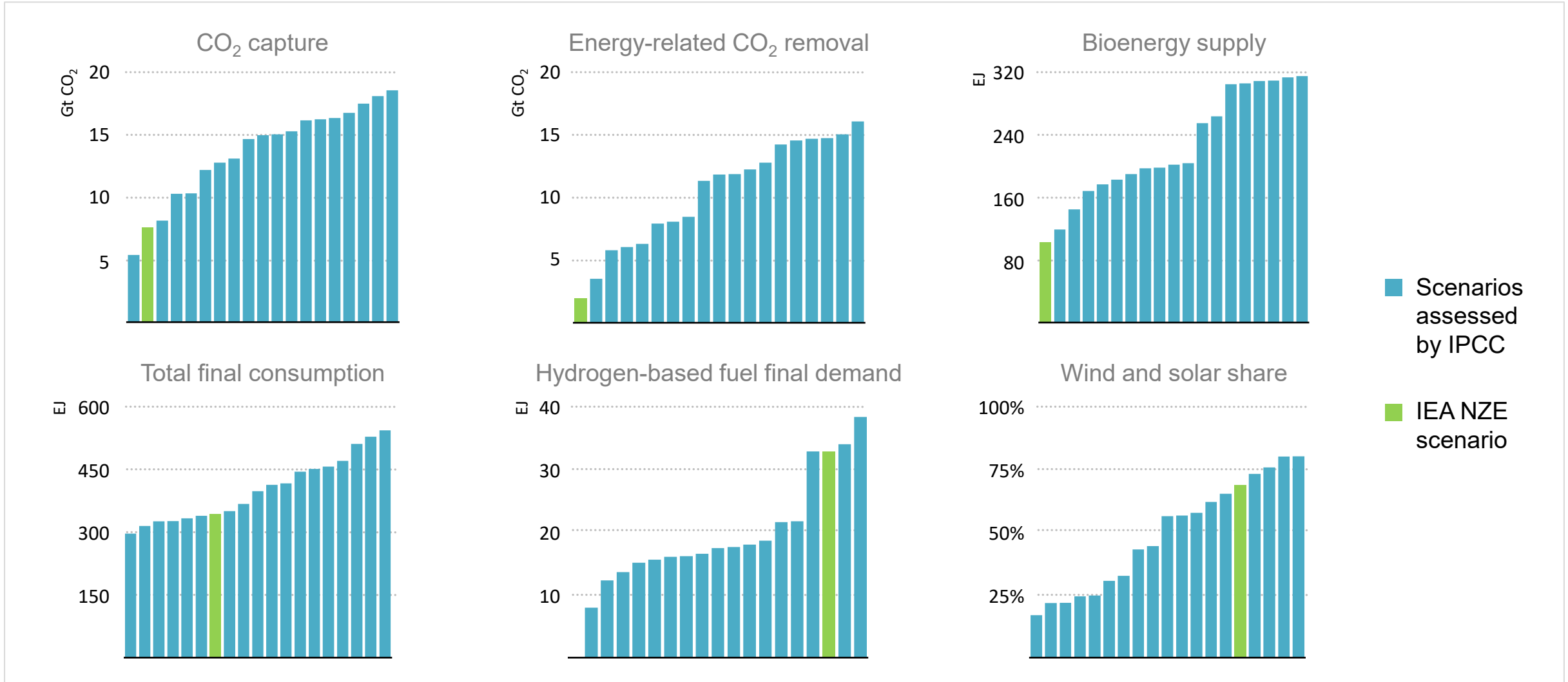International
Energy Agency

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

IEEJ Global Energy Webinar
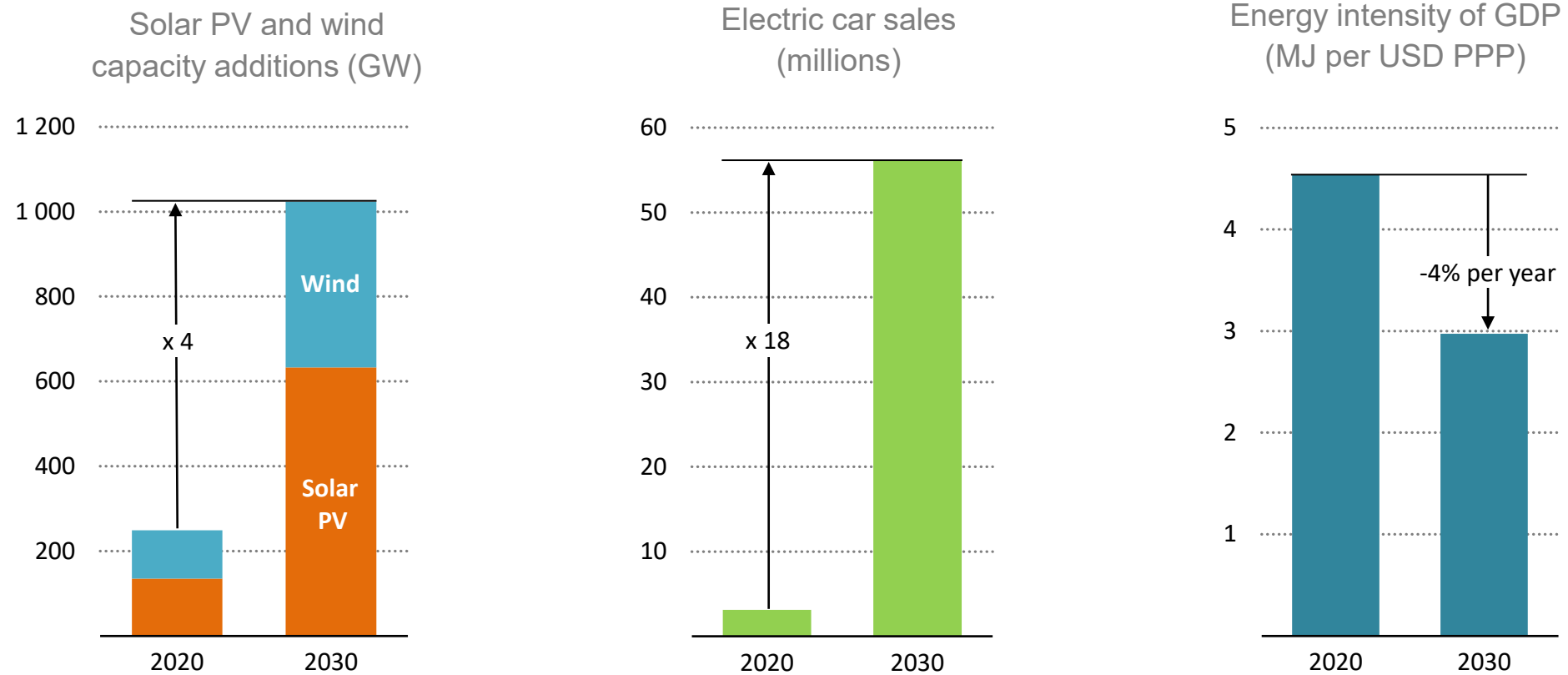
Tokyo / Paris, 28 May 2021

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)

