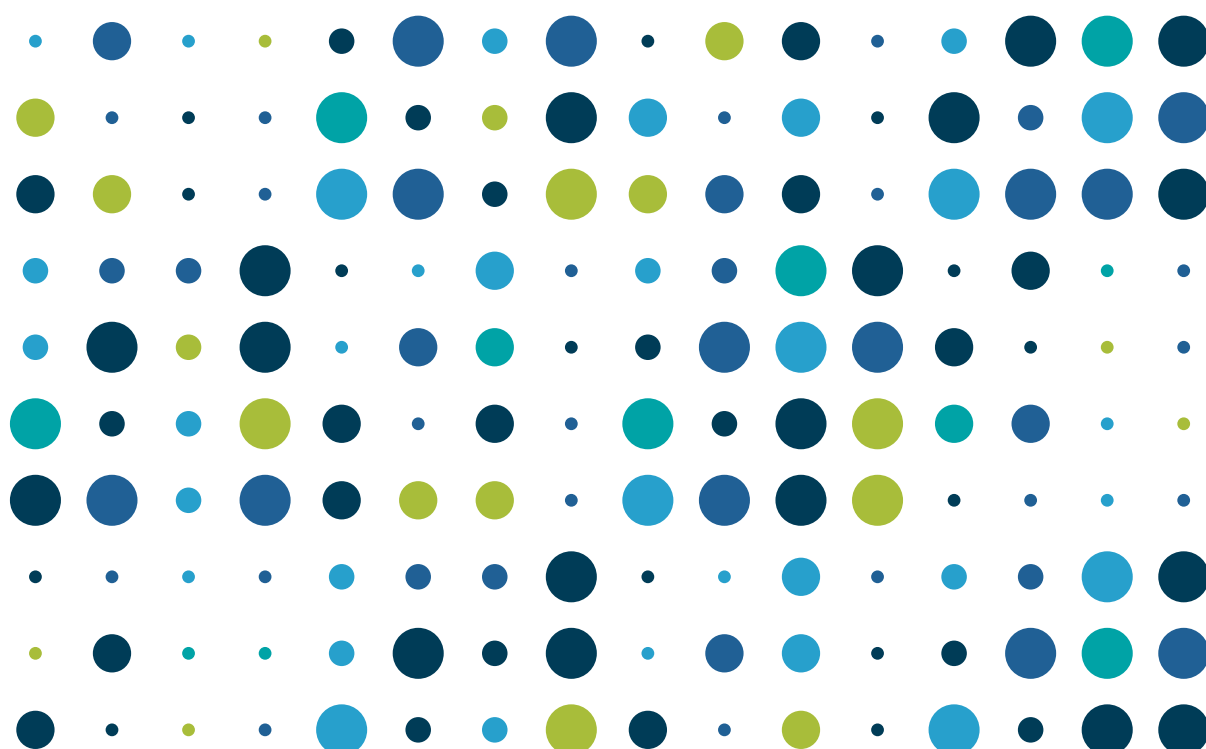


Fossil Fuel Depletion in the UK National Accounts

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Disclaimer – Experimental Estimates

The following are early estimates to illustrate the practical issues in measuring the depletion of natural resources and gather feedback.

The analysis and data presented here are subject to change before any official publication

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1 - Context: SNA25 and Depletion

The United Nations System of National Accounts (hereafter ‘SNA’) sets out guidance for the construction of national economic accounts by national statistical institutions (hereafter ‘NSIs’). In 2025, the latest revision was published (hereafter ‘SNA25’), which significantly changed its guidance on how natural resources should be recorded in national economic accounts¹. The list of specified natural resources is more extensive in the SNA25², and the classification of natural resources as assets has been refined.

Moreover, the SNA25 gives greater prominence to net measures of economic productivity and income, which enable a better understanding of the sustainability of economic activity. The SNA25 now includes the depletion of natural resources as a component of these net flows, along with the consumption of fixed capital (now called depreciation). At the headline level, SNA25 recommends Net Domestic Product³ as the “the conceptually preferred measure of economic growth, not replacing but to be used alongside the volume change of gross domestic product (GDP)”⁴

The depletion of natural resources (hereafter simply ‘depletion’) has both a physical and monetary lens. Physically, it is the extraction of a natural resource for economic purposes, in excess of the capacity of the resource to regenerate. For non-renewable resources such as fossil fuels, all economic extraction is depletion. The monetary aspect of depletion evaluates the effect of physical depletion on the asset value of the natural resource in question. The asset value today reflects the potential earnings in the future, and so the monetary value of depletion indicates the cost of extracting a resource today, rather than in the future. For renewable resources, if regeneration or restocking exceeds extraction, then in the procedure of the SNA25

¹ Note that the current publication of the SNA25 does not bear printed page numbers. Page references here will refer to the PDF document pages based on the file accessed from the official website as of 28/07/2026: (System of National Accounts 2025, 2025)

² (System of National Accounts 2025, 2025, p. 1104), included within the series of tables of non-financial asset codes beneath §A2.38. A more concise and informative list is presented in (OECD, 2025, p. 32)

³ Net Domestic Product = Gross Domestic Product – Depletion – Depreciation

⁴ (System of National Accounts 2025, 2025, p. 8), Preface, Section B, subsection “Wellbeing and sustainability”

negative monetary depletion is recorded, even though extraction has still occurred. The capacity of future generations has not, per se, been reduced by extraction today and therefore the economic returns from that resource are sustainable. Again, all extraction of non-renewable resources is depletion as they cannot regenerate meaningfully, and therefore all extraction of such resources will reduce their value as assets, all else being equal.

