Aurora keynote:

Short term pain and long term gain?

Consequences of the Russian gas crisis for Germany's Net Zero transition

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Renewables Summit

Berlin 2022

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TAGESSPIEGEL BACKGROUND
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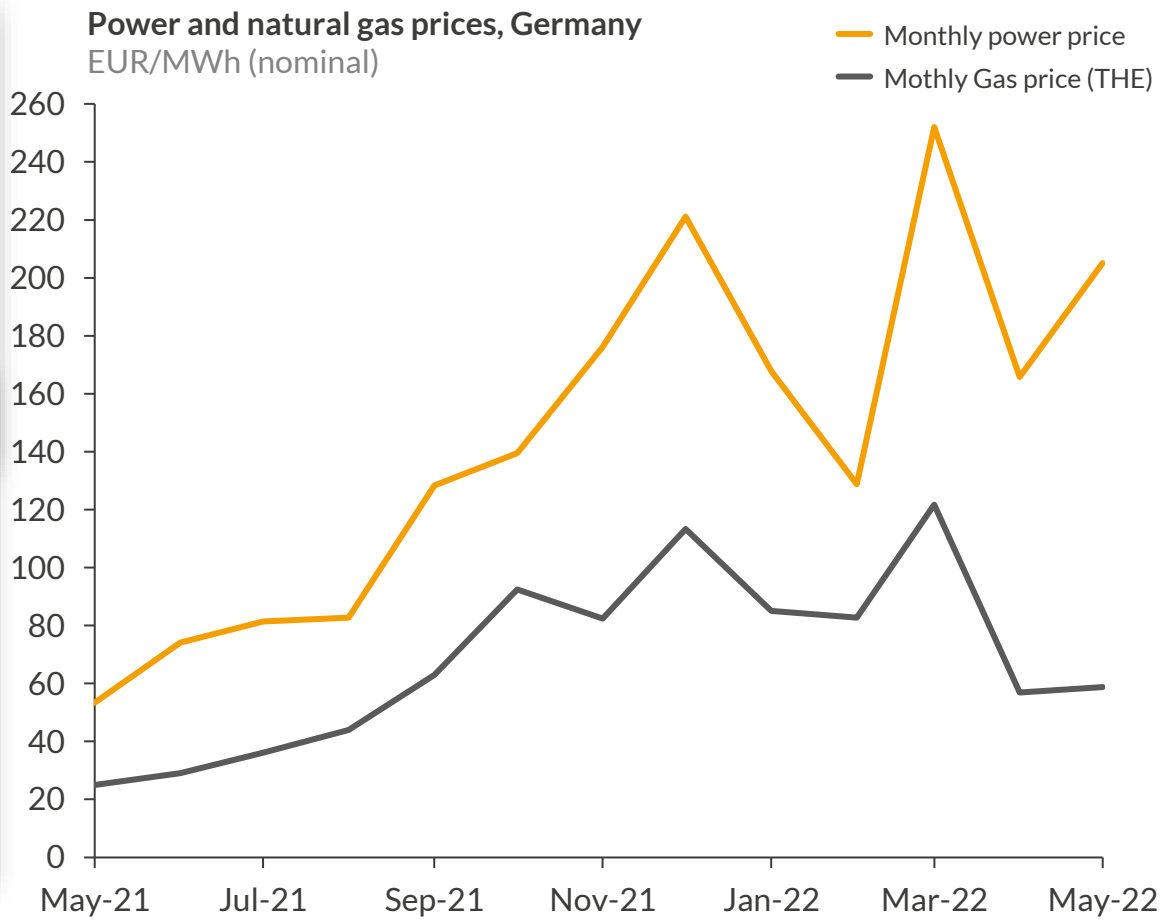
The war in Ukraine urges Germany to address its dependency on Russian energy imports…



Sources: Aurora Energy Research, Deutsche Welle, MDR, The Conversation, Zeit Online

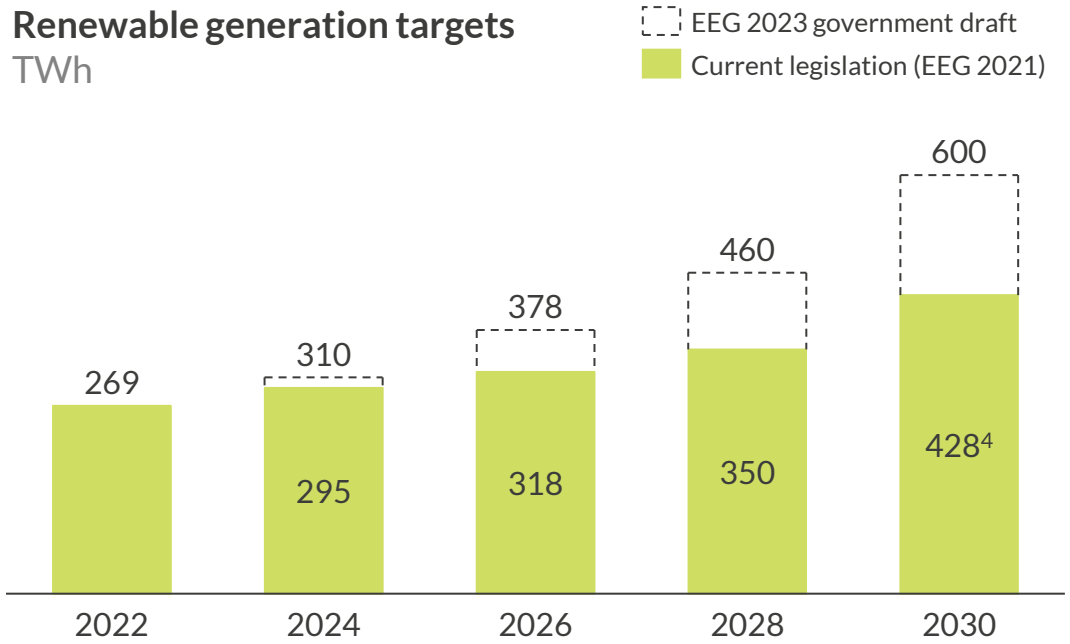
… while delivering on ambitious decarbonisation targets

Government targets

- 80% share of renewables with demand of 750 TWh by 2030
- 10 GW of electrolyser capacity by 2030
- Power supply almost entirely from renewables by 2035
- All sectors to be climate neutral by 2045

