

Article

The energy intensity of the Consumer Prices Index: 2022

Estimates of the direct and indirect energy intensity of the Consumer Prices Index.

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1 . Main points

- We estimate that the Consumer Prices Index (CPI) has an indirect energy intensity (the proportion of the consumer price of products accounted for by energy costs) of 6.6%, reflecting how energy is an important input for the production process of businesses.
- Restaurants and hotels have the highest energy intensity (2.7%) of the CPI divisions that do not contain direct energy components, where there are relatively high energy requirements to provide a minimum service.
- Clothing and footwear have the lowest energy intensity (0.3%) as its production process is more dependent on non-energy inputs, such as labour.
- Services components of CPI have more wide-ranging energy intensity estimates than non-energy goods components, where insurance and financial services have a low energy intensity and transport services have very high energy intensity.
- Goods and services with the highest energy intensity rates have been making the largest contributions to inflation over the last year.

2 . Overview

There has been a sharp increase in UK consumer price inflation over the last year, which reached 40-year highs in late 2022. These include the effects of the large increases in food and energy prices following the Russian invasion of Ukraine. There was more than a doubling in wholesale gas and electricity prices in 2022, while the prices for crude oil also rose sharply in the year. Although these prices have fallen back more recently, these higher food and energy prices led to [a large increase in consumer price inflation for much of the global economy](#).

Energy price movements are a primary driver of inflation. The direct effects are seen in price movements for motor fuels and household gas and electricity bills, which reflect the way higher wholesale energy prices are passed on to consumers. However, there are also indirect effects, which reflect how energy is an important intermediate input for the production processes of businesses.

As energy prices increase, they push up costs for businesses as gas, electricity and fuel are essential inputs into production. These higher input costs will likely be passed on to some extent to higher prices faced by consumers. The exposure of different products to these indirect effects will vary depending on how energy intensive these production processes are.

We estimate the energy intensity of the Consumer Prices Index (CPI) basket to reflect these indirect effects of higher energy prices, based on estimates of energy inputs into the production of the goods and services that are available for use in the UK economy and the role this plays in their respective consumer prices. We then show how much the energy intensity varies by product and how much this has contributed to the 12-month rate of CPI inflation in recent years.

3 . Estimating the indirect effects of energy in CPI

The supply and use tables (SUTs) provide a framework for the reconciliation of the three approaches to measuring gross domestic product (GDP). This framework includes the products consumed by businesses to produce their output. The input-output tables (IOTs) are an extension of this framework, showing interdependencies between production processes. These allow the user to analyse how a change in final use might feed through the economy, leading to changes in the inputs needed to produce that output.

One feature of the IOTs is that they provide estimates of the inputs into the production of the goods and services available for use in the UK economy. These inputs might be produced domestically or imported, which also includes the usage of energy inputs [note 1] - gas, electricity, crude, and refined petroleum - in the production of all goods and services in the economy [note 2]. This provides a proxy of the energy intensity of individual products, which shows what proportion of the end price consumers pay is driven by the energy usage of firms - see [Section 7: Data sources and quality](#).

This provides estimates of energy intensity for 112 products on a Classification of Product by Activity (CPA) basis. To apply these values to corresponding components of the Consumer Prices Index (CPI) basket, we need to map the CPA categories to the Classification Of Individual Consumption by Purpose (COICOP) categories that underpin the CPI. We use the published [CPA-COICOP converter](#) for these purposes.

We use the latest available [input-output tables](#), which cover 2019. As such, the interdependencies between production processes reflect the 2019 economy and do not capture any changes that may have occurred since, including the coronavirus (COVID-19) pandemic and the recent energy crisis. Likewise, these estimates do not reflect any effects of taxes or subsidies introduced since 2019 except indirectly as they feed through into consumer prices.

Notes for: Estimating the indirect effects of energy in CPI

1. We take the product-by-product information on imports in the input-output Tables and so make no further assumptions about energy intensity further up supply chains for imported goods and services.
2. Consumer prices also include the effects of taxes and subsidies.

