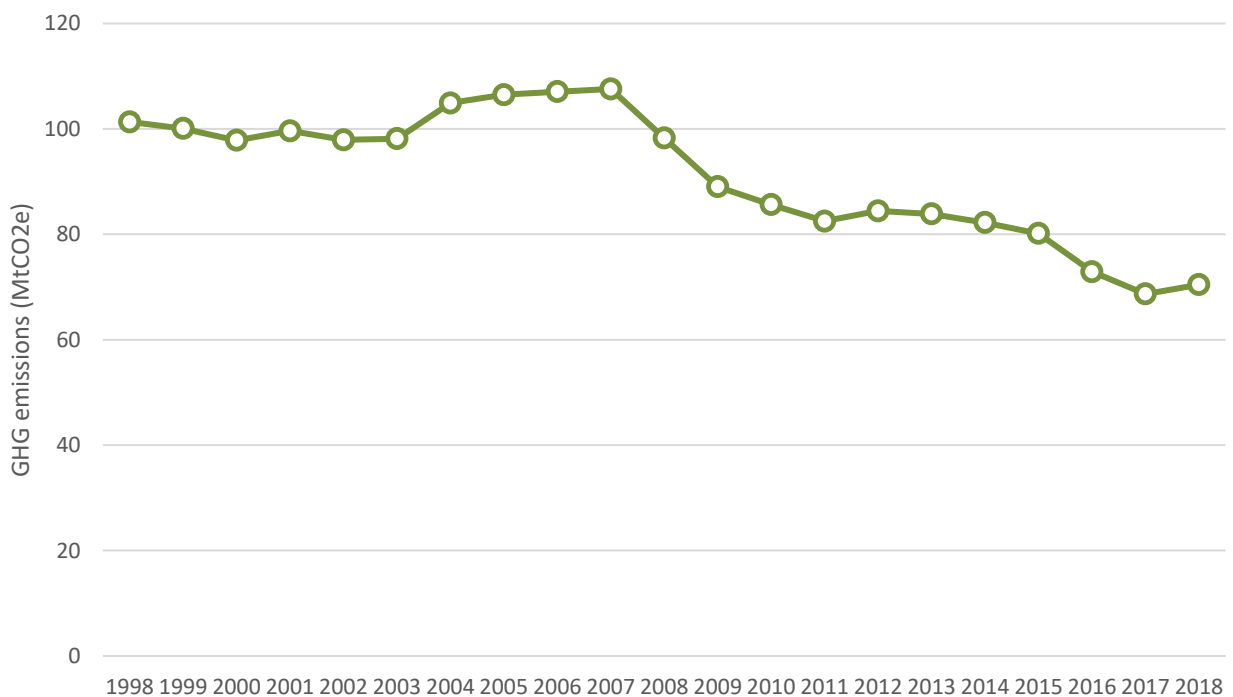


AGRICULTURE, ENVIRONMENT AND MARINE

Scotland's Carbon Footprint 1998 – 2018

Chart 1. Scotland's Carbon Footprint, 1998-2018. Values in MtCO_{2e}



Key points

- Between 2017 and 2018, Scotland's carbon footprint (emissions from all greenhouse gases) increased by 2.6 per cent from 68.7 in 2017 to 70.4 million tonnes carbon dioxide equivalent (MtCO_{2e}) in 2018.
- Between 1998 and 2017, Scotland's carbon footprint fell by 30.5 per cent, from 101.3 MtCO_{2e} in 1998 to 70.4 MtCO_{2e} in 2018.
- Scotland's carbon footprint rose from 2004 onwards to a peak of 107.6 MtCO_{2e} in 2007 before falling sharply in the following years (coinciding with the recession) and, with the exception of 2012 and 2018, has fallen each subsequent year. The overall reduction between the 2007 peak and 2018 is 34.5 per cent.

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Acknowledgements

We would like to thank John Barrett, Anne Owen and Jonathan Norman of the Sustainability Research Institute (SRI) at Leeds University for their invaluable support in compiling the figures and for continually improving the methodologies and data used in the Scottish Carbon Footprint statistics release.

What is Scotland’s Carbon Footprint?

Scotland’s Carbon Footprint refers to estimates of Scotland’s greenhouse gas emissions on a consumption basis. This refers to greenhouse gas emissions which are associated with the spending of Scottish residents on goods and services, wherever in the world these emissions arise together with emissions directly generated by Scottish households, through private heating and motoring. These greenhouse gas emissions are often referred to as “consumption emissions” to distinguish them from estimates relating to the emissions “produced” within a country’s territory or economic sphere. Scotland’s Carbon Footprint is also sometimes referred to as its Consumption Based Account. Information on the different reporting bases can be found in the section Comparison of Scotland’s carbon footprint and its territorial emissions within this publication.

To find out what effect Scottish consumption has on greenhouse gas emissions we need to take into account where the goods we buy come from and their associated supply chains. More information on the methods used can be found in the section “How has Scotland’s Carbon Footprint been calculated?”

The carbon footprint of Scotland includes the six main greenhouse gases including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and fluorinated compounds (hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride). Unless otherwise specified, these emissions are presented in this publication in units of million tonnes of carbon dioxide equivalent (MtCO₂e)¹.

This statistical report meets the requirements under Section 37 of the Climate Change (Scotland) Act 2009 and is used to inform the Scotland Performs National Indicator 47: Reduce Scotland's Carbon Footprint

- Scotland’s greenhouse gas emissions can be broken up into three main categories: emissions embedded in imported goods and services, those embedded in UK produced goods and services and those directly produced by Scottish residents, through activities such as heating and motoring. More information on these categories can be found in the section “Breakdown of Scotland’s Carbon Footprint 1998-2018”.
- Whilst Scotland’s carbon footprint has fallen by 30.5 per cent between 1998 and 2018, equivalent greenhouse gas emissions on a territorial basis have fallen by 41.3 per cent over the same time period².
- Similarly, Scotland’s carbon dioxide footprint is measured on the same basis as the carbon footprint although it relates only to carbon dioxide (CO₂) emissions. Scotland’s carbon dioxide footprint decreased by 25.3 per cent between 1998 and 2018 whilst reaching its peak in 2007.

Since 1990, the UK’s economy has continued to shift from manufacturing to having a greater reliance upon the services sector. One of the consequences of this is that more of the goods we buy and use are now produced outside Scotland and the rest of the UK. The current data in this publication breaks down greenhouse gas emissions into those generated by households and businesses, those produced in the UK and imports from a number of global countries and regions.

¹ Carbon dioxide equivalent is a measure used to compare the emissions from various greenhouse gases on the basis of their global warming potential by converting amounts of other gases to the equivalent amount of carbon dioxide based on their global warming potential. Global warming potential describes the relative potency, molecule for molecule, of a greenhouse gas, taking account of how long it remains active in the atmosphere.

² Scottish Greenhouse Gas Emissions 2019

Inherently the greenhouse gas emissions relating to the overseas production of imports to Scotland are not as easily measured as emissions generated within Scotland's borders. There are general conventions on how to do this, using shares of production based on financial data, but the results cannot be viewed as being as robust as the estimates of greenhouse gas emissions generated domestically. The methodology and data for calculating these emissions resulting from imports have been revised since the last release. More information can be found in the revisions section of the publication.

Breakdown of Scotland's Carbon Footprint, 1998-2018

Table 1 outlines how the Carbon Footprint has been categorised for this publication.

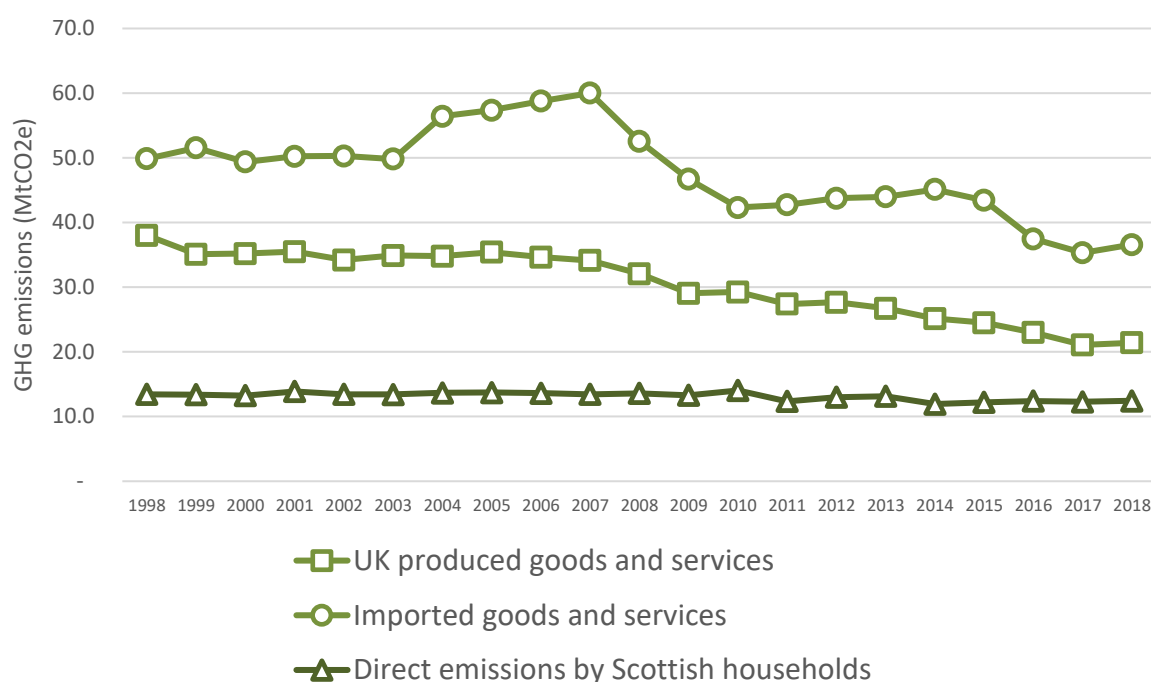
Table 1. Categorisation of Scotland's Carbon Footprint

