

Article

Business energy spending: experimental measures from the Office for National Statistics' business surveys

Business energy spending intensity in the Office for National Statistics' (ONS) Annual Business Survey 2019 and Annual Purchases Survey 2018, by industry, energy type, firm size and distribution.

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1 . Main points

- The most energy intensive industry section in 2019 was electricity, gas, steam and air conditioning supply, with 24% of the industry's total purchases of energy, materials, goods and services spent on energy; transportation and storage was the second most energy intensive, with 21% of total purchases spent on energy.
- At the more detailed industry group level, the three most energy intensive groups in 2019 were sea and coastal freight water transport (38%), passenger air transport (36%) and freight transport by road and removal services (31%).
- Natural gas was a smaller proportion of energy costs than either electricity or petrol and diesel in all industry sections in 2018; it accounted for more than a quarter of energy spending in the electricity, gas, steam and air conditioning supply industry, and the human health and social work activities industry.
- The smallest "micro" businesses with 0 to 9 employees were much more likely than larger businesses to have a very high energy intensity of more than 20% of total purchases being spent on energy in 2019.
- The majority of businesses in residential care activities spent more than 10% of their total purchases on energy in 2019.
- There is a positive association between the energy intensity of an industry division in 2019 and the proportion of businesses in that industry in the June and July 2022 Business Insights and Conditions Survey reporting that they have been affected by energy prices.

2 . Introduction and motivation

Rising energy prices over the past year have affected businesses as well as households. Businesses might respond to the increased cost of energy by adjusting their prices, profits, or other costs including wages. Households will be affected by these business decisions in their roles as consumers, investors and employees. Increases in energy costs may also make it more difficult for businesses to survive.

Businesses that use energy more intensively, with large spending on energy relative to the size of their business, may find themselves under more pressure to pass on higher energy costs or may be more vulnerable to closure.

This article presents experimental measures of energy intensity using the Annual Business Survey (ABS) and Annual Purchases Survey (APS). Both surveys ask businesses about their spending on energy and other aspects of their business performance. Using the firm-level data from these surveys allows us to look at how energy intensity varies between and within industries, and by other business characteristics such as firm size.

3 . Using older business survey data to provide relevant insights today

The most recent firm-level data available are the 2019 Annual Business Survey (ABS) data and the 2018 Annual Purchases Survey (APS) data. This means that results in this article will not reflect any changes in energy use or business performance that may have occurred throughout the coronavirus (COVID-19) pandemic, and the results will not reflect higher levels of spending on energy resulting from increases in energy prices during 2021 and 2022.

Nevertheless, these data should be useful for understanding the energy intensity of industries and businesses relative to each other, rather than providing an up-to-date measure of energy expenditure by these businesses. Energy intensity is measured as the proportion of a business's total purchases of energy, materials, goods and services that it spends on energy. This measures direct expenditure on energy so will not capture how businesses are affected by the impact of energy costs on their supply chain.

To measure the energy intensity of a group of businesses, such as an industry, energy purchases are summed across the businesses in the group and divided by the sum of their total input purchases.

