Evolution of the electricity system in Europe: electrification, challenges and perspectives

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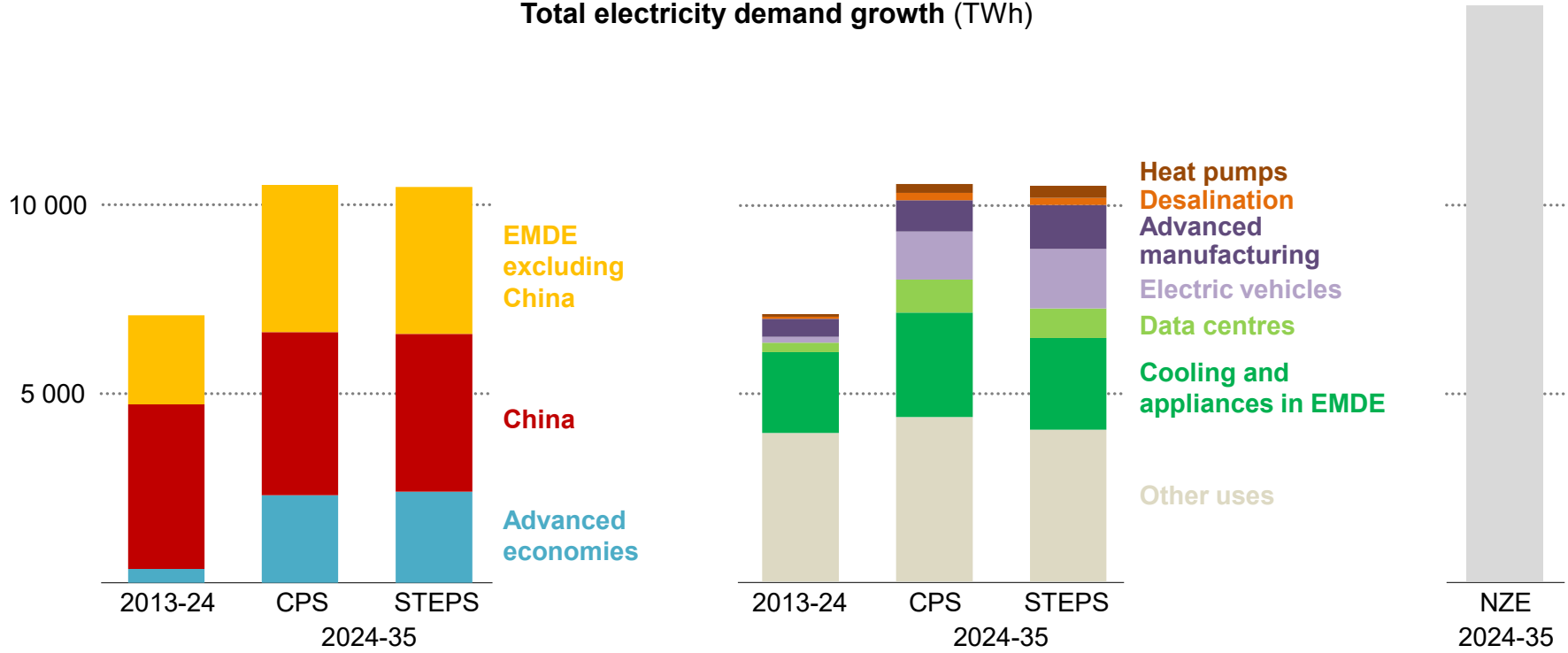
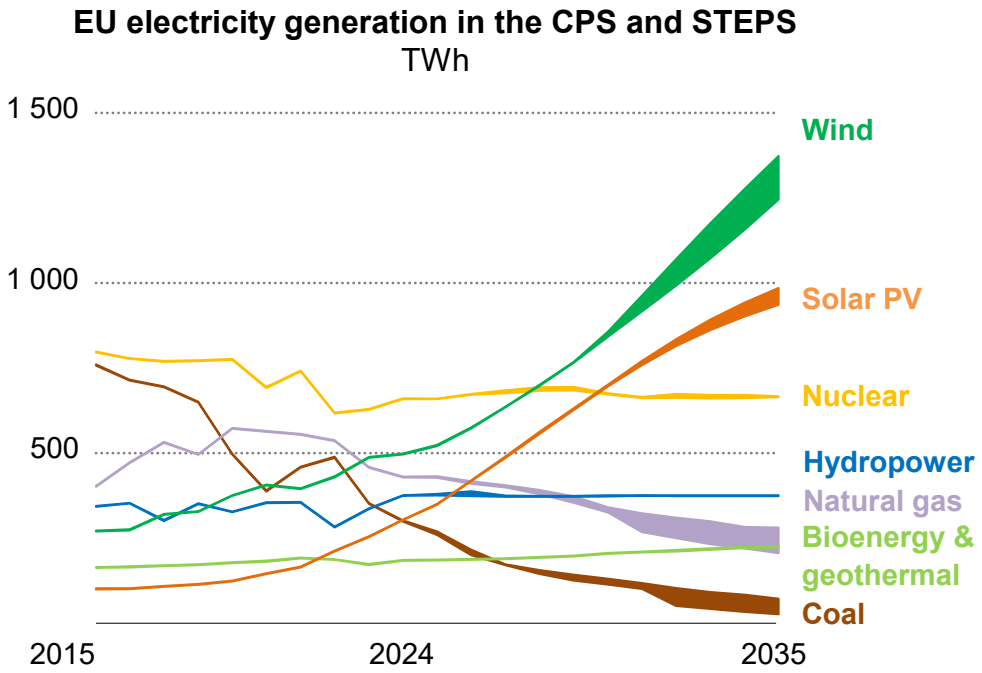
International Energy Agency

