ENERGY UPDATE 2023

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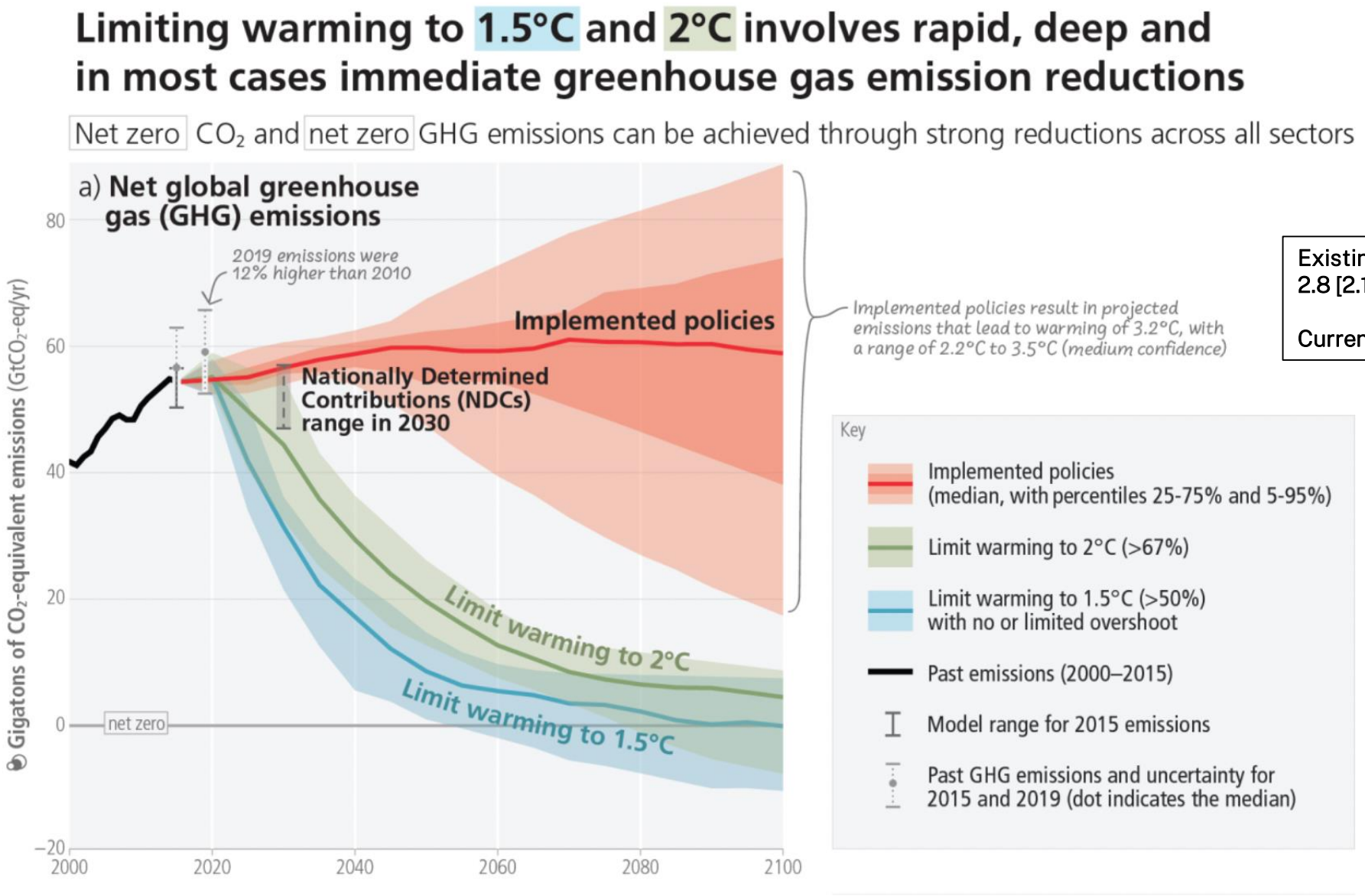
NOVEMBER 2023

Australian National University

Global emissions trajectories to limit future warming



Existing NDCs collectively consistent with 2.8 [2.1–3.4]°C by 2100.

Current policies on track to 3.2 [2.2–3.5]°C.

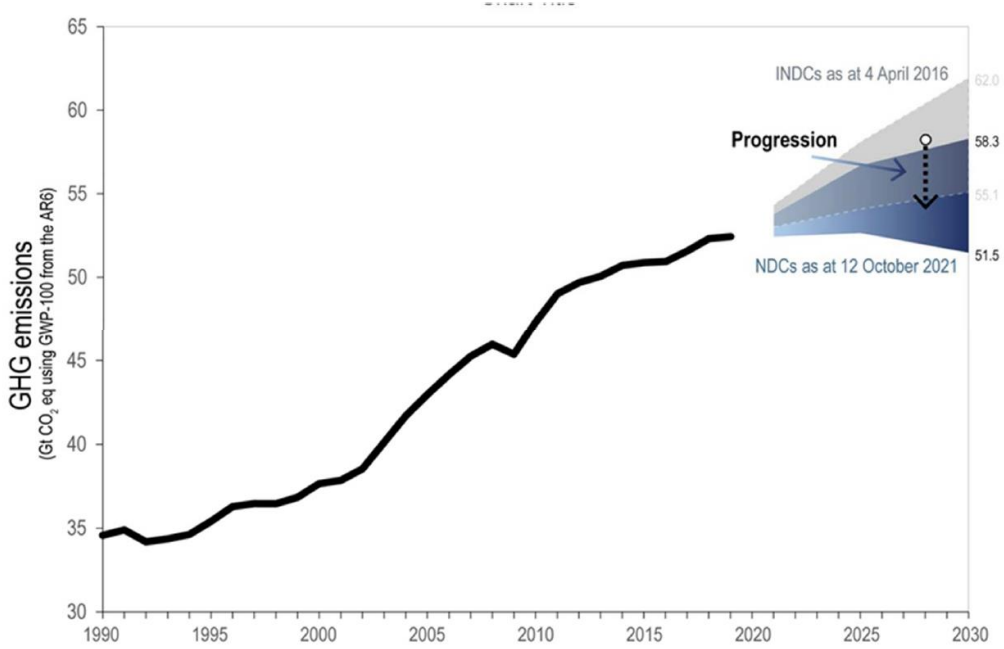
Carbon dioxide emissions are reduced more deeply than total GHG emissions

Most modelled 1.5d pathways include overshooting 1.5 in the period before 2100

Source: IPCC 6AR Synthesis Report, 2023

Global Stocktake (COP28)

Figure 2
Projected range and progression of emission levels



Paris Agreement has driven climate action

… but the world is falling far short of what is needed

… need much more ambition in future NDCs,

implementation of pledges,

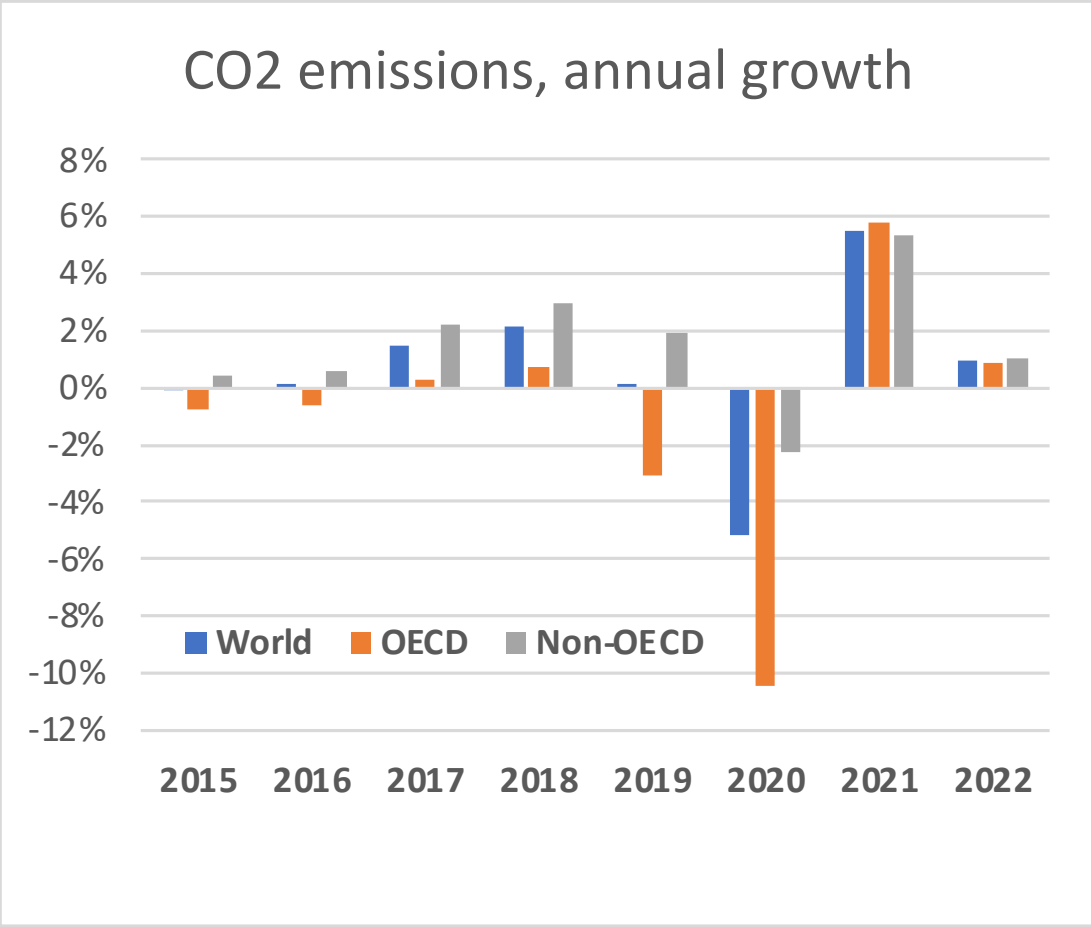
support for action in developing countries

