International Energy Agency

Evolution of electricity systems and flexibility needs in the World Energy Outlook 2023

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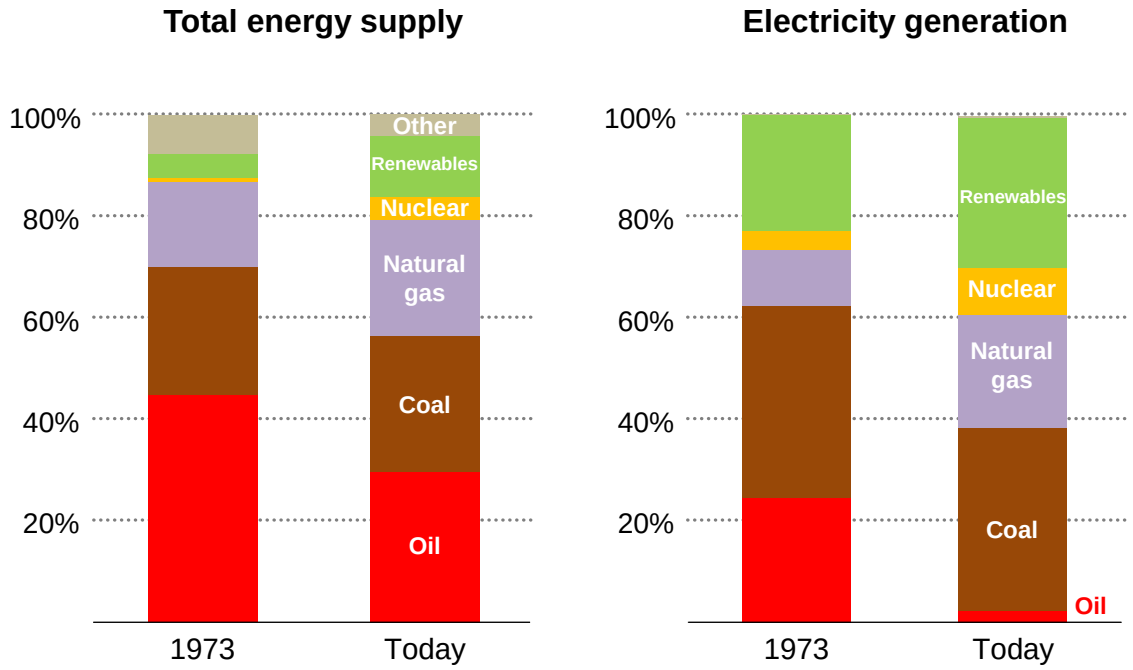
Scenario analysis in the World Energy Outlook

The *World Energy Outlook (WEO)* uses the latest available data to analyse energy, emissions and climate trends.

3 core scenarios

Where do existing policies take us?	*What is the impact of announced net zero and other pledges if they are met in full?*	*What is required for the energy sector to reach net zero CO_2 emissions by 2050?*
STEPS	APS	NZE
Stated Policies Scenario	**Announced Pledges Scenario**	**Net Zero Emissions by 2050 Scenario**

Fifty years on from the first oil shock



The world still faces acute energy security vulnerabilities, but also has more tools than ever to change the outlook for global energy

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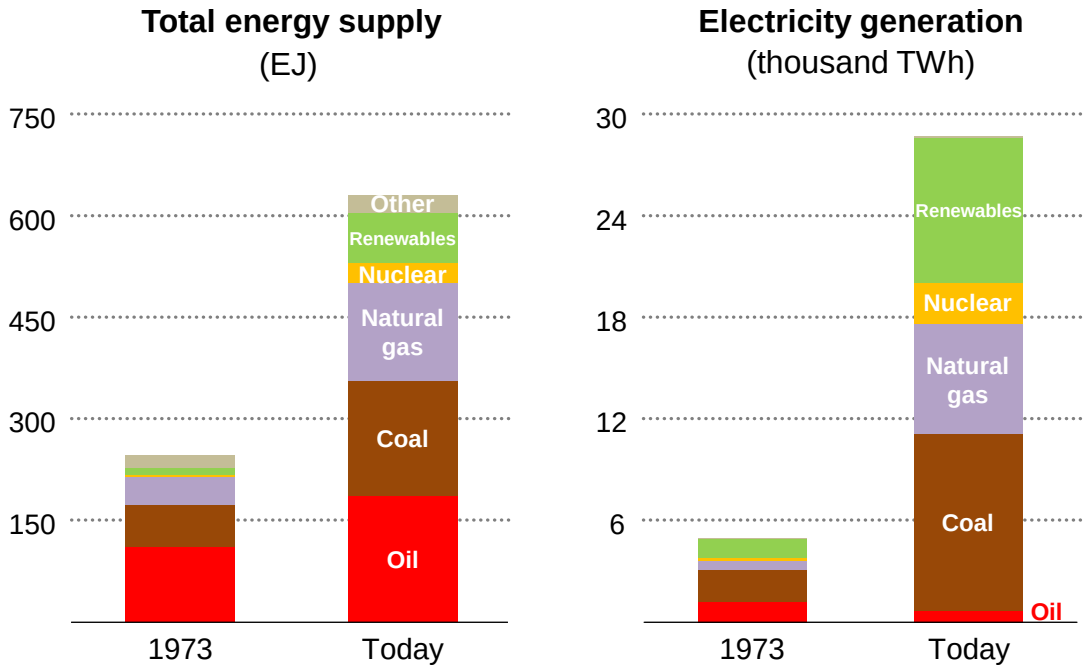