x 4

Wind

Solar PV

2020 | 2030

Electric car sales (millions)

x 18

2020 | 2030

Energy intensity of GDP (MJ per USD PPP)

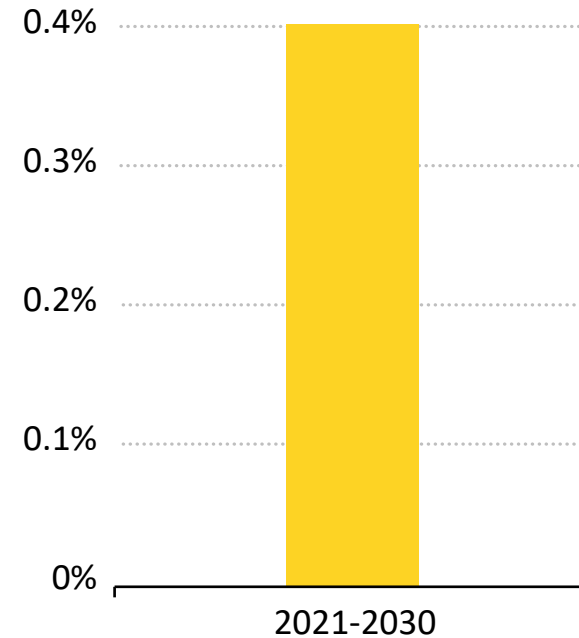-4% per year

2020 | 2030

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.