Main Category	Activity	Description
Greenhouse Gas Emissions from UK Produced Goods and Services	Scottish consumption of UK production	UK production emissions attributable to Scottish final consumption, including manufacturing and transport, international aviation and shipping provided by Scottish operators.
Greenhouse Gas Emissions Embedded in Imported Goods and Services – By Region of Import <ul style="list-style-type: none"> • EU • China • Middle East • Africa • USA • India • Russia • Rest of world 	Imports used by UK businesses for Scottish consumption	Greenhouse Gas Emissions associated with the production of imports which are used by UK industry and attributable to Scottish final consumption
	Imports directly used by Scottish consumers	Greenhouse Gas Emissions associated with the production of imports which are used by Scottish final consumers
Greenhouse Gas Emissions Directly Produced By Scottish Residents	Private motoring	Greenhouse Gas Emissions generated directly by households through private motoring.
	Household heating	Greenhouse Gas Emissions arising from households' use of fossil fuels for heating, households use of aerosols, etc.

Chart 2 shows Scotland's carbon footprint, broken down into three main components, from 1998 to 2018.

- Greenhouse gas emissions embedded in imported goods and services from overseas. These accounted for 51.9 per cent of Scotland's carbon footprint in 2018; up from 49.2 per cent in 1998.
- Greenhouse gas emissions embedded in UK produced goods and services. These accounted for 30.4 per cent of Scotland's carbon footprint in 2018; down from 37.5 per cent in 1998.
- Greenhouse gas emissions directly produced by Scottish residents. These account for 17.7 per cent of Scotland's carbon footprint in 2018; up from 13.3 per cent of total consumption-based emissions in 1998.

Chart 2. Scotland's Carbon Footprint, by main component, 1998 to 2018.
Values in MtCO₂e



Additionally, Chart 2 shows that:

- Greenhouse gas emissions associated with imported goods and services increased from 49.9 MtCO₂e in 1998 to their peak of 60.0 MtCO₂e in 2007 (an increase of 20.3 per cent over this time period). These emissions accounted for 55.8 per cent of Scotland's carbon footprint in 2007.
- Between 2007 and 2018, greenhouse gas emissions embedded in imported goods and services fell by 39.0 per cent; this compares with a 26.6 per cent reduction in emissions embedded in imports over the whole time period from 1998 to 2018.
- Greenhouse gas emissions relating to the consumption of UK produced goods and services by Scottish residents fell from 38.0 MtCO₂e in 1998

to 21.4 MtCO_{2e} in 2018 – a fall of 43.7 per cent. There was a year-on-year fall in greenhouse gas emissions from this category over the majority of years in the time period.

- Greenhouse gas emissions generated directly by Scottish residents have fallen from 13.5 MtCO_{2e} in 1998 to 12.4 MtCO_{2e} in 2018 – a fall of 7.5 per cent over this time period.

Chart 3 shows the change in the components of Scotland's carbon footprint. In total, the carbon footprint fell by 30.9 MtCO_{2e} (30.5 per cent) between 1998 and 2018.

Chart 3. Change in Scotland's Carbon Footprint between 1998 and 2018 - in MtCO_{2e}, and percentage changes

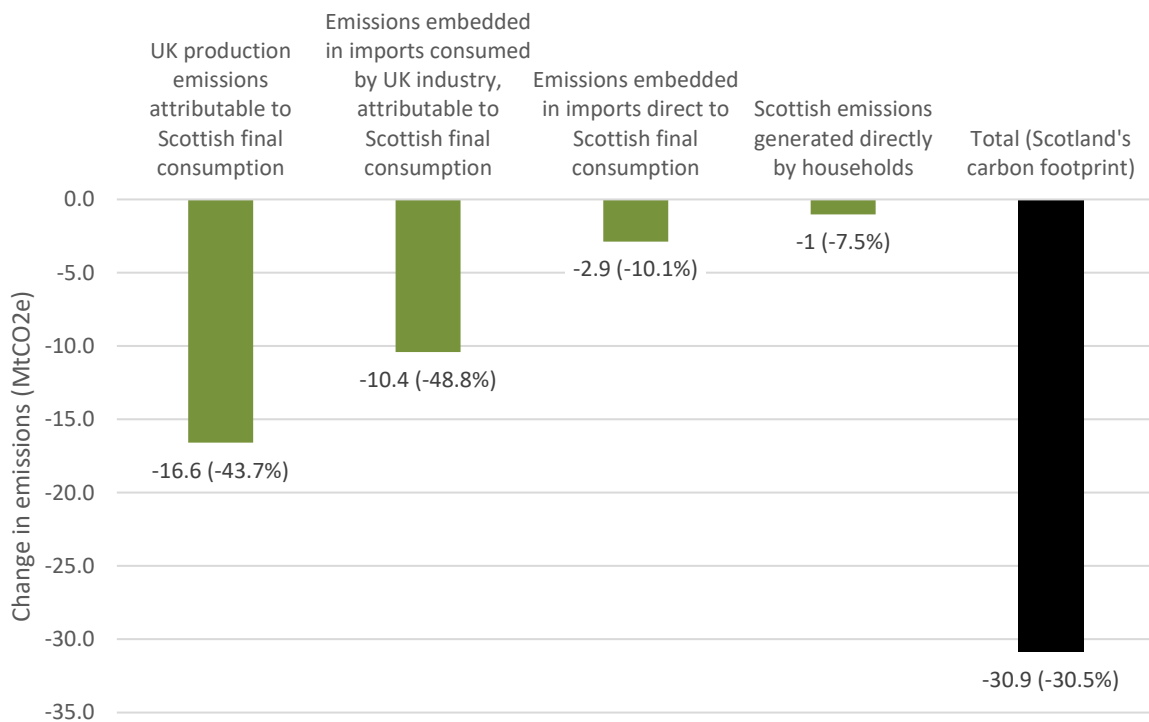


Chart 3 shows that between 1998 and 2018:

- Greenhouse gas emissions from Scottish consumption of UK production have seen the greatest absolute reduction over this time period (16.6 MtCO_{2e}; a 43.7 per cent reduction), reflecting the emissions-reduction in territorial emissions seen in the Scotland and the rest of the UK over this period.
- Greenhouse gas emissions embedded in imports directly used by Scottish consumers have reduced by 2.9 MtCO_{2e} (a 10.1 per cent reduction).
- Emissions embedded in imports used by UK businesses for Scottish consumption have decreased by 10.4 MtCO_{2e} (a 48.8 per cent decrease).

- Greenhouse gas emissions generated directly by households (via heating and personal transport) have decreased by 1.0 MtCO₂e (a 7.5 per cent reduction).

Chart 4 shows how Scotland's carbon footprint has changed from its peak in 2007 to 2018. Scotland's carbon footprint has fallen by 37.1 MtCO₂e (34.5 per cent) over this time period.