'Systems transformations' needed

… and a focus on inclusion and equity, to support an increase in ambition

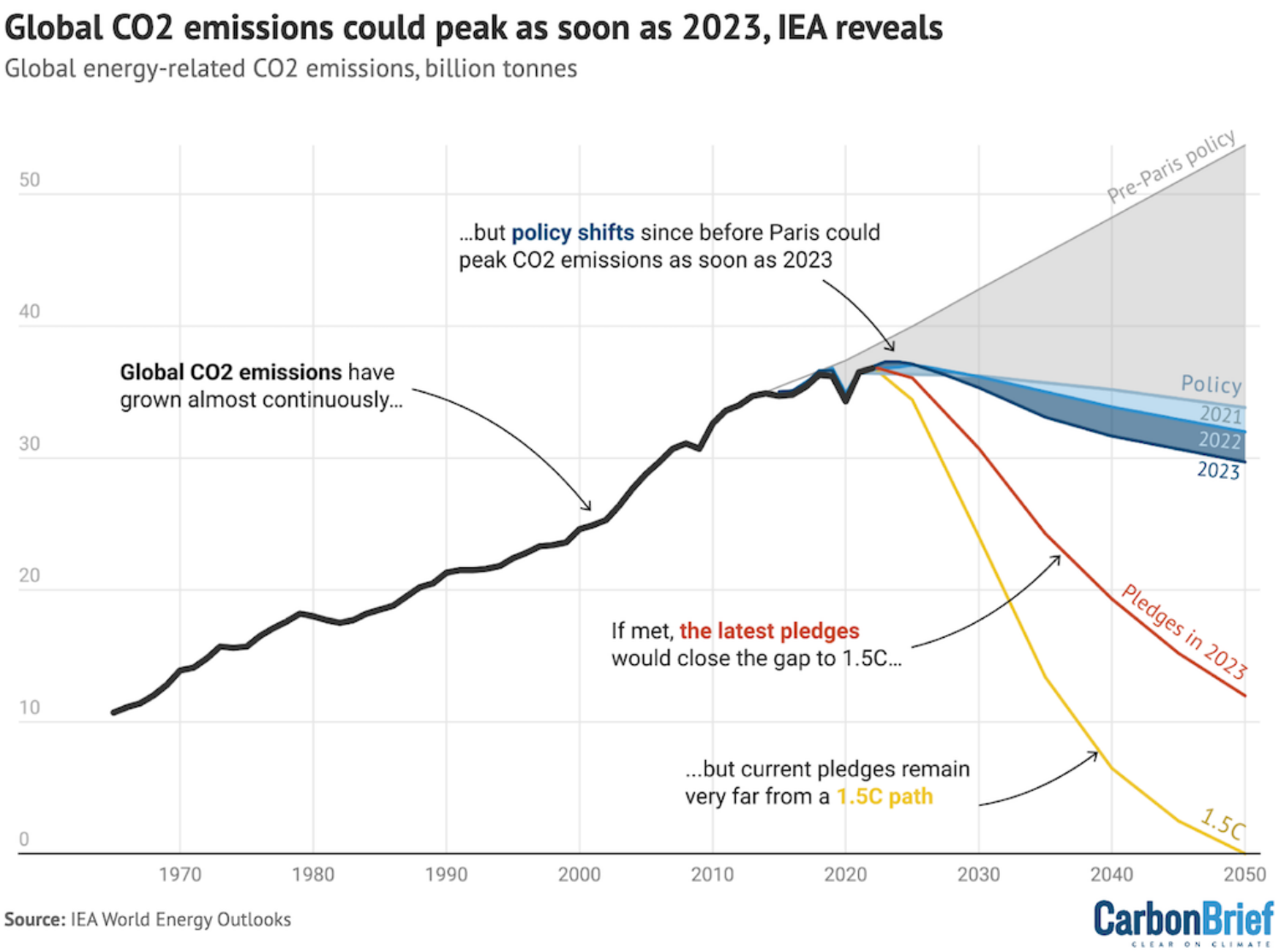
Source: Global Stocktake Synthesis Report

Emissions growth rates



Data: BP

Implications for future world emissions trajectories



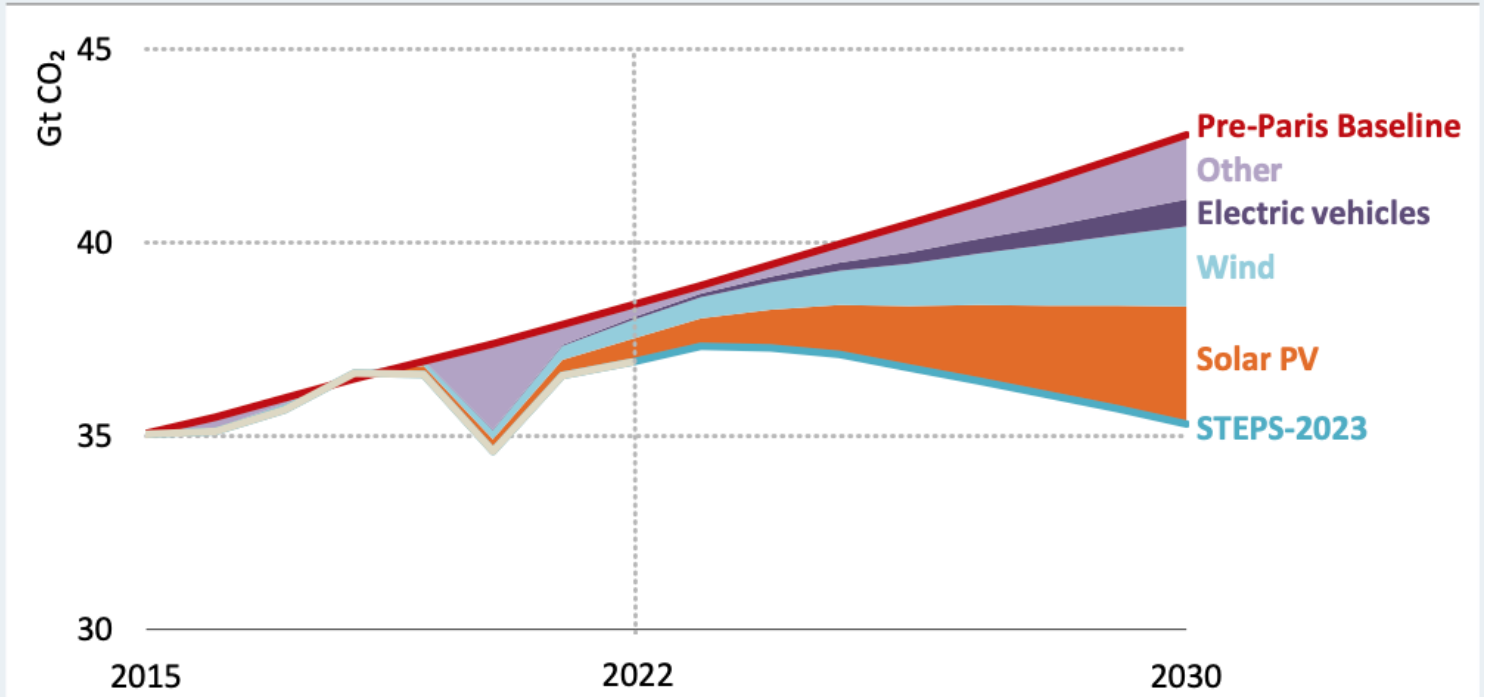
Peak CO2 is in reach:

- Renewables
- Electrification
- Slower growth eg China

Pledges towards net-zero keep below-2°C in reach

Renewables have made, will make the biggest difference

Figure 1.15 ▷ **Global energy sector CO_2 emissions in the pre-Paris Baseline Scenario and the STEPS, 2015-2030**



STEPS is the IEA ‘stated policies’ scenario

Source: IEA WEO 2023

Very large *potential* to cut emissions, globally

- Options for 50% emissions by 2030 identified at cost <US$100/tCO2-eq

Large potential at very low costs

- Half of the total at cost <US$20/tCO2-eq

Majority of low-cost potential in energy

- Esp solar, wind
- Overall reduction potential split roughly 1/3 between
  1) energy,
  2) ag/forestry/land-use-change,
  3) everything else

IPCC 6th Assessment Report, Working Group III

Many options available now in all sectors can together substantially reduce net emissions by 2030.