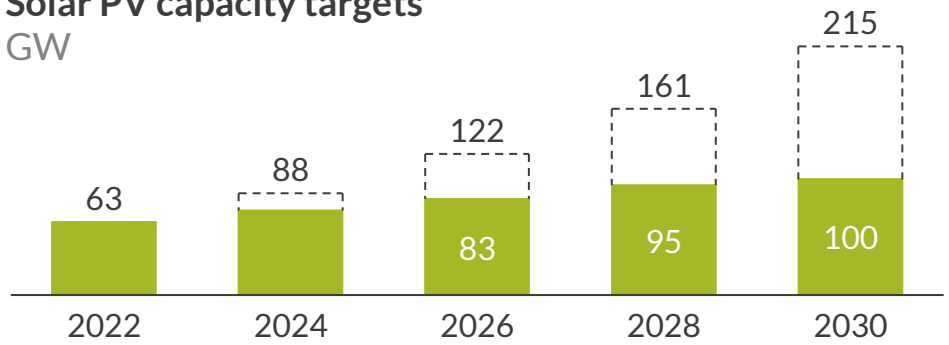
Renewable generation targets

TWh



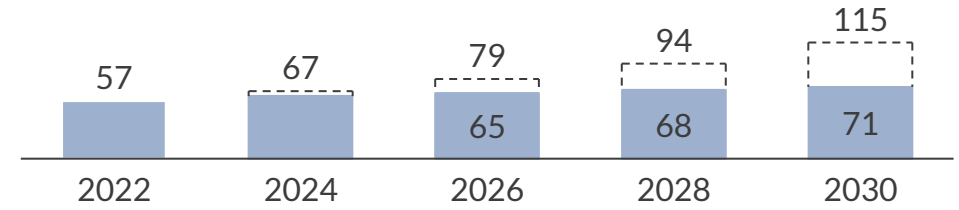
Solar PV capacity targets

GW



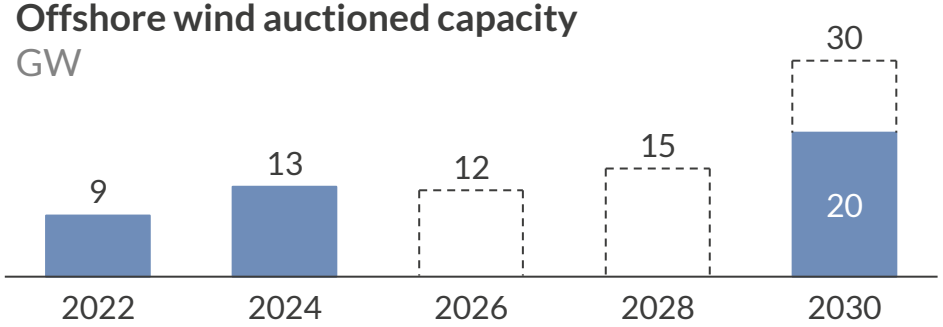
Onshore wind capacity targets

GW



Offshore wind auctioned capacity

GW



Sources: Aurora Energy Research, BMWK

Three questions for today

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1. What would happen in case of a gas supply stop this month?
2. What are medium term scenarios for the Germany's gas supply?
3. What are the implications for renewables and hydrogen in Germany?

1 If Russian gas flows stop, supply falls short by 4-11 bcm in winter, leading to demand cuts in industry and prices above 200 EUR/MWh

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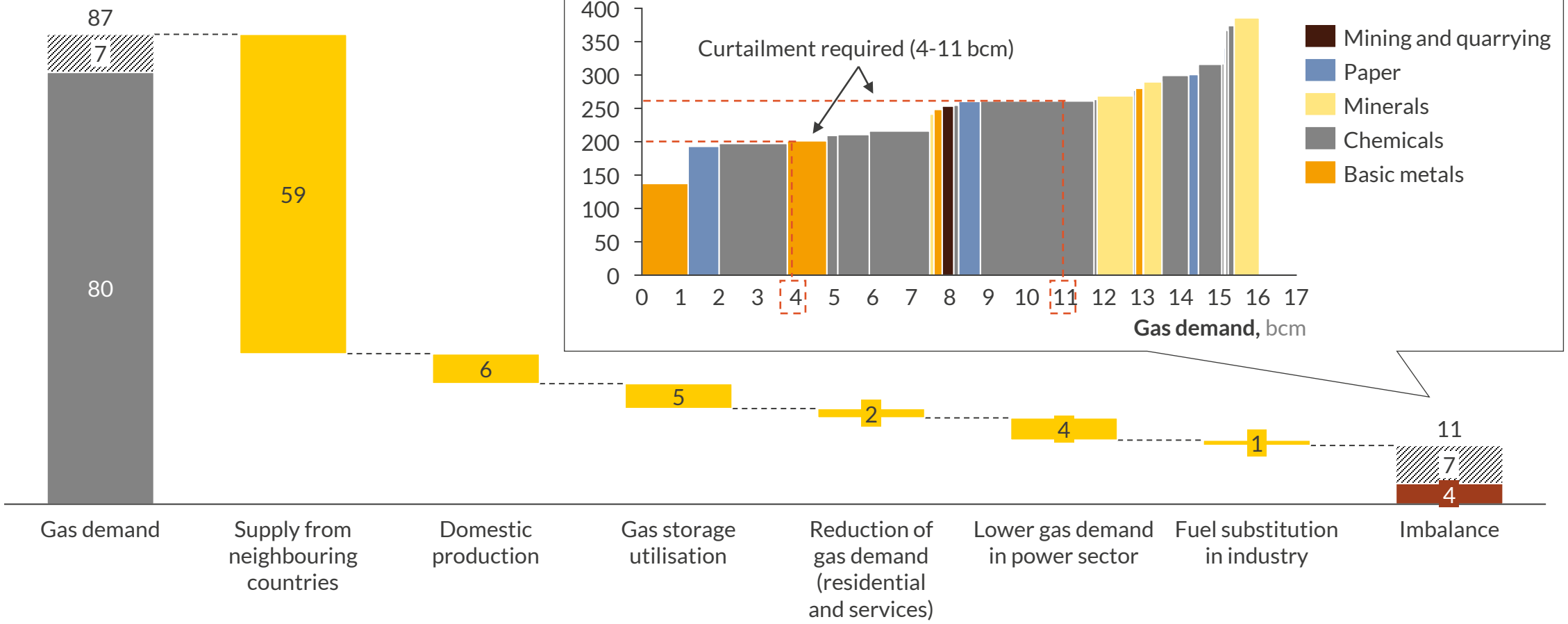
German natural gas demand and supply
April 2022 to March 2023
bcm



Exit gas price for the most price-sensitive industries in Germany
EUR/MWh (real 2021)

Source: Aurora Energy Research

2 Germany can become independent of Russian gas by 2025, a switch to LNG as main source of supply would lead to gas price of 35–53 EUR/MWh