Chart 4. Change in Scotland's Carbon Footprint between 2007 and 2018 - in MtCO₂e, and percentage changes

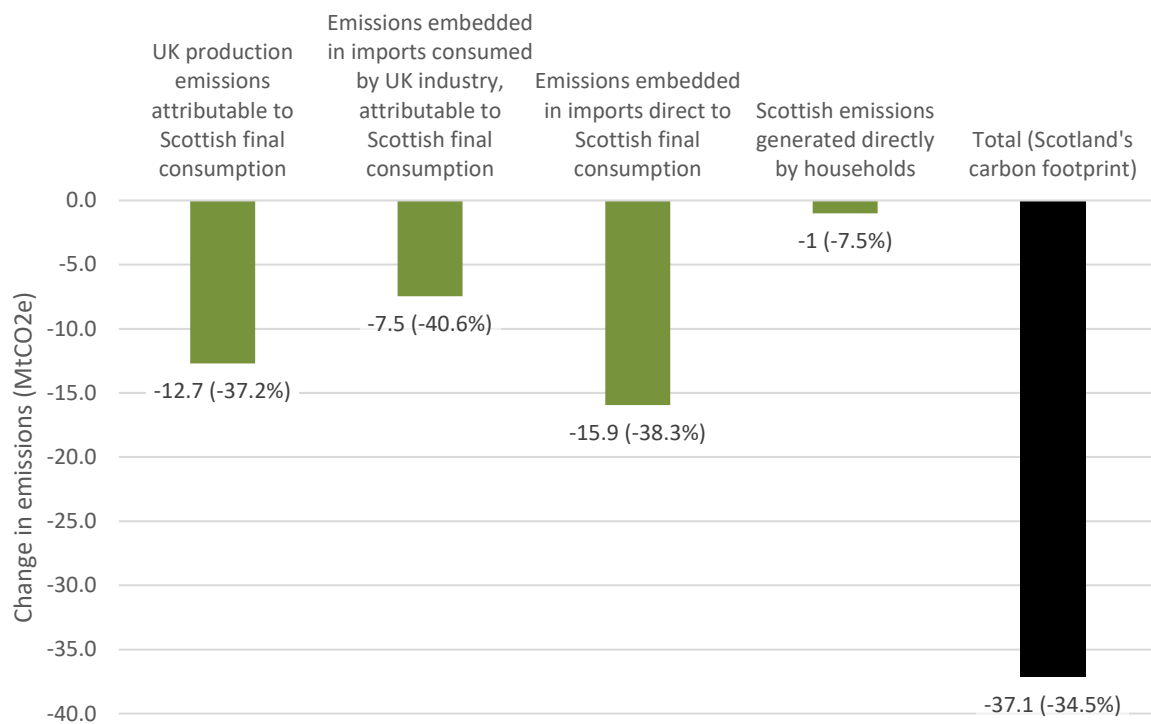


Chart 4 also shows that between 2007 and 2018:

- Greenhouse gas emissions embedded in Scottish consumption of imports fell by the greatest amount in absolute terms (a reduction of 15.9 MtCO₂e; 38.3 per cent).
- Emissions associated with Scottish consumption of UK produced goods and services decreased by 12.7 MtCO₂e (a fall of 37.2 per cent).
- Emissions embedded in imports used by UK businesses for Scottish consumption decreased by 7.5 MtCO₂e (a fall of 40.6 per cent).
- Greenhouse gas emissions directly emitted by Scottish households have seen smaller reductions of 1.0 MtCO₂e (a fall of 7.5 per cent).

Chart 5 shows that Scotland's carbon footprint rose by 1.8 MtCO₂e (2.6 per cent) in the latest year.

Chart 5. Change in Scotland's Carbon Footprint between 2017 and 2018 - in MtCO₂e, and percentage changes

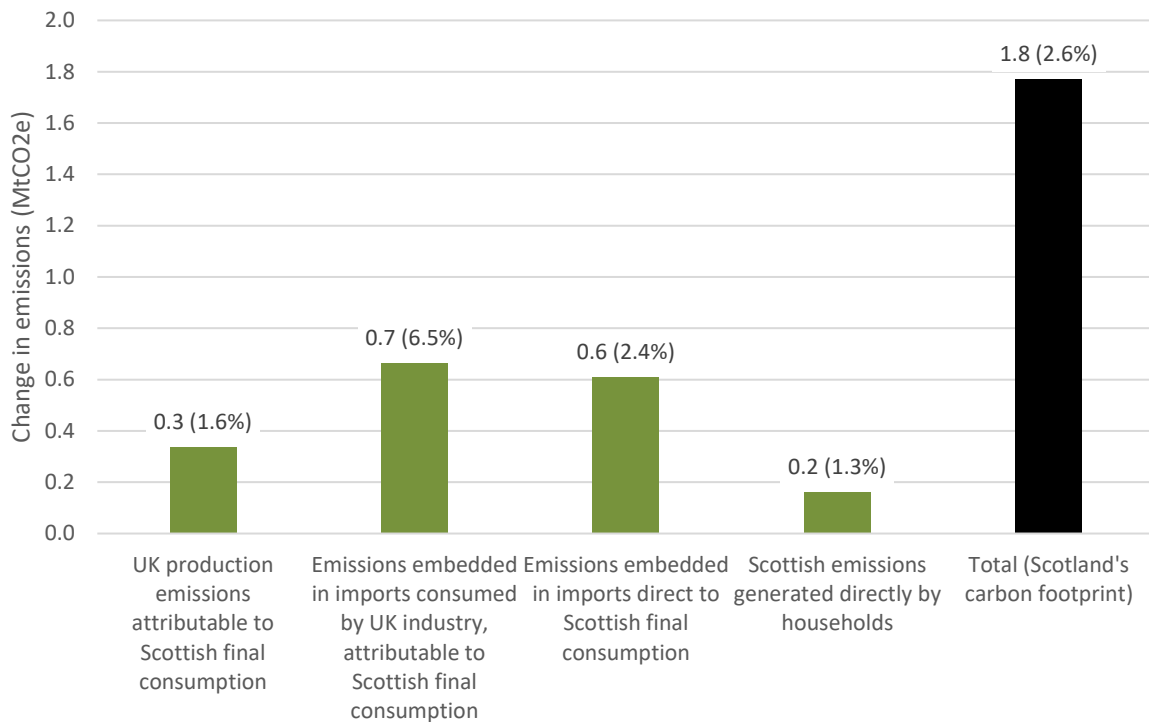


Chart 5 also shows that between 2017 and 2018, all emissions components of Scotland's carbon footprint rose to some degree:

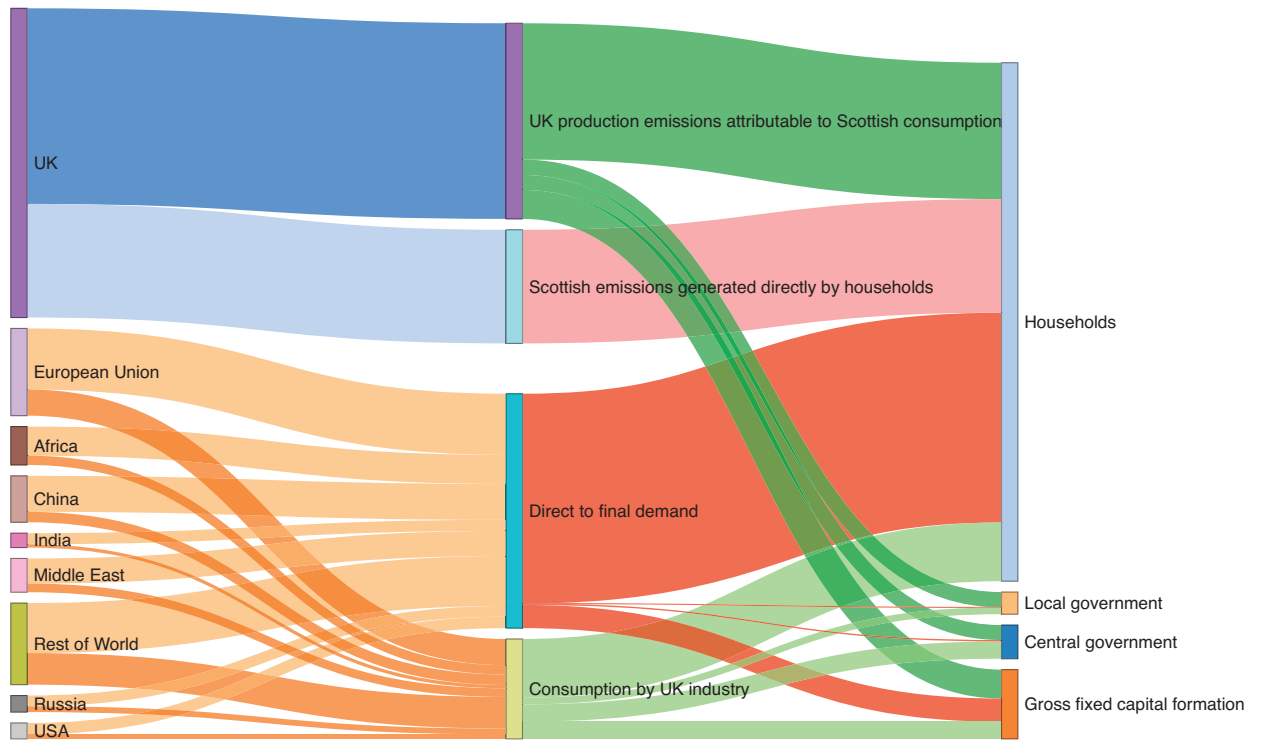
- Emissions embodied in Scottish consumption of UK production rose by 0.3 MtCO₂e (1.6 per cent).
- Embedded emissions in imports directly consumed in Scotland rose by 0.6 MtCO₂e (2.4 per cent).
- Emissions embedded in imports used by UK businesses for Scottish consumption also increased by 0.7 MtCO₂e (6.5 per cent).
- There was a relatively minor increase in the level of emissions directly generated by Scottish households of 0.2 MtCO₂e (1.3 per cent).

Figure 1 below shows all flows of embedded emissions from country of origin to their final consumption sector, and the route taken, for 2018. The diagram shows that:

- Almost half of embedded emissions associated with the consumption of goods and services in Scotland, originate from the UK.
- Imported emissions account for a slight majority of total consumption-based emissions with the European Union and Rest of World (excluding other named areas) being the largest sources.
- A substantial majority of imported emissions are directly "consumed" by Scottish households and other final demand sectors.