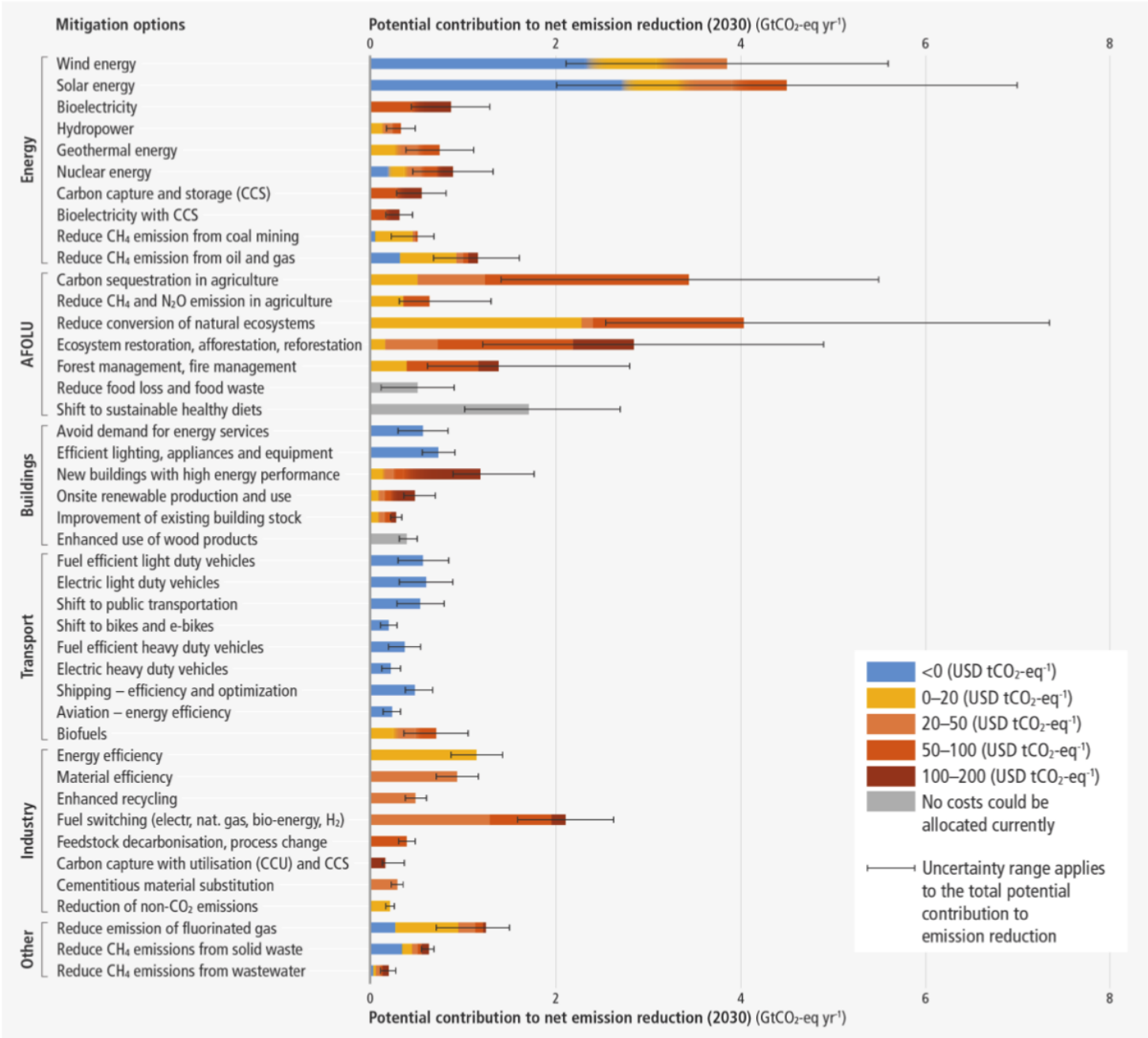
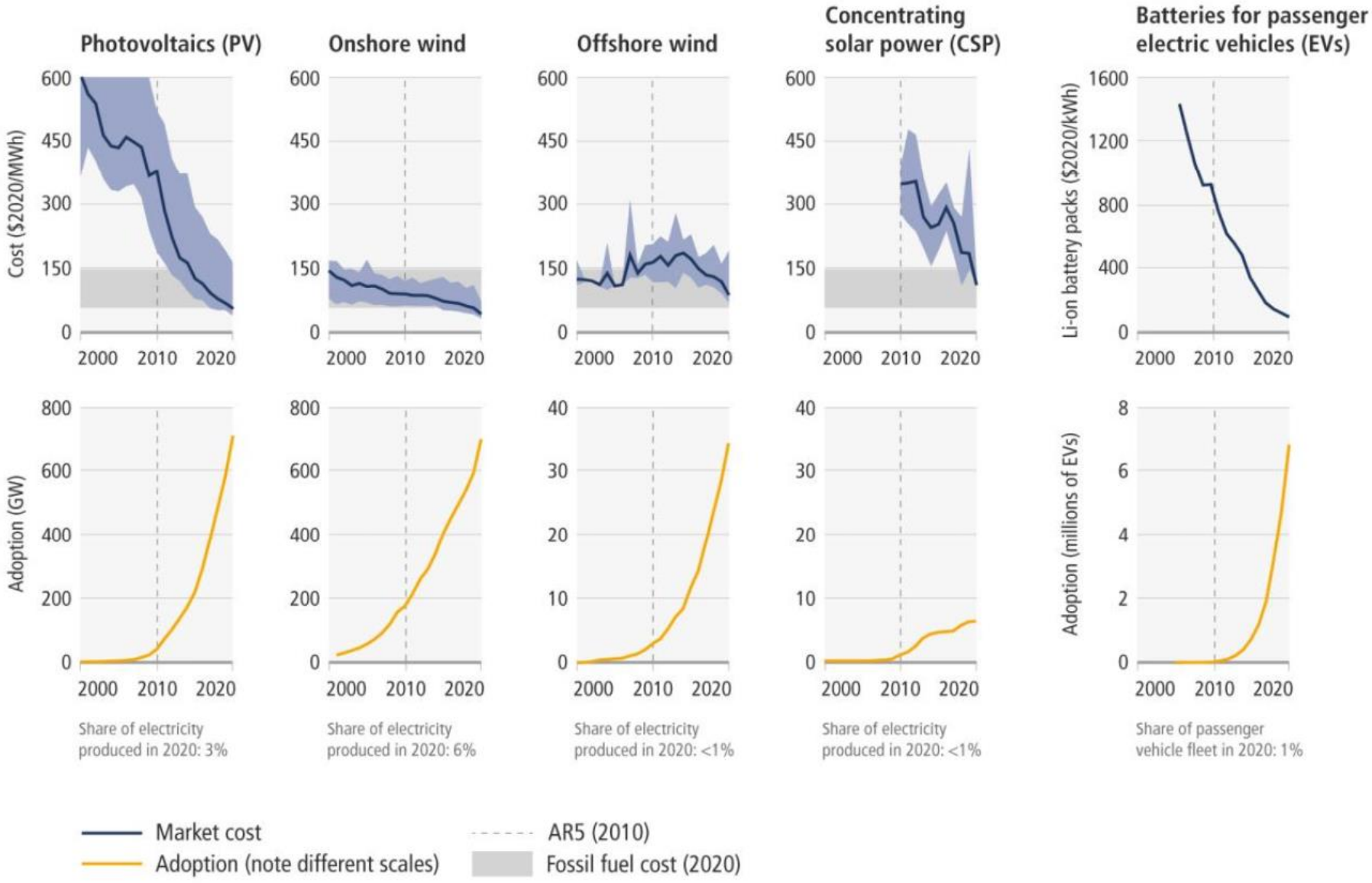
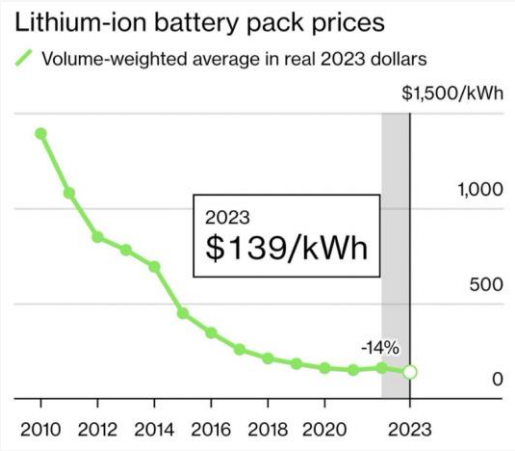


Figure SPM.7: Overview of mitigation options and their estimated ranges of costs and potentials in 2030

The unit costs of some forms of renewable energy and of batteries for passenger EVs have fallen, and their use continues to rise.





Solar PV

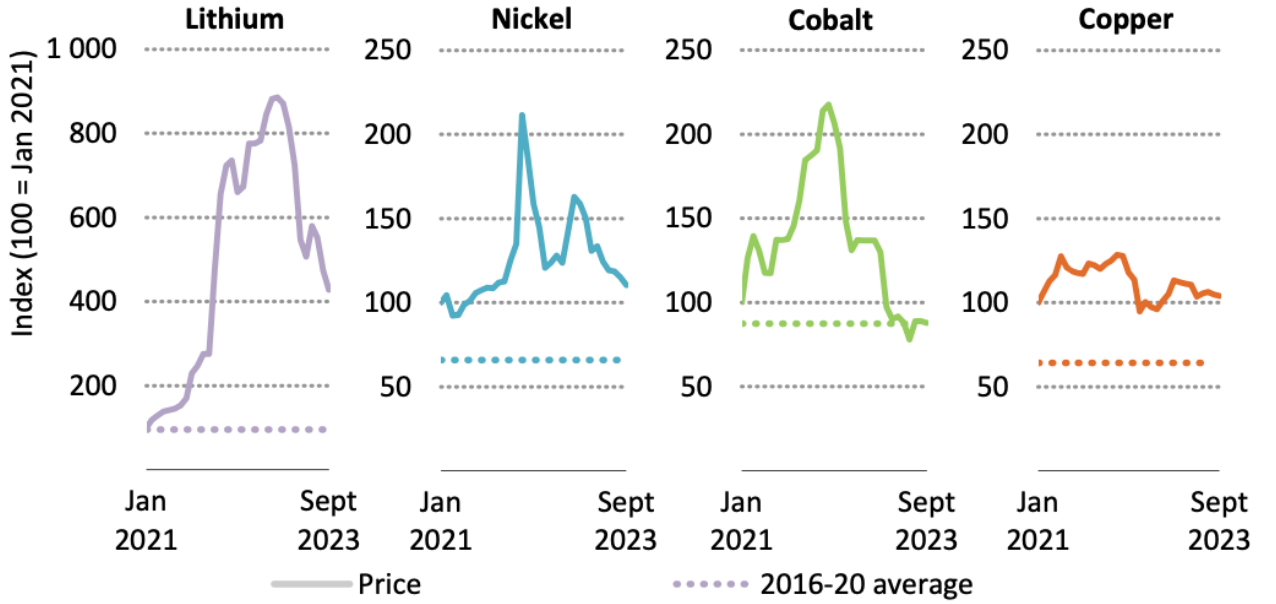
Typical module price now US$0.16/W

Global new build 2023 ~400 GW

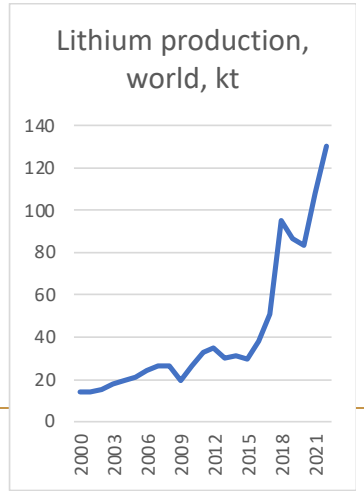
2023 ~ +50%

Supply bottlenecks are usually temporary

Figure 2.7 ▷ **Price developments for selected energy transition minerals and metals, January 2021 to September 2023**



