World Energy Outlook 2022

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CORC Carbon Forum

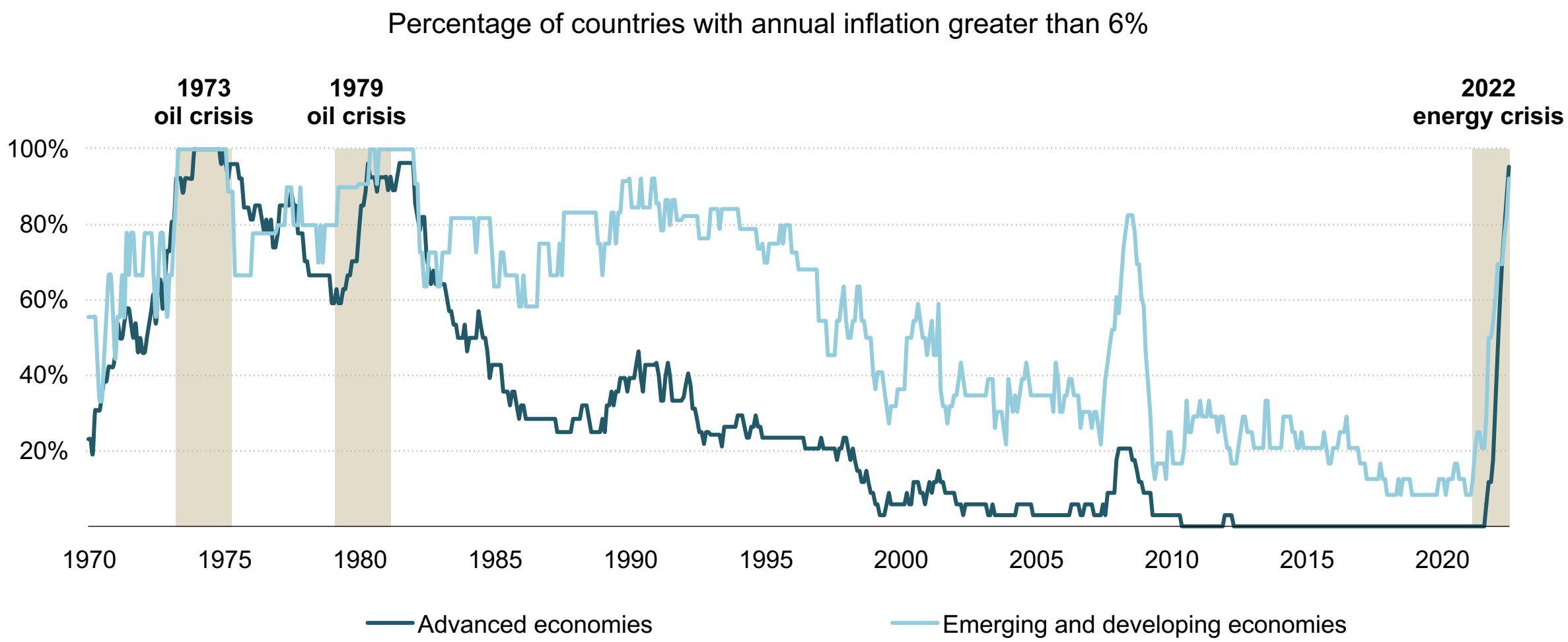
7 November 2022

International Energy Agency

Russia’s invasion of Ukraine has sparked a global energy crisis

- Russia’s invasion of Ukraine has plunged the energy sector into full-blown turmoil, cutting supplies from the world’s largest fossil fuel exporter
- Oil & gas markets are facing major uncertainties amid today’s geopolitical upheaval
- High energy prices have stoked inflation and created a looming risk of global recession

An energy shock of unprecedented breadth and complexity



Exacerbating already tight energy markets, the Russian invasion of Ukraine has tipped the world into a global energy crisis of unprecedented breadth and complexity, affecting all countries and the vulnerable in particular

Russia's invasion of Ukraine has sparked a global energy crisis

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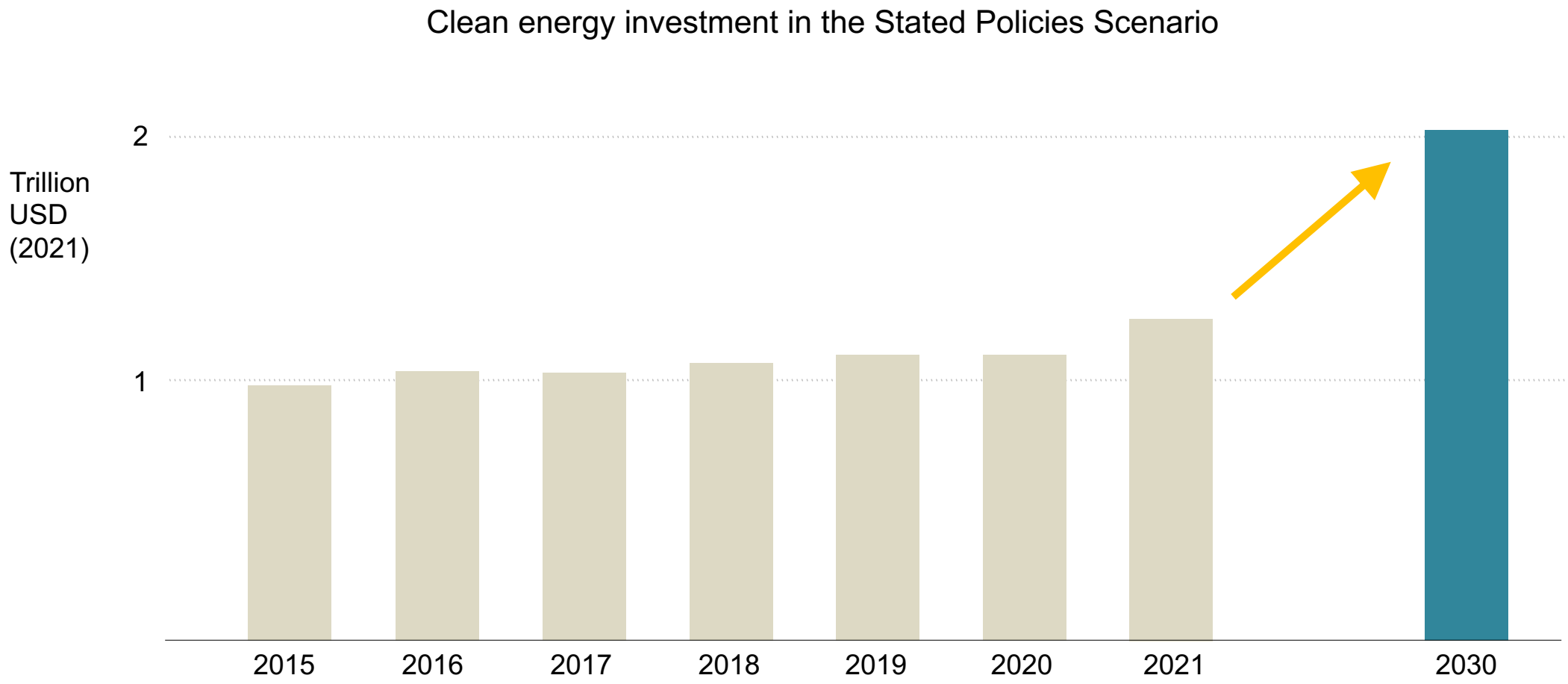
Is today's energy security crisis a lasting setback for energy transitions, or a catalyst for accelerated action?