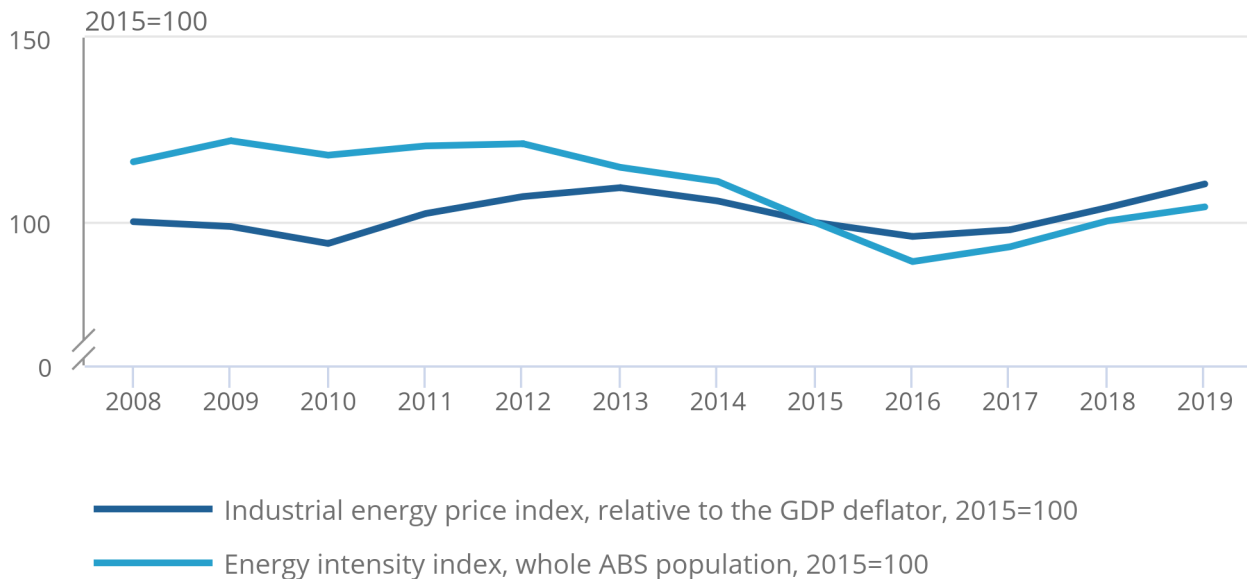
Figure 1 shows energy intensity for the entire ABS sample between 2008 and 2019. Energy intensity is indexed to 2015 and plotted alongside an index of industrial energy prices relative to the gross domestic product (GDP) deflator published by the Department for Business, Energy and Industrial Strategy. Although not perfectly aligned in their coverage of sectors and fuel types, energy intensity tracks movements in energy prices quite closely, particularly since 2013. Declining total purchases during the global financial crisis of 2008 to 2009 explain the relative stability of energy intensity in these years despite the drop in energy prices.

Figure 1: Business energy intensity follows recent movements in industrial energy prices

Energy intensity for the Annual Business Survey population and industrial energy prices relative to gross domestic product (GDP) deflator, 2008 to 2019, indexed to 2015=100, Great Britain

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Energy intensity for the Annual Business Survey population and industrial energy prices relative to gross domestic product (GDP) deflator, 2008 to 2019, indexed to 2015=100, Great Britain



Source: Office for National Statistics – Annual Business Survey, 2008 to 2019; Department for Business, Enterprise and Industrial Strategy – Industrial energy price indices, June 2022

Notes:

1. Industrial fuel price is in real terms relative to the GDP deflator. It combines prices for electricity, gas, heavy fuel oil and coal, weighted by their use in the UK industrial sector, excluding the climate change levy.
2. Energy intensity is energy purchases divided by total purchases.

Figure 2 ranks the 20 most energy intensive industry divisions in 2008 and 2019. Relative energy intensity across industries is stable even over long periods of time. Only three of the 20 most energy intensive divisions in 2008 dropped out of the top 20 by 2019.

Figure 2: Most of the top energy intensive industries in 2008 were still ranked among the top energy intensive industries in 2019

Ranking of 20 most energy intensive industry divisions in 2008 and 2019, Great Britain

Notes:

1. Energy intensity is energy purchases divided by total purchases.
2. Industry divisions are two-digit Standard Industrial Classification.
3. Industry divisions are ranked by their energy intensity in 2008 and 2019; only the top 20 divisions out of a total 80 are shown.
4. Industry divisions that are suppressed because of disclosure risk are excluded from the ranking in both years.