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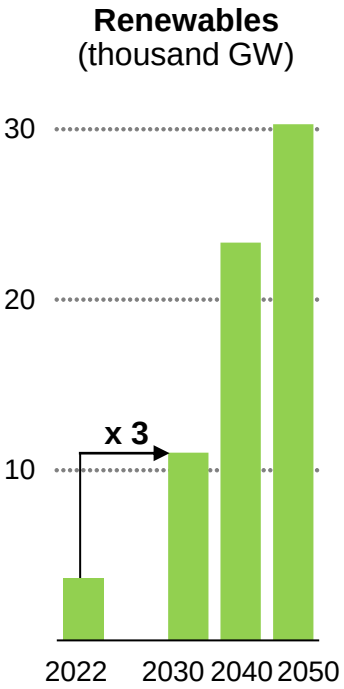
Electricity systems are re-imagined for net zero electricity



Renewables capacity triples by 2030 in the NZE Scenario and grid investment doubles, unabated coal is phased out by 2040 and nuclear capacity more than doubles by 2050

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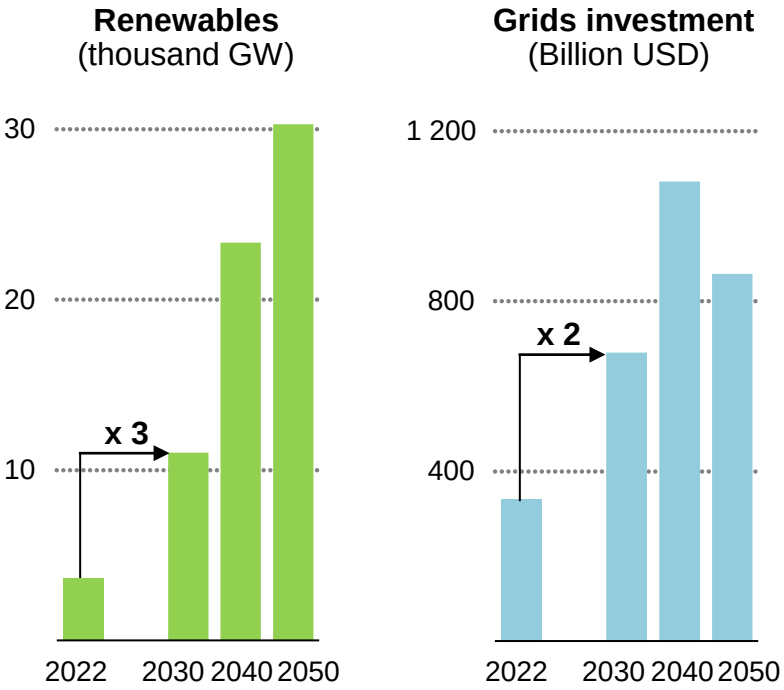

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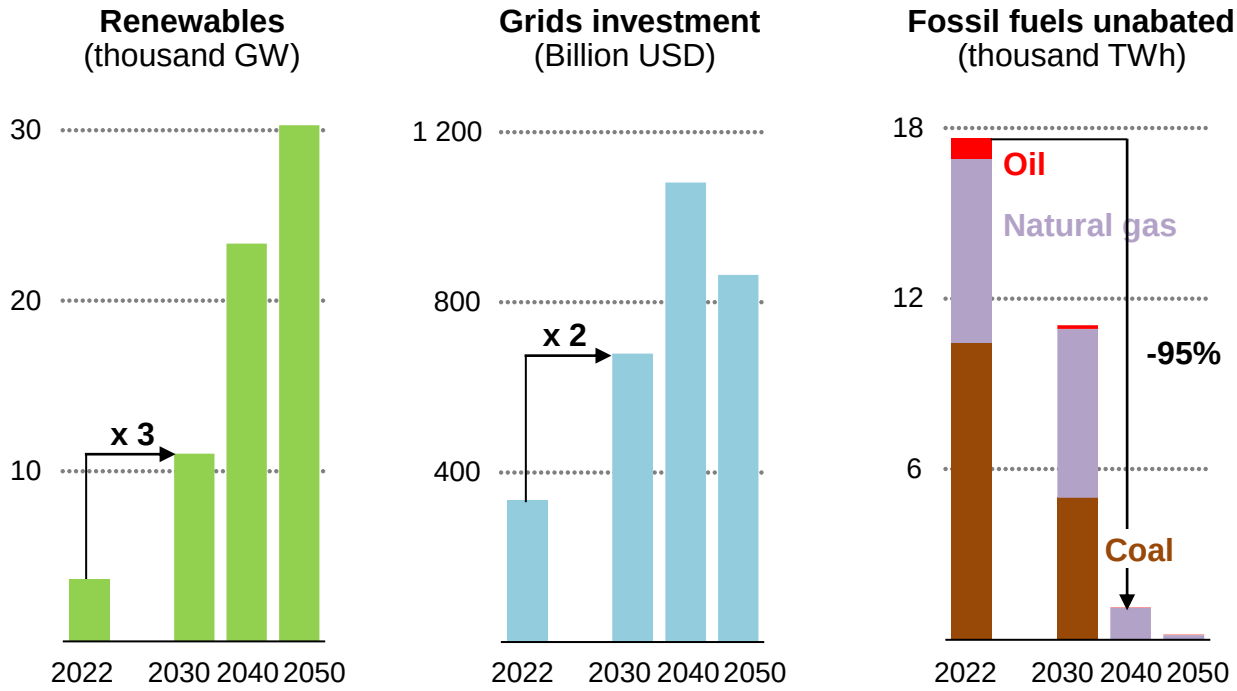

