International Energy Agency

Net Zero by 2050: a Roadmap for the Global Energy Sector

Nordic Energy Research Forum, A Carbon Neutral Nordic Energy System, 21 September 2021

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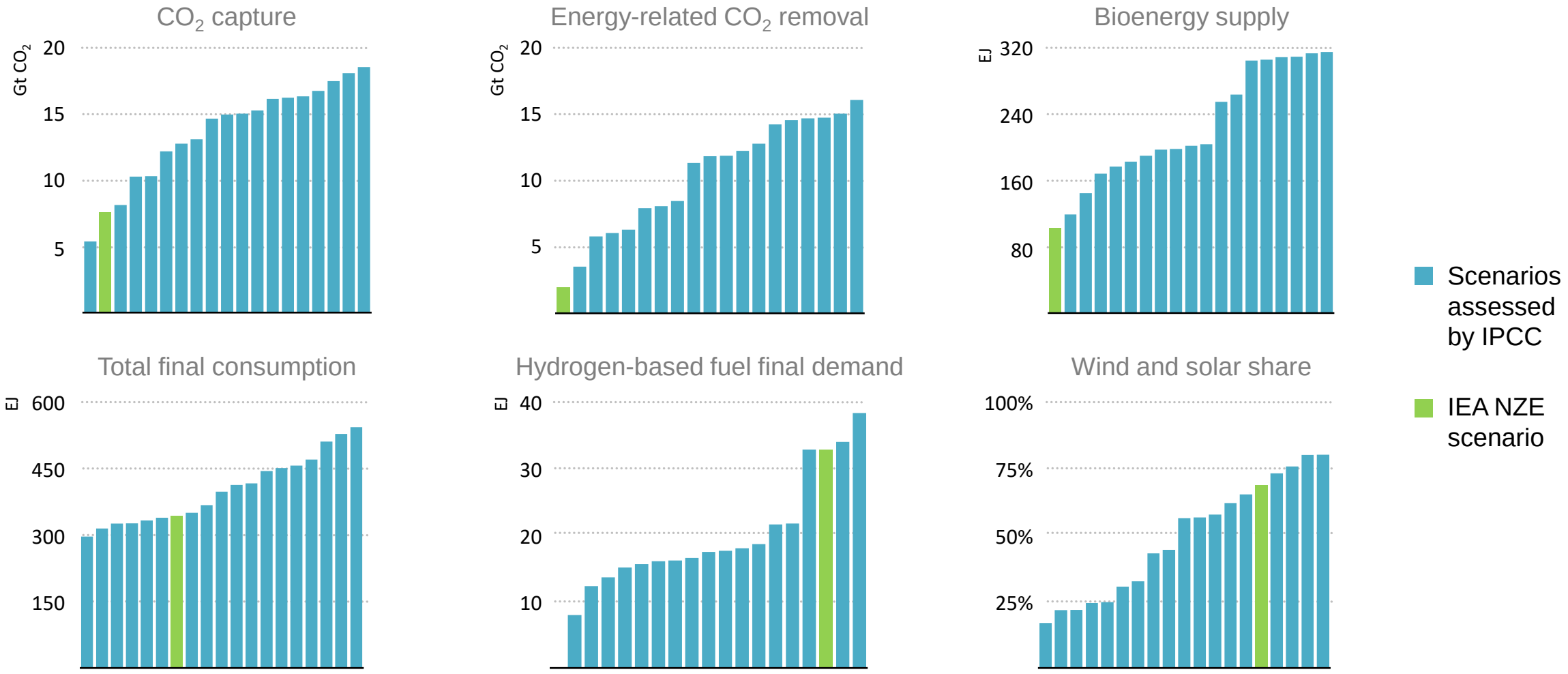
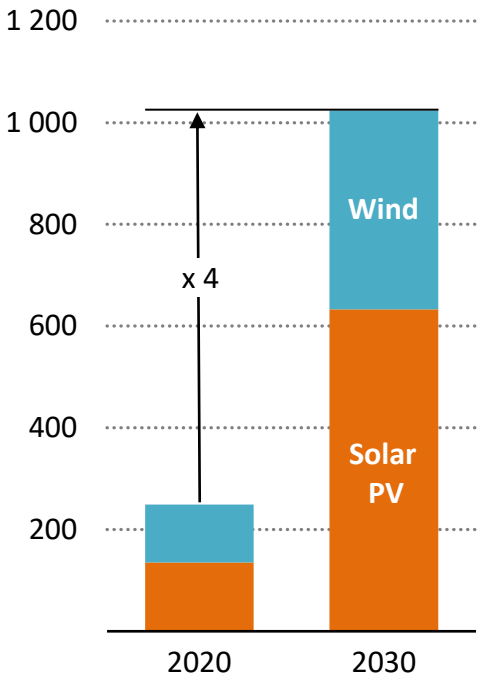
The IEA's NZE in 2050 compared with IPCC net-zero scenarios