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4 . Energy intensity of industries

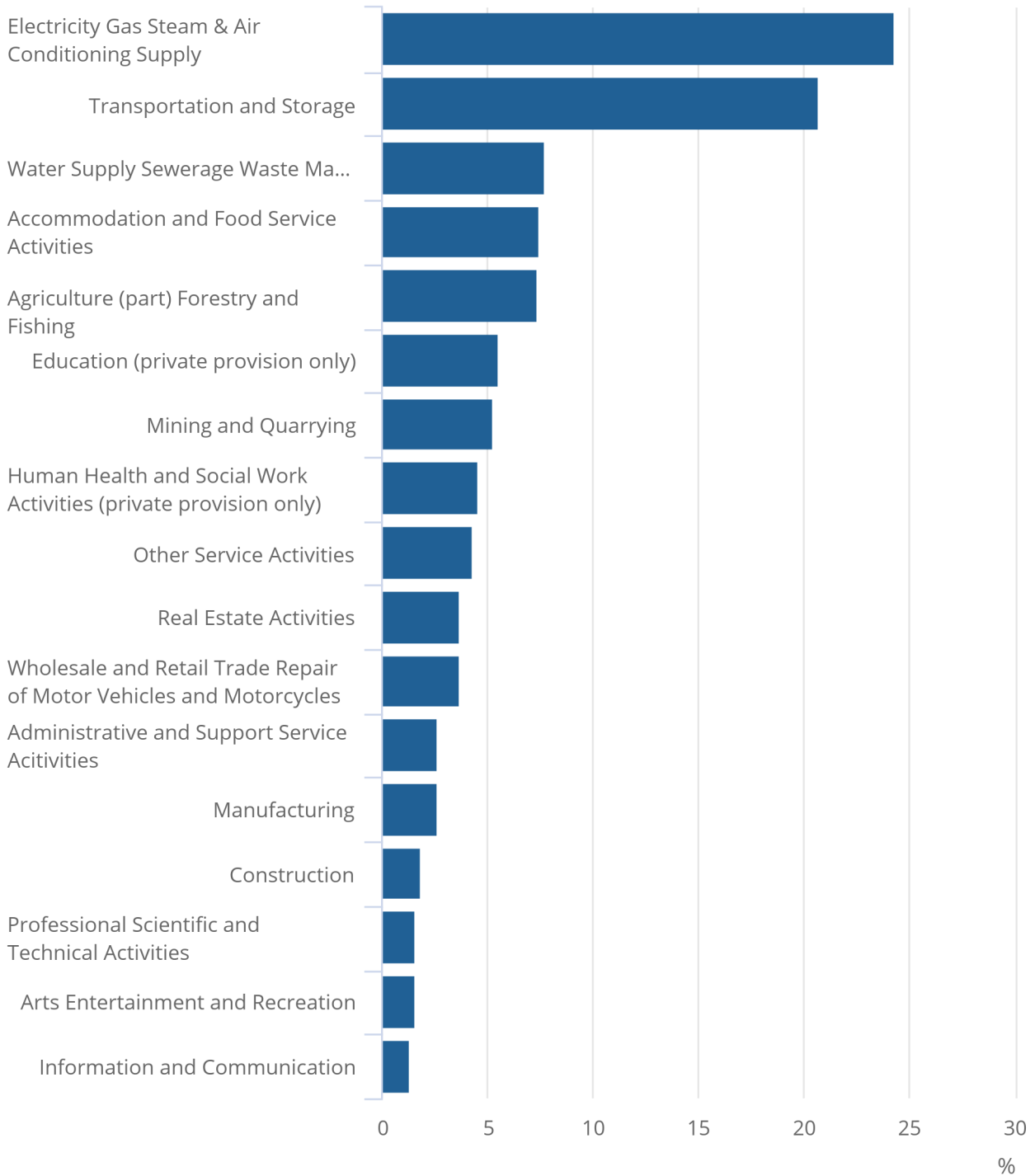
Figure 3 ranks industry sections by their energy intensity in 2019. Industry sections related to production and transportation were particularly energy intensive. Lighting and heating may have been a significant cost for some service sectors with relatively high energy intensity, such as accommodation and food service activities.