The Age of Electricity is here



Electricity demand accelerates in all scenarios as growth resumes in advanced economies and strengthens across emerging markets. Electricity is key to major growth areas for the economy such as advanced manufacturing & AI.

Changing power systems are reshaping electricity security in the EU

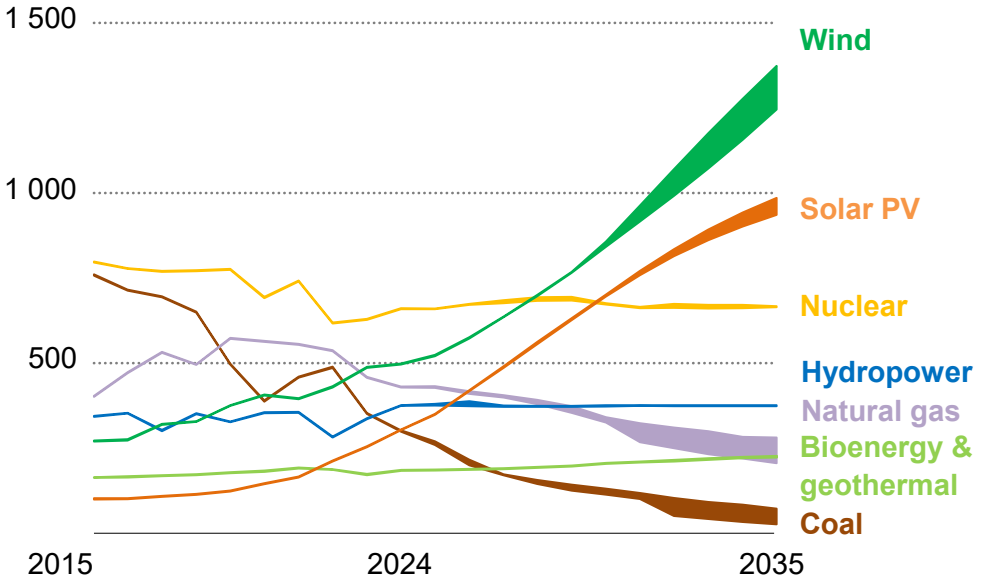


Renewables surge led by wind, while nuclear stabilises: low-emissions electricity exceeds 90% of the mix in 2035;

