

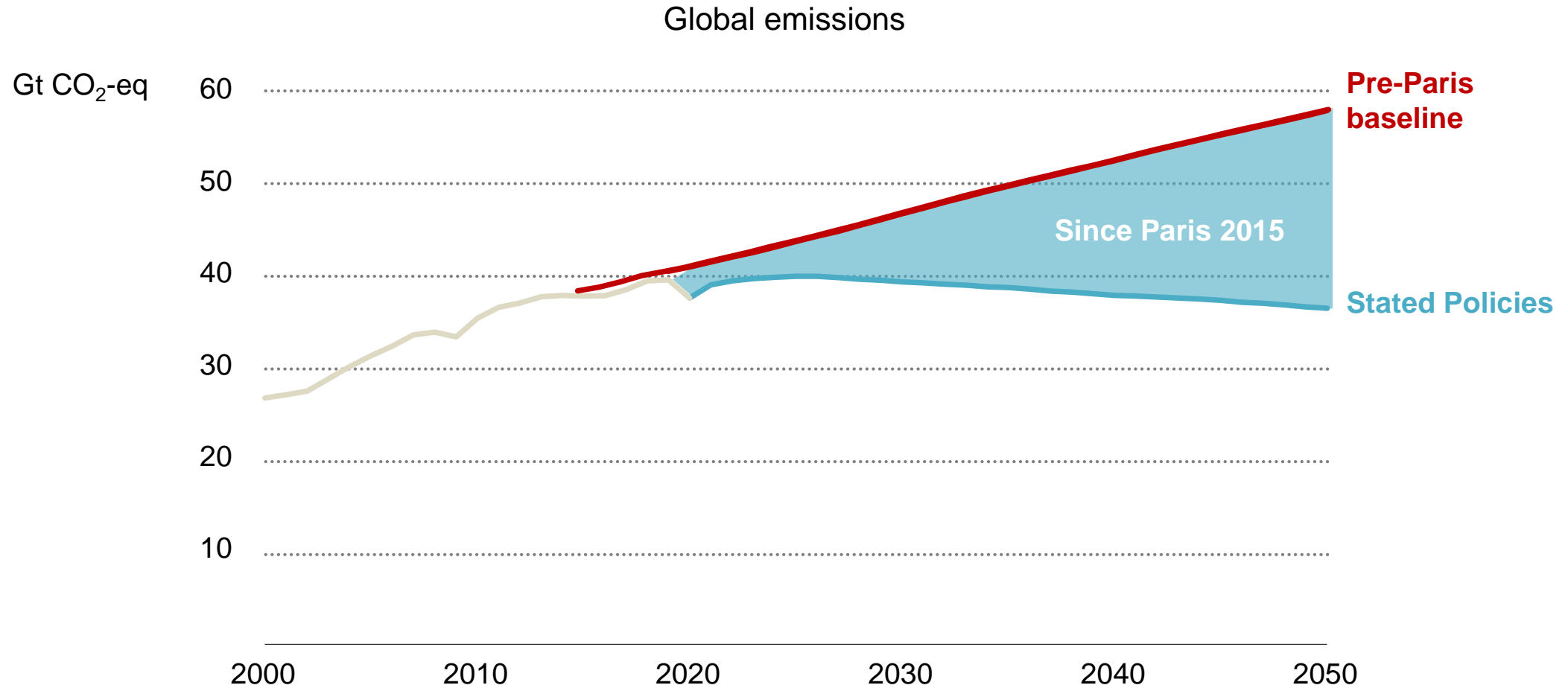
The difference between aspirational goals and reality: the global energy perspective

Peter Fraser

CCRE Annual Energy Leaders Roundtable 15 June 2022

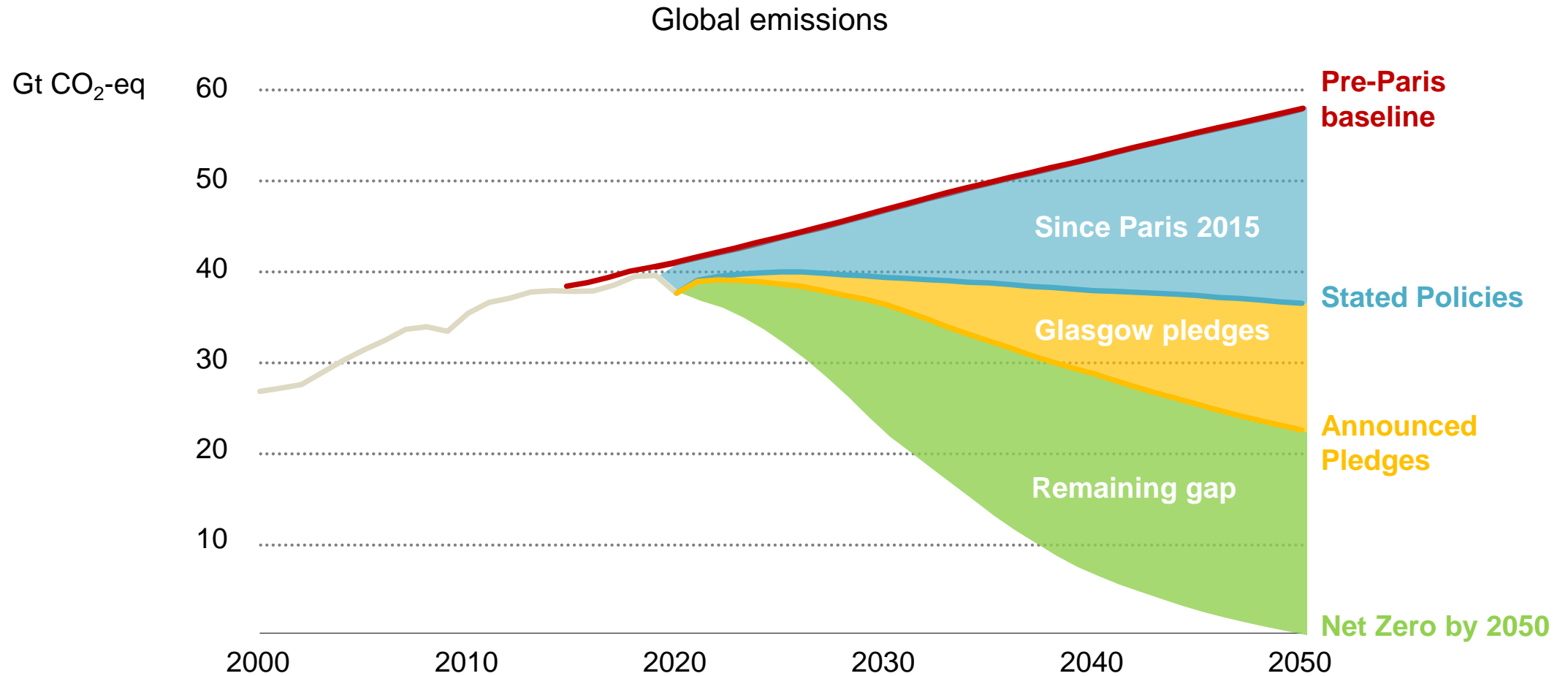
Aspirational Goals

The world is starting to bend the emissions curve ...



New policies, technology cost reductions, and the pandemic have pulled the projected emissions curve down.

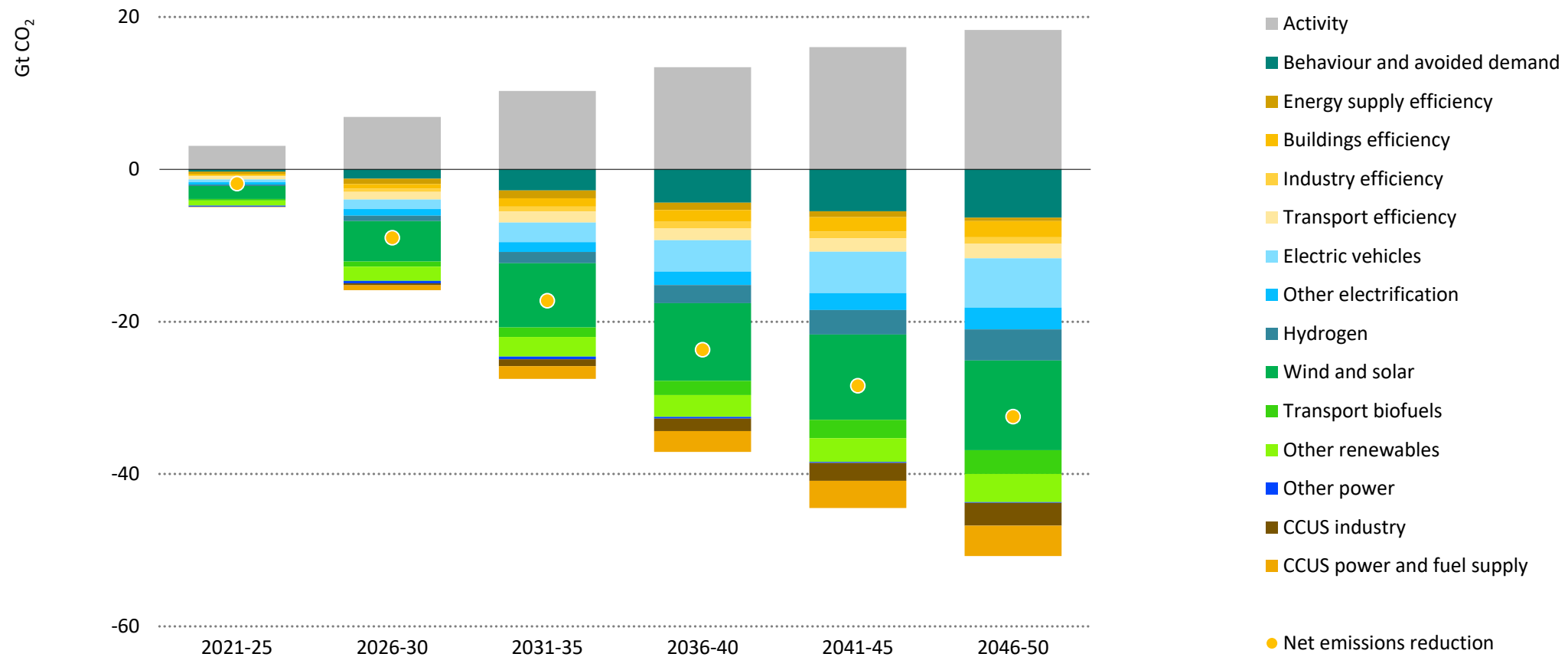
Yet a large ambition gap remains to reach the 1.5 degree goal



