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The Energy Transition

Myths and Realities

The Transition

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Existential Threat to Civilisation: Climate Change

Global heating has already exceeded 1.5ºC above pre-industrial

Time is running out to avoid crossing tipping points

Impacts of Fossil Fuels (FF) → Energy Transition

- Climate change: 1.5ºC exceeded in 2024
- Air pollution and respiratory diseases
- Water pollution and over-use
- Land degradation
- Energy insecurity:
  e.g. Europe's dependance on Russian fossil fuels;
  Australia's dependance on oil imports
- Fluctuating fuel prices
- FF electricity is too expensive for villages in less developed countries

LA teenager's lungs

Open cut coal mine

How Renewable Energy can replace Fossil Fuels

Energy end-use 2024	Energy end-use	Future renewable energy contribution
Electricity **Australia NEM: coal 54.5%; RE 39%; fossil gas 5.3%** **(AEMO data, 12/2024)**		100% renewable electricity is technically & economically feasible in Australia & many other countries within 10–15 yrs.
Transport **Currently mostly oil**		Urban: electric public transport & elec. cars, cycling & walking; inter-city high-speed rail; air and sea travel need renewable liquid or gaseous fuels
Heat (non-electrical) **Currently mostly fossil gas**		Low temperature heating & cooling from direct solar & electric heat pumps; high temperature from renewable electricity

Electricity will play a much greater role in heating and transportation

Recommended Energy Transition Strategy

In the nutshell: renewables + electrification + efficiency + fairness

First 6 actions will mitigate at least ¾ of Australia's GHG emissions; 7th action (red font) is challenging.

- Set targets for 5-year periods 2025-2045
- Rapidly replace fossil fuel (FF) electricity with renewable electricity (RElec)
- Replace petrol/diesel road vehicles with electric
- Replace FF in domestic & industrial heating with electricity
- Greatly increase energy efficiency of buildings, appliances & transport; foster behavior change too
- Social justice: assist disadvantaged workers and countries

- To do: develop industry to produce renewable fuels, 'green' hydrogen and ammonia, for air & sea transport and non-energy industrial use

Contribution of Renewable Electricity in Selected Regions, 2023

Source: from author's compilation of official data

Region	% of annual electricity generation
Regions with large hydro potential, e.g. Norway, Iceland, Bhutan, Tasmania	95–100%
Regions with little or no hydro potential	
Denmark	88% (100% expected by 2030); 67% variable
South Australia	74% (100% expected by 2028); all variable
Australia as a whole	38%
Scotland	62% (= 113% of electricity consumption; difference is exported)
2 windy North German states	Over 100% of consumption *net*

Diversity of RE Sources and Siting


CST with thermal storage


Wind, Albany, WA

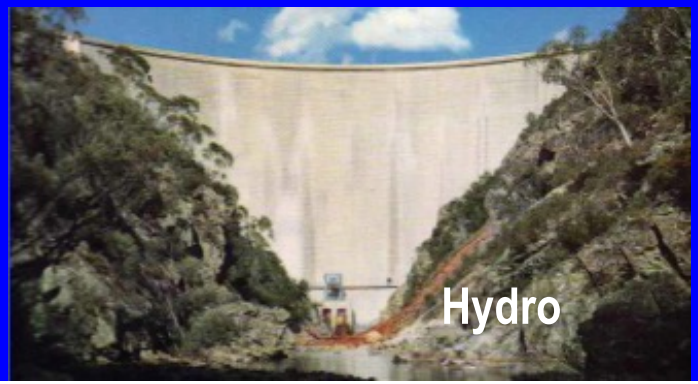
Wind
Biomass
Solar PV
Concentrated solar thermal (CST)
Hydro
Wave?
Tidal current?
Geothermal electricity?

