Citizens' Climate Lobby
Scotland

SUSTAINABILITY SOCIETY

Emissions Sources

Oscar Mitcham
Some slides stolen (with permission)
from Alexander Heavens

Greenhouse Gas	**CO_2 Equivalent (CO_2e) over 100 years**
Carbon Dioxide (CO_2)	1
Methane (CH_4)	28-36
Nitrous Oxide (N_20)	256-298
*-flourocarbons (CFCs, HFCs, HCFCs, PFCs)	Thousands

https://www.epa.gov/ghgemissions/understanding-global-warming-potentials

Global greenhouse gas emissions by gas

Greenhouse gas emissions are converted to carbon dioxide-equivalents (CO_2eq) by multiplying each gas by its 100-year 'global warming potential' value: the amount of warming one tonne of the gas would create relative to one tonne of CO_2 over a 100-year timescale. This breakdown is shown for 2016.

Our World in Data

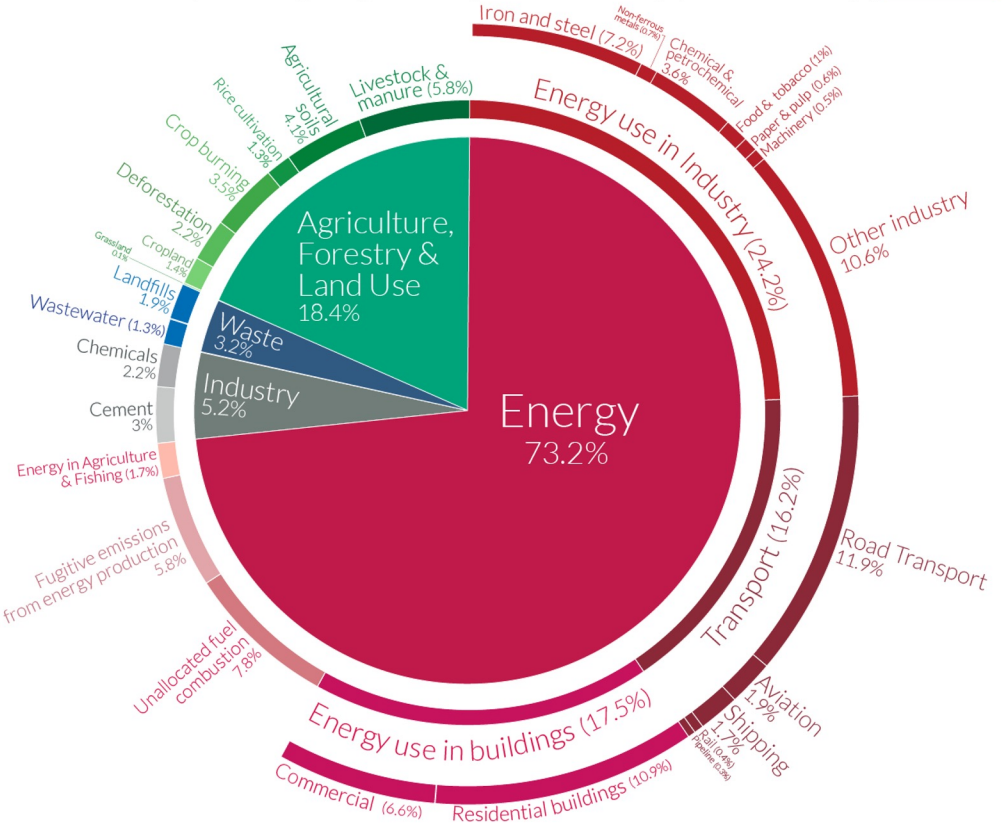
OurWorldinData.org – Research and data to make progress against the world's largest problems.
Source: Climate Watch, the World Resources Institute (2020).

https://ourworldindata.org/greenhouse-gas-emissions

Global greenhouse gas emissions by sector

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO_2eq.

Our World in Data



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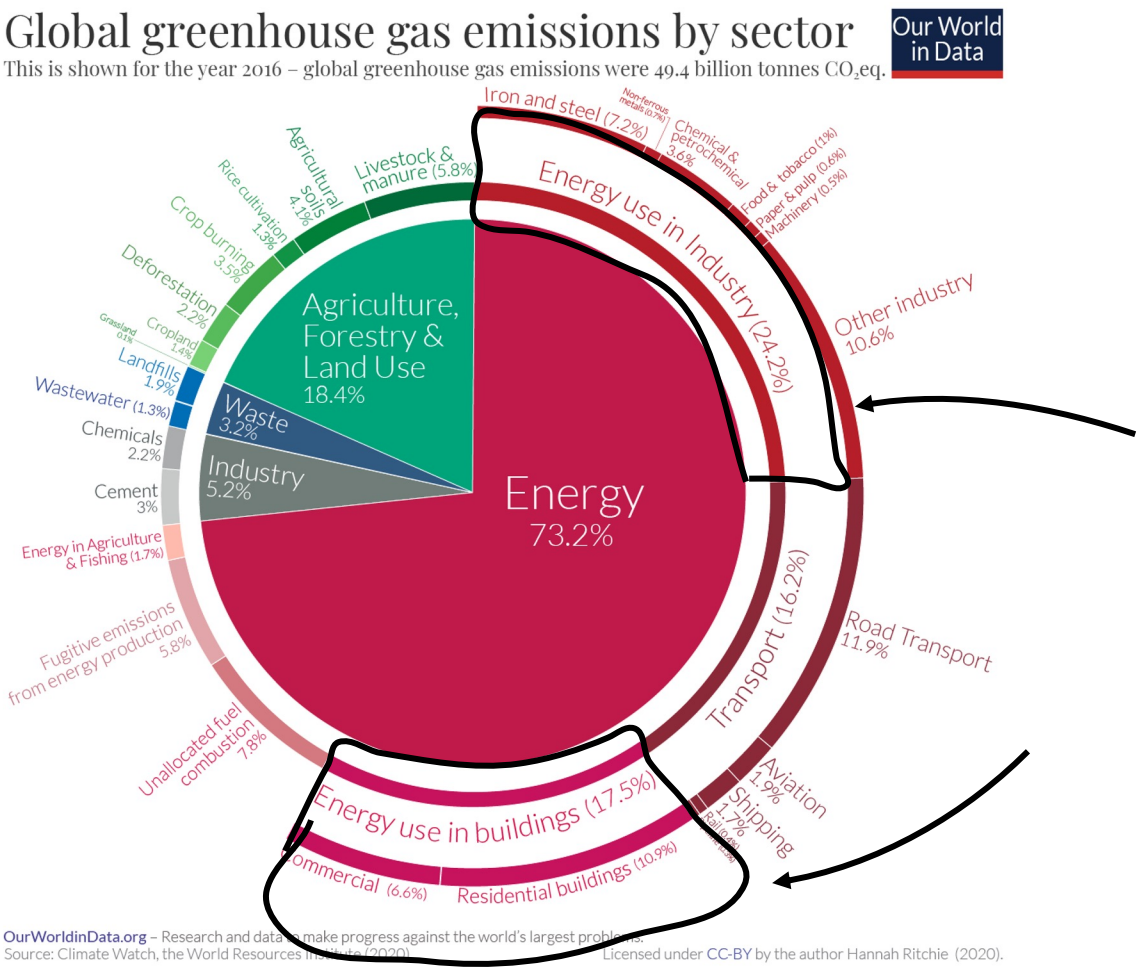
https://ourworldindata.org/emissions-by-sector