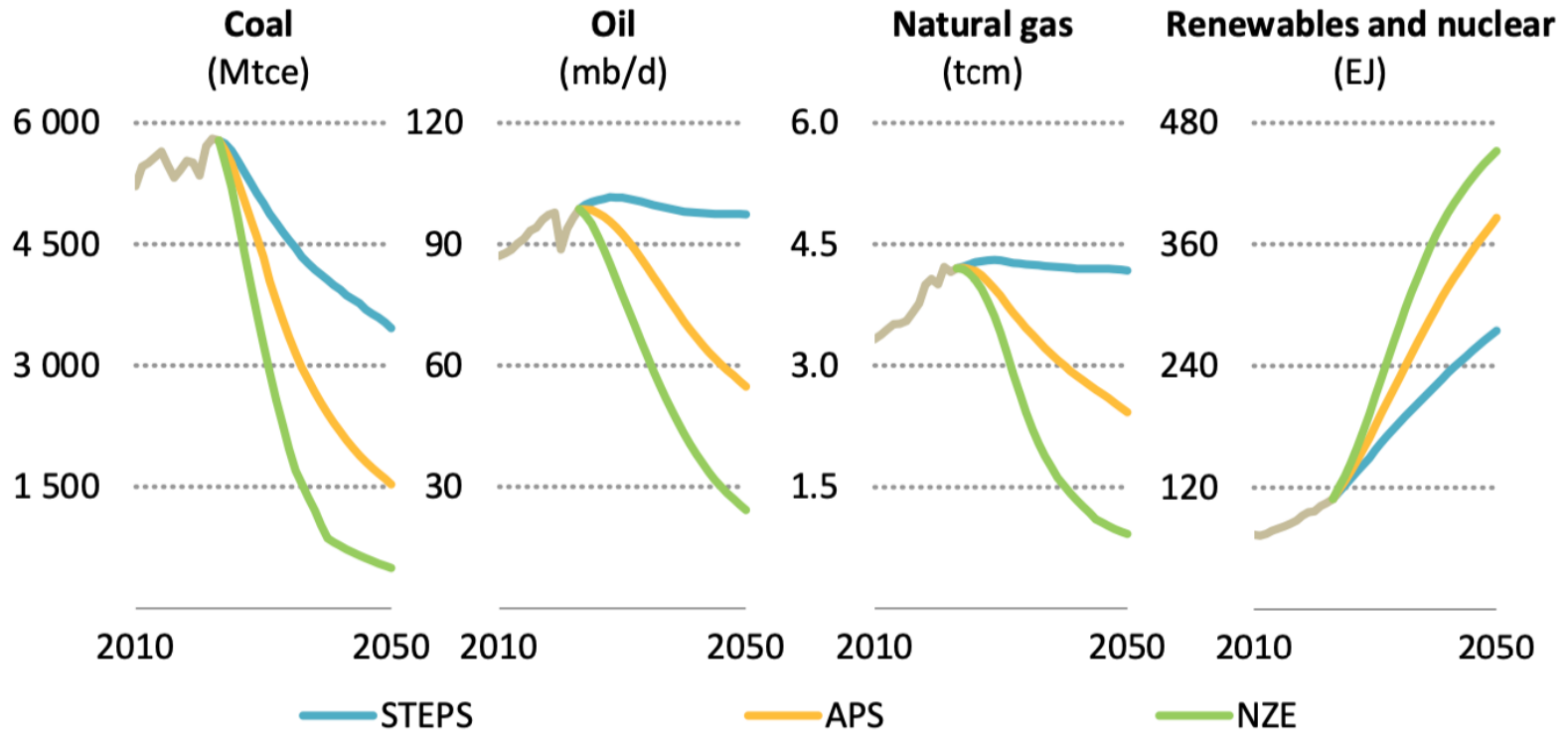
Supply catches up to demand, moderating price increases



Source: IEA WEO 2023 (prices), BP (production)

Outlook to 2050: A radically changing energy mix

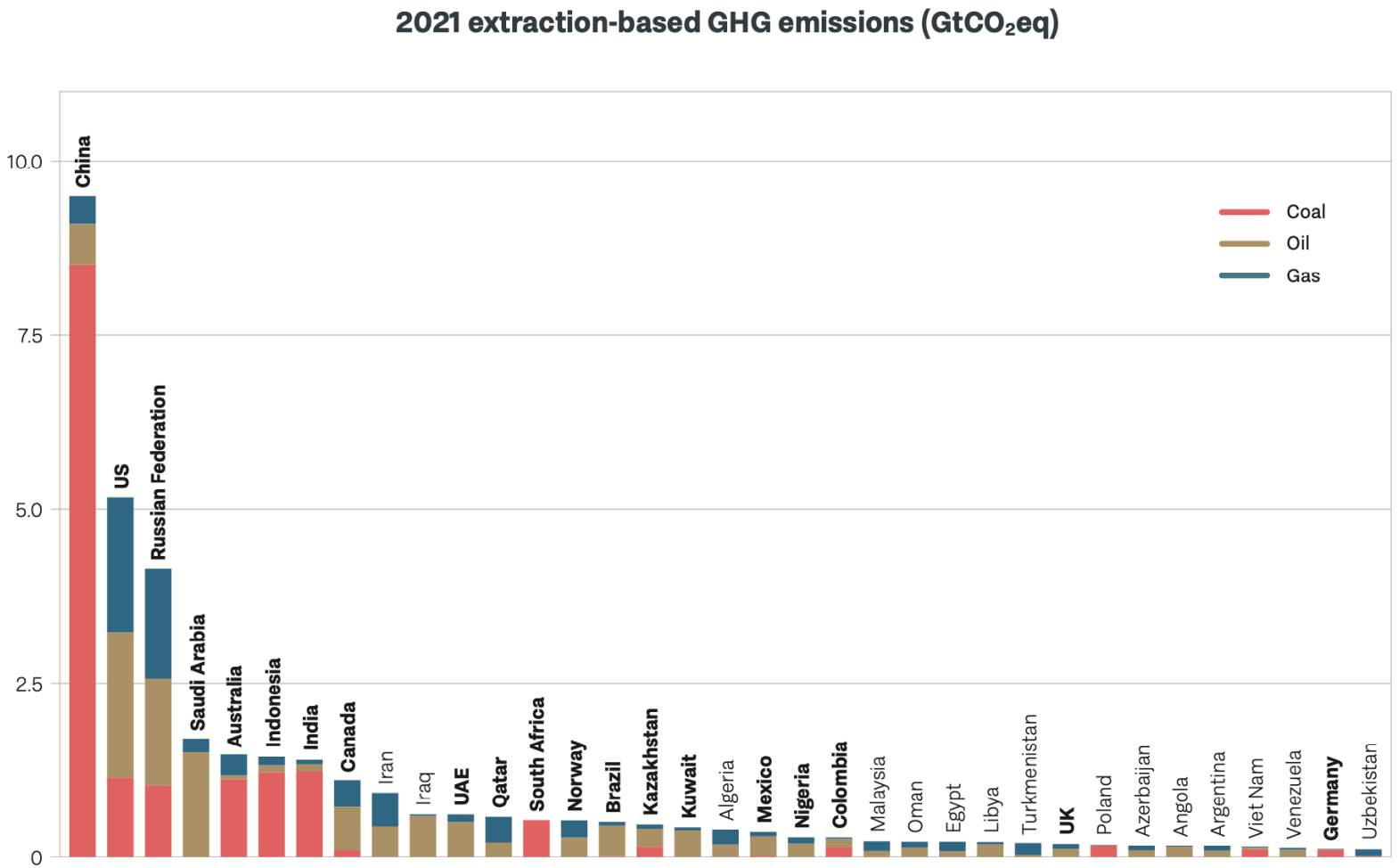
Figure 3.1 ▷ Global total energy demand by fuel and scenario, 2010-2050



STEPS: ‘stated policies’, APS: announced pledges, NZE: net zero

Source: IEA WEO 2023

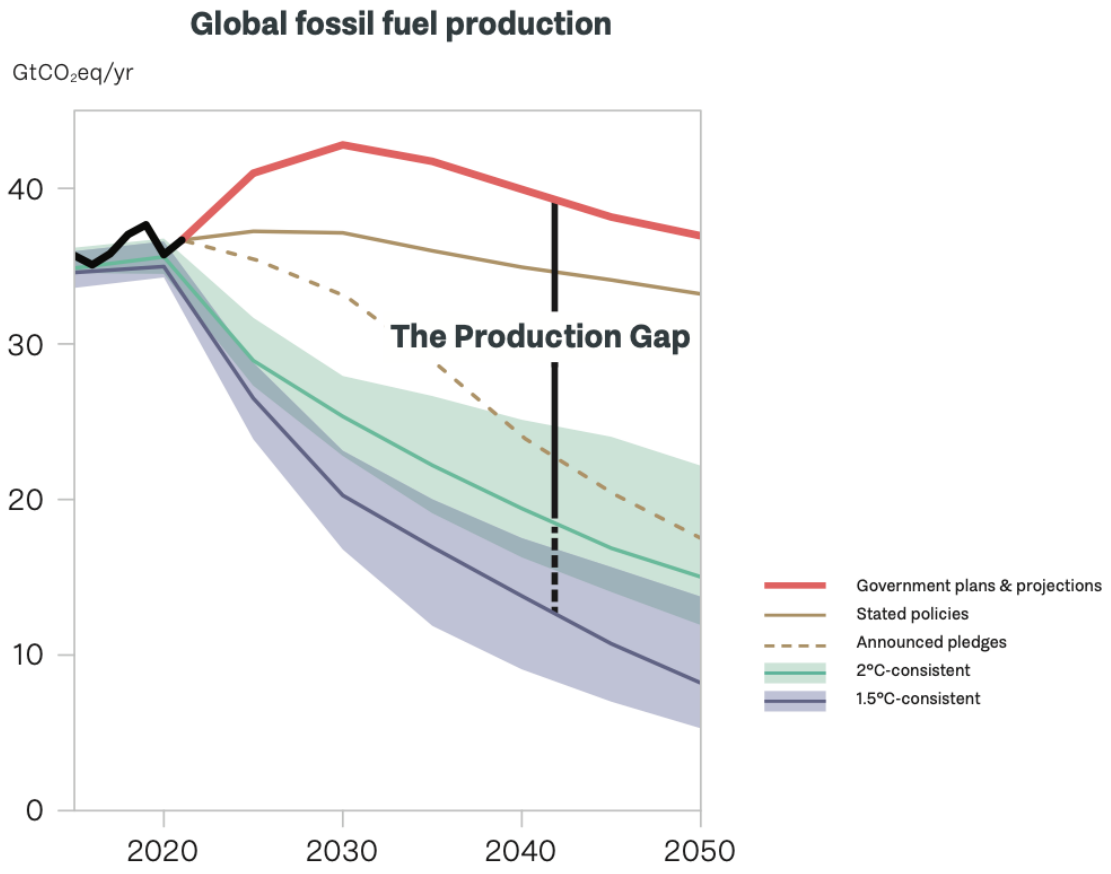
Economic vulnerability to fossil fuel phase-down concentrated in a small set of countries

