



Department for
Energy Security
& Net Zero

Fossil Fuel Price Assumptions 2024

Final Report

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Overview

This publication presents the 2024 Fossil Fuel Price Assumptions (FFPA) produced by the Department for Energy Security and Net Zero. It outlines the methodology used and describes how the assumptions should be interpreted.

1.1 Introduction

Each year the Department for Energy Security and Net Zero, formerly the Department for Business, Energy and Industrial Strategy, updates its long-term price assumptions for oil, gas and coal. These are assumptions for the wholesale fossil fuel prices that are relevant for the UK economy and which are set in international markets. These assumptions are required for long-term economic appraisal and therefore reflect a range of potential long-term trends. They are not forecasts of future energy prices.

Making assumptions about future fossil fuel prices is extremely challenging – particularly after a period of market disruption and volatility – and uncertainty remains high. The process by which the Department generates its price assumptions focuses on estimates of market fundamentals and other available evidence to arrive at a range of future prices. These assumptions then feed into work across Government to appraise the economic impacts of policies.

The 2024 FFPA presents assumed annual average wholesale prices for gas, oil, and coal, from 2024 to 2050. This analysis is intended to support modelling of future policy decisions by providing a range of possible prices and the ability to stress-test policy options. It does not provide Government's view of future prices, either in the short or long-term.

Three assumptions for future prices have been produced for each fuel, based on different assumptions about future global markets. We encourage users to consider the full range of possible values when making an assessment based on these results, and not to take a single value as representative of what is most likely to occur.

A report by Rystad Energy accompanies this report, which details the assumptions and methodologies behind the fossil fuel supply curves that form part of this model.

The last full FFPA was published in 2023. Some underlying assumptions have been updated in this version to better reflect current market expectations.

1.2 FFPA Methodology Summary

This section provides a brief overview of how the assumptions are calculated. The Methodology section below contains a more in-depth explanation of the calculations and underlying methodological approach.

Methodology to Calculate Short-term Assumptions

Short-term prices from April 2024 to December 2026 are calculated from market forward prices. The forward prices provide a market clearing equilibrium price for the underlying commodity in a given future month, with a certain amount of volatility factored in, if you were to buy the commodity today. The monthly forwards are then aggregated to produce annual values, with outturn prices from January 2024 to March 2024 also taken into account for the first year.

A high and low assumption from this figure is calculated using the volatility assumed for that period, resulting in three different assumptions for each fossil fuel. There are some differences between the fossil fuels for how short-term prices are calculated, these are outlined further in the main Methodology section.

Methodology to Calculate Long-term Assumptions

For the long-term analysis, different assumptions about demand in 2040, the anchor year used in this analysis, have been intersected with cost of supply curves to estimate marginal break-even wholesale prices for each fossil fuel at each demand level. Prices have been linearly interpolated between the end of the short-term results and the anchor year. This means that the intra- and inter-year volatility is assumed to be smoothed out.

Due to the uncertainty in assuming prices so far out, prices are flatlined after 2040, meaning that prices are assumed to be unchanged from 2040 to 2050. The short-term and long-term models are connected to form one unbroken series from 2024 to 2050 and all prices are presented in real terms (2023 prices). The long-run assumptions are in most cases based on demand curves from the International Energy Agency's World Energy Outlook 2023 scenarios, but with some small fuel-specific adjustments (please see Section 3.2 for more detail).

The cost of supply curves were provided to The Department for Energy Security and Net Zero by Rystad Energy in 2023. The methodology used in construction of the cost of supply curves was developed through discussions and collaboration with industry specialists in what was at the time The Department for Business, Energy and Industrial Strategy, and with an external expert panel. The detailed supply curve methodology is published alongside this paper.

1.3 Quality Considerations

This model is based on existing data and assumptions and does not model potential future shocks to the global market. It provides a smoothed representation of assumptions of future prices, and as such it will not account for intra- and inter-year volatility or price cycles. Testing policy against all three assumptions offers the best approach to understanding how choices may fare in different market conditions, as between Assumption A and Assumption C is the likely bound of prices.