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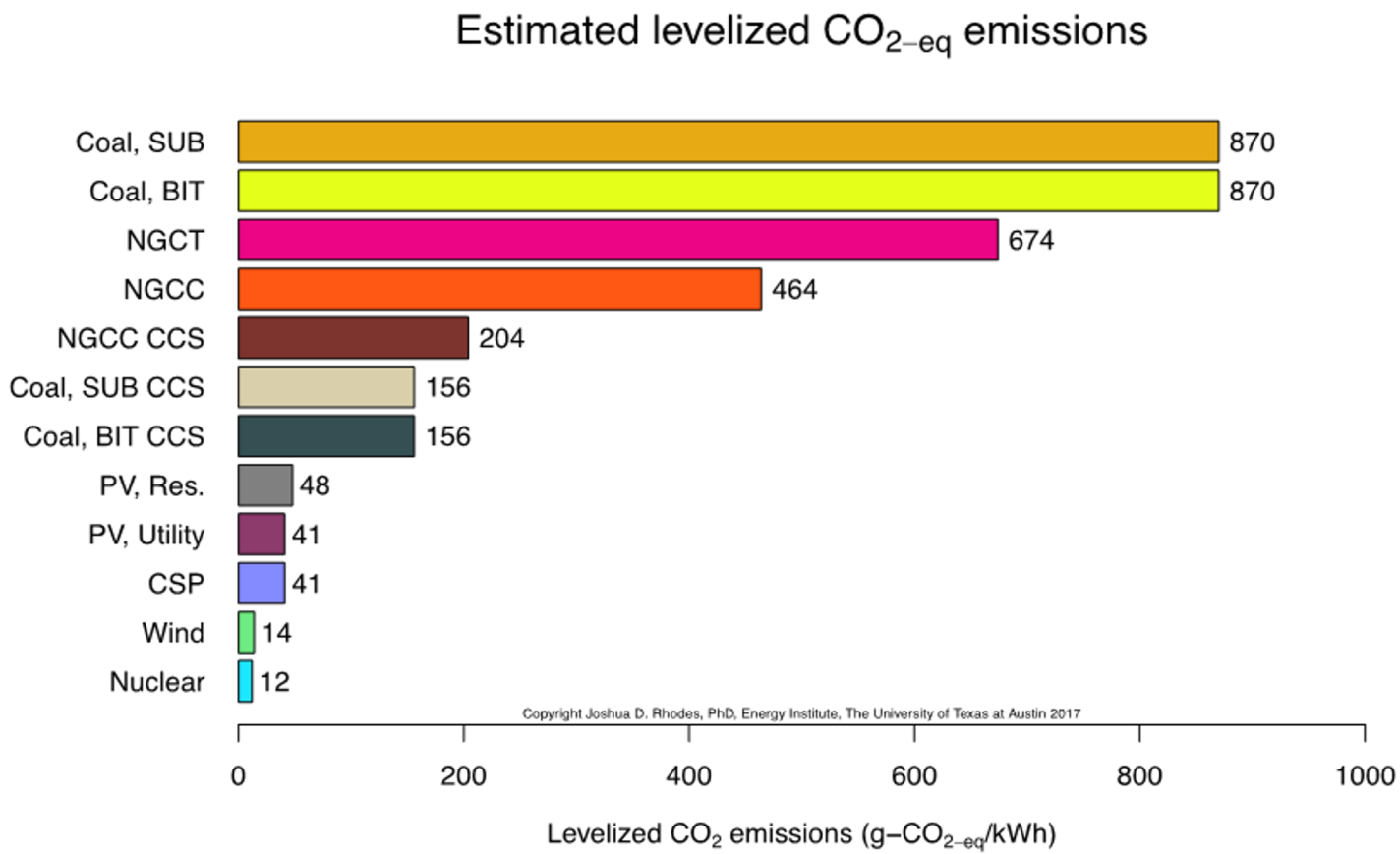
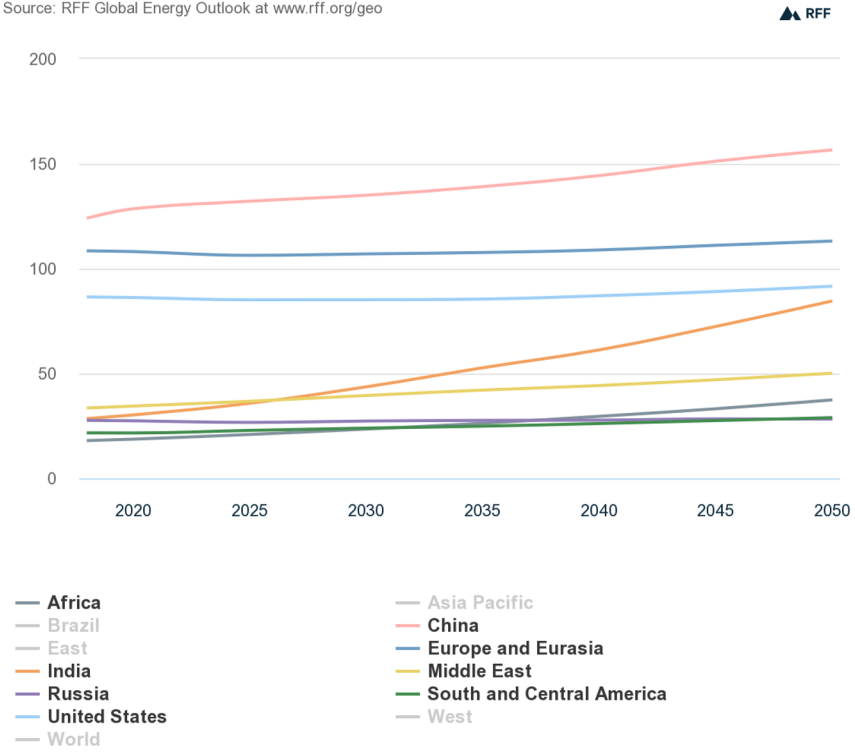
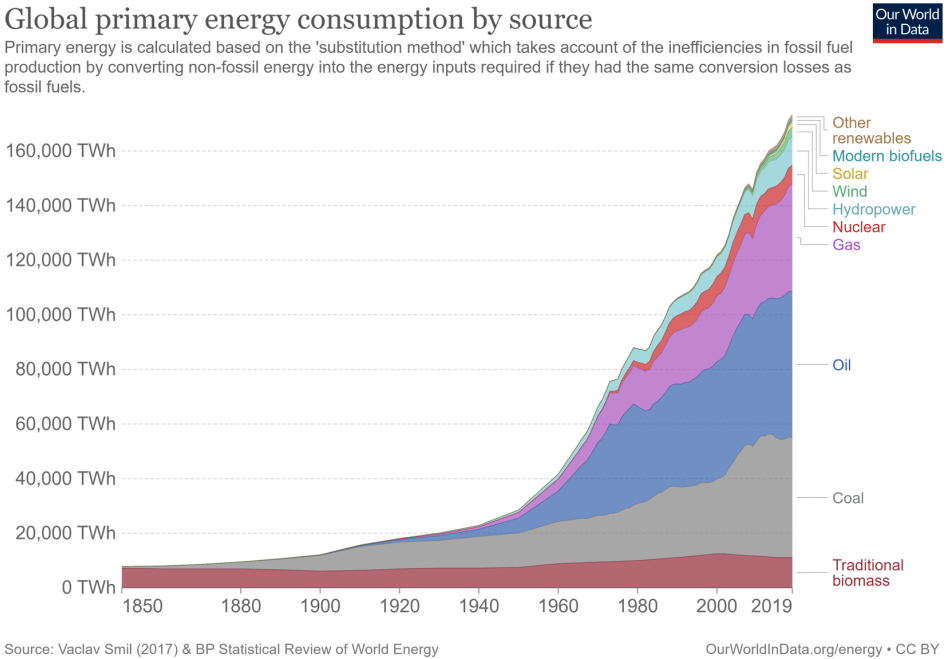


https://energy.utexas.edu/news/nuclear-and-wind-power-estimated-have-lowest-levelized-co2-emissions

Primary energy consumption (QBtu), by Regions. Filtered by Region: World; Fuel: All; Sector: All; Outlook: 2019 EIA (Reference).