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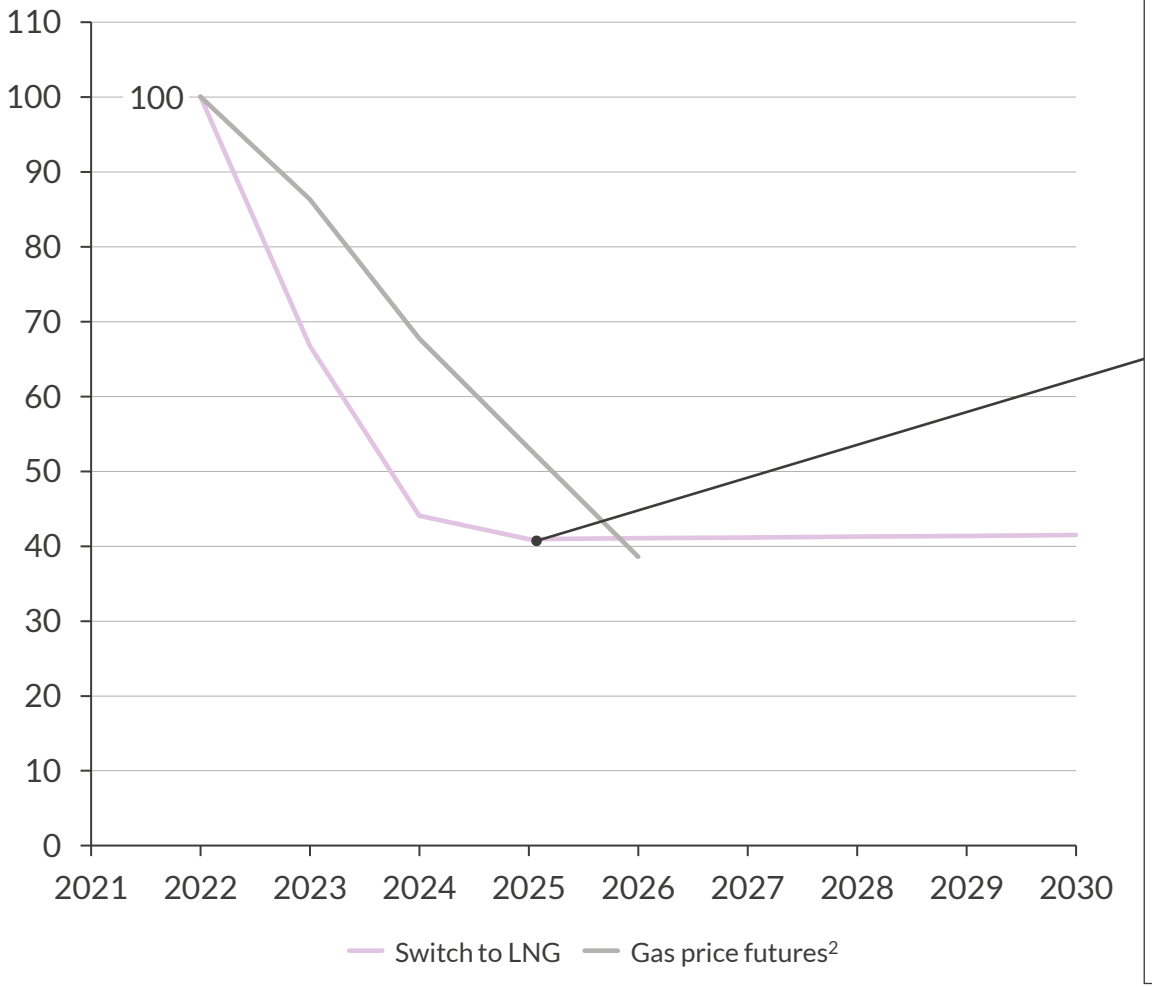
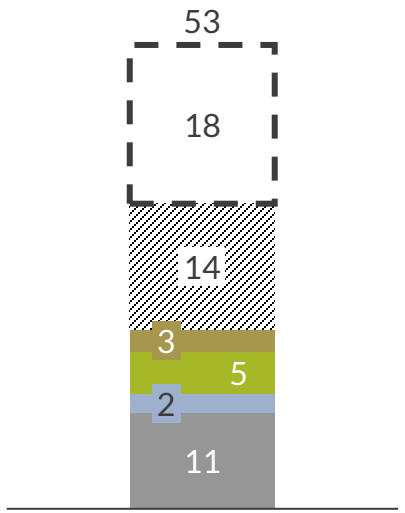
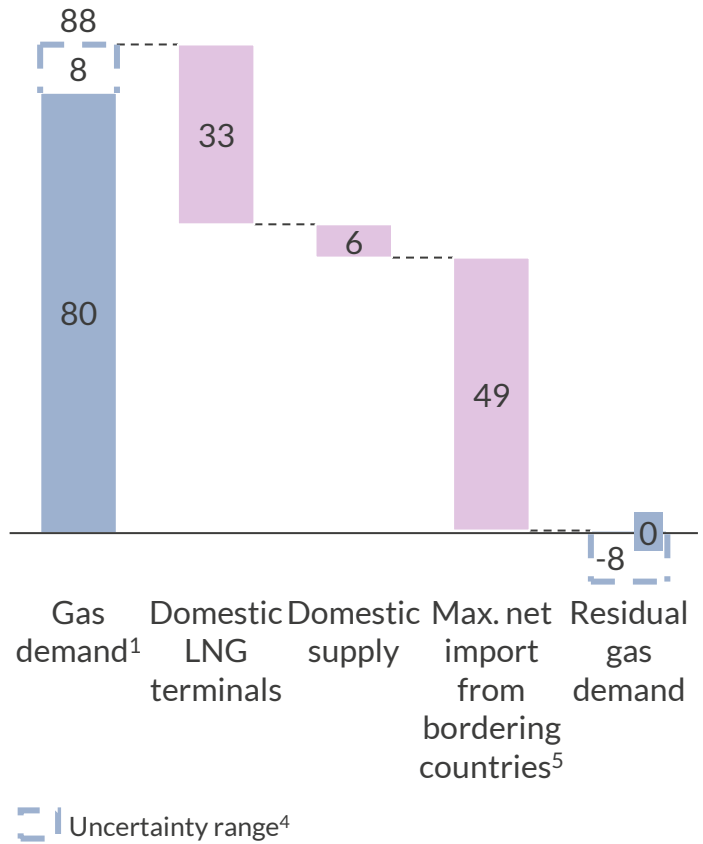
Natural gas price[1]
EUR/MWh (real 2021)



