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Russia-Ukraine war: how is UK gas security affected?

28th March 2022

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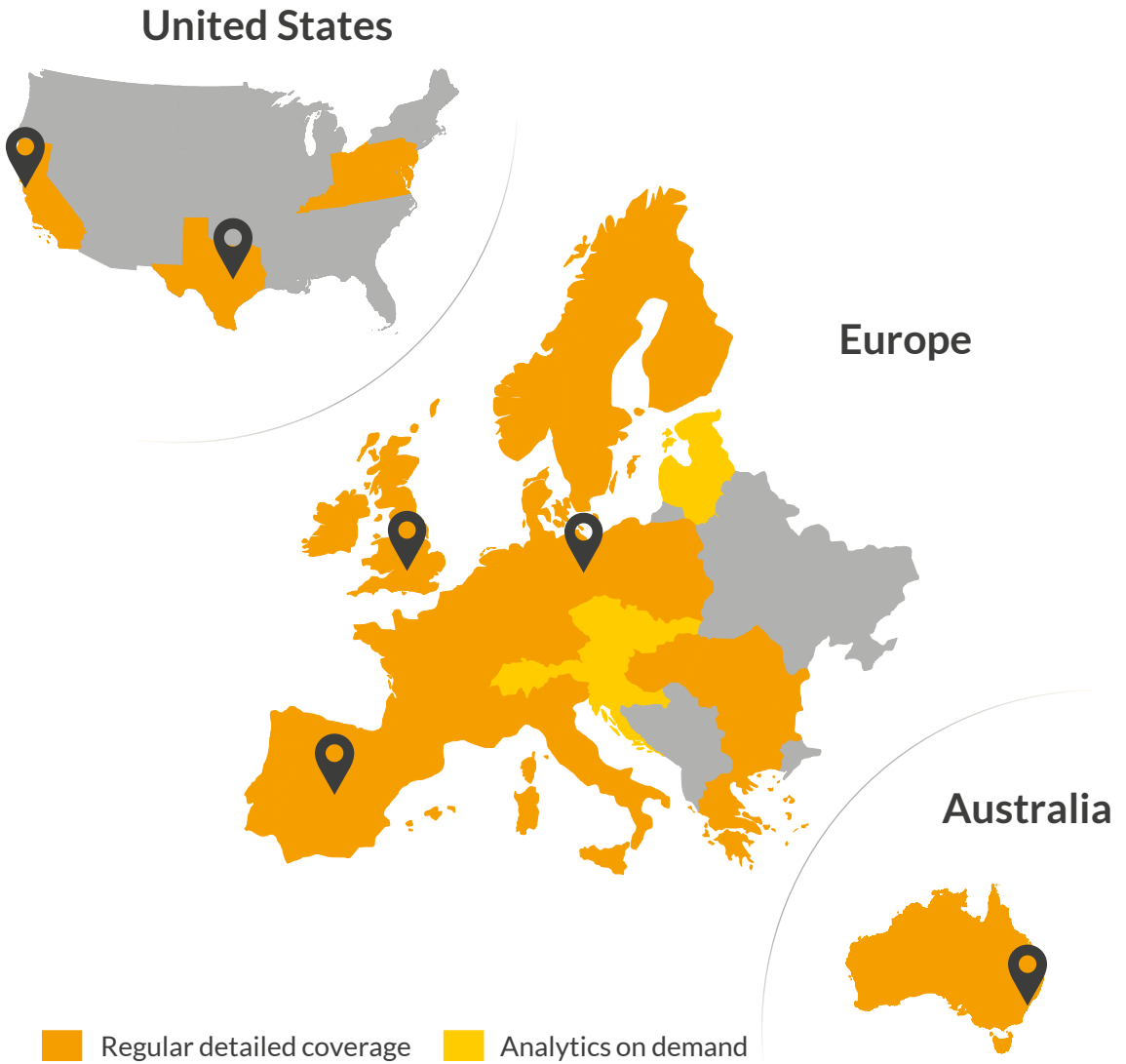

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Source: Aurora Energy Research

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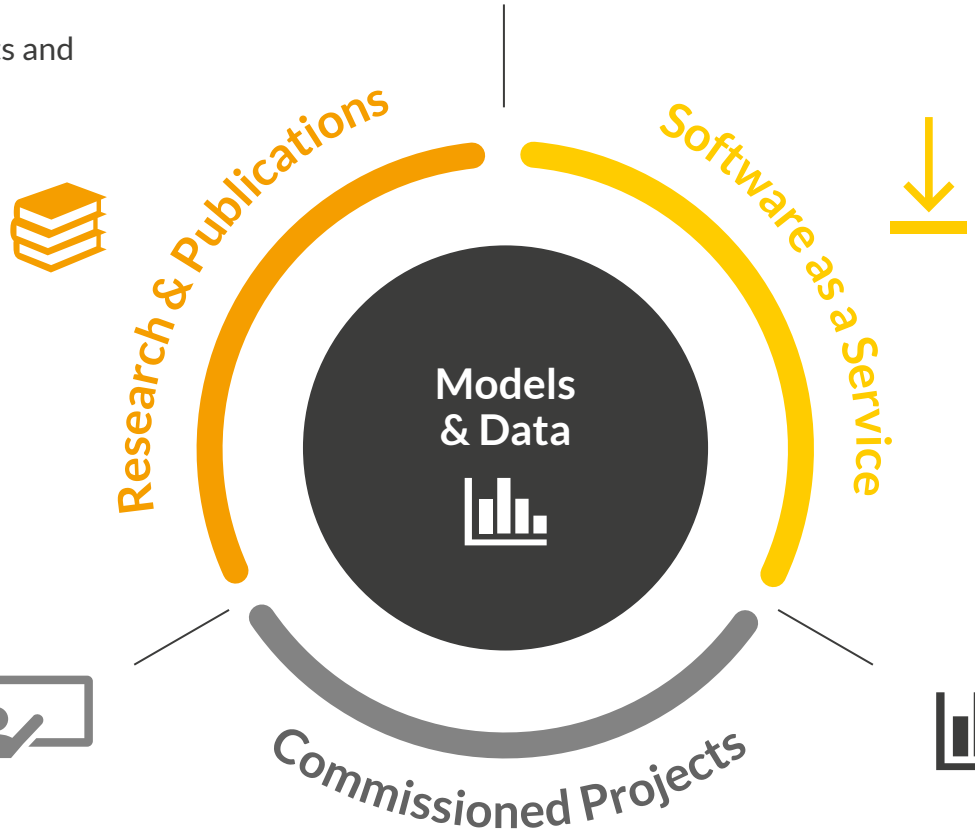

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Source: Aurora Energy Research

Agenda

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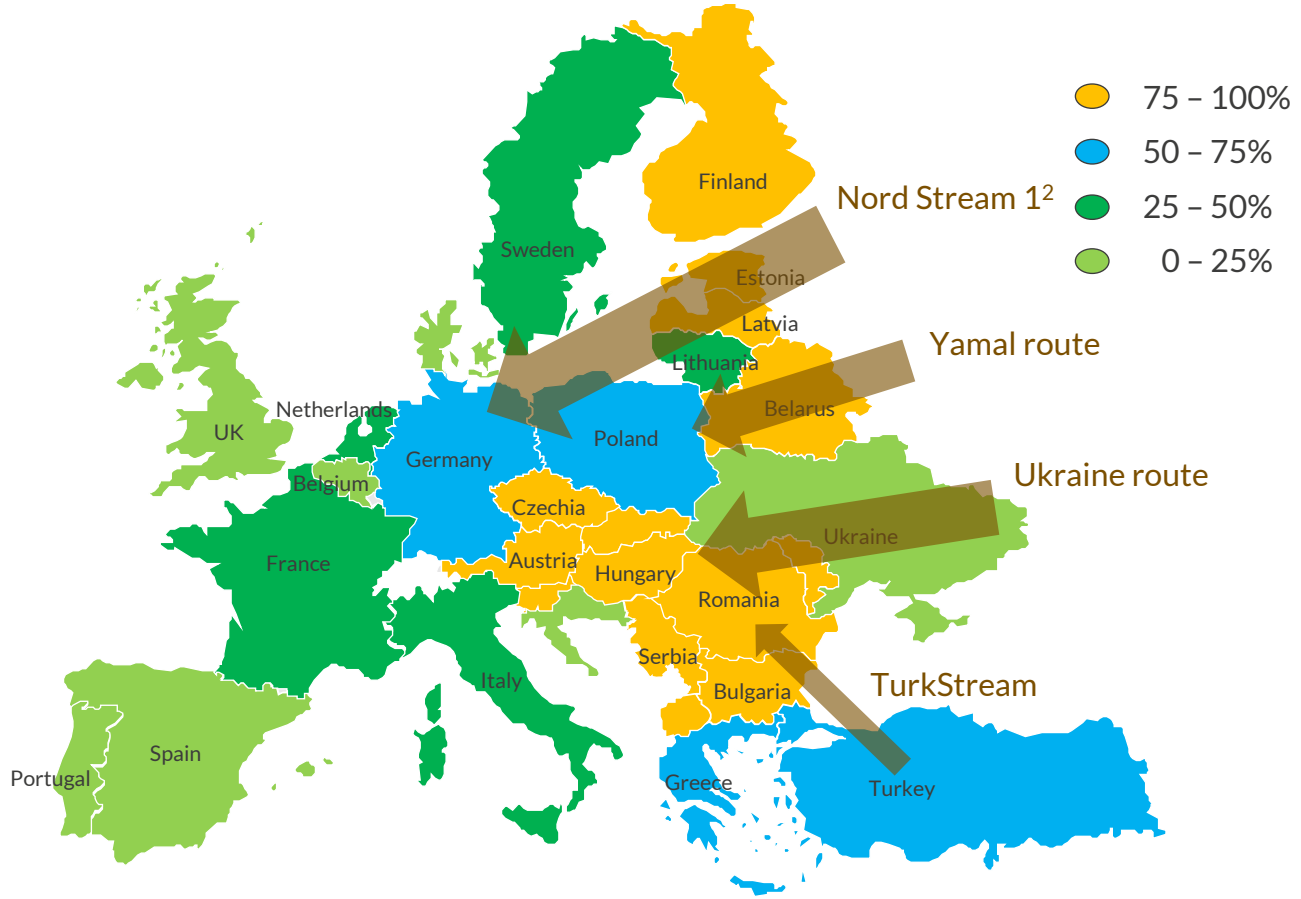
I. Physical gas security in EU and UK