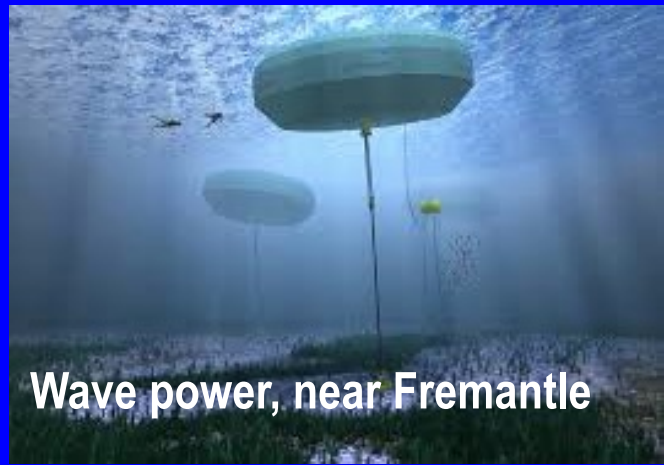
Australia has most sources


PV


Geothermal


Bioenergy, Rocky Point, Qld


Hydro


Wave power, near Fremantle

Key Tasks and Government Policies needed for the Energy Transition

Achieving 100% renewable electricity

- Fund infrastructure (e.g. new & upgraded transmission lines)
- Temporarily subsidise storage (e.g. batteries; pumped hydro)
- Remove subsidies to fossil fuels
- Make new rules for electricity market

Electrifying transport & facilitating human energy

- Expand public transport, cycleways and pedestrian areas
- Integrate urban planning with transport planning
- Set fleet fuel efficiency mandates on FF vehicles;
- Build network of charging points for EVs

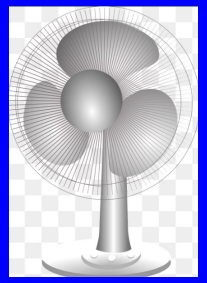
Electrifying combustion heating

- Offer incentives to replace FF combustion heating with electric

A price on carbon would assist the transition of all three types of energy use

Energy Efficiency saves Energy and Money

Renter



Key Policies needed

- Energy audits & energy ratings with mandatory disclosure upon sale and lease of buildings; carrots & sticks for landlords
- Energy labelling and performance standards for appliances and equipment

Home-owner

Key Tasks & Policies, continued

Social justice and fairness

- Assistance in retraining, relocation and pensions for fossil fuel workers who lose their jobs as a result of the transition

- Government incentives to create new, clean industries and jobs in former fossil fuel regions

Vested Interests are spreading False Myths about Renewable Energy (RE); Here are four.

N.B. for concise refutations of 14 energy myths, see markdiesendorf.com/energy-myths

- Myth 1: 'RE is too diffuse to run an industrial society; there is insufficient land'
- Myth 2: 'Base-load power stations*, either coal or nuclear, are necessary, and RE cannot provide them'
- Myth 3: 'RE is expensive, nuclear is cheap'
- Myth 4: 'We need new gas fields to support the energy transition'

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*Baseload power stations generate 24/7 at rated power, except for breakdowns and planned maintenance; coal, nuclear, very large hydro