LNG cost in 2025
EUR/MWh (real 2021)



German gas demand and supply balance in 2025
bcm

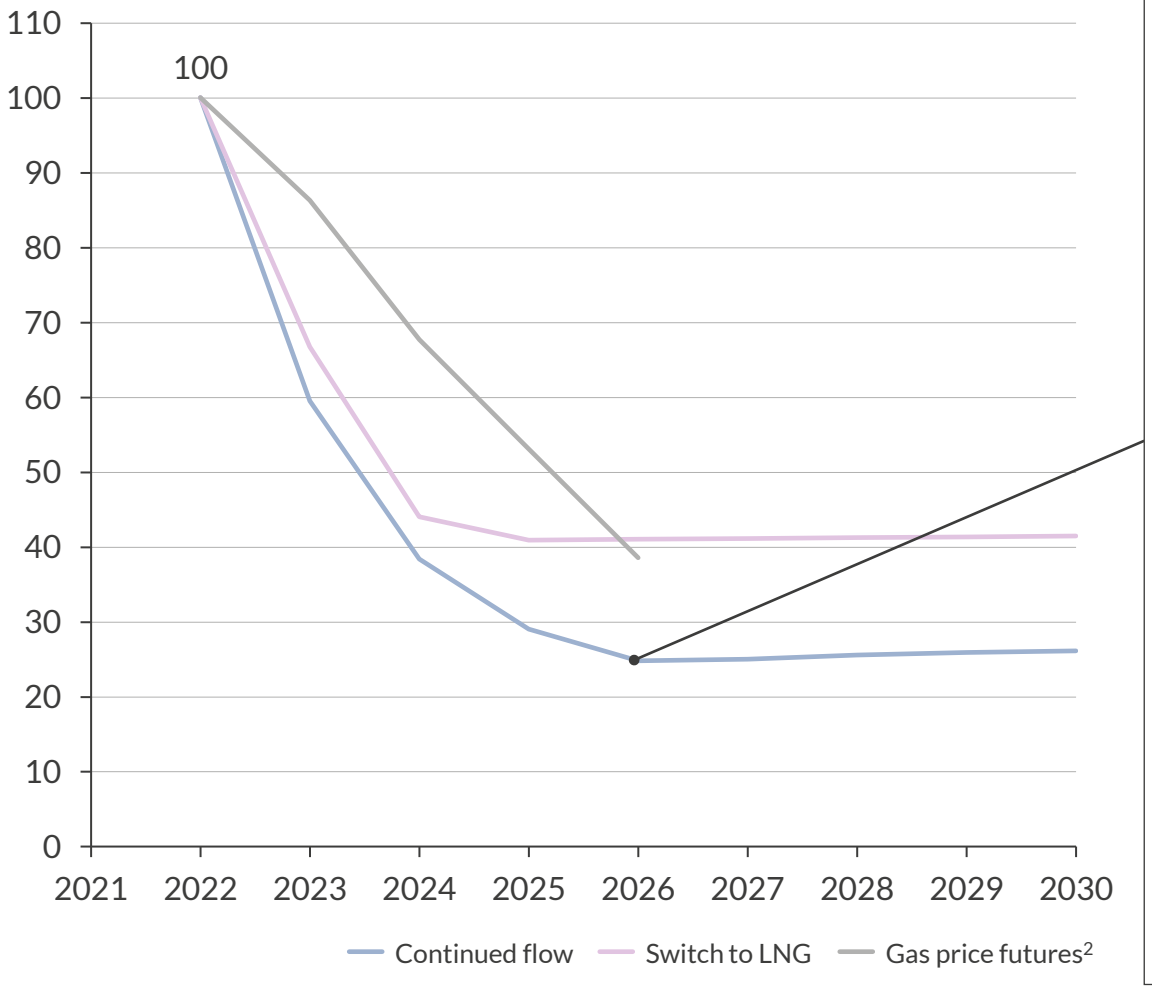


1) Gas price reflecting hub price at THE (Trading Hub Europe). 2) As of 19th May 2022. 3) Assuming LNG to be sourced solely from (a) the USA or (b) Algeria. 4) Assuming two scenarios: (a) gas demand lower compared to Continued flow due to higher gas prices and government actions and (b) gas demand at the same level as in Continued flow. 5) Based on Aurora's preliminary analysis.

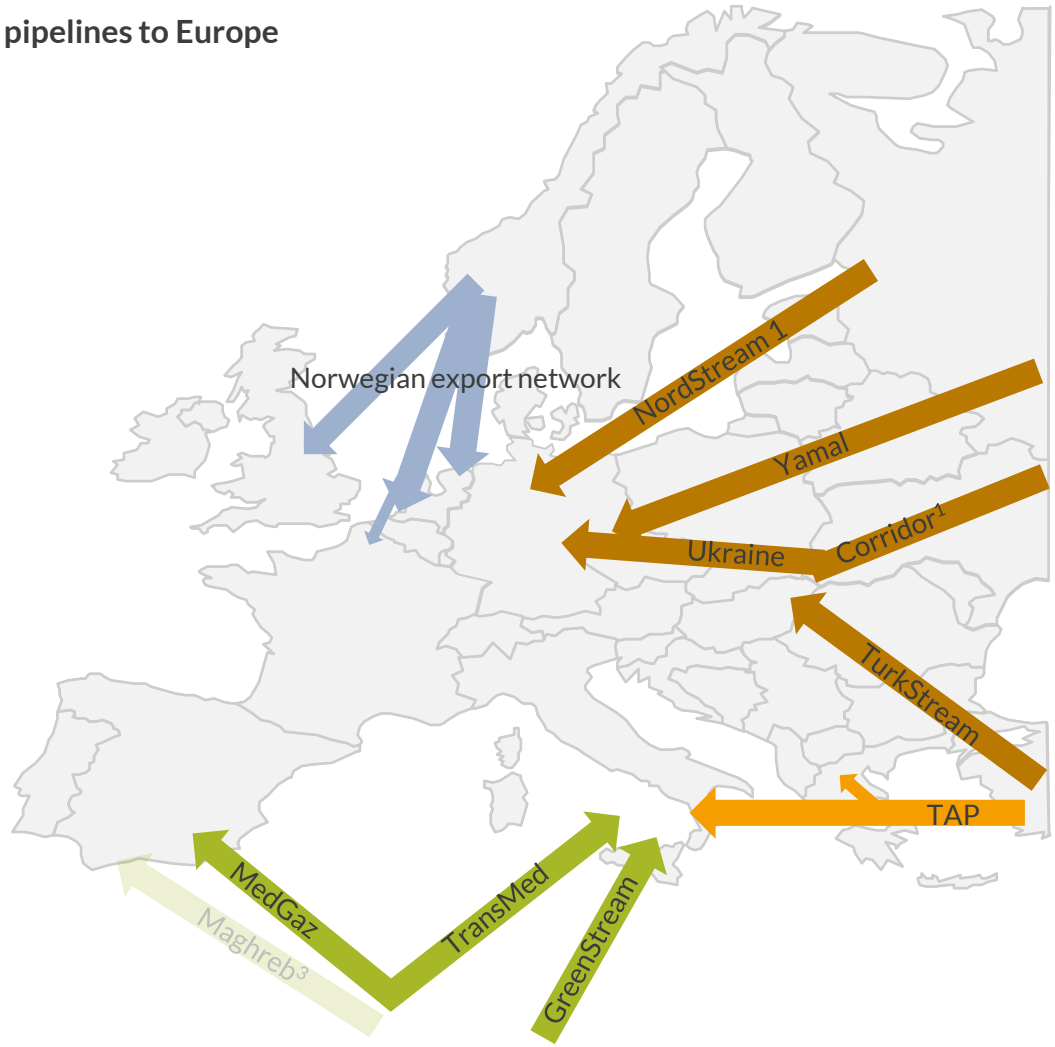
Sources: Aurora Energy Research, EIKON, Eurostat