Changing power systems are reshaping electricity security in the EU

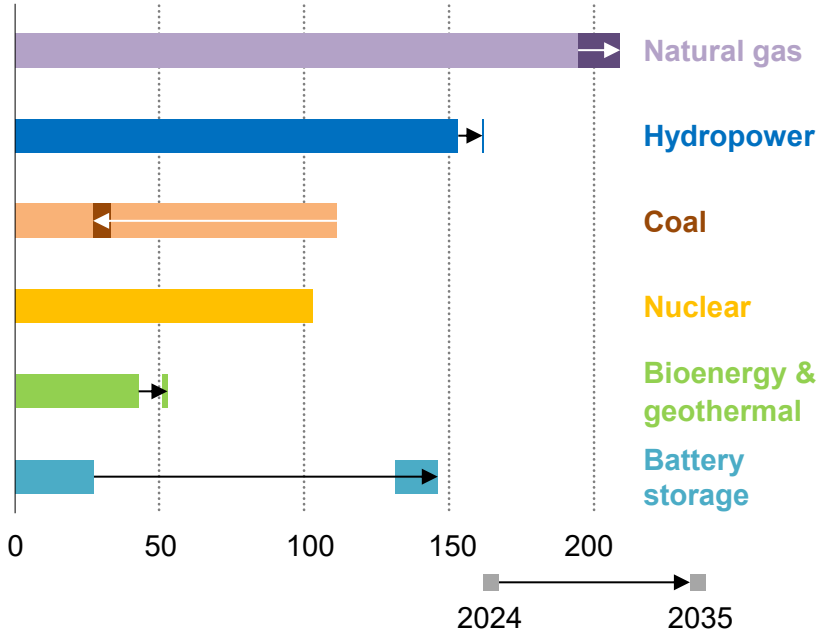
EU electricity generation in the CPS and STEPS

TWh



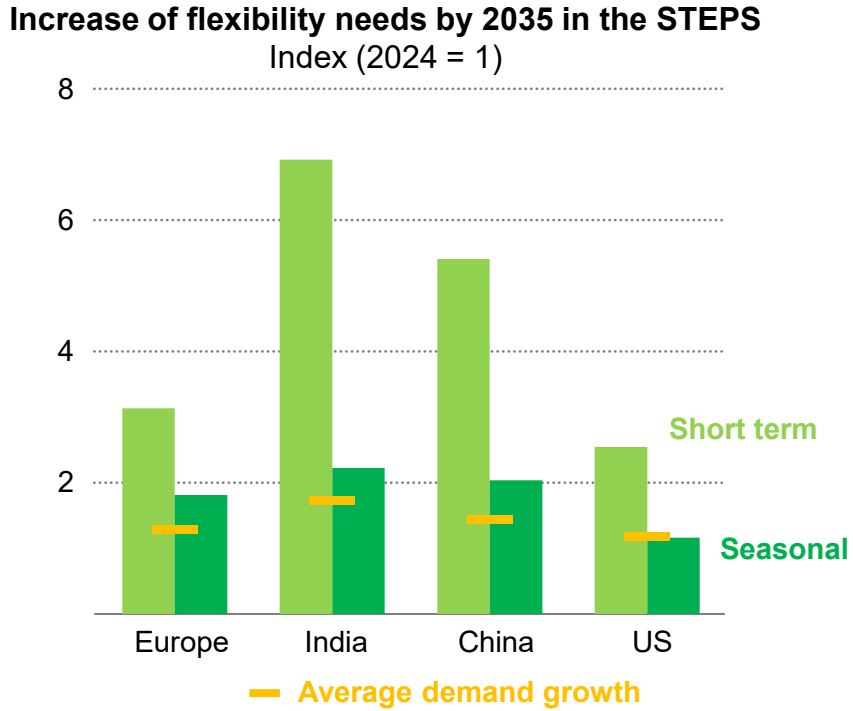
Dispatchable power capacity in the CPS and STEPS