Source: RFF Global Energy Outlook at www.rff.org/geo

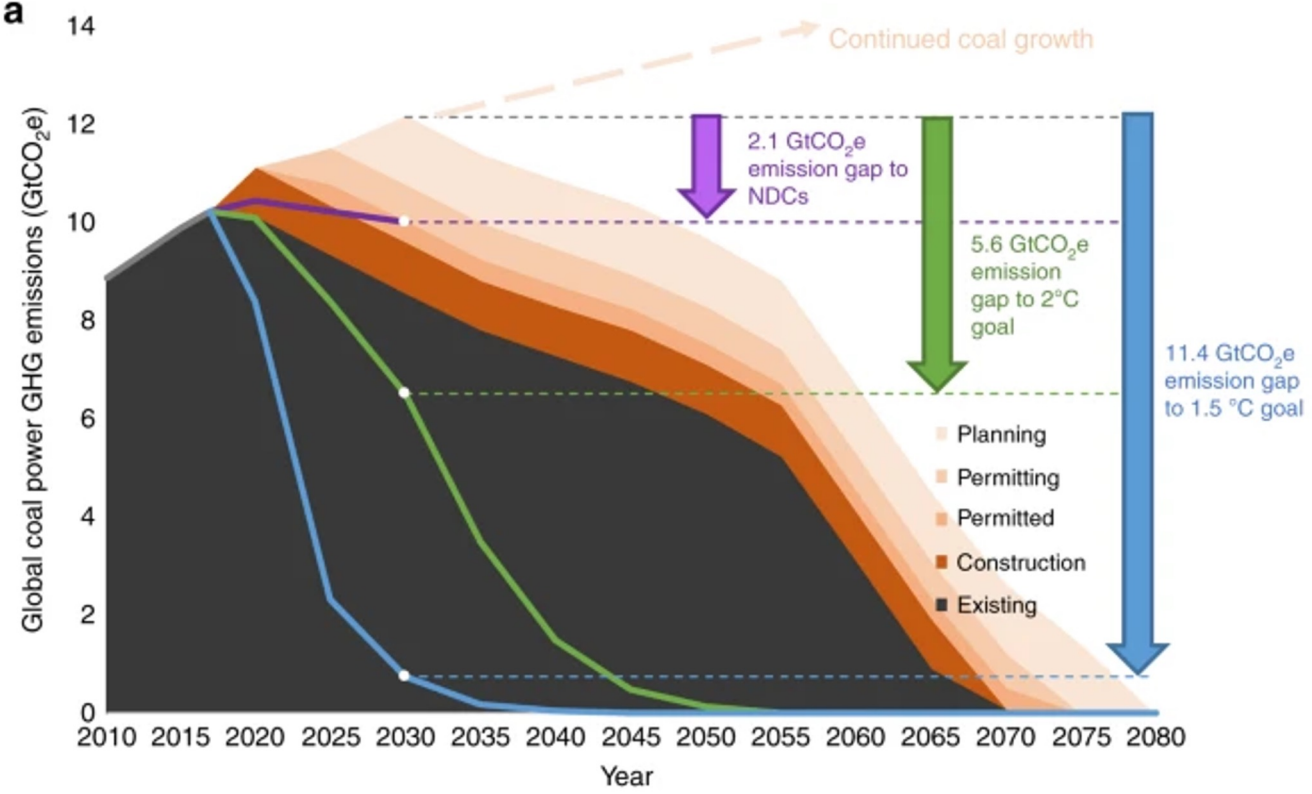




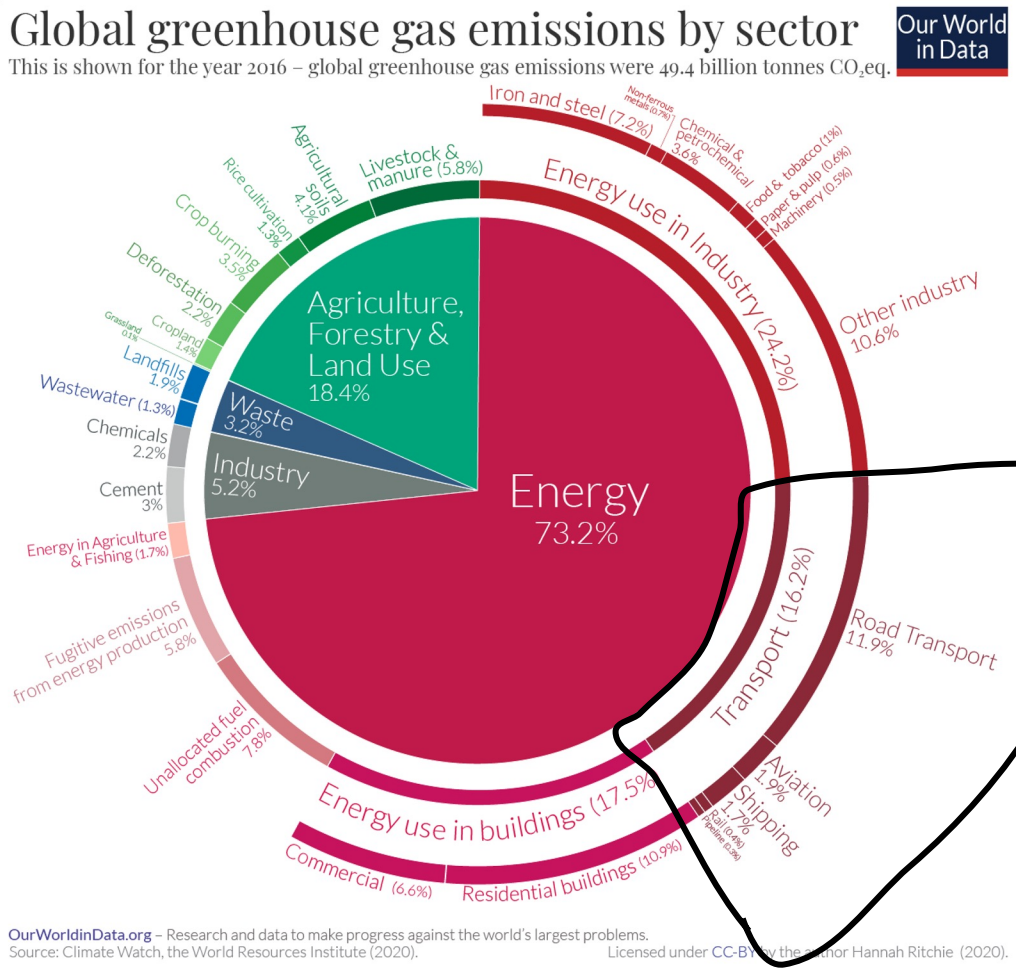
https://www.rff.org/publications/data-tools/global-energy-outlook/

Fig. 2

a



https://www.nature.com/articles/s41467-019-12618-3

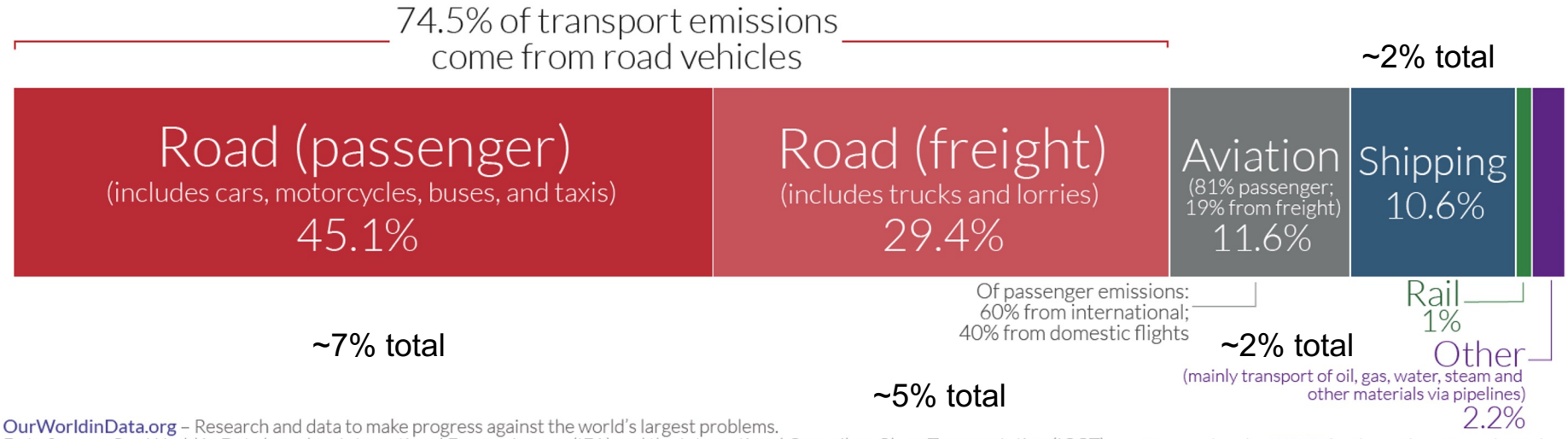


https://ourworldindata.org/emissions-by-sector

Global CO_2 emissions from transport

This is based on global transport emissions in 2018, which totalled 8 billion tonnes CO_2.
Transport accounts for 24% of CO_2 emissions from energy.

Our World in Data



Welsh government suspends all future road-building plans

Deputy minister for climate change announces move as part of plans to reach net zero emissions by 2050

Work on the construction of a dual carriageway between Brynmawr and Gilwern in Wales. Projects that are in progress are expected to continue as planned. Photograph: Huw Fairclough/Getty

The Labour-led Welsh government is freezing new road-building projects as part of its plans to tackle the climate emergency, and an external panel will review all proposed schemes.

The deputy minister for climate change, Lee Waters, told the Welsh parliament on Tuesday: "Since 1990, Welsh emissions have fallen by 31%. But to reach our statutory target of net zero emissions by 2050, we need to do much more.

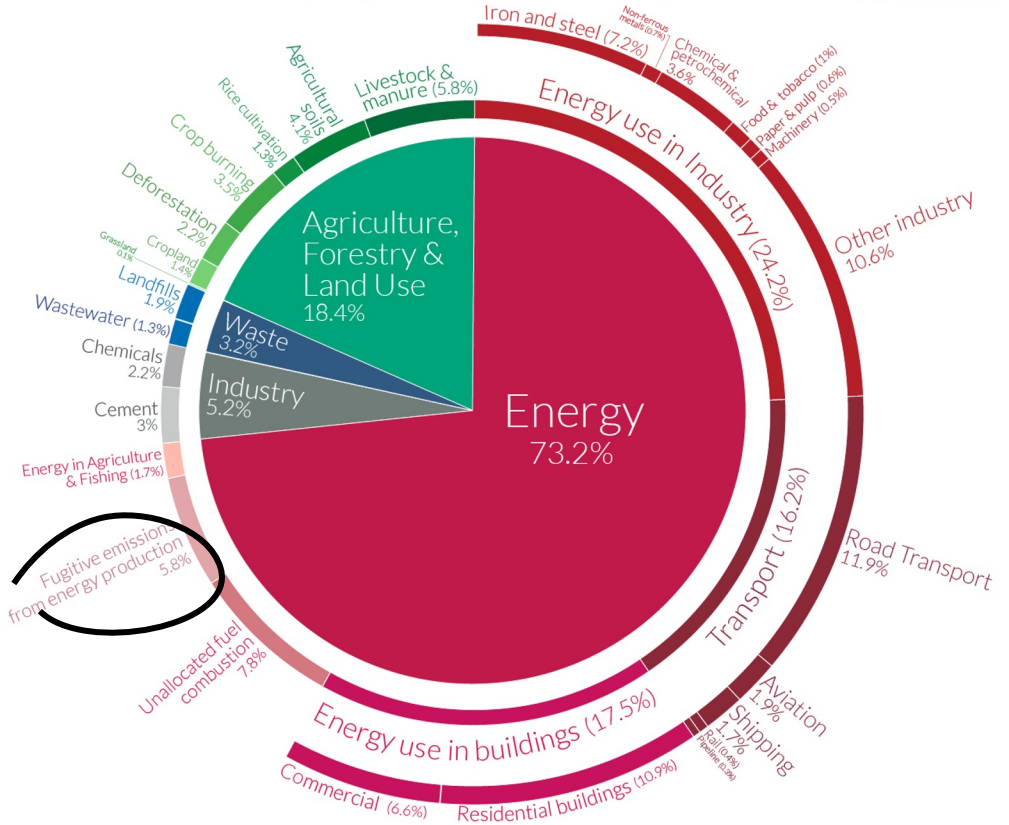
"In the next 10 years, we are going to need to more than double all the cuts we have managed over the last 30 years if we are going to keep temperature rises within safe limits. That means changes in all parts of our lives. Transport makes up some 17% of our total emissions and so must play its part.

"We need a shift away from spending money on projects that encourage

Global greenhouse gas emissions by sector

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO_2eq.