II. Can the UK help the EU fill gas storage?

Many countries in Europe particularly in the south and east use Russian gas for over half of their needs

Share of Russian gas in all imports in 2021
%



- Reliance on Russian gas is much higher in central and eastern Europe than in western Europe and is nearly 100% in some countries in the southeast Europe
- The UK imports very little from Russia:
  - There is a 4bcm/a medium-term supply agreement between Gazprom and Centrica until 2025
  - The UK imports low levels of Russian LNG but this can be replaced with other global sources (see slide 4)
- Ten EU Member States (Bulgaria, Czechia, Estonia, Latvia, Hungary, Austria, Romania, Slovenia, Slovakia and Finland) sourced more than 75% of their gas imports from Russia in the first half of 2021

1) Pipeline + LNG flows. Share % of trade in value. Extra-EU trade flows (no intra-EU trading). 2) The Nord Stream 2 pipeline will follow a near identical route

Sources: Aurora Energy Research, Eurostat database Comext

In the UK, only 5% of supply comes directly from Russia, mainly via LNG. The majority comes from UK's own production and Norway

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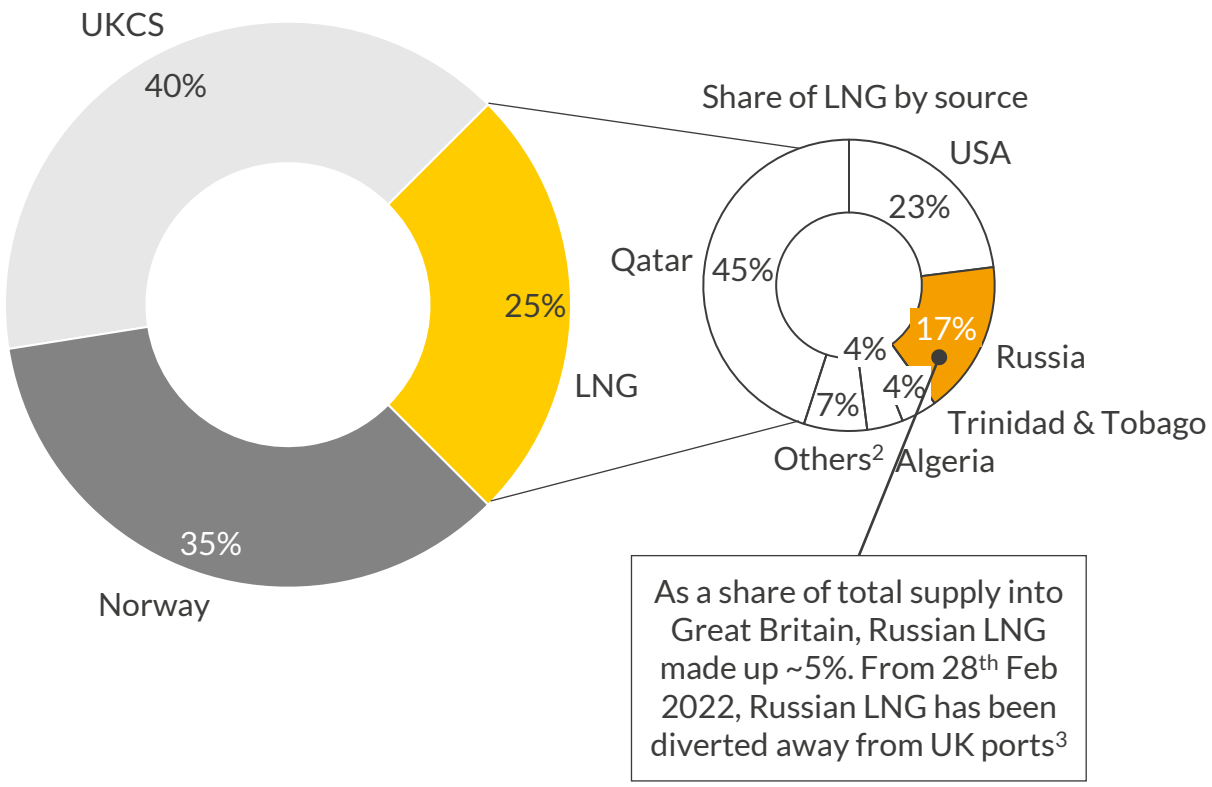
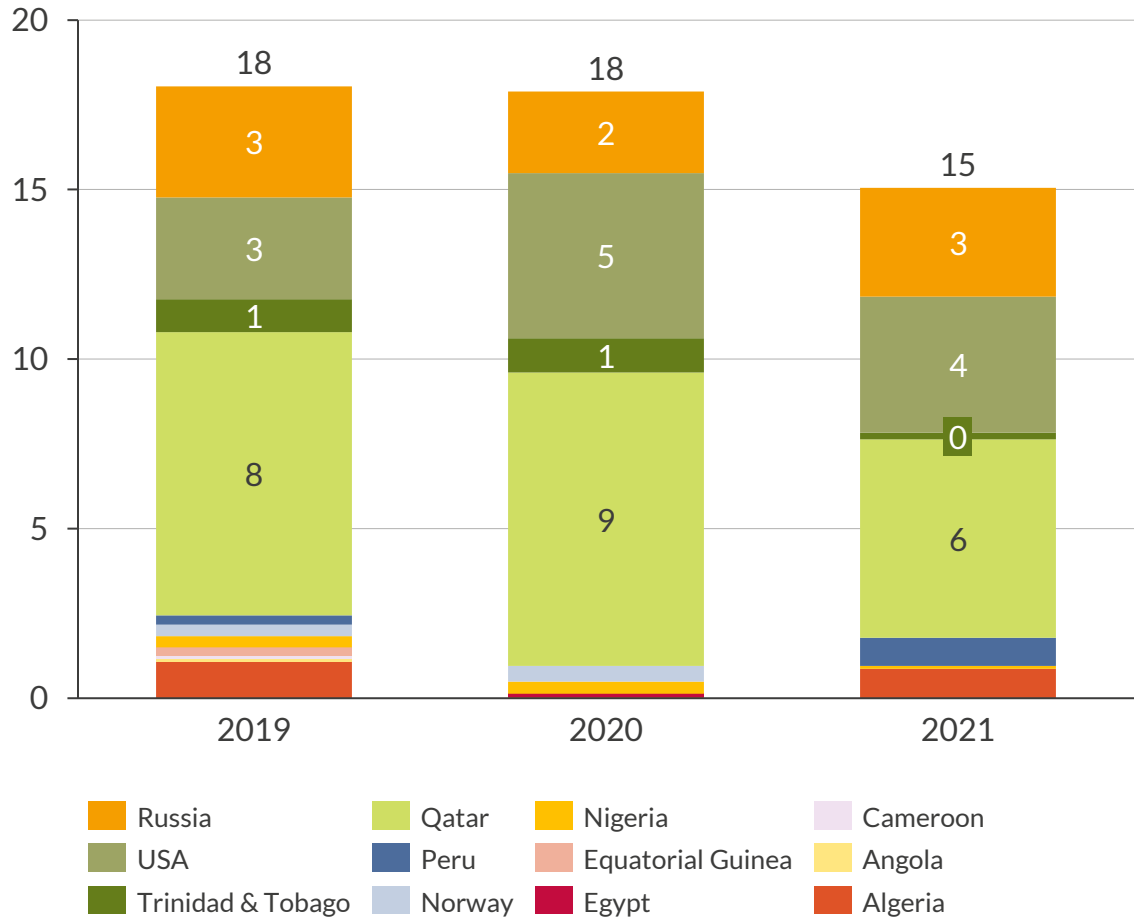
Gas supply[1] to Great Britain, average 2019-2021
Average % share



