ANU ENERGY UPDATE 2021

Frank Jotzo
ANU Institute for Climate Energy & Disaster Solutions
and Crawford School of Public Policy

1 December 2021

Australian
National
University

2021 ANU Energy Update

Decarbonisation trajectories (1pm)

Leon Clarke, University of Maryland:
How the United States can achieve a 50% emissions cut by 2030 and net zero by 2050

Peta Ashworth, University of Queensland:
Decarbonisation options for Australia

Chair: Mark Howden

Zero-emissions industries (2.30pm)

Fiona Beck, ANU: Hydrogen technologies, emissions and costs

John Pye, ANU: Green Iron and Steel

Emma Aisbett, ANU: Trade and certification for green products and fuels

Marghanita Johnson, Australian Aluminium Council:
Pathways for decarbonising Australia's aluminium industry

Chair: Ken Baldwin

Australia's energy transition: the agenda for research and action (4pm)

Bruce Godfrey, ACOLA and ATSE:
ACOLA and Australia's Energy Transition Research Plan

Amanda Cahill, The Next Economy: Regional issues in energy transition

Bec Colvin, ANU: Social and regional transition

Chair: Frank Jotzo

Solar Oration 2021 (5.30pm)

The Solar Century - renewable energy's role in a zero carbon future

Matt Stocks, Marta Victoria; opening by Minister Rattenbury

How to get to Net Zero?

The pillars of net zero

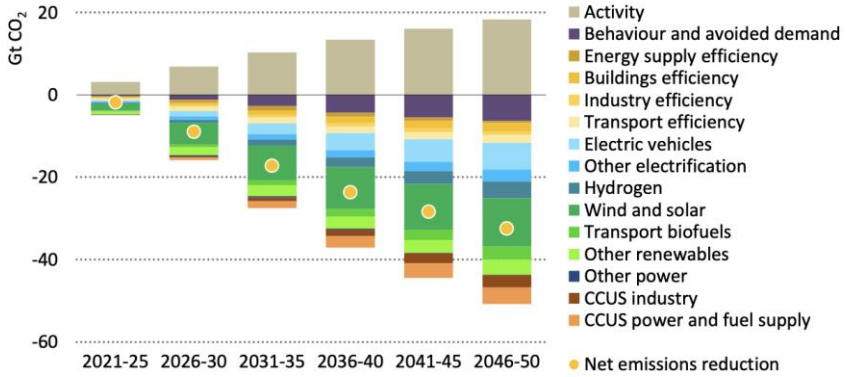
1. *Zero emissions electricity supply*
   A larger, more flexible, integrated, more decentral power system
   Renewables, also nuclear and possibly some CCS
2. *Electrification*
   Transport, industry, buildings
3. *Process changes, product mix adjustment*
   Includes non-CO2 emissions, some CCS in industry
   Industry, agriculture, consumer demand
4. *Carbon dioxide removal*
   To compensate for remaining emissions
   Biological and technical; CCS/CCU in negative emissions systems

Net Zero: IEA scenario

Main element: clean energy – mostly renewables – displaces fossil fuels

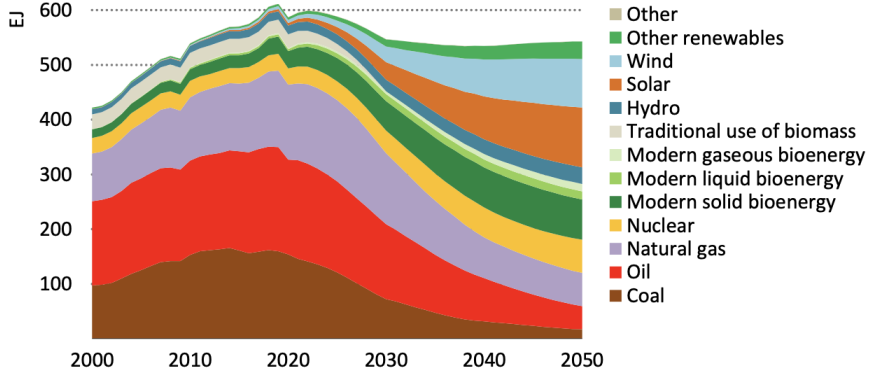
"Total annual energy investment surges to USD 5 trillion by 2030, adding an extra 0.4 percentage point a year to annual global GDP growth"