Our World in Data



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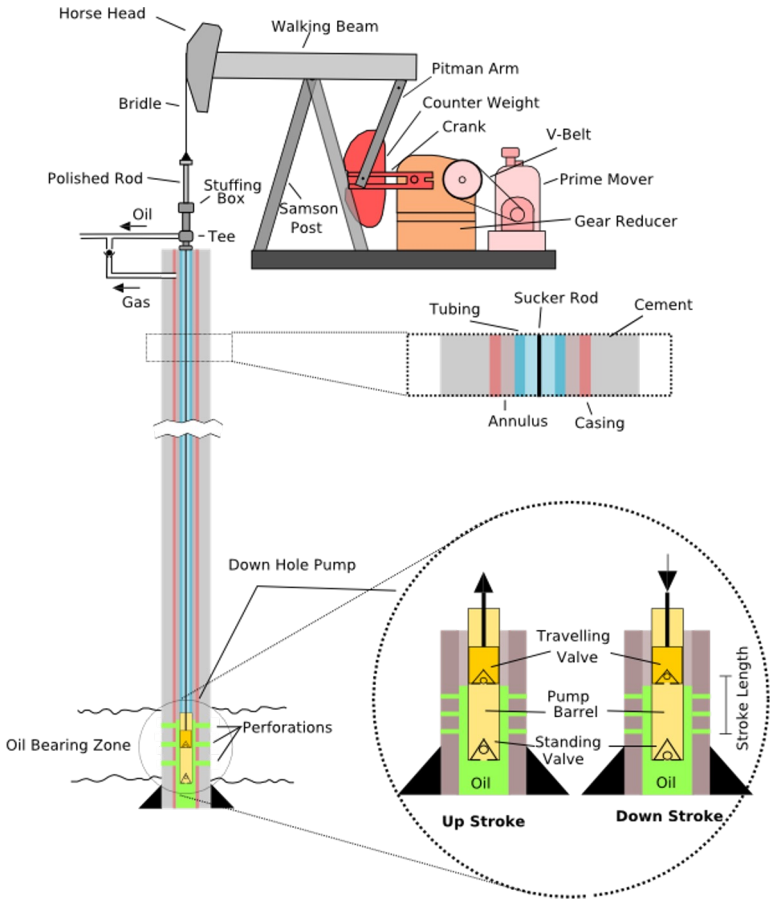

https://www.youtube.com/watch?v=LQcFfJ8bsc8

COMMODITIES NEWS JUNE 16, 2020 / 12:14 PM / UPDATED A YEAR AGO

Special Report: Millions of abandoned oil wells are leaking methane, a climate menace

By Nichola Groom

15 MIN READ

SALYERSVILLE, Kentucky (Reuters) - (This June 16 story corrects comparison in paragraph eight of climate damage from methane leaks to that from U.S. oil consumption. The leaks cause climate damage roughly equivalent to typical U.S. oil consumption in one day, not two days.)

https://www.reuters.com/article/us-usa-drilling-abandoned-specialreport-idUSKBN23N1NL

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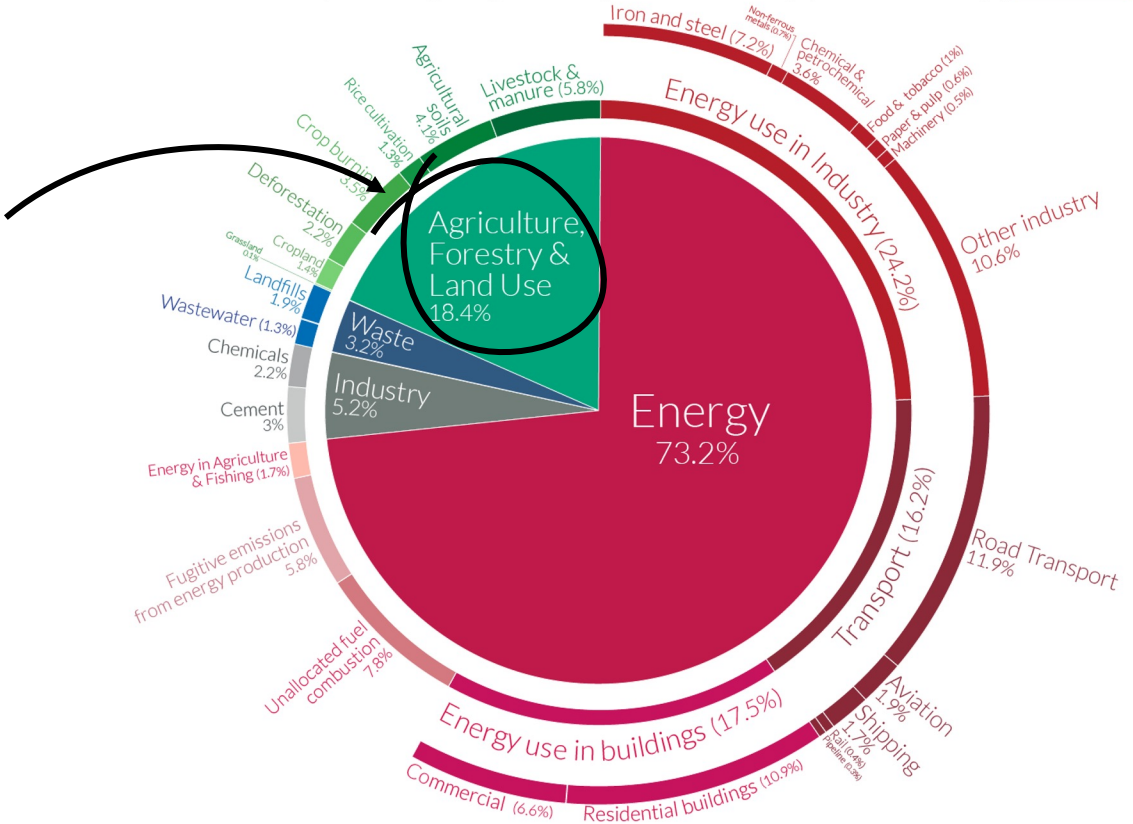

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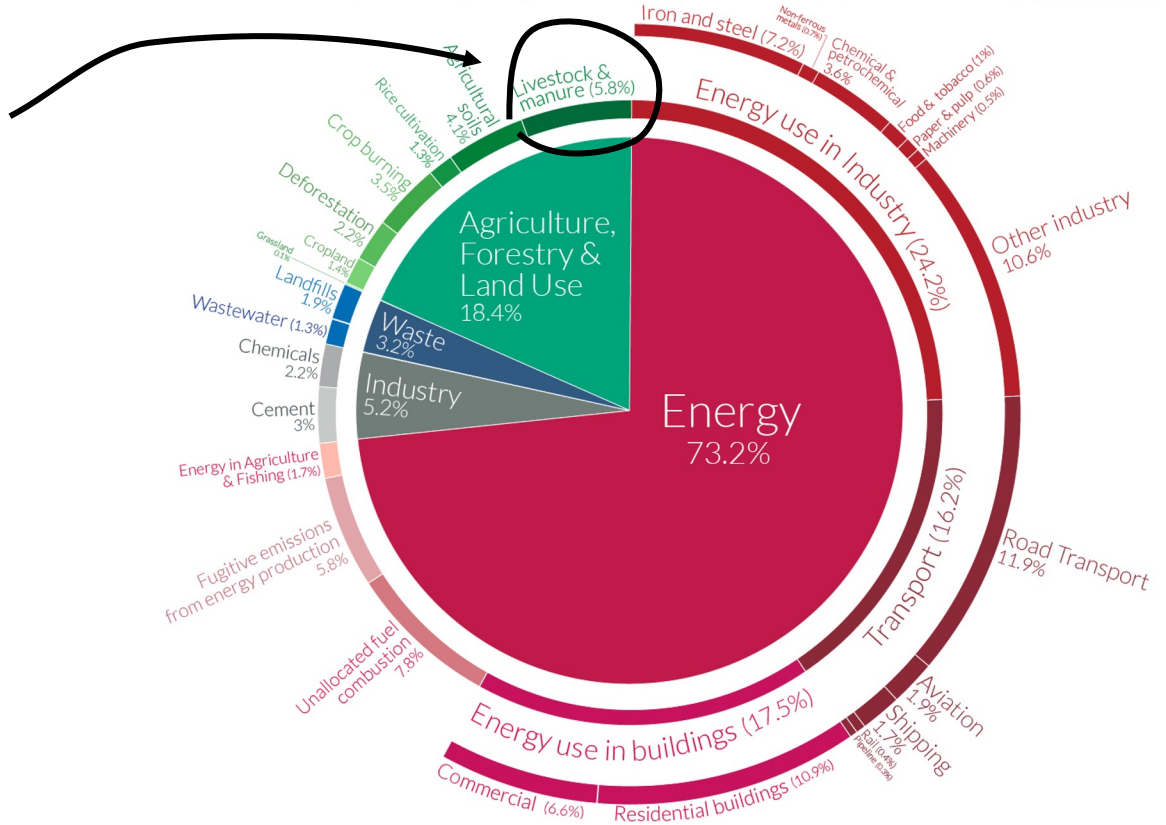

https://ourworldindata.org/emissions-by-sector


0677
0674
0658
0707
0701

Global greenhouse gas emissions by sector

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Source: Climate Watch, the World Resources Institute (2020).

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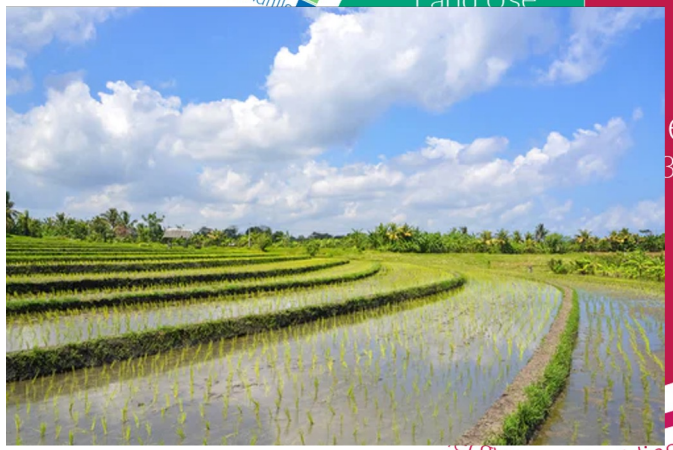