Myth 1: Land area required

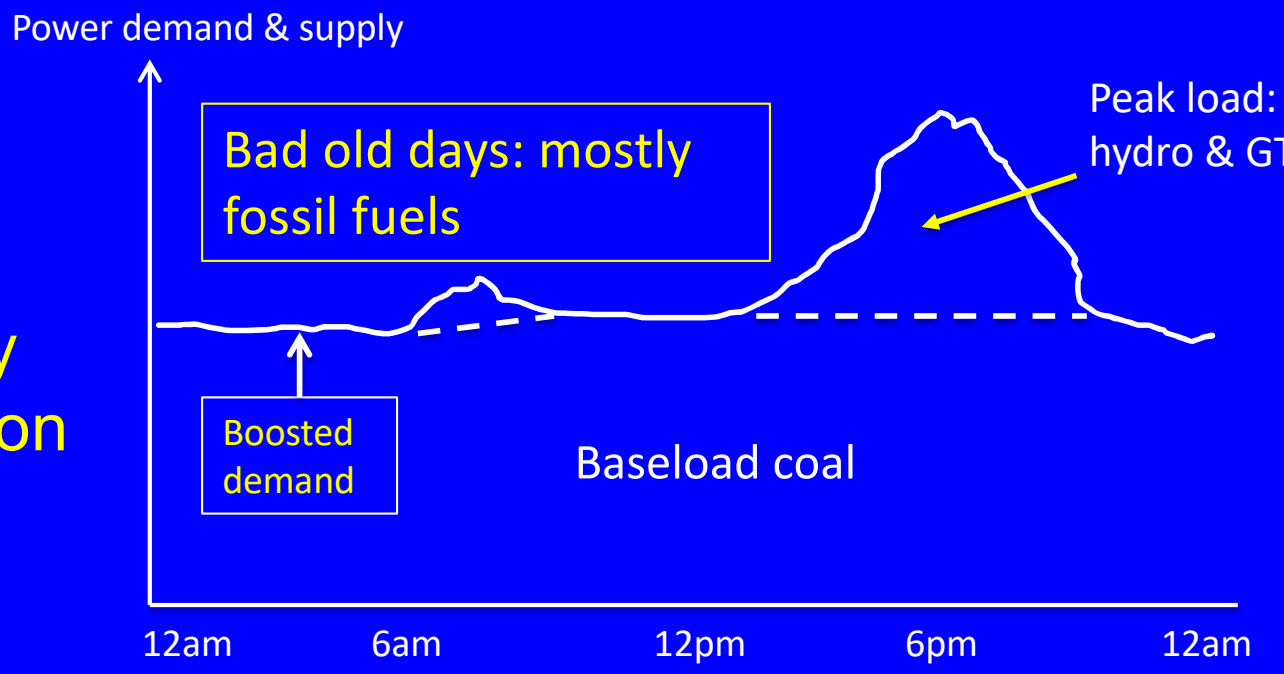
Agrivoltaics

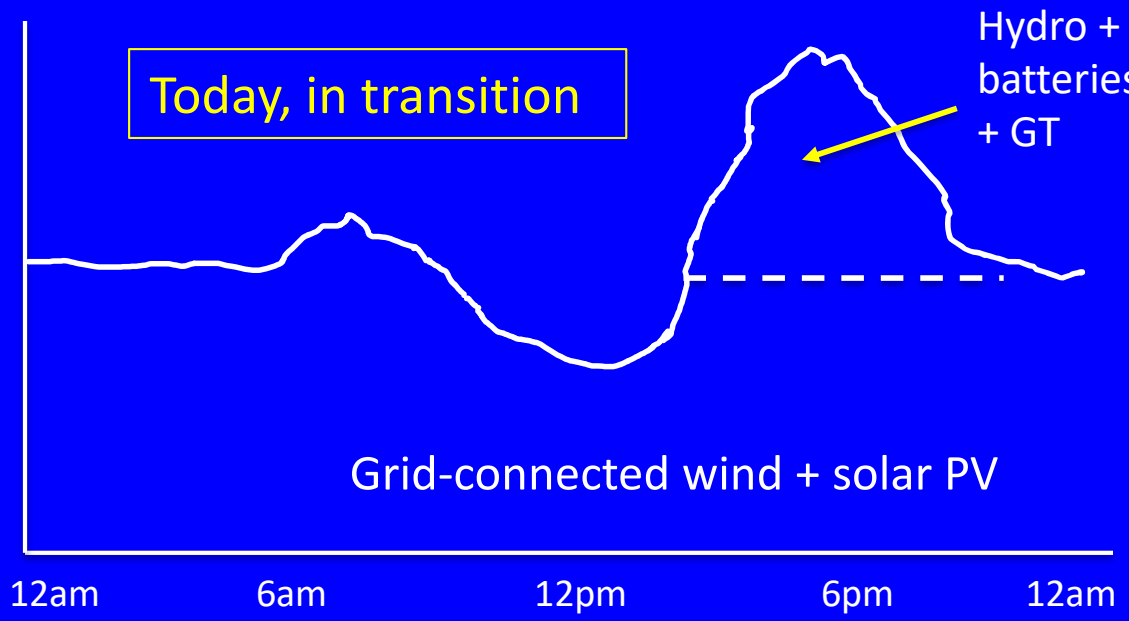
Wind spans large area but occupies little

Myth 2: Baseload

Background: daily electricity demand on the grid, past & present

Hydro, batteries & gas turbines have fast & flexible response





Baseload Myth Refuted by Observation & Simulation

- Australia's National Electricity Market: baseload coal has declined from over 85% to 54.5% in 2024, still declining.
- South Australia generates 74% of electricity, reliably, from variable renewables ***without baseload power stations***
- Denmark with 88% renewable electricity has no nuclear and is phasing out baseload coal, already down to 8% of generation, zero by 2030
- Computer simulations of electricity systems with 100% renewables from Australia and around the world confirm reliability without baseload
- Rare periods of *Dunkelflaute* (dark doldrums) can be supplied by gas turbines fuelled on either fossil gas (temporarily), or biofuels or, in future, green hydrogen: reliability insurance with low premium