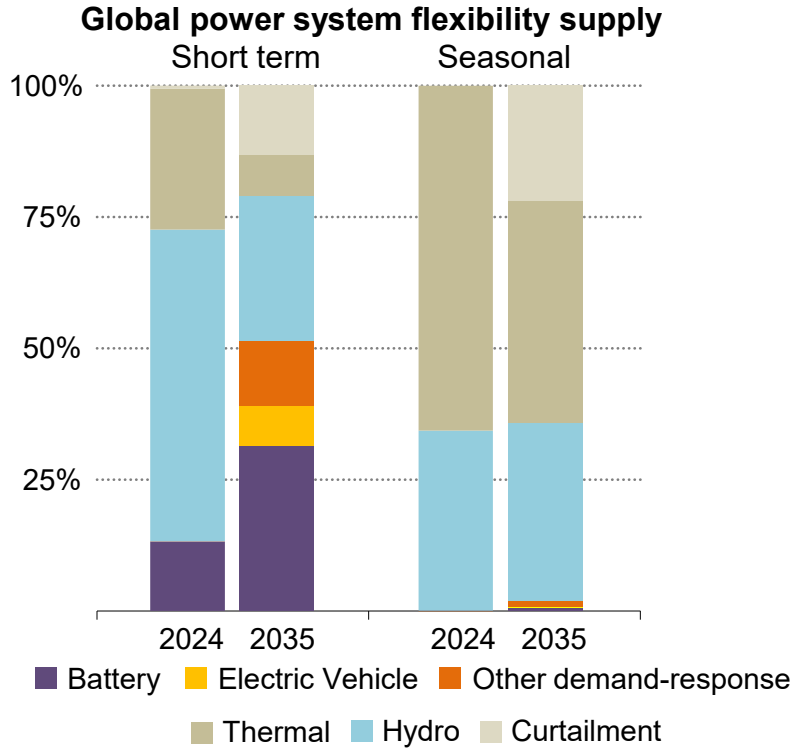
GW



Renewables surge led by wind, while nuclear stabilises: low-emissions electricity exceeds 90% of the mix in 2035; robust electricity security strategies require dispatchable sources, more flexibility & resilience, and modernised grids