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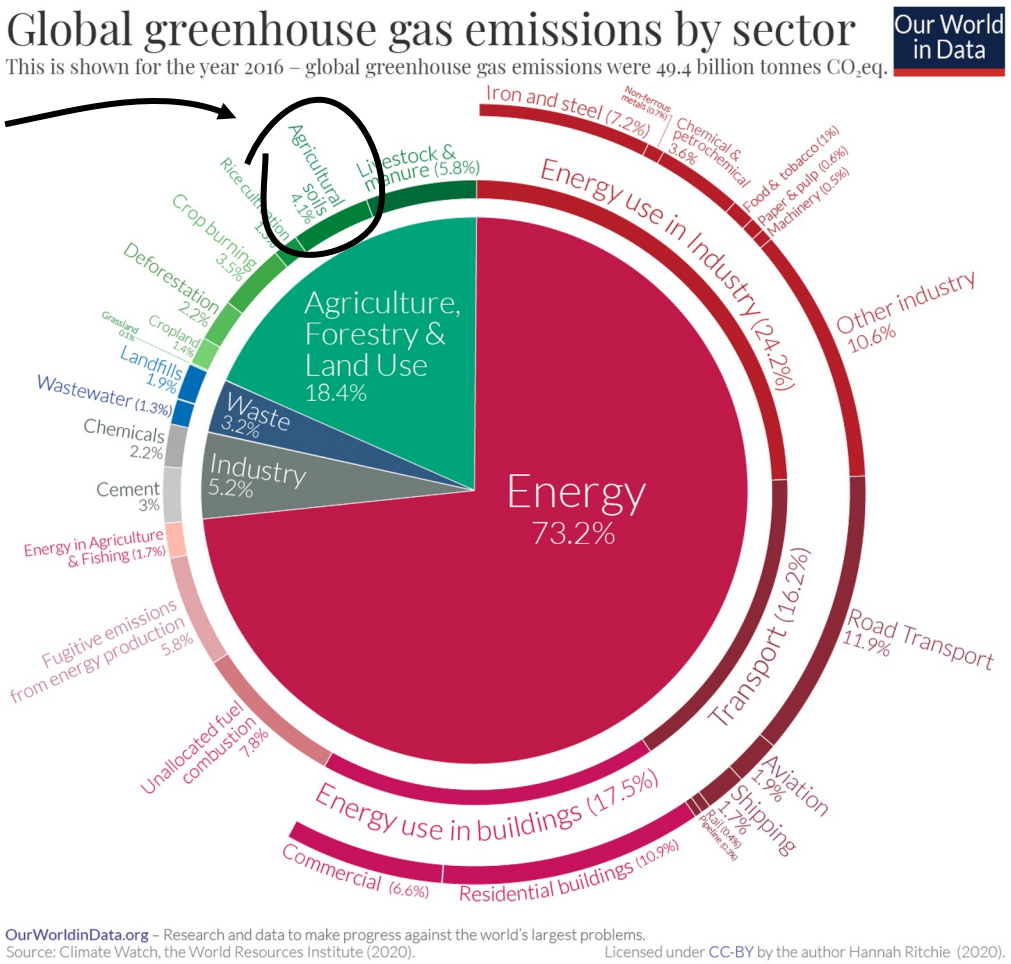
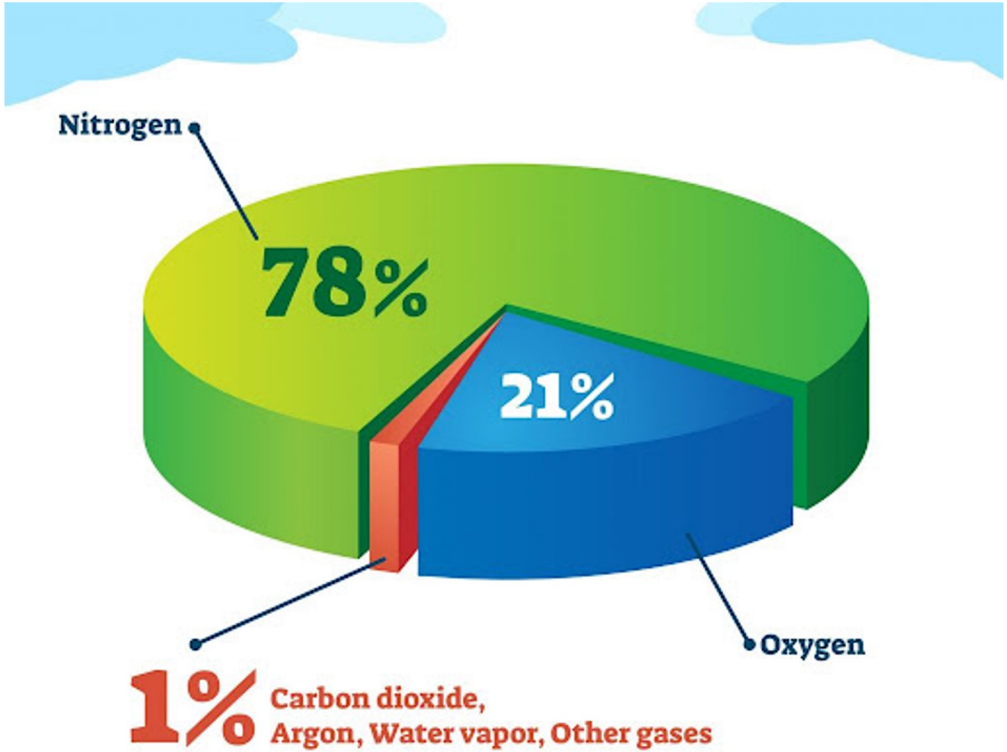


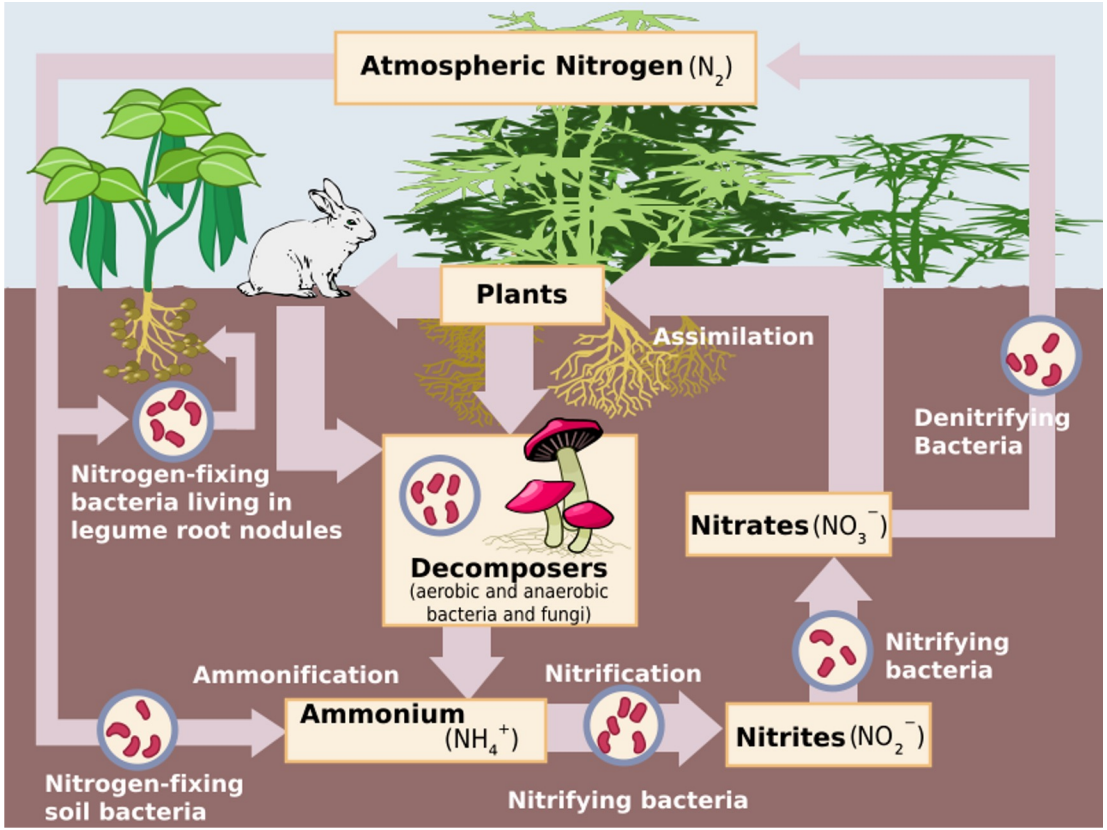
https://ourworldindata.org/emissions-by-sector

...without [fertilizer] almost half the world's population would not be alive today.

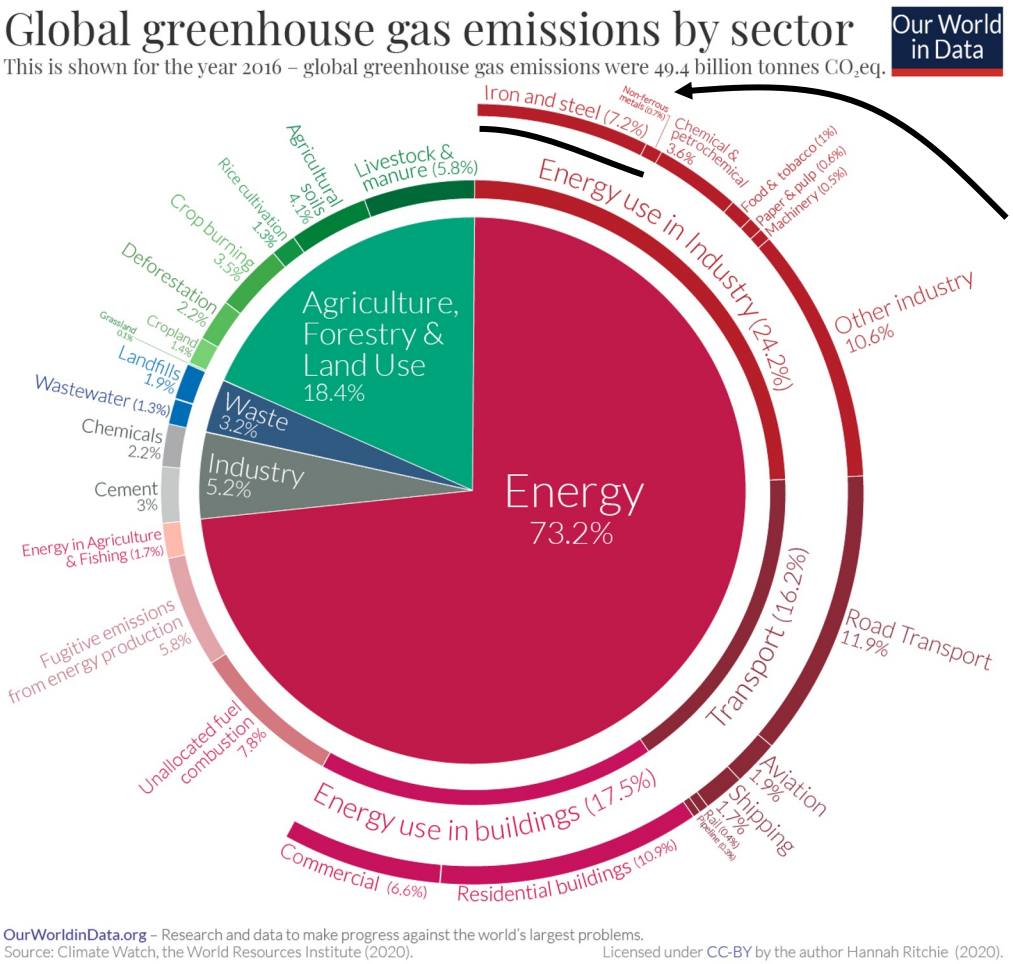
https://www.bbc.co.uk/news/business-38305504