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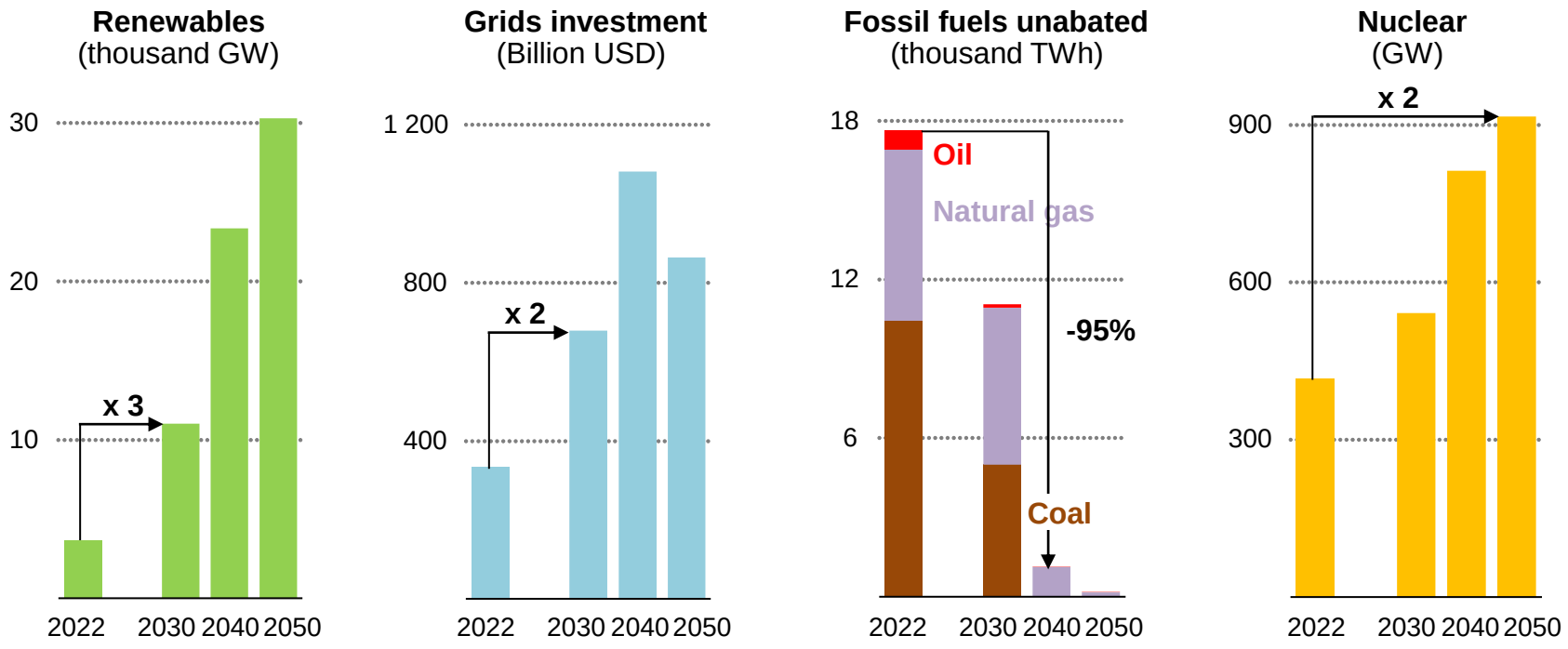