Short-term Storage for 100% RElec:
Batteries for storage over several hours

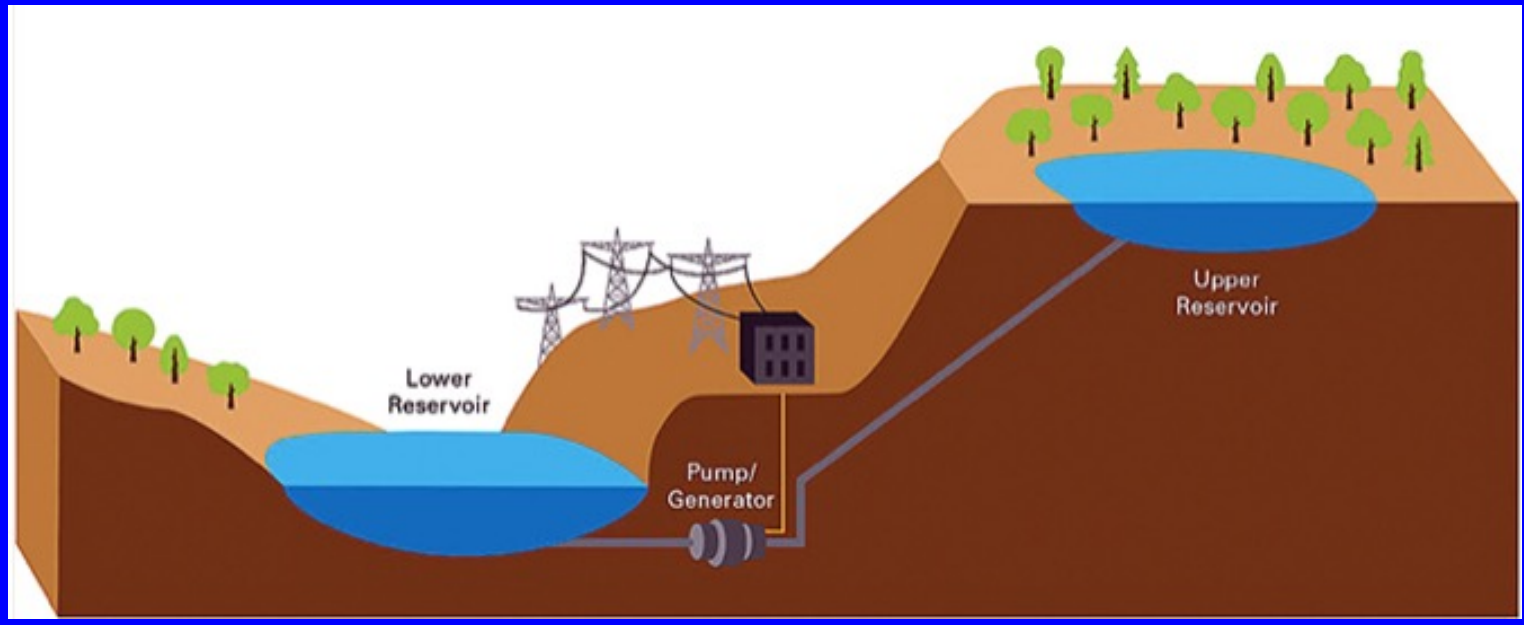
Domestic scale
Battery below, inverter above