Nitrogen
78%
21%
Oxygen
1%
Carbon dioxide,
Argon, Water vapor, Other gases

Molecular Nitrogen



https://ucanr.edu/sites/Nutrient_Management_Solutions/stateofscience/Nitrous_Oxide__In_focus/



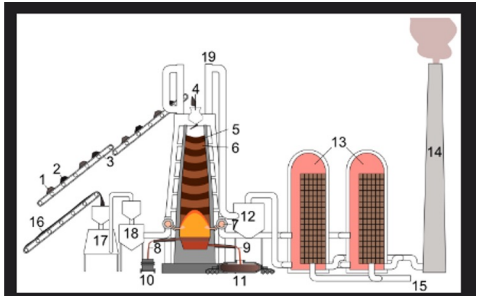
https://ourworldindata.org/emissions-by-sector

Iron Ore

E.g. Hematite Fe_2O_3

We want Iron (Fe)

$2Fe_2O_3 + 3C = 4Fe + 3CO_2$



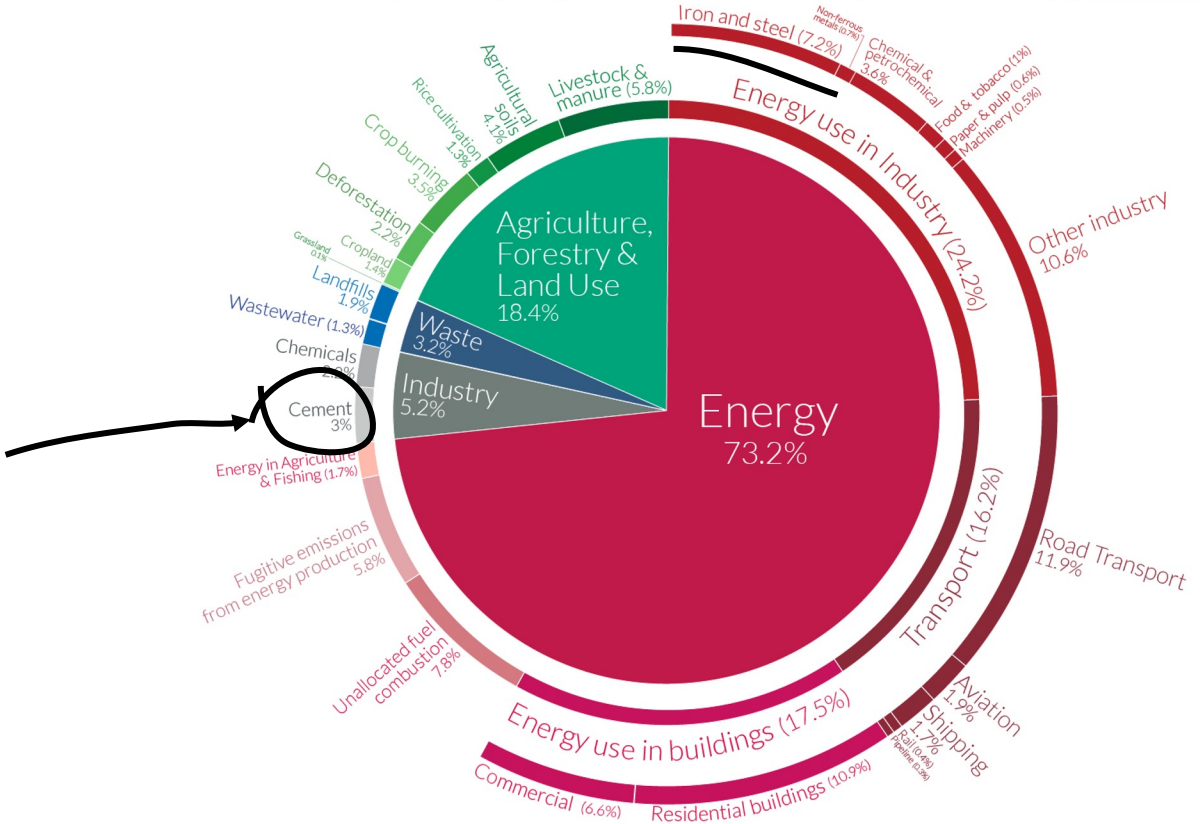
Blast furnace placed in an installation

1. Iron ore + limestone sinter
2. Coke
3. Elevator
4. Feedstock inlet
5. Layer of coke
6. Layer of sinter pellets of ore and limestone
7. Hot blast (around 1200 °C)
8. Removal of slag
9. Tapping of molten pig iron
10. Slag pot
11. Torpedo car for pig iron
12. Dust cyclone for separation of solid particles
13. Cowper stoves for hot blast
14. Smoke stack
15. Feed air for Cowper stoves (air pre-heaters)
16. Powdered coal
17. Coke oven
18. Coke
19. Blast furnace gas downcomer

Global greenhouse gas emissions by sector

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO_2eq.

Our World in Data



OurWorldinData.org – Research and data to make progress against the world's largest problems.
Source: Climate Watch, the World Resources Institute (2020).

https://ourworldindata.org/emissions-by-sector

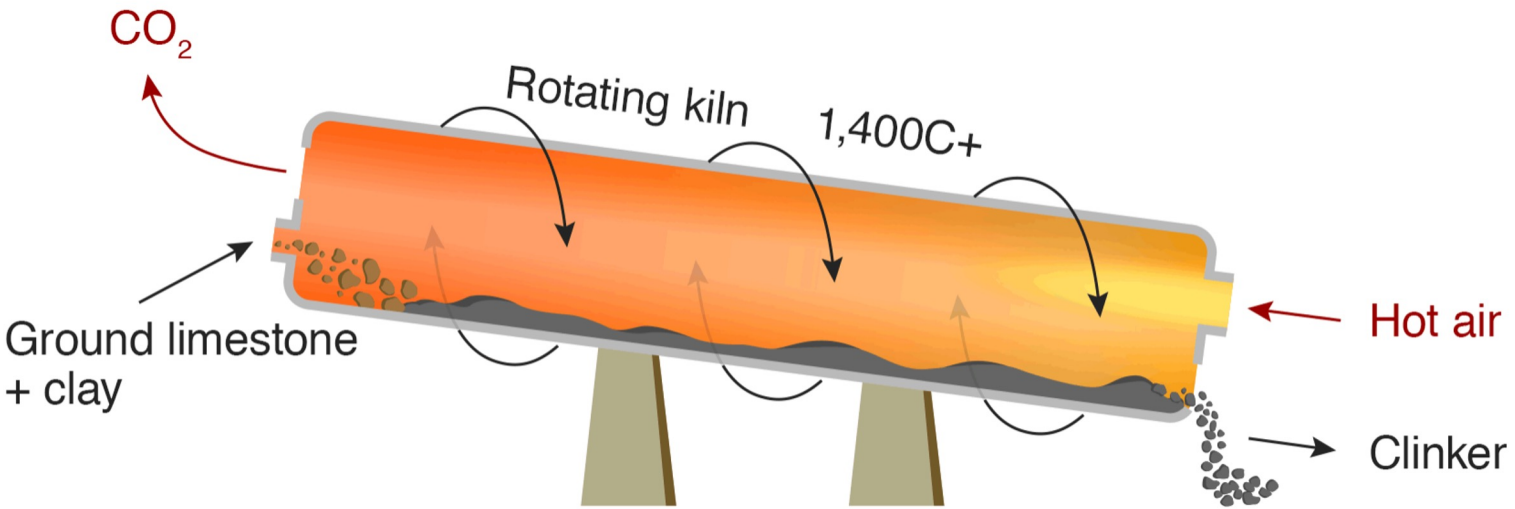
Limestone

Calcium carbonate, $CaCO_3$

We want quicklime, CaO

$CaCO_3 = CaO + CO_2$

Calcination



https://www.bbc.com/news/science-environment-46455844

http://www.cementplantequipment.com/all-the-things-about-cement-clinker-calcination-in-cement-production-process/

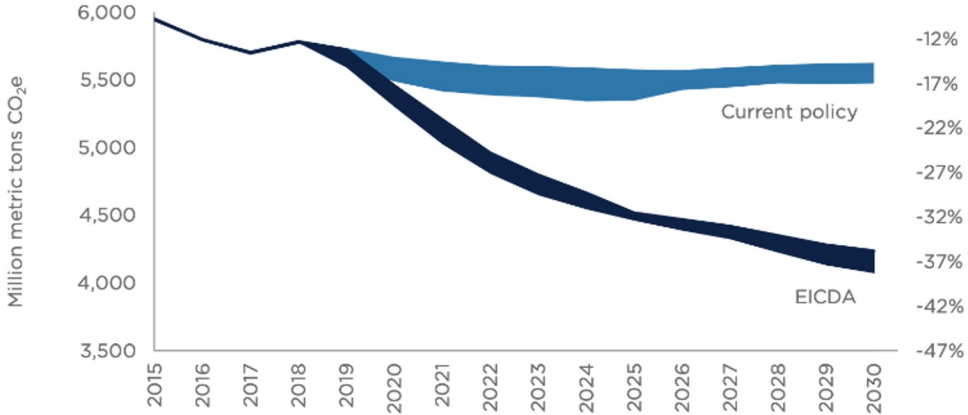
“The big optimizations come from refining the high-level design, not the individual routines.”