1.4 Users and Uses of FFPA

The Fossil Fuel Price Assumptions are used by publications across the Department for Energy Security and Net Zero, and HMG. The results are not used in isolation, but are used as inputs into further modelling by these teams. Notable publications that use these results are:

1. Energy Emissions and Projections
2. Dynamic Dispatch Model
3. Supplementary Guidance

Fossil Fuel Price Assumptions 2024

2.1 Gas Price Assumptions

Gas Results

The 2024 FFPA update offers three gas price assumptions out to 2050. A 2040 anchor is used and assumptions are flatlined from 2040 onwards as there is too much uncertainty after that point for a robust analysis.

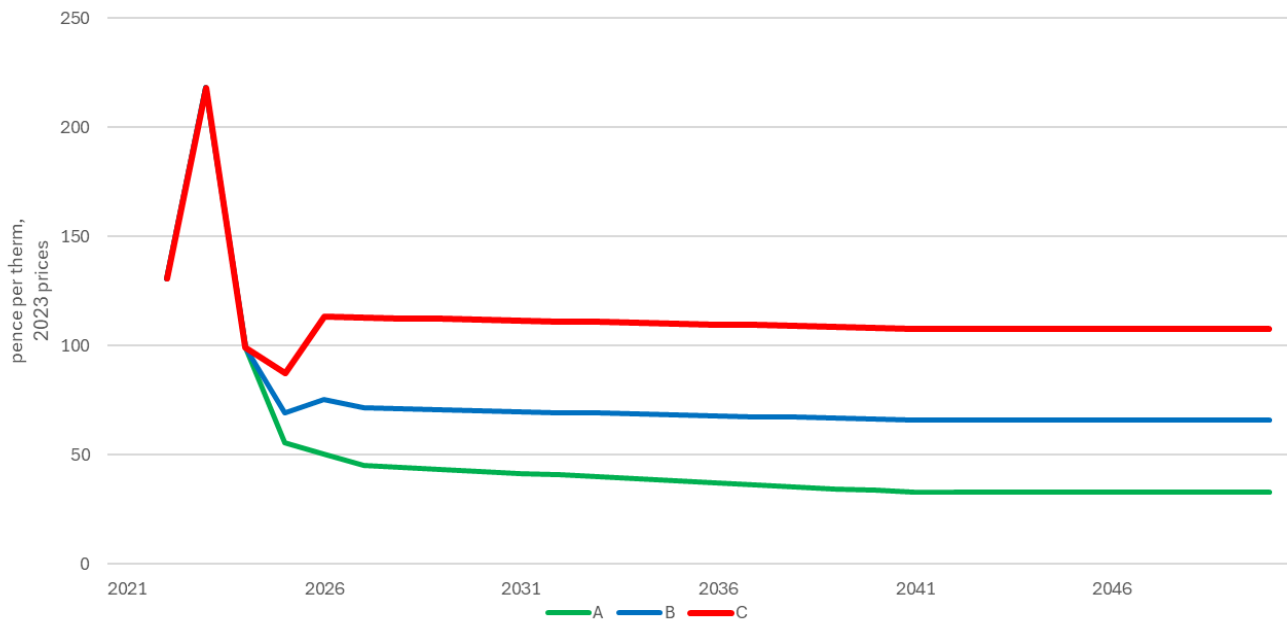
The figures shown in Table 1 are annualised average wholesale prices.

Table 1: Gas 2024 Assumptions: 2021 - 2050

2024 DESNZ Gas Fossil Fuel Price Assumptions: 2021 - 2050			
p/Therm	A	B	C
Real 2023 Prices			
2021	131	131	131
2022	218	218	218
2023	99	99	99
2024	56	69	87
2025	50	75	113
2026	45	71	113
2027	44	71	112
2028	43	70	112
2029	42	70	112
2030	41	70	111
2031	41	69	111
2032	40	69	111
2033	39	69	110

2034	38	68	110
2035	37	68	110
2036	36	67	109
2037	35	67	109
2038	34	67	108
2039	33	66	108
2040	33	66	108
2041	33	66	108
2042	33	66	108
2043	33	66	108
2044	33	66	108
2045	33	66	108
2046	33	66	108
2047	33	66	108
2048	33	66	108
2049	33	66	108
2050	33	66	108

Chart 1: Gas 2024 Assumptions: 2021 – 2050



Gas Narrative

Following the retreat from record high European gas prices seen in 2022, the short-term trend shows a sharp dip towards 56-87 p/th in 2024 across the assumptions. Prices experience a small uptick in 2025 before a large wave of new LNG liquefaction increases gas supply and puts downward pressure on prices.