Depletion, in this context, considers only the use of a resource that is, or could be, finite, and does not consider wider environmental impacts of extraction or use. It concerns the physical stock of a natural resource and how its extraction relates to its regeneration. Depletion in this context makes no reference to or consideration of any externalities attached to natural resource extraction or use. For example, it does not consider the impact of burning fossil fuels on green-house gas emissions and climate change, nor does it account for the impact on soil quality or habitat condition from intensively managing a timber forest (regardless of whether or not harvesting exceeds replanting). Any reference to sustainability, in this context, relates quite literally to whether or not the extraction of a resource can be sustained over time.

For measures of depletion to be effective indicators of sustainability, they must be based on valuations that reflect the scarcity and exchange value of the resource. The SNA25 refers to the Central Framework of the UN System of Environmental Economic Accounting (hereafter 'SEEA-CF') and the recent OECD compilation guide for natural resources in the national accounts (hereafter 'the OECD compilation guide') for detailed methodologies of how to do this valuation. Indeed, issues relating to defining and measuring depletion of natural resources now form one of the issues being discussed in the review of the SEEA-CF. At the 31st Meeting of the London Group in 2025, debate begun around the challenges faced estimating depletion and the valuation of subsoil energy resources under the SNA25, with examples presented from Norway⁵ and the United States⁶. For many resources, in many jurisdictions, valuations can be achieved by analysing the price of royalty fees, extraction licenses and permits on the premise that they reflect a market equilibrium between owners and potential operators⁷. To be most effective there needs to be competitive markets in place for these so-called "access prices", such as through the market for fishing

⁵ (Liu, 2025)

⁶ (Chambers, et al., 2025)

⁷ (OECD, 2025, pp. 44-45; §117-118) and (System of Environmental-Economic Accounting 2012 - Central Framework, 2015, pp. 154; §5.128-5.130)

rights in Australia⁸. However, it is often the case that resources are owned by the state, who do not supply access rights through simple price-competitive exchange, and may set the cost of such rights low, or consider other factors, for political or strategic reasons.

In the case of the UK, many resources are, by law or by location, in the ownership of the state. For fossil fuels, licenses in recent years have been granted based on holistic consideration of applications by prospective operators that considers more than simple price bidding⁹. Access prices are, therefore, not traditionally marketed, readily accessible, or easily capable of supporting a regular time series. In this case, use of the residual value resource rent approach is usually the next recommended for valuing natural resources in the context of national economic accounts¹⁰. This approach assumes that the supernormal profit of extractive industries can be attributed to the resource rent earned by the extractor that could have been charged by the owner. This approach, however, requires supernormal profits to be present, and, as we will discuss here, the UK coal industry presents difficulties for this approach to valuation also.

The UK Office for National Statistics (hereafter 'ONS') has committed to a target of 2030 to implement SNA25 developments into its programme of national economic accounts¹¹. Towards this, it has built a team to improve estimates of natural resources as assets, and work towards robust estimates of depletion. Early progress has revealed characteristics of the UK's extractive industries that do not fit neatly into the scenarios described by the current guidance, and in this paper we demonstrate these problems to seek advice and stimulate debate on and development of such guidance.

⁸ Known as the Individual Transferrable Quota system (Australia Fisheries Management Authority, 2025).

⁹ See (North Sea Transition Authority, n.d.) for oil and gas licensing, and (HM Government, 2023) for coal.

¹⁰ (System of National Accounts 2025, 2025), §4A.30-4A.33 and (OECD, 2025, pp. 44; §112-113)

¹¹ (The plan for ONS economic statistics, 2025)

2 - ONS Methodology

2.1 Monetary Valuation – ONS Approach to Residual Value

The ONS previously published experimental work estimating the depletion of multiple non-renewable natural resources in 2024¹². These results were based primarily on the data already collected for the ONS' Natural Capital Accounts¹³, which treats fossil fuels as abiotic ecosystem provisioning services and values them using the residual value approach. In that publication monetary depletion estimates were only feasible for oil and natural gas, with coal being prevented by a persistently negative annual value. Negative values are arithmetically possible in the residual value resource rent approach, but when they are applied to depletion, the result implies that the economy is made more sustainable by the depletion of the resource in question. Whilst this may seem conceptually plausible in a broader welfare analysis that considers externalities, in the very specific scope of the National Accounts, social bads are not accounted for and thus the negative depletion of non-renewable resources does not reflect traditional economic logic. In the residual value approach, negative resource rents are usually produced due to the profits of the extractive industry themselves being negative (the industry makes an operating loss) or positive but less than the opportunity cost of the fixed capital invested in the industry. The guidance in the OECD compilation guide and the SEEA-CF is to set resource rent, in these situations, to zero.

Since the ONS' 2024 publication, we have extended the time series using instruments and data in several archival sources of which we were previously unaware, allowing a more comprehensive assessment of the depletion of fossil fuels in the UK. In the case of coal, this has allowed us to compare the resource rent earned by the industry under the nationalised monopoly of the National Coal Board, and the more recent privatised period, which has seen significant decline in output. For oil and gas, this extension has allowed us to evaluate depletion during the

¹² (Developing estimates of depletion for the UK natural capital accounts: 2024, 2024)

¹³ (UK natural capital accounts: 2025, 2025)

sector's peak in the 1980s, by indexing components of the residual value equation to comparable variables in older editions of the UK National Accounts¹⁴.