LNG imports by source[2] to Great Britain
bcm



1) This excludes storage and interconnectors with Belgium, the Netherlands, and Ireland. On average Great Britain net exported 2bcm/a to Belgium, 2bcm/a to the Netherlands, and 5bcm/a to Ireland. 2) Others include Peru, Norway, Nigeria, Equatorial Guinea, Egypt, Cameroon and Angola. 3) On 28th Feb 2022 the UK imposed a bank on tankers flagged, registered, owned, controlled, chartered or operated by Russian people or companies. At least two Russian LNG tankers were diverted as a result

Sources: Aurora Energy Research, EIKON

By maximising imports from the North Sea and LNG, Great Britain could meet gas demand and export gas to the EU even on a 'cold day'

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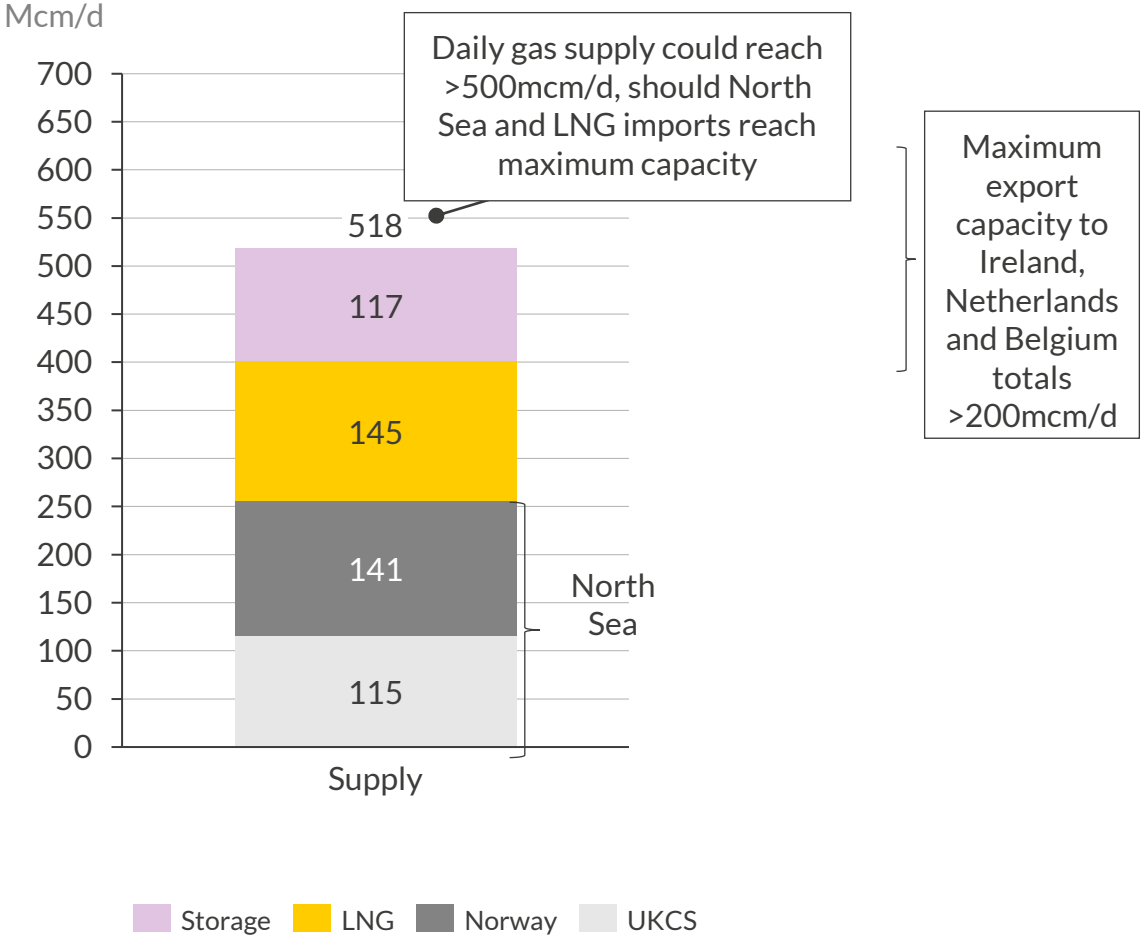
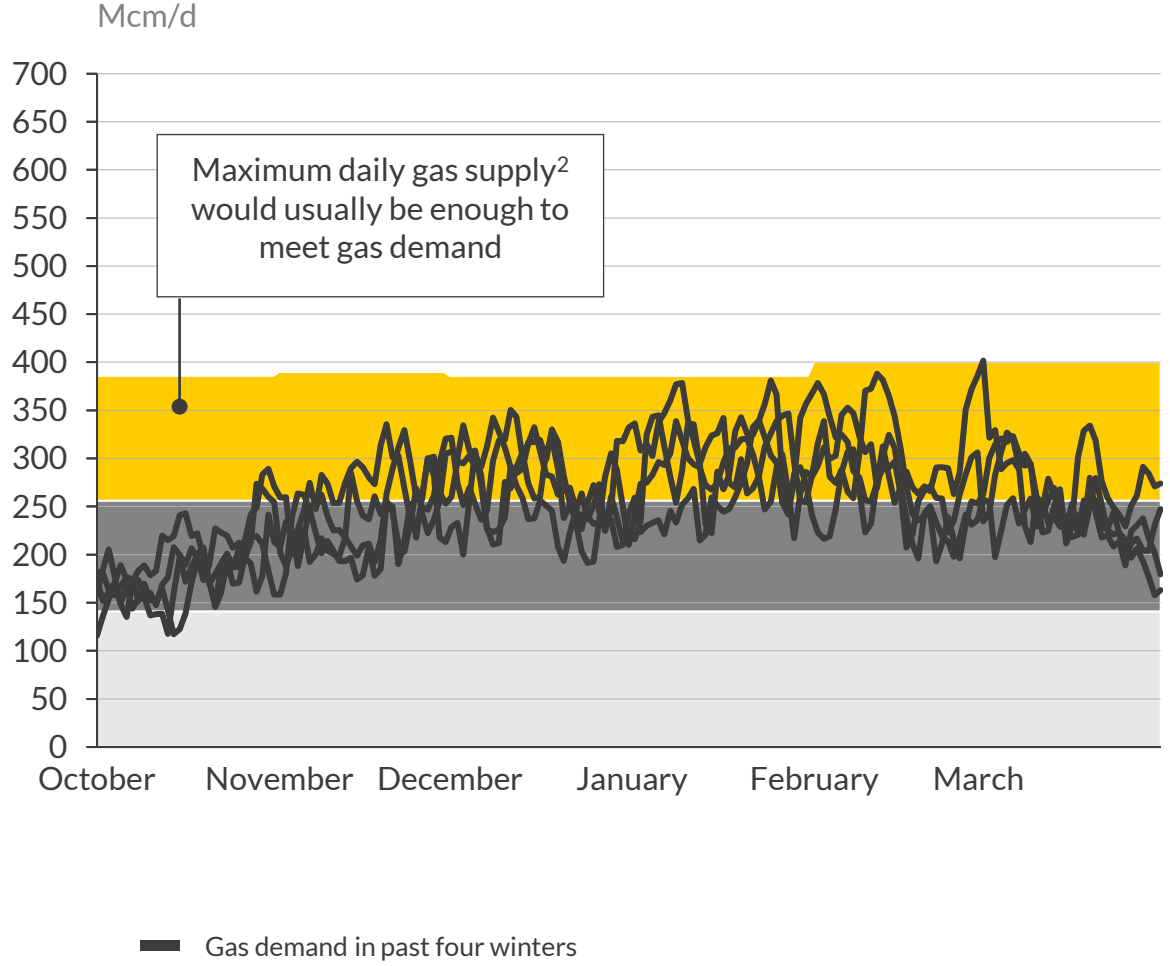
Maximum supply and demand on a 'Cold Day[1]'



Daily gas demand vs maximum import capacity of UKCS, NCS, LNG



1) Cold day is defined by National Grid in its Winter Gas Outlook 2021/2022. 2) Storage supply is not shown here as the UK does not have significant seasonal storage capacity