The promises at Glasgow are not sufficient to get to 1.5 degrees

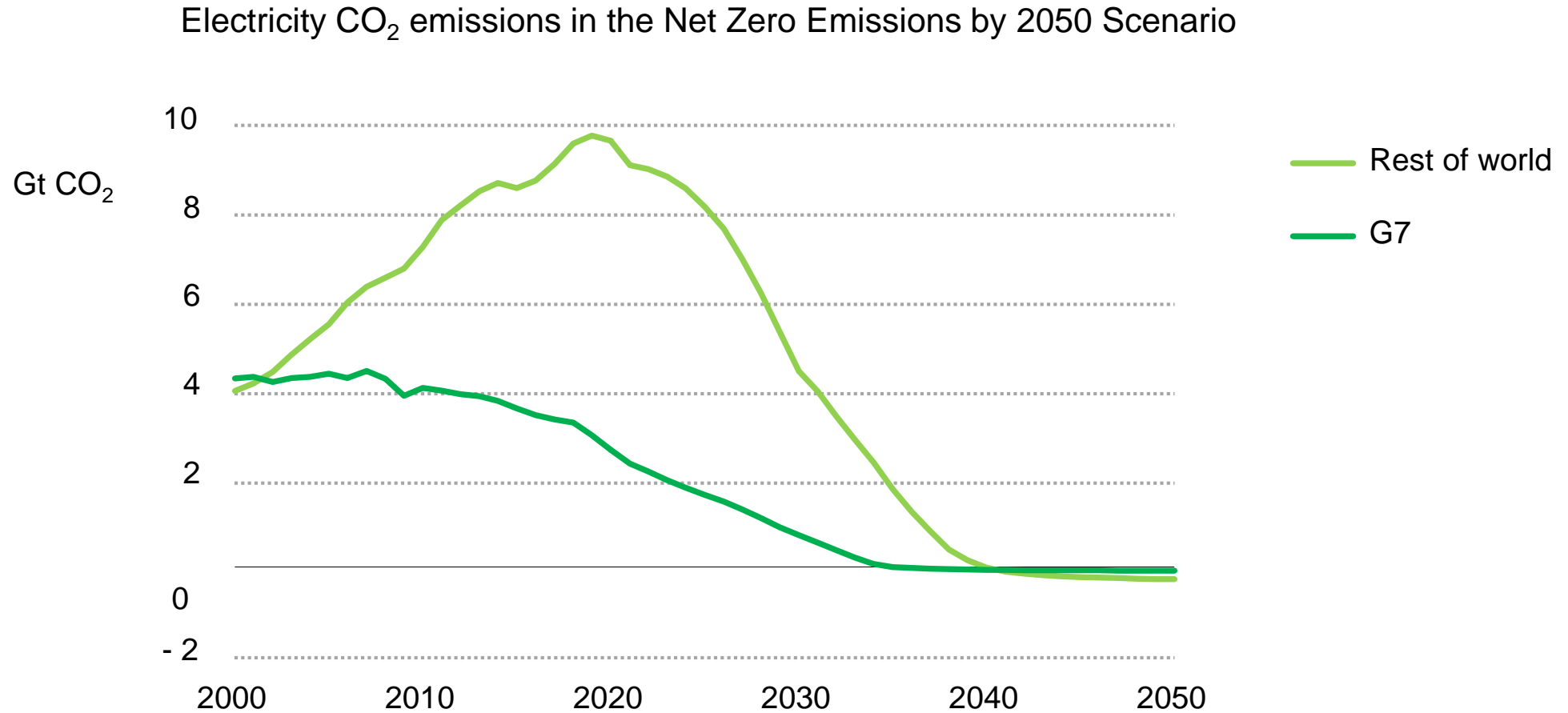
IEA's Net Zero Emissions in 2050 scenarios relies on changing demand

Average annual CO2 reductions from 2020 in the NZE



Efficiency, decarbonising generation, electrification, hydrogen, biofuels, and CCUS are all needed

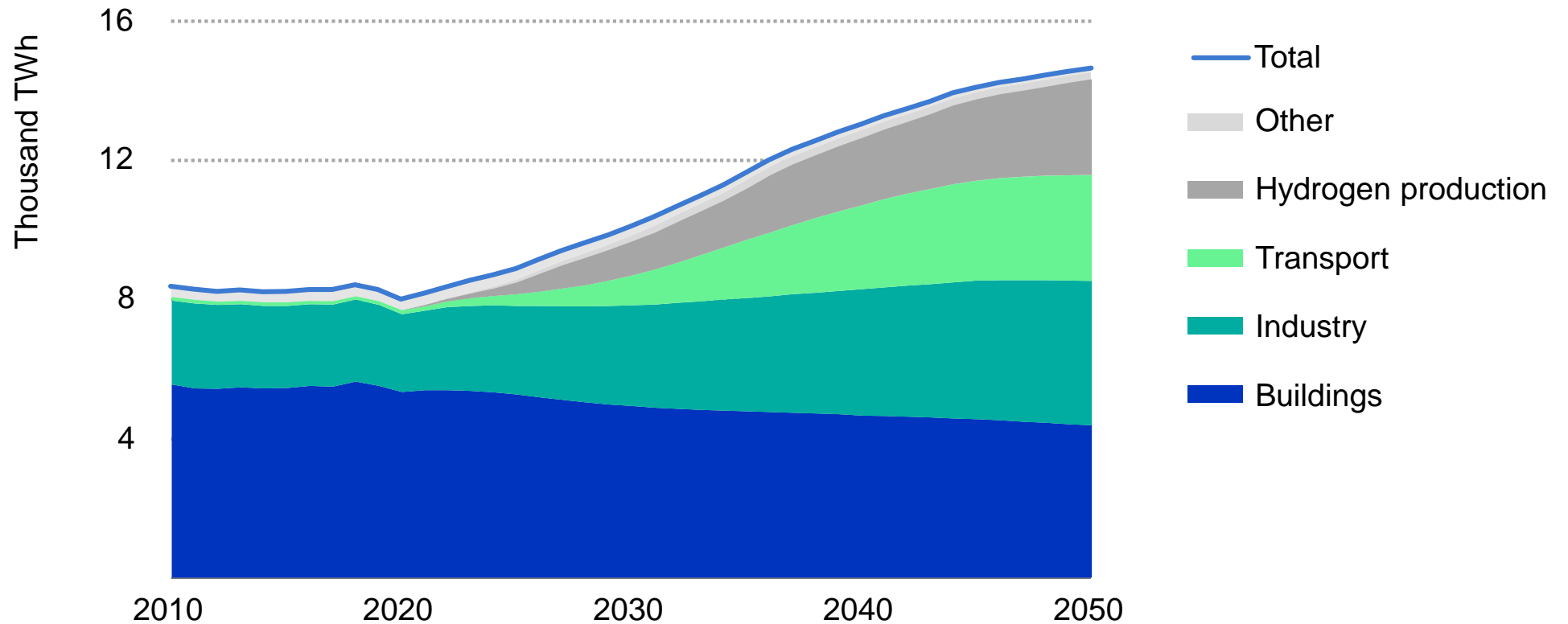
The G7 can lead by example to reach net zero electricity



G7 electricity emissions have been falling, mainly due to the switch from coal to natural gas and rising renewables, though the pace of reductions needs to accelerate to reach net zero by 2035