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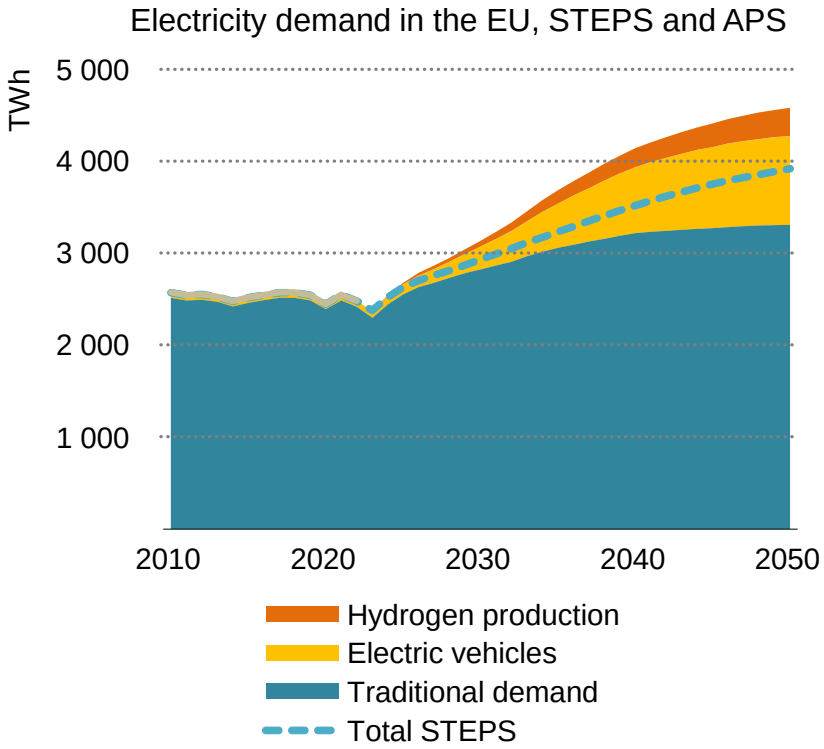
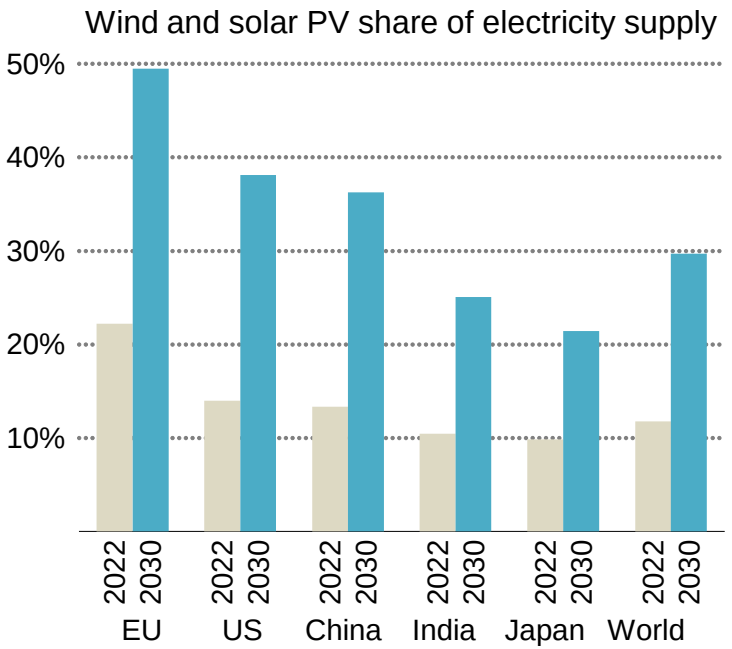
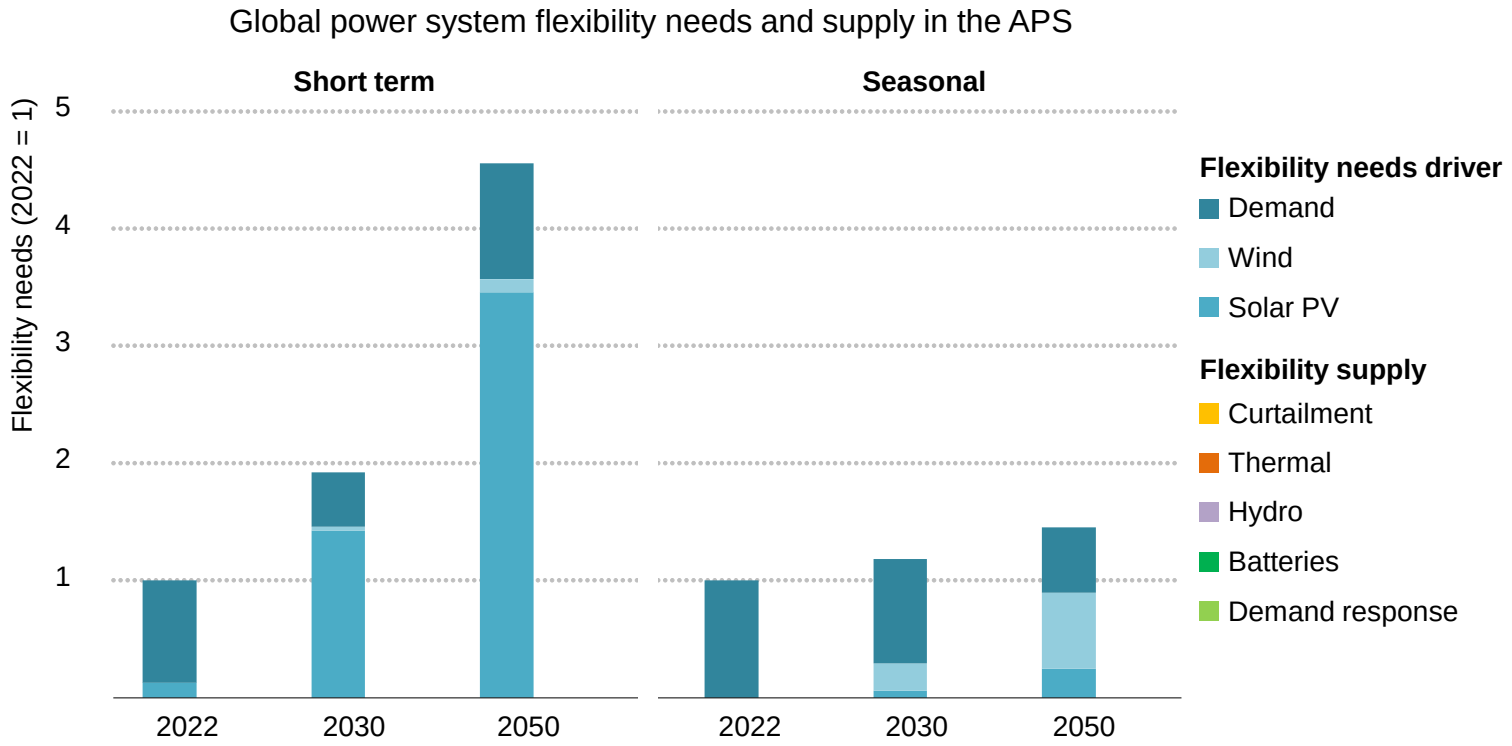
The nature of electricity systems is changing