- There is a slightly greater tendency for embedded emissions originating from the EU and rest of world to be initially consumed by UK industry (e.g. as raw materials or components), before flowing to final consumers.

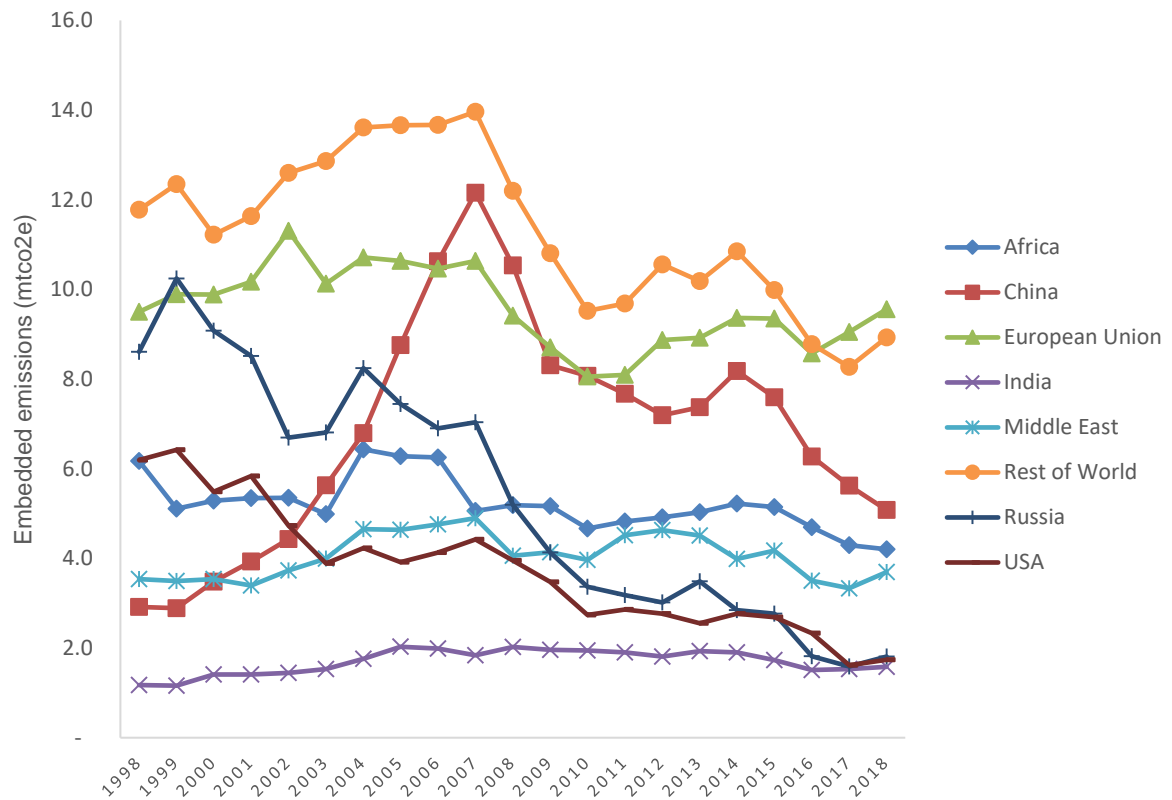
Figure 1. Sankey diagram of embedded emissions sources related to Scottish final consumption in 2018.



Additionally, figure 1 above shows that households account for the overwhelming majority (around 80 per cent) of consumption-based emissions. With capital investment and other types of capital formation accounting for around a further 10 per cent of total consumption-based emissions.

Chart 6 presents a breakdown of Scotland's embedded greenhouse gases by region of import over time.

Chart 6. Breakdown of Scotland’s embedded greenhouse gas emissions by region of import, 1998 to 2018. Values in MtCO_{2e}

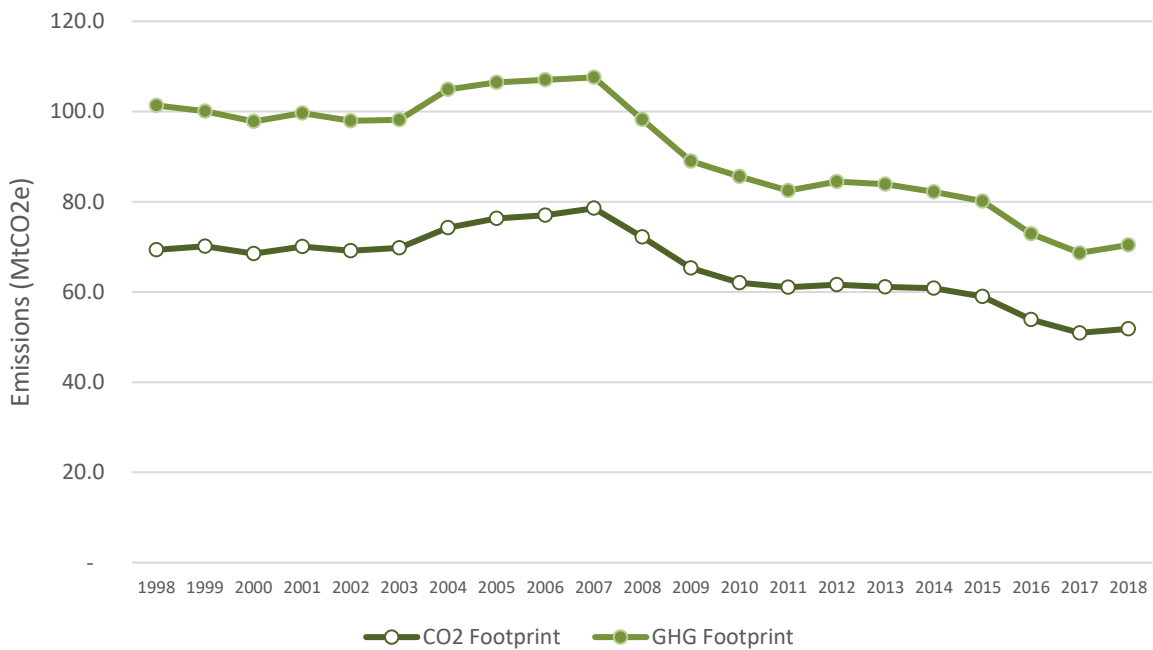


- The most striking aspect of the above chart relates to the very rapid increase in embedded emissions from China between 1999 and 2007, followed by a rapid reduction in the years immediately afterward until 2012. Since 2014, these emissions have decreased consistently each year and have reduced by 74 per cent since 1998.
- Consumption emissions from Rest of world shows a similar pattern although less pronounced pattern, to China; again peaking in 2007 before the recession in 2008.
- Embedded emissions originating from Russia and the USA have shown considerable year-on-year volatility although they have shown a generally reducing trend across the time-series and have reduced by 79 per cent (Russia) and 72 per cent (USA) since 1998.
- Embedded emissions originating from India and the Middle-East are the only regions to show increased emissions over the period 1998-2018.

Contribution of carbon dioxide (CO₂) emissions to Scotland's carbon footprint

CO₂ is the main greenhouse gas in Scotland's carbon footprint. It accounted for 73.5 per cent of Scotland's total carbon footprint in 2018, up from 68.5 per cent in 1998. Between 2017 and 2018, Scotland's carbon dioxide footprint from all sources increased by 1.7 per cent.

Chart 7. Scottish Carbon Footprint. Comparison of Carbon and CO₂ footprint. Values in MtCO₂e



Data tables

Table 2. Detailed breakdown of Scotland's carbon footprint, 1998 and 2005 to 2018. Values in MtCO_{2e}

Main Category	Activity	1998	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
TOTAL - SCOTLAND'S CARBON FOOTPRINT		101.3	106.5	107.0	107.6	98.2	89.0	85.6	82.5	84.4	83.9	82.2	80.2	72.9	68.7	70.4
Emissions from UK Produced Goods and Services	Scottish consumption of UK production	38.0	35.4	34.6	34.1	32.1	29.1	29.3	27.4	27.7	26.7	25.1	24.5	23.0	21.1	21.4
Emissions Embedded in Imported Goods and Services	Imports used by UK businesses for Scottish consumption	21.3	17.6	18.1	18.4	16.4	14.9	13.4	13.8	14.6	15.3	14.8	13.8	11.6	10.3	10.9
	Imports directly used by Scottish consumers	28.5	39.7	40.7	41.6	36.1	31.8	28.9	29.0	29.2	28.7	30.4	29.6	25.9	25.0	25.7
Emissions Directly Produced By Scottish Residents	Private motoring	5.1	5.7	5.8	5.8	5.7	5.6	5.4	5.3	5.4	5.4	5.3	5.3	5.4	5.4	5.3
	Household heating	8.3	8.1	7.9	7.6	7.9	7.7	8.6	7.0	7.7	7.8	6.6	6.9	7.0	6.9	7.1