Steve McConnell, Code Complete

Tax Carbon!

We find that the EICDA proposal could drive US economy-wide net GHG emissions down 32–33 percent from 2005 levels by 2025 and down 36–38 percent from 2005 levels by 2030 (figure 1). The range reflects the three energy cost scenarios discussed above. The bill represents a departure from current policy, under which emissions are projected to be between 15–19 percent below 2005 levels in 2025 and 15–17 percent below 2005 levels by 2030.

Figure 1: US economy-wide net GHG emissions, 2015-2030



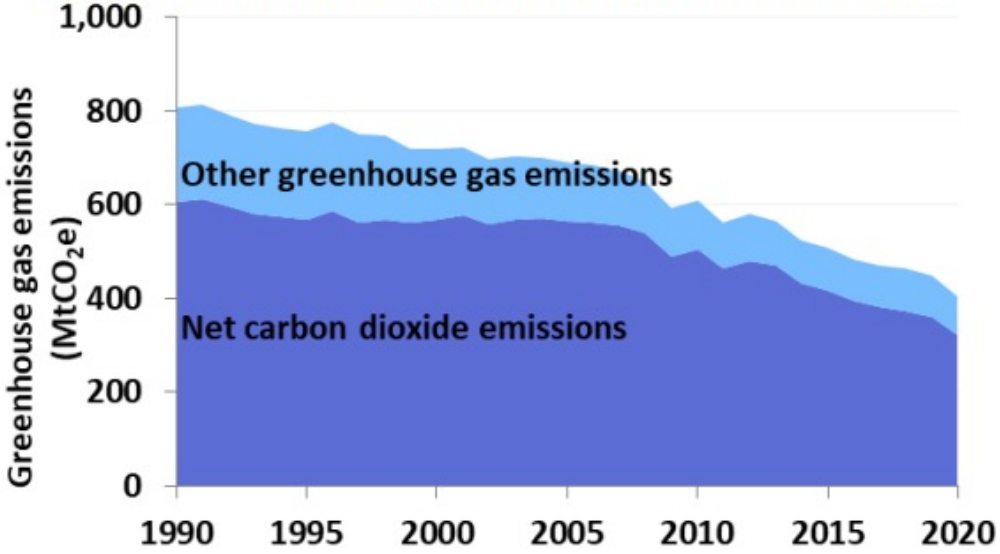
Source: Rhodium Group analysis

https://www.energypolicy.columbia.edu/research/report/assessment-energy-innovation-and-carbon-dividend-act

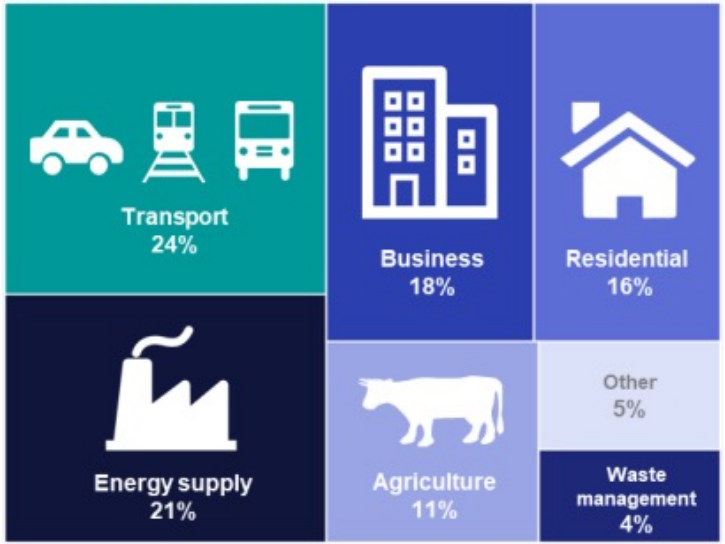
Summary of global emissions

- CO_2, methane and N_2O are the big bads.
- Energy to power our vehicles, manufacturing, heat and cool our homes is the largest share.
- Energy demand is climbing rapidly.
- We need innovation to provide green alternatives for cement and long distance fuels.
- Methane comes from many decomposing organic substances.
- N_2O within our soils helps grow much of the world’s food, but is a serious greenhouse gas.

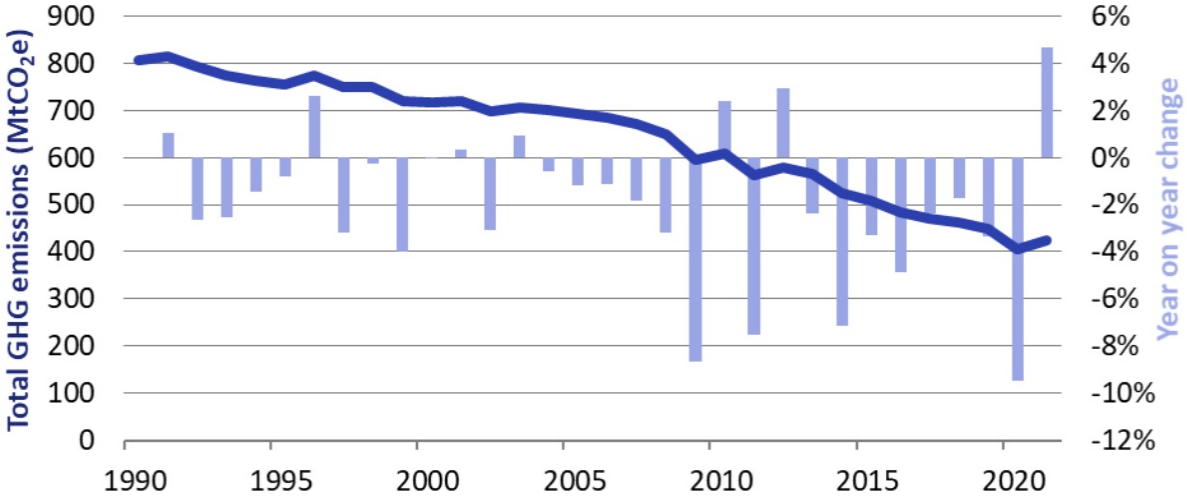
In 2020, UK territorial greenhouse gas emissions were 406 million tonnes CO_2 equivalent ($MtCO_2e$), reducing 9.5% from 2019 and were 49.7% lower than in 1990

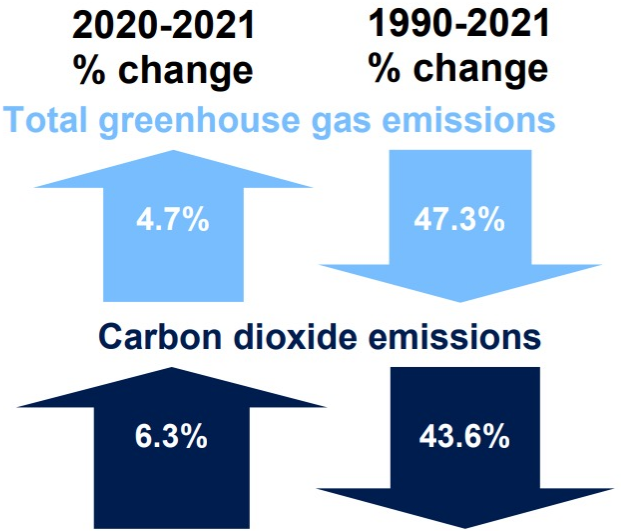


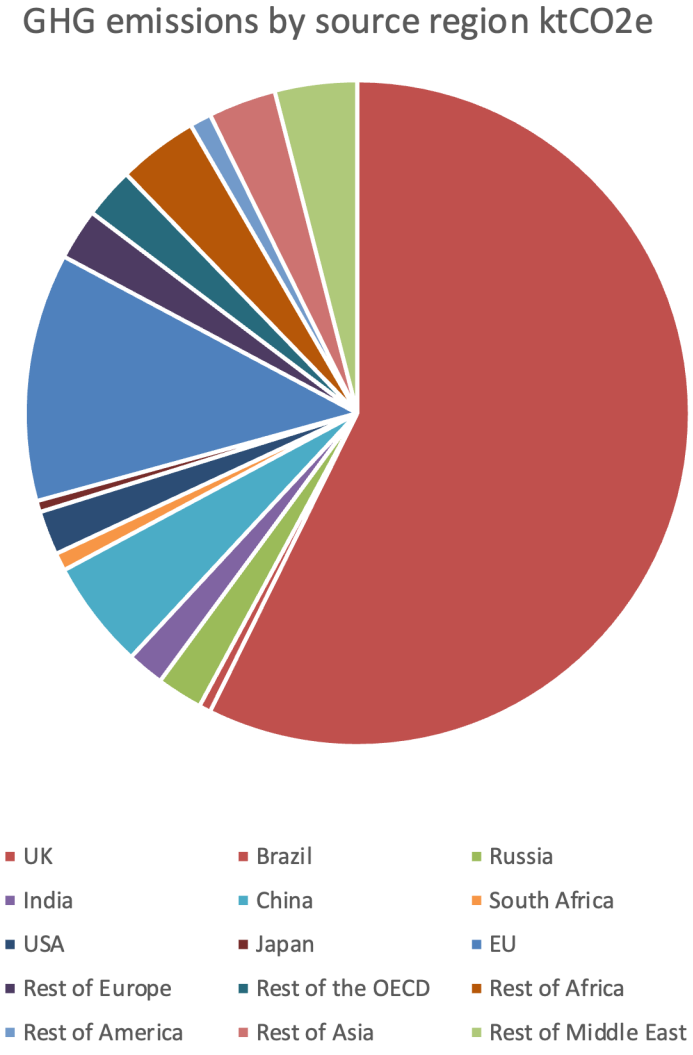
Transport was the largest emitting sector in the UK in 2020, responsible for almost a quarter of emissions



In 2021, total UK territorial greenhouse gas emissions were 424.5 million tonnes carbon dioxide equivalent ($MtCO_2e$), 4.7% higher than 2020, yet 5.2% lower than 2019, reflecting the impacts of the COVID-19 restrictions on emissions.