Figure 3: Electricity, gas, steam and air conditioning supply is the most energy intensive industry section, followed by transportation and storage

Energy intensity by industry section, 2019, Great Britain

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Energy intensity by industry section, 2019, Great Britain



Notes:

1. Energy intensity is energy purchases divided by total purchases.

Figure 4 breaks this down into detailed industry groups within each section. The three most energy intensive groups in 2019 were all transport industries: sea and coastal freight water transport (38%), passenger air transport (36%) and freight transport by road and removal services (31%). Although manufacturing as an industry section had relatively low energy intensity, some specific manufacturing groups such as manufacture of clay building materials (19%) were among the most energy intensive activities.

Figure 4: There is wide variation in energy intensity across detailed industry groups

Energy intensity by industry group, clustered by industry section, 2019, Great Britain

Notes:

1. Energy intensity is energy purchases divided by total purchases.
2. Industry groups are three-digit Standard Industrial Classification.
3. Industry groups are clustered by industry sections, which are ranked in order of section-level energy intensity.
4. Industry groups that are suppressed because of disclosure risk are excluded from the chart.

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5 . Industry energy intensity by energy type

The Annual Purchases Survey (APS) includes data about the types of energy purchased.

Figure 5 shows the energy type composition of industry sections ranked by their energy intensity measured with the 2018 APS. Natural gas was a smaller proportion of energy costs than either electricity or petrol and diesel in every industry section, but it accounted for more than a quarter of energy spending in the electricity, gas, steam and air conditioning supply industry, and the human health and social work activities industry.

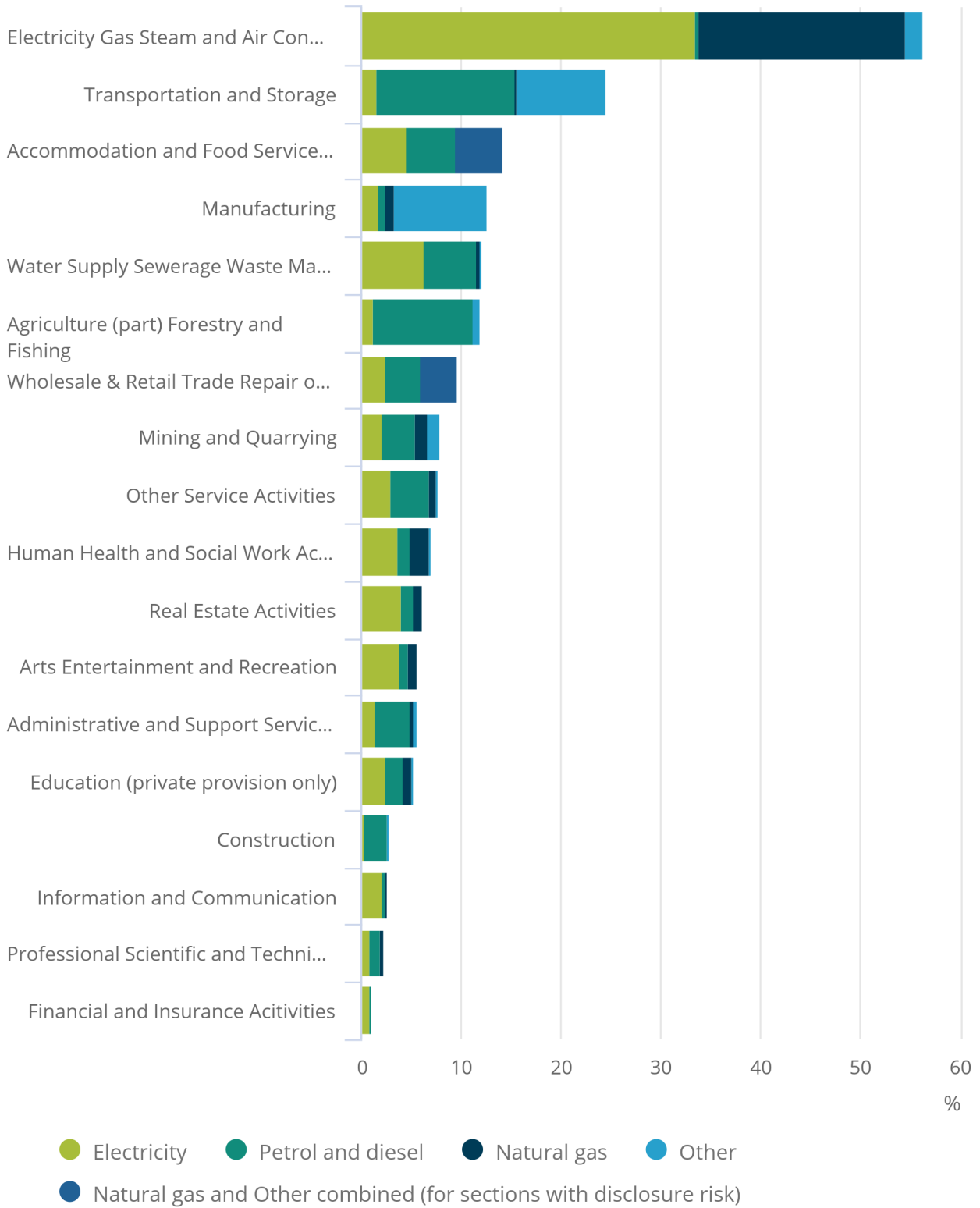
“Other” includes fuel types such as kerosene, liquefied petroleum gas (LPG), coal and coke, and other refined petroleum products. These were largest as a share of total spending in transportation and storage, and manufacturing.