Data for years 1999-2004 are available in the spreadsheet accompanying this publication

Table 3. Breakdown of Scotland’s embedded greenhouse gas emissions by region of import, 1998 and 2005 to 2018.
Values in MtCO₂e

Region of import	1998	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
TOTAL IMPORTS	49.9	57.4	58.8	60.0	52.6	46.7	42.3	42.7	43.8	44.0	45.1	43.4	37.5	35.3	36.6
Africa	6.2	6.3	6.3	5.1	5.2	5.2	4.7	4.8	4.9	5.0	5.2	5.1	4.7	4.3	4.2
China	2.9	8.8	10.6	12.2	10.5	8.3	8.1	7.7	7.2	7.4	8.2	7.6	6.3	5.6	5.1
European Union	9.5	10.6	10.5	10.6	9.4	8.7	8.1	8.1	8.9	8.9	9.4	9.4	8.6	9.1	9.6
India	1.2	2.0	2.0	1.8	2.0	2.0	1.9	1.9	1.8	1.9	1.9	1.7	1.5	1.5	1.6
Middle East	3.5	4.6	4.8	4.9	4.1	4.1	4.0	4.5	4.6	4.5	4.0	4.2	3.5	3.3	3.7
Rest of World	11.8	13.7	13.7	14.0	12.2	10.8	9.5	9.7	10.6	10.2	10.8	10.0	8.8	8.3	8.9
Russia	8.6	7.4	6.9	7.0	5.2	4.1	3.4	3.2	3.0	3.5	2.8	2.8	1.8	1.6	1.8
USA	6.2	3.9	4.1	4.4	3.9	3.5	2.7	2.9	2.8	2.5	2.8	2.7	2.3	1.6	1.7

Data for years 1999-2004 are available in the spreadsheet accompanying this publication

Table 4. Comparison of Scotland's carbon footprint and carbon dioxide footprint, 1998 and 2005 to 2018. Values in MtCO₂e

Year	1998	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carbon footprint (MtCO ₂ e)	101.3	106.5	107.0	107.6	98.2	89.0	85.6	82.5	84.4	83.9	82.2	80.2	72.9	68.7	70.4
Carbon dioxide footprint (MtCO ₂)	69.4	76.3	77.0	78.5	72.2	65.3	62.1	61.0	61.6	61.1	60.8	59.0	53.9	50.9	51.8

Data for years 1999-2004 are available in the spreadsheet accompanying this publication

How has Scotland's Carbon Footprint been calculated?

Step 1. Develop an Input-output (IO) model

Input-output models are used by environmental researchers to make the link between the environmental impacts associated with production techniques and the consumption of products. The Leontief Input-Output model is constructed from economic data and shows the interrelationships between the industries that produce goods (outputs) and those that consume goods (inputs) from other industries in the process of making their own product. Further information on the Input-Output (IO) model and a User Guide can be found on the [Input-Output](#) webpages of the Scottish Government website.

Within the IO model, greenhouse gas emissions are reallocated from the industries that produce them to the final consumption activities that are assumed to ultimately have been their drivers. The emissions of each industry required in the production of a product are reallocated to the demand of this product, rather than the supply. In other words, we can show the greenhouse gas emissions associated with consumption. Adding an exogenous environmental variable to an IO framework produces an Environmentally Extended Input-Output model (EEIOM). The Greenhouse Gas model, also known as a Carbon Footprint, is one such example of a model.

Step 2. Develop a Multi-Regional Input-Output (MRIO) model

The University of Leeds has been contracted by the Scottish Government to provide estimates of Scotland's carbon footprint. The project updates previous work carried out by the Stockholm Environment Institute (SEI) published by the Scottish Government in 2009. A Multi-Regional Input-Output (MRIO) model allows the greenhouse gas emissions embodied to be estimated within traded goods and services. An MRIO model is used to link the flows of goods and services described in monetary terms, with the greenhouse gas emissions generated in the process of production.

Data relating to pre-1998 were assessed as being less reliable and consequently the time series used for this release is limited to 1998-2018. The system assumes a linear relationship between greenhouse gas emissions and changes in final demand, meaning that if all final demand doubled for a particular commodity, emissions would double too.

Step 3. Develop UK Based MRIO Model

In 2012, researchers from the Sustainable Research Institute at the University of Leeds constructed a UK MRIO model for DEFRA. The model uses the Office for National Statistics UK supply and use tables in 106 sectors and data from the Eora MRIO to trace the trade with a number of identified regions in the rest of the World to complete the MRIO. In the latest release, the number of regions identified has been substantially increased over previous releases.

Step 4. Develop the Scottish Consumption Based Account (the Scottish Carbon Footprint)

To calculate a consumption based account for Scotland, we use the UK MRIO model and replace the UK final demand with the Scottish final demand taken from the Scottish Input-Output tables.

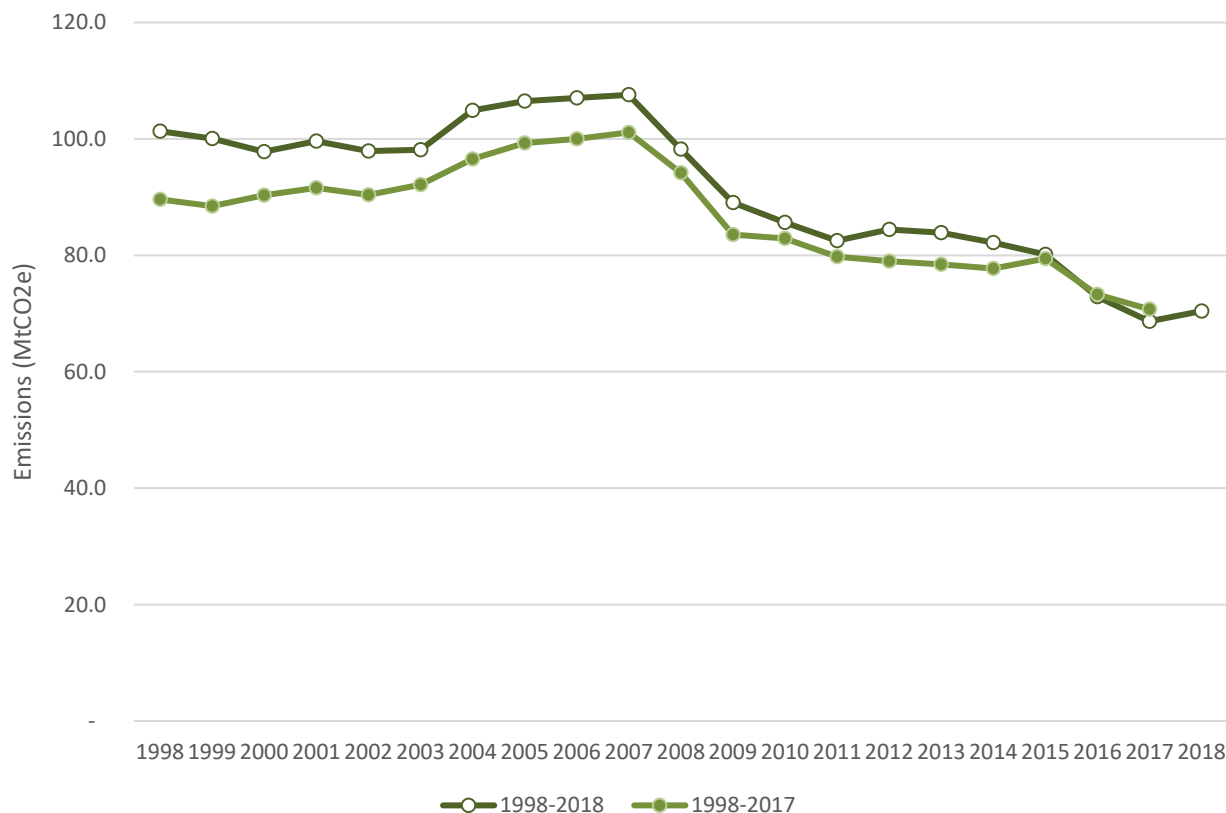
The consumption based account also contains data on direct greenhouse gas emissions from households and is broken down into those from home heating and travel. Data from the UK Environmental Accounts produced by the Office for National Statistics at a UK level have been used to calculate residential heating and private motoring consumption based emissions. Scotland's share of these UK greenhouse gas emissions are calculated using data from the National Atmospheric Emissions Inventory website.

Revisions since the previous Carbon Footprint for Scotland

There have been nine releases of the model used to estimate Scotland's Carbon Footprint.

Chart 8 shows the differences between the 2017 and 2018 releases of the carbon footprint. Revisions to previously published estimates in this release mainly relate to the earlier part of the time-series. These higher emissions are due to the increased sectoral disaggregation of the latest model. In particular the separation of mining of metal ore and mining of crude petroleum and natural gas is an important improvement. These two sectors have significantly different impacts per unit of economic output, with the mining of crude petroleum and natural gas having the higher emissions intensity. When the sectors are combined, as in previous releases, the intensity of the combined sector is much too small for use with petroleum heavy goods. This means that for certain products, where petroleum is used in their manufacture (as an energy source or feedstock), their footprints will have previously been underestimated. Conversely for products which use significant ore in their manufacture previous footprints will have been overestimated.