Source: Aurora Energy Research

Physical shortage of natural gas to the UK is unlikely, even with high demand and supply outages – but import capacity is important in extreme scenarios

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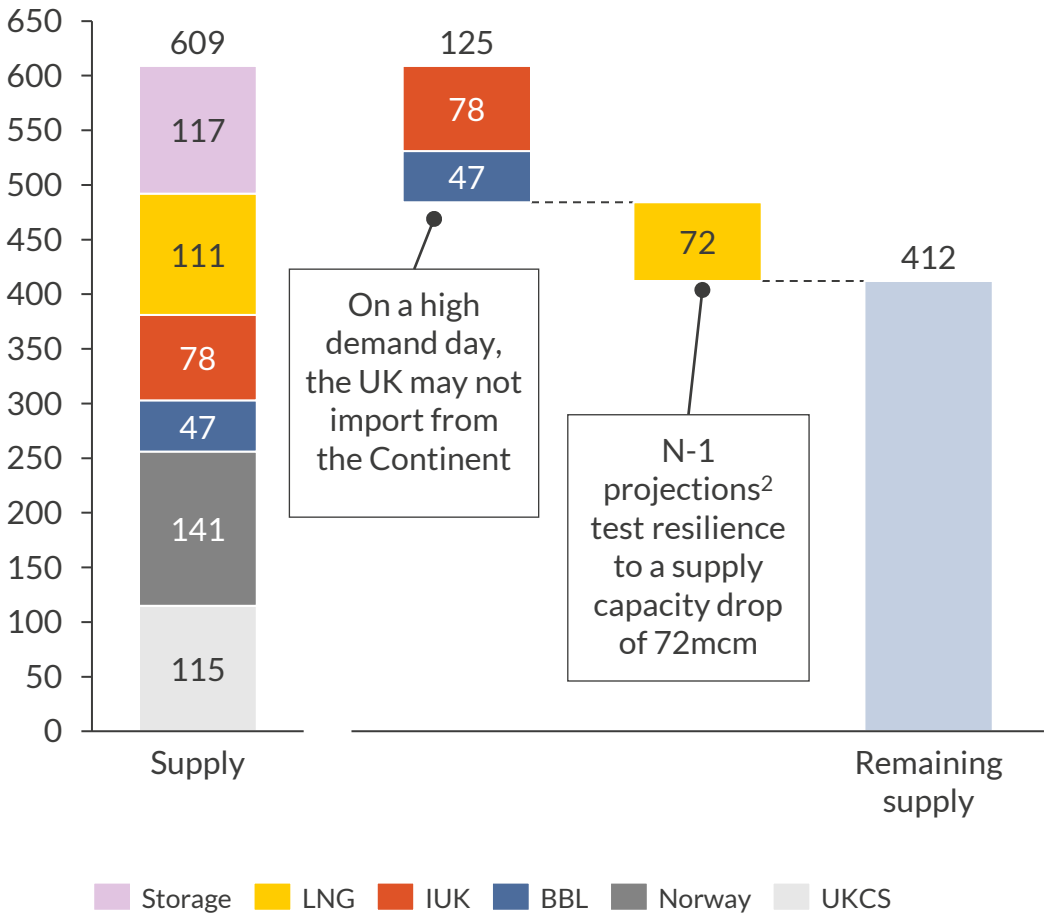
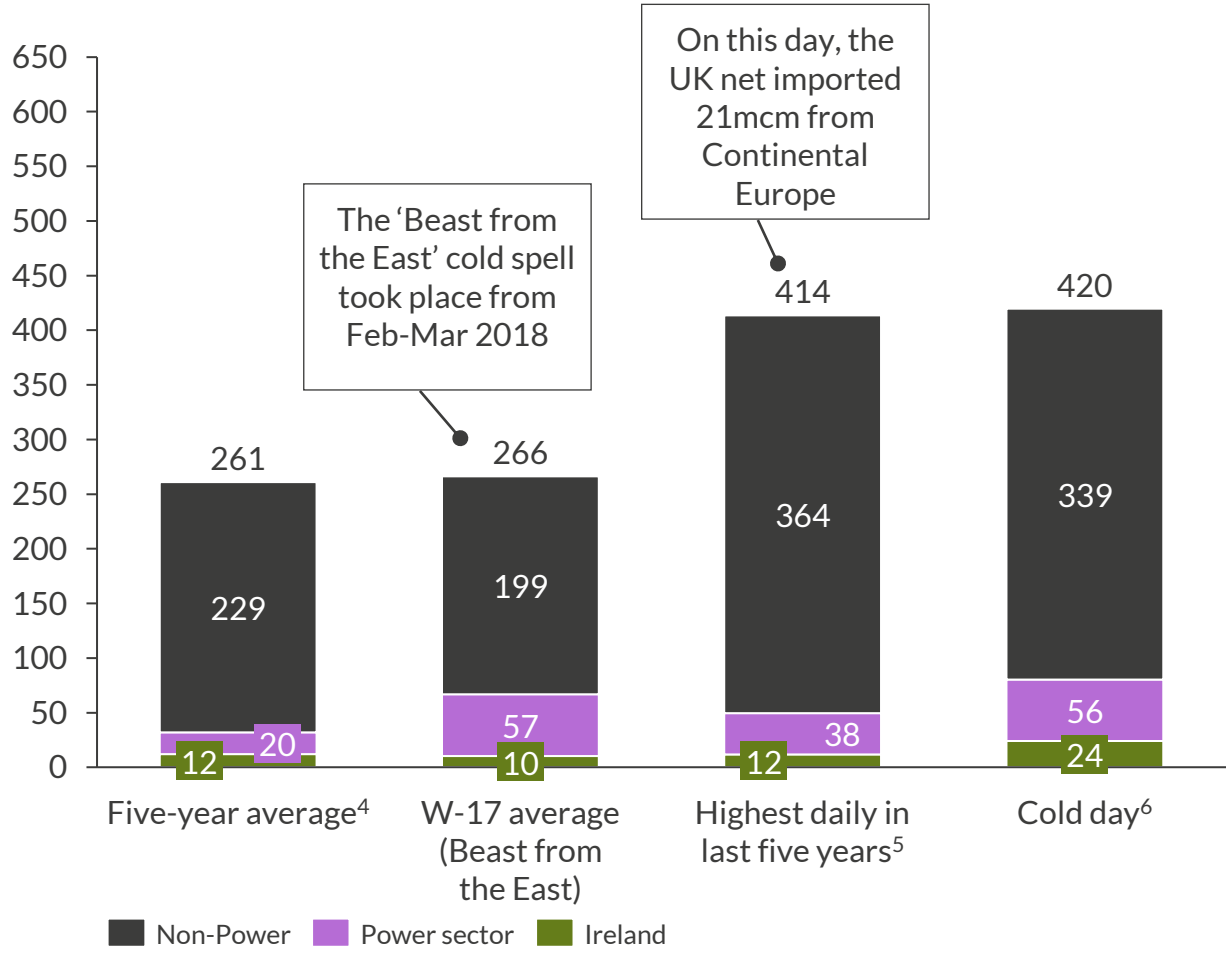
Total daily supply capacity[1] to Great Britain
Mcm/d



Total daily demand[3] under various scenarios
Mcm/d



1) Peak supply capacity defined by National Grid (NG) in its Gas Winter Outlook 2021/22. 2) N-1 projections from NG simulate the effect of losing the single largest supply point on the system at the same time as peak demand. 3) Daily gas consumption excluding storage injections and export to Belgium and the Netherlands. 4) Winter 2016-Winter 2020. 5) Occurred on 1st March 2018 during 'Beast from the East'. 6) 'Cold day' as defined by National Grid

Sources: Aurora Energy Research, National Grid

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II. Can the UK help the EU fill gas storage?