Electricity is the beating heart of modern economies and demand is set to grow fast, with new demand types growing, while wind and solar PV are re-shaping electricity supply and are set to be 75% of new capacity additions worldwide

Power system flexibility needs increase significantly



Short-term flexibility needs increase significantly, mainly due to solar PV. The mix of short-term flexibility supply evolves over time with batteries and demand response emerging as important sources of flexibility supply

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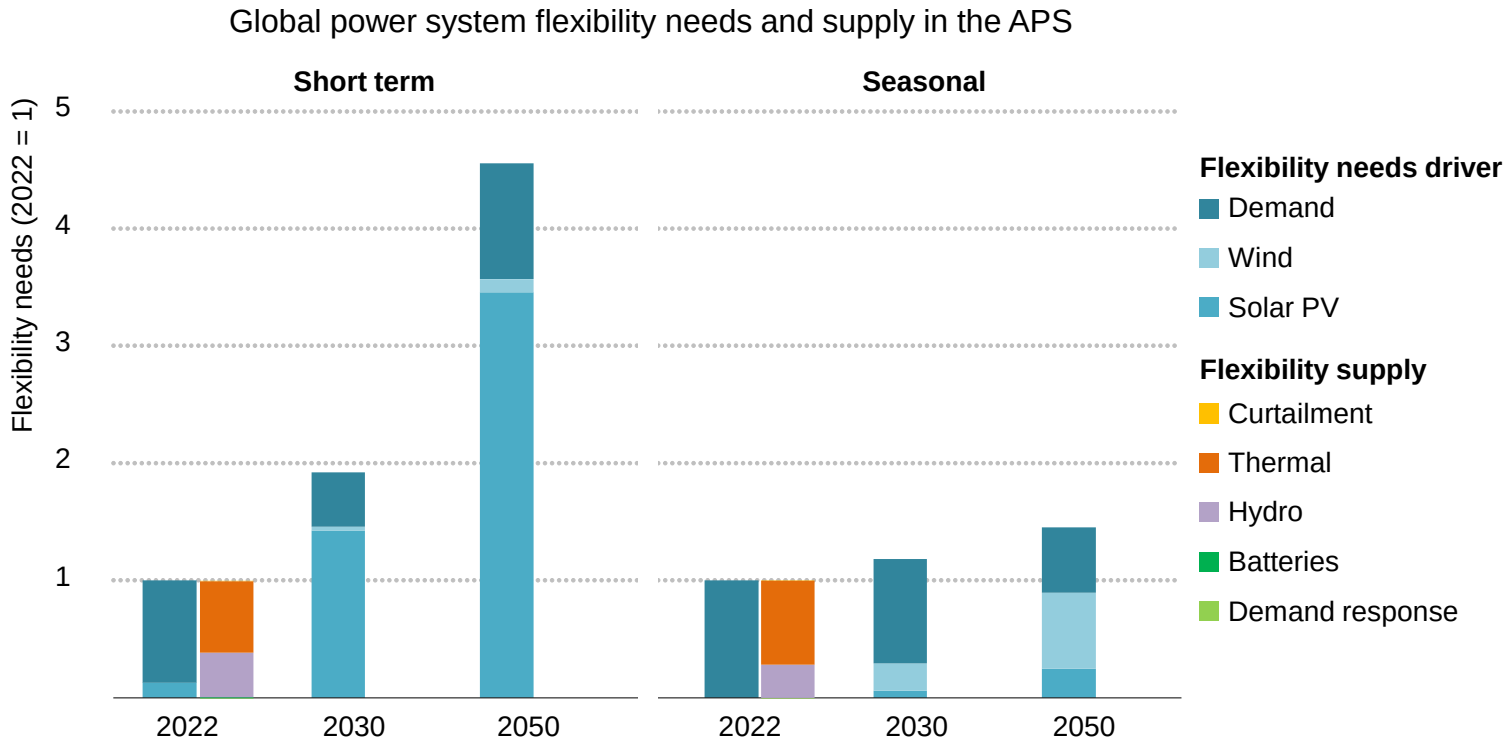