Figure 5: The intensity with which different energy types are used varies across industries

Energy intensity by industry section and energy type, 2018, Great Britain

Figure 5: The intensity with which different energy types are used varies across industries

Energy intensity by industry section and energy type, 2018, Great Britain



Notes:

1. Energy intensity is energy purchases divided by total purchases.
2. Where one energy category for an industry section risks being disclosive, it has been merged with a second energy category.
3. See the Data sources and quality section for components of the energy type categories.

6 . Distribution of energy intensity by firm size and within industries

Industry results will often be dominated by a few very large firms, so these results may not be representative of the small and medium-sized firms that make up most of the business population.

Figure 6 splits the Annual Business Survey (ABS) population into four size bands, according to the number of employees in a firm. The firms within each size band are grouped into energy intensity bands so that the columns in each size band chart sum to 100%.

The smallest “micro” businesses with 0 to 9 employees were much more likely than larger businesses to have very high energy intensity of over 20%. The largest businesses with 250 or more employees were more likely to have low energy intensity (0% to 2%) than smaller businesses. Medium and small businesses were relatively more likely than the biggest and smallest businesses to have energy intensity in the 2% to 6% range.

Figure 6: The smallest businesses are more likely to be highly energy intensive

Distribution of energy intensity by firm size, 2019, Great Britain

Notes:

1. Energy intensity is energy purchases divided by total purchases.
2. Businesses are grouped into size bands by number of employees.
3. Energy intensity is calculated at the firm level. Businesses within each size band are grouped into energy intensity bands, and the number of businesses calculated as a proportion of all the businesses in that size band. The columns within each size band chart sum to 100%.

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The distributional analysis can also improve understanding of the industry aggregates shown in the previous section. For example, all three industries in Figure 7 were in the top quarter of industry divisions by overall energy intensity but had very different distributions of energy intensity across their businesses.

Businesses in residential care activities rarely had extremes of energy intensity but commonly spent between 5% and 20% of their total purchases on energy. 87% of businesses in land transport and transport via pipelines spent more than 20% of their purchases on energy.

The majority of businesses in electricity, gas, steam and air conditioning supply had low energy intensity, despite this being a very energy intensive industry in aggregate. This implies that a few large purchasers of energy are driving the aggregate result in this industry.

Figure 7: Highly energy intensive industries have different underlying distributions of energy intensity

Distribution of energy intensity within selected industry divisions, 2019, Great Britain

Notes:

1. Energy intensity is energy purchases divided by total purchases.
2. Industry divisions are two-digit Standard Industrial Classification.
3. Businesses within each industry division are grouped into energy intensity bands, and the number of businesses calculated as a proportion of all the businesses in that industry division. The columns within each industry division chart sum to 100%.