Figure 2.4 ▷ **Average annual CO_2 reductions from 2020 in the NZE**



Renewables and electrification make the largest contribution to emissions reductions, but a wide range of measures and technologies are needed to achieve net-zero emissions

Figure 2.5 ▷ **Total energy supply in the NZE**



Renewables and nuclear power displace most fossil fuel use in the NZE, and the share of fossil fuels falls from 80% in 2020 to just over 20% in 2050

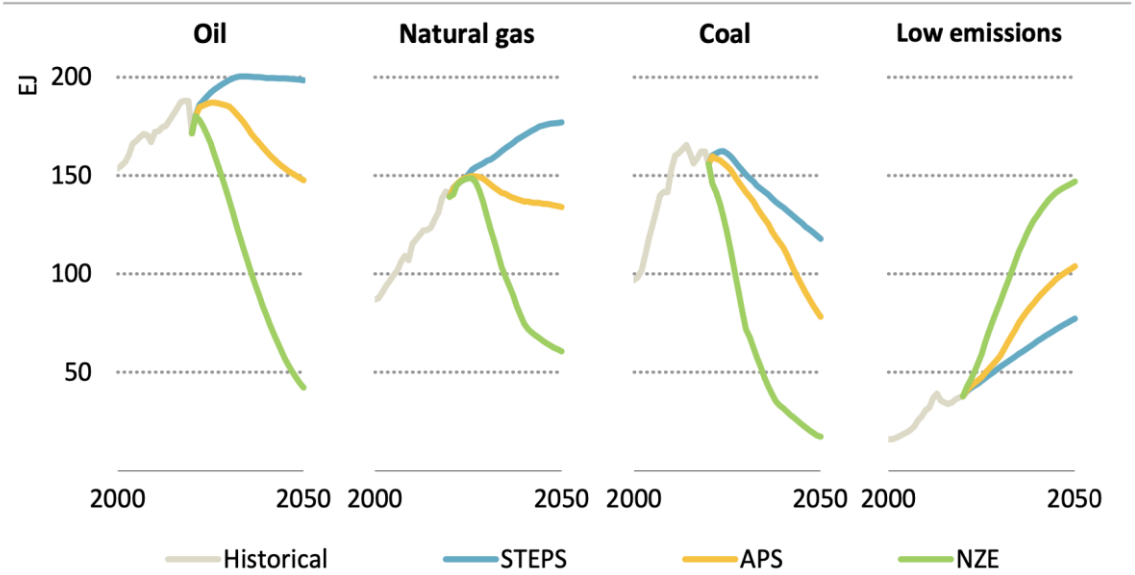
Source: IEA Net Zero report, 2021

Energy supply transition scenarios

How quickly (or slowly) will fossil fuel energy be displaced?