4 . Energy intensity of CPI

The gas, electricity, liquid fuels, and fuels and lubricants components of the Consumer Prices Index (CPI) reflect the direct effect of energy price movements through motor fuel and energy bills for consumers. Figure 1 shows the energy intensity of the 12 CPI divisions, which captures the indirect effects of energy price movements, including for the production and distribution of direct energy components. We estimate that CPI has an indirect energy intensity of 6.6% reflecting the role of energy costs in driving prices for consumer goods and services.

Energy intensity is highest for housing and household services (20.5%) - which includes gas, electricity, and liquid fuels - and transport (17.5%), which includes fuels and lubricants. These energy components have indirect energy intensity rates of 58% (gas), 57% (electricity), 69% (liquid fuels) and 68% (fuels and lubricants) and reflect around four-fifths of the total energy expenditure of the CPI basket. In contrast, energy intensity is lowest for insurance (0.2%).

The indirect energy intensity of these energy products is not 100% as it reflects all of the costs that go into producing and delivering energy to households, including capital and labour costs, as well as differences between production costs and consumer prices, which include taxes less subsidies, direct imports and profits.

If we remove fuels and lubricants, the remainder of transport has an energy intensity of 2.7%, reflecting the relatively high energy intensity of other transport products. For example, passenger transport by air (11.4%) and passenger transport by road (7.1%) have among the highest energy intensity of any class besides the direct energy components. The transport component with the lowest energy intensity is motorcycles and bicycles (0.8%).

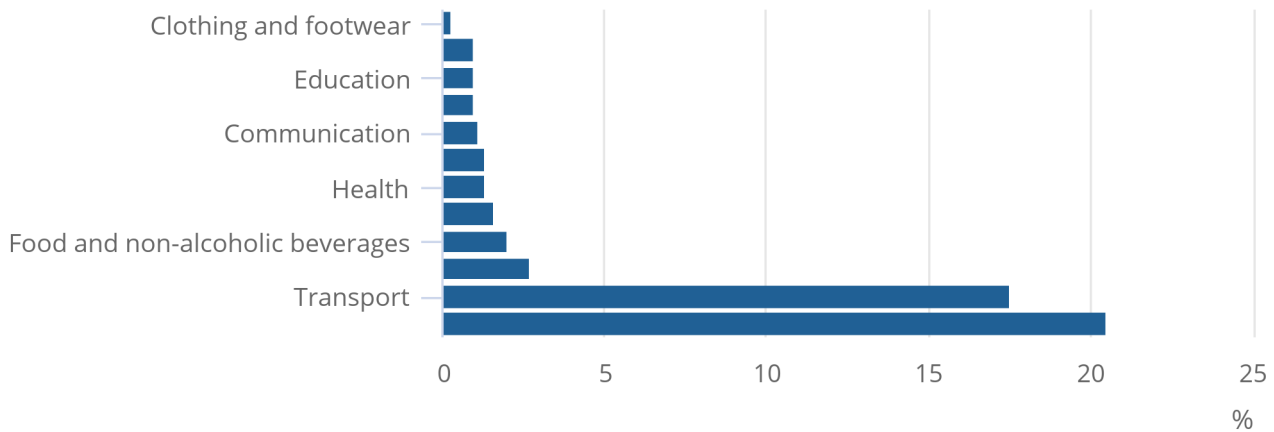
The remainder of the housing and household services division has an energy intensity of only 1.2%. This reflects how rents are not energy intensive but account for almost two-thirds of spending on housing and household services.