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Figure 8 shows industry examples of energy intensity by firm size. The relatively high energy intensity of the smallest “micro” firms was very pronounced in the postal and courier activities industry, with a mean energy intensity of 45% for firms in the 0 to 9 employee size band. This was double the mean energy intensity of the firms in the next largest size band. The land transport and transport via pipelines industry had a high mean energy intensity across all firm sizes. The mean energy intensity of manufacture of other non-metallic mineral products increased with firm size.

Figure 8: Patterns of energy intensity by firm size vary by industry

Average energy intensity by firm size for selected industry divisions, 2019, Great Britain

Notes:

1. Industry divisions are two-digit Standard Industrial Classification.
2. Businesses within each industry division are grouped into size bands by number of employees.
3. Mean energy intensity is energy purchases divided by total purchases calculated at the firm level, with the mean average taken across all businesses within each size band and industry division. This is the “typical business” method of measuring energy intensity described later in the article.

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7 . Comparison with the June 2022 Business Insights and Conditions Survey

A limitation of the Annual Business Survey (ABS) and Annual Purchases Survey (APS) for analysing business energy spending is that the data are only available with a significant lag. Figures 9 and 10 plot energy intensity from the 2019 ABS against recent business responses to [Wave 60 of the Business Insights and Conditions Survey \(BICS\)](#), with June 2022 as the reference period. These are compared at industry division level.

The results show the relevance of the energy intensity measure to understanding businesses’ recent experience of rising energy prices. Figure 9 shows that an industry’s energy intensity from the ABS is positively associated with the proportion of businesses in that industry reporting in the BICS that:

- production has been affected by increases in energy prices
- they are facing increased input prices
- they are considering raising prices because of energy prices

Figure 9: Businesses in energy intensive industries are more likely to have reported being affected by recent energy price rises

Proportion of businesses affected by energy prices, June and July 2022 (Business Insights and Conditions Survey wave 60), and energy intensity (Annual Business Survey 2019)

Notes:

1. Energy intensity is energy purchases divided by total purchases.
2. Industry divisions are two-digit Standard Industrial Classification.
3. The Annual Business Survey (ABS) covers Great Britain. The Business Insights and Conditions Survey (BICS) covers UK businesses not permanently stopped trading with 10 or more employees.
4. The BICS results at this level should be interpreted with caution, as some industry divisions are based on a small number of responses.
5. Industry divisions that are suppressed because of disclosure risk in either the BICS or ABS are excluded from the chart.
6. Reference period is June 2022 compared with previous month for input prices, June and July 2022 for production affected by energy prices, and expectations for August 2022 for considered raising prices.

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The BICS also asks whether businesses are fully trading and whether they have permanently ceased trading. Although the data for these measures are more limited than other questions in the survey, Figure 10 shows some positive correlations between an industry’s energy intensity and the proportion of businesses in that industry that have had to reduce or cease trading.

Figure 10: Businesses in energy intensive industries are more likely to be not fully trading or to have permanently ceased trading

Proportion of businesses affected, June and July 2022 (Business Insights and Conditions Survey wave 60), and energy intensity (Annual Business Survey 2019)

Notes:

1. Energy intensity is energy purchases divided by total purchases.
2. Industry divisions are two-digit Standard Industrial Classification.
3. Annual Business Survey (ABS) data cover Great Britain. Business Insights and Conditions Survey (BICS) data cover UK businesses with 10 or more employees.
4. The BICS results at this level should be interpreted with caution, as some industry divisions are based on a small number of responses.
5. Industry divisions that are suppressed because of disclosure risk in either the BICS or ABS are excluded from the chart.

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These correlations do not indicate a causal relationship, so we cannot say for certain from this simple analysis that higher energy intensity causes a business to be more affected by rising energy prices. Many factors other than a business's energy use will affect its trading status or pricing decisions, for example.

