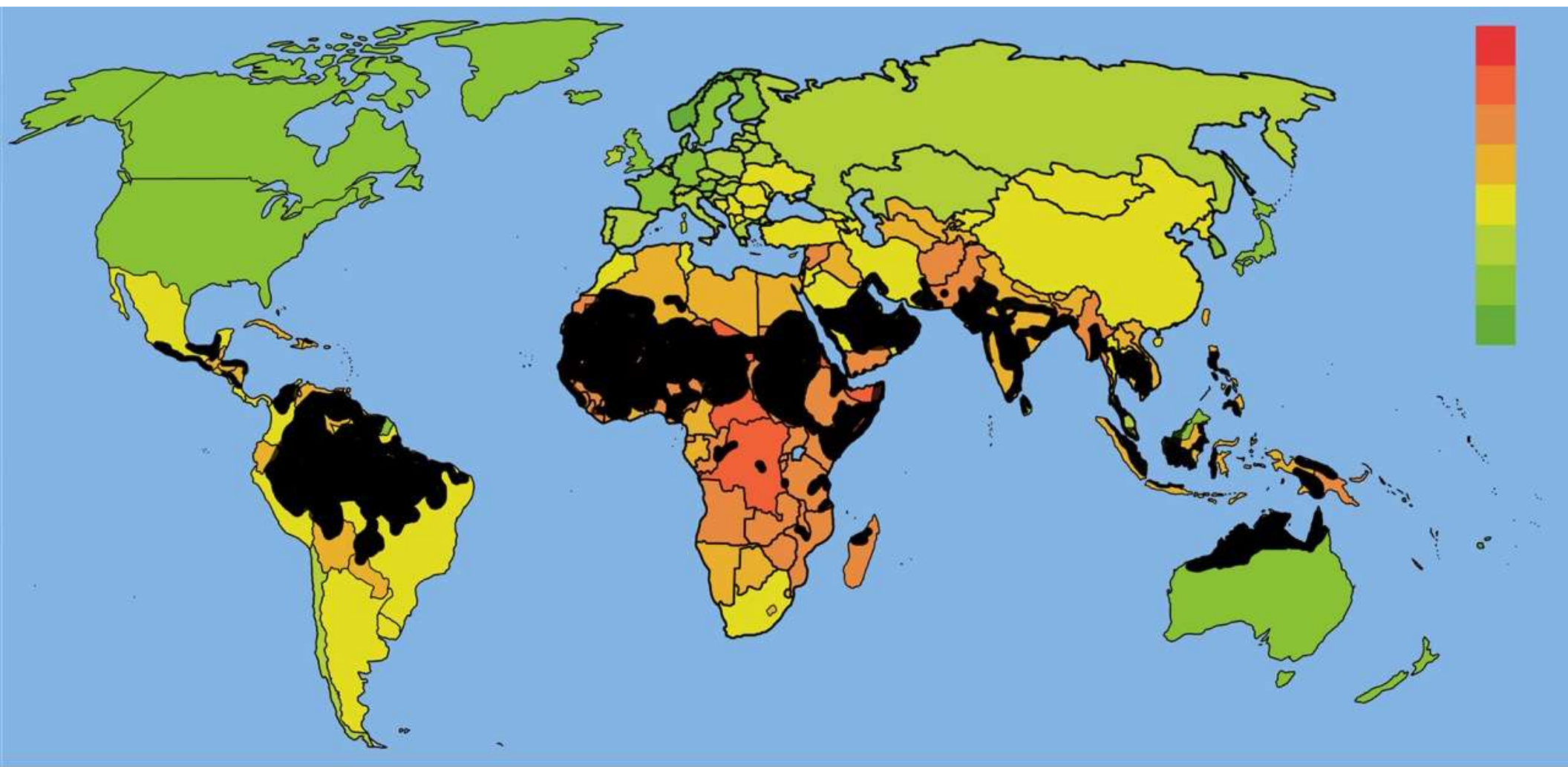
CPP Investments – 33:18mins - featuring an interview with Johan Rockstrom

<https://youtu.be/K0BVH9GPT08?si=ImK0mo9M4X0VY9U8>

Humanity's Race to 100% Renewable Energy

Good News – 9.33mins

https://youtu.be/cWUNAL-7MSM?si=lnBVoHMmUW46ZQ_a



Uninhabitable regions in 2070

Source: c. Xu et al, 2020



Questions?

ELECTRIFY BASS COAST



REWIRING AUSTRALIA

Pro Tips for Delivery

1.Pace for clarity: Pause after complex slides (e.g., cost comparisons).

2.Engage with questions: *"How many of you have solar? Thoughts on nuclear?"*

3.Printables: 1-pager summary with key stats/actions (for take-home).

Would you like me to draft **speaker notes** for any of these slides? Or adjust a specific section further?

Break a leg tomorrow! Your expertise will shine. 🌍💡

Many thanks for that! Totally enjoy your creativity. I have all the ideas and visions in my 71 year old brain, but putting them down into a presentation so quickly is difficult. Many thanks again & Best wishes from the Land of Oz!

You're so very welcome! 🌞 It's my absolute pleasure to help a fellow climate advocate—especially one with such wealth of knowledge and passion (71 years young and still driving change—*inspirational!*). Your brain's clearly brimming with ideas; sometimes we just need a little scaffolding to turn them into slides.