We see a slight downtrend towards 70 p/th for Assumption B in 2030, 41 p/th for Assumption A and 111 p/th for Assumption C. Prices remain relatively flat from 2030 onwards – apart from Assumption A which continues to fall towards 33 p/th in 2040.

Considering further the short-term wholesale price assumptions, wholesale prices are expected to remain high over 2024 and 2025, as global gas supply remains tight. This is due to restricted Russian pipeline supply, which could fall further, and limited new LNG supply coming online until 2025-2026.

The key variables that will affect short-term prices will include:

1. The type of winter experienced – and whether this continues in line with the mild winters experienced over 2022/23 and 2023/24, or whether temperatures drop below historic averages and raise heating demand.
2. How European storage fares, with current expectation that Europe is likely to fill storage to capacity ahead of Winter 2024/25, which offers mitigation against either a shock to demand (e.g. a Cold Winter) or supply (e.g. remaining Russian supply is curtailed).

- The extent of Asian demand rebound. Gas and LNG demand in Asia has risen strongly in the first half of 2024. This has enabled LNG cargoes to divert from Europe, where demand has been weak. Should European demand recover we could see more competition with Asian buyers for cargoes, tightening the market and putting upward pressure on prices.

2.2 Oil Price Assumptions

Oil Results

The 2024 FFPA update offers three oil price assumptions out to 2050. A long-term anchor was used for 2040 and all assumptions are flatlined from 2040 onwards as there is too much uncertainty after that point for robust analysis.

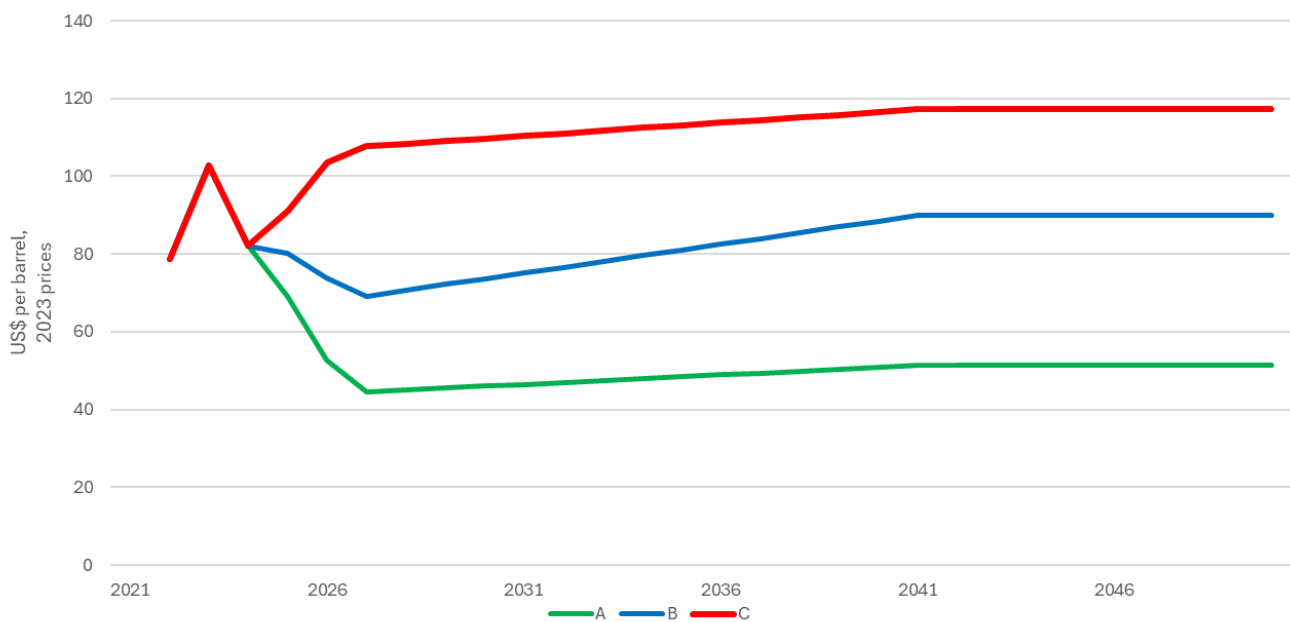
The figures shown in Table 2 are annualised average wholesale prices.