Electrification drives electricity demand growth

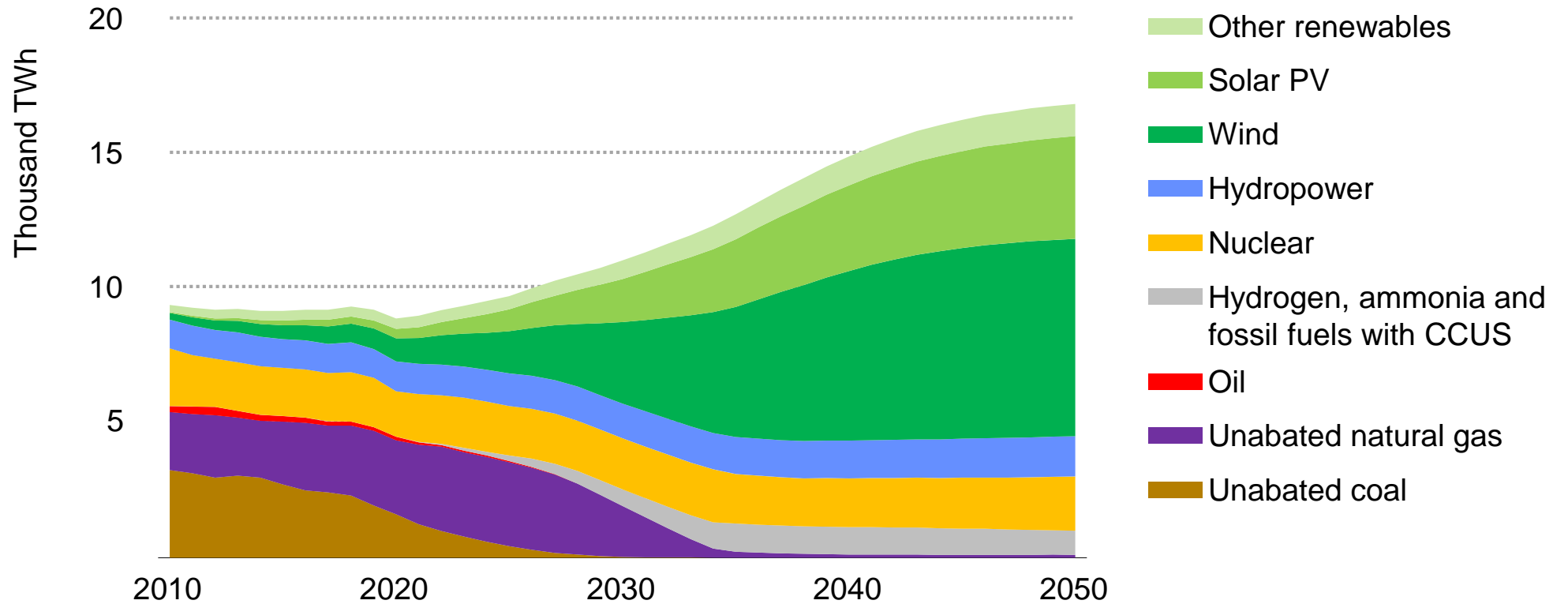
G7 electricity demand by sector in the Net Zero Emissions by 2050 Scenario



Electricity demand returns to growth on a path to net zero, raising the share in final consumption to 56% by 2050, driven by electrification of transport & industry and hydrogen production, moderated by energy efficiency

The electricity mix is re-imagined for net zero electricity

G7 electricity generation by technology in the Net Zero Emissions by 2050 Scenario



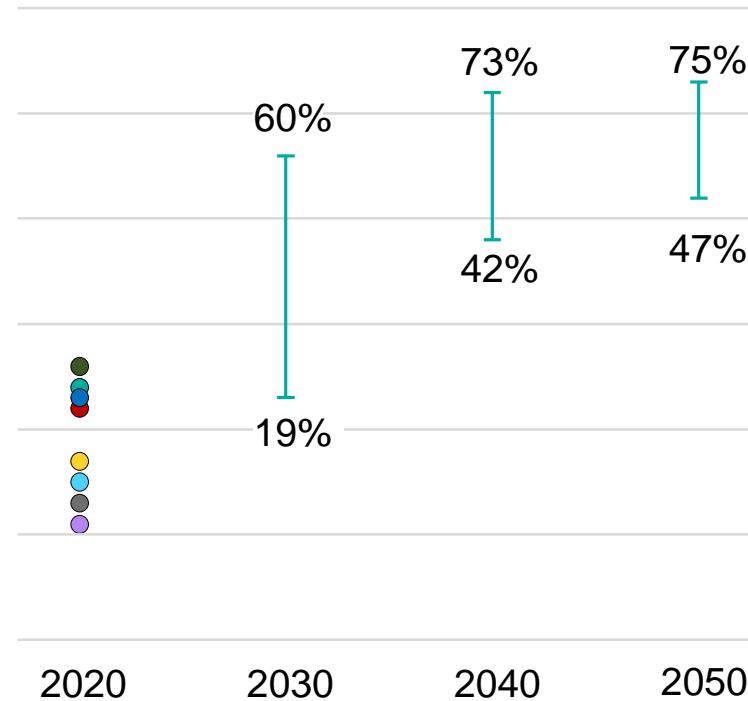
Unabated fossil fuels fall from half of electricity supply while wind and solar PV rise from 14% in 2020 to 66% in 2050, re-shaping the nature of electricity supply and system operations

New challenges emerge for electricity security

G7 phases of integration in the Net Zero Emissions by 2050 Scenario

2020 wind and solar PV share:

Germany 29%
United Kingdom 29%
European Union 20%
Italy 15%
United States 11%
Japan 9%
France 8%
Canada 6%



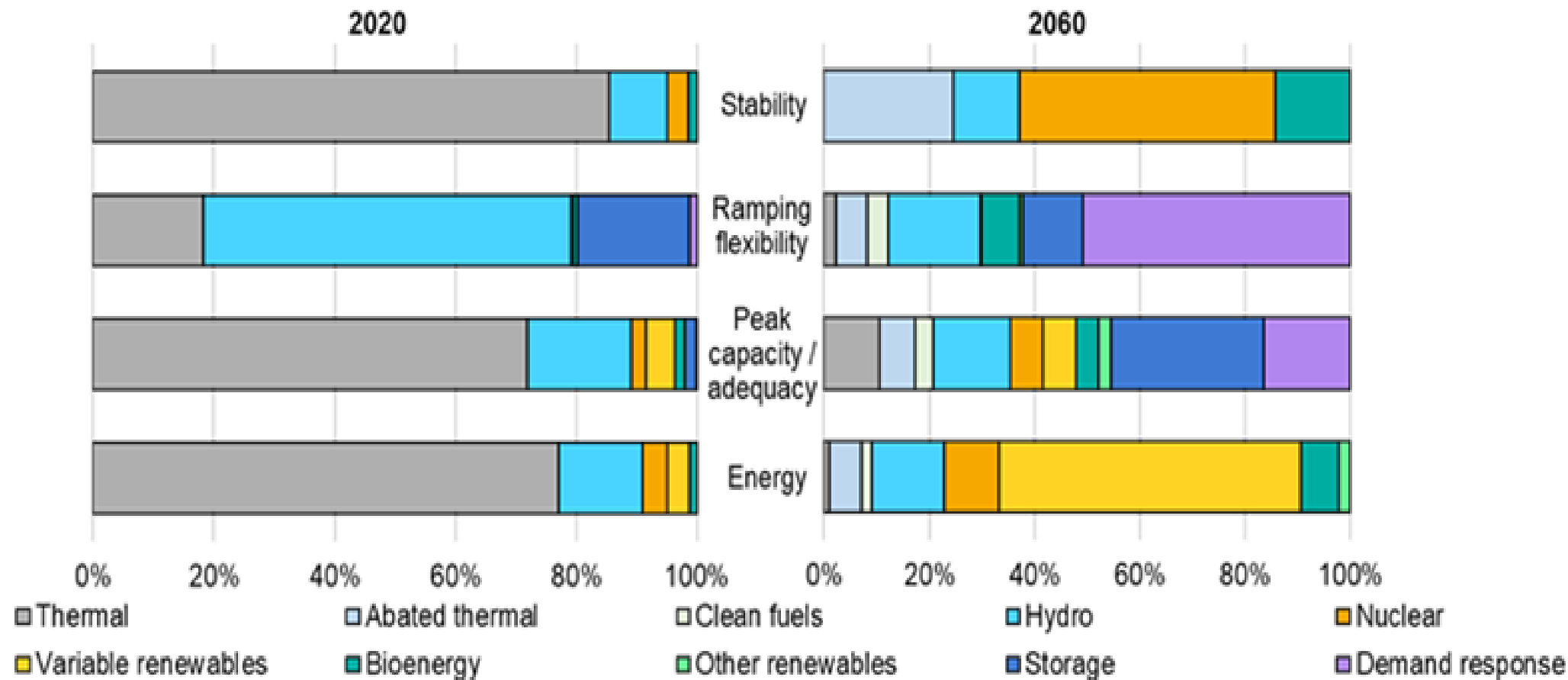
I Range for G7 members

- Phase 6** Wind & solar PV lead to excess or deficit over months and seasons
- Phase 5** Frequent periods of wind & solar PV exceeding demand
- Phase 4** Require advanced technologies
- Phase 3** Flexibility investment in all measures
- Phase 2** Draw on existing flexibility
- Phase 1** System integration not a relevant issue

G7 members have pushed forward on wind and solar PV, moving through the early phases of renewables integration, soon they move into new territory, tripling flexibility needs by 2050 & calling for new approaches to meet challenges

Dispatchable capacity helps balance a high VRE power system

Share of system services by type for China, 2020 (actual) and 2060 (carbon neutral scenario)