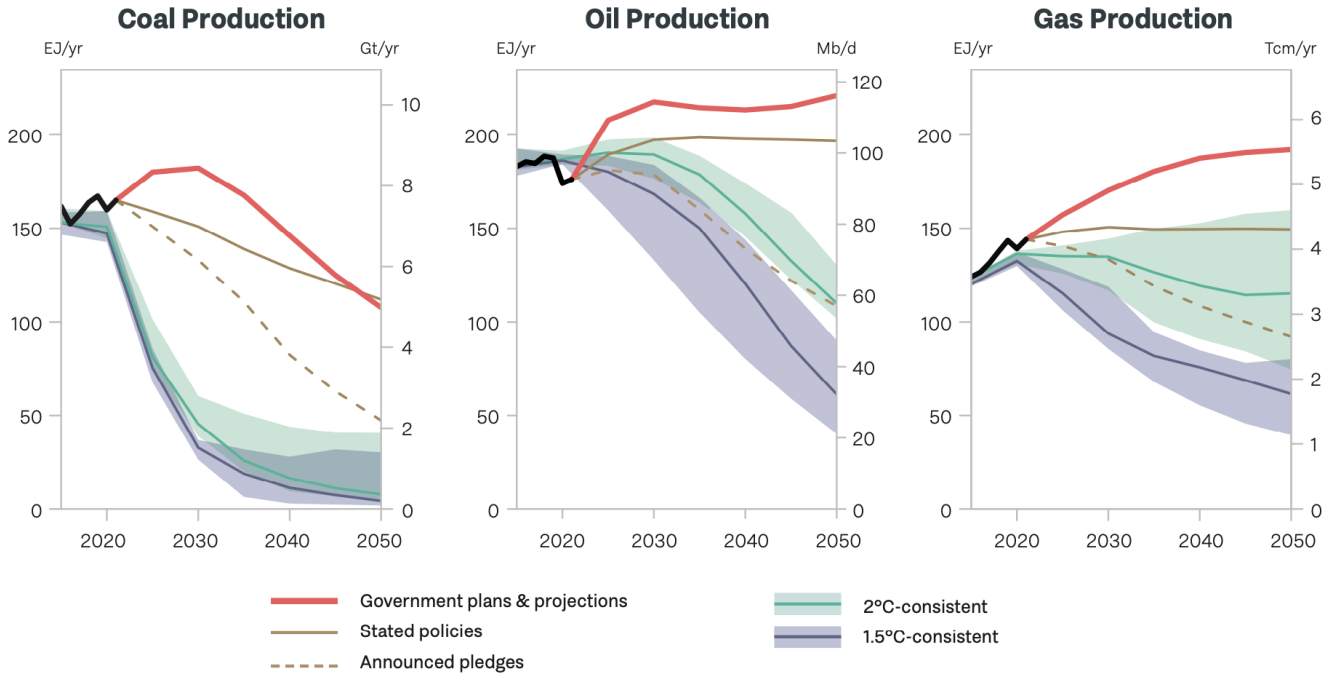


Watch for ‘fossil-fuel phase-down’ or ‘phase-out’ at COP28

Source: SEI ea Production Gap Report 2023

Are fossil fuel producing countries planning for the coming fossil fuel phase-down?





Source: SEI ea Production Gap Report 2023

Industrial decarbonization: big shifts on the horizon

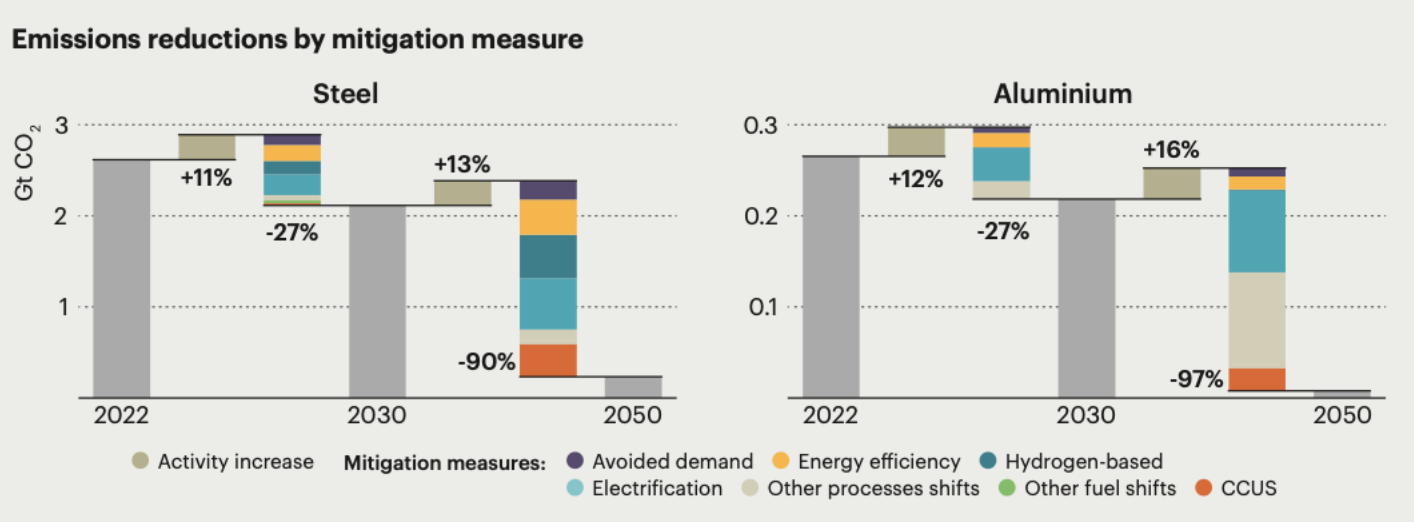
Steel: Recycling, efficiency, electrification, hydrogen

Aluminium: zero-emissions electricity, process improvements

Cement: CCUS, efficiency, feedstocks

Chemicals: CCUS, hydrogen, electrification, efficiency, feedstocks

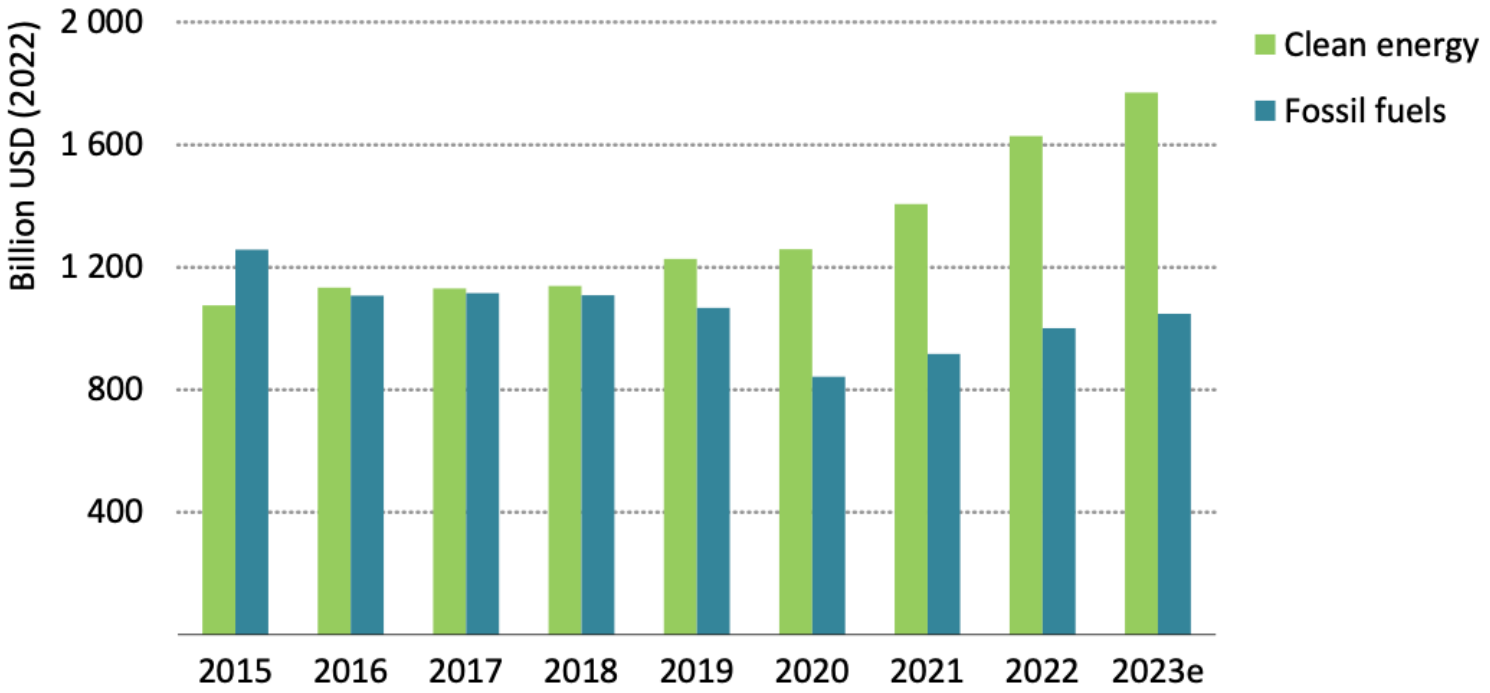
Zero-emissions supply chains are geographically different: Australia's renewable energy export opportunity



Source: IEA Net Zero Roadmap 2023

Clean energy investment growing fast, fossil fuel investment still growing gradually