Figure 1: Restaurants and hotels have the highest energy intensity at the CPI division level, if we exclude those that include the direct effects of energy

Energy intensity by division of Consumer Prices Index (CPI), UK, January 2019 to February 2023

Figure 1: Restaurants and hotels have the highest energy intensity at the CPI division level, if we exclude those that include the direct effects of energy

Energy intensity by division of Consumer Prices Index (CPI), UK, January 2019 to February 2023



Source: Consumer Prices Index and Input Output Tables from the Office for National Statistics

Notes:

1. The gas, electricity, liquid fuels, and fuels and lubricants components of CPI reflect the direct effect of energy price movements through motor fuels and energy bills for consumers. These reflect 7.9% of the CPI basket in 2023.
2. Energy intensity rates map across from CPA categories to COICOPs at class level, these divisional values are a weighted average of the energy intensity rates of the classes within each division.

Restaurants and hotels have an energy intensity of 2.7%. Accommodation services (3.1%) is more energy intensive than catering services (2.6%), although there is more spending on catering services. The minimum energy usage needed to be able to provide these services, regardless of the number of customers, likely accounts for their high energy intensity.

In contrast, clothing and footwear have an energy intensity of 0.3%. Its production process is more dependent on non-energy inputs, such as labour.

Table 1 provides more information on the distribution of energy intensity between and within these CPI divisions. This highlights how the role of energy as an intermediate input varies within each of these 12 divisions, even if we exclude transport, and housing and household services.

Table 1 shows that for transport, and housing and household services, the mean energy intensity is higher than the median for those classes within the division. This captures the effect of the very high energy intensity of the direct energy components within these divisions. When we exclude the direct energy components, goods have a similar mean (1.4%) and median (1.3%) rate of energy intensity, reflecting that energy intensity rates are more evenly spread. For services, the mean (2.0%) is also above the median (1.4%) because of a small number of classes with high energy intensity, but if we remove transport services we see a similar energy intensity as for non-energy goods.

Table 1: Energy intensity varies between and within CPI divisions
Mean, median and range of energy intensity classes by Consumer Prices Index (CPI) division, UK, per cent

	Mean	Median	Min	Max
Food and non-alcoholic beverages	2	2	1.2	3.2
Alcoholic beverages and tobacco	1	1	1	1
Clothing and footwear	0.3	0.5	0.3	1
Housing and household services	20.5	3	0.9	69
Furniture and furnishings	1.3	1.2	0.9	2.5
Health	1.3	1.3	1.1	1.4
Transport	18.7	4.3	0.8	68
Communication	1.1	1.7	1.1	2.4
Recreation and culture	1.3	1.3	0.5	4.4
Education	1	1	1	1
Restaurants and hotels	2.7	2.6	2.6	3.1
Miscellaneous goods and services	1	0.8	0.2	1.7
Goods	6.3	1.4	0.3	69
Goods excluding energy	1.4	1.3	0.3	4.4
Services	2	1.4	0.2	11.4
Services excluding transport	1.4	1.3	0.2	3.1

Source: Consumer Prices Index and Input Output Tables from the Office for National Statistics

Notes

1. Mean, median, minimum and maximum values relate to the distribution of energy intensity at the class level. Each of the 85 classes in the CPI basket falls into one of the 12 divisions shown in the table and can also be categorised as either a good or service.

The energy intensity of goods is 6.3%, which include the role of direct energy components: gas, electricity, other liquid fuels, and fuels and lubricants. If we look at only non-energy goods, the energy intensity of goods is 1.4%, which is lower than that for services (2.0%). If we look at the 82 classes that exclude energy, we have an energy intensity of 1.7%. This ranges from 0.2% to 11.4%, which shows how production processes of individual products vary in their mix of energy and non-energy inputs.

Figure 2 shows that energy intensity rates for services classes are more wide-ranging than those for goods excluding energy. For example, insurance and financial services have very low energy intensity (10% of classes have an energy intensity below 0.5%) and rely more on labour and capital in their production process. In contrast, transport services such as passenger transport by air (11.4%) and passenger transport by road (7.1%) have very high energy intensity, reflecting their dependence on motor fuels. Over a third of services classes have energy intensity between 1% and 1.5%, primarily those that are relatively labour-intensive such as dental services, cultural services and tertiary education.