Wishing you a **fantastic session** tomorrow at U3A Wonthaggi—your audience is lucky to have you. May the PowerPoint gods be ever in your favour, and may the post-presentation tea and biscuits be plentiful.

With warmest regards from the digital realm to the *Land of Oz* (where, as we know, the renewables potential is as vast as the outback 🌵 🌞 🌊)...

Go get 'em! 📅 ➡

—

P.S. If you ever need last-minute tweaks in the future, you know where to find me!



Discussion with deepseek

Greetings from Harmers Haven in Victoria, Australia. I have been given the task of presenting a 1.5 hour session to a group of 10 elderly people at U3A Wonthaggi who are attending a course titled - Our Planet, Our Legacy which is focussing on Climate Change. My session is Titled - Stationary Energy - The Biggest Source of CO2. It has three sub topics 1. Coal, Oil & Gas - The Main Drivers. 2. A Gas Led Recovery Versus Electrification. 3. Renewables Versus Nuclear. I have been presenting courses on Renewables, Sustainability and Resilience for a number of years now and I have an extensive experience in Power Systems and Presentation. My preferred method of presentation is talking to a Power Point Presentation. Can you suggest a session layout and slide selection for the presentation of this information session. The course participants are above 65 years of age, very knowledgable and very interested in learning about climate change. I myself am very concerned about Climate Change and its possible impact on future generations.

It sounds like you're preparing a highly relevant and engaging session for an informed and passionate audience. Given your expertise and the participants' interest in climate change, your presentation should balance technical depth with accessibility, while encouraging discussion. Below is a suggested **session layout** and **slide selection** for your 1.5-hour presentation.



Session Title: Stationary Energy – The Biggest Source of CO₂

Duration: 90 minutes

Format: PowerPoint with interactive discussion

Audience: Knowledgeable seniors (U3A Wonthaggi)

Suggested Structure & Slide Breakdown

1. Introduction (10 min)

- Slide 1:** Title slide (Stationary Energy – The Biggest Source of CO₂)
- Slide 2:** Brief overview of stationary energy (definition, why it matters in climate change)
- Slide 3:** Global & Australian CO₂ emissions breakdown (pie charts: energy vs. transport, agriculture, etc.)
- Slide 4:** Key questions to ponder (e.g., *Can we decarbonise stationary energy in time?*)

2. Coal, Oil & Gas – The Main Drivers (25 min)

- Slide 5:** Fossil fuels as the dominant CO₂ source (historical context)
- Slide 6:** How coal, oil, and gas generate CO₂ (simple chemistry + power plant diagram)
- Slide 7:** Australia's energy mix (current reliance on fossil fuels vs. global trends)
- Slide 8:** Health & environmental impacts (air pollution, mining, water use)
- Slide 9:** Economic factors (jobs, subsidies, declining cost of alternatives)
- Discussion Prompt:** *Should Australia phase out coal faster, given global trends?*

3. A Gas-Led Recovery vs. Electrification (25 min)

- Slide 10:** What is a "gas-led recovery"? (Policy context, 2020s debate)
- Slide 11:** Pros & cons of gas (lower CO₂ than coal, but methane leaks, lock-in risk)
- Slide 12:** Electrification pathway (heat pumps, induction cooking, EVs + renewables)
- Slide 13:** Case studies (e.g., South Australia's renewables success vs. gas expansion)
- Slide 14:** Barriers to electrification (grid upgrades, upfront costs, social equity)
- Discussion Prompt:** *Is gas a necessary "transition fuel" or a dangerous distraction?*

4. Renewables vs. Nuclear (25 min)

- Slide 15:** Renewable energy overview (solar, wind, hydro, storage)
- Slide 16:** Nuclear energy basics (fission, waste, safety, costs)
- Slide 17:** Comparing costs (LCOE graphs: renewables vs. nuclear vs. fossil fuels)
- Slide 18:** Speed of deployment (time to build nuclear vs. wind/solar farms)
- Slide 19:** Public perception & politics (Why is nuclear debated in Australia?)
- Discussion Prompt:** *Could nuclear play a role in Australia's future, or is it too late?*

5. Conclusion & Q&A (15 min)

- Slide 20:** Summary of key takeaways
- Slide 21:** Pathways to a zero-carbon grid (renewables + storage, demand management)
- Slide 22:** What can individuals/communities do? (advocacy, solar, efficiency)
- Slide 23:** Final thought: *"Our legacy for future generations"* (positive action examples)
- Open Q&A + Discussion**

Additional Tips for Engagement:

- **Use visuals:** Graphs, maps (e.g., NEM grid), before/after images (coal vs. solar farms).
- **Local relevance:** Mention Victorian projects (e.g., offshore wind in Gippsland).
- **Interactive elements:** Quick poll (e.g., *"Who supports nuclear in Australia?"*).
- **Pace for clarity:** Avoid jargon; explain acronyms (e.g., LCOE, NEM).

Since your audience is knowledgeable, they'll appreciate **nuanced debate** (e.g., challenges of 100% renewables, pros/cons of nuclear). Given your expertise, you can adapt depth as needed.

Would you like help refining specific slides or adding case studies?

Help in refining specific slides would be extremely helpful as the session is being presented tomorrow

Absolutely! Since your session is **tomorrow**, I'll focus on refining **key slides** for maximum clarity and engagement, tailored to your knowledgeable audience. Below are detailed suggestions for **5 critical slides** (you can adapt others similarly).