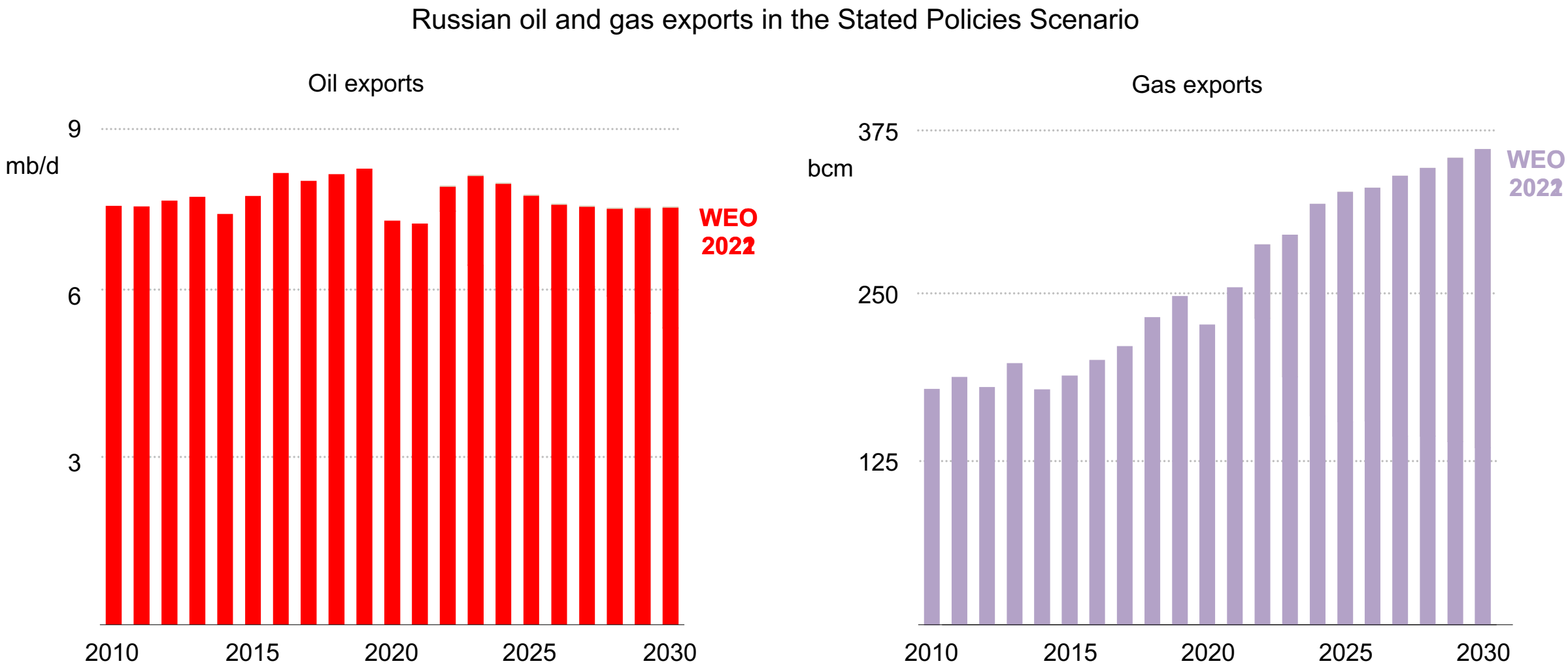
- The new *Outlook* considers multiple scenarios:
  - ***Stated Policies*** (STEPS) reflects today's policy settings
  - ***Announced Pledges*** (APS) if country net zero and other pledges are met in full
  - ***Net Zero Emissions by 2050*** (NZE) – an updated roadmap to limit warming to 1.5°C

Government responses are fast-tracking the clean energy economy



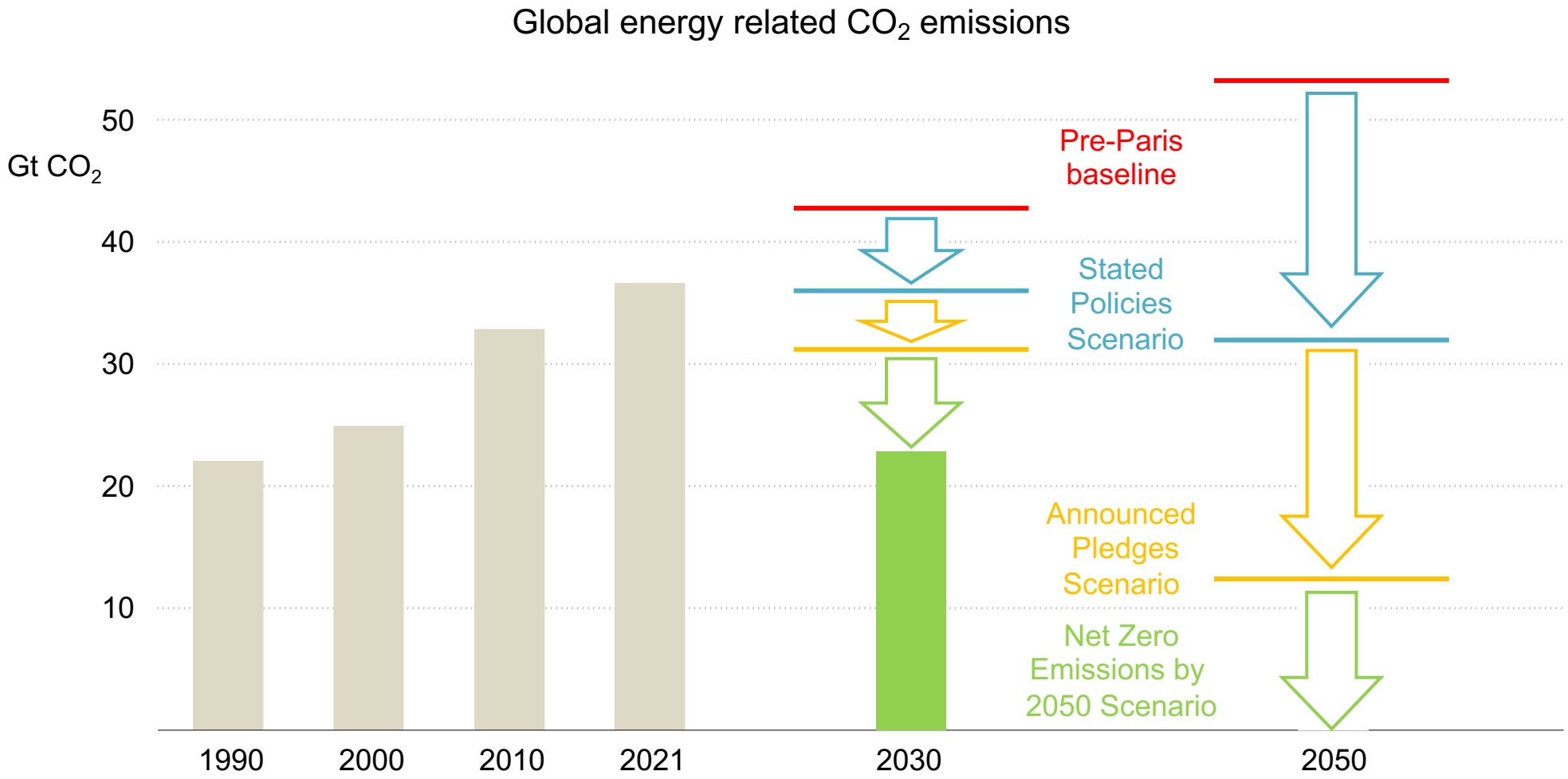
The US Inflation Reduction Act, the EU's Fit for 55 package, Japan's GX, China's new clean energy targets and India's solar revolution propel clean energy investment to new highs, but $4 trillion is needed by 2030 to be on track for 1.5 °C

Russia faces a much-diminished role in international energy



Russia's share of global oil and gas trade halves by 2030, with exports from the United States, Middle East, South America and East Africa – and enhanced efforts to reduce demand – filling the gap