Dramatically different scenarios/visions

Uncertainty for businesses, investors, policymakers, communities

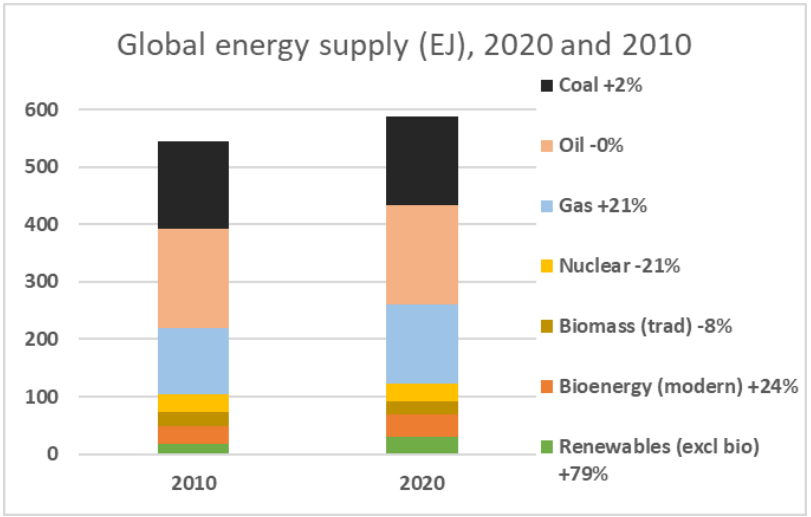


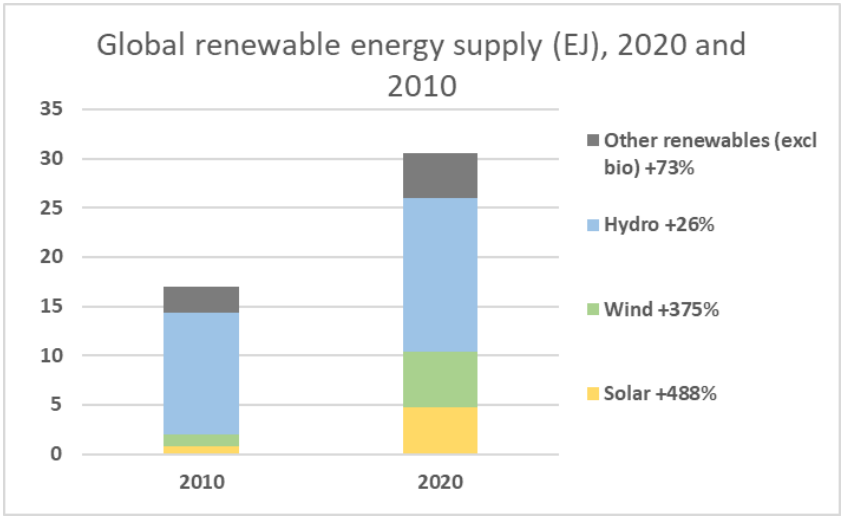
Source: IEA World Energy Outlook 2021

Global energy supply over the last decade

Persistence of fossil fuels

Rapid rise of renewables from low base



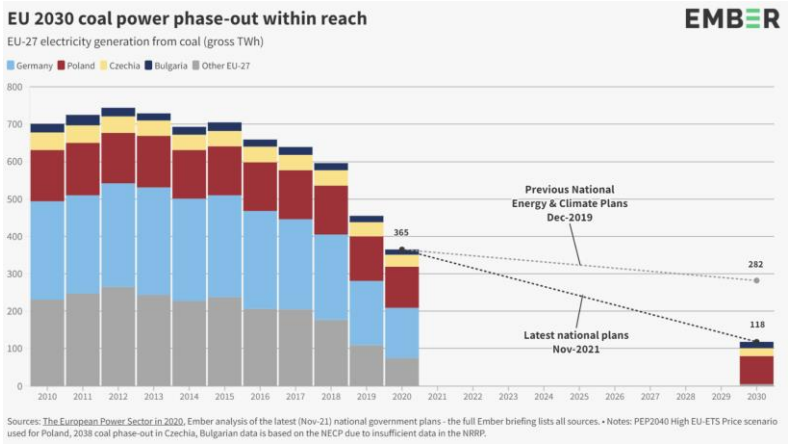


Data: IEA World Energy Outlook 2021

Coal for power is on the decline

Glasgow Pact: "phase down" coal

Europe: coal exit underway (Germany: 2030)



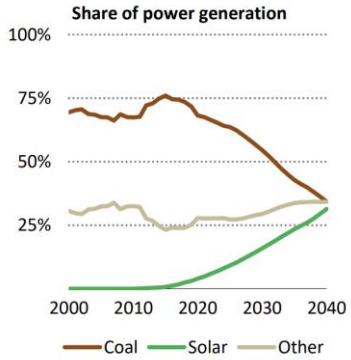
Source: Ember

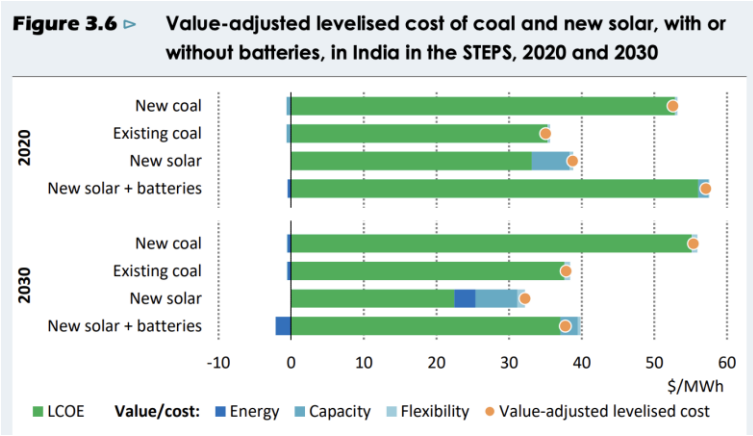
India:
new solar cheaper than coal power