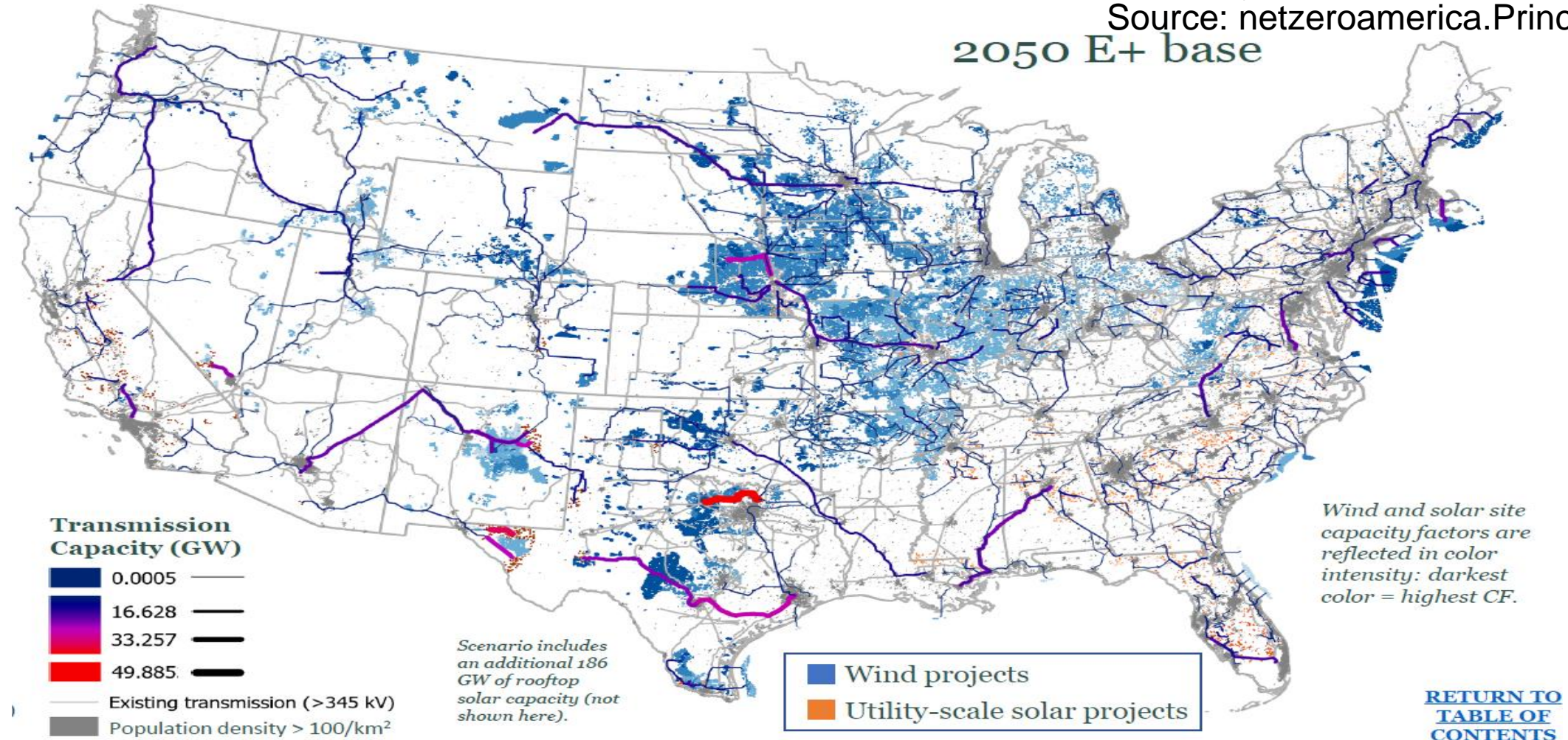
In a future high wind/solar power system in China, nuclear provides 10% of energy but nearly 50% of stability

High wind and solar cases require substantial land

Wind, solar and transmission, E+ case, Net Zero America Study

Source: netzeroamerica.Princeton.edu

2050 E+ base

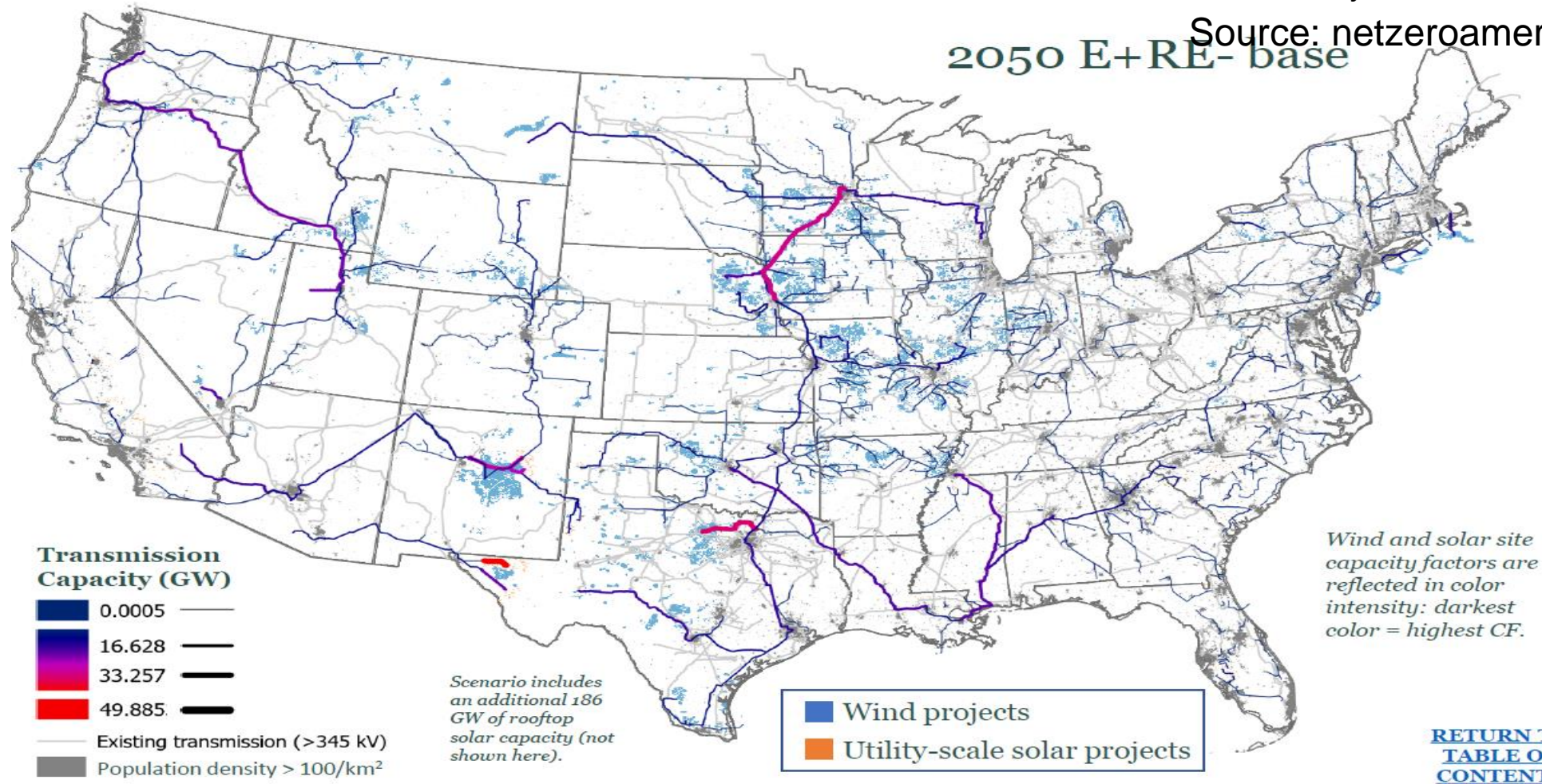


High wind and solar means significant land use and tripling transmission investment