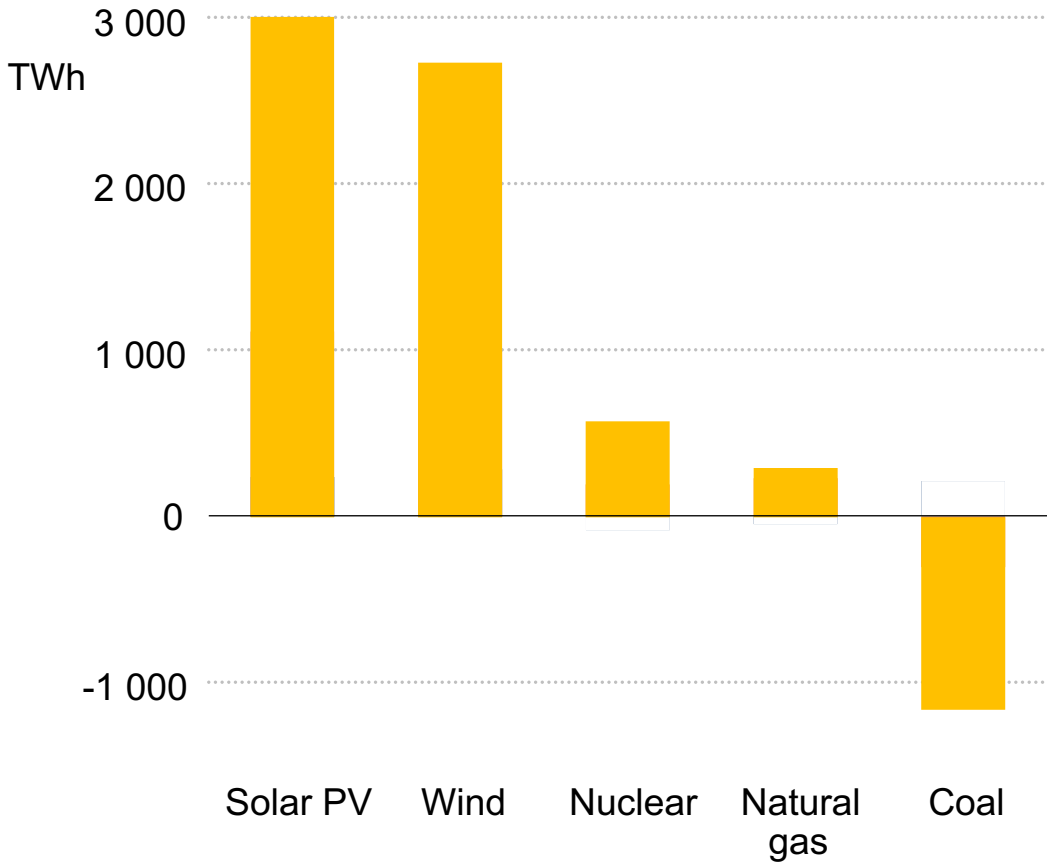
Keeping the door to 1.5 °C open



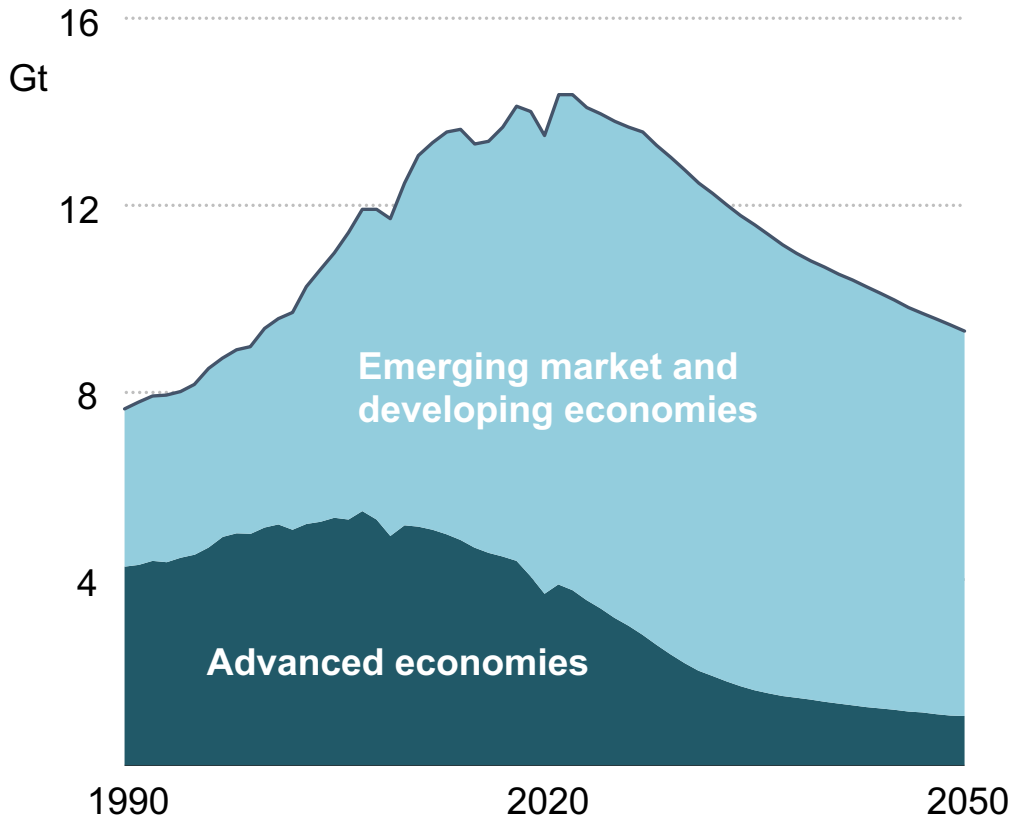
Policy and technology progress since 2015 has shaved 1 °C off projected warming, a step in the right direction; but much more needs to be done in order to avoid dramatic climate damages