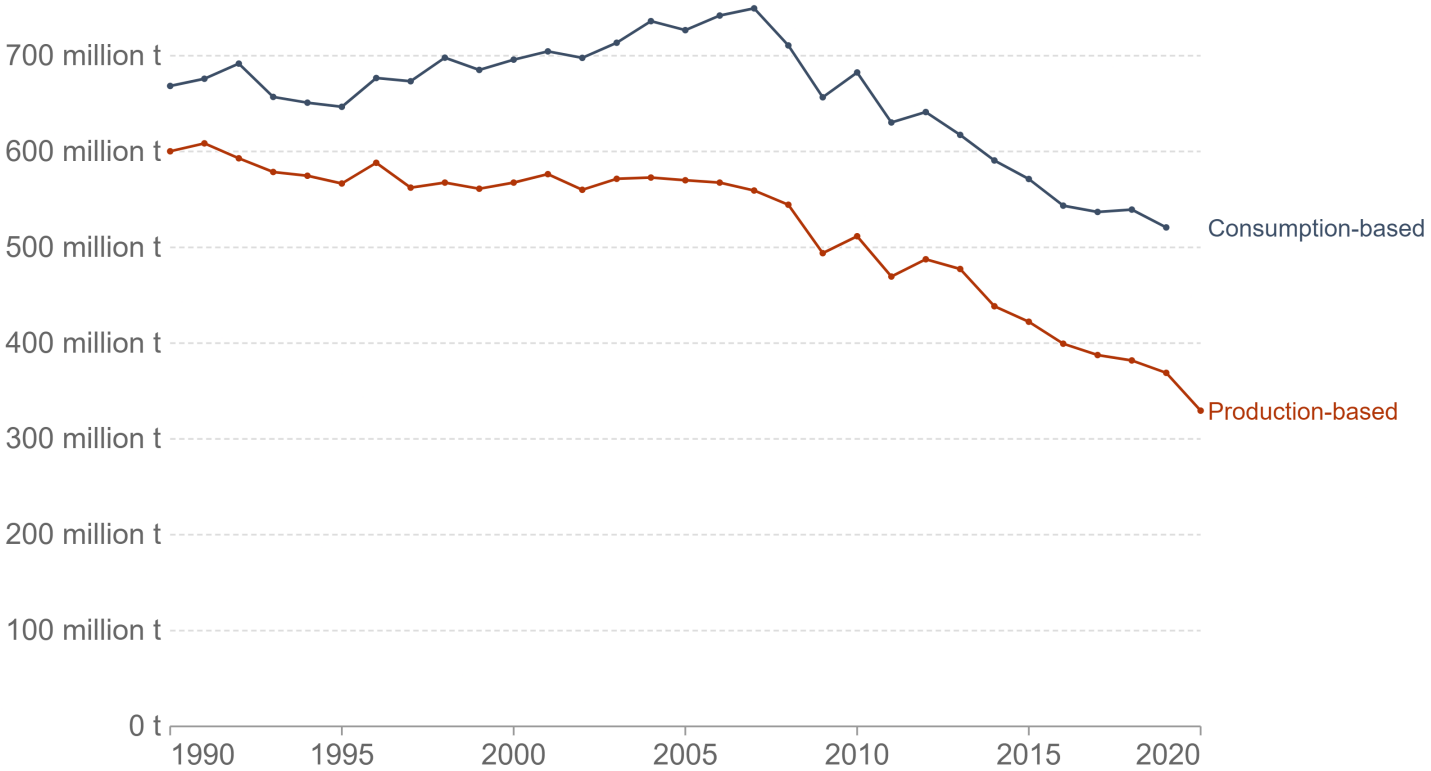


https://oifdata.defra.gov.uk/9-1-1/

Production vs. consumption-based CO_2 emissions, United Kingdom

Our World in Data

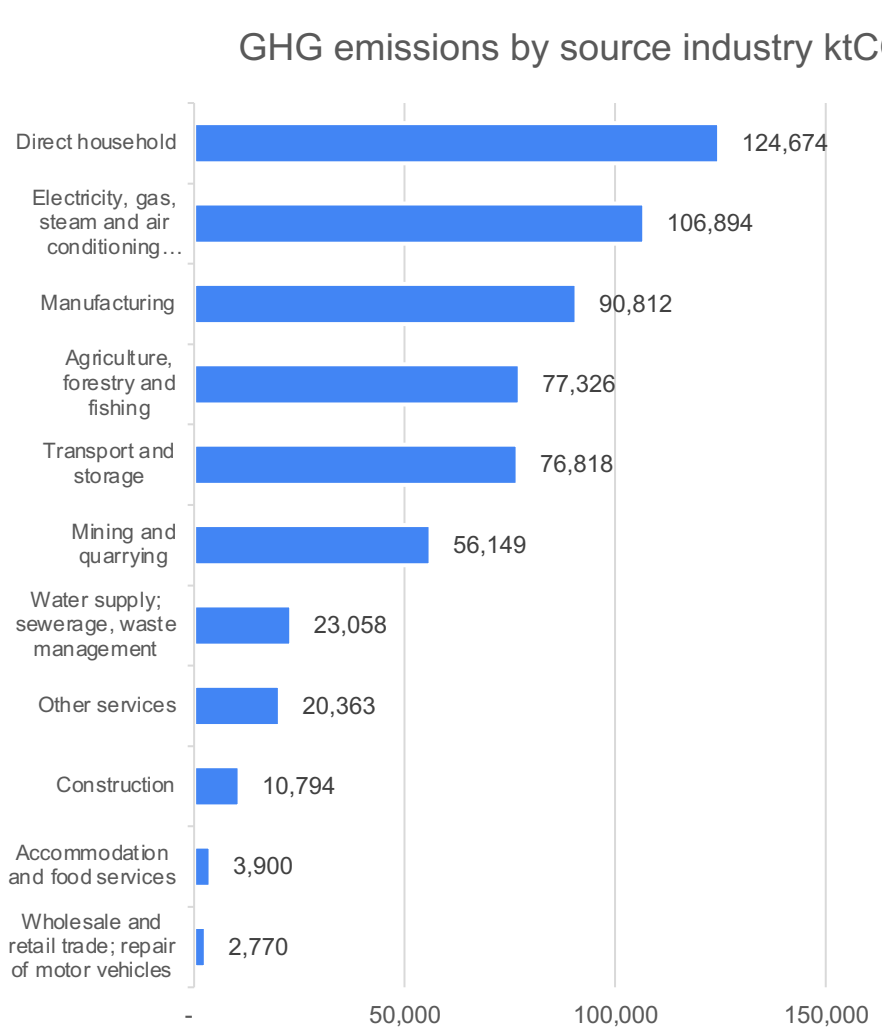
Annual consumption-based emissions are domestic emissions adjusted for trade. If a country imports goods the CO_2 emissions needed to produce such goods are added to its domestic emissions; if it exports goods then this is subtracted.

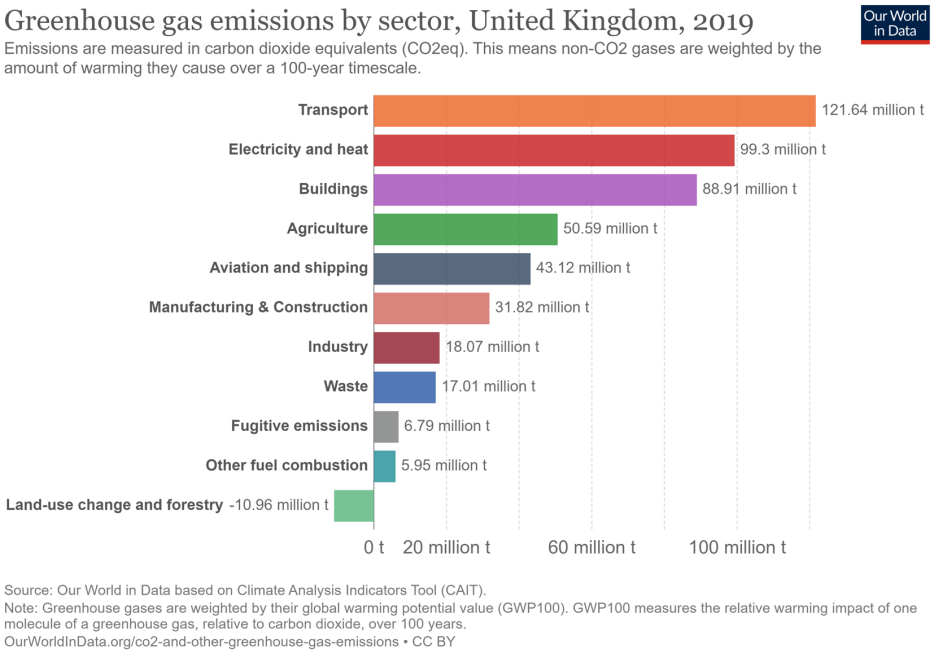