Chart 8. Scotland's Carbon Footprint. Comparison of 1990-2017 and 1990-2018 series. Values in MtCO₂e



Revisions between the 1990-2012 and 1990-2018 publications

Since the carbon footprint was first published, successive releases have used different versions of the UK MRIO model. The 2012 release used a 2-region model which only distinguished the UK and the Rest of the World as trade regions. The 2013, 2015 and 2016 releases used a four region model, distinguishing imports from Europe, China and the Rest of World, using trade data from the Eora global MRIO. The 2017, 2018 and 2019 model adopted the same four regions but used trade data from the EXIOBASE MRIO. In this release, the UK MRIO model uses a 15 region configuration although this has been collapsed to a degree in the publication for clarity. The full 15 region detail is provided in a spreadsheet which accompanies this publication.

Comparison of Scotland's carbon footprint and its territorial emissions

In addition to Scotland's carbon footprint, Scotland's carbon emissions are measured on a territorial basis. The different bases should be viewed as complementary ways of accounting for carbon emissions.

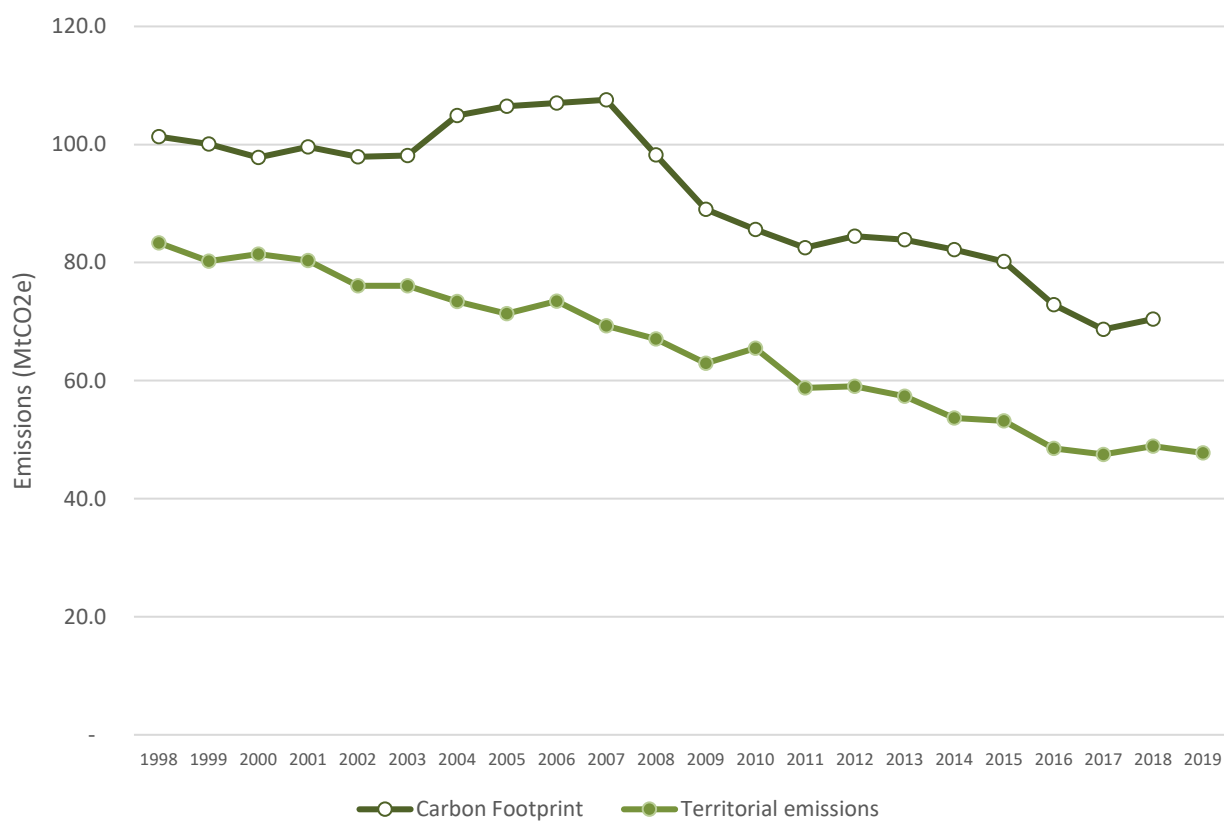
What are Territorial Emissions?

Territorial greenhouse gas emissions are those which occur within a country's or region's borders. The Scottish Government publishes emissions on a territorial basis from the Scottish greenhouse gas inventory as part of the Official Statistics publication [Scottish Greenhouse Gas Emissions 2019](#). The Scottish greenhouse gas inventory measures greenhouse gas emissions on a territorial basis, so only includes emissions within Scottish borders, though it also includes estimates of greenhouse gas emissions from international aviation and shipping. The inventory also includes emissions and removals resulting from land use, land use change and forestry, which have been removed from the Carbon Footprint. Data from the Scottish Greenhouse Gas Inventory are used for reporting progress against the [Climate Change \(Emissions Reduction Targets\) \(Scotland\) Act 2019](#) and for progress against the [Scottish Government's Sustainability Purpose Target](#).

The Scottish greenhouse gas inventory is a disaggregation of the UK's greenhouse gas inventory, which is used for reporting UK emissions to the EC and United Nations Framework Convention on Climate Change (UNFCCC). The [National Atmospheric Emissions Inventory](#) website contains direct comparisons between the Scottish and UK greenhouse gas inventory.

Chart 9 shows the relationship between the two different measures of greenhouse gas emissions relating to Scotland. The carbon footprint is notably bigger due to the impact of embedded greenhouse gas emissions from imports. Whilst the carbon footprint has fallen by 32.2 per cent between 1998 and 2018, equivalent greenhouse gas emissions on a territorial basis have fallen by 43.0 per cent over the same time period.

Chart 9. Comparison of Scotland's Carbon Footprint with its territorial greenhouse gas emissions: 1998 to 2018/19. Values in MtCO₂e



Emissions-intensities by product (Experimental Statistics)

All results in this section are designated as experimental statistics. These are defined as new official statistics undergoing development and testing. The methods, data sources and results in this section are open for ongoing consultation with users, and we welcome feedback on all aspects of the statistics. All users should be aware that the results in this section are provisional and will be revised and updated when further developments are made. They should therefore be used with appropriate caution at this time. We welcome any thoughts or views on this analysis, including intended uses and alternative presentations by users. Please contact andrew.mortimer@gov.scot

Introduction

This section introduces two conceptually similar measures of emissions-intensity, i.e. Kilogrammes of embodied emissions per pound (£ GBP) of final demand expenditure. These are currently called Total Impact Multipliers, and Conversion Factors and each has its own benefits and weaknesses depending on their use.

Conversion Factors

The main benefits of this measure are:

1. The classification system used in the Conversion Factors better aligns to expenditure items that households buy. For example, rather than 'wearing apparel' the COICOP³ system has categories for garments, accessories and haberdashery.
2. Conversion Factors allow users to work with the actual prices of products as bought from shops, including any taxes, duties and retail & wholesale margins. The conversion factors are developed by calculating the emissions by COICOP category and then dividing by the annual spend on products according to the Living Costs and Food Survey 2018.

The key weakness of the Conversion Factors is that they are not presented by 'country of final assembly'.

Total Impact Multipliers (TIMs)

In contrast to Conversion Factors, Total Impact Multipliers have the key benefit of providing separate emissions-intensities for goods and services produced in each region (UK / EU27 / China / Middle East / Africa / USA / Rest of World). However, the denominator used in TIMs is valued in basic prices. As a result, users will need to adjust these values for retail and wholesale mark-ups and apply any taxes &

³ Classification of individual consumption by purpose (COICOP)

duties that may apply. The TIMs do however allow consideration of instances where buying locally produced goods and services would reduce global emissions. Additionally, TIMs potentially have a role in industrial policy by allowing consideration of the wider impacts of offshoring production (and emissions) currently taking place in the UK.

Results

The following section presents the most polluting goods and services for all greenhouse gases in terms of Kg of CO₂ equivalent per £GBP in the latest year (2018). Emissions-intensities for all goods and services can be obtained in an accompanying spreadsheet (see “supporting files” section on the web-page for this release).