Electricity is turning the corner

Change in generation in the STEPS, 2021-2030

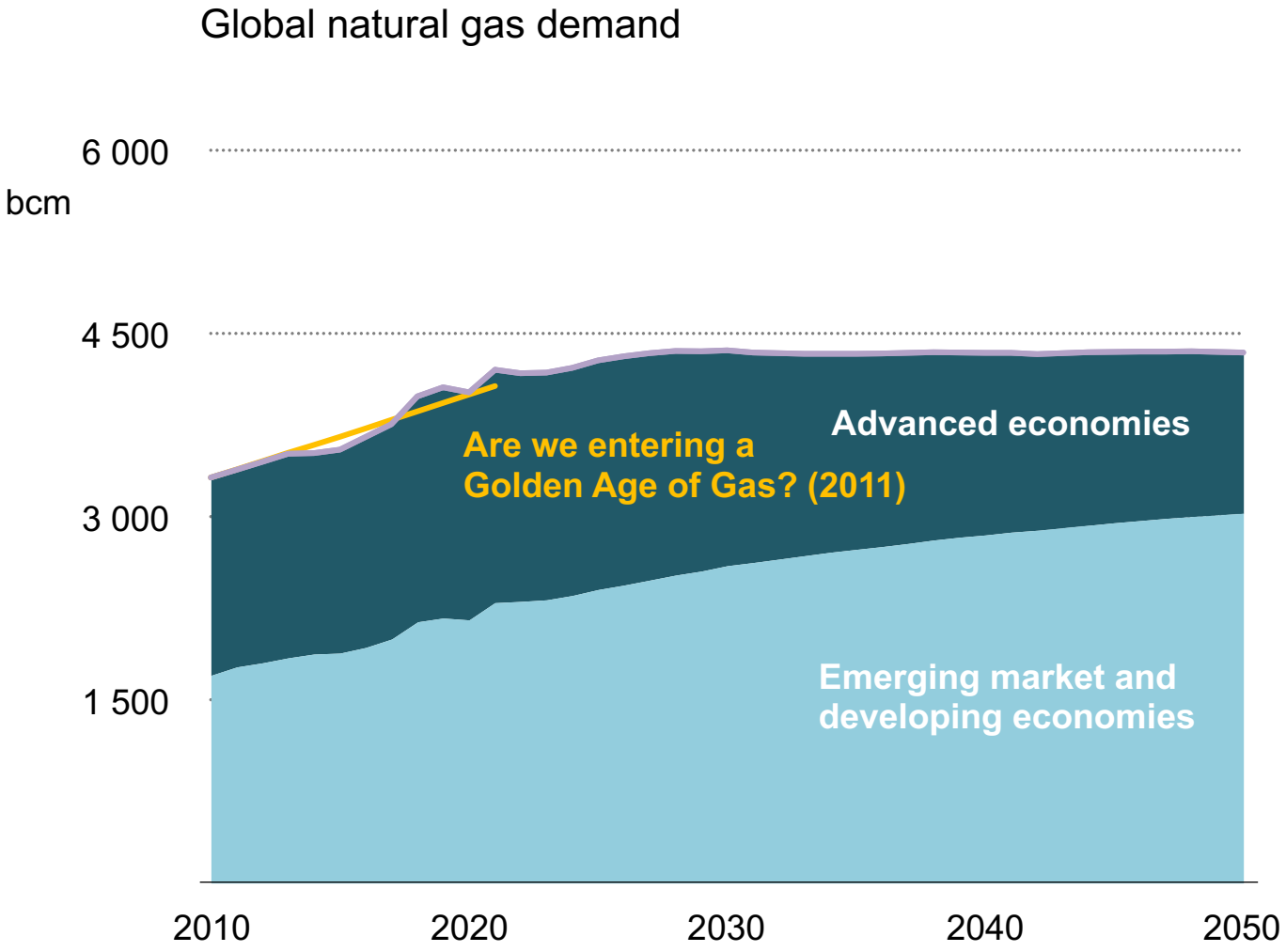


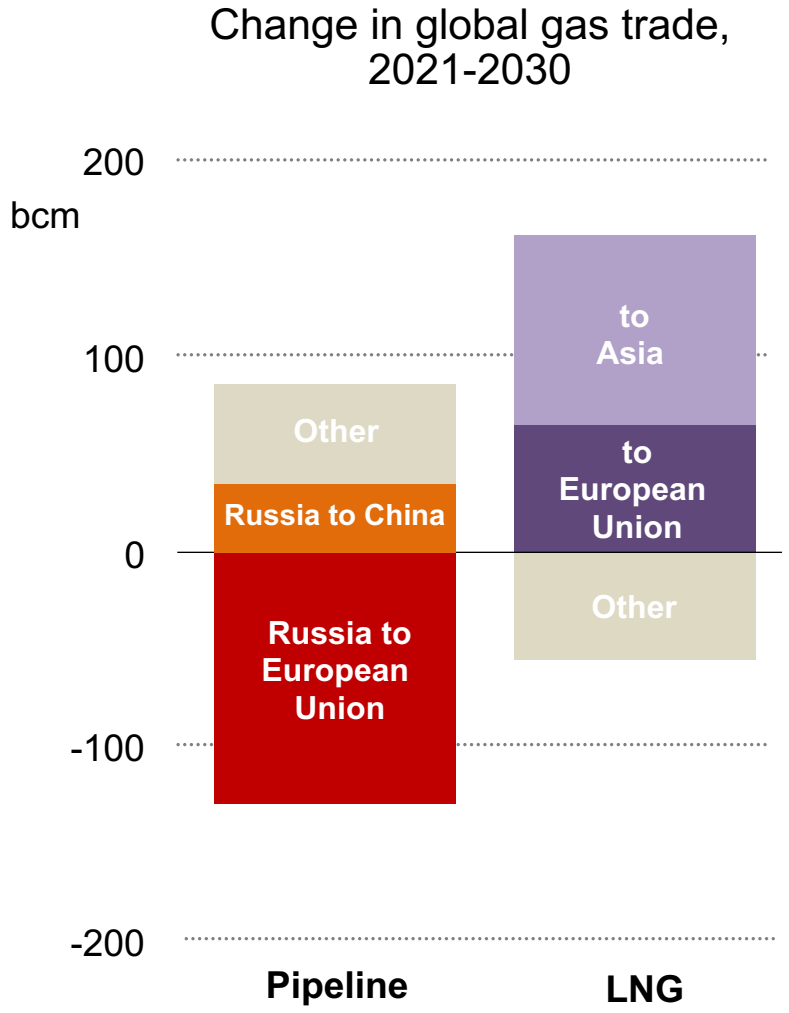
Power sector CO_2 emissions



As markets rebalance, the upside for coal is temporary as renewable generation rises by 90% to 2030; the peak in power sector emissions needs to be followed by a much steeper decline to be consistent with global climate goals

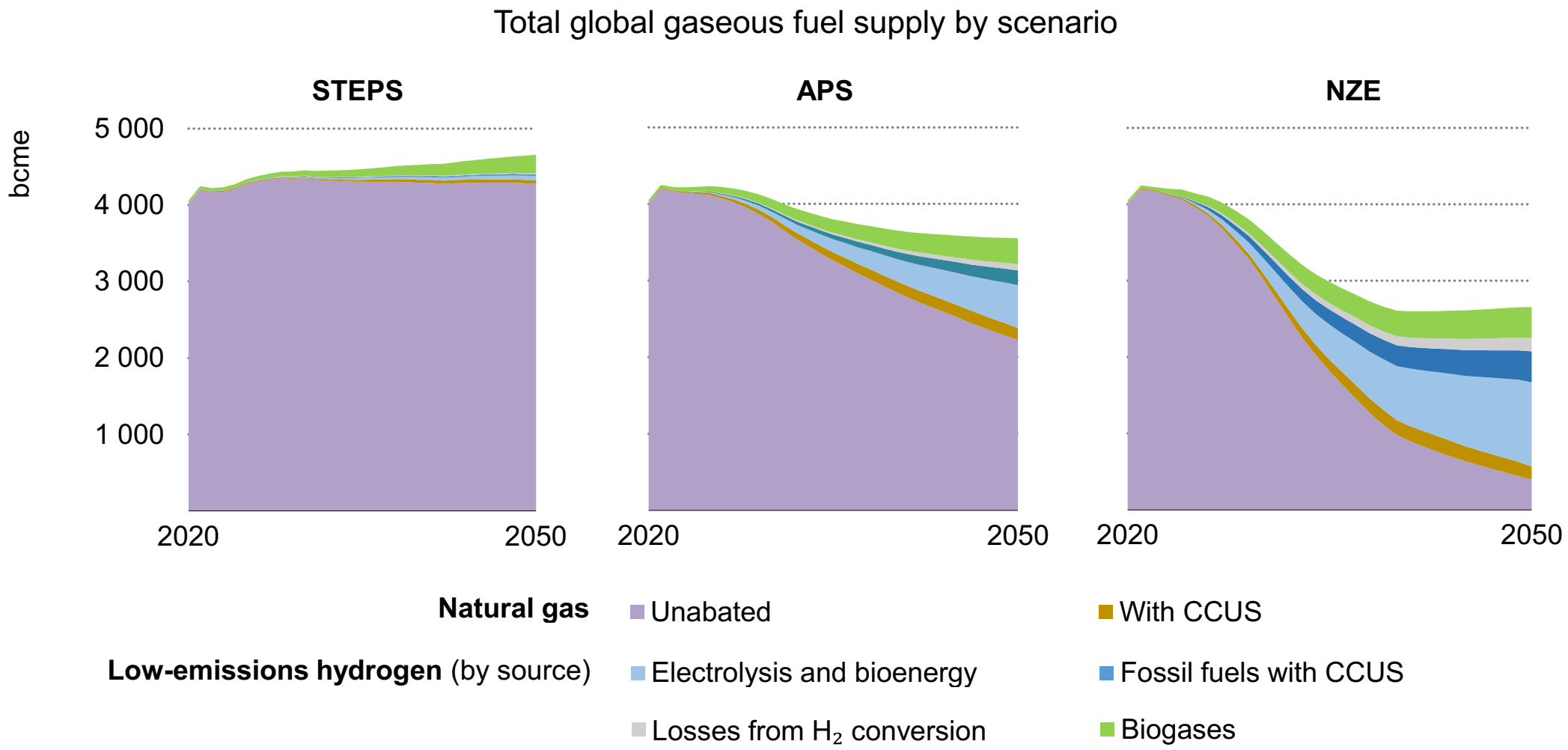
The era of natural gas demand growth is coming to an end





Strengthened policies, high near-term prices & energy security concerns are bringing the "Golden Age of Gas" to a close

While natural gas peaks in STEPS, total gases continue to rise

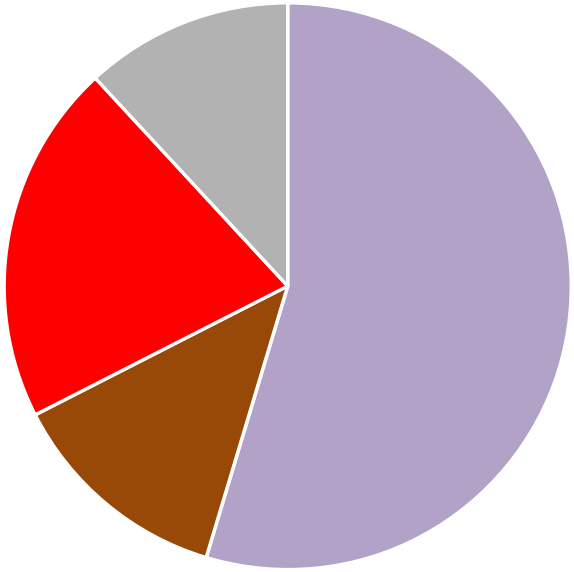


Drops in supply for unabated uses are partly offset by a rise in hydrogen, biogas and gas use with CCUS