Lower wind and solar case doubles transmission but much less land

Wind, solar and transmission, E+ RE- case Net Zero America Study

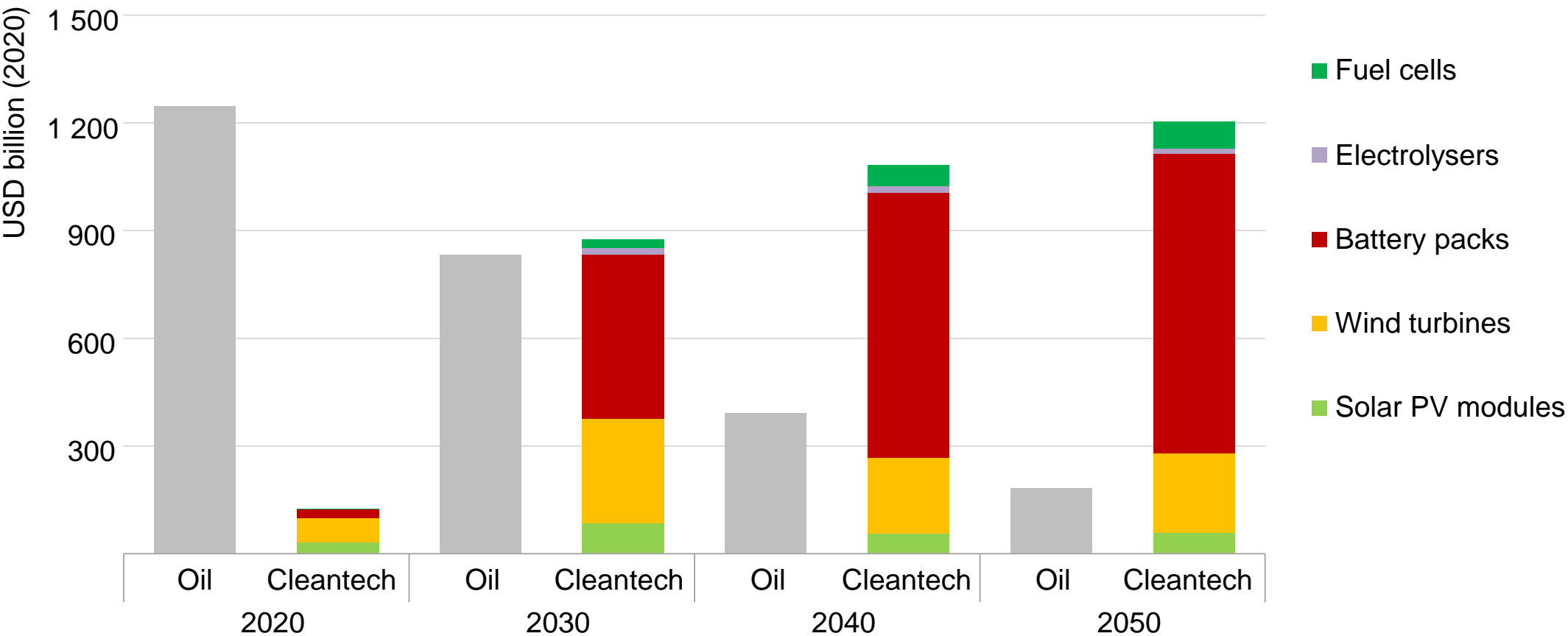
Source: netzeroamerica.princeton.edu



More nuclear, CCUS would reduce land use implications but cost more

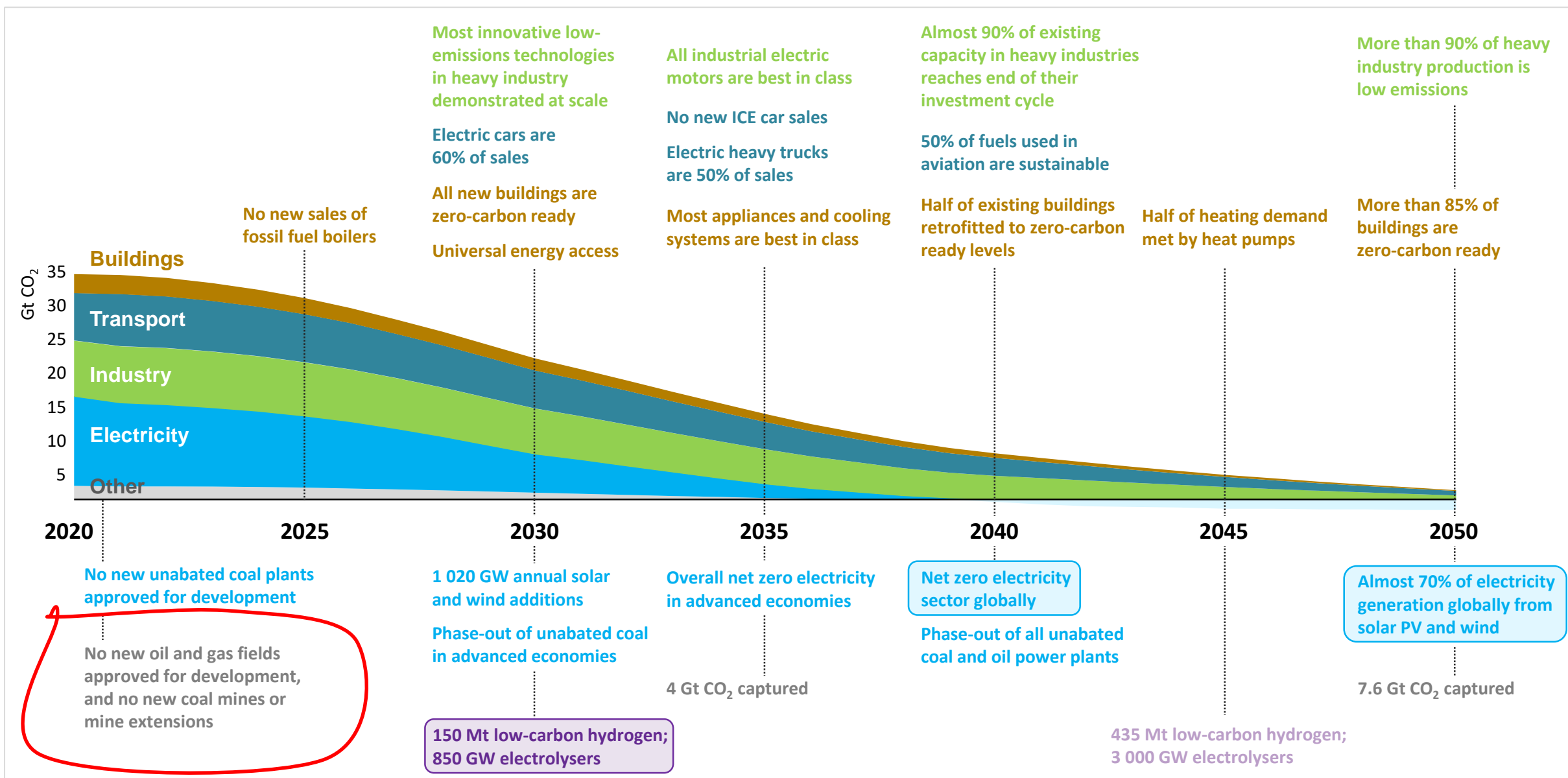
A new global energy economy would need to emerge

Estimated market sizes of oil and selected clean energy technology equipment in the Net Zero Scenario



Explosive growth in clean energy deployment over the next decades could create a market opportunity for manufacturers of key equipment worth a cumulative USD 27 trillion through to 2050

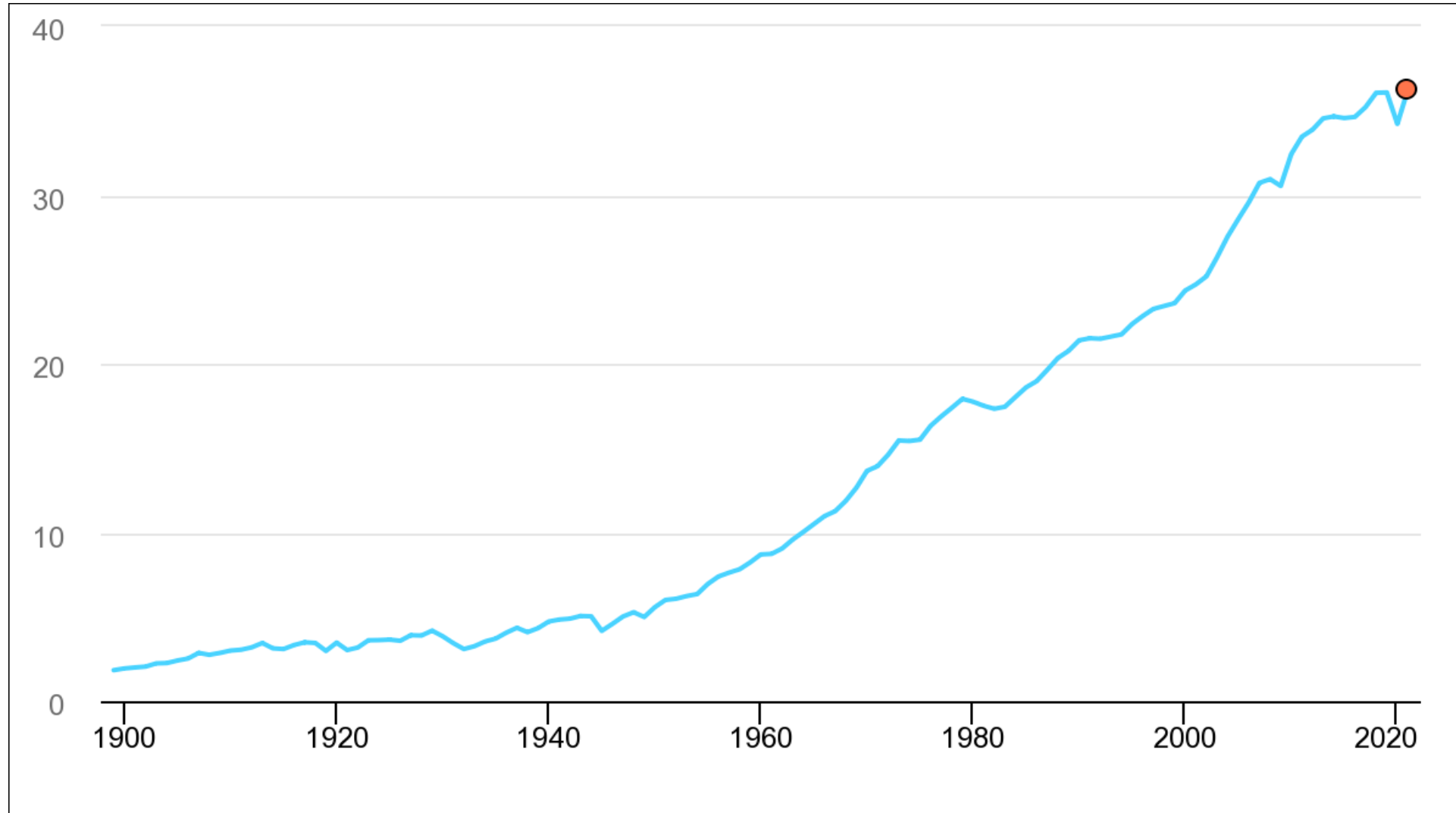
NZE says “cut demand” ... but what was heard was “stop FF investment”