2 But a full phase-out of Russian gas imports should not be taken for granted: in a "continued flow" scenario, we expect gas prices at 25 EUR/MWh

Natural gas price[1]
EUR/MWh (real 2021)



Main gas pipelines to Europe



1) Gas price reflecting hub price at THE (Trading Hub Europe). 2) As of 19th May 2022.

Sources: Aurora Energy Research, EIKON

3 Next to future supply of gas, speed of decarbonisation is a big swing factor in Germany's power market – we assess these uncertainties in 4 scenarios

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		Power market assumptions	
		Moderate decarbonisation by 2030	Ambitious decarbonisation by 2030
Gas demand reduction	High RES buildout	✗ Intermittent RES capacity reaches 250 GW	✓ Intermittent RES capacity reaches 340 GW (+36%)
	Fast electrification of heat	✗ Power demand from electric heating reaches 25 TWh	✓ Power demand from electric heating reaches 41 TWh (+64%)
	Strong hydrogen uptake	✗ Hydrogen demand reaches 69 TWh	✓ Hydrogen demand reaches 127 TWh (+84%)
	Delayed coal exit	✗ Coal exit by mid-2030s (i.e. ahead of government timeline)	✗ Even earlier coal exit 2030s
Gas supply	Continued flow	Central (cont'd flow)	Target (cont'd flow)
	Switch to LNG	Central (LNG)	Target (LNG)

Source: Aurora Energy Research

3 Reaching 2030 renewable targets requires tripling wind and quadrupling solar growth rates, while power demand rises by 28%