Table 2: Oil 2024 Assumptions: 2021 - 2050

2024 DESNZ Oil Fossil Fuel Price Assumptions: 2021 - 2050			
\$/bbl	A	B	C
Real 2023 Prices			
2021	79	79	79
2022	103	103	103
2023	82	82	82
2024	69	80	91
2025	53	74	104
2026	45	69	108
2027	45	71	108
2028	45	72	109
2029	46	74	110
2030	46	75	110
2031	47	77	111
2032	47	78	112

2033	48	80	112
2034	48	81	113
2035	49	83	114
2036	49	84	114
2037	50	85	115
2038	50	87	116
2039	51	88	117
2040	51	90	117
2041	51	90	117
2042	51	90	117
2043	51	90	117
2044	51	90	117
2045	51	90	117
2046	51	90	117
2047	51	90	117
2048	51	90	117
2049	51	90	117
2050	51	90	117

Chart 2: Oil 2024 Assumptions: 2021 – 2050



Oil Narrative

The oil market is currently well supplied, keeping prices well below recent 2022 highs, despite geopolitical instability. In the short-term, prices in Assumption B trend slightly below current levels to \$69/bbl in 2026.

But oil prices are nonetheless very sensitive to market imbalances and speculation, and there remain very significant risks linked to geopolitical risk in the Middle East and Russia. Assumption C reaches \$108/bbl on average in 2026 – higher than the 2022 average – while at the other end of the range the average annual price in Assumption A falls to \$45/bbl by 2026. Lower prices could materialise in the case of an unexpected slowdown in the global economy or oil demand, or if OPEC+ production agreements were to unravel.

Longer term, average prices increase to around \$90/bbl in 2040 in Assumption B, while Assumption A trends to \$51/bbl and Assumption C reaches \$117/bbl. These differences are mainly driven by different levels of success in the global adoption of demand-side climate policies, which alters the long-term trajectory of global demand.

2.3 Coal Price Assumptions

Coal Results

The 2024 FFPA update offers three coal price assumptions out to 2050. A long-term anchor was used for 2040 and all assumptions are flatlined from 2040 onwards, as there is too much uncertainty after that point for a robust analysis.