By 2030, solar+batteries likely cheaper than coal

Solar to rapidly gain market share from coal, in IEA stated policy scenario

India's 2030 renewable pledge (Glasgow) indicates faster change



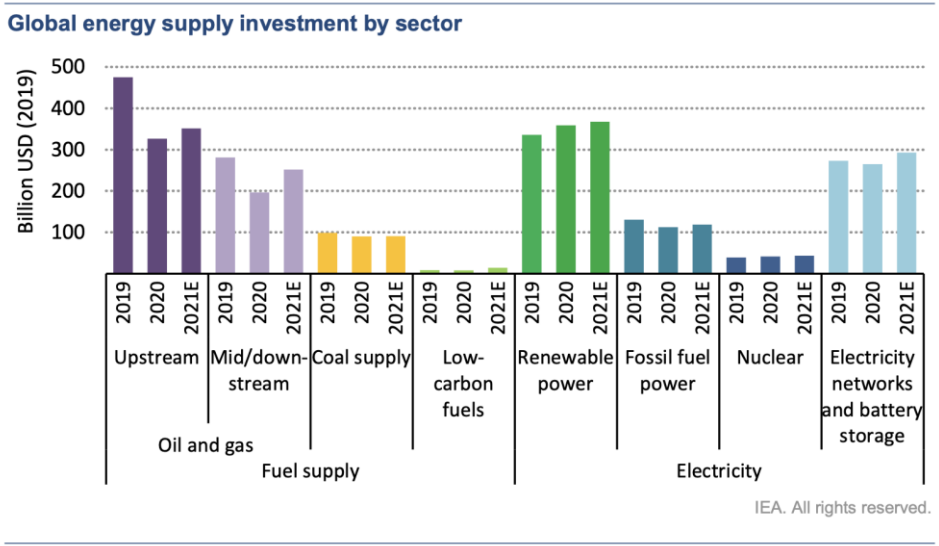


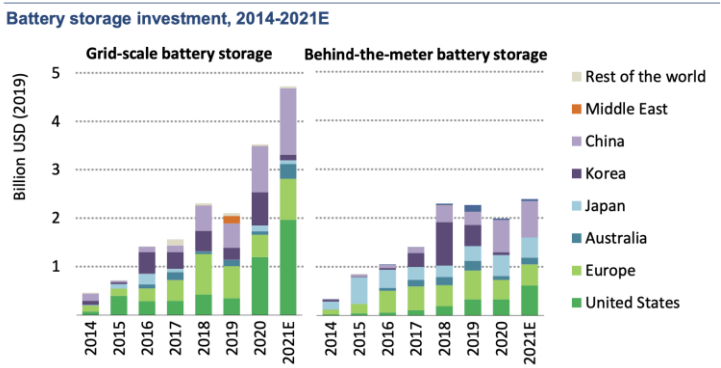
Source: IEA WEO 2021 India special report

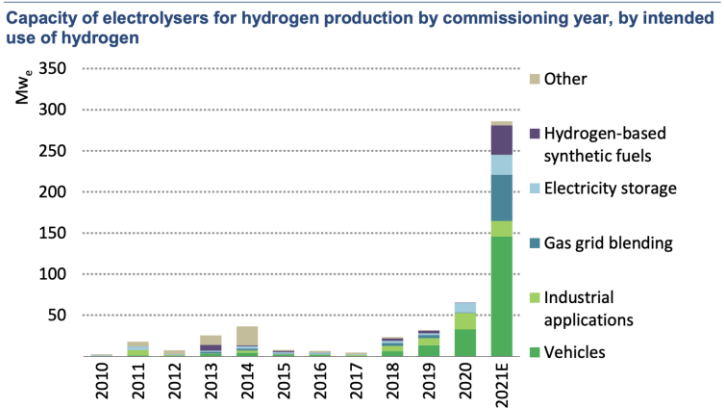
Global energy sector investment

Renewables dominant in power supply investment, but fossil fuel supply investments are still larger