For this paper, we have largely followed the guidance set out by the OECD compilation guide for estimating the value and depletion of mineral energy resources (the category within which fossil fuels fall). This guidance was published after the ONS' last publication on depletion, and therefore the approach here differs slightly. The conceptual core of the approach remains consistent with the 2024 publication, however. The procedure employed here is as follows:

Step 1: Estimate a time series of resource rent using the residual value method

Residual value is given by the following equation:

$$(1) \quad RV_t = GOS_t + Tax_t - Sub_t - Depr_t - Ret_t$$

Whereby:

- RV_t is the residual value resource rent earned in year t
- GOS_t is the Gross Operating Surplus, in year t , of the relevant extractive industry.
- Tax_t is the total of taxes on production bore by the relevant extractive industry in year t
- Sub_t is the total of subsidies on production received by the relevant extractive industry in year t
- $Depr_t$ is the depreciation of fixed capital estimated in the relevant extractive industry in year t
- Ret_t is the return to produced capital assets in year t , which can be seen as the opportunity cost of capital investment in the relevant extractive industry. In the UK it is calculated as the following:

$$(2) \quad Ret_t = NCS_{t-1} * \gamma_t$$

¹⁴ Archives of UK National Accounts publications back to 1941 are hosed by the Economic Statistics Centre of Excellence:

<https://www.escoe.ac.uk/research/historical-data/national-accounts-2/>

Whereby:

- NCS_{t-1} is the net capital stock held by the extractive industry at the end of year $t - 1$
- γ_t is the benchmark rate of return used to estimate how much capital investment could have earned elsewhere in the economy.

For the calculation of the return to produced assets, the relevant net capital stock estimate is multiplied by the yield on 10-year UK government bonds (often referred to as 10-year 'gilts'). This is the default approach used in the UK Natural Capital Accounts and is chosen as a conservative and low-risk rate of return with which the opportunity cost of invested capital can be estimated¹⁵.

Step 2: Project resource rent into the future using reasonable assumptions

For both industries, we have assumed a rolling 3-year average of resource rent to be projected continuously into the future. This simple approach is driven by uncertainty around the future of the coal industry, which suggests we should avoid tying future projections too closely to past resource rents. The same averaging approach is applied to oil and gas for parity of approach¹⁶.

Step 3: Estimate the asset value of the resources by calculating the net present value of future resource rent.

The asset life of coal, oil and gas is assumed to be 25 years. This is the default asset life assumed for non-renewable resources in the UK Natural Capital Accounts and is assumed here for simplicity and ease of

¹⁵ Recent quotes of 10-year gilt rates can be accessed via the Bank of England database (Bank of England Database, n.d.), with historic data available from one of its research datasets (Research Datasets).

¹⁶ The North Sea Transition Authority publish projections for future oil and gas extraction, which can be used to construct more dynamic resource rent projections. This is done to calculate the asset value of the oil and gas provisioning ecosystem service in the UK's Natural Capital Accounts, but not in this paper. The interested reader can find those projections here: <https://www.nstauthority.co.uk/data-and-insights/insights-and-analysis/production-and-expenditure-projections/>

comparison¹⁷. Future resource rent is brought into present value using the standard UK social discount rate, set by His Majesty's Treasury¹⁸ (the UK's finance ministry).

Step 4: Calculate the price-in-situ by dividing the asset value by the estimated volume of accessible and proven reserves in situ.

The SNA25 specifies that compilers only consider what the SEEA Central Framework refers to as “class A: commercially recoverable resources”¹⁹, which in turn is based on the UN Framework Classification of Resources (hereafter ‘UNFC’)²⁰. This classification aligns with the typical definition of “reserves” as distinct from “resources”, the latter referring to estimated volume of a material in the earth and the former referring to a subset that are commercially recoverable. Modern reporting of reserve estimates in the UK align relatively well with the UNFC, and so this is how the boundary of reserves is set in this paper. Past estimates of reserves often predate this framework, and the basis on which they have been selected is elaborated on in the relevant sections below.

Step 5: Multiply the price-in-situ by extraction volumes to construct a time series of monetary depletion estimates.

All time series are brought into 2024 prices using the UK GDP deflator²¹. This approach was chosen for simplicity of comparison, but industry-specific deflators and chained-volume measures are also being considered for future work.

Although the procedure outlined above is the same for both coal and oil and gas, the data sources (other than those explicitly referenced above) vary between

¹⁷ This approach could be improved by a combination of future extraction projections and subtracting them from reserve estimates to estimate an asset life. This is an approach we are exploring for the future of this work in the UK national economic accounts.

¹⁸ (HM Treasury, 2026)

¹⁹ (System of National Accounts 2025, 2025, p. 382) §11.186

²⁰ (United Nations Framework Classification for Resources, Update 2019, 2020)

²¹ (HM Treasury, 2025) and references therein.

resource due to availability, and are described in sections 2.2 Coal and 2.3 Oil and Gas²².

2.2 Coal

For the modern period of 1998-2023, the components of the residual value method for coal resource rent come from the UK national accounts following the UK's standard industry classification (SIC²³) for coal²⁴. Gross operating surplus, taxes and subsidies are derived from Supply and Use Tables²⁵, whilst the consumption of fixed capital and net capital stock are taken from internal disaggregation of their own eponymous accounts²⁶. For the period of 1960-1976 analogues for the national accounts components of the residual value equation are taken from the financial accounts of the National Coal Board which were published in the Digest of UK Energy Statistics²⁷. The National Coal Board (hereafter 'NCB') was a nationalised, state-owned monopoly over the coal industry in the UK from 1947 until, effectively, 1994²⁸. The UK Supply and Use Tables prior to the 1990s were not published

²² Note that the methodology employed here is similar to, but not the same as, that employed for the coal, oil and gas provisioning services in the ONS' Natural Capital Accounts. Furthermore, the approach employed here is fundamentally different to the approach used to value natural resource assets currently in the UK national balance sheet, which currently follows the 2008 revision of the SNA.

²³ (UK SIC 2007, 2022)

²⁴ B05: Mining of Coal and Lignite

²⁵ (Input-output supply and use tables, 2025)

²⁶ (Gross and net capital stocks for total UK economy, by industry and asset, 2025) for publicly available data, although note this is more aggregated than the data used for calculations presented here.

²⁷ (Department of Trade and Industry, 1972) and (Department of Energy, 1978) cover the period comprehensively, but accounts are also published in the intervening years. Financial accounts for the NCB were found in their own organisation archives going further back in time, however key components of the residual value equation were otherwise missing for that period.