Utility scale battery

Medium-Term Storage

Gravitational energy for storage over several days

Pumped hydro

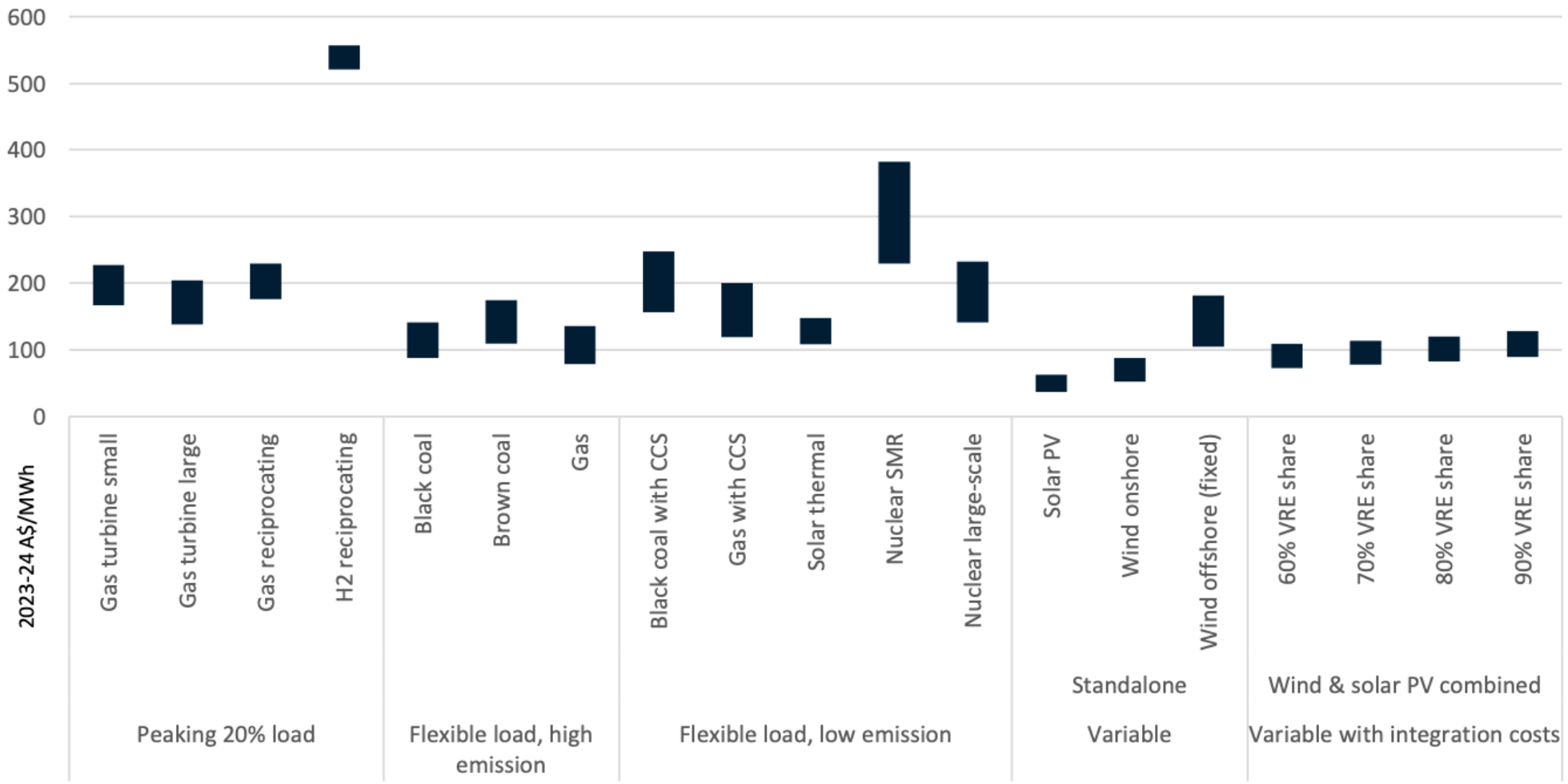


Kidston mine, Qld

Lifting weights

Myth 3: Costs of electricity generation

CSIRO GenCost results for 2030*



*Nuclear is hypothetical as it could not be operating by 2030.

Myth 4: Do we need more gas fields for the energy transition?

- Australia is one of world's biggest exporters of gas. 80% of production is exported (including 5% for liquefaction)

- There is plenty of gas; no need for new gas fields; no immediate threat of shortages, possible shortage in Victoria in 2028 if electrification is slower than declining reserves
- From 2014 to 2022, while coal-fired generation decreased and renewable electricity & battery storage increased, gas-fired electricity decreased by 47%; now 5% of electricity
- Electrification, big batteries & high gas prices are working
- Coalition policy: proposed east coast gas reservation scheme may reduce domestic gas price slightly, undermining transition away from gas heating

Cost of Frontier Economics' Fossil-Nuclear Scenario Vs AEMO 'Step Change' Renewables Scenario

1. Frontier chose capital cost of nuclear to be a fraction of recent nuclear power stations completed or under construction in Finland, France, UK and USA, all highly experienced in nukes
2. Frontier assumes greatly reduced electrification of transportation and combustion heating; then only considers electricity costs, ***ignoring costs of additional oil for transportation and gas for combustion heating***
3. Frontier assumes negligible cost of maintaining old coal-fired power stations on their last legs until nuclear becomes available in 20 years
4. Frontier ignores the substantial additional cost of back-up for *big* nuclear reactors (small modular reactors don't exist), assumes decommissioning is cheap, and ignores waste costs
5. Frontier ignores costs of additional emissions