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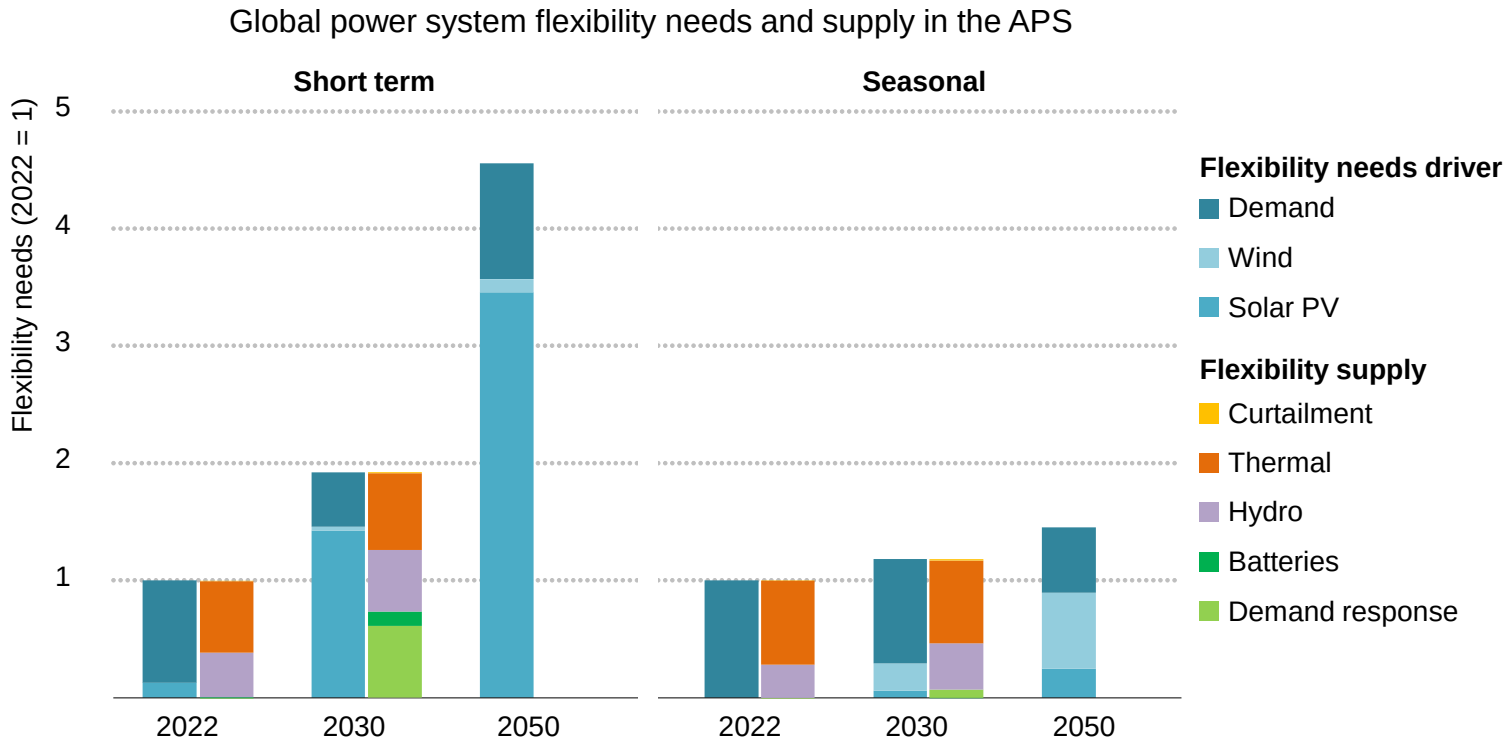