Rapid rise in investment in new energy technologies







Source: IEA World Energy Investment 2021

Australia: potential for deep, rapid emissions cuts

2050 net-zero target but no real national strategy for emissions reductions

2030 target remains at 26-28%, expectation of reduction up to 35%

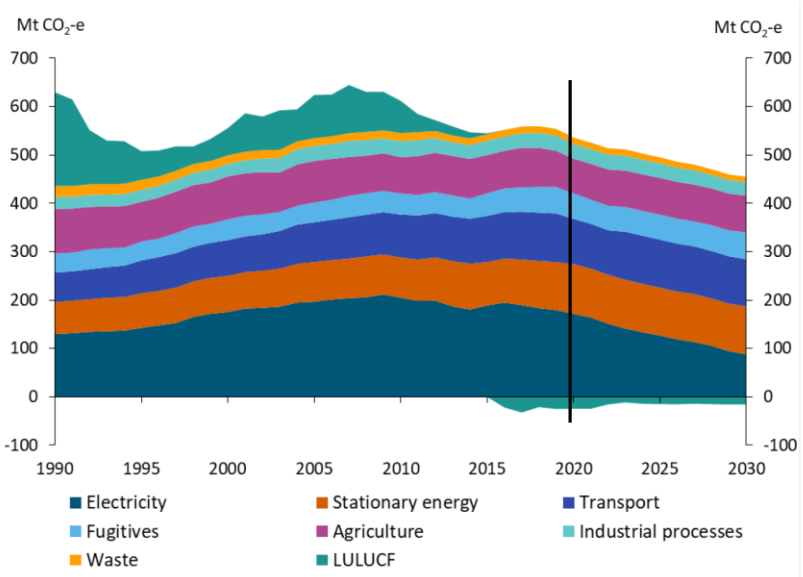
2020 / 2005: emissions -20%, mostly from land-use change and forestry

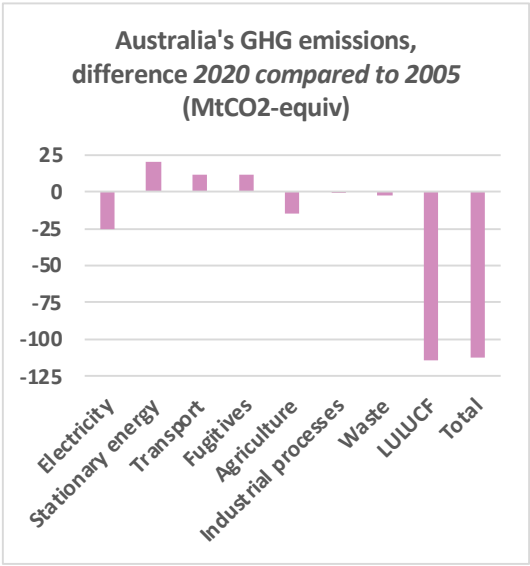
Electricity emissions lower since 2016, no movement elsewhere