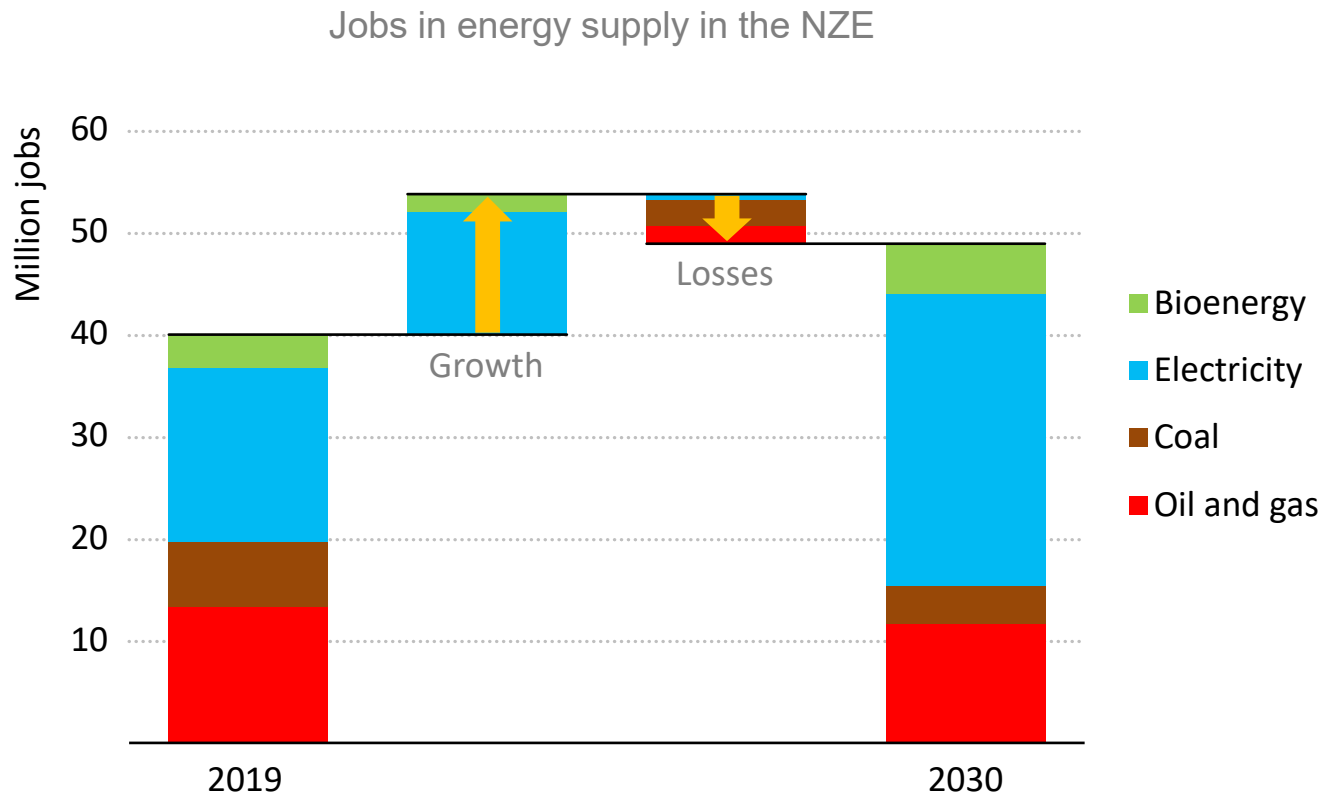# Drive a historic surge in clean energy investment