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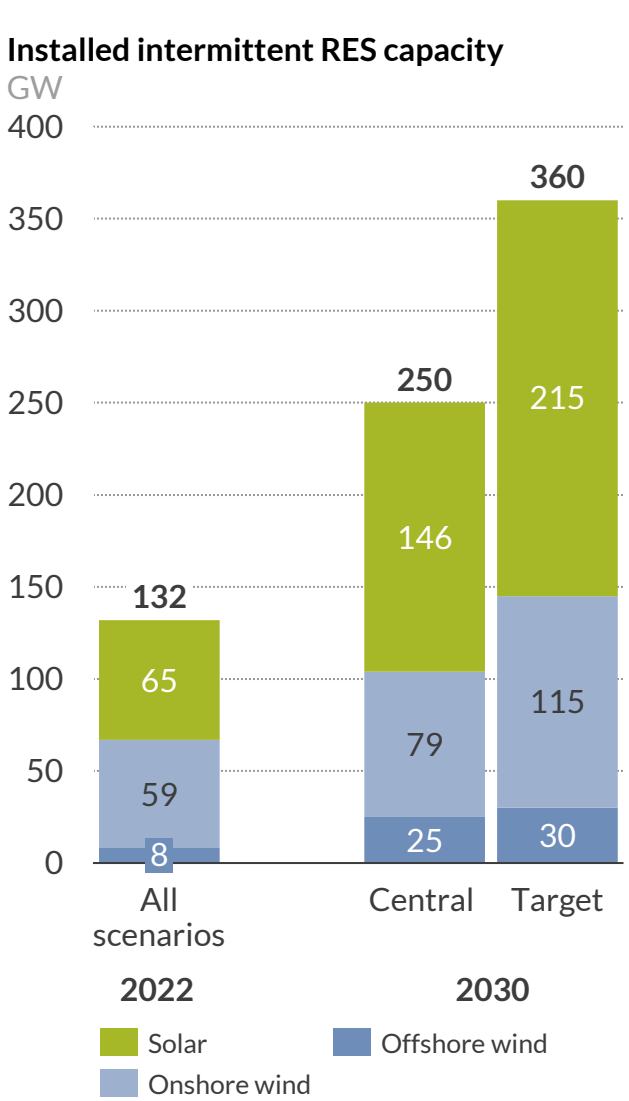
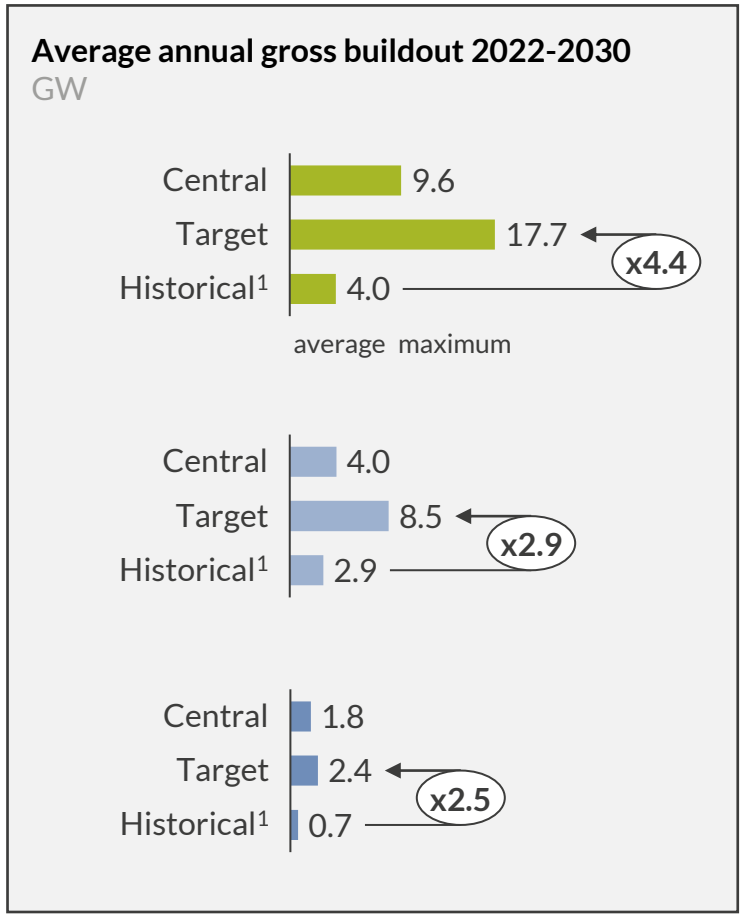
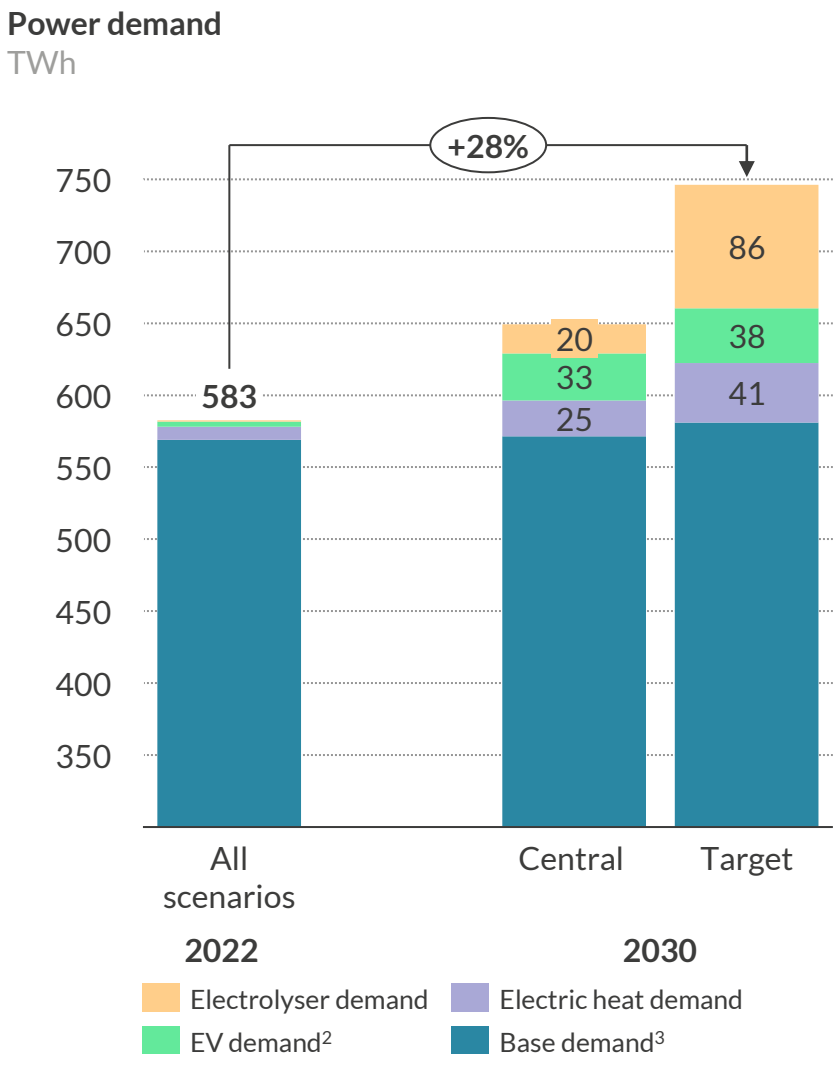




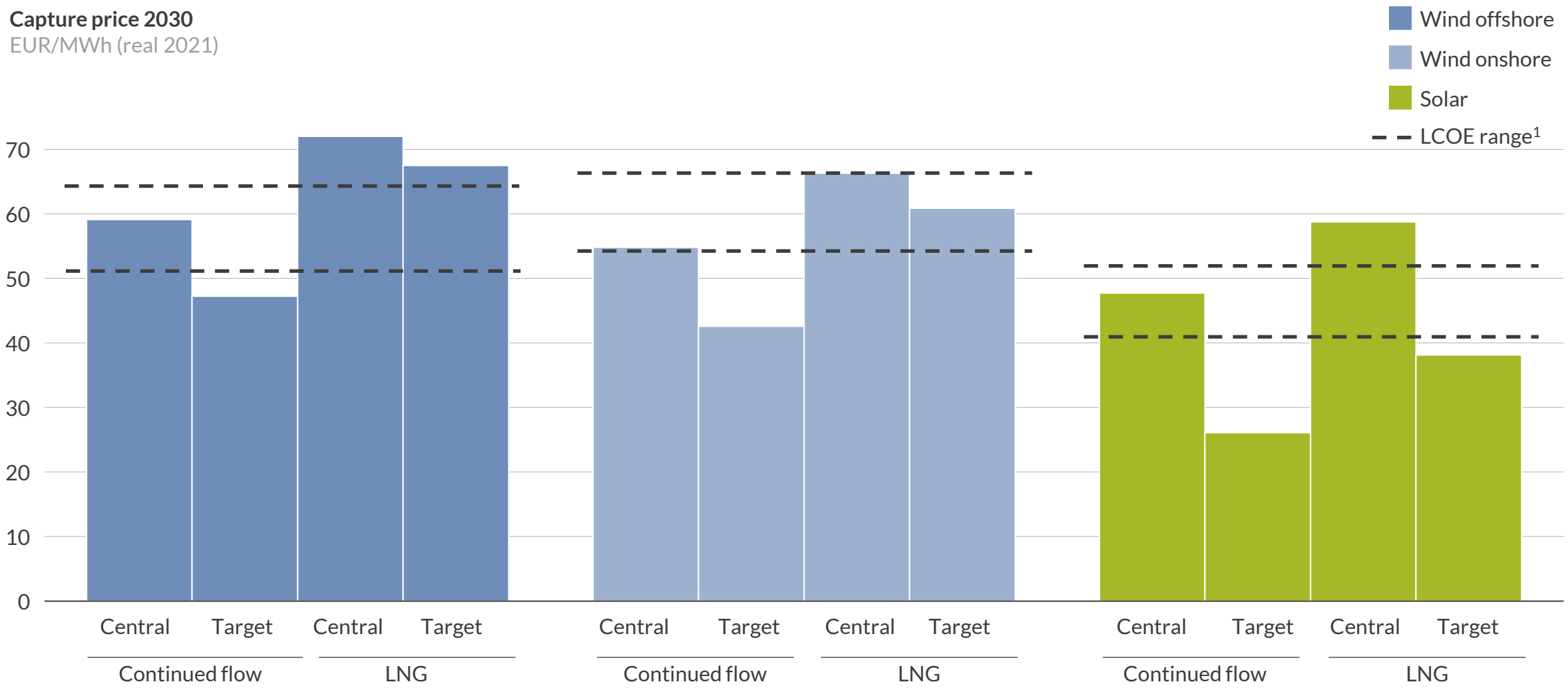


1) Historical average and maximum annual gross buildout from 2010 to 2020. 2) Only pure battery EVs, not including PHEVs. 3) Industry, commerce, households, transport other than EVs.