Unused opportunities for policy to guide and accelerate low-carbon

Source: Australian Government, Australia's Emissions Projections 2021

Figure 7: Australia's 2021 emissions projections, 1990 to 2030, Mt CO_2-e

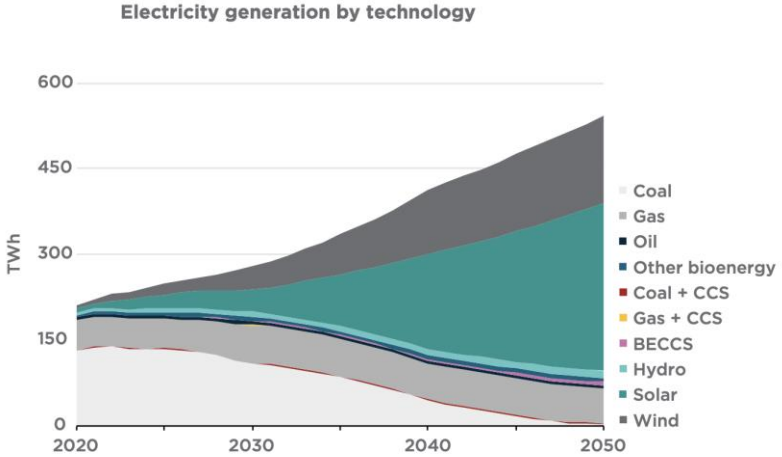


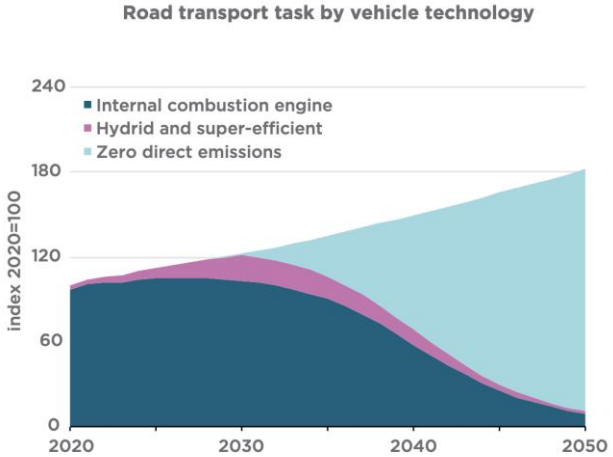


Projections and analysis are often rooted in the past, may overlook rapid change

Modelling of fossil fuels for the Australian "plan":

- *Projected change in value of output, 2020-2050: Coal -51%, gas +13% (incl exports)*
- *Gas-fired electricity generation* ***growing*** *(?!)*
  AEMO ISP 2020: gas generation falling to ~2% in the 2030s. SA ~6% gas at >100% RE
- *Very slow electrification in transport*





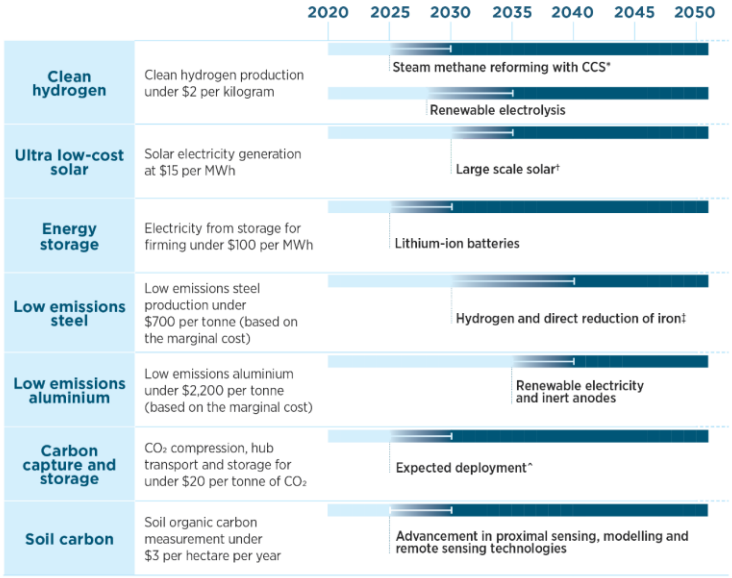
Source: Australian Government 2021, AUSTRALIA'S LONG-TERM EMISSIONS REDUCTION PLAN: Modelling and Analysis

Technology targets

Decarbonisation is enabled by cost-competitive zero-emissions technologies

The majority of technologies needed for decarbonisation already exist
What is needed is large scale deployment

R&D needed for some specific technologies
Eg in industry/agriculture, and carbon dioxide removal
'Priority technologies': Where can Australia make a difference in global



Australia's energy transition: electricity

Decarbonisation of Australia's electricity supply is underway
Much more wind and solar; less coal, less gas
Emissions intensity of electricity supply reduced by 20% over 5 years (15% on-grid)

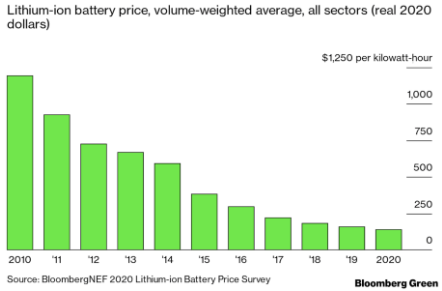
Details: ANU Australia Energy Emissions Monitor, 1st issue this week