The distribution of energy intensity in non-energy goods is less wide-ranging. Energy intensity rates for goods reflect differences in production processes and the relative importance of the physical materials in the end price of the product. Those with higher energy intensity include fruit (3.2%) and gardens, plants and flowers (4.4%). These are goods for which the raw materials undergo relatively little transformation in creating the final product, where the production itself accounts for a large part of the end price. It also includes glassware, tableware and household utensils (2.5%), which reflects the high energy intensity of mining raw materials.

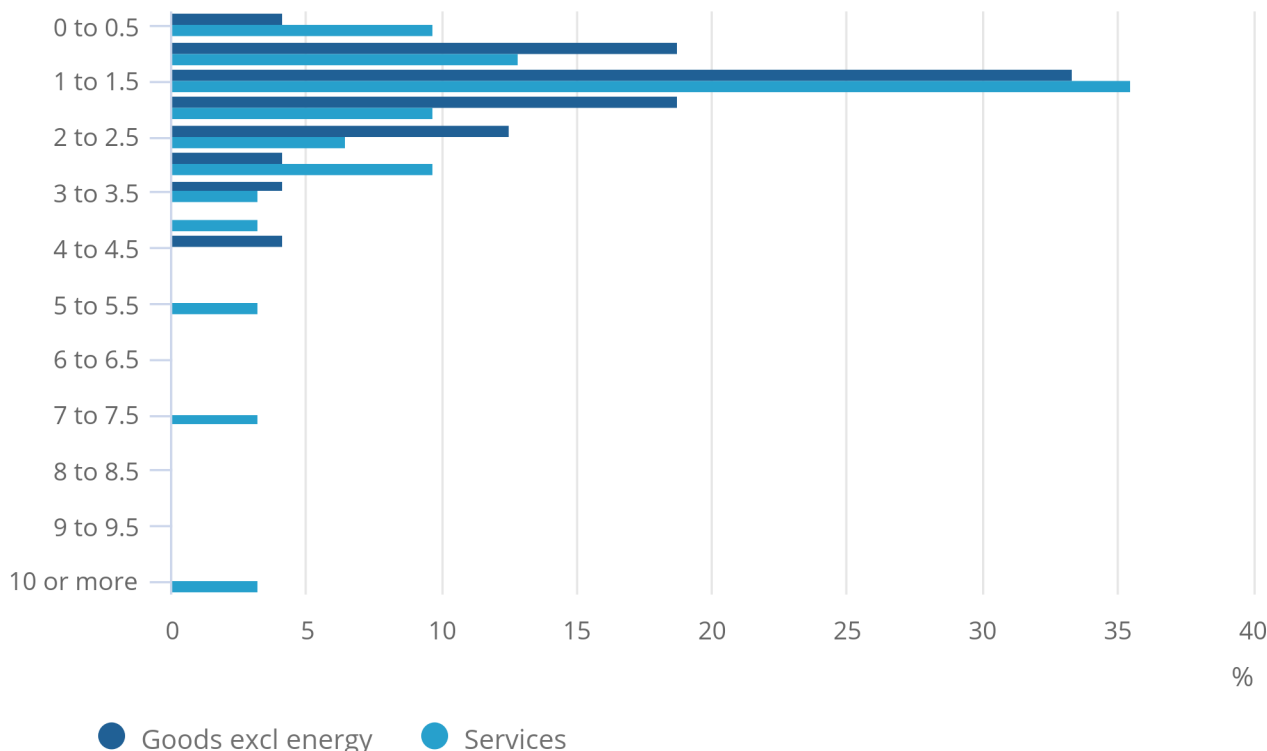
The non-energy goods with the lowest energy intensity rates include those associated with a high degree of intellectual property, and for which the materials used in production represent a lower part of their value, such as books and newspapers (0.6%). They also include garments (0.3%) and footwear (0.3%), which may rely more on non-energy inputs such as labour for its production.