Nevertheless, these results are encouraging that energy intensity measures from the 2019 ABS are relevant to the experience of industries affected by high energy prices today.

8 . Alternative definitions of energy intensity

An alternative definition of energy intensity weights all businesses equally so that the experience of larger firms will not dominate industry results. This measure is more representative of the energy intensity of a typical business within an industry.

Figure 11 compares our standard definition of aggregated energy intensity for industry groups with the mean of firm-level energy intensities within each group that is more representative of a "typical business". About a fifth of industry groups had a difference of more than five percentage points between the two energy intensity definitions.

Figure 11: Comparing "typical business" mean energy intensity with the standard energy intensity measure

Energy intensity by industry group: standard measure and "typical business" mean, 2019, Great Britain

Notes:

1. Aggregate energy intensity is industry energy purchases divided by industry total purchases of energy.
2. "Typical firm" mean energy intensity is energy purchases divided by total purchases calculated at the firm level, with the mean average taken across all businesses in the industry.
3. Industry groups are three-digit Standard Industrial Classification.
4. Industry groups that are suppressed because of disclosure risk are excluded from the chart.

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Another definition of energy intensity divides energy purchases by gross value added (GVA), which measures the contribution to the economy of each producer or industry.

Figure 12 compares our standard definition of energy intensity using the total purchases denominator with energy intensity measured using an approximate GVA denominator, for industry groups. Production and manufacturing industries were more likely to be measured as high energy intensity with the GVA denominator than with the total purchases denominator.

Figure 12: Comparing gross value added (GVA) energy intensity with the standard "total purchases" energy intensity measure

Energy intensity by industry group: total purchases denominator and GVA denominator, 2019, Great Britain

Notes:

1. Energy intensity with “total purchases” denominator is energy purchases divided by total purchases.
2. Energy intensity with “GVA” denominator is energy purchases divided by approximate GVA at basic prices.
3. Industry groups are three-digit Standard Industrial Classification.
4. Industry groups that are suppressed because of disclosure risk are excluded from the chart

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9 . Business energy spending data

[Energy intensity: Annual Business Survey 2019 and Annual Purchases Survey 2018](#)

Dataset | Released 7 September 2022

Data tables to accompany the article Business energy spending: experimental measures from the Office for National Statistics’ business surveys. Includes data on energy intensity by industry, energy type, firm size and distribution across businesses, and compared with recent business survey results.

10 . Data sources and quality

Methodology notes

This analysis excludes purchases of energy or other inputs bought for direct resale without further processing. Purchases also exclude employment costs, interest payments, depreciation, amounts charged to a capital account and capitalised building repairs.

Design and employment calibration weights have been applied to reflect the business population and correct sample imbalances.

Reporting units are used as the units of observation for businesses.

Disclosure control has been applied to reduce the risk of individual businesses being identified and to keep confidential information protected. This includes the suppression of results based on low numbers of observations and of results that are dominated by the spending of one or two large businesses. The chart notes indicate where it has been necessary to suppress results for this reason.

Industries are classified using Standard Industrial Classification (SIC) 2007. The article refers to a variety of levels of detail for industry classification: section (the least detailed level), division (two-digit SIC), and group (three-digit SIC). More [information on SIC 2007](#) is available on the ONS website.

Gross value added (GVA) measures the contribution to the economy of each producer or industry, and it is [the value of the goods and services that have been produced, minus the cost of all inputs and raw materials directly attributable to that production](#). It is equivalent to the [sum of labour costs paid by producers \(which includes wages\) and gross operating surplus \(which includes profits\)](#), neither of which are captured in the total purchases measure.

Approximate GVA can be measured using the Annual Business Survey (ABS), but the Annual Purchases Survey (APS) does not collect the necessary information to use a GVA denominator for energy intensity. Another downside of this approach when applied at the firm level or to detailed industries is that businesses can have very low or negative GVA, resulting in very large or negative energy intensity values that are difficult to compare.