Ten energy realities

Reality # 1: Global emissions are increasing as fossil fuel use rises

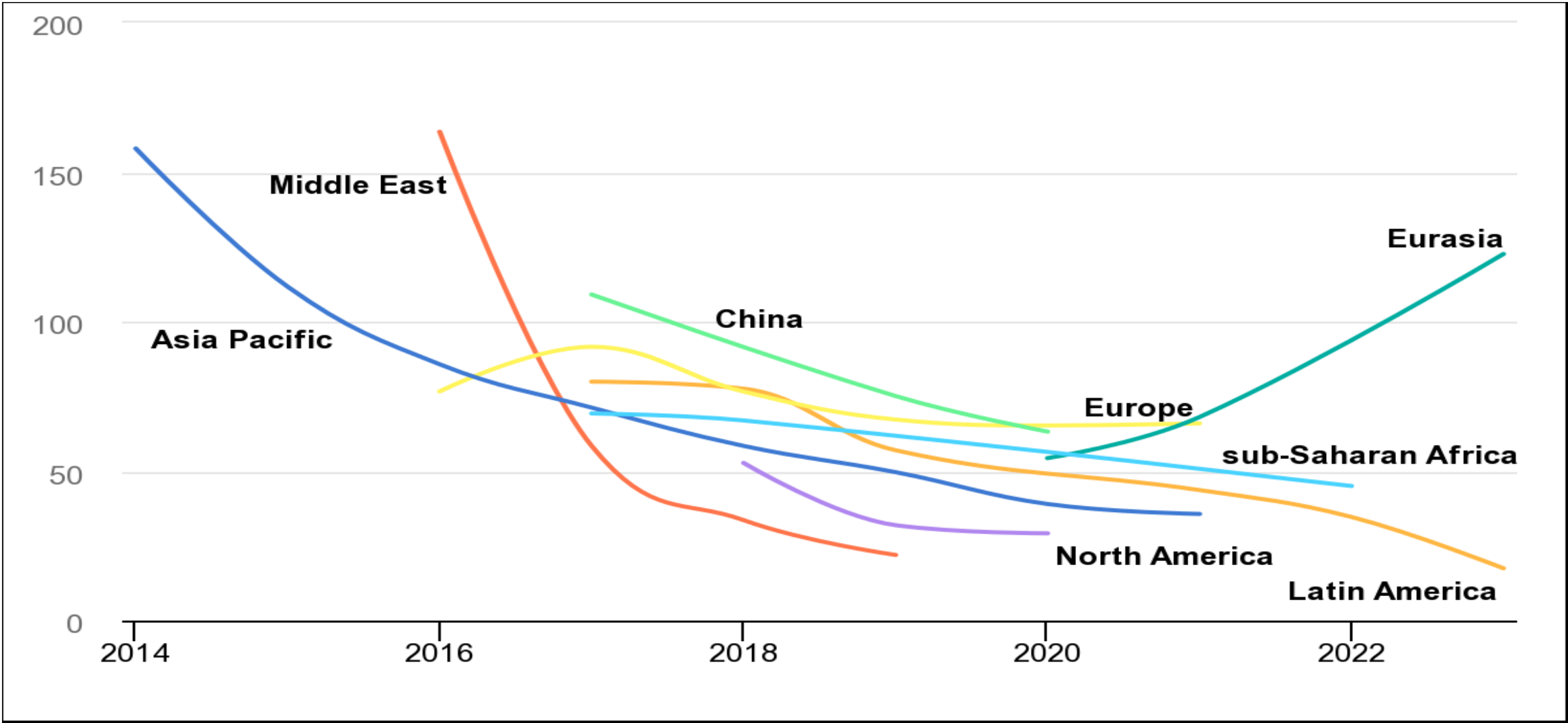
CO2 emissions from energy combustion and industrial processes, 1900-2021



Reality # 2: Solar PV and Wind are making really cheap electricity



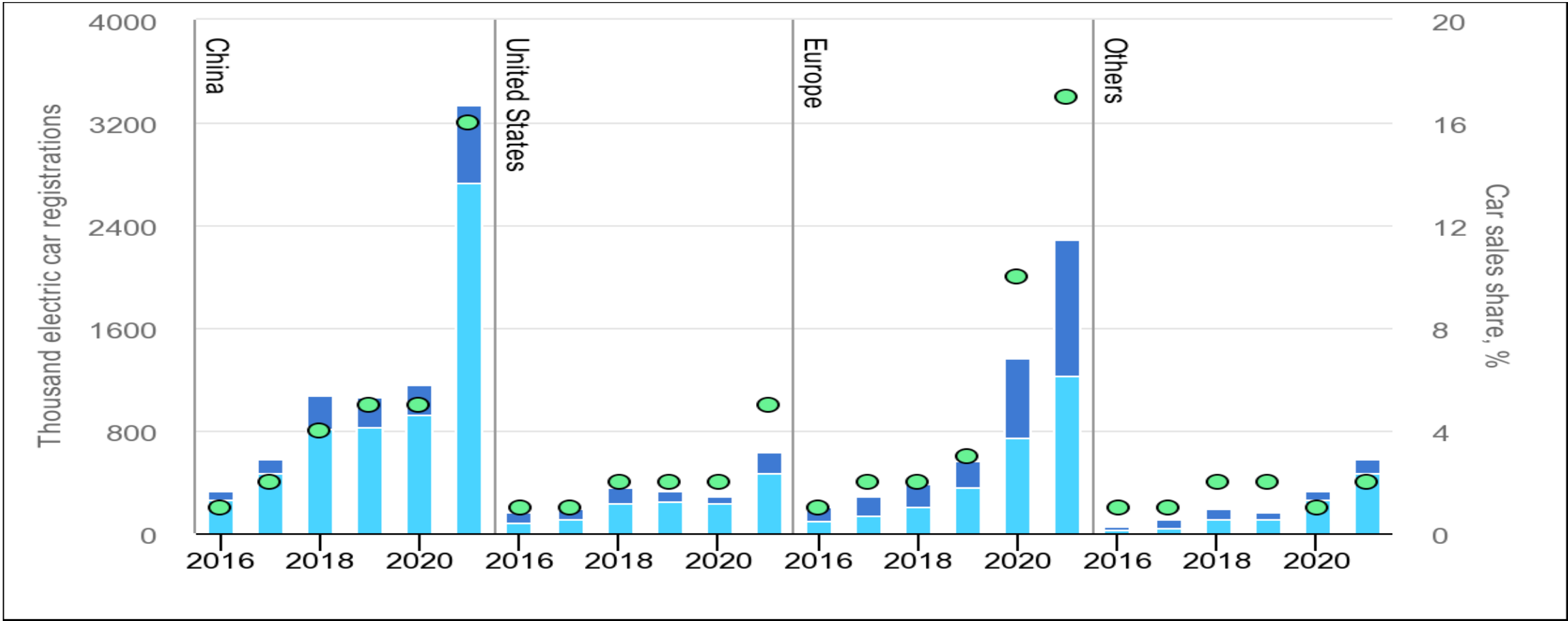
Average Solar PV auction contract price by region and commissioning date 2014-2023



Reality #3: EVs are having a real impact on global vehicle markets



Electric car registrations and sales, selected regions, 2016-2021



EVs accounted for 8.9% of global sales in 2021, and much higher in China and Europe