Gas storages in the EU need to net inject at least 39bcm by 1st August this year, and a further 18bcm by 1st November

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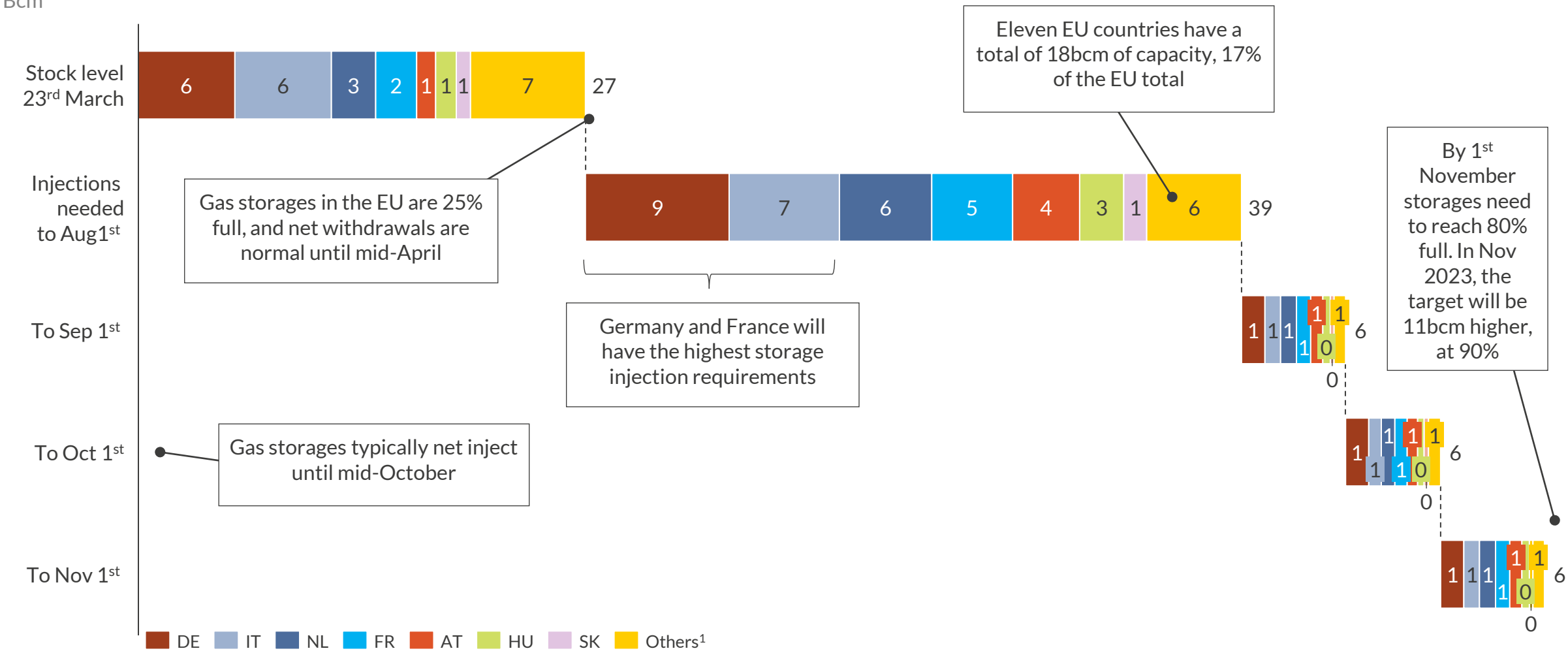
Eu gas storage stock level and targets in the draft European Commission law for 2022

Bcm

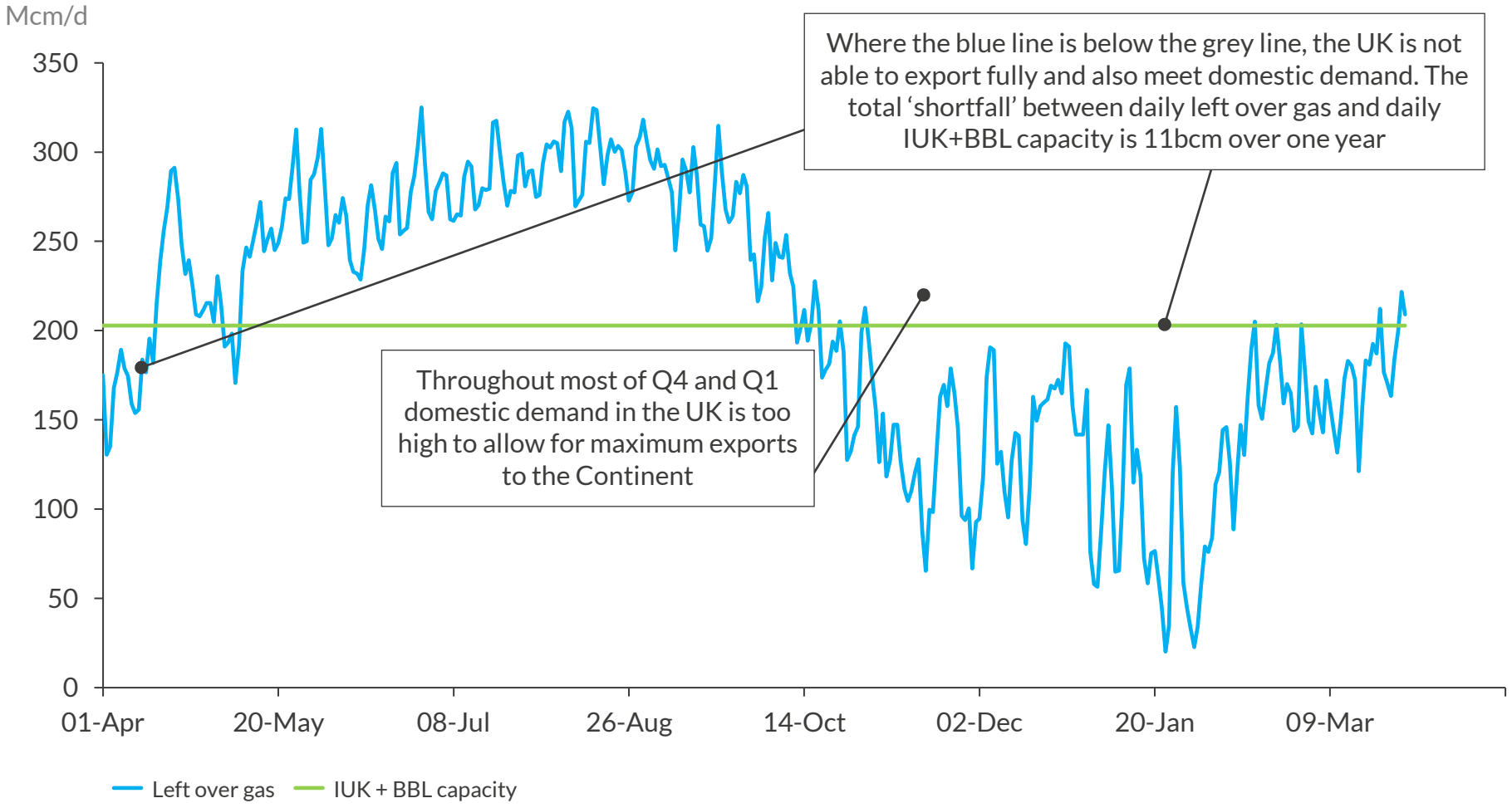


1) Others includes PL, CZ, ES, RO, LV, DK, BE, BG, HR, PT, SE

Sources: Aurora Energy Research, AGSI GIE, European Commission

For the next 12 months, the UK could fully export to the Continent half the time, if its supplies from LNG and North Sea are at maximum

Situation where the UK sees normal demand, and maximum supplies from LNG, UKCS and Norway



1) Cold day is defined by National Grid in its Winter Gas Outlook 2021/2022. 2) Storage supply is not shown here as the UK does not have significant seasonal storage capacity

Source: Aurora Energy Research

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The UK can export to the Continent at maximum capacity only half the time

- Here we assume the actual daily gas demand seen in 2019
- We assume supplies from LNG, UKCS and Norway reach maximum capacity every day
- By subtracting demand from supply, we're left with a 'left over gas' figure every day. In this situation, there is 70bcm of spare gas that could be exported, of which 48bcm is over the summer months, and could help Europe refill its storages
- In 2019, net exports to the Continent totalled 5bcm
- By comparing the daily left over gas with export capacity, we see that on 51% of days the UK could meet both normal domestic demand and fully export to the Continent, albeit mainly in summer

Gas supply potential could grow by late 2020s to maximise potential winter exports to the Continent only if daily deliverability capacity also increased