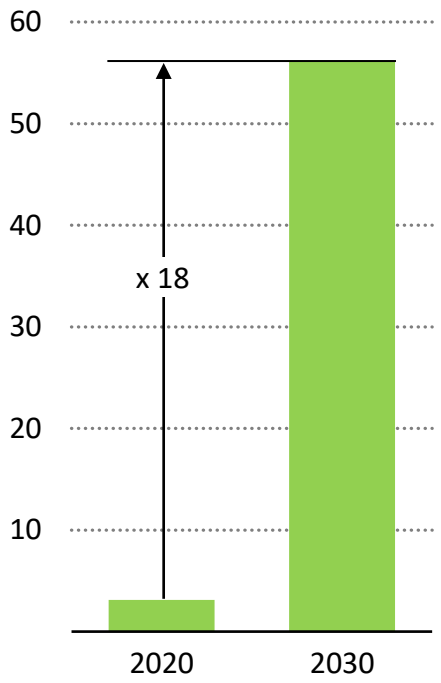
The IEA NZE scenario uses more renewables, energy efficiency, and hydrogen – and less CO_2 capture, negative emissions and bioenergy – than IPCC scenarios of a comparable ambition

Make the 2020s the decade of massive clean energy expansion

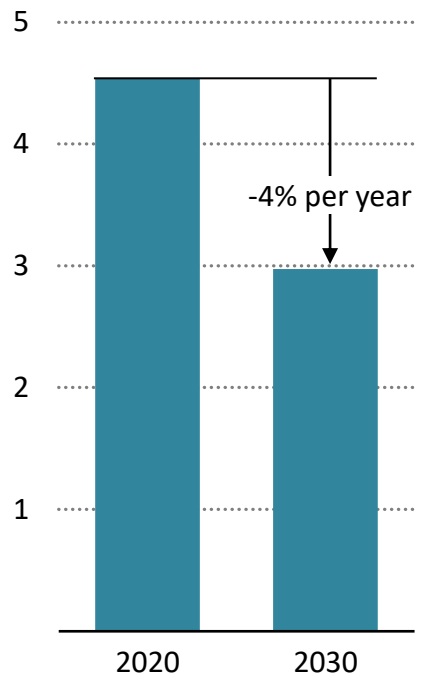
Solar PV and wind capacity additions (GW)



Electric car sales (millions)