Clean energy investment
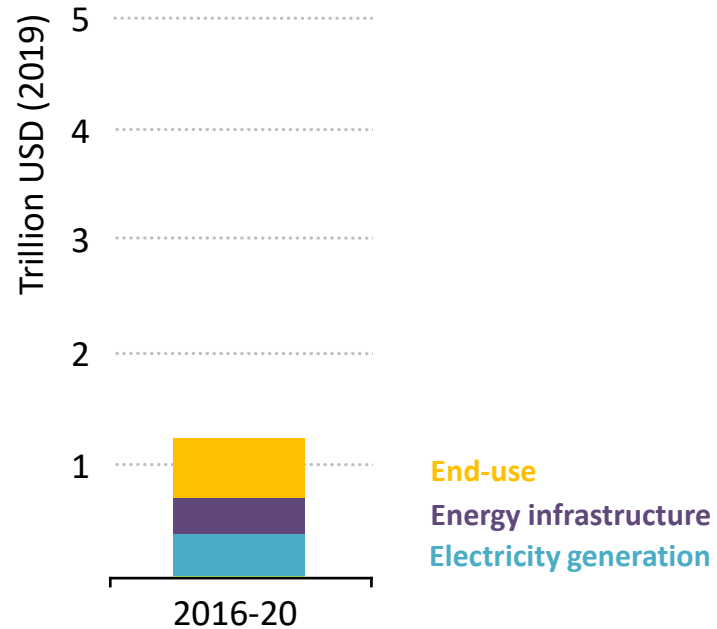
Additional annual global GDP growth in NZE

**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**

Clean energy jobs will grow strongly but must be spread widely

Jobs in energy supply in the NZE

Skill level of new workers in the NZE, 2030

Legend:
- Bioenergy
- Electricity
- Coal
- Oil and gas

Pie chart: Low, 8%; Medium, 27%; High, 65%
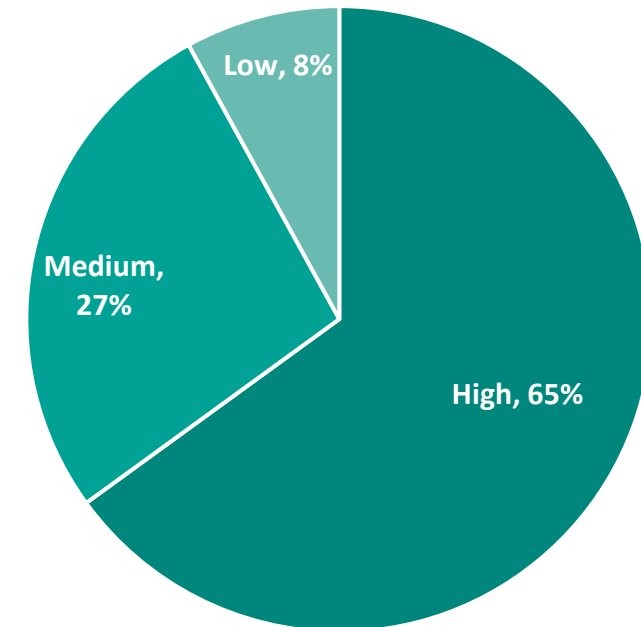
By 2030 there are 14 million jobs created in global energy supply, and a further 16 million in clean energy end-uses; but inclusive policies are needed to support reskilling & diversification in fossil-fuel dependent communities