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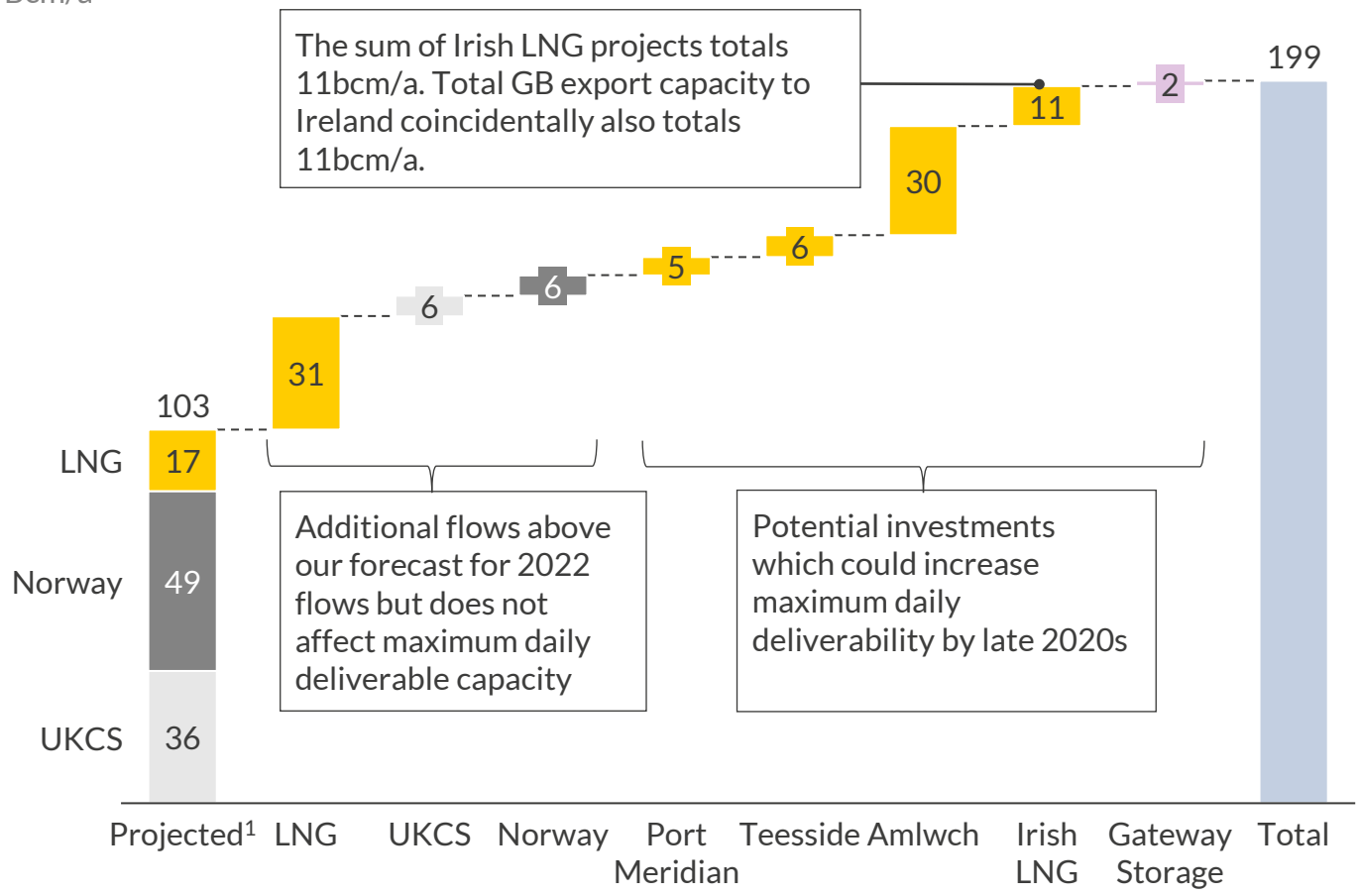
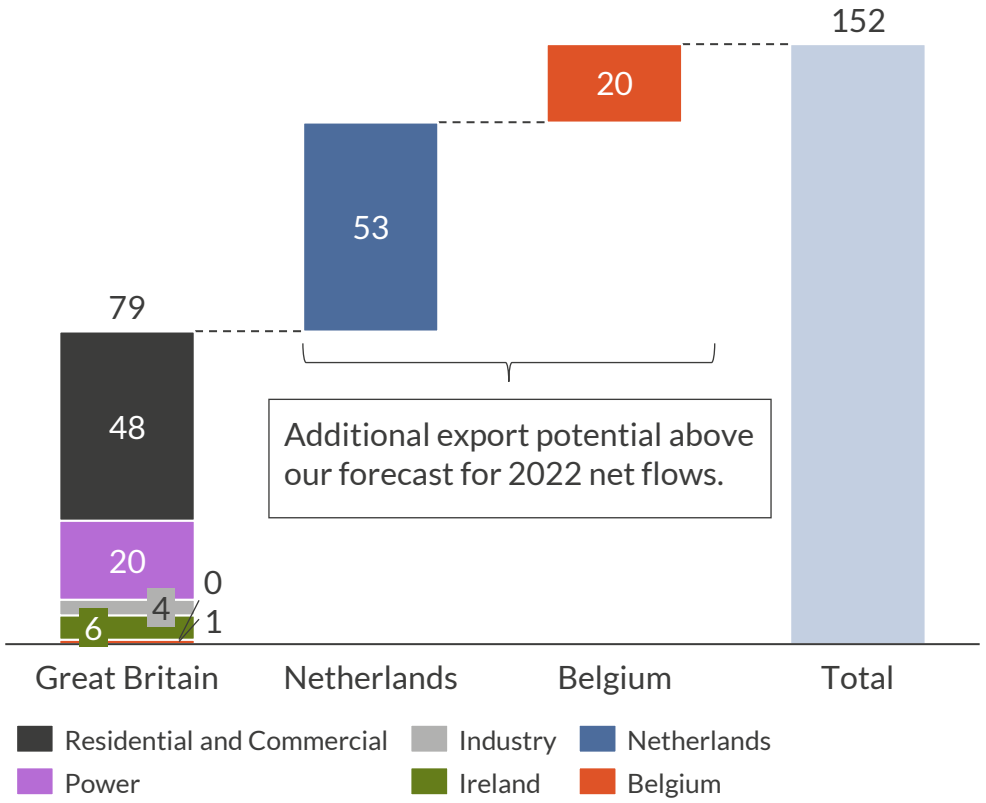
Supply forecast and additional potential

Bcm/a



Projected UK demand[2], and additional export potential to NL and BE

Bcm/a



1) Projected for 2022 in Aurora's Central Scenario before the Ukraine gas crisis. 2) 2022 projected including domestic consumption, export to Ireland, and net exports to the Netherlands and Belgium. Does not include storage injection demand.

Source: Aurora Energy Research

The UK could pursue a range of options to reduce gas demand – but most carry significant economic, political or carbon costs

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	Policy option	Short term (2022) Demand reduction	Short term (2022) Feasibility	Barriers and limitations	Risks of implementation	Medium term (2027) Demand reduction	Medium term (2027) Feasibility
Power sector	Delay nuclear retirements	**< 0 bcm**	○	▪ Plants have already started their decommissioning process	▪ Extending lifetimes of the existing fleet would raise safety concerns due to cracks in the graphite core	**< 0 bcm**	○
	Keep the entire current coal fleet online until the mandatory closure in Oct 2024 (~4 GW)	**>2.0 bcm**	◑	▪ Plants need to deviate from existing decommissioning plans, with uncertainty on how much they are actually able to generate ▪ Increased coal demand (~4.5Mt) must be secured from suppliers	▪ No impact beyond 2024 ▪ Setback to decarbonisation efforts (~11MtCO_2e increase in emissions)	**>0 bcm**	○
	Accelerate renewables deployment	**<0 bcm**	◔	▪ Long term planning and development process, high cost	▪ Limited short term impact ▪ Also need grid/system investment	**<8.5 bcm**	◕
Residential	Behaviour change or price-induced demand response[1]	**>2.5 bcm**	◔	▪ Consumer and political acceptability – effect on standard of living	▪ Requires coordinated demand reduction campaign ▪ Particularly challenging in winter	**>2.5 bcm**	◔
	Accelerate renovations and heat pump deployment	**<0.5 bcm**	◔	▪ Insufficient incentives at present to encourage faster deployment ▪ Supply chain disruptions/limitations	▪ The time period until next winter limits the retrofits that can realistically be implemented	**>1.5 bcm**	◕
	Home energy efficiency upgrades	**<0.5 bcm**	◑	▪ Supply chain disruptions/limitations	▪ The time period until next winter limits the retrofits that can realistically be implemented	**>2.0 bcm**	◕