Biomethane helps the developing world move away from coal

Drivers of biomethane demand growth in the Announced Pledges Scenario, 2021-2050

Advanced economies
80 bcm by 2050



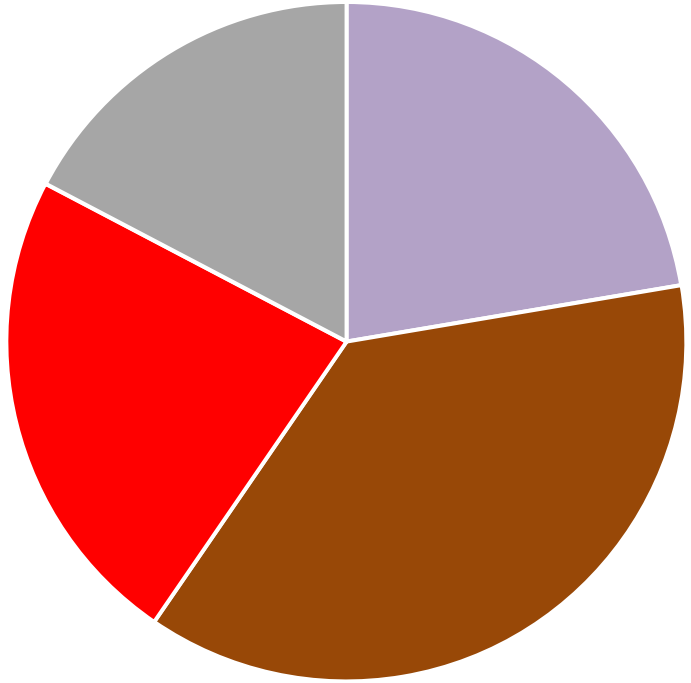
Replacing natural gas

Replacing coal

Replacing oil

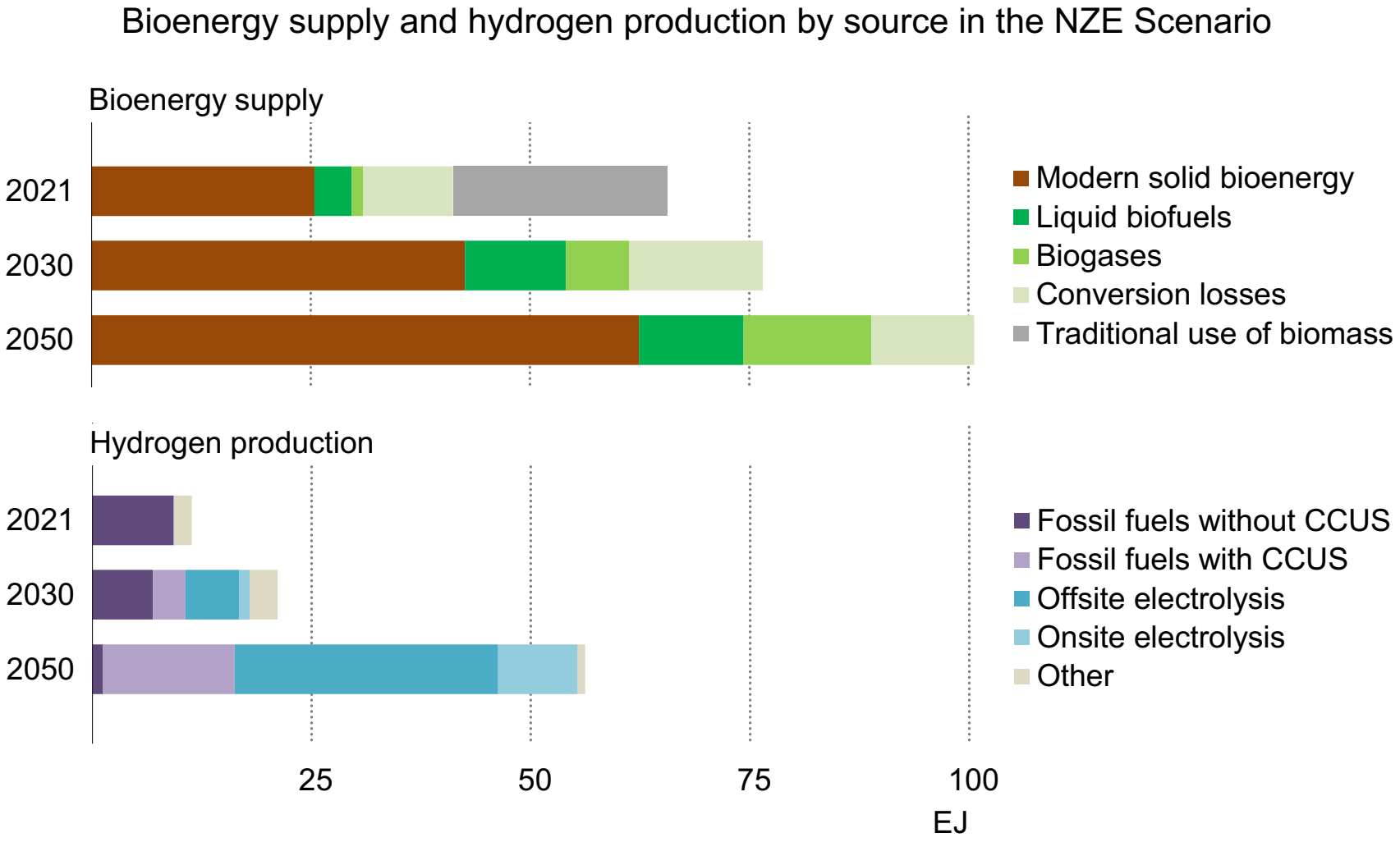
Other drivers

Emerging market and developing economies
120 bcm by 2050



In advanced economies, biomethane is deployed primarily to displace existing natural gas demand.

For net zero emissions, molecular low-emissions fuels grow rapidly

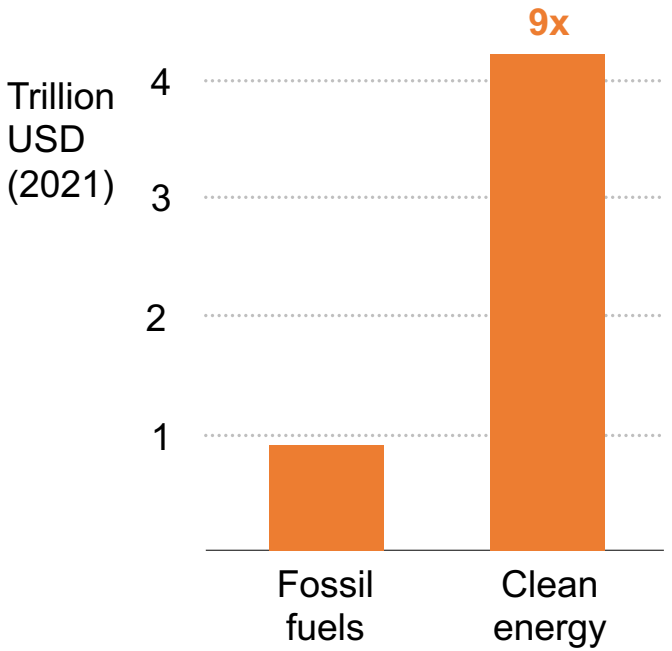


Hydrogen production rises nearly fivefold, while modern bioenergy supply is limited by sustainable potentials

A new energy security paradigm is needed for secure transitions

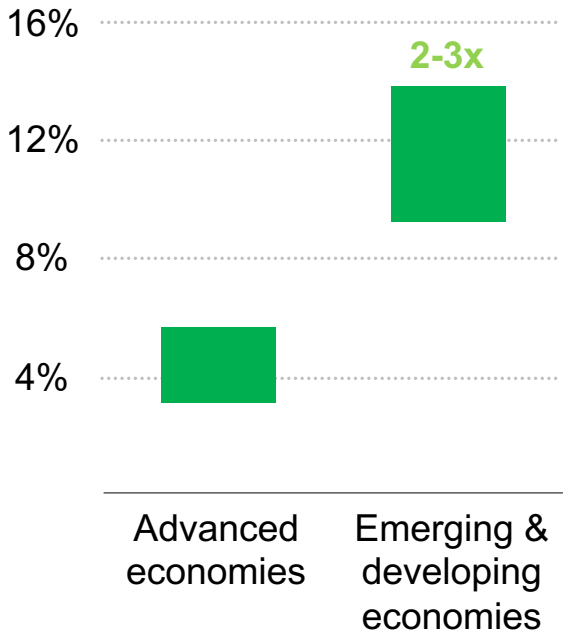
Scale up clean energy to scale back fossil fuels

Investment in NZE Scenario, 2030



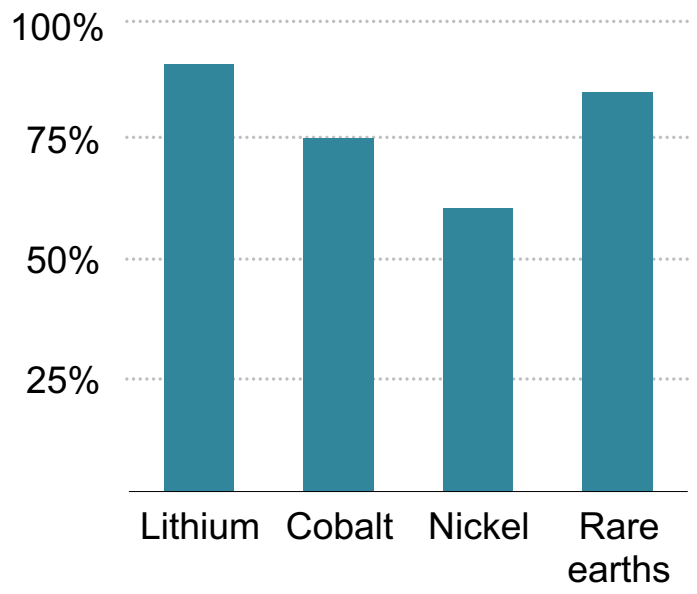
Lift emerging economies into the new energy economy