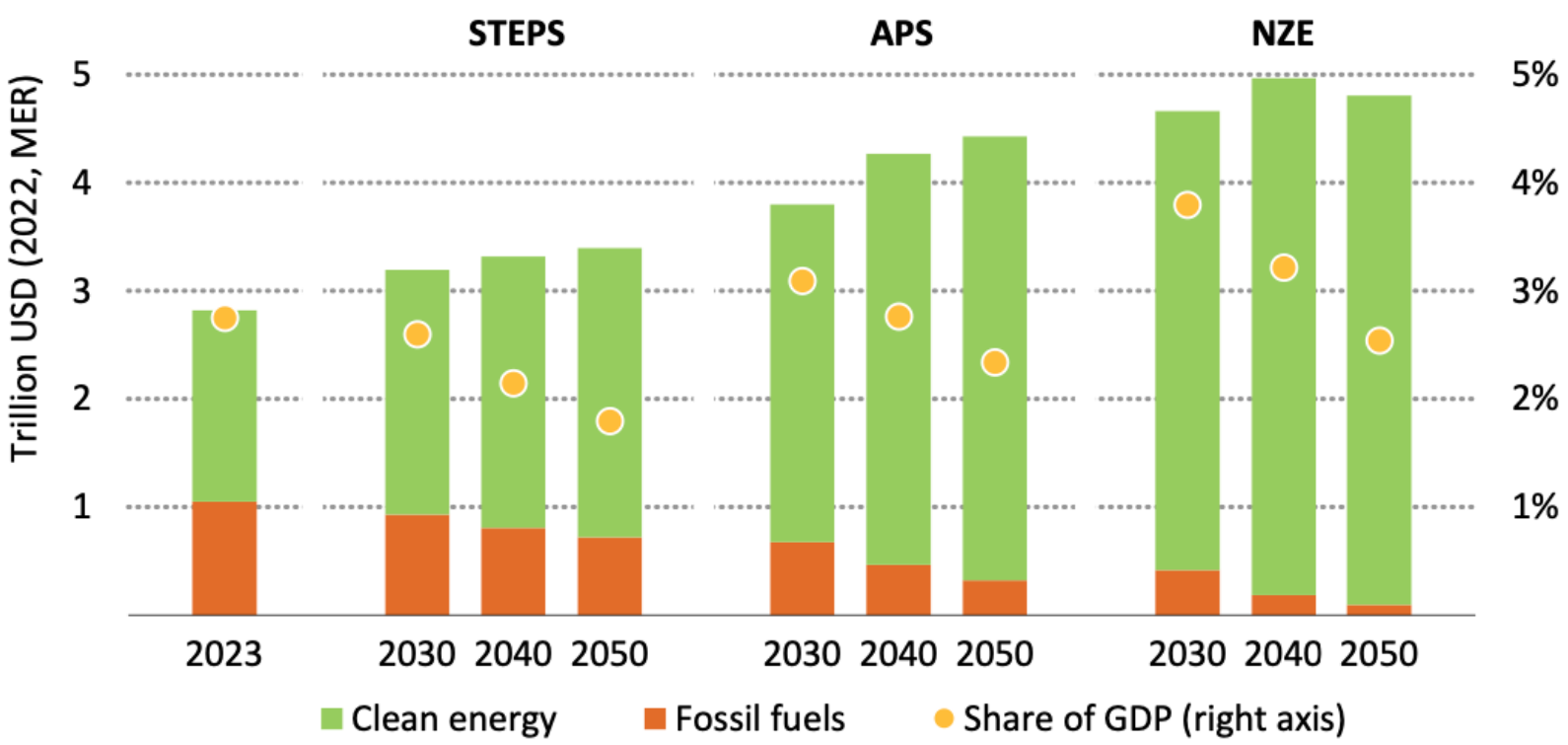
Figure 2.3 ▷ **Global energy investment in clean energy and fossil fuels**



Source: IEA WEO 2023

Investment: massive scaling up, shift from fossil to clean energy supply and new end use equipment

Figure 1.19 ▷ Investment trends as share of global GDP by scenario, 2023-2050



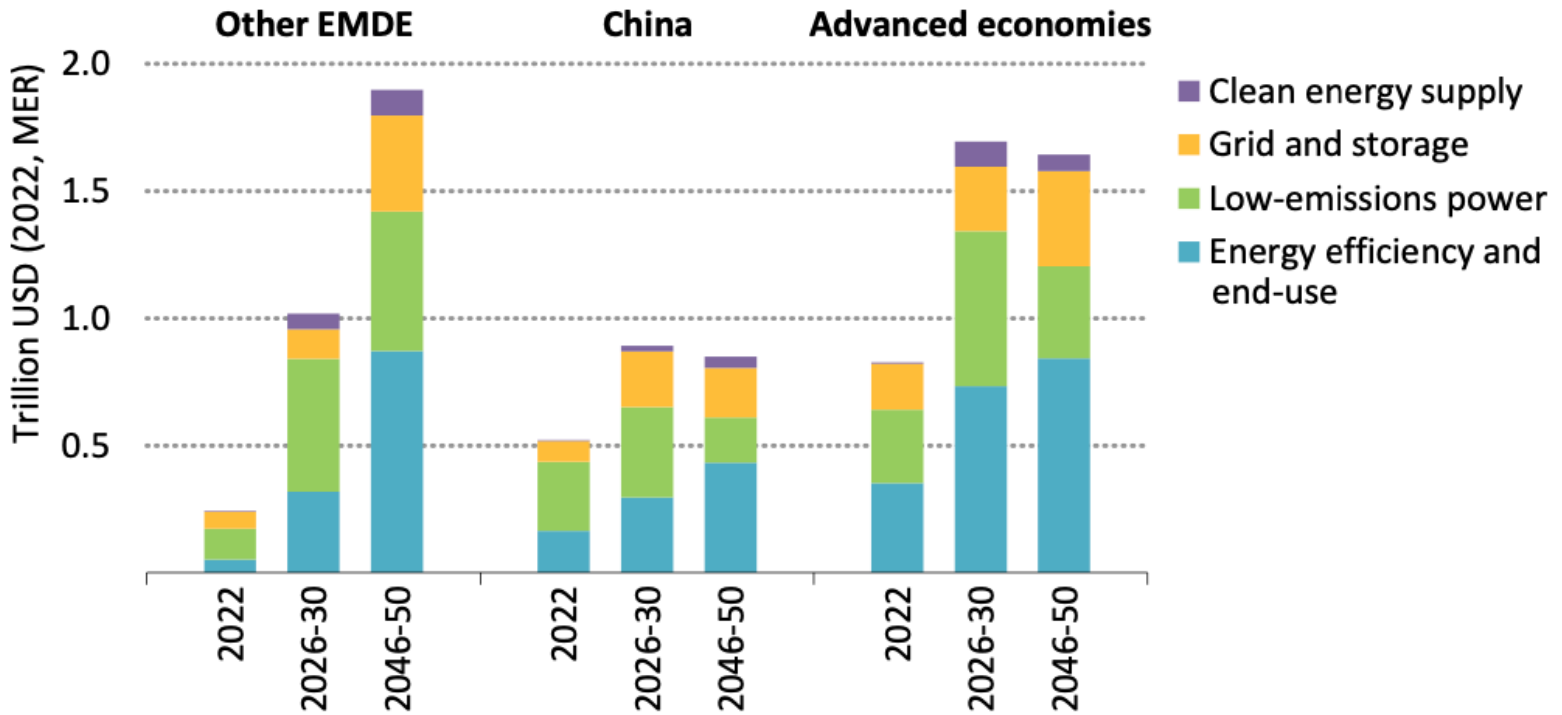
World energy investment ~$3tr/yr → ~$4-5tr/yr

Building a clean energy system with low running costs, and high up front costs.

Source: IEA WEO 2023

Investment ramp-up needed esp in developing/industrializing countries ex-China

Figure 1.18 ▷ **Average annual clean energy investment needs by region/country in the NZE Scenario, 2022-2050**



Where will all the extra investment come from?

Source: IEA WEO 2023

Global energy and climate policy: factors of influence

Looking inward: Rise of nationalism, isolationism

(--) Diverts from climate policy, and from international cooperation

(+/-) Can go either way on energy policy – focus on domestic supplies, industry leadership

Geostrategic shifts: Anticipating conflict

(--) Diverts resources to security, military

(+) Can favour renewables re energy supply security

Cost-of-living: democratic reverberation

(--) Detracts from climate objectives, scarcer fiscal resources

(+) Can favour investment toward lower energy prices

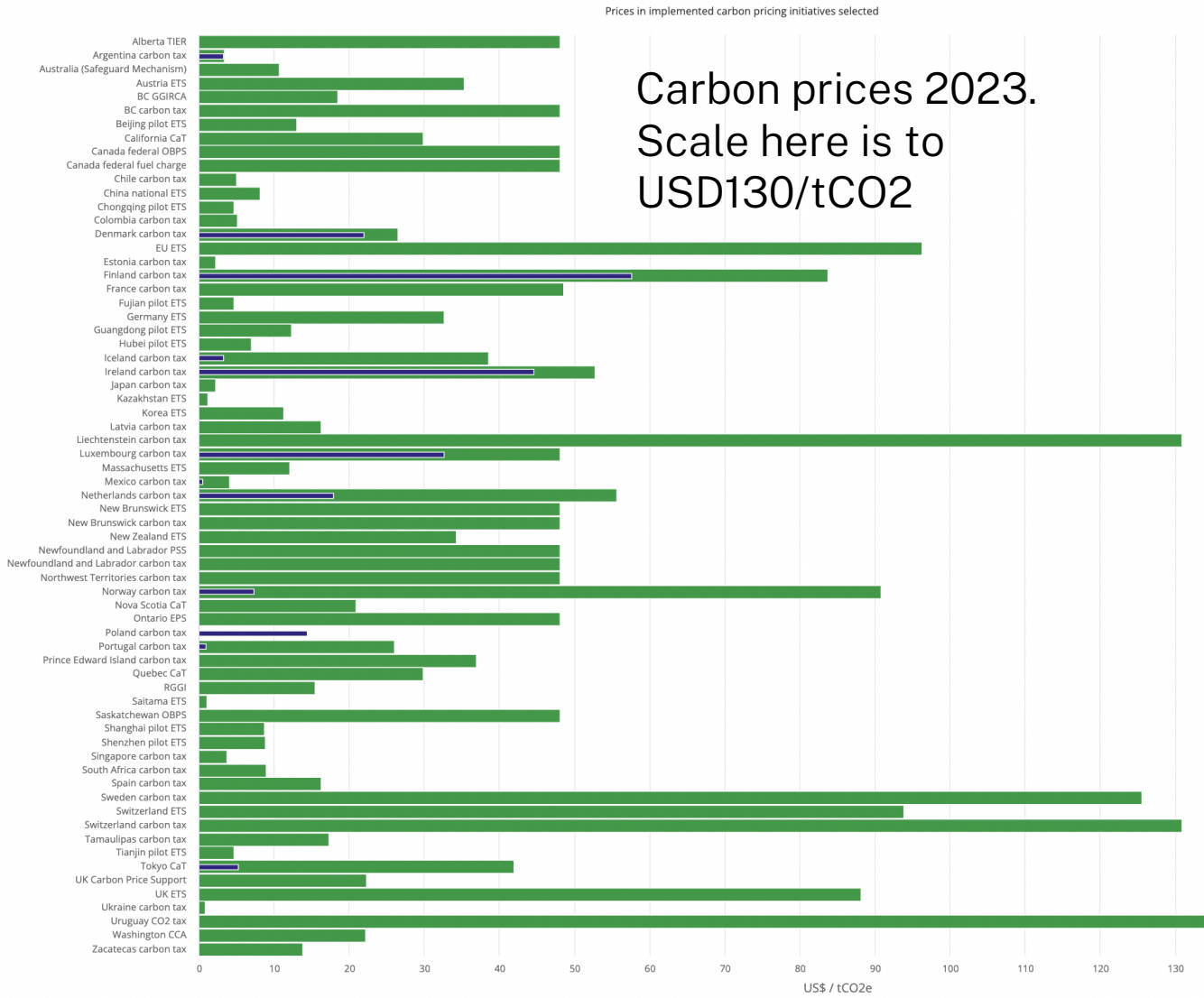
Global energy and climate policy: some trends