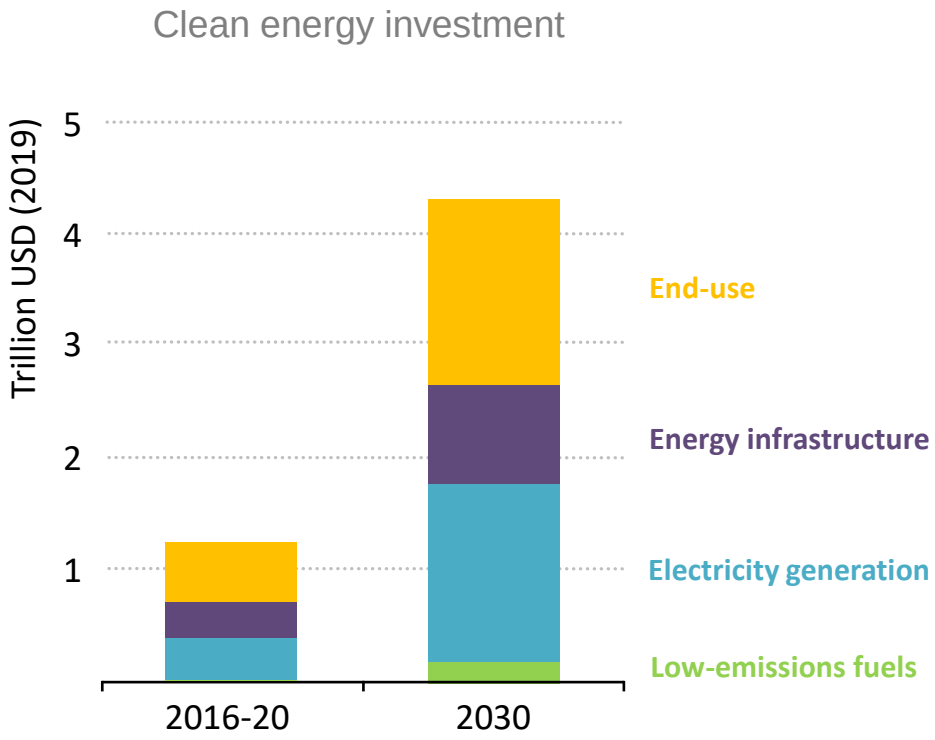


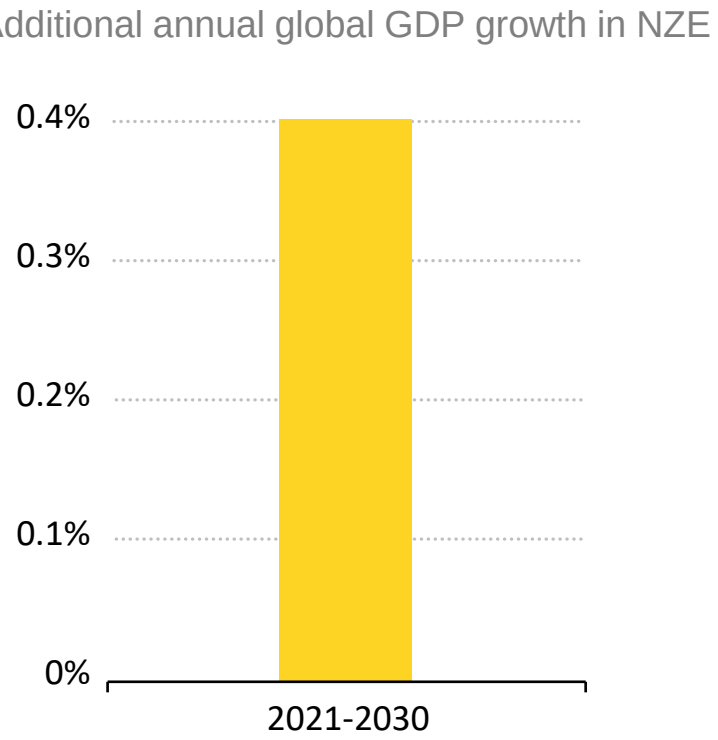
Energy intensity of GDP (MJ per USD PPP)



Technologies for achieving the necessary deep cuts in global emissions by 2030 exist, but staying on the narrow path to net-zero requires their immediate and massive deployment.

Drive a historic surge in clean energy investment

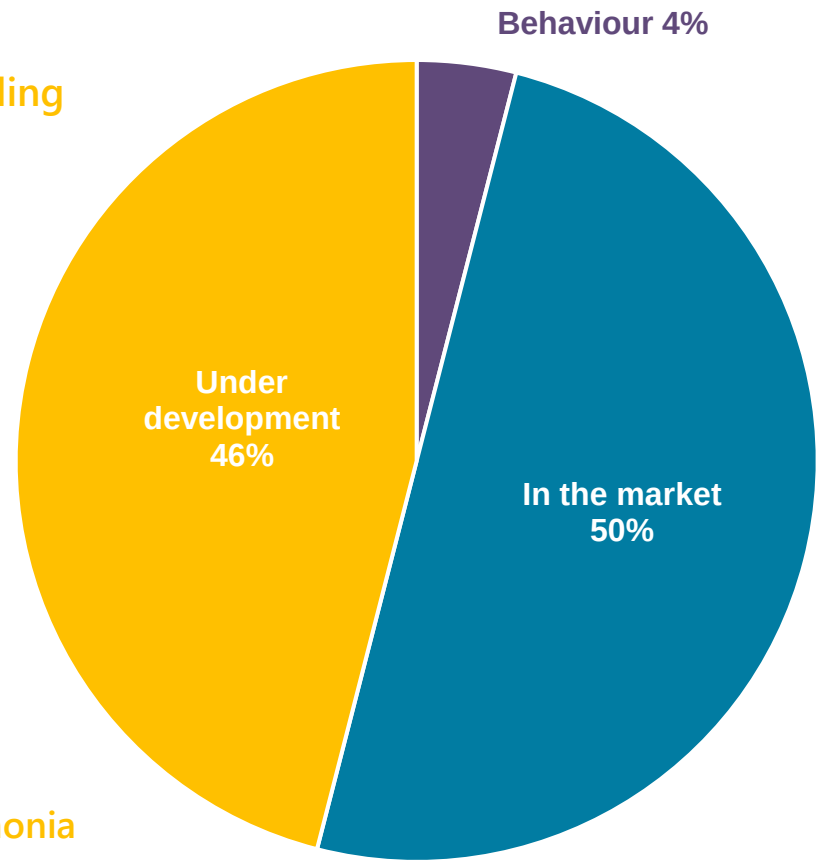




Annual clean energy investment more than triples by 2030 in the NZE scenario, driving an average 0.4% per year increase in global GDP to 2030 & speeding the recovery from the COVID-19 shock

