Annex: Analysis methodology and assumptions

This annex provides additional detail on the analysis included in Chapter 2: Priorities for gas security of supply, including the scope, methodology and assumptions behind the modelling.

Overall modelling approach

DESNZ has undertaken analysis to better understand future gas security in GB. The analysis shown in Chapter 2 compares 1-in-20 peak day gas demand[1], as extracted from NESO Future Energy Scenarios (FES), against the expected available gas supply, modelling using internal DESNZ analysis. This is modelled over a seven-day period to reflect a high gas demand week in a given year, with these snapshots taken in five-year intervals, ranging from 2025 to 2050. The decision to model the analysis over a weeklong demand period, as opposed to a shorter timeframe helps draw out any nuances that may arise from each supply operating at near peak levels for multiple days. The visuals and charts shown reflect day four of that peak demand week, which is the highest demand day of that period.

Demand

Gas demand forecasts are created principally using NESO's FES 2025 data[2]. These NESO FES pathways (further defined below) do not necessarily represent the government's views or policies. We use 1-in-20 demand to reflect the standards that the Government and the Gas System Operator need to plan for. This 1-in-20 demand is the maximum demand that we expect to see once every twenty years, based upon weather events. We have created a peak seven-day demand profile for each year which builds upon the FES 1-in-20 peak day demand data. This seven-day period considers previous peak demand events and the changing profile of peak gas demand for electricity generation.

Supply

To estimate peak day supply, we used a "de-rated" approach for each major UK gas supply source. De-rating processes are used to reduce the nominal capacity of infrastructure to reflect an expected and reliable output under real-world conditions. As mentioned above, as this analysis reflects day four of a seven-day peak period, it should better account for possible reduced supply from some sources. This is especially prevalent for medium-range gas storage, where withdrawal may be at lower rates due to some depletion over the previous few days. The model also considers the 'South-East constraint', a bottleneck in the National Transmission System which limits the simultaneous maximum flow of both Liquified Natural Gas (LNG) and interconnector supply during periods of very high demand.

Key assumptions

Demand

We have selected four pathways from the NESO FES 25 analysis to reflect different perspectives around possible future gas demand. More detail on each of these scenarios

[1] 1-in-20 equates to levels of gas demand that we might expect to see once every 20 years. This is also the industry standard to assess risk to the gas system.
[2]Future Energy Scenarios 2025 Data Workbook V003, sheet DB.ED3, available via: https://www.neso.energy/document/364551/download

and the underlying assumptions can be found in the FES 2025 publication[3]. These assumptions do not necessarily represent government views or policies.

Electric engagement: This is NESO's lowest gas demand pathway and reflects a scenario where we are on track to meet government net zero goals by 2050. Power demand is met primarily through renewable and nuclear sources, with consumers being highly engaged in the transition using smart technologies, heat pumps and electric vehicles.

Hydrogen evolution: This NESO scenario reflects a gas demand pathway that is net zero 2050 compliant, involving greater use of hydrogen in the energy system compared to the electric engagement scenario. The level of gas demand is higher than the electric engagement pathway, as more gas is needed to produce blue hydrogen.

10-year forecast: This scenario represents NESO's view of the next ten years, taking into account where the gas system is at present, existing projects and policies, and planned actions.

Falling behind: This is the highest gas demand pathway modelled by NESO, which is not consistent with government net zero goals – although there is some decarbonisation compared to the present day. The pace is insufficient to meet net zero by 2050.

We have not used the Holistic Transition pathway given notable crossover with the electric engagement pathway regarding annual and peak gas demand estimates.

Supply

Supply from each source has been de-rated from its nominal capacity to reflect an expected and reliable output under real-world conditions.

Capacity assessments are based on current capacities. Several projects to expand capacities are in development but as they have not reached final investment decisions they have not been included. Similarly, only where asset-owners have made public announcements about the unviability of assets remaining open have these assessments been incorporated into our assumptions.

UK Continental Shelf (UKCS): Annual projections are taken from the North Sea Transition Authority (NSTA)[4] forecasts. To convert to daily supply projections, we have firstly used Energy Trends data[5] to calculate the historic summer / winter split of UKCS production over gas winter and gas summer months[6]. We then apply that winter weighting to the NSTA annual projections to get a winter UKCS forecast, before finally converting to a daily figure (assuming no variance in each winter day's production).