Nuclear Power Hazards 1

- Proliferation of nuclear weapons assisted & cloaked by the 'peaceful' nuclear industry

  UK, France, India, Pakistan, North Korea, South Africa
  Discontinued attempts by Algeria, Argentina, Australia, Brazil, Libya, South Korea, Taiwan

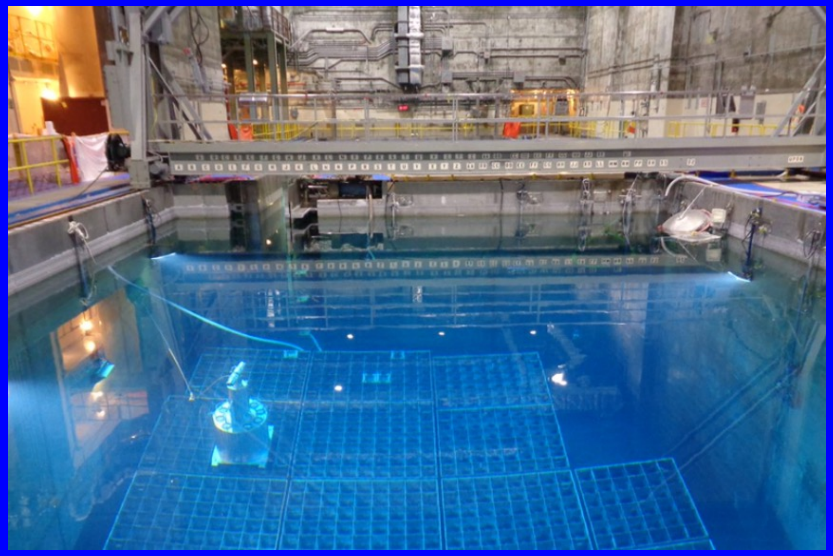
Nuclear Hazards 2

- Disastrous accidents
  - Kyshtym, USSR, 1957: thousands of estimated deaths
  - Three Mile Island, USA, 1979
  - Chernobyl, Ukraine, 1986: IARC estimates 16,000 additional deaths from cancer in Europe
  - Fukushima, Japan, 2011: radiation exposure in Tokyo higher than expected

Kamisu Wind Farm 300 km from earthquake epicenter by Wind Power Ibaraki

Nuclear Hazards 3

- High-level nuclear wastes: no operating final repository Finland will be first; very little waste is reprocessed (except for nuclear weapons); temporary storage in pools (a terrorist risk) and casks



Nuclear Hazards 4

Childhood Cancers near Nukes in Germany

Kaatsch et al. (2007); Spix et al. (2007); Fairlie (2009)

- Case-control study commissioned by the German Federal Office for Radiation Protection
- Considered *all* cancers in children aged < 5 near *all* major nuclear power stations in W. Germany, 1980–2003
- The best study of this issue in the world
- Results: 2.2X leukemias and 1.6X solid cancers within 5 km of a reactor, compared with children living further out
- Dose-response: cancer incidence declined as residential distance increased beyond 5 km
- Results are statistically significant
- Cancers likely due to prenatal exposure to radioisotopes emitted by the nuclear reactors