Cost of capital for solar PV, 2021



Manage new vulnerabilities

Share of top 3 countries in mineral production



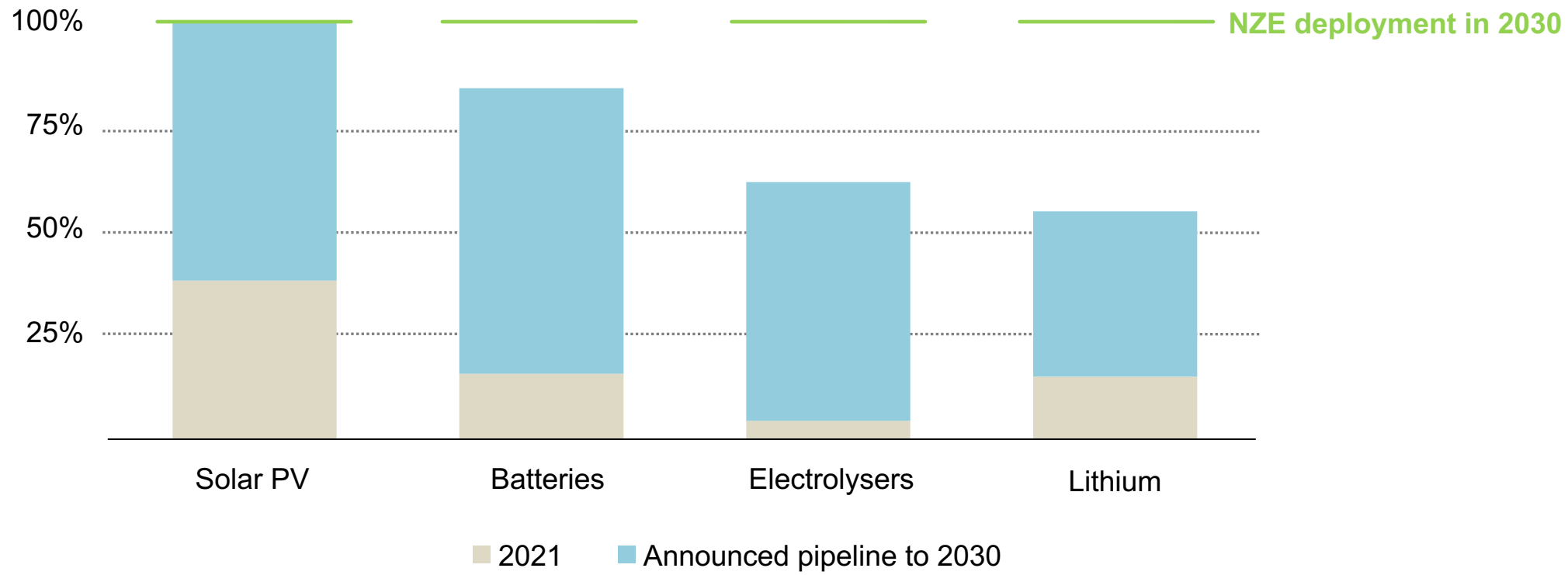
For the duration of energy transitions, the clean energy and fossil fuel systems are *both* required to deliver energy services; assessing & managing the evolving co-existence of both systems is crucial

Conclusions

- Government responses to today's energy crisis are marking this out as a major turning point towards a cleaner and more secure energy system
- Russia's invasion of Ukraine is prompting a wholesale reorientation of energy trade & investment flows, leaving Russia with a much-diminished position in global energy
- Global fossil fuel use has grown alongside GDP since the Industrial Revolution: putting fossil fuel demand into reverse will be a pivotal moment in energy history
- A massive surge in clean energy investment is vital to keep the door to 1.5°C open; without this, avoiding renewed price volatility would require higher oil & gas investment, putting climate goals in jeopardy
- Today's energy crisis provides a stark reminder of why we have to press ahead with energy transitions, & the importance of making change inclusive, affordable & secure

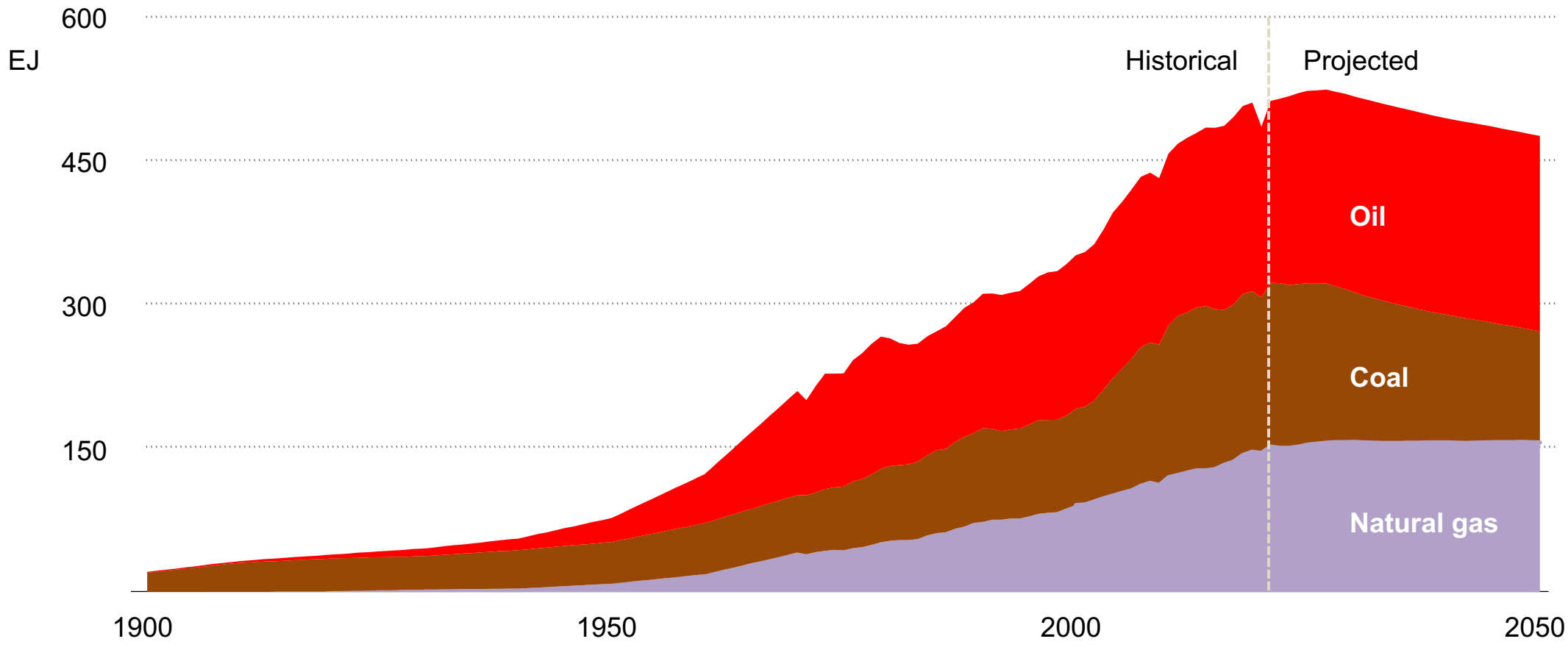
Clean energy manufacturers prepare the ground for faster transitions

Announced manufacturing capacity pipeline compared with NZE Scenario deployment in 2030



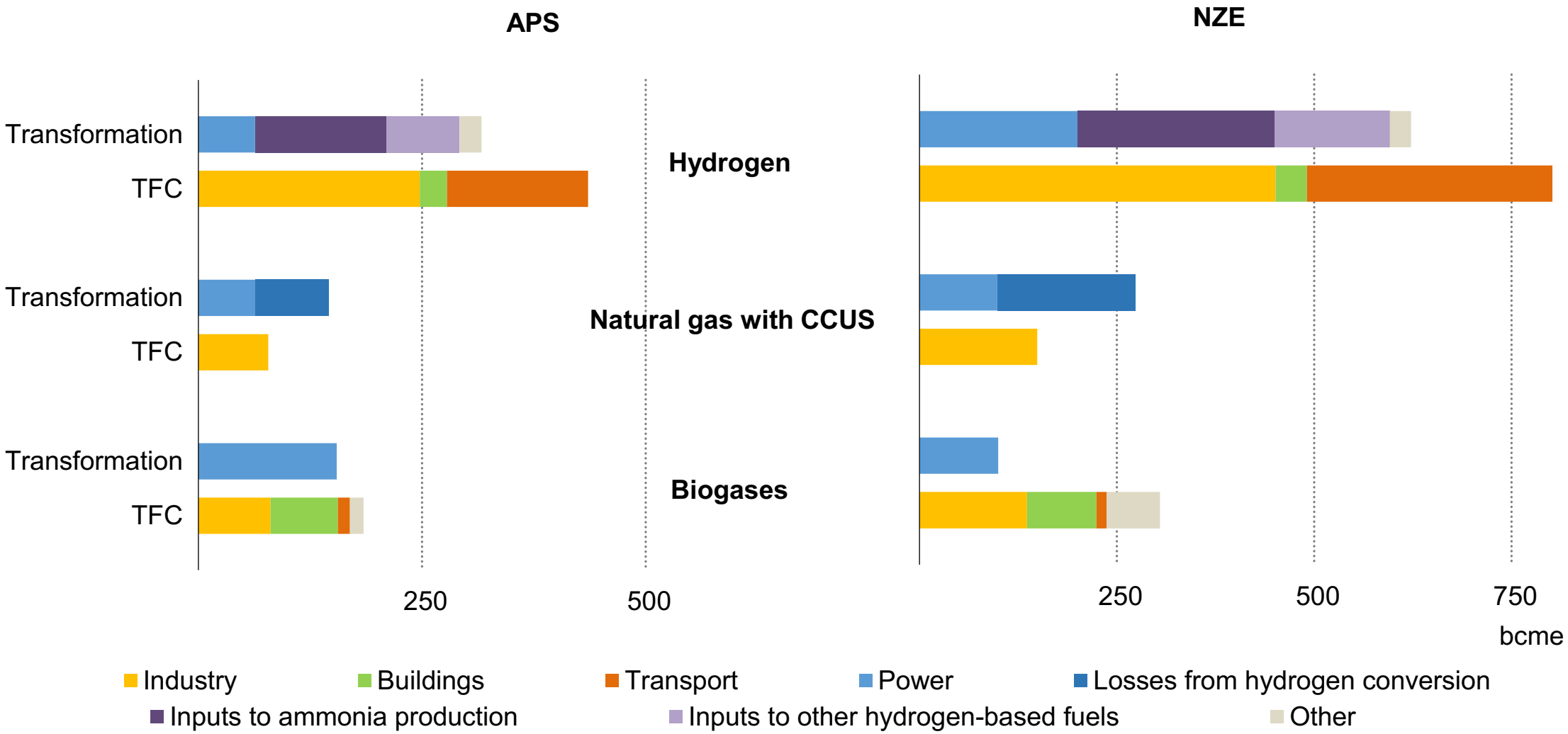
Announced plans to scale up clean energy manufacturing capacity help to accelerate cost reductions and would, in some cases, approach the levels needed to put the world on track with a 1.5 °C pathway