Source: Aurora Energy Research

3 Higher LNG prices and rising power demand mitigate cannibalisation of renewables capture prices and improve their economics

Capture price 2030
EUR/MWh (real 2021)



1) WACC equals 8.5% for the upper limit and 5.0% for the lower limit.

Source: Aurora Energy Research

3 Even in a decarbonised power market, prices are unlikely to crash, as high marginal cost flexible technologies will set the price

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Hourly power generation[1] by technology in 2050 in Net Zero scenario
% of demand

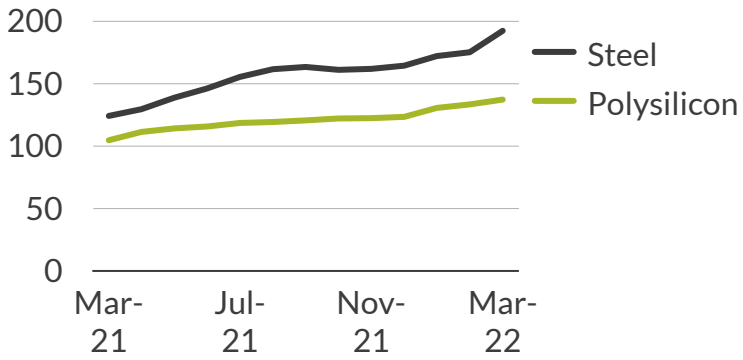
1) Simplified by showing average generation for 16-hour intervals. 2) Includes all RES except biomass CHPs. 3) Flexible technologies include batteries, pumped storage, EV and heat pump demand as well as DSR. 4) Includes biomass CHP.

Source: Aurora Energy Research

3 Main challenges to realise the renewable targets are a constrained supply chain, permitting and consenting, as well as grid extension

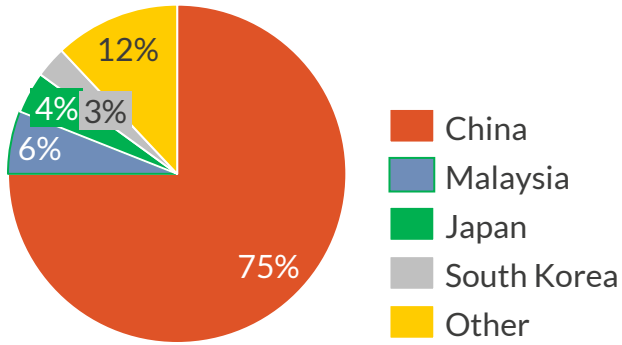
Supply chain

German producer price index



EU imports of solar panels in 2020

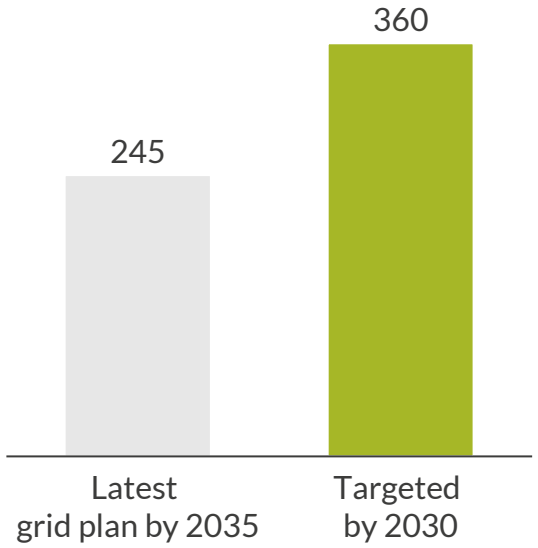
GW



Grid extension

Renewable capacity

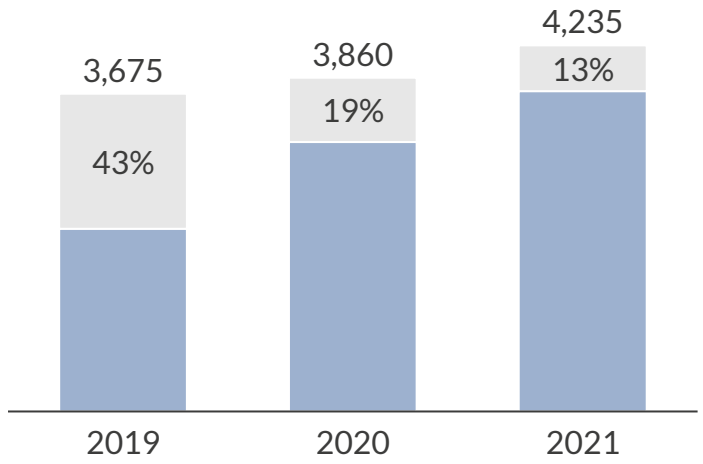
GW



Permitting and consenting

Wind onshore auction

MW, % of unallocated volume



Announced delays versus the latest plan

- Neuenhagen – Vierraden – Bertikow overhead line – 1-year delay
- Utfort – Osterath overhead line – 2-year delay
- Parchim/Süd – Perleberg extra-high voltage line – 4-year delay

Sources: Aurora Energy Research, Bundesnetzagentur, Eurostat, Netzentwicklungsplan Strom, Statistisches Bundesamt

3 Over the next decade, natural gas will continue to play a key role in power as increased hydrogen use replaces fossil fuels in industry first