The need for flexibility in electricity systems is growing

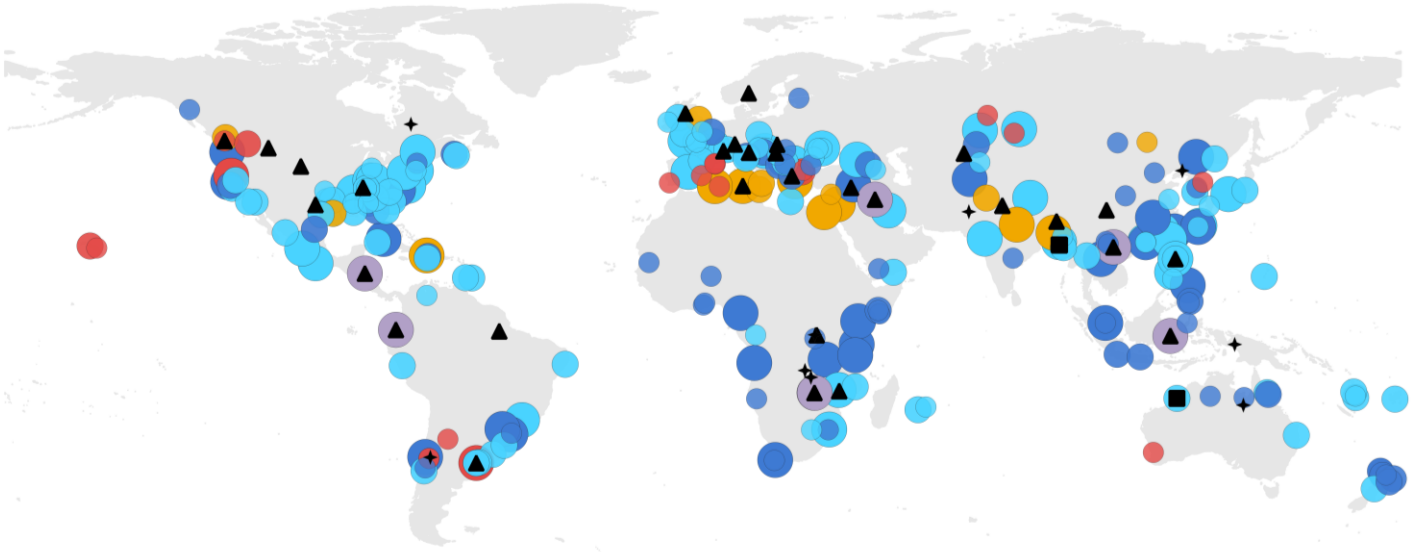




Electricity sector transitions raise short-term flexibility needs, primarily met by batteries and demand response, and seasonal flexibility, calling largely on hydro and thermal power, with robust grids supporting and enabling them all

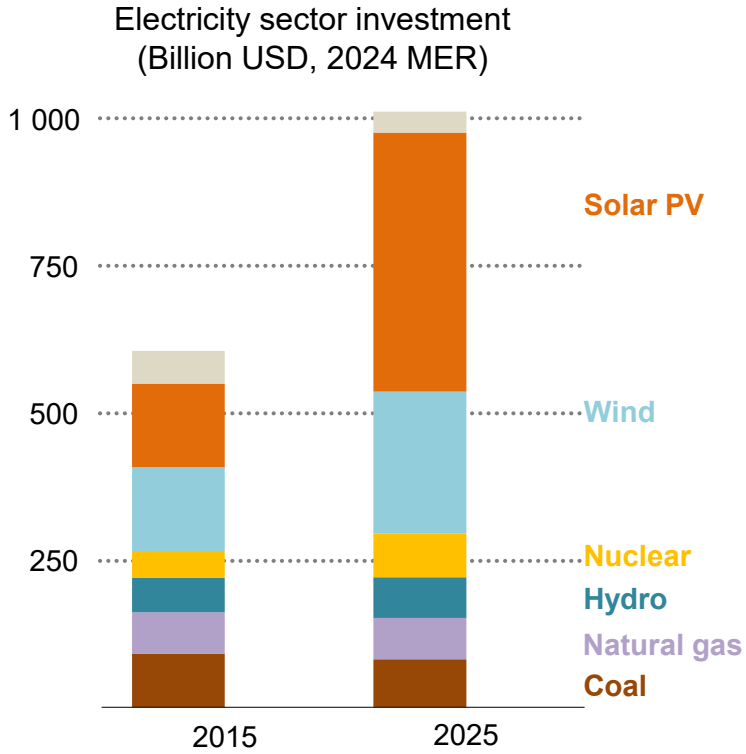
Physical disruptions pose growing risks for energy infrastructure

Power outages and operational disruption of energy infrastructure caused by extreme weather events in 2023