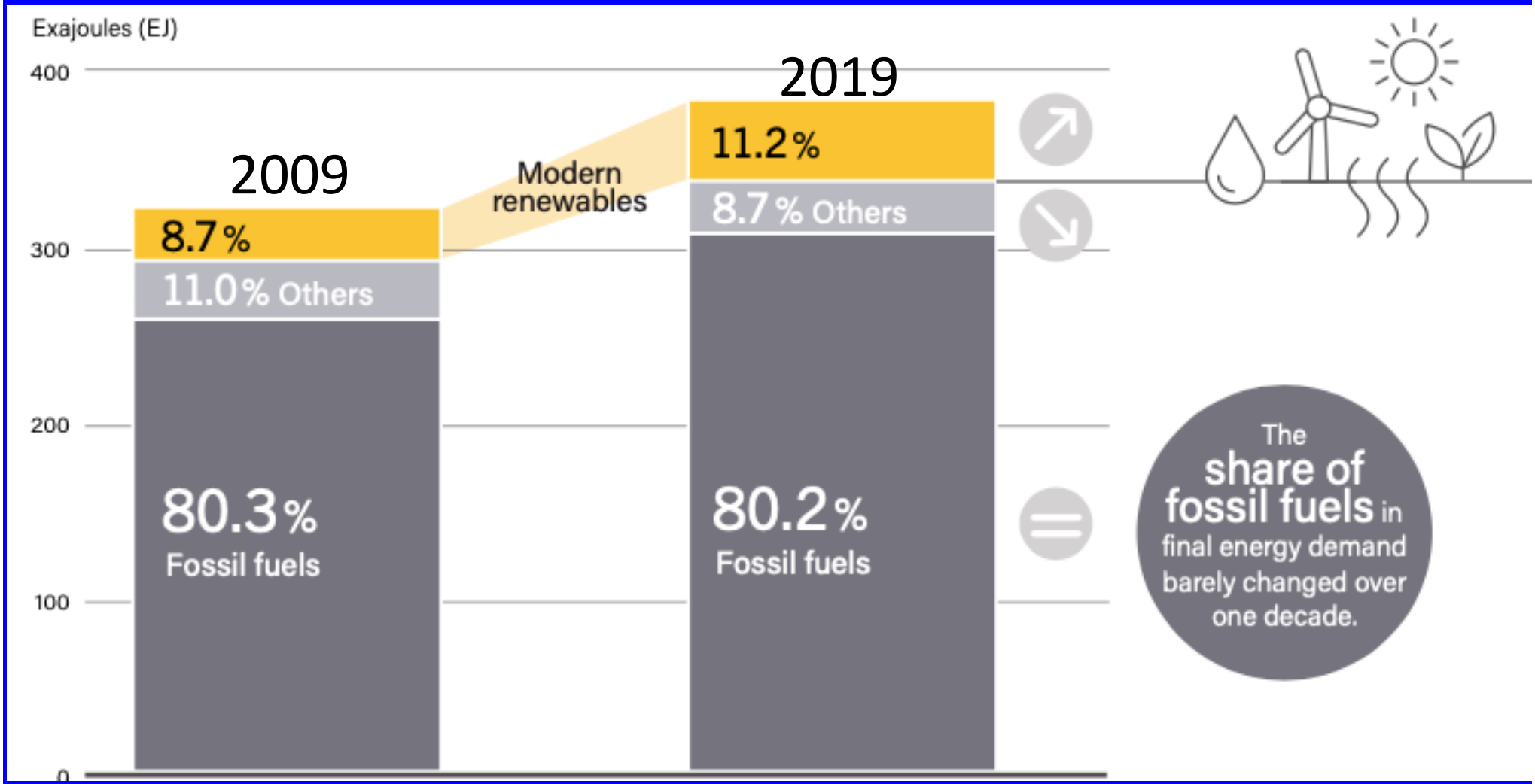
Wallerawang & several small communities are about 5 km from Mt Piper site

Summary: Why Nuclear is a Bad Idea, especially for Australia

- Nuclear is too expensive, too dangerous, too slow to plan and build, and too inflexible in operation to be a suitable partner for renewables
- Most sites proposed by the Coalition are unrealistic
  - WA and SA grids cannot cope with big nuclear stations
  - SA will reach 100% renewables by 2028
  - NSW & Vic could reach 100% renewables by 2035, i.e., before nuclear could be operating
  - Liddell NSW site is already committed to renewables
  - Mt Piper NSW site is only 5 km from town of Wallerawang

Transition Slowed by Growth in Energy Consumption (TFEC = Electricity + Transport + Heating)

Source: REN21 (2021), Fig. 2, based on IEA data



Growth in consumption ⟹ renewable energy is chasing a retreating target

Major Barrier: State Capture

According to Political Scientists & Political Economists

- Capture of the nation-state – government, opposition, public service, media, other institutions – by powerful vested interests
- E.g. fossil fuel, forestry, armaments, finance, property, pharmaceutical and gambling industries
- Captors can include foreign governments

Picture by Rod Taylor

Capture of the Australian Nation-State by Fossil Fuel Interests

- Retiring Ministers for Energy/Resources of both major political parties appointed to highly-paid jobs in fossil fuel industry
- Both the Chief of Staff and a senior political adviser to previous Prime Minister Morrison appointed from Minerals Council of Australia
- Huge donations to both major parties from fossil fuel industry
- Campaigns by News Corp against climate science and renewable energy

Note: I do not question the motives of the people involved.