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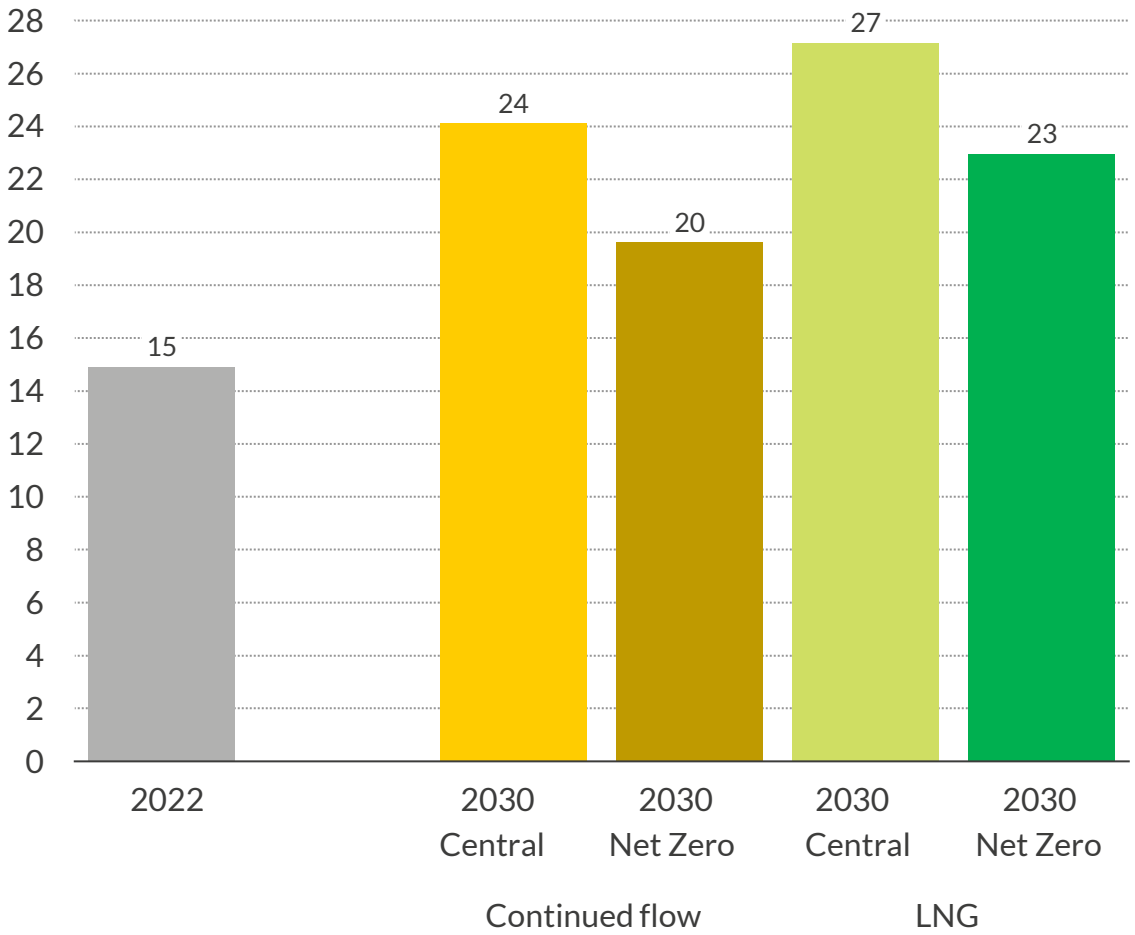
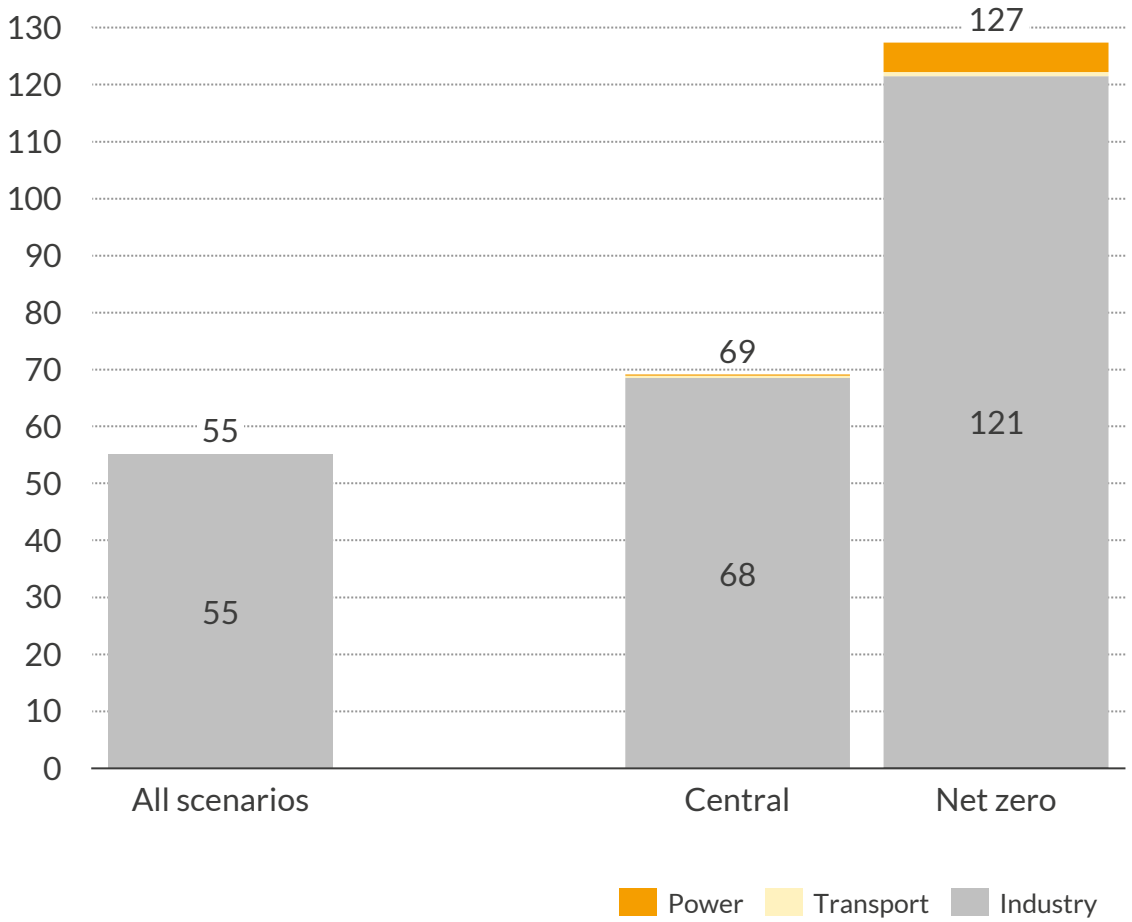
Power sector natural gas demand
bcm



Hydrogen demand across sectors
TWh



Source: Aurora Energy Research

Details and disclaimer

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