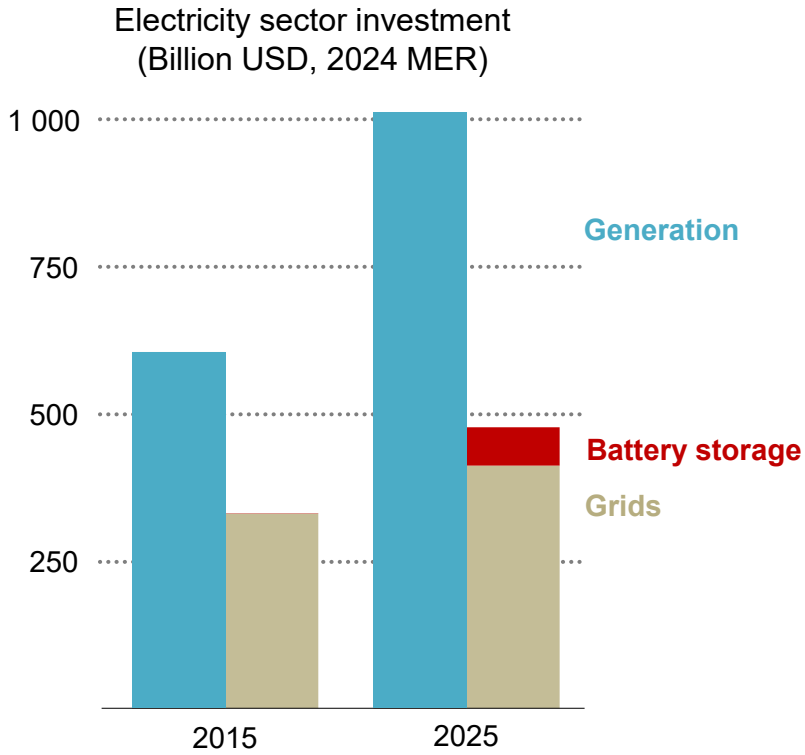
Impacts of disruptions are becoming more frequent and increasingly consequential – especially in the power sector, where extreme weather is often responsible for power cuts impacting millions of households around the world.

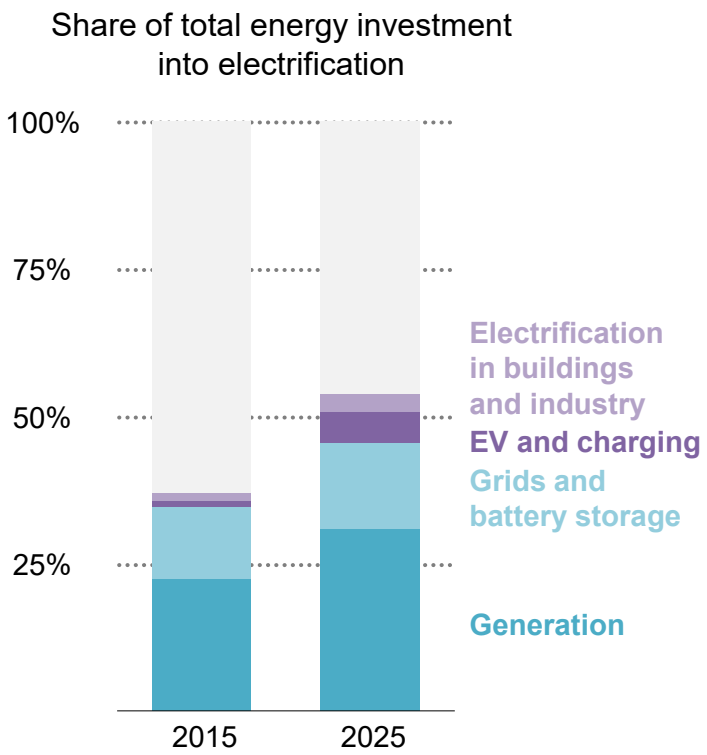
The Age of Electricity drives investment, but spending on grids is lagging



Non-fossil sources drove growth in electricity generation investment in over the past decade;