Figure 2: Services classes have a wider range of energy intensity than goods classes

Proportion of non-energy goods and services classes by energy intensity, UK

Figure 2: Services classes have a wider range of energy intensity than goods classes

Proportion of non-energy goods and services classes by energy intensity, UK



Source: Consumer Prices Index and Input Output Tables from the Office for National Statistics

5 . Contributions to CPI inflation by energy intensity

We can show the impact of energy prices on the increase in consumer prices over the last year by looking at how much of that Consumer Prices Index (CPI) inflation has been explained by goods and services that have a relatively high and low energy intensity, in addition to the direct effects of energy price movements. Figure 3 shows that those goods and services with higher energy intensity are making the largest contributions to inflation.

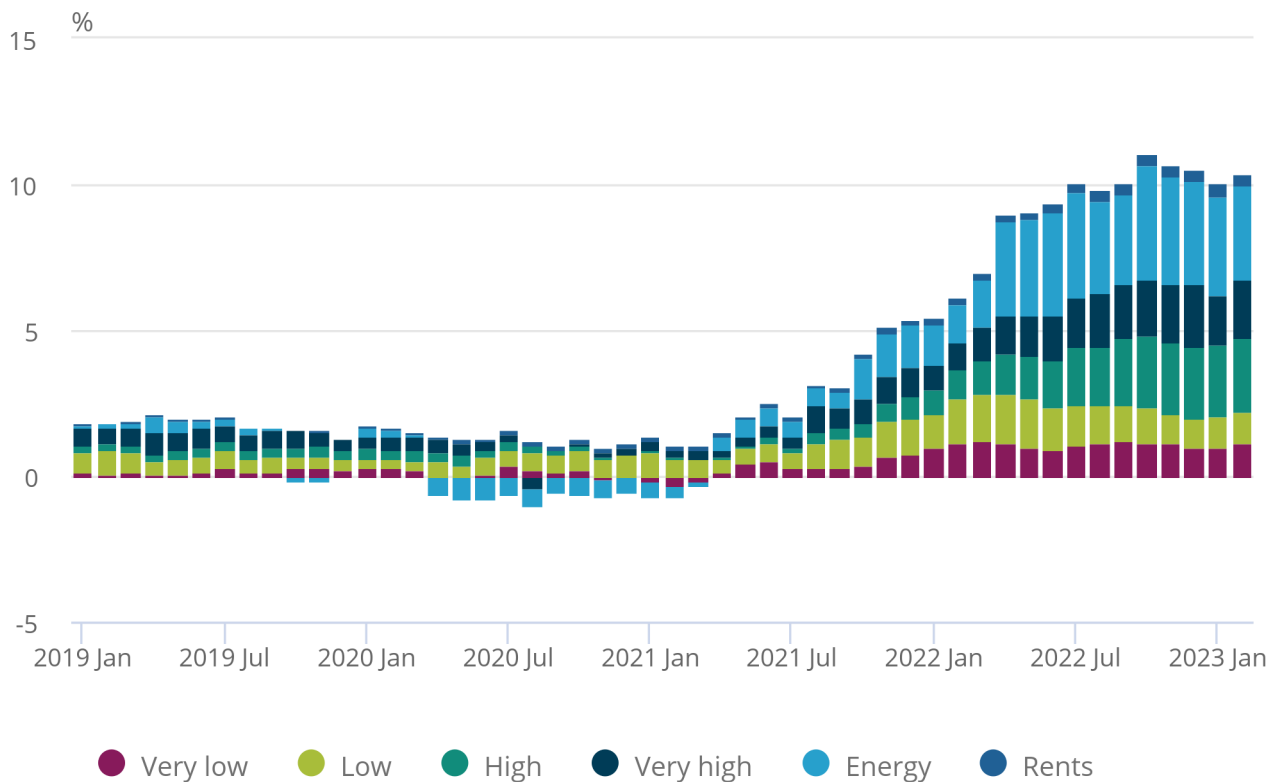
Excluding direct energy components, the "high" energy intensity components have made the largest contribution to the 12-month CPI inflation rate in recent months, as higher energy prices have pushed up the costs and prices for these components. For instance, Figure 3 shows CPI inflation increased by 10.4% in the 12 months to February 2023. Of this increase, 33% was explained by the direct energy effects. The "very high" energy intensive goods and services explained a further 20% and the "high" energy intensive goods a further 25%.