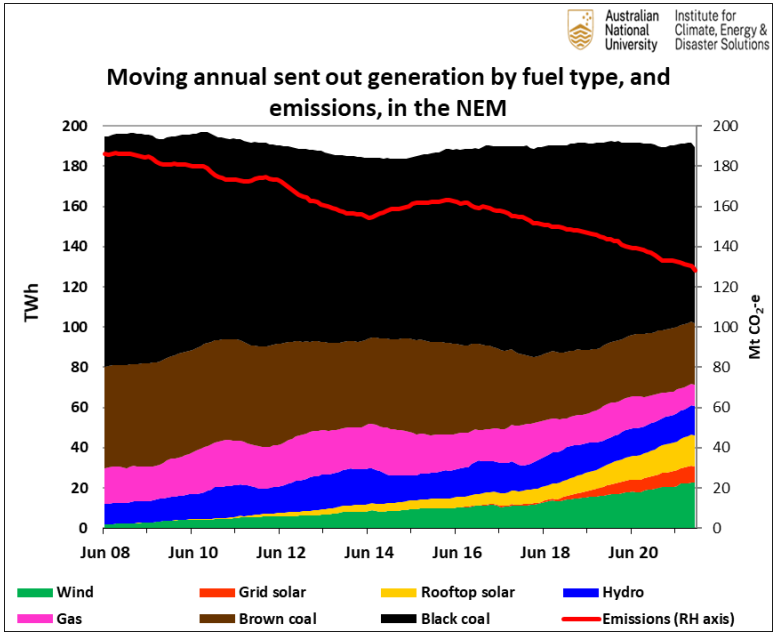
Storage: batteries becoming rapidly cheaper

Grid-scale storage needs appropriate market rules to efficiently use cheap/free energy when available

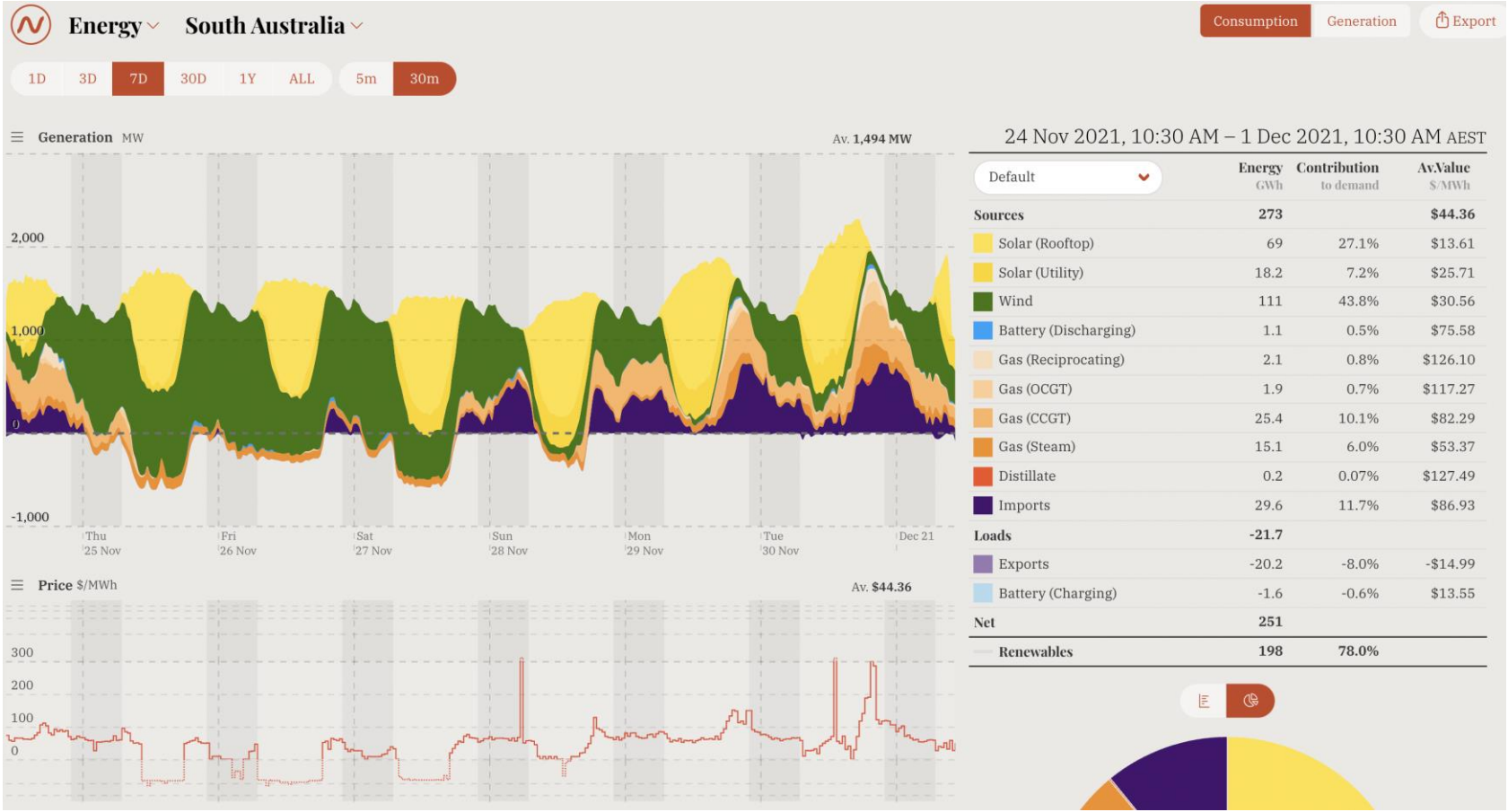
Decentralized battery storage, incl neighbourhood level batteries, EV integration