Annual Business Survey

The Annual Business Survey firm-level data used for this analysis cover Great Britain. The data exclude the financial and insurance sector, public sector organisations and part of the agriculture sector. The measure of business energy expenditure is “energy used in the running of the business”. This includes petrol, diesel, electricity and gas, and other energy types.

The analysis in this article uses the ABS 2019, which is the most recent firm-level data available. [Results have been published](#) from the ABS 2020, but as that bulletin explains, the low response rate during the coronavirus (COVID-19) pandemic means that estimates are subject to more uncertainty than usual, and it is not clear how that would affect the quality of firm-level analysis.

More information is available in the [ABS quality and methodology information \(QMI\)](#).

Annual Purchases Survey

The Annual Purchases Survey firm-level data used for this analysis have been adjusted to be more comparable with the ABS firm-level data, by aligning geographic coverage (Great Britain), sector coverage and weighting, and by excluding purchases for direct resale.

However, differences in samples, methodology and timing remain, including that the most recently available firm-level data for the APS are 2018, rather than 2019 for the ABS. This means that the rankings and levels of energy intensity by industry are not consistent between the two surveys.

The energy categories in Figure 5 contain the following variables:

Electricity

- Electricity (includes electricity utility bills and electricity transmission and distribution services)

Petrol and diesel

- Petrol
- Diesel (includes derv oil)
- Gas oils (includes red diesel)

Natural gas

- Natural gas, liquefied or in gaseous state
- Gas supply from mains (includes gas utility bills and gas transmission and distribution services)

Other

- Coal and lignite
- Crude petroleum and tar sands
- Coke oven products
- Lubricating petroleum oils
- Liquefied petroleum gas (LPG) (includes propane and butane)
- Other refined petroleum products (includes briquettes, ovoids, petroleum jelly and paraffin wax)
- Other fuel oils (includes kerosene jet fuel, white spirit and naphtha)
- Steam and air conditioning

More information is available in the [APS QMI](#).

Business Insights and Conditions Survey

Part of the analysis presented in this article is based on responses from Wave 60 of the Business Insights and Conditions Survey (BICS), of businesses with 10 or more employees. Wave 60 was live from 27 June to 10 July 2022.

BICS is a voluntary, fortnightly survey that captures businesses' responses on how their financial performance, workforce, prices, trade, and business resilience have been affected, over a reference period. For more detailed information on the survey, including a description of the weighting methodology, please see our published [BICS QMI](#).

11 . Future developments

This article has demonstrated how energy intensity of businesses and industries can be measured using the Annual Business Survey (ABS) and Annual Purchases Survey (APS).

Beyond this initial analysis and its insights for the current period of high energy prices, further research could make more use of energy spending from these data sources by linking them to other business data at the firm level. This could provide a valuable data source for research into understanding how businesses will adapt to net zero greenhouse gas emissions, and as a benchmark for potential new sources for measuring business energy spending, such as business-to-business financial transactions data.

12 . Related links

[Energy, goods and services used by UK businesses: 2018 final results](#)

Bulletin | Released 15 May 2020

Detailed product by industry proportion estimates using the results from the Annual Purchases Survey 2018

[Non-financial business economy, UK and regional \(Annual Business Survey\): 2020 results](#)

Bulletin | Released 16 June 2022

Size and growth within the UK and regional non-financial sectors as measured by the Annual Business Survey.

[Industrial energy price indices](#)

Dataset | Last updated 30 June 2022

The Department for Business, Energy and Industrial Strategy (BEIS) publishes quarterly and annual price indices for industrial fuels, in real and current terms, including and excluding the Climate Change Levy (CCL).

[Business insights and impact on the UK economy: 25 August 2022](#)

Bulletin | Released 25 August 2022

The impact of challenges facing the economy and other events on UK businesses. Based on responses from the voluntary fortnightly business survey (BICS) to deliver real-time information to help assess issues affecting UK businesses and economy, including financial performance, workforce, trade, and business resilience.

13 . Cite this article

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