Figure 3: More than three-quarters of the 10.4% increase in CPI in February 2023 can be explained by the direct effects of energy prices and where the indirect effects are largest

Contributions to Consumer Prices Index (CPI) inflation by energy intensity, percentage points, UK, January 2019 to February 2023

Figure 3: More than three-quarters of the 10.4% increase in CPI in February 2023 can be explained by the direct effects of energy prices and where the indirect effects are largest

Contributions to Consumer Prices Index (CPI) inflation by energy intensity, percentage points, UK, January 2019 to February 2023



Source: Consumer Prices Index and Input Output Tables from the Office for National Statistics

Notes:

1. These energy intensity groups are based on broadly equal sets of CPI classes, by weight, so the “very low” category is the 25% of classes with the lowest energy intensity, the “low” category is those between the 25th and 50th percentile and so on.
2. We use the latest available CPI weights, which are for 2023. We keep the categories the same throughout the reference period. Expenditure weights are updated annually so there may be some slight variation in the classes included in each category if they were to be adjusted annually.
3. Direct energy components have been separately captured to show their direct effect. Rents are also shown separately as they have a low energy intensity but have been making increasing contributions to CPI, driven by other factors specific to the housing market. We would not expect energy prices to be a large factor in determining rental prices.

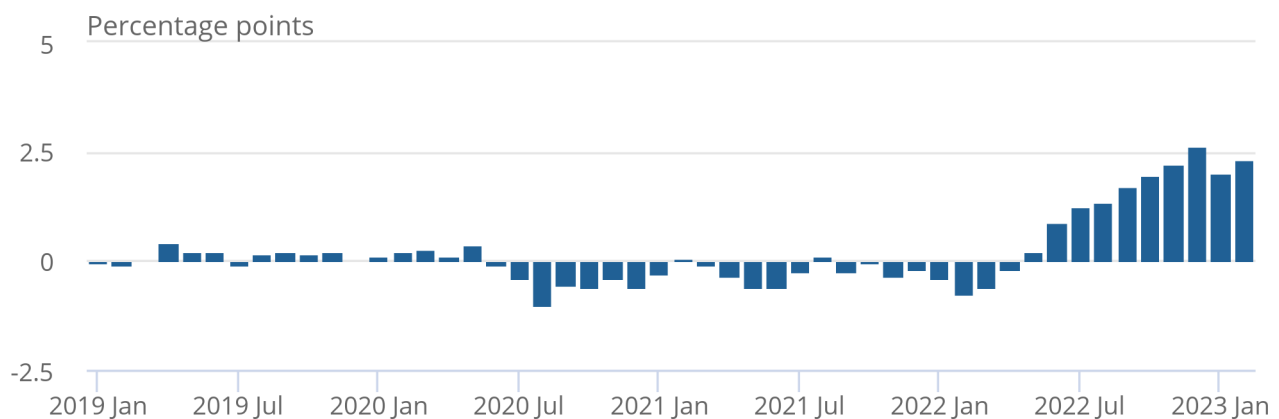
Figure 4 shows the difference in contributions to CPI between components with above average energy intensity and those with below average energy intensity. This shows that the very high and high energy intensive components have been contributing much more to the headline 12-month rate of CPI inflation over the last year, despite accounting for around the same amount of the CPI basket by weight.