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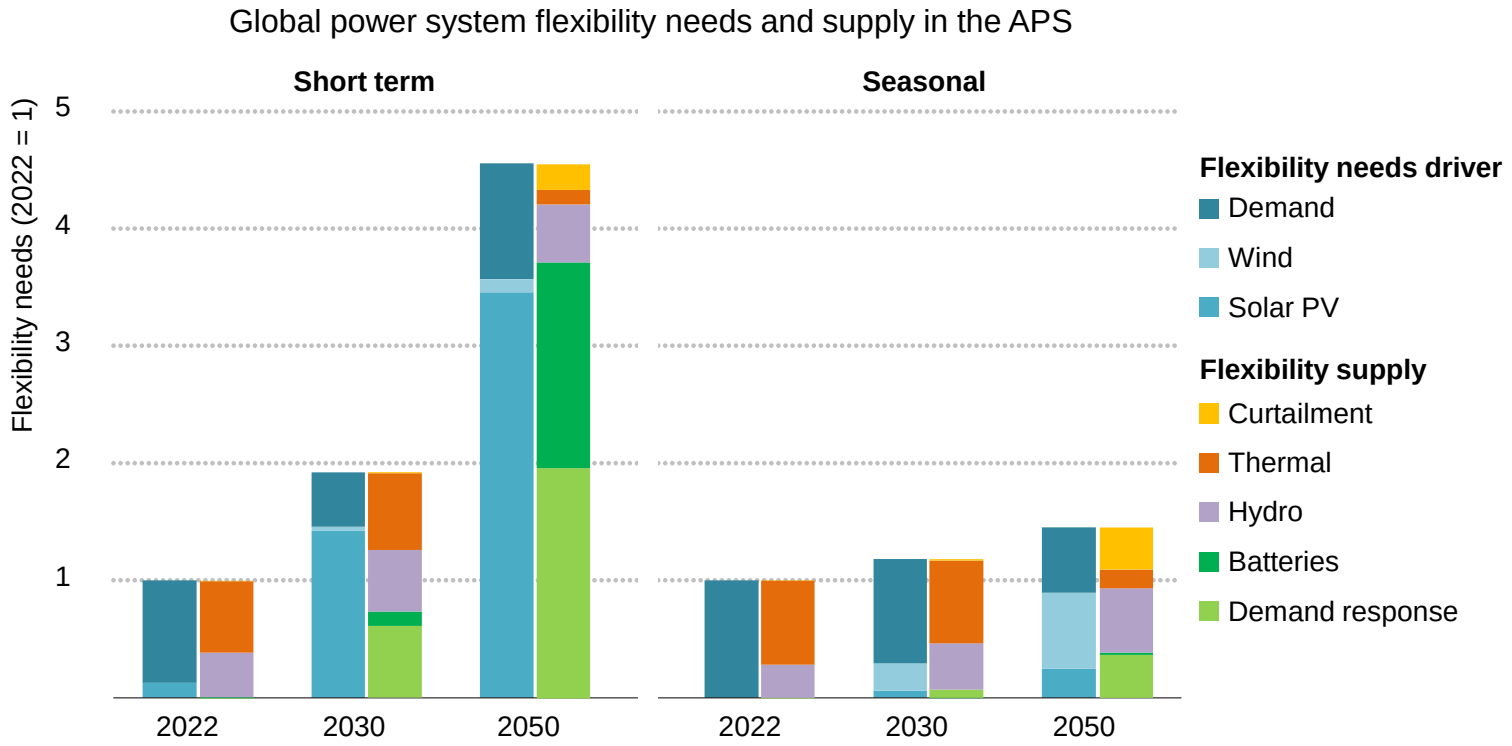

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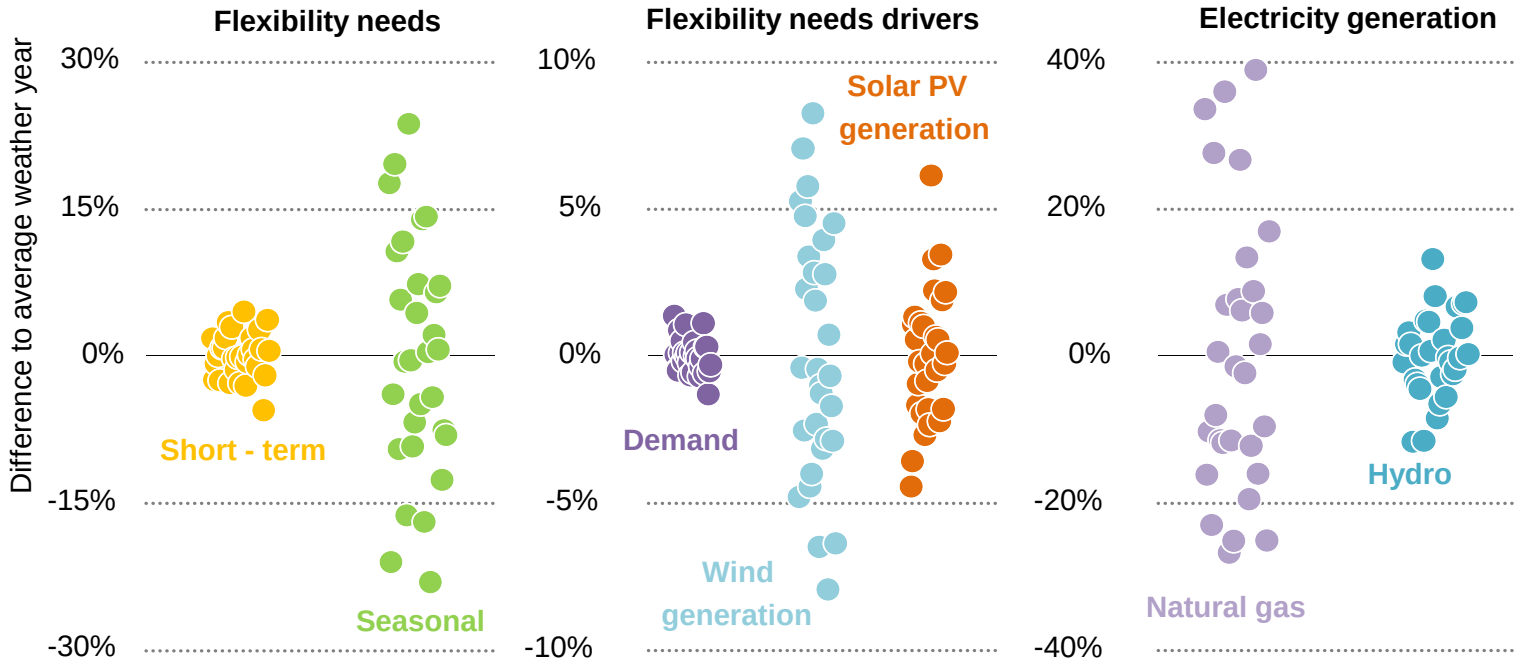
Impact of weather variability on power systems operations