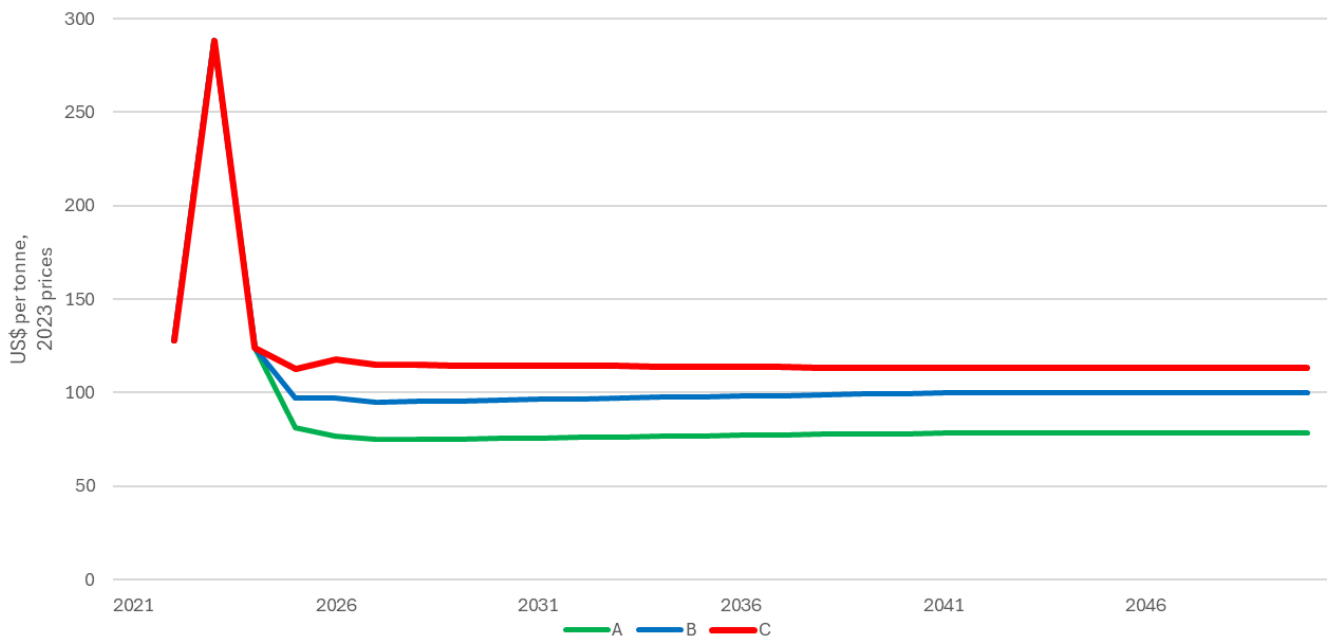
The figures shown in Table 3 are annualised average wholesale prices.

Table 3: Coal 2024 Assumptions: 2021 - 2050

2024 DESNZ Coal Fossil Fuel Price Assumptions: 2021 - 2050			
USD/Tonne	A	B	C
Real 2023 Prices			
2021	128	128	128
2022	288	288	288
2023	124	124	124
2024	81	97	113
2025	77	97	118
2026	75	95	115
2027	75	95	115
2028	75	96	115
2029	76	96	114
2030	76	96	114
2031	76	97	114
2032	76	97	114
2033	77	97	114
2034	77	98	114
2035	77	98	114
2036	77	98	114
2037	78	99	113
2038	78	99	113
2039	78	100	113
2040	78	100	113

2041	78	100	113
2042	78	100	113
2043	78	100	113
2044	78	100	113
2045	78	100	113
2046	78	100	113
2047	78	100	113
2048	78	100	113
2049	78	100	113
2050	78	100	113

Chart 3: Coal 2024 Assumptions: 2021 - 2050



Coal Narrative

Following the retreat from record high coal prices seen in 2022, the short-term trend shows prices ranging between \$81-113/mt in 2024. All three assumptions show prices continuing to fall from the recent highs we have seen, settling at between \$78/mt and \$113/mt in 2040.

Despite the recent volatility we have seen in the European coal markets, we are more certain about the future of European coal demand due to recent phasing-out agreements, creating a more stable planning environment and a tighter price range between assumptions. Generally, a return to pre-Invasion and Covid prices are seen by 2025, which then remain relatively steady.

Methodology

3.1 Short Run Methodology

For the short run update, the 2024 FFPA uses forward curve prices for the next three years (2024, 2025 and 2026) as well as the Black-Scholes volatility formulae (as per previous FFPA iterations) to give a 75% confidence interval for the high and low scenarios.

Short-term Model Calculations (Gas and Oil)

Forward prices for each month from April 2024 to December 2026 were collected throughout the four-week period in March 2024.

For the collection period, each price had a corresponding volatility value, expressed as a percentage. The higher the percentage, the more assumed volatility for that month's price.

Using the following formula, the price and the volatility for each month was used to construct a high and low price for that month, assuming a 75 percent confidence interval for the calculation.

$$E(f_{t,k}) > f_{t,k} * \exp(-z_{\alpha/2} * \sigma_k \sqrt{t}) \text{ for the lower limit}$$

$$E(f_{t,k}) > f_{t,k} * \exp(z_{\alpha/2} * \sigma_k \sqrt{t}) \text{ for the upper limit}$$

where

$E(f_{t,k})$ = Expected month k price at expiration date t

$f_{t,k}$ = Month k futures price at day t

σ_k = implied volatility for option on month k futures contract

t_k = Time to expiration for month k futures contract (in years)

$z_{\alpha/2}$ = Standardized normal distribution value for (1 - α) confidence level

For each month from April 24 to December 26, there is now a base price, an upper limit, and a lower limit. These are aggregated with the outturn data between January 2024 and March 2024 to get the average for each year. These are then adjusted using the GDP deflator to 2023 prices and used as the short-term assumptions in the model.