Prepare for the next phase of the transition by boosting innovation

IEA

CO_2 savings by technology maturity in 2050, NZE scenario

Behaviour 4%

Refrigerant-free advanced cooling

Advanced batteries

Next-generation biofuels

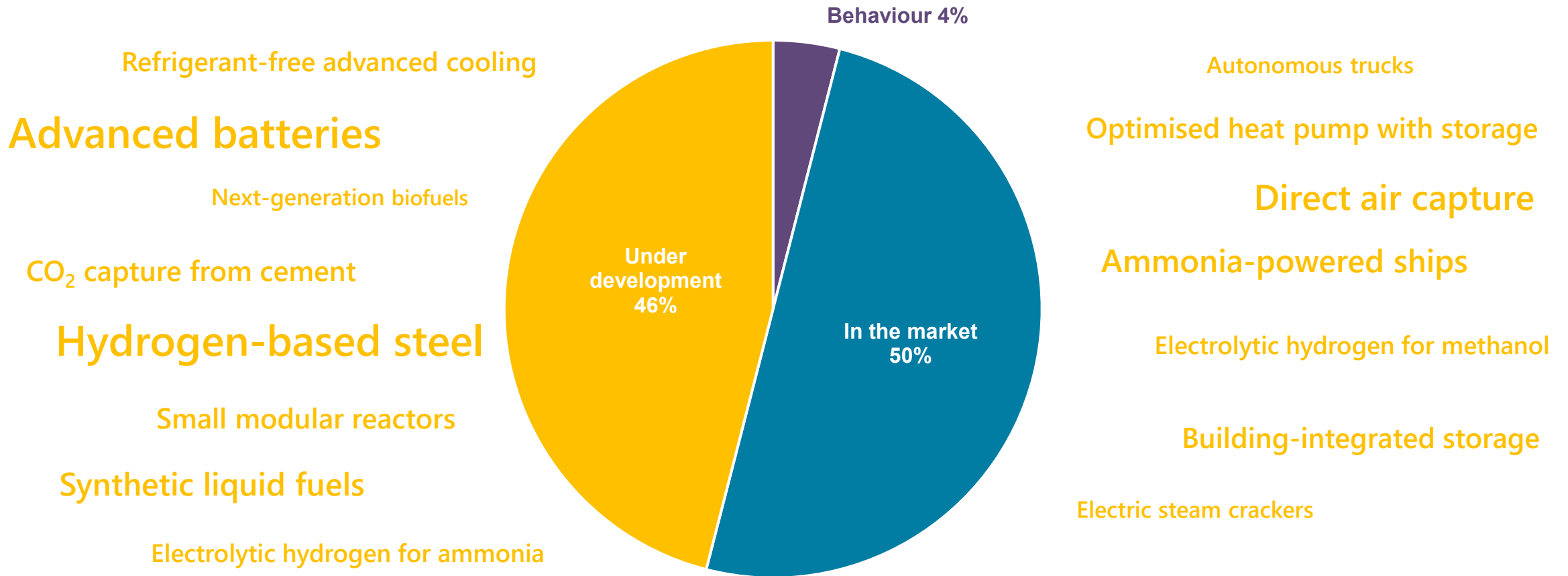CO_2 capture from cement

Hydrogen-based steel

Small modular reactors

Synthetic liquid fuels

Electrolytic hydrogen for ammonia

Under development 46%

In the market 50%

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

IEA

Oil supply and OPEC share

Critical minerals demand

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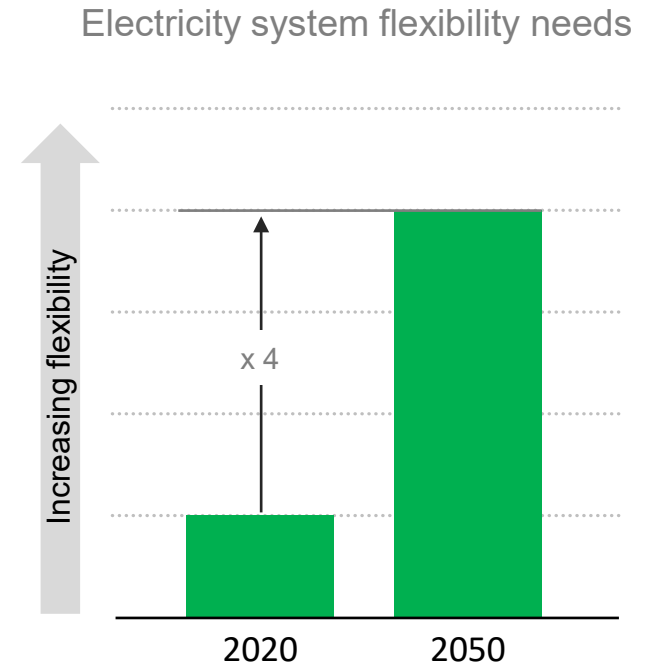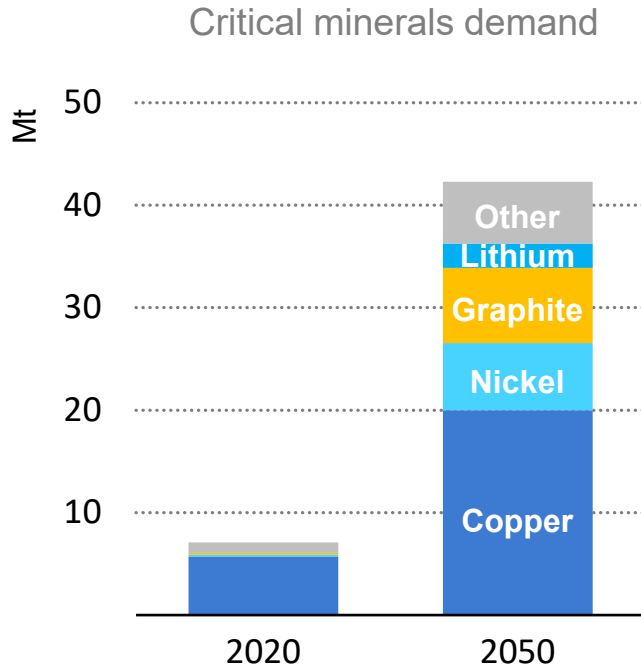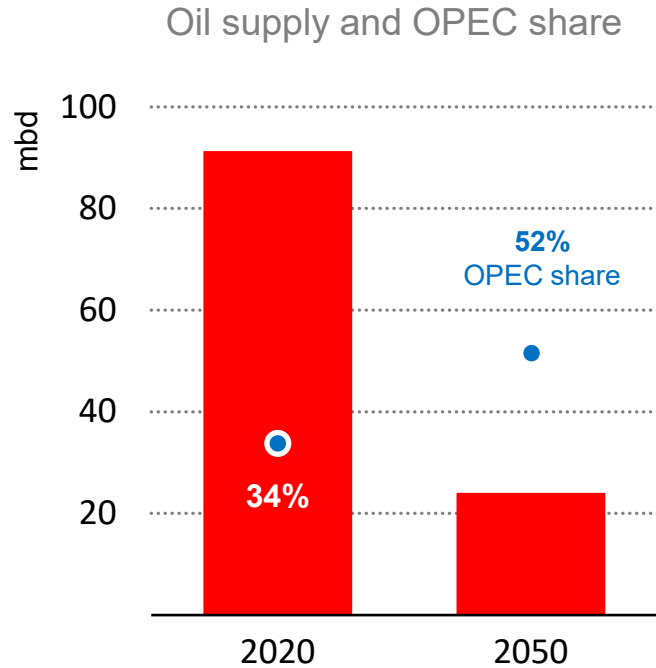
New energy security concerns emerge, and old ones remain; governments need to proactively plan for energy security risks related to market concentration, critical minerals and electricity systems.

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

Most innovative low-emissions technologies in heavy industry demonstrated at scale

All industrial electric motors are best in class

Almost 90% of existing capacity in heavy industries reaches end of their investment cycle

More than 90% of heavy industry production is low emissions

Electric cars are 60% of sales

No new ICE car sales

Electric heavy trucks are 50% of sales

50% of fuels used in aviation are sustainable

No new sales of fossil fuel boilers

All new buildings are zero-carbon ready

Universal energy access

Most appliances and cooling systems are best in class

Half of existing buildings retrofitted to zero-carbon ready levels

Half of heating demand met by heat pumps

More than 85% of buildings are zero-carbon ready

Buildings

Transport

Industry

Electricity

Other

Gt CO_2

35
30
25
20
15
10
5

2020   2025   2030   2035   2040   2045   2050

No new unabated coal plants approved for development

1 020 GW annual solar and wind additions

Overall net zero electricity in advanced economies

Net zero electricity sector globally

Almost 70% of electricity generation globally from solar PV and wind

Phase-out of unabated coal in advanced economies

Phase-out of all unabated coal and oil power plants

No new oil and gas fields approved for development, and no new coal mines or mine extensions

4 Gt CO_2 captured

7.6 Gt CO_2 captured

150 Mt low-carbon hydrogen; 850 GW electrolysers

435 Mt low-carbon hydrogen; 3 000 GW electrolysers

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