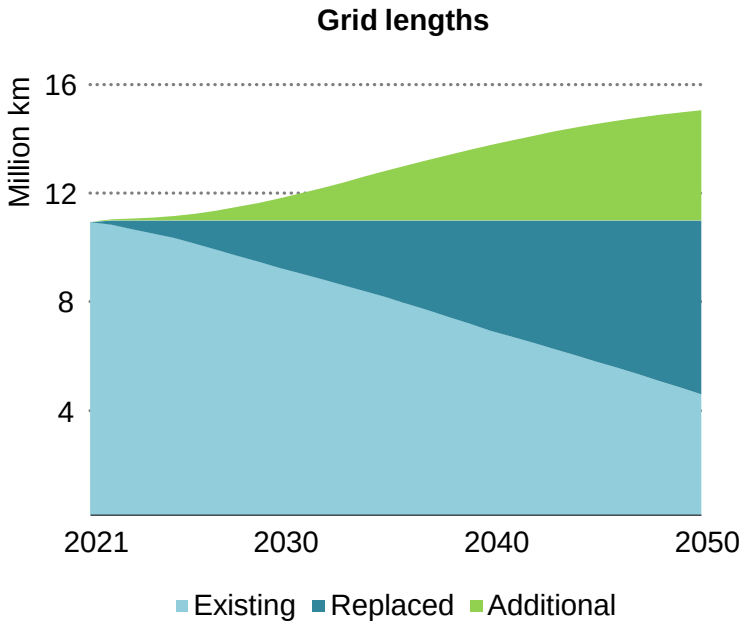
Variability of flexibility needs and generation for different weather years in Europe in the APS, 2030

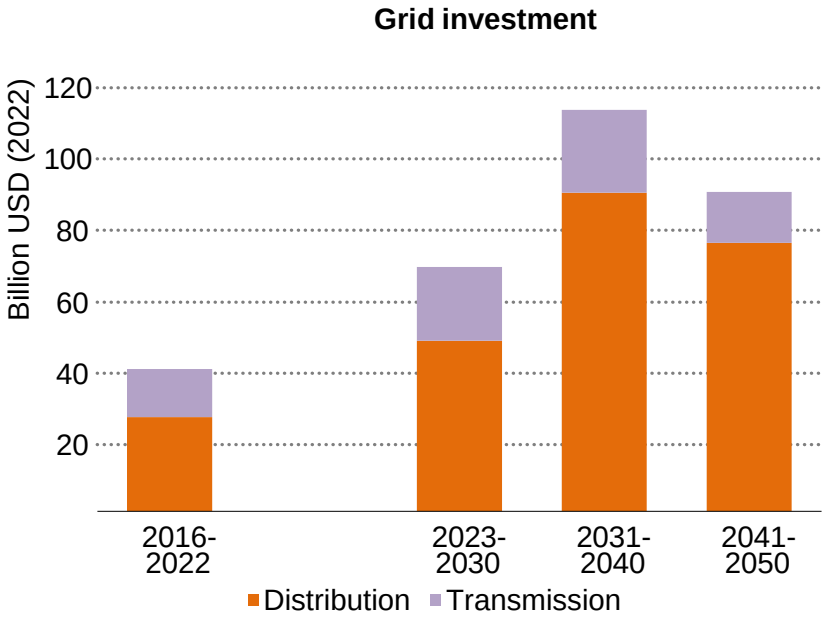


Seasonal flexibility needs can vary significantly, leading to large differences in the load factor of the dispatchable power plant fleet from one year to the next

Grid development needs to accelerate to keep up with transitions

Grid development in the European Union the Announced Pledges Scenario





In the next 20 years, more than 6 million km of lines need to be added or replaced, 55% of the total in use today in the EU, calling for grid investment to almost double by 2030 in the APS, raising material needs.