Peak fossil fuel demand is coming this decade

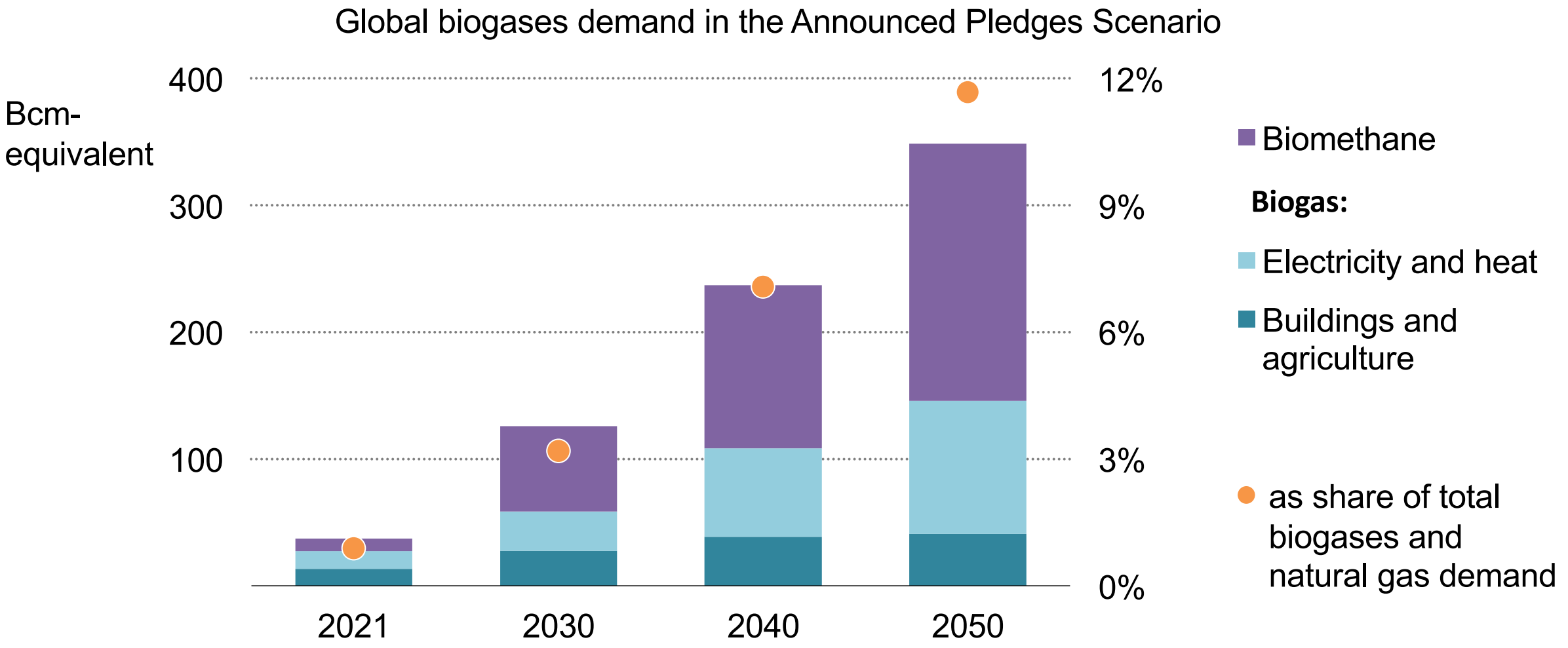


Today's policy settings are now sufficiently strong that they produce a distinct peak in fossil fuel use before 2030

Gas flows to meet demand for low-emissions fuels by sector and scenario



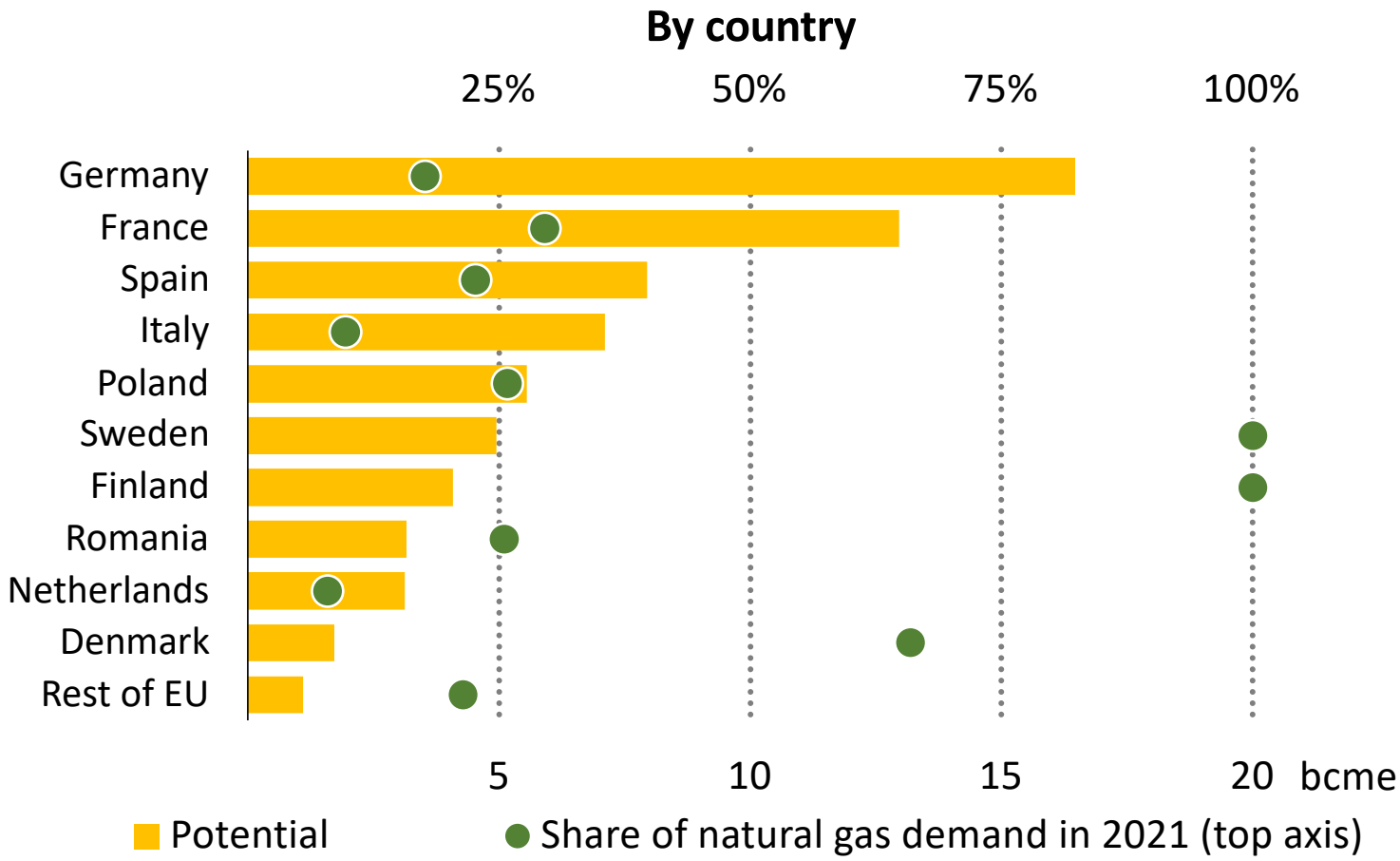
Biomethane is an important fuel for the energy transition