The Age of Electricity drives investment, but spending on grids is lagging

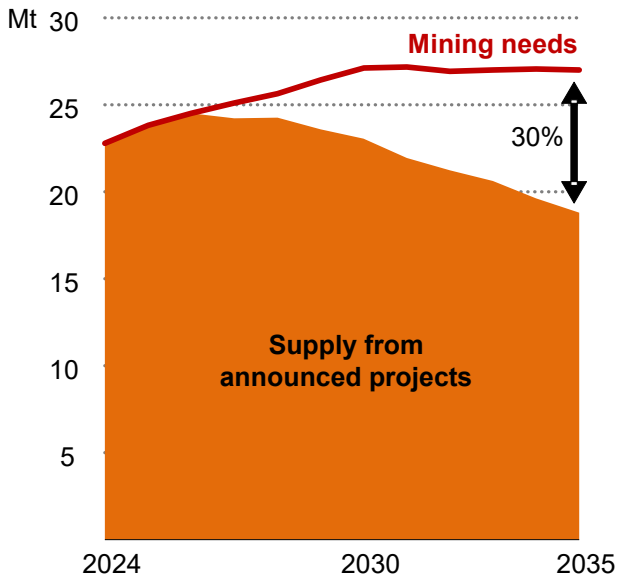




Non-fossil sources drove growth in electricity generation investment in over the past decade; grids lagged behind. Today, over half of all energy investment goes into the power sector and towards the electrification of end-uses.

Critical minerals: copper supply and concentration are major concerns

Expected copper mine supply from announced projects and mining needs under today's policy settings



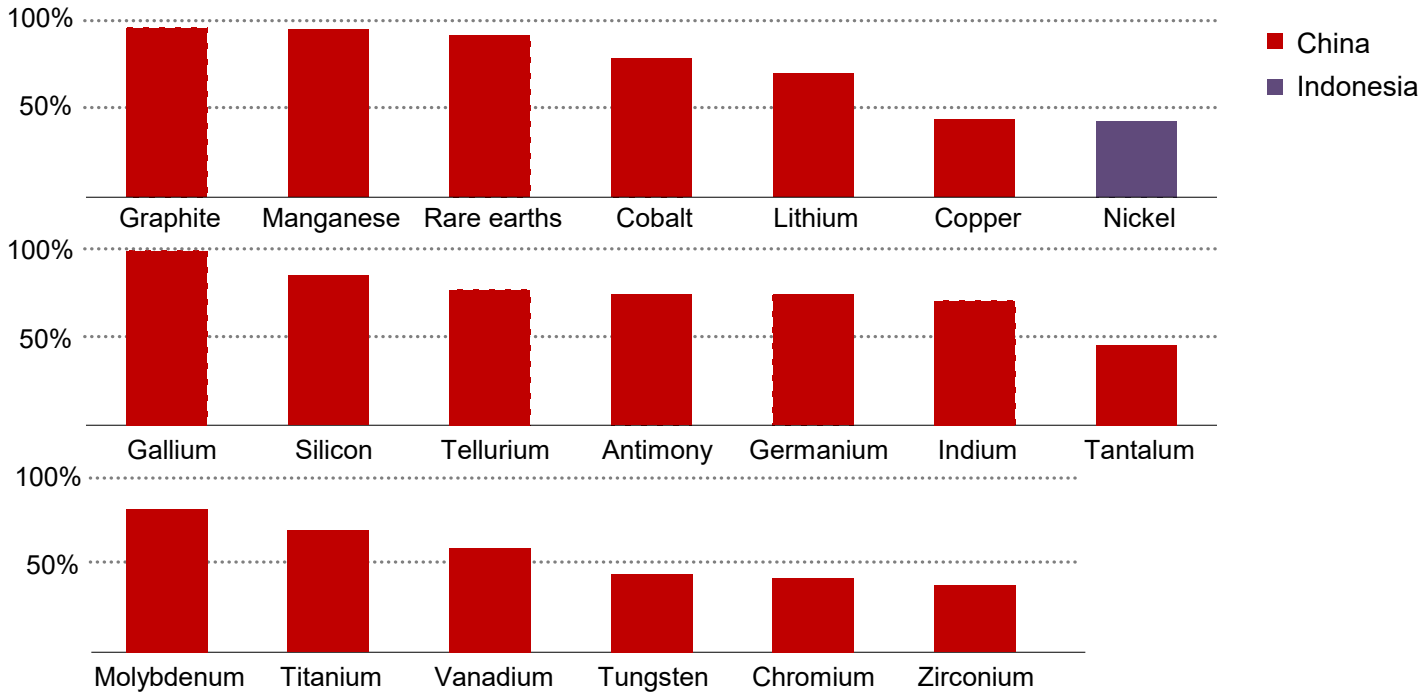
Projected supply-demand balances for copper remain a concern, with a potential 30% supply shortfall by 2035.