State Capture in Australia: Methods

- Political donations & election expenditure
- Revolving door jobs
- Concentrated media ownership
- Social media campaigns
- Think tanks (e.g. IPA; ASPI)
- Covert lobbying
- Consultancies
- Neoliberal economics
- Trade dependence

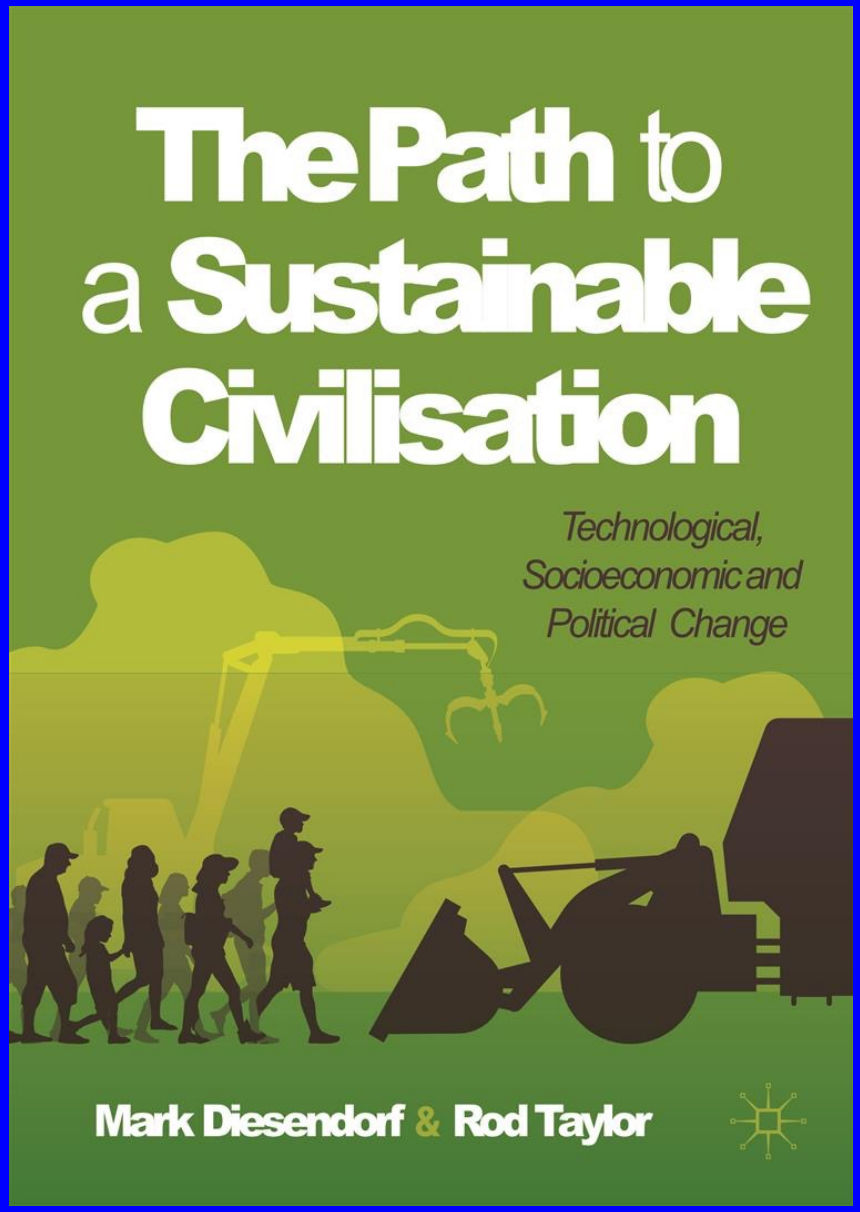
These methods are used to undermine climate action, social justice, human rights and world peace. By combatting them, we can address all these threats.

We Need a Strong Social Change Movement to Challenge State Capture

- We must form an alliance of environmental, public health, social justice, trade union, peace and alternative economics organisations to to expose & combat the driving forces of common to all these issues

- The benefits of weakening state capture will flow to all areas of social change action
- A possible common theme for the proposed alliance is Democracy; e.g., Australian Democracy Network

Further Information



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