More policy that supports energy transition

- Emissions trading/taxes on the rise
- Many other support measures for clean energy, lower emissions, transition from fossils
- Rising appetite for border carbon measures

Increasing focus on industry policy

- US Inflation Reduction Act accelerates (or diverges?) clean energy/industry investment
- Competition for leadership in green technology, manufacturing, supply chains

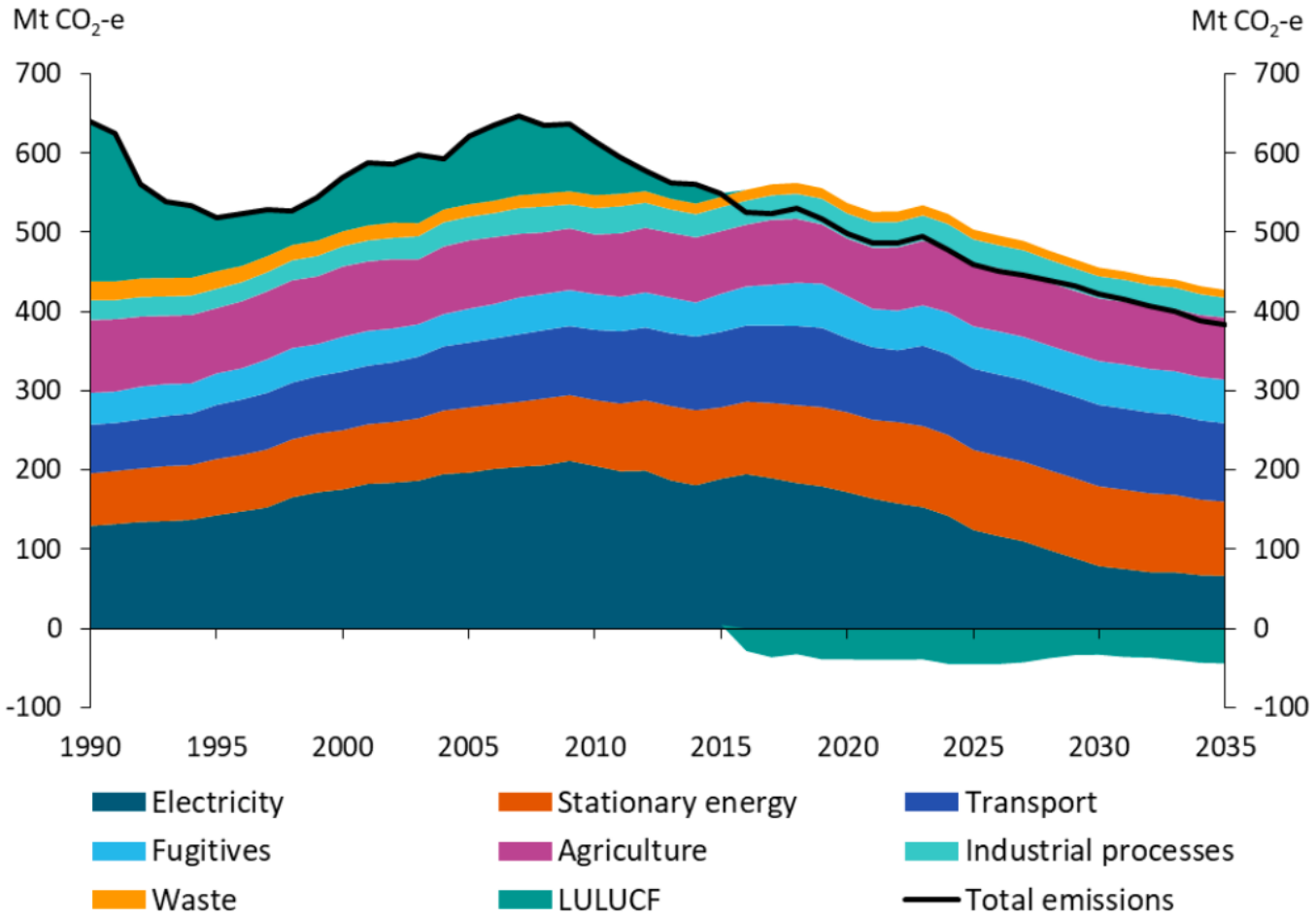


Carbon prices 2023. Scale here is to USD130/tCO2

Source: World Bank carbon pricing dashboard

Australia’s emissions profile and trends

Figure 2 Australia's emissions projections in the baseline scenario, 1990 to 2035, Mt CO_2-e



Reductions since 2005 almost entirely from land use, land use change and forestry

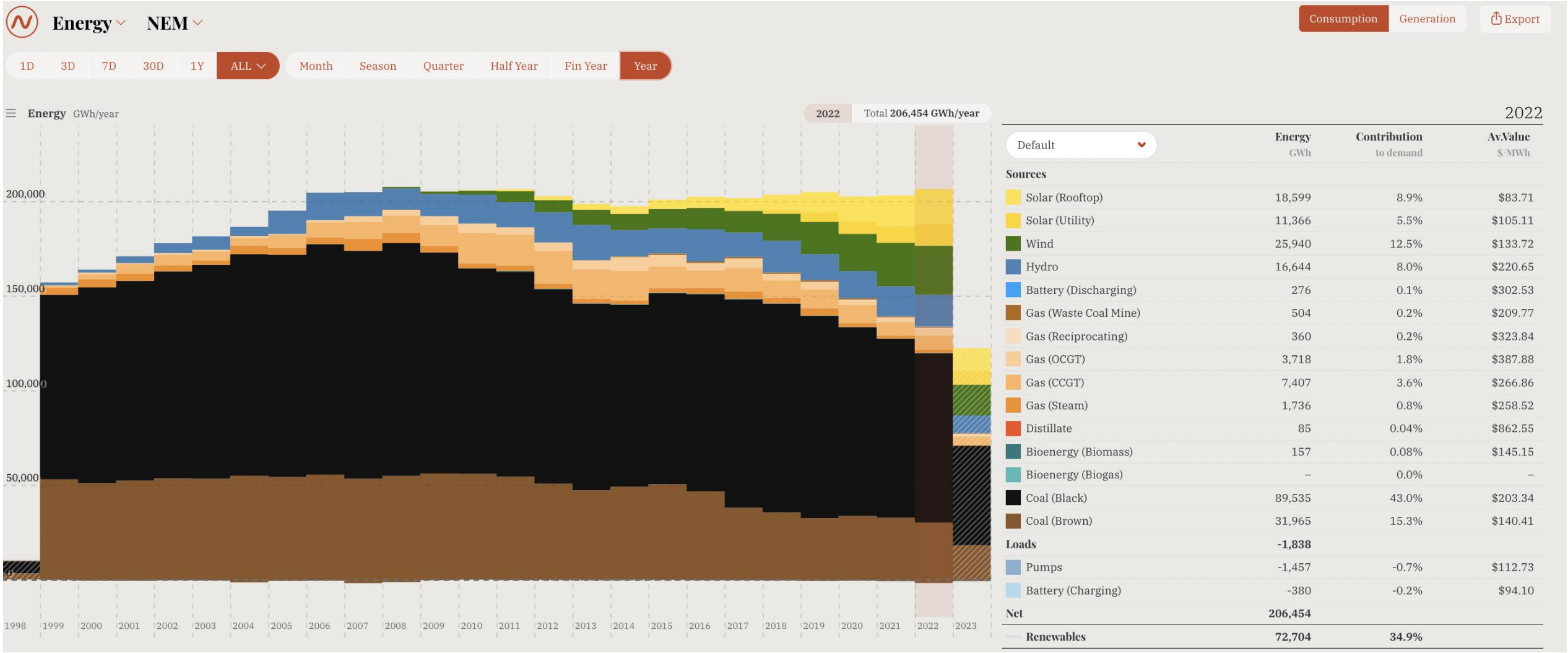
… and more recently, reductions in electricity emissions