Prepare for the next phase of the transition by boosting innovation

CO_2 savings by technology maturity in 2050, NZE scenario



Refrigerant-free advanced cooling

Advanced batteries

Next-generation biofuels

CO_2 capture from cement

Hydrogen-based steel

Small modular reactors

Synthetic liquid fuels

Electrolytic hydrogen for ammonia

Autonomous trucks

Optimised heat pump with storage

Direct air capture

Ammonia-powered ships

Electrolytic hydrogen for methanol

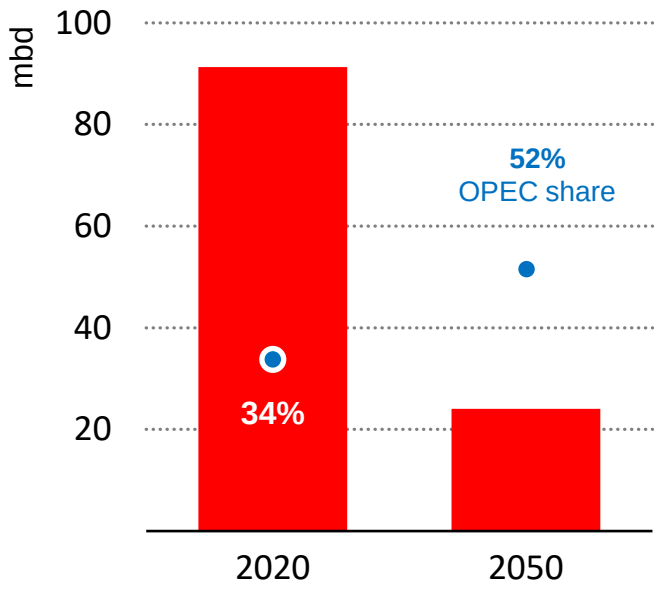
Building-integrated storage

Electric steam crackers

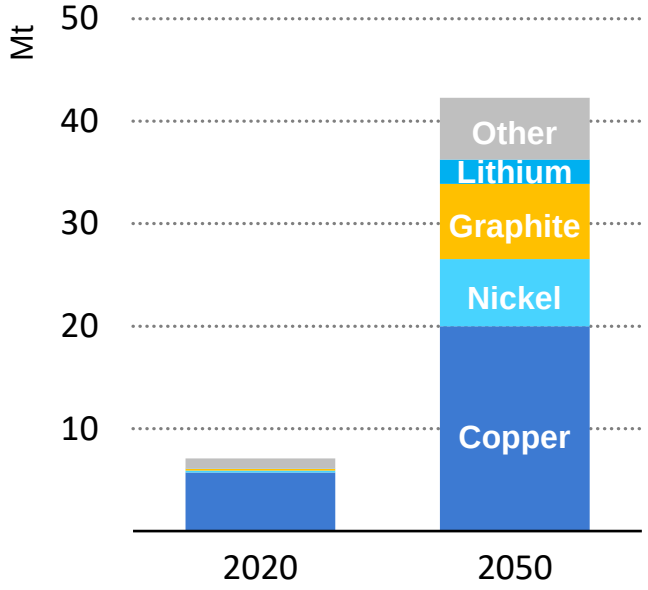
Unlocking the next generation of low-carbon technologies requires more clean energy R&D and $90 billion in demonstrations by 2030; without greater international co-operation, global CO_2 will not fall to net-zero by 2050.