Reality #4: Hydrogen – more than hype, but not cheap

Hydrogen-powered Fuel Cell Taxi

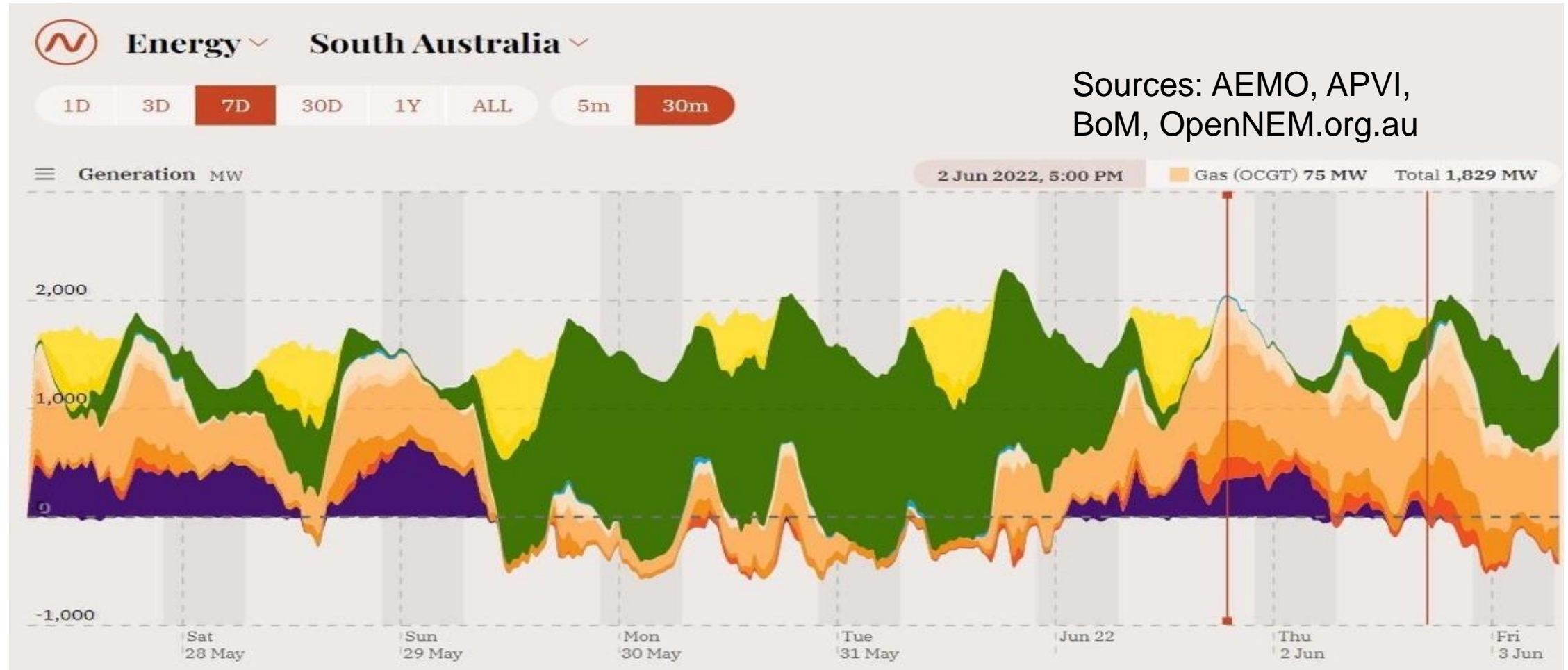


Source: hype.taxi

Hydrogen energy is not inexpensive: very cheap electricity is required to make electrolytic hydrogen feasible

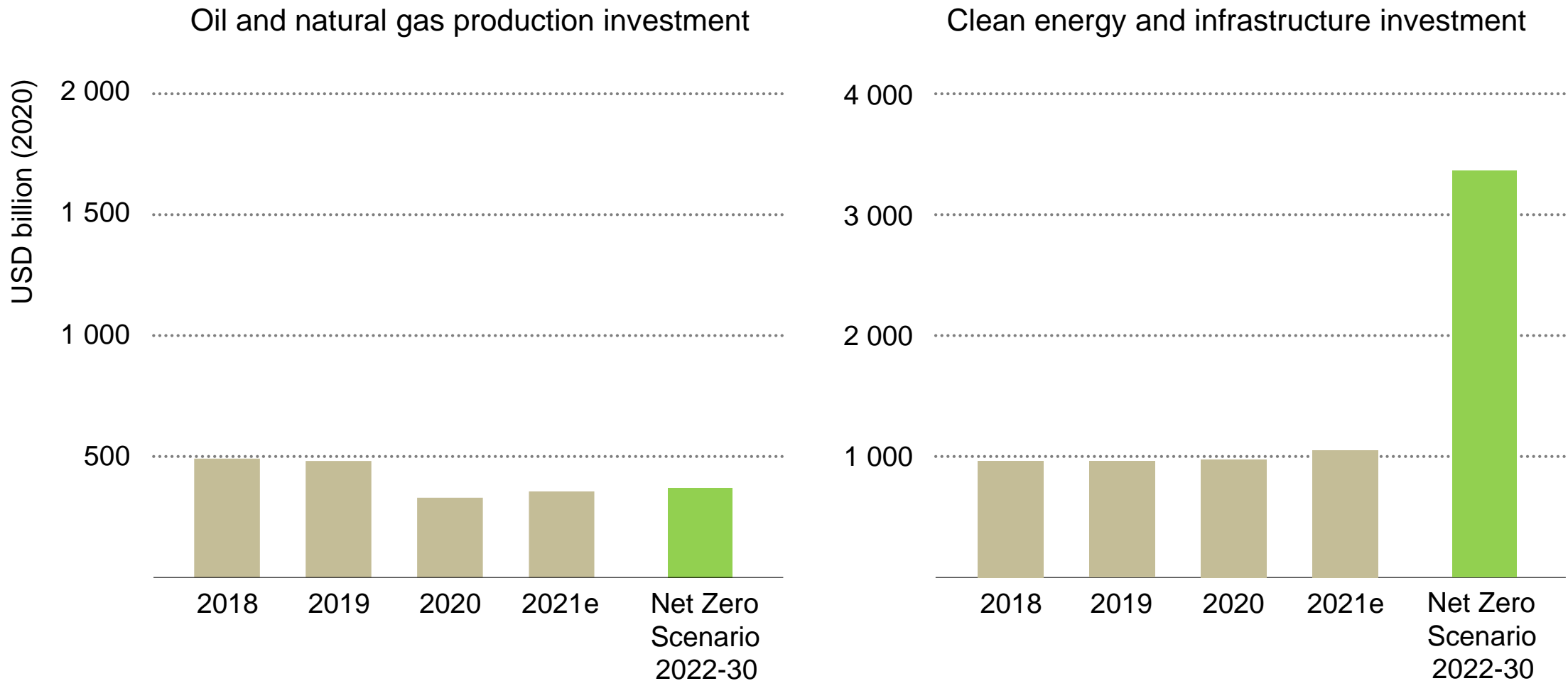
Reality #5: Transition to high wind and solar is already happening

South Australia Electricity Generation – 27 May to 3 June 2022



We can learn from experience...rather than from models

Reality #6: There is not enough energy investment



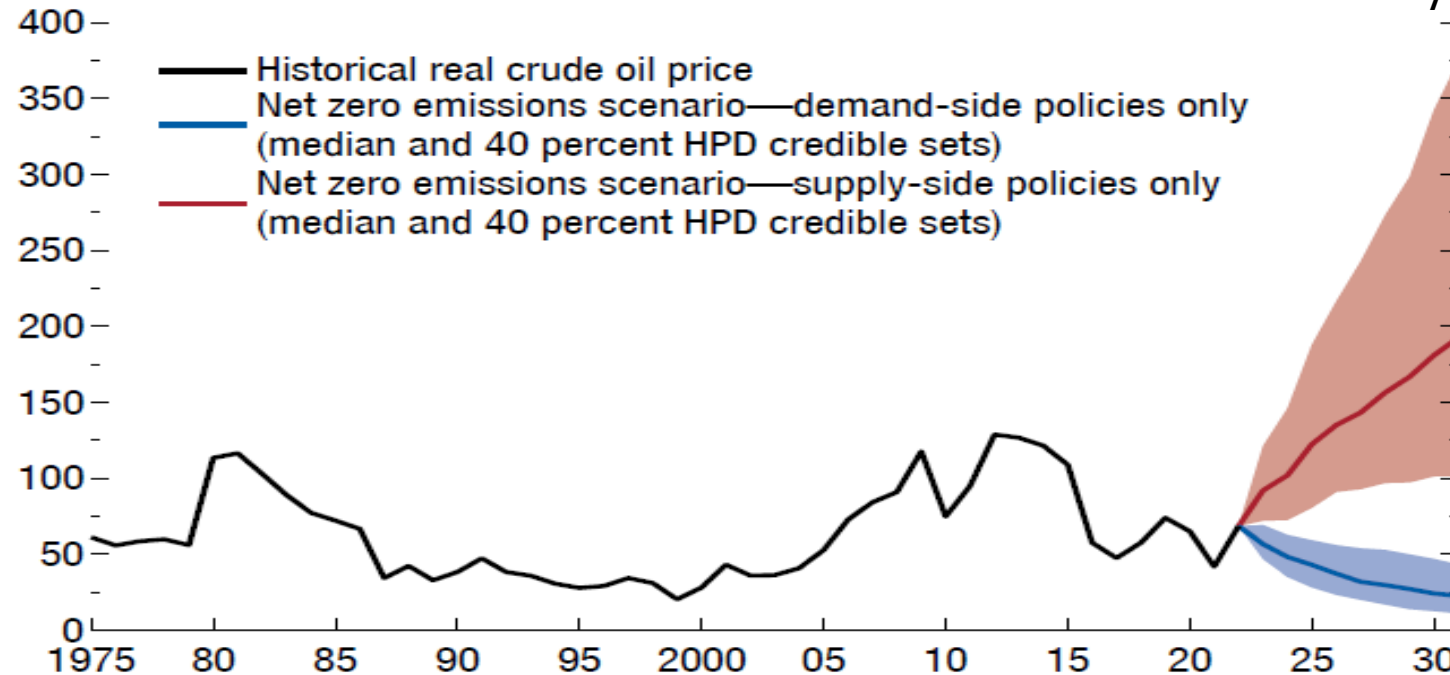
The world is not investing enough to meet its future energy needs; oil and gas investment is geared to a world of stagnant or falling demand, while transition-related spending is not rising nearly fast enough