Figure 4: The very high and high energy intensive components have been contributing much more to the headline 12-month rate of CPI inflation of late

Difference in contributions to Consumer Prices Index (CPI) inflation between higher and lower energy intensity, percentage points, UK, January 2019 to February 2023

Figure 4: The very high and high energy intensive components have been contributing much more to the headline 12-month rate of CPI inflation of late

Difference in contributions to Consumer Prices Index (CPI) inflation between higher and lower energy intensity, percentage points, UK, January 2019 to February 2023



Source: Consumer Prices Index and Input Output Tables from the Office for National Statistics

Notes:

1. These energy intensity groups are based on broadly equal sets of CPI classes, by weight, so the “very low” category is the 25% of classes with the lowest energy intensity, the “low” category is those between the 25th and 50th percentile and so on.
2. We use the latest available CPI weights, which are for 2023, and keep the categories the same throughout the reference period. Expenditure weights are updated annually so there may be some slight variation in the classes included in each category if they were to be adjusted annually.
3. This captures the difference in contributions to CPI between components with above average energy intensity (“very high” and “high”) and those with below average energy intensity (“low” and “very low”).

6 . Contributions to the Consumer Prices Index (CPI) by energy intensity data

[Contributions to the Consumer Prices Index \(CPI\) by energy intensity](#)

Dataset | Released 17 April 2023

CPI energy intensity of household purchases, COICOP class level categories.

7 . Data sources and quality

We estimate the total energy expenditure used in the domestic production of each product, which as a proportion of total output at basic prices gives us an estimate of the energy intensity of domestic production. This output is valued at basic prices, which is the amount a producer can obtain for a unit of output. However, we also need to account for direct imports and the energy used in the distribution and retail of consumer products to estimate the energy intensity of consumer prices.

Final consumer demand is valued in purchasers' prices, which include Distributors' Trading Margins (DTMs) and taxes and subsidies -- this is the market price of these products. DTMs are the difference between the actual price realised on a good purchased for resale and the price that would have to be paid by the distributor to replace the good at the time it is sold or otherwise disposed of. The supply and use tables (SUTs) provide estimates of these DTMs, which we use to estimate the energy intensity of distribution and retail for each product.

The Classification of Product by Activity (CPA) framework includes wholesale and retail trade services, but these are not included in the consumer prices basket as these are not purchased directly by consumers. Instead, it is built into the price of consumer products. As such, we apportion the energy expenditure of wholesale and retail trade services to the other CPA products based on their DTMs. Adding this energy expenditure to our previous values for energy used in domestic production we estimate the total energy used in domestic production and distribution of consumer products as a proportion of the total supply of products at purchasers' prices.

This provides estimates of energy intensity for 112 products on a CPA basis. To apply these values to corresponding components of the Consumer Prices Index (CPI) basket, we need to map the CPA categories to the Classification Of Individual Consumption by Purpose (COICOP) categories that underpin the CPI. We use the published [CPA-COICOP converter](#) for these purposes.

In some cases, CPA categories map across directly to the class-level COICOP categories, such as the manufacture of grain mill products, starches and starch products, which falls entirely into the COICOP class bread and cereals. In other cases, CPA categories are split across different COICOP categories, such as the manufacture of textiles, which falls into clothing materials (3%), garments (5%), other clothing and clothing accessories (12%), furniture and furnishings (5%), carpets and other floor coverings (24%), household textiles (42%) and equipment for sport and open-air recreation (9%).

8 . Related links

[Consumer price inflation, UK: February 2023](#)

Bulletin | Released 22 March 2023

Price indices, percentage changes and weights for the different measures of consumer price inflation.

[Global inflation: 1970 to 2022](#)

Article | Released 22 November 2022

Examining trends in consumer price and producer price inflation in the global economy over the last 50 years, including the main drivers and the extent of co-movements.

[The dispersion of price changes in the Consumer Prices Index: 2022](#)

Article | Released 16 March 2023

Measuring the dispersion of inflation rates across the individual goods and services that make up the Consumer Prices Index including owner occupiers' housing costs (CPIH).

[Demand and supply factors in CPI inflation, UK: 2021 to 2022](#)

Article | Released 9 March 2023

Insights into the effects of the re-opening of economies and supply bottlenecks on Consumer Prices Index (CPI) inflation in 2021 and 2022.

9 . Cite this article

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