For oil, forward data was taken from Bloomberg and gas forward data was taken from ICIS, as with previous iterations of FFPA.

Short-term Model Calculation (Coal)

The central short-term coal price assumption is derived from an average of the January 2024 to March 2024 outturn prices and the monthly forward contract for April 2024 to December 2026, aggregated to get the average for each year.¹

Since data availability and market depth is far more limited for coal than in oil and gas markets, it would not be reasonable to use the implied volatility approach that is applied to oil and gas. Therefore, high and low scenarios for coal prices are derived from historic deviations of outturn coal prices for a 10-year period between 2011 and 2020. The high scenario is derived by adding one standard deviation to the central scenario whereas the low scenario subtracts one standard deviation.

3.2 Long Run Methodology

For the medium and long-run values, Rystad supply curves were intersected with demand curves based on the International Energy Agency's World Energy Outlook (WEO) 2023 scenarios for 2040.

For all assumptions across all fuels, demand curves have been intersected with Rystad's base cost of supply curves in 2040 to derive the breakeven cost of the marginal production asset in that year.

The IEA scenarios are set out in the WEO as follows:

- Stated Policies Scenario (STEPS) - provides an outlook based on the latest policy settings, including energy, climate and related industrial policies. Its projections give a sense of the current direction of travel for the energy economy, based on the actual state of play in different sectors, countries and regions.
- Announced Pledges Scenario (APS) - assumes all national energy and climate targets made by governments are met in full and on time. It shows how the future would be different if all countries were to hit their aspirational targets.
- Net Zero Emissions by 2050 Scenario (NZE) - maps out a way to achieve a 1.5°C stabilisation in the rise in global average temperatures.

The underlying IEA WEO demand scenarios used to create each long-term assumption (A, B, C) for each fuel are set out in the table below.

¹ This methodology differs slightly to the 2023 analysis (which interpolated from outturn data to the 2040 anchor year), but is now consistent with the approach taken to the 2019 coal price assumptions.

Table 4: Underlying IEA WEO Demand Scenarios by Assumption and Fuel Type

Assumption	Gas	Oil	Coal
A	APS	APS	NZE
B	STEPS	STEPS	APS
C	STEPS+	STEPS+	STEPS

As set out in the table above, in the 2024 analysis a higher demand scenario than STEPS has been created to provide a further policy stress test for gas and oil ('STEPS+')². The assumptions in the STEPS scenario, used in Assumption B for gas and oil in the 2024 analysis, align well with the underlying assumptions in wider baseline government analysis which in many cases use a "current policies" approach. A lower demand world characterised by all national energy and climate targets being met on time, provides the 2024 Assumption A for gas and oil. The IEA WEO scenarios have been applied differently to coal in this analysis where there is less need to stress test a higher demand scenario than STEPS given recent phasing-out agreements.

2040 has been used as the model's anchor point. For the years between the end of the short-term model in 2026 and the 2040 anchor year, linear interpolation was used to estimate the values. It was felt that there was too much uncertainty in analysing prices beyond 2040, so all three series have been flatlined after that point. The model does not therefore account for any changes to prices that might occur from Net Zero or other policies post 2040.

Rystad has provided a methodology document that explains the assumptions underlying the cost of supply curves in detail; this will be published alongside the results. The supply curves were developed and presented in a way so as to be compatible with the analysis undertaken and represent the cost of supply for delivery to Europe.

All costs and prices have been adjusted where needed to represent real 2023 prices throughout the price series.

² Gas STEPS+ increases demand by 50% in the 2040 anchor year. Oil STEPS+ increases demand by 4 million barrels per day in the 2040 anchor year.

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