Reality #7: Limiting supply, rather than demand, means high prices

IMF Comparison of Oil Prices for NZE demand-only vs supply-only policies

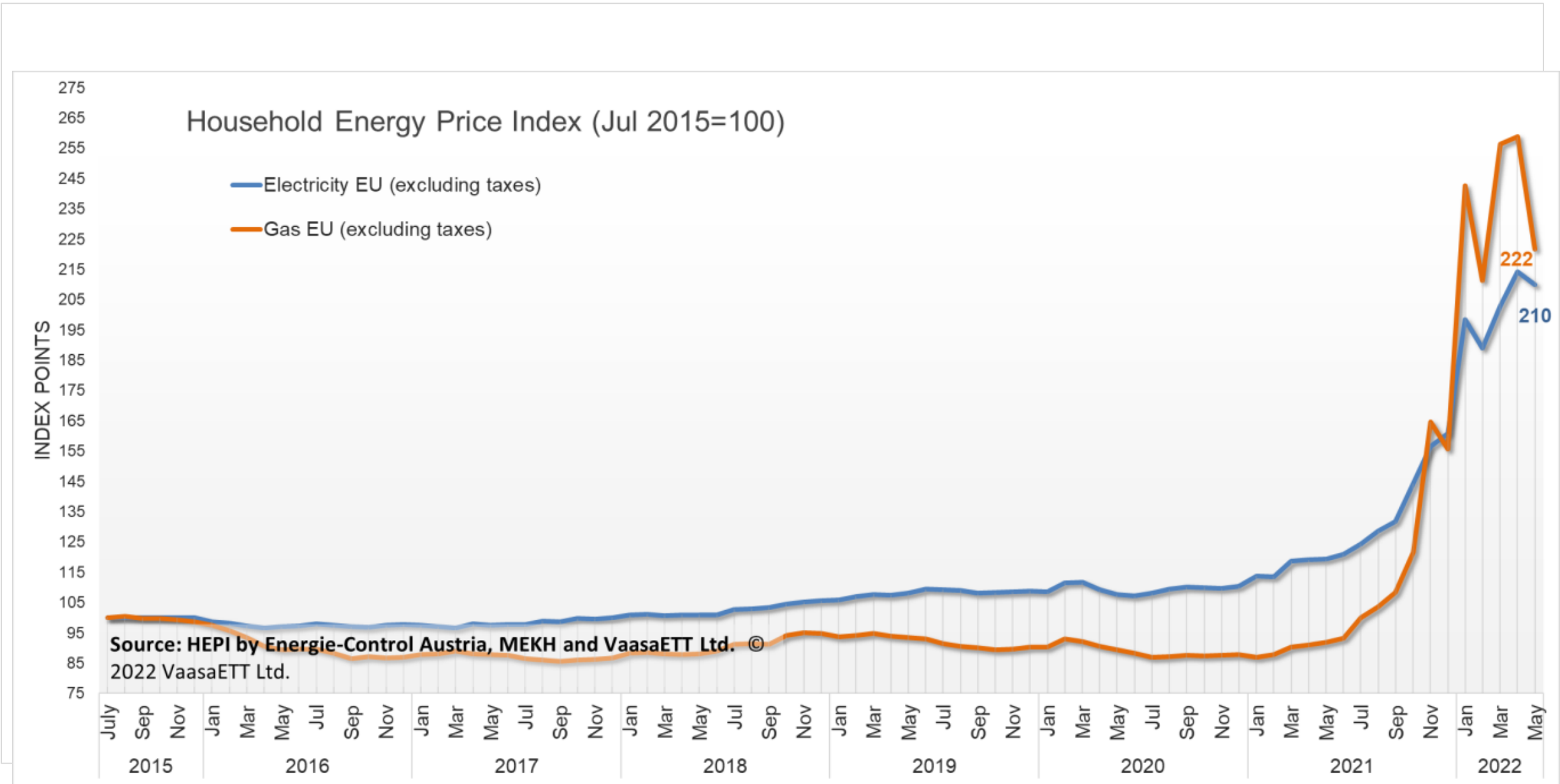
Figure 1.SF.7. Oil Prices Rise in a Net Zero Emissions Scenario Driven by Supply Policies, Decline when Driven by Demand Policy
(US dollars a barrel)

Source: IMF World Economic Outlook, April 2022.



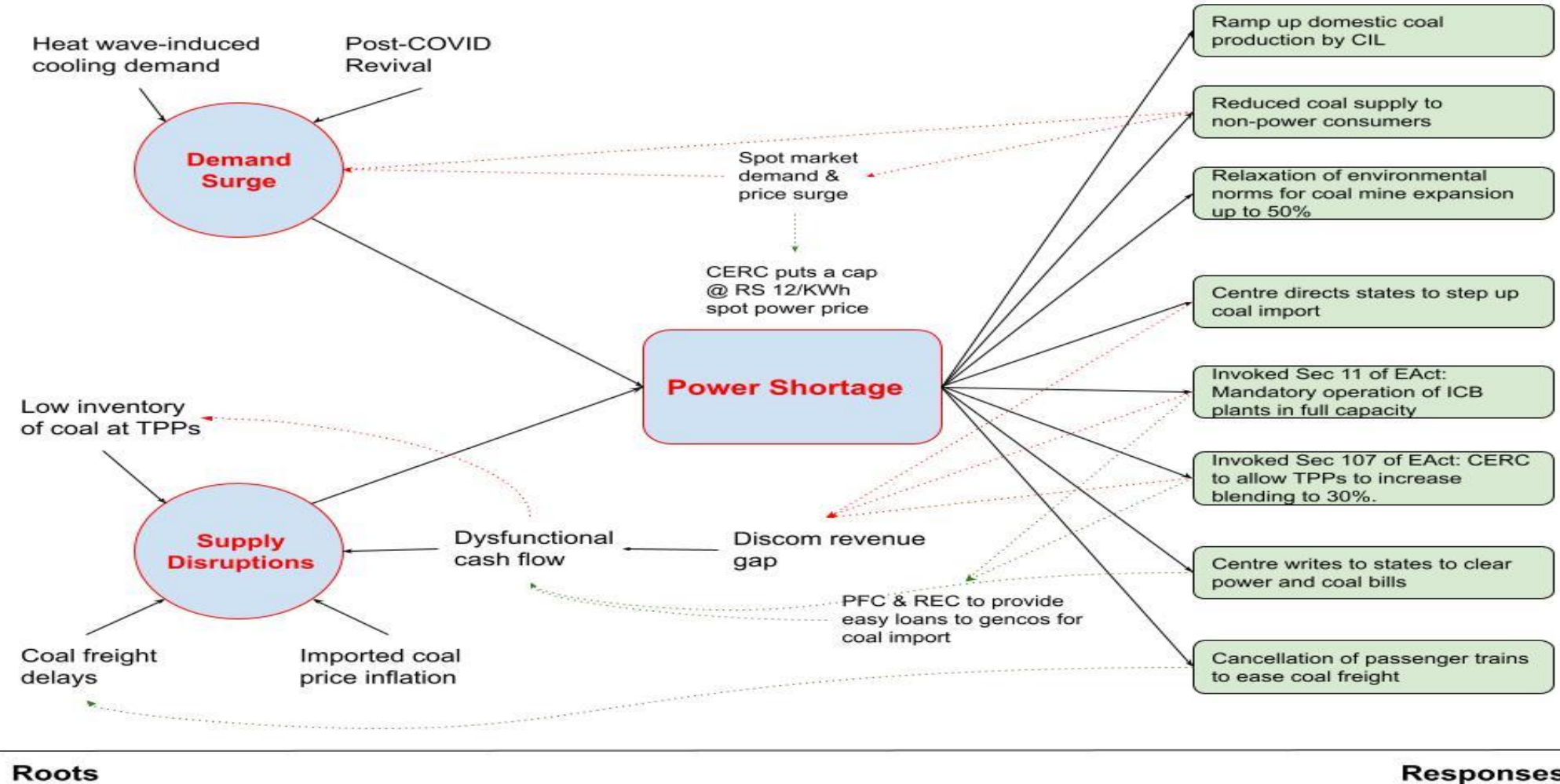
High prices through investment restrictions can accelerate transitions to the benefit of producers

Reality #8: Affordability and security will drive change in Europe



Reality #9: High prices can have more profound impacts in developing markets

Causes and State Responses to Power Shortage in India



- Nearly all the growth in the demand for energy services comes from developing economies.
- China produces more _____ than the rest of the world combined
(correct answers include coal 54%, steel 57%, cement 55%, aluminum 60%, solar panels 70%, rare earths 60%, and wind turbines 50%, among others). Almost half of the world's (four wheeled) EVs are Chinese.
- China has a proven ability to execute policy...should it decide to fully commit to low emissions it would change China... and the world.

Key Messages

- **We could get to NZE by 2050 by focussing on changing the demand for fossil energy.** It means much more efficiency, decarbonisation of power supply, electrification, biofuels and hydrogen, and we'd still need carbon capture and storage.
- **Today's realities are much different.** Despite huge progress on solar PV, wind and EVs, demand and emissions are up, investment is too low, leading to high prices and energy insecurity.
- **Yet clean energy transitions are still moving ahead.** High wind and solar PV futures appear inevitable, how to make them reliable futures is still to be proven.
- **Energy geopolitics is back, with some new players.** China, India and other large developing countries are feeling the effects of current crisis. Their response will shape the global energy future.