Critical minerals: copper supply and concentration are major concerns

Batteries, grids, renewables

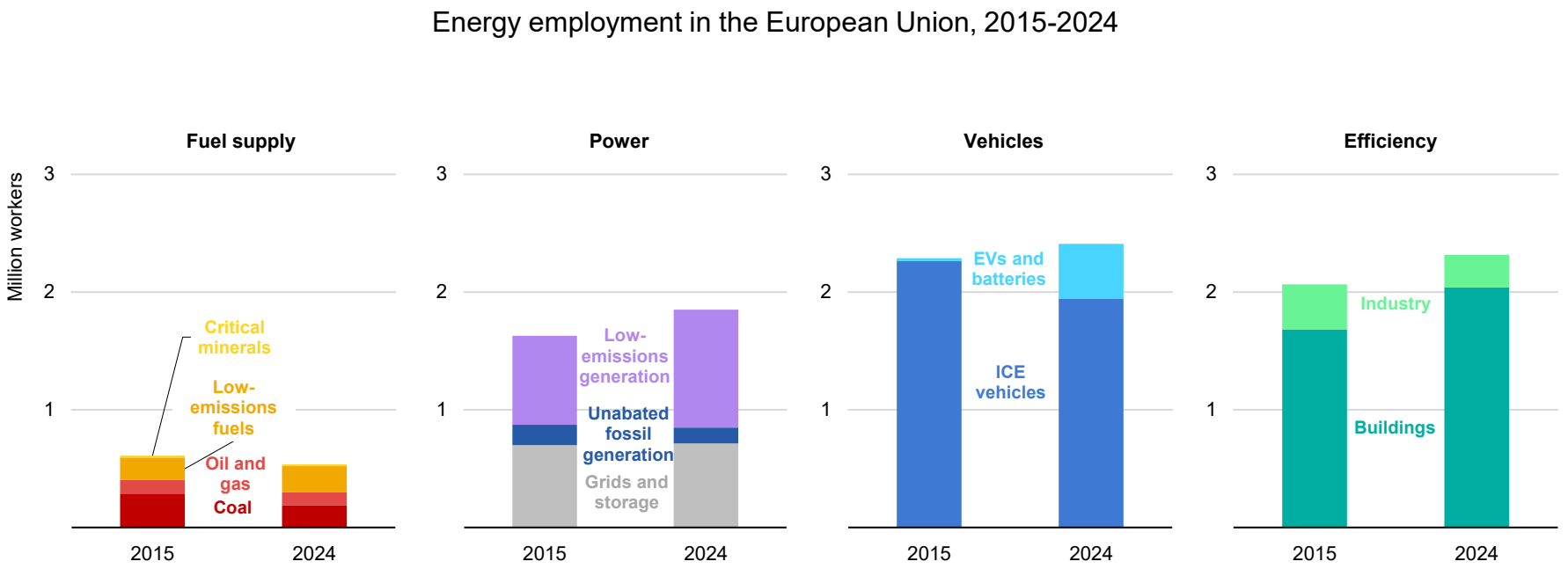
AI, data centres, high-techs

Aerospace, industry, defence



Projected supply-demand balances for copper remain a concern, with a potential 30% supply shortfall by 2035. The remarkably high level of market concentration leaves global supply chains vulnerable to disruptions.

The Age of Electricity supports EU job growth, but challenges remain



Over the past decade, low-emissions generation has accounted for 9 out of 10 jobs added in the EU power sector, with electrification and efficiency also supporting job growth. But recruiting skilled workers presents challenges.