Chart 10. Conversion Factors: top 20 emissions intensities by product, 2018

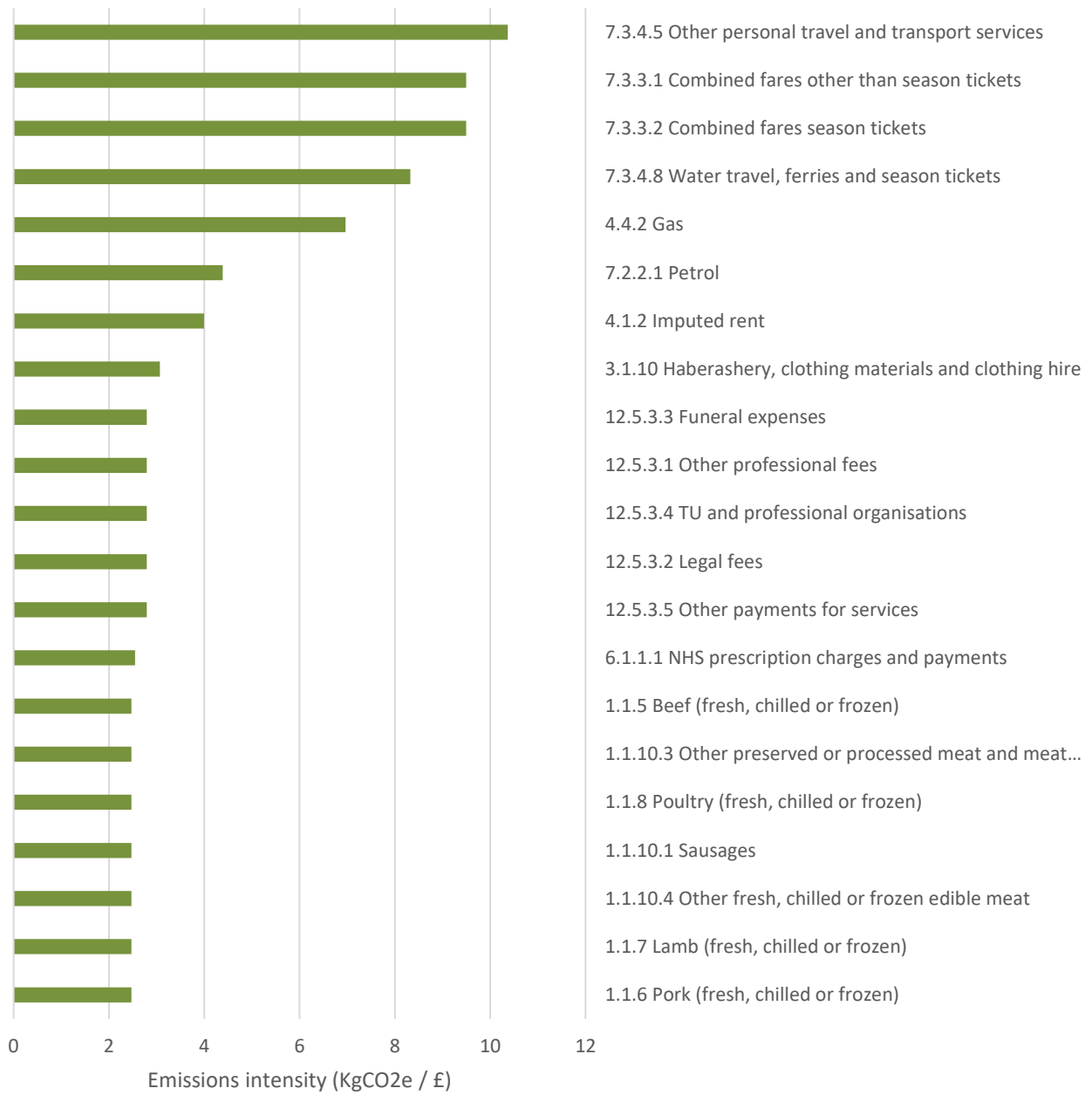
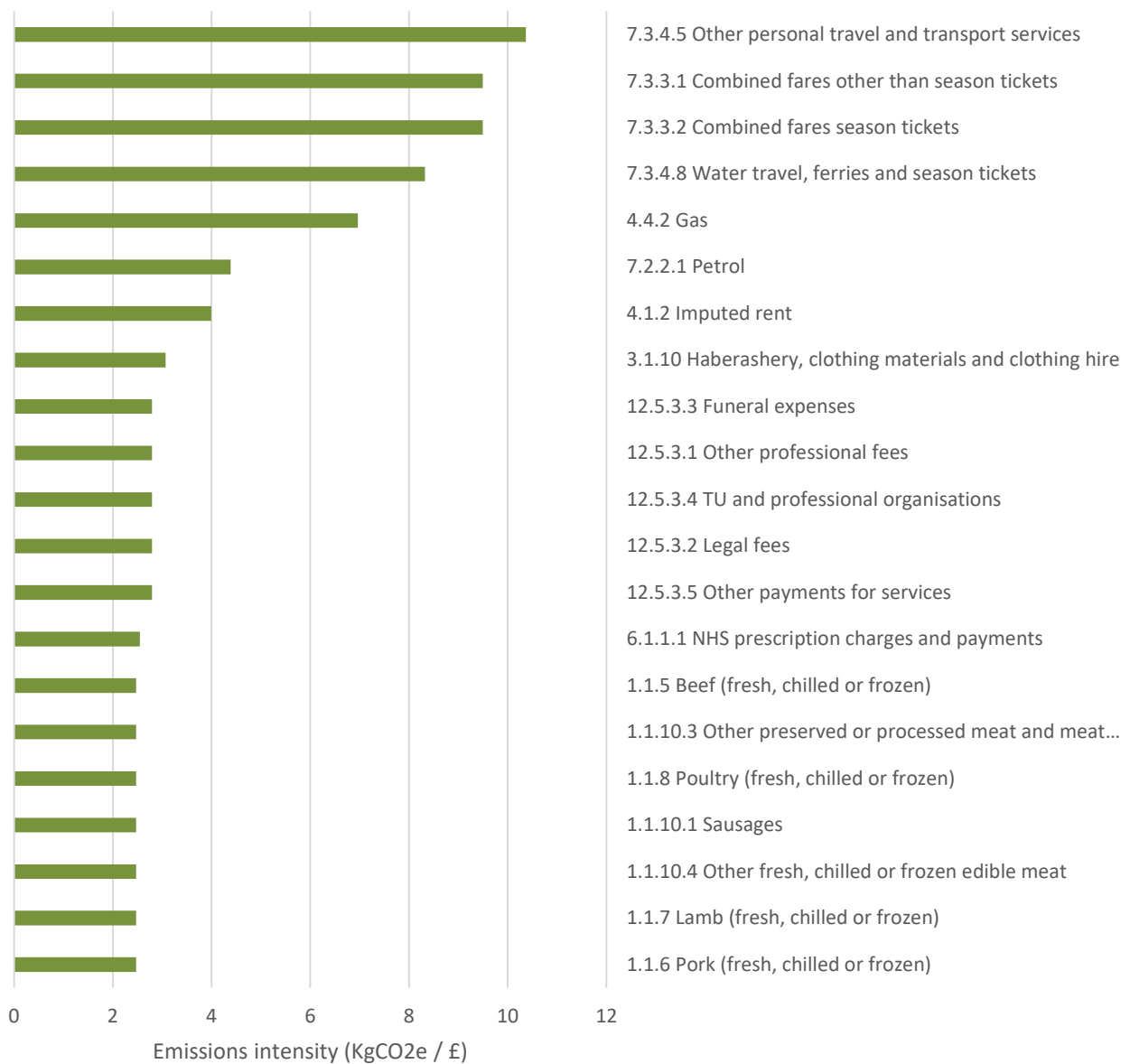


Chart 11. Total Impact Multiplier (UK): top 20 emissions intensities by product, 2018



The accompanying spreadsheet to this publication provides a fine breakdown of Total Impact Multipliers for a range of individual countries and geographical regions.

Energy footprint for Scotland (Experimental Statistics)

All results in this section are designated as experimental statistics. These are defined as new official statistics undergoing development and testing. The methods, data sources and results in this section are open for ongoing consultation with users, and we welcome feedback on all aspects of the statistics. All users should be aware that the results in this section are provisional and will be revised and updated when further developments are made. They should therefore be used with appropriate caution at this time. We welcome any thoughts or views on this analysis, including intended uses and alternative presentations by users. Please contact andrew.mortimer@gov.scot

Chart 12. Scotland's energy footprint by origin, 2018. Values in thousand tonnes of oil equivalent (KtOe).