²⁸ The NCB was renamed to 'British Coal' in 1987, although the industry didn't begin to be privatised until 1994. For the sake of simplicity, the UK's nationalised industry is

annually, with relatively high levels of industry aggregation, meaning that the annual accounts of the NCB are a more frequent and detailed approximation when they are available.

Gross operating surplus, less subsidies and plus taxes, has been approximated using operating profit/loss figures in the financial records of the NCB itself along with estimates of depreciation. The net capital stock of the industry in this period has been constructed using data on the net asset balance of the NCB.

2.3 Oil and Gas

The North Sea Transition Authority (hereafter 'NSTA') is UK Government agency that oversees the oil and gas industry in the UK and manages licenses. It publishes long-running annual economic data about the industry²⁹, including revenues and operating expenses, which are used to calculate gross operating surplus. The NSTA also publish data on costs associated with decommissioning plants, which we smooth over time following recommendations made to us by the NSTA that oil and gas extractors plan ahead for decommissioning costs when embarking on new extractions.

Net capital stocks are only estimated on an annual basis for the oil and gas sector for recent years. Prior to 1995 net capital stock has been indexed to gross capital stock for the equivalent sector from archived UK Annual National Accounts³⁰. Depreciation (consumption of fixed capital) is also limited to 1995 for modern methods, and so historic figures are indexed against older methodologies present in the UK Annual National Accounts.

The NSTA also publish long time series of extraction volumes, along with annual reserve estimates, allowing for complete calculations of physical extraction and depletion. The NSTA report reserve estimates in segments divided by the

referred to here as the 'National Coal Board' or 'NCB' throughout the paper for the period 1947-1994.

²⁹ (Norht Sea Transition Authority, 2025), note this data is updated annually.

³⁰ UK National Accounts are archived as documents, which tend to only estimate the previous 10 years. Indexes for net capital stock and depreciation have therefore been pieced together with series of the most relevant publications to reach the required time series. They are available here: <https://www.escoe.ac.uk/research/historical-data/national-accounts-2/>

likelihood of commercial viability, following the Petroleum Resources Management System (hereafter 'PRMS') from the Society of Petroleum Engineers³¹. The PRMS combines two of the three dimensions used to classify resources in the UNFC system, but a bridging is possible³². By bridging these classifications, it is clear that what the SEEA-CF refers to as "Class A" reserves are equivalent to what the NSTA refers to as "Proved", "Probable" and "Possible" reserves. Therefore, all three segments of NSTA reserves data are summed for the purposes of calculating depletion. Note that the NSTA publish data also on wider oil and gas resource stocks that may be present, but are not seen as commercially viable, and therefore fall outside the scope for depletion calculations.

³¹ (North Sea Transition Authority, 2025, pp. 21-23)

³² (Bridging Document between the Petroleum Resources, 2023)

3 Experimental Results

3.1 Coal

3.1.1 Resource Rent

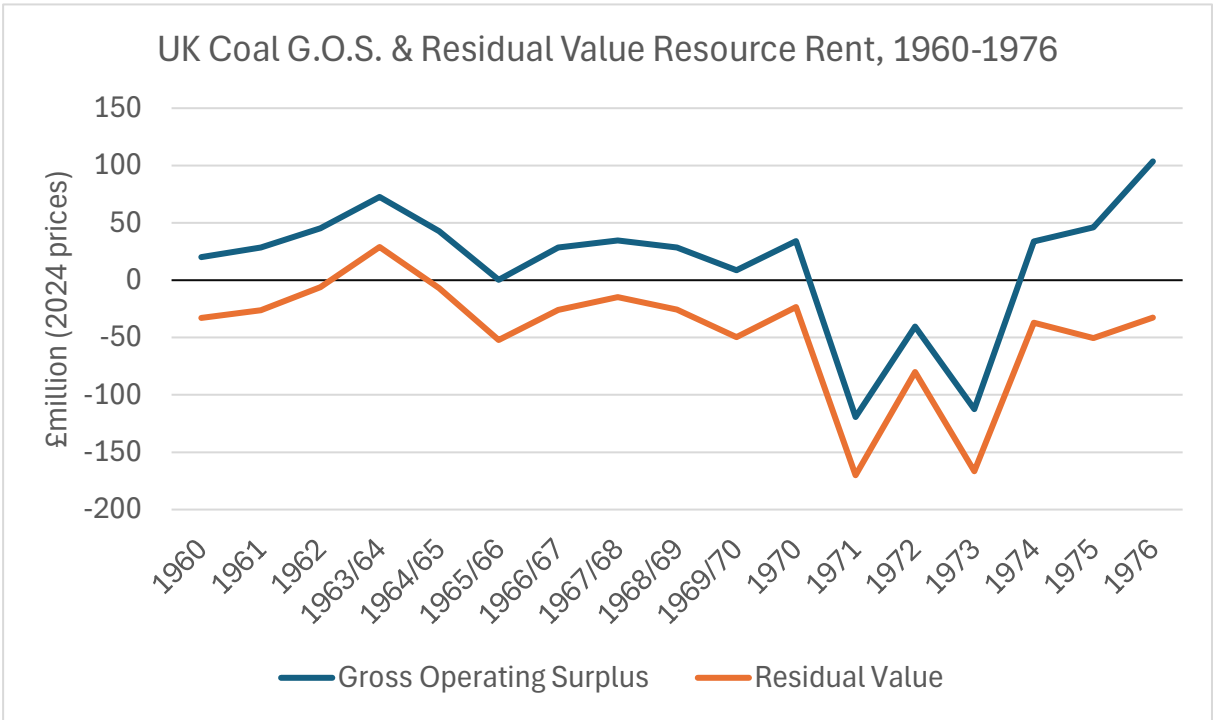


Figure 1 UK Coal Resource Rent, 1960-1976³³

During the 1960s and 1970s, the operating profits of the NCB were volatile, and sometimes negative. Accounting for the user costs of capital in the residual value resource rent equation consumes these profits for nearly every year in this period, yielding a negative annual resource rent for UK coal. Following the guidance of the OECD compilation guide and the SEEA central framework, would set resource rent to a minimum of zero for almost the entirety of this period. This valuation does not

³³ Calculations by the author and colleagues, utilising data several sources, see 2.1 Monetary Valuation – ONS Approach to Residual Value and 2.2 Coal

seem to reflect that an average of 72% of the electricity generated in the UK over this period was fuelled by coal³⁴, due to the financial position of the NCB.