Shown here are the 2022 emissions projections – 2023 issue due this week

Source: Australian Government, Australia’s Emissions Projections 2022

Electricity generation mix, NEM, 1999-2022

Wind+solar: 2022 27%, 2017 9%

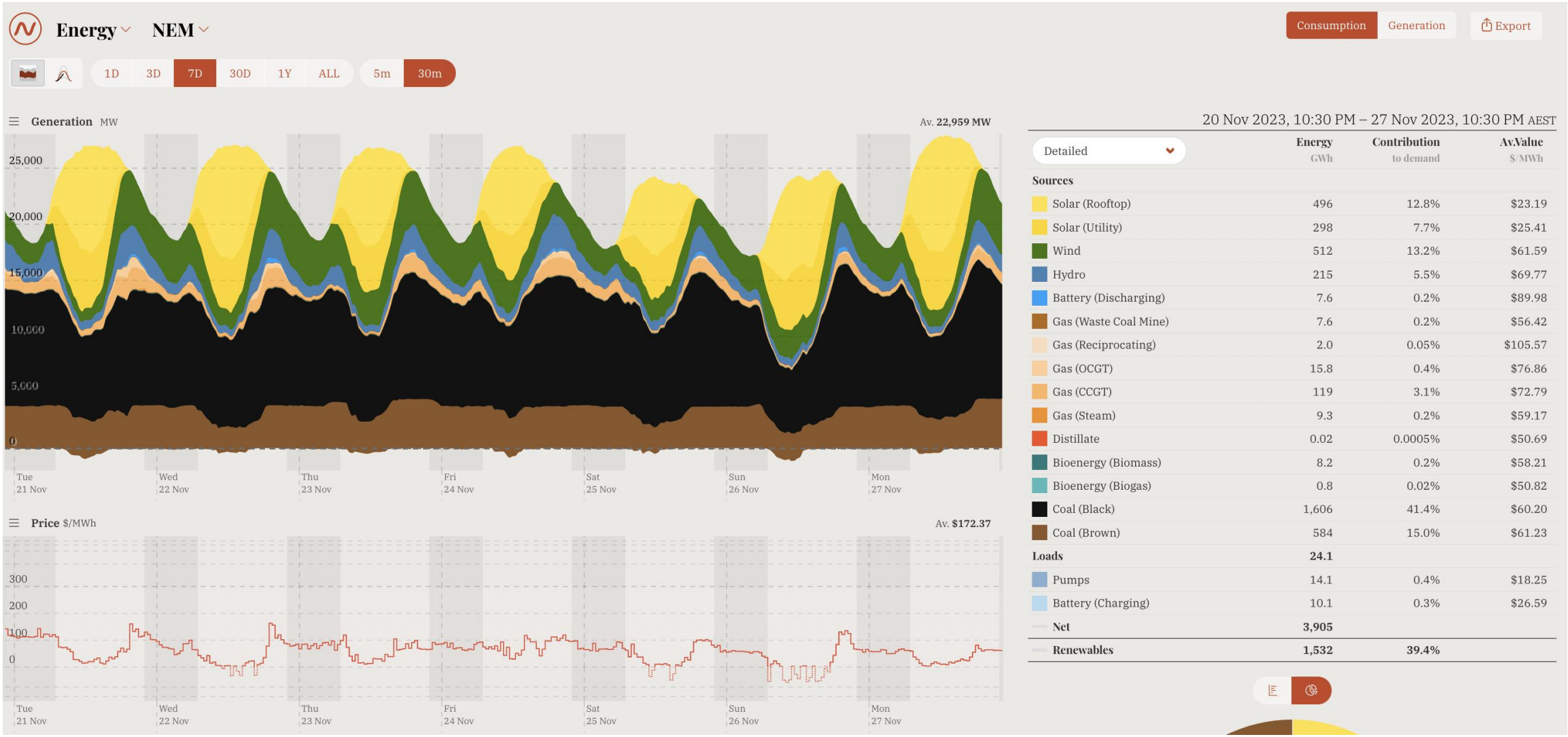


2022

Default	Energy GWh	Contribution to demand	Av.Value $/MWh
Sources			
Solar (Rooftop)	18,599	8.9%	$83.71
Solar (Utility)	11,366	5.5%	$105.11
Wind	25,940	12.5%	$133.72
Hydro	16,644	8.0%	$220.65
Battery (Discharging)	276	0.1%	$302.53
Gas (Waste Coal Mine)	504	0.2%	$209.77
Gas (Reciprocating)	360	0.2%	$323.84
Gas (OCGT)	3,718	1.8%	$387.88
Gas (CCGT)	7,407	3.6%	$266.86
Gas (Steam)	1,736	0.8%	$258.52
Distillate	85	0.04%	$862.55
Bioenergy (Biomass)	157	0.08%	$145.15
Bioenergy (Biogas)	–	0.0%	–
Coal (Black)	89,535	43.0%	$203.34
Coal (Brown)	31,965	15.3%	$140.41
Loads	**-1,838**		
Pumps	-1,457	-0.7%	$112.73
Battery (Charging)	-380	-0.2%	$94.10
Net	**206,454**		
Renewables	**72,704**	**34.9%**	

Source: AEMO via OpenNEM

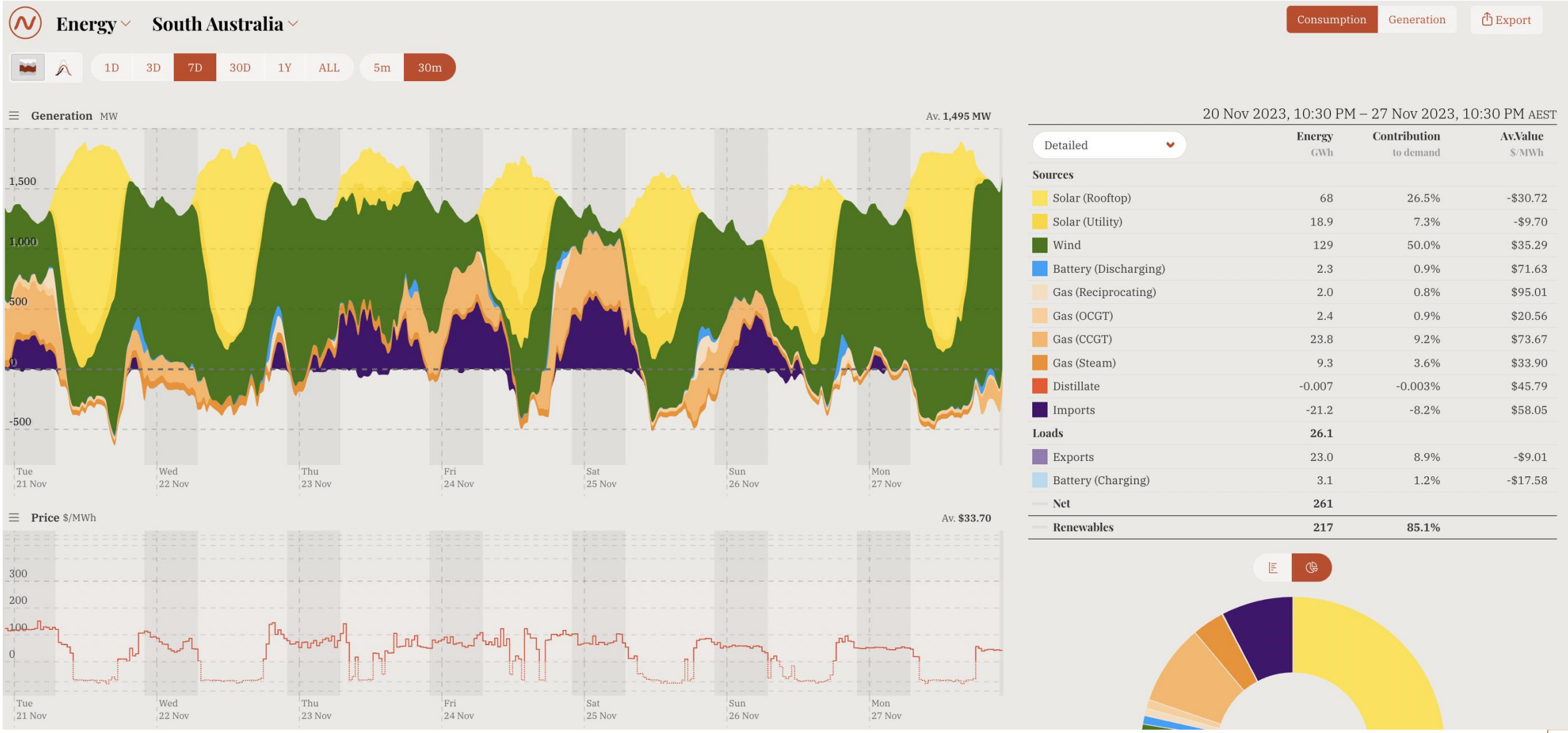
Electricity generation mix, NEM, 21-27 Nov 2023



	Energy GWh	Contribution to demand	Av.Value $/MWh
Sources			
Solar (Rooftop)	496	12.8%	$23.19
Solar (Utility)	298	7.7%	$25.41
Wind	512	13.2%	$61.59
Hydro	215	5.5%	$69.77
Battery (Discharging)	7.6	0.2%	$89.98
Gas (Waste Coal Mine)	7.6	0.2%	$56.42
Gas (Reciprocating)	2.0	0.05%	$105.57
Gas (OCGT)	15.8	0.4%	$76.86
Gas (CCGT)	119	3.1%	$72.79
Gas (Steam)	9.3	0.2%	$59.17
Distillate	0.02	0.0005%	$50.69
Bioenergy (Biomass)	8.2	0.2%	$58.21
Bioenergy (Biogas)	0.8	0.02%	$50.82
Coal (Black)	1,606	41.4%	$60.20
Coal (Brown)	584	15.0%	$61.23
Loads	**24.1**		
Pumps	14.1	0.4%	$18.25
Battery (Charging)	10.1	0.3%	$26.59
Net	**3,905**		
Renewables	**1,532**	**39.4%**	

Source: AEMO via OpenNEM

Electricity generation mix, South Australia, 21-27 Nov 2023



Source: AEMO via OpenNEM

Australia’s emissions targets

43% at 2030

- Projections: target will be just about met
- Involves assumption of 82% renewables by 2030
- Only gradual change in industry, transport, agriculture

2035 target?

- What Australia ‘should’ do as a contribution towards <2°C, vs what can be done short of an all-out effort
- CCA advice, government’s sector-based net-zero plans

Electricity policy

Supporting investment in wind, solar, storage: the Capacity Investment Scheme

New policy: federal government underwriting of revenue for electricity (min/max price contracts)

Main alternative would have been extending the RET

CIS disadvantages: direct government involvement, budget exposure

CIS advantages: greater steering by government, lower and more stable consumer prices

Argument: low power prices the key for political sustainability & electrification

Other hurdles

Supply chain bottlenecks, incl skilled labour

Transmission, also with regard to social licence at local level

Coal-plant shutdown fears

Facilitating the transition

Net Zero Energy Agency → Net Zero Authority

Defining its role… among existing Federal and State departments and agencies

- Easing regional and social transition, esp in coal regions
- Facilitating green investment
- A role in industry policy?

Australia’s inherent advantage in the shift to net-zero emissions

Australia as a resource and energy supplier in a net-zero world economy

- Exports large amounts of embodied renewable energy: fuels (H2, NH3, CH3OH), processed metals (green iron, aluminium), other resources (lithium, copper, rare earths…)
- Replacing coal & gas revenue

Australia as a carbon dioxide removalist

- The ‘net’ in net zero refers to carbon dioxide removal
- Australia has preconditions for large-scale technological CDR … eg direct air capture, enhanced weathering
- Who pays?

Industry policy: government stance

Objectives

“competitiveness, distribution of opportunity, resilience and national security - all anchored to our climate and energy goals”

Priority areas for industry policy

“Refining and processing critical minerals.

Supporting manufacturing of generation and storage technologies, including batteries.

Producing renewable hydrogen and its derivatives like ammonia.

And forging green metals.”

2 November 2023

Keynote address to the Economic and Social Outlook Conference, Melbourne

Energy, the economy, and this defining decade

Hydrogen Headstart:

$2b production credits, with competitive bidding

Industry policy: some fundamentals and principles

Australia is not America

USA (EU, East Asia): large economies, domestic market, manufacturing base, strategic objectives

Australia: comparative advantage in resource base, feeding into international markets

Relationship bw domestic energy transition and export industries

- short term competition for resources, long term complementarities

Ensuring benefits to Australia

Focus on enabling Australia's comparative advantage, productivity

Value-for-money for public expenditure

Indigenous and local communities, environmental impacts

Future tax returns

Thank you

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