Battery costs falling with volume





South Australia's power supply: sometimes >100% renewables



Source: OpenNEM (AEMO

Renewable energy: opportunities for Australia

Low-cost, zero-emissions domestic energy supply
Solar and wind based, with storage and decentralized supply

Energy exports
Hydrogen, ammonia/synthetic fuels, electricity by cable

Hydrogen
Feedstock for energy intensive products, heavy transport

Energy intensive export industries
Aluminium, green iron/steel, minerals/metals, chemicals

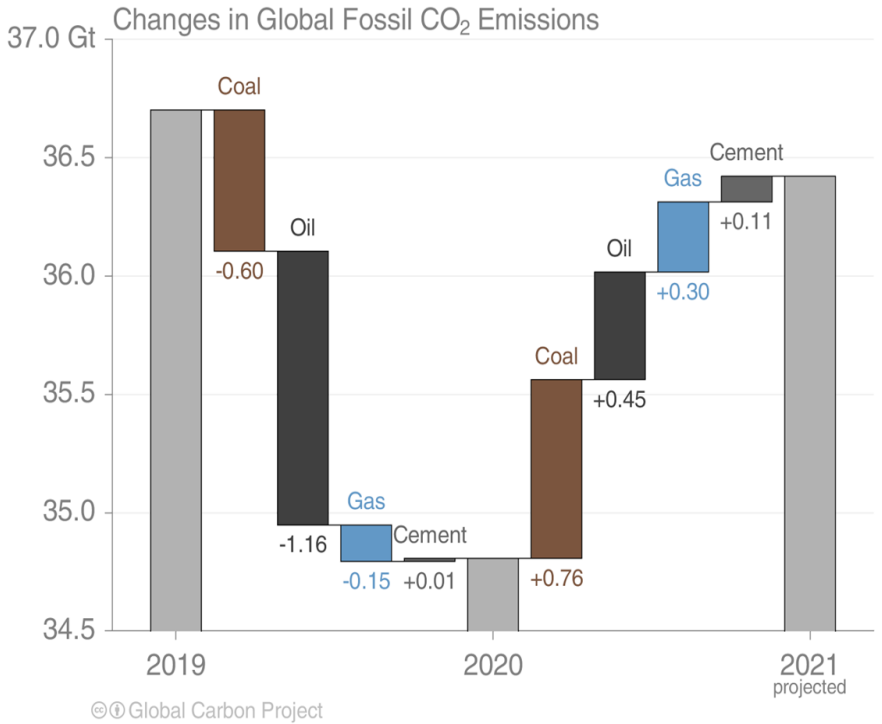
Value added from future renewables based industries could be very large
… while fossil fuel output and value will decline, structural adjustment

Need signalling, positioning, paving the way for the large investments needed

… and support for fossil fuel heavy regions to adjust.

COVID's temporary effect

2021 Rebound of global energy use and emissions after 2020 Covid dip



Source: Global Carbon Project – Global Carbon Budget 2021