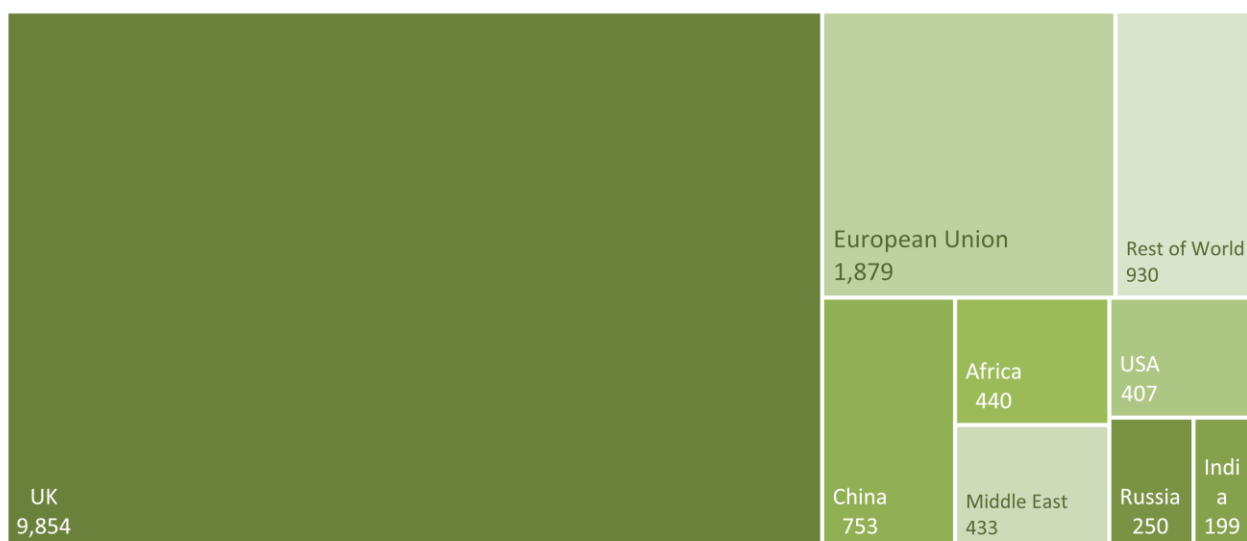


Chart 12 above shows the embedded energy use by country of origin in 2018 associated with final consumption in Scotland.

The UK provides the majority of energy used, or consumed indirectly, by Scottish consumers and in 2018, energy equal to around 9.9 million tonnes of oil was consumed from the UK.

At the equivalent of around 1.9 million tonnes of oil, the European Union provided the next most substantial source of embedded energy consumed in Scotland.

The data used to construct the energy footprint is conceptually very similar to the carbon footprint. As such, subject to further development, most of the analyses presented for the carbon footprint in this release could be replicated for this energy footprint and presented in future editions of this publication.

Material footprint for Scotland (Experimental Statistics)

All results in this section are designated as experimental statistics. These are defined as new official statistics undergoing development and testing. The methods, data sources and results in this section are open for ongoing consultation with users, and we welcome feedback on all aspects of the statistics. All users should be aware that the results in this section are provisional and will be revised and updated when further developments are made. They should therefore be used with appropriate caution at this time. We welcome any thoughts or views on this analysis, including intended uses and alternative presentations by users. Please contact andrew.mortimer@gov.scot

Chart 13. Scotland's material footprint by type, 2018. Values in thousand tonnes.

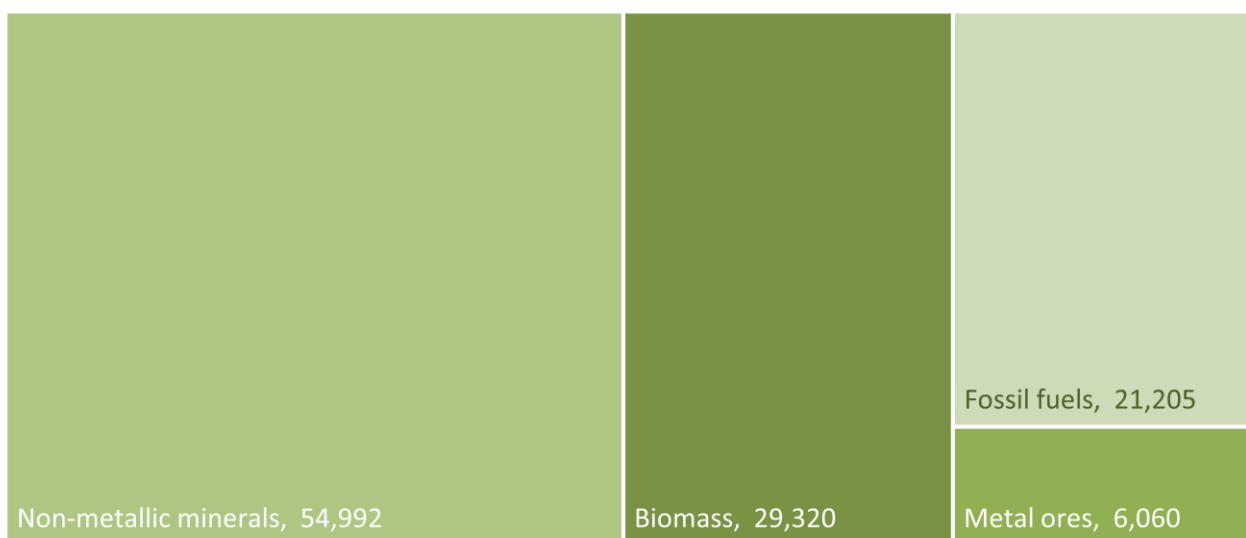


Chart 13 above shows the total materials used directly or indirectly by Scottish consumers, by the type of material used.

Non-metallic minerals (for example construction materials) are the single largest input required to meet final demand in Scotland. In 2018, almost 55 million tonnes of these materials were used globally to meet Scottish demand.

Biomass (for example, food, wood) had the second largest demand, with 29 million tonnes of these materials were required to meet Scottish final demand.

Fossil fuels (21 million tonnes) and Metal ores (6 million tonnes) made up the balance of the 112 million tonnes of total materials required globally to meet Scottish final demand.

Chart 14. Scotland’s material footprint by country of origin, 2018. Values in thousand tonnes.

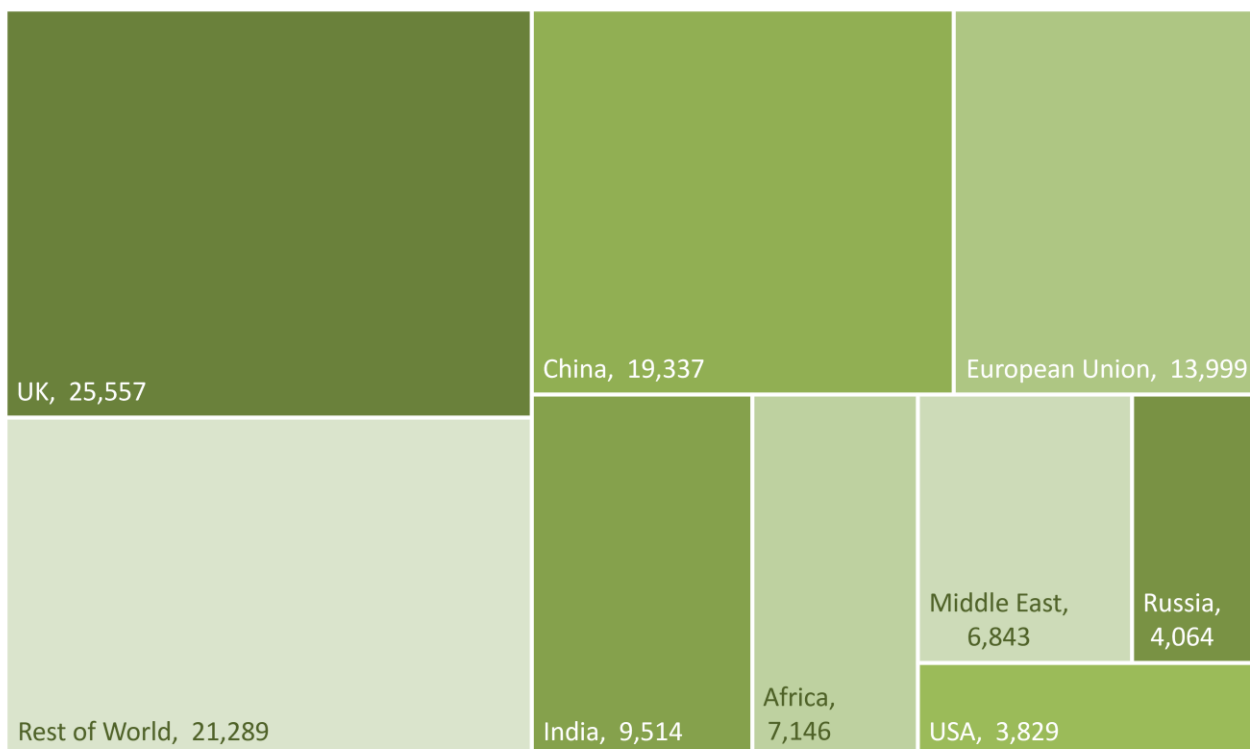


Chart 14 above shows the embedded material requirements by country of origin in 2018 associated with final consumption in Scotland.

The UK was the single largest source of materials required to meet final demand in Scotland and required around 26 million tonnes of all materials.

In 2018, around half of all materials consumed in Scotland were sourced from the UK, China and the European Union combined.

Access to Background Data and Charts

All the data which underpin the charts are available from an Excel workbook accompanying this release. This Excel workbook also contains the underlying outputs from the MRIO model with data for each year from 1998 to 2018 with information on greenhouse gas and carbon dioxide emissions for each economic sector.

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Correspondence and enquiries

For enquiries about this publication please contact:

Andrew Mortimer

Office of the Chief Economic Adviser

e-mail: andrew.mortimer@gov.scot

For general enquiries about Scottish Government statistics please contact:

Office of the Chief Statistician

Telephone: 0131 244 0442

email: statistics.enquiries@gov.scot

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