Norwegian Continental Shelf (NCS): The current peak daily supply from each Norway-UK pipeline is estimated via published daily flow data produced by the Norwegian Offshore Directorate[7] (NPD). In that report, we use long term NPD forecasts describing the future

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[3] Future Energy Scenarios 2025, available via: FES Documents | National Energy System Operator
[4] North Sea Transition Authority Production and Expenditure Projections, available via: Data and insights - Production and expenditure projections
[5] Table 4.2 of Energy Trends, available via: https://www.gov.uk/government/statistics/gas-section-4-energy-trends
[6] The gas winter runs from the start of Oct to the end of March. The gas summer covers the April to Sept period.
[7] Norwegian Offshore Directorate Resource Report 2024, available via: Three potential scenarios - The Norwegian Offshore Directorate

decline in Norway's production of fossil fuel products. This is then applied to current supply estimates to determine the potential decrease in gas delivery.

Biomethane: Departmental estimates for maximum future potential biomethane supply from a range of feedstocks. Annual estimates converted to peak daily supply under a flat profile which assumes no flexibility in daily supply.

Liquified Natural Gas (LNG): De-rated maximum send-out based on historic maximum[8] from each UK LNG terminal, with consideration of the South-East network constraint.

Gas Storage: De-rated maximum supply[9] from each storage site under typical end of winter stock level, using publicly available stock-deliverability curves to estimate maximum withdrawals. We do not expect the Rough storage site to be available in 2030 due to commercial decisions taken by Centrica.

Interconnection with Europe: Derated maximum supply from both European interconnectors being fully operational at current capacities with consideration of the South-East network constraint[10].

Uncertainty

Demand

To account for uncertainty over net zero trajectories and the pace of decarbonisation, we have taken four distinct gas demand pathways from NESO. These pathways all factor in differing views on key policies such as the speed of heat pump roll out, and the use of certain technologies, such as the amount of hydrogen used within the economy (these views do not necessarily reflect Government policy). These demand pathways create a 'fan' of uncertainty, to reflect a plausible range of where future peak day gas demand might be. This should allow government to assess future energy security under a range of different scenarios.

Supply

Our analysis on future peak day supply accounts for the maximum possible supply based on de-rated capacity. There are risks that either some of that supply does not materialise and/or some gas supply assets are unable to operate at their derated max. We've described below some factors that may impact future gas supply:

UKCS: NSTA produce a range of estimates reflecting uncertainty to the final delivered volume.

NCS: Like the NSTA, the Norwegian Offshore Directorate provide different scenarios as to how NCS production will change over time.

Gas Storage: Stock levels are linked to deliverability (ability to withdraw at maximum rates). Assuming higher or lower storage fullness (akin to the start/end of winter) will impact the available gas supply from storage. Our modelling assumes a cold spell nearer the end of

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[8] National Gas, Find Gas Transmission Data, Daily LNG landed at Dragon, South Hook and Isle of Grain, available via: Find gas data | National Gas Transmission Data Portal

[9] National Gas, Gas Ten Year Statement (GTYS), available at: Gas Ten Year Statement (GTYS) | National Gas

[10] National Gas, Find Gas Transmission Data and Gas Ten Year Statement (GTYS), available as above.

winter; more supply would likely be available if this peak period occurs earlier in the gas winter.

Resilience of supply: Government and the Gas System Operator are obliged to plan for a gas system that can meet both a future peak 1-in-20 gas demand event, as well as an N-1 event.[11] Chapter 2 references DESNZ analysis that models a sensitivity where we encounter both 1-in-20-day gas demand as well as an outage of our largest single piece of gas infrastructure – the Milford Haven pipeline. In that scenario, gas supply from both the South Hook and Dragon LNG terminals is reduced to zero.

NG's pre-emergency and stage 1 measures

Analysis in chapter 2 illustrates future gas margins in peak 1-in-20 demand conditions after accounting for the impact of pre-emergency and stage 1 measures.

The pre-emergency stage focusses on utilising commercial contracts made by the Gas System Operator. These are usually large customers, which can include gas fired power stations. This measure would help reduce gas demand if required.

The modelled stage 1 measures include partial utilisation of available reserve gas held in the national transmission system, known as the linepack. When required, further reductions in demand could be achieved via a public appeal for domestic households to voluntary reduce gas consumption.

[11] N-1 is a standard that helps ensure that even if the biggest piece of gas infrastructure has an outage, the system can still continue to operate.