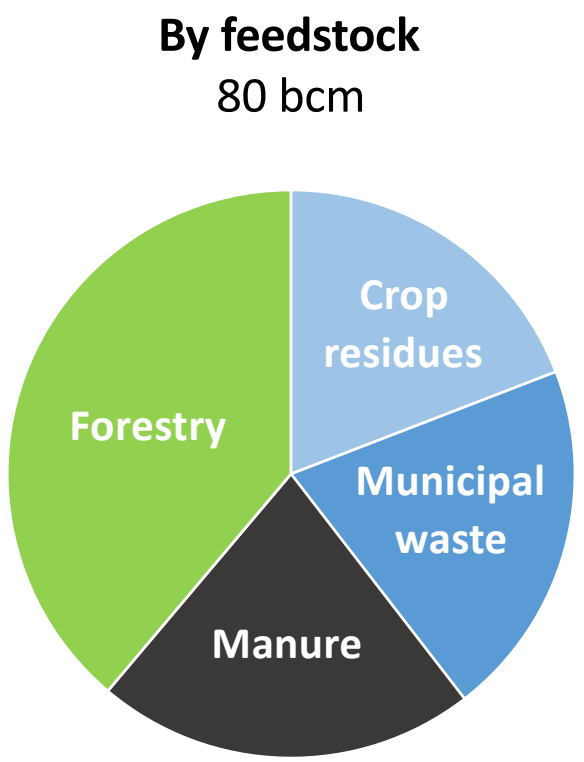


Biogases grow strongly in the APS, reaching 350 bcm by 2050, underpinned by growing policy support around the world for scaling up biomethane.

Europe is the focal point of efforts to develop biomethane

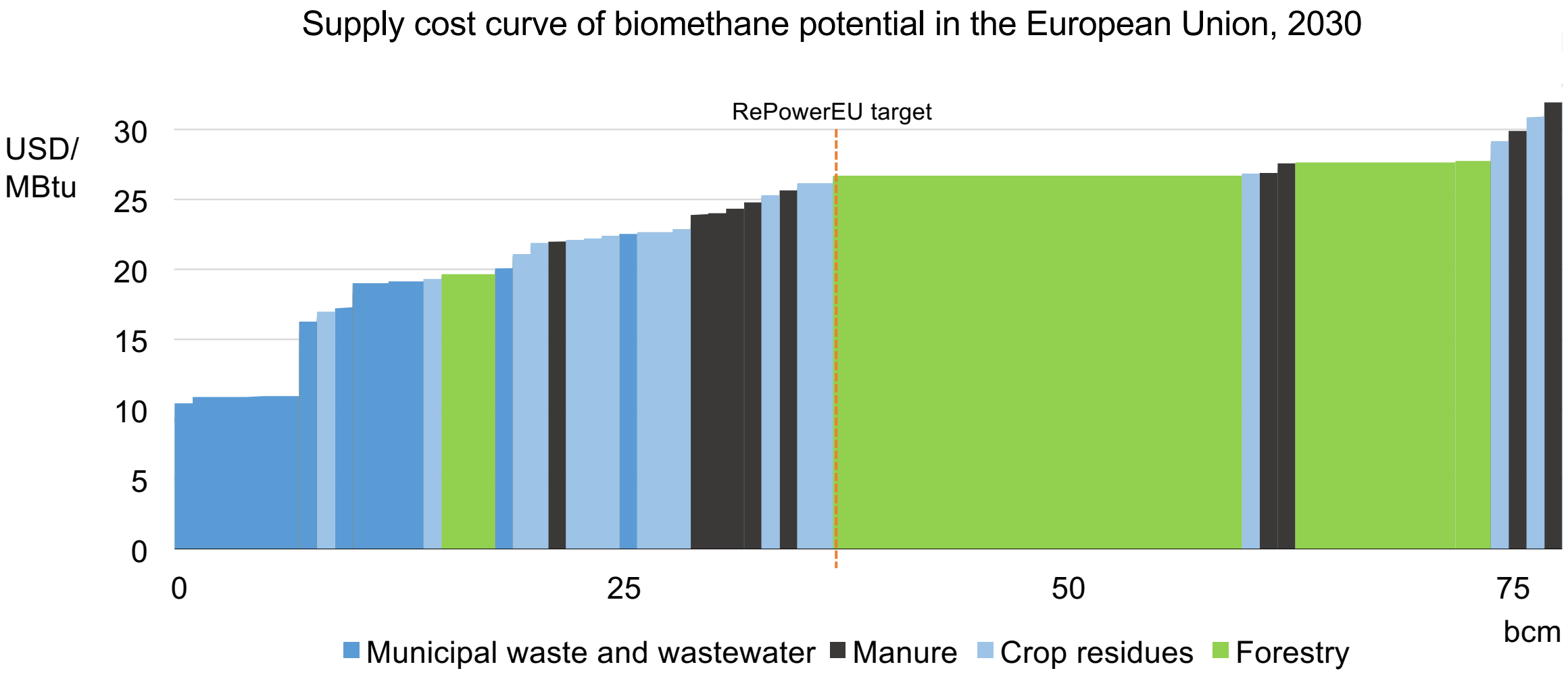
Biomethane potential in the European Union by 2030 compared with the share of natural gas demand in 2021





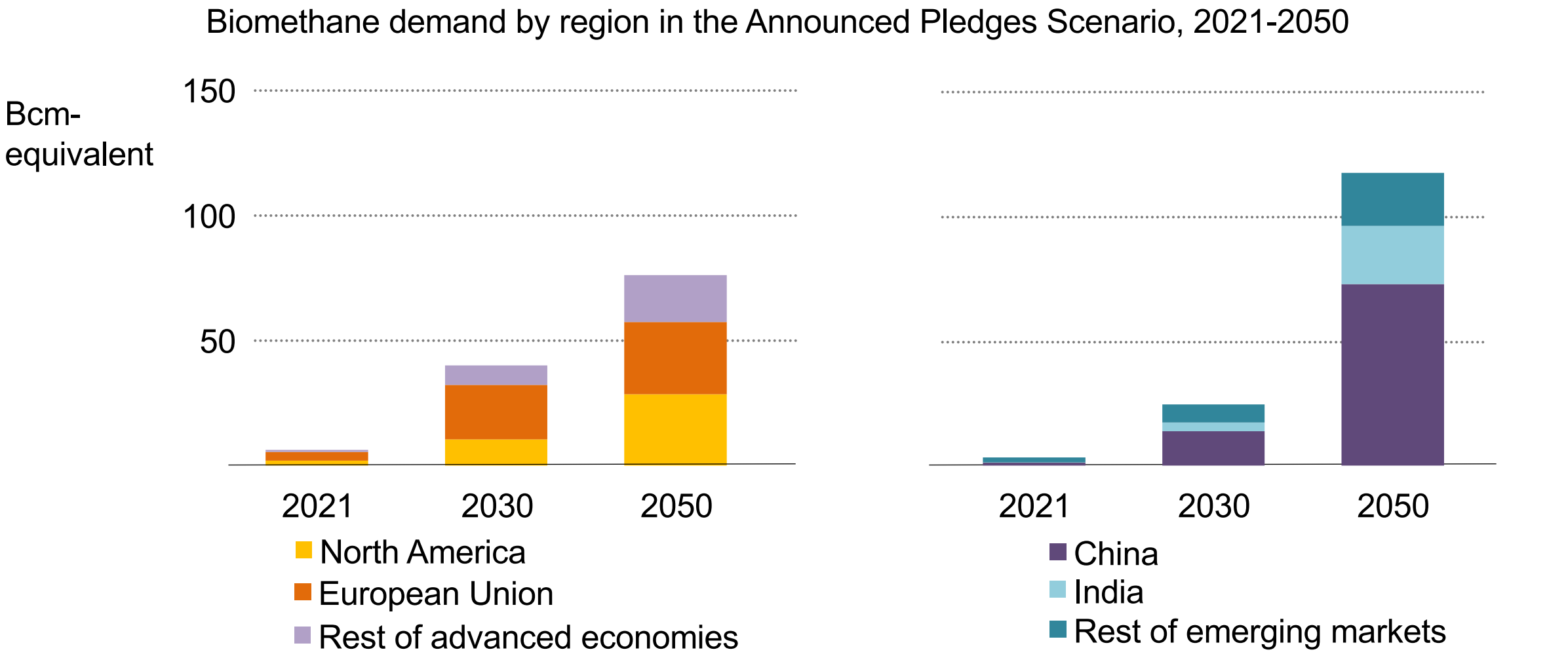
Up to 80 bcm of biomethane could be produced sustainably in the European Union by 2030.

Biomethane is cost-competitive now, but needs long-term support



Up to 35 bcm of biomethane could be produced for around USD 25/MBtu, well below today's record prices. However this excludes grid connection fees, which in some cases may be significant.

There is a wide geographical spread in biomethane deployment



Biomethane is projected to grow strongly in the near-term, especially in advanced economies. Most of the growth after 2030 comes from emerging market and developing economies – led by China.