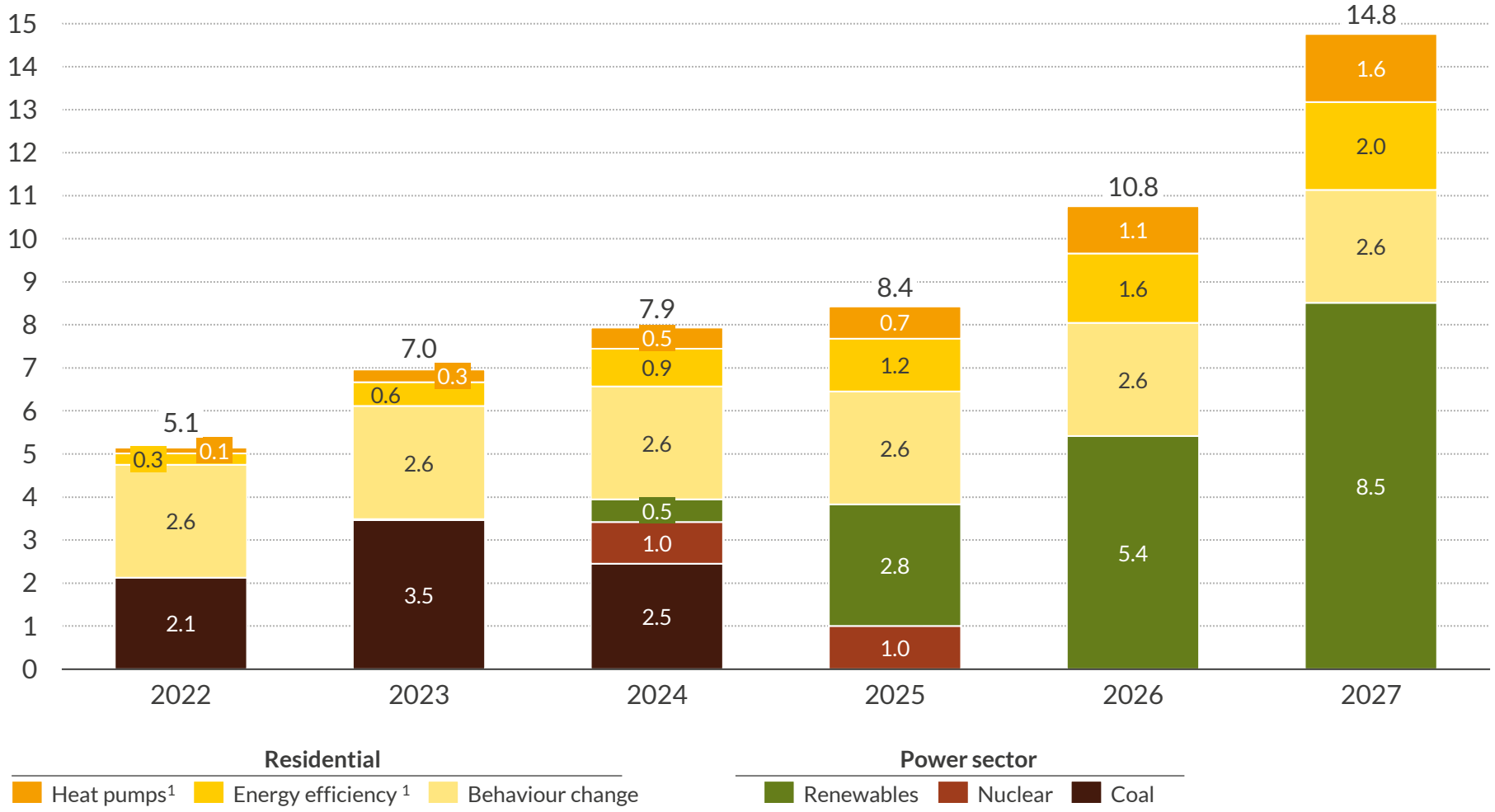
1) Modelled as a 1˚C reduction in space heating by 50% of UK households, 10% less hot water use

Source: Aurora Energy Research

UK yearly gas consumption savings could amount to ~15 bcm by 2027 as a result of higher deployment of renewables and heat savings

Potential yearly gas consumption savings

bcm

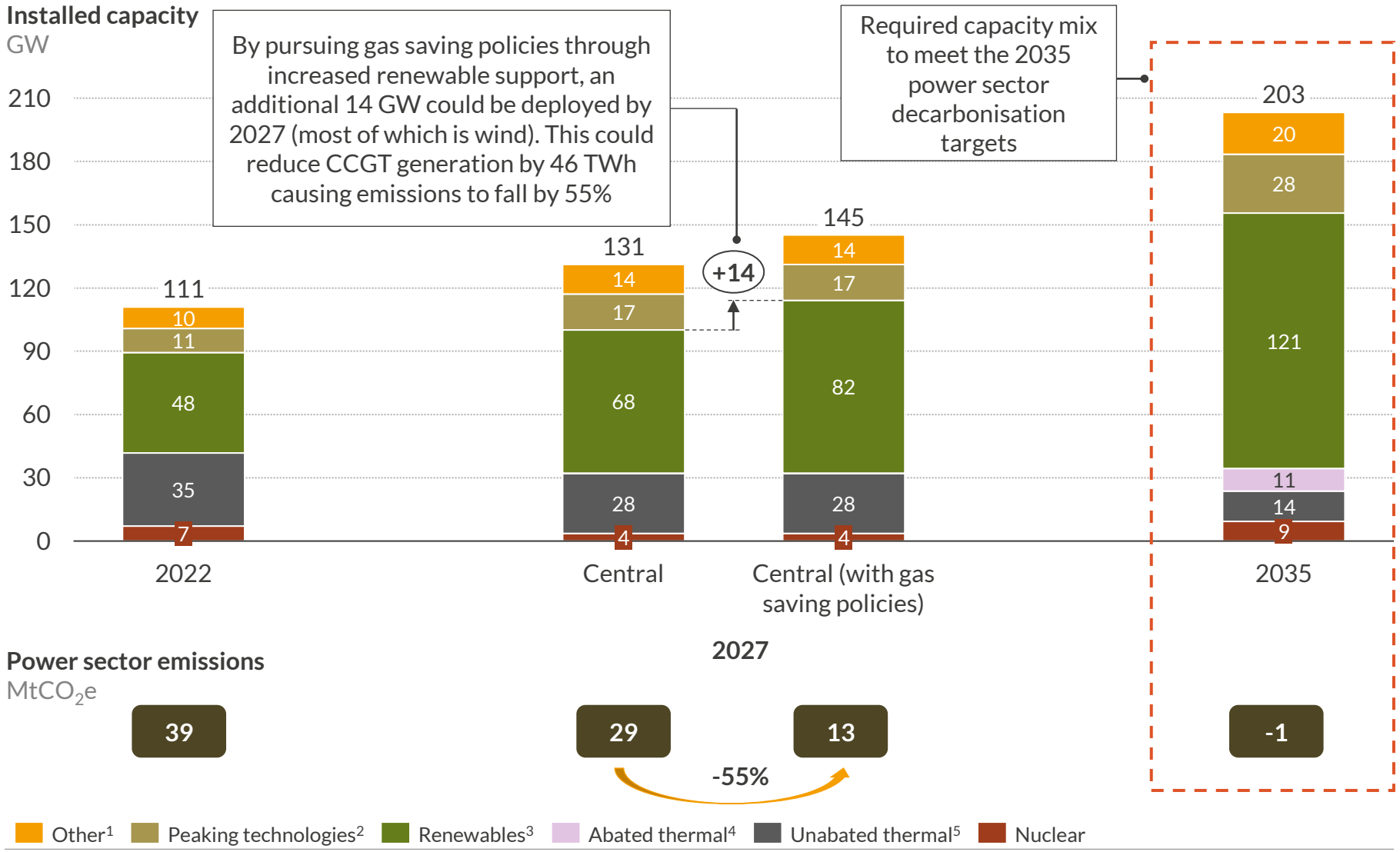


1) Cumulative savings shown to reflect benefit of continued investments.

Sources: Aurora Energy Research, BEIS, National Grid

- UK could pursue a range of policy options to reduce gas demand with the savings expected to grow over time
- In the short-term, increasing the lifetime of coal plants towards their mandatory closure date in Oct 2024 could reduce yearly gas demand by 2.1 bcm in 2022 and 3.5 bcm in 2023
- In the medium–term, the lifetime of nuclear plants (Heysham 1 and Hartlepool) could be extended by 1-year, which could result in 1 bcm savings in 2024 and 2025, subject to safety.
- While, long-term renewable deployment could be accelerated by 14 GW by 2027 but also requires significant investment in grid integration
- Additionally, in the residential sector gas demand could be reduced by ~6 bcm by 2027 through behaviour changes and efficiency improvements

These gas saving policies help GB move closer to the power sector 2035 net zero emission targets with emissions 55% lower in 2027



1) Includes interconnectors and DSR. 2) Includes gas and H_2 recips/OCGTs and storage. 3) Includes, offshore and onshore wind, solar PV, biomass, hydro, EfW and BECCS. 4) Includes gas CCS and H_2 CCGTs. 5) Includes coal and CCGTs.

Source: Aurora Energy Research

- With low carbon generation only expected to account for 60% of total demand in 2022, power sector emissions are projected to amount to ~40 $MtCO_2e$
- Under Aurora Central assumptions power sector emissions are expected to fall to 29 $MtCO_2e$ by 2027 with still a long way to go to meet the 2035 power sector targets.
- However, through gas saving polices such as increased renewable support, an additional 14 GW could be deployed by 2027 which would lower emission to 13 MtCO2e and bring the system significantly closer to meeting its 2035 targets.
- However, questions remain if the grid will be able to expand fast enough to accommodate the rise in renewable capacity needed to meet these targets.