Address emerging energy security risks now

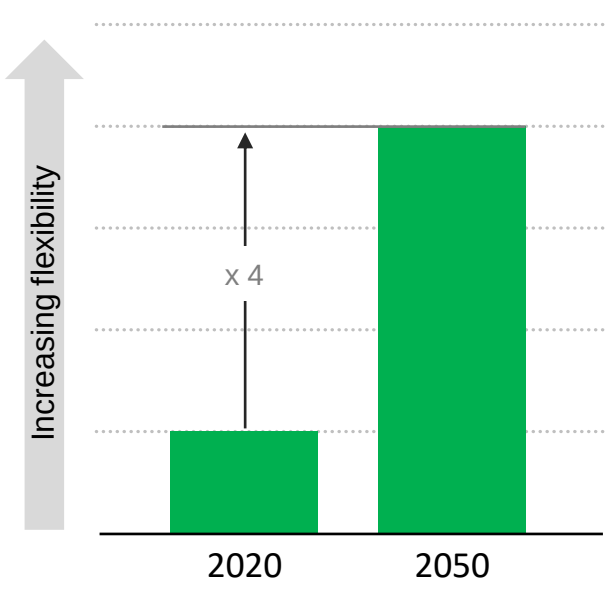
Oil supply and OPEC share



Critical minerals demand

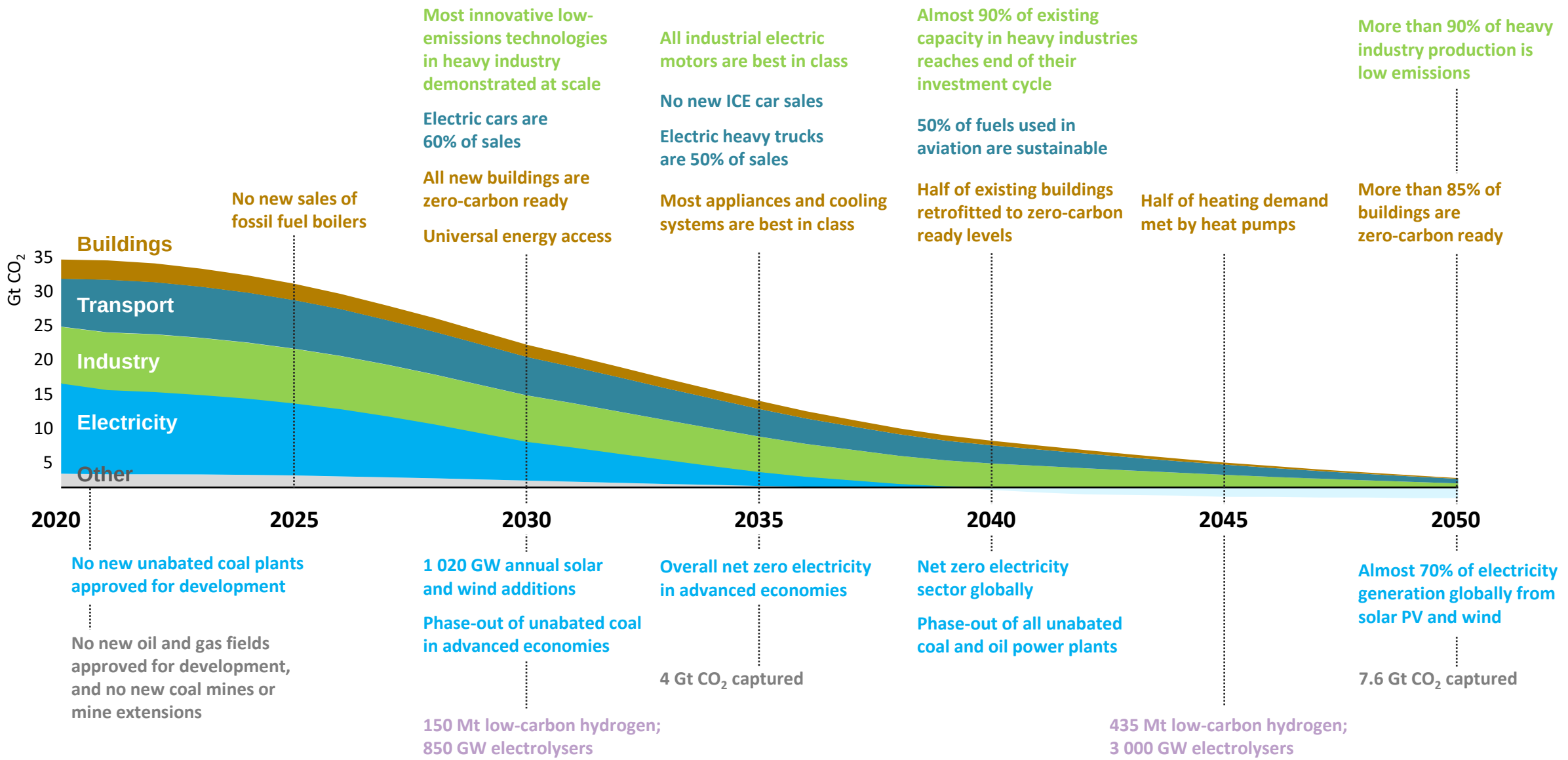


Electricity system flexibility needs



New energy security concerns emerge, and old ones remain; governments need to proactively plan for energy security risks related to market concentration, critical minerals and electricity systems.

Set near-term milestones to get on track for long-term targets



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