The financial accounts of the NCB could not be found in our exploration of archived materials after 1976, and the UK's detailed Supply and Use Tables do not become consistently annual until the late 1990s. By 1998, when the Supply and Use Tables became consistently annual, enabling the calculation of the residual value resource rent of coal, the sector had declined significantly. Moreover, the coal sector, in its much smaller and now privatised state, continues to routinely make negative gross operating surplus, and constant negative resource rents. Such is this the case, that the national resource rent of coal in the UK has become less negative in recent years primarily due to less volume being extracted. Persistently negative operating profits begs the question, in a privatised market, from *where* operating funds are being derived and whether these funds could be incorporated into the resource rent calculation. This, however, requires ad hoc investigative work that may prove challenging to incorporate into a repeatable process for constructing annual economic accounts.

3.1.2 Asset Value

Persistently negative resource rent, transformed through the net present value approach, yields a negative asset value, and in turn the counter-intuitive negative depletion rate. It is therefore not informative to calculate an asset value for UK coal.

³⁴ Author's calculations based on data from (Department for Energy Security and Net Zero, 2025)

3.1.3 Physical Reserves

Year	Operational Reserves (m tonnes)
1970	4,711
1975	4,196
1980	4,427
1983	4,017
1988	2,887

Figure 2 UK coal operational reserve estimates, 1970-1988³⁵

Once a natural resource has been valued as an asset, this value needs to be divided by the total assessed reserves of said resource, to calculate a per unit asset value called “price-in-situ”. This is the price that is later attributed to physical depletion to derive monetary depletion. Price-in-situ is highly dependent on the scope of reserves considered. Data on the physical reserves of coal in the UK have also been difficult to locate. Sporadic estimates have been located in the archived internal documents of the NCB for the period of 1970-1988³⁶, with next to no explanation of the basis on which they were calculated. Reserves specifically are an economic concept, and the boundary of resources that fall into a reserve class are determined in part by the economic viability of extraction. Indeed, in 1988, the NCB’s internal estimate of its economic reserves significantly declined from the previous estimate made in 1983. Without consistent financial and economic data on coal extraction over this period it is very difficult to retrospectively estimate what economic conditions lead to such a significant reappraisal. Without this step, it is in turn very difficult to imply a time series of coal reserve balances. The price in situ calculation is very sensitive to changes in assumed reserves, and therefore we are uncertain how

³⁵ (Office of the Chief Geologist and Head of Surface Environment, National Coal Board, 1975-1988)

³⁶ (Office of the Chief Geologist and Head of Surface Environment, National Coal Board, 1975-1988)

to estimate a robust time series of UK coal depletion in monetary terms and welcome suggestions and advice from readers.

3.2 Oil and Gas

3.2.1 Resource Rent

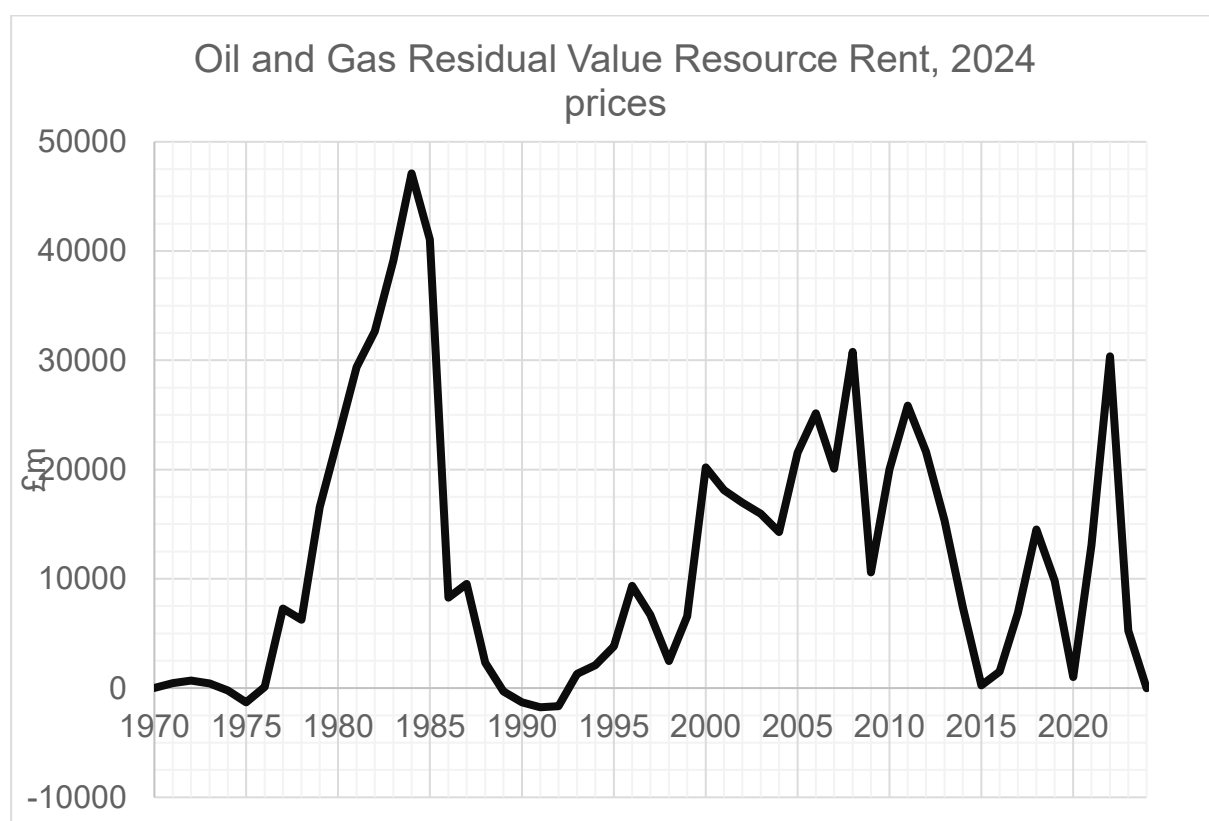


Figure 3 UK Oil and Gas Residual Value Resource Rent, 2024 prices, 1970-2024

The UK oil and gas sector has been considerably more profitable than the UK coal industry, and this has produced consistently positive, and large, resource rents. Although gross operating surplus is volatile in response to global oil and gas markets, the user cost of capital has been relatively stable, and a smaller proportion of output than in the coal industry. The greater value of oil and gas over coal is perhaps not surprising, given that it generally has more uses, such as plastics production and fuelling combustion engines, in addition to supplying a significant portion of UK

electricity generation through the late 20th century into the 21st ³⁷. Furthermore, oil and gas are generally more energy dense by weight than coal³⁸.

With consistently positive resource rents, we are able to project those rents into the future on a rolling basis to estimate asset value through the net present value method.

3.2.2 Physical Extraction and Reserves

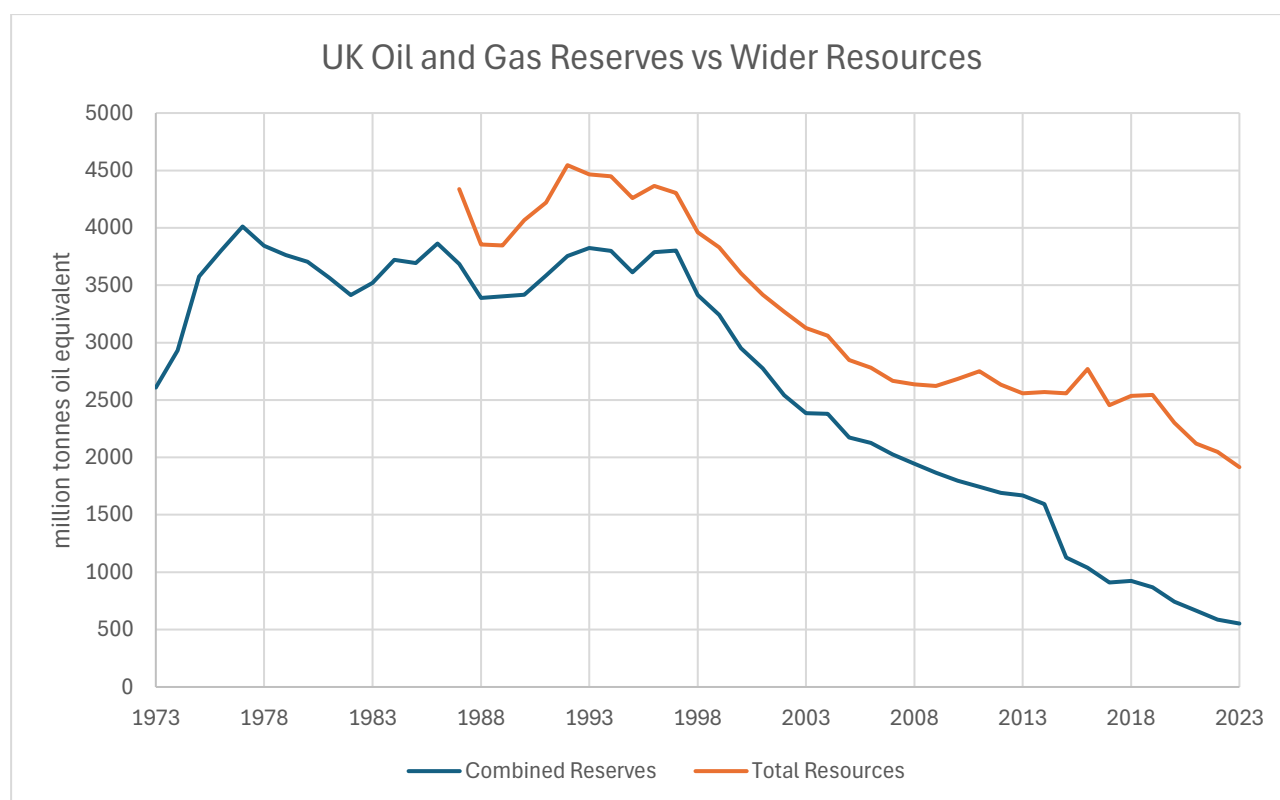


Figure 4 UK Oil and Gas Reserves vs Wider Resources, 1973-2023³⁹

³⁷ (Department for Energy Security and Net Zero, 2025)

³⁸ (Department for Energy Security and Net Zero, 2026)

³⁹ Author's summation and presentation of data from (North Sea Transition Authority, 2025). Combined reserves include 3P reserves for both oil and gas. Total resources includes upper potential additional resources until 2014, thereafter 3C conditional resources are used.

In contrast to coal, oil and gas reserve estimates have been calculated and published annually since discovery of North Sea reserves in the late 1960s. Figure 4 shows the volume of oil and gas reserves (economically viable) and resources (physically present). The divergence between reserves and resources demonstrates the role that economic viability plays in reserve estimates, and how reserve stocks themselves respond to market conditions. Whilst such reappraisals are not counted against extraction for the purposes of estimating depletion in physical terms, reappraisals do affect the physical reserve stock that is used to estimate the price-in-situ. This highlights the difficulties in imputing reserve volume data based on extraction rates, without a strong understanding of the how reserves are reappraised in response to market conditions.

3.2.3 Monetary Depletion

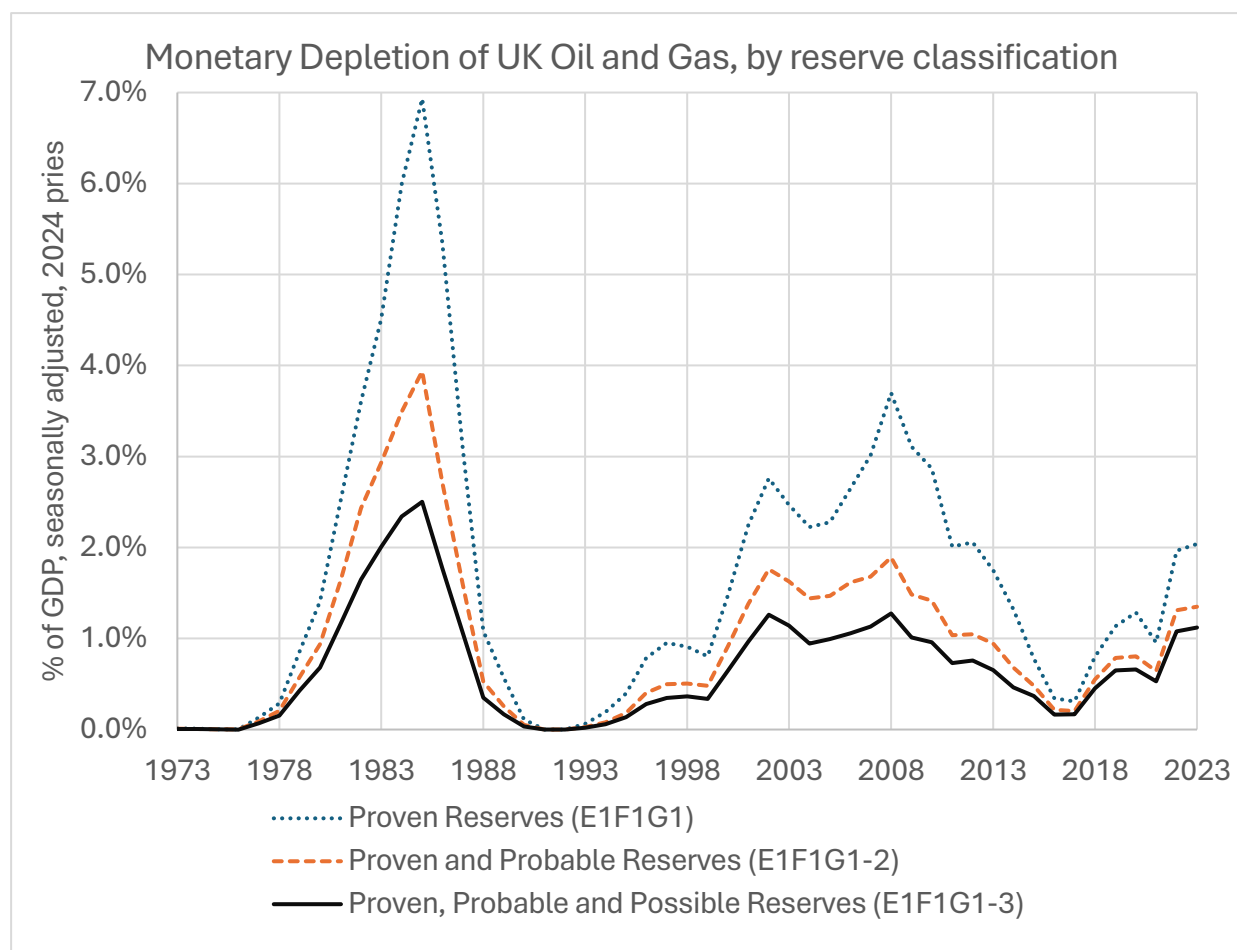


Figure 5 Depletion of Oil and Gas in Monetary Terms⁴⁰

Dividing the asset value of oil and gas by reserve estimates allows us to calculate a long and consistent time series of price-in-situ, which in turn we can multiply by physical extraction to estimate depletion in monetary terms. Figure 5 shows estimates of monetary depletion as a percentage of GDP. Figure 5 also shows variants on depletion estimates, derived from different viability classes of reserves. The UNFC class of reserves recommended by the SNA25 considers only

⁴⁰ Author's presentation based on author's calculations from various sources (see section 2.3 Oil and Gas. The reserve classifications refer to different tiers of commercial viability, as classified by the NSTA. This is in line with the Petroleum Resource Management System, which is in turn consistent with the UNFC. The codes in brackets refer to the relevant UNFC categories.

economically viable reserves and not wider identified resources. Even within the class of resources that can be classified as “reserves”, several levels of likelihood of viability can be considered within the recommended class. As the denominator of price-in-situ, a larger reserve stock can significantly reduce the monetary value of depletion. This highlights the importance of consistent guidance on setting a boundary for reserve stock to be considered but also demonstrates that any variation in this practice (for example, due to data limitations) could lead to significant variations in depletion estimates, and NDP in turn.

Figure 5 demonstrates that natural resource depletion can comprise a noteworthy portion of economic output, with these experimental estimates putting oil and gas depletion at around 2.5% of UK GDP in 1985. Clearly, this significance varies with global markets, the policy environment, and the general performance of the UK oil and gas sector. That the importance of natural resource depletion can be relatively episodic through time indicates the importance of consistent estimates for the study of economic history. Whilst the depletion of natural resources may not be large for a given resource in recent years, the origins of a nation’s wealth, and the sustainability of that wealth generation, has clear implications for modern policy and understanding the economic policies of the past.

In the UK, measuring the economic depletion of oil and gas is both possible and meaningful, however the UK coal industry demonstrates how the importance of a resource can coincide with periods of relatively poor data. Nations that no longer rely on exploiting natural resources for modern economic output may have a biased understanding of the sustainability of their long-run economic growth; how sustainable past economic policies were and, therefore, how applicable they may be again in the future.

4 Implications for International Guidance

Our research to date indicates that the currently available guidance on natural resource depletion for the SNA25 is effective when its underlying assumptions hold, and sufficient data (on reserves in particular) are available. However it’s important to acknowledge those assumptions, as they often do not hold. The monetary value of the depletion of natural resources in line with the current international guidance rests heavily on transparent, competitive licensing, or competitive extraction industries that can be easily identified in national accounts. Both assumptions relate to the main ways that are recommended to value natural resources in national accounts: the access price approach the former, and the residual value resource rent approach the latter.

4.1 Access Prices

The access price approach is extremely difficult to implement when no competitive bidding process is in place for extraction licenses. This includes where governments negotiate directly and privately with applicants, but also where governments take a very active role in the extraction industry, such as through state-owned companies or national monopolies. In some scenarios, no license or royalty fee may exist, they may be entirely confidential or they may be negotiated on a case-by-case basis. The UK's NCB presents an example where the only access price charged was that paid by the UK Government in compensation when it nationalised the industry. In practice, however, it is extremely difficult to identify the portion of that compensation that can be attributed to the raw coal resources themselves, but also how to annualise and pull forward that compensation into modern prices over such a long timeframe (1947 to 1994).

These difficulties with the access price approach make it hard to use as an alternative to residual value resource rent, but moreover it also makes it difficult to apply the new split-asset ownership approach recommended by the SNA25⁴¹, for which it is not an alternative but entirely necessary. The split-asset ownership approach sets out that a share of ownership over a natural resource is effectively transferred to the extractor if the owner does not charge some kind of access price that is equivalent to at least 90% of the rent actually earned by the resource. In the UK, this may lead to owner-borne depletion being entirely attributed to the Government sector or the extractor sector by default, for want of being able to calculate a robust variable split in effective ownership.

4.2 Residual Value Resource Rent

By a similar virtue, there is no guarantee that resource extraction markets are competitive, with often significant investment required to establish plants and, for technological reasons, a large minimum efficient scale of operation. This can generate inflated resource rents, as market power can be used to earn large producer surpluses that are unrelated to the scarcity, or technical nature, of the resource in question. Conversely, if there is significant regulatory involvement or control by governments, producer surplus can be suppressed below the user costs of capital, yielding negative resource rents. Indeed, the user costs of capital can be

⁴¹ (OECD, 2025, pp. 68-70; §222-235) for more detail.

poorly managed under any market structure, yielding narrow operating profit margins and suppressed resource rent.

In this last scenario, it may be possible to identify where funds come from to maintain firms that make little or negative operating profit. As suggested in the OECD compilation guide⁴², if negative resource rents persist compilers should consider including direct subsidies within the residual value calculation as an indicator of the total value placed on the resource by the economy (or some kind of producer surplus foregone). Indirect subsidies may be a valuable avenue to explore as a solution to this problem. Standard input-output tables tend to only include direct subsidies on production, but as has been studied in the agricultural economics literature, indirect subsidies can have an in-kind effect on production⁴³, as though they were some equivalent fraction of direct subsidies (often referred to as the “coupling coefficient”). When it is clear that a firm is primarily involved in extracting the relevant natural resource, over other enterprises, then an assessment could be made of the relevant portion of indirect subsidies that could be included in the residual value resource rent equation.

Alternative sources of funds, besides Government subsidies, may also be present in persistently loss-making private firms. Such examples could be due to owners cross-subsidising one firm with another in their portfolio. Uncovering such flows of funds can be a time-intensive exercise of investigative work, requiring creative and ad hoc approaches that are likely to be difficult to operationalise into the standard procedure of national accounting. In such cases, it isn’t clear how to proceed, in a way that is consistent over time, to correct negative resource rents.

Natural resources, in this context, are unprocessed goods. As explained in section 1 - Context: SNA25 and Depletion, the externalities of natural resources are not considered in the SNA. Therefore the value of natural resources, although potentially very low, should not be zero or negative – especially in the long run. Currently there are a number of ways that the SNA, and related guidance can produce negative resource rents. The UK coal example demonstrates how this situationally seems wrong, but it also highlights gaps in the current guidance that are more broadly applicable. (Pascoe, Van Landeghem, Scheufele, & Abrahams, 2026) demonstrates how the residual value approach fundamentally overestimates the resource rent that would be charged in an efficient market. This amplifies the

⁴² (OECD, 2025, p. 71)

⁴³ (Bhaskar & Beghin, 2009)

negative resource rent problem, as it would indicate that the efficient resource rents in such scenarios are even more deeply negative.

Taking inspiration from (Pascoe, Van Landeghem, Scheufele, & Abrahams, 2026) perhaps a new frontier for the international guidance in valuing natural resources, ex ante refinement through the supply chain, is to construct production functions and simulation models for the markets of these resources, in abstract. From such models efficient market equilibria could be hypothesised, from which appropriate resource rents could be implied that rely much more heavily on the relative scarcity and technical nature of each resource, and much less on the policy framework of the time or the efficient management of firms.

5 Questions for Readers and Delegates

5.1 When resource rents prove negative, and there seems no ecosystem service value to be observed, to what extent can we take inspiration from the SEEA-EA, and consider estimation of unobserved value for the SNA?

5.2 How should we consider estimating natural resources as assets, and natural capital more widely, into the past, when data is limited and/or classification systems change over time?

5.3 More broadly, what role should SEEA guidance play in the study of economic history, and the sustainability path of historic economic growth?

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