Conclusion

- Although both the EU and GB will face the same cost pressures, the physical gas position in GB is much more secure than in the EU
- GB has a diversity of North Sea and global supplies which can meet demand even in challenging circumstances, although – if EU storage stocks are high – interconnectors provide additional resilience against the most extreme shocks in GB
- GB has sufficient North Sea and LNG import capacity to meet domestic demand and export at full capacity to the EU throughout the summer months. However, there is 11bcm per year underutilised winter export capacity on GB/EU gas interconnectors
- GB would need to reduce domestic demand or increase supply in order to fully utilise this export capacity
- This winter, the most viable measures are household demand reduction and coal substituting for gas generation in the power sector
- Within five years, additional investment in renewables, insulation and heat pumps could reduce GB gas demand sufficiently to enable full export to the EU all year round. This acceleration of wind generation is likely to be needed in any case to meet the UK's 2035 target to reach net zero carbon emissions in the power sector

GB is more gas secure than the EU but policy action could increase exports to the EU whilst helping meet Net Zero targets.

Source: Aurora Energy Research

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Appendix

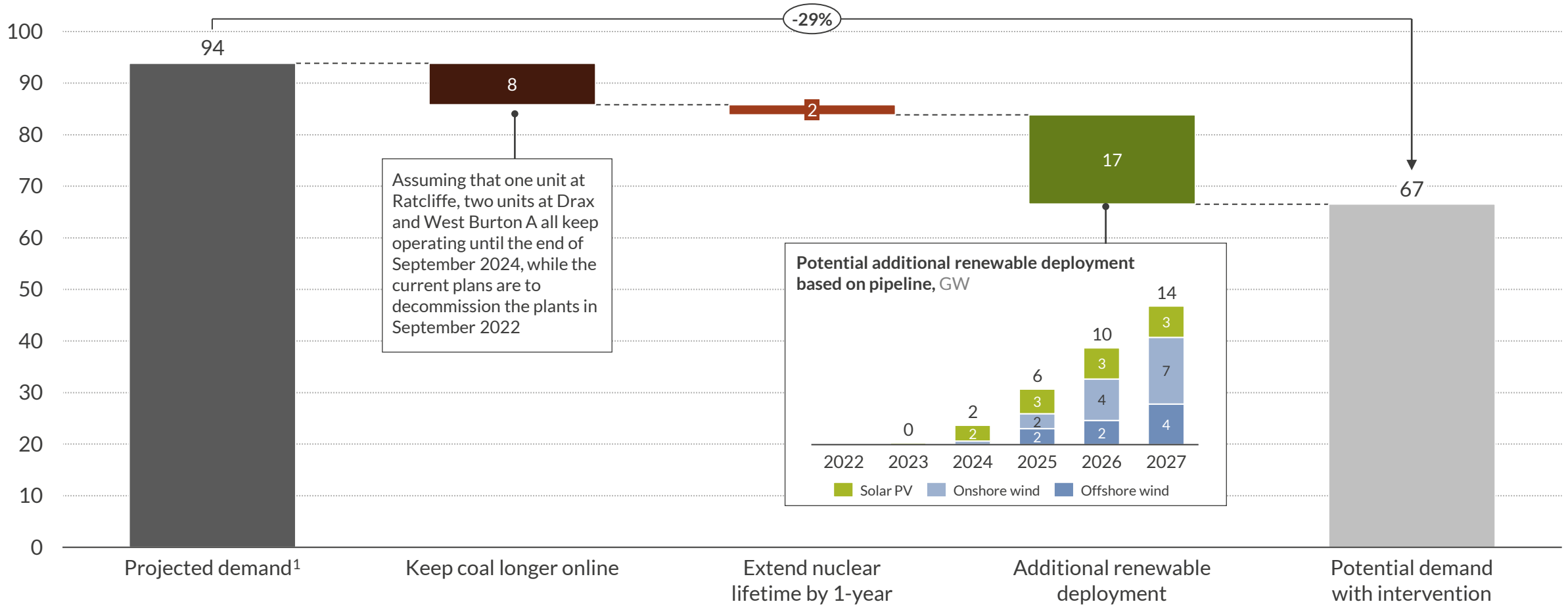
The UK could restore shelved or cancelled gas storage and LNG import terminal projects both in Great Britain and Ireland

	Name	Medium term by 2027 bcm/a Supply upside	Status
Storage	Gateway underground gas storage	**1.5bcm gas storage capacity 37.8mcm/d withdrawal**	Has planning permission to build in the east Irish Sea
UK LNG terminals	Port Meridian	**5 bcm**	Cancelled in June 2021
	Amlwch	**30 bcm**	Cancelled, no news since 2013
	Teesside	**6 bcm**	Decommissioned 2015
Ireland LNG	Shannon	**5 bcm**	Planning approval expired in 2018
	Inisfree	**4 bcm**	Memorandum of Understanding expired Dec 2020
	Predator	**2 bcm**	Could commission 2024

Sources: Aurora Energy Research, Stag Energy

Cumulative over the next 5-years, GB could cut power sector gas consumption by almost 30% due to higher coal and renewables generation

Projected power sector gas consumption and potential savings between 2022 – 2027
bcm (cumulative)

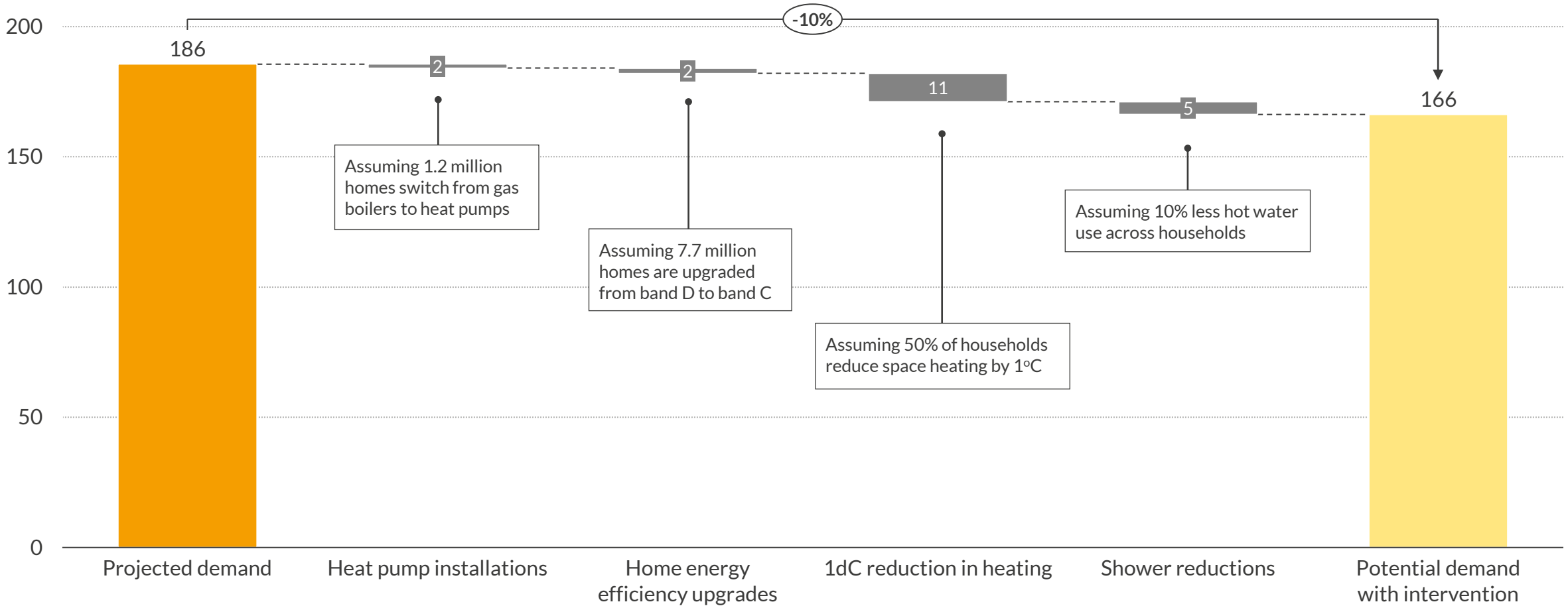


1) Based on power sector gas generation from Aurora January 2022 Central Scenario.

Sources: Aurora Energy Research , BEIS, EDF.

Cumulative over the next 5-years, residential gas consumption could fall by 10% through a combination of behaviour changes and home upgrades

Projected residential sector gas consumption and potential savings between 2022 – 2027
bcm (cumulative)



Sources: Aurora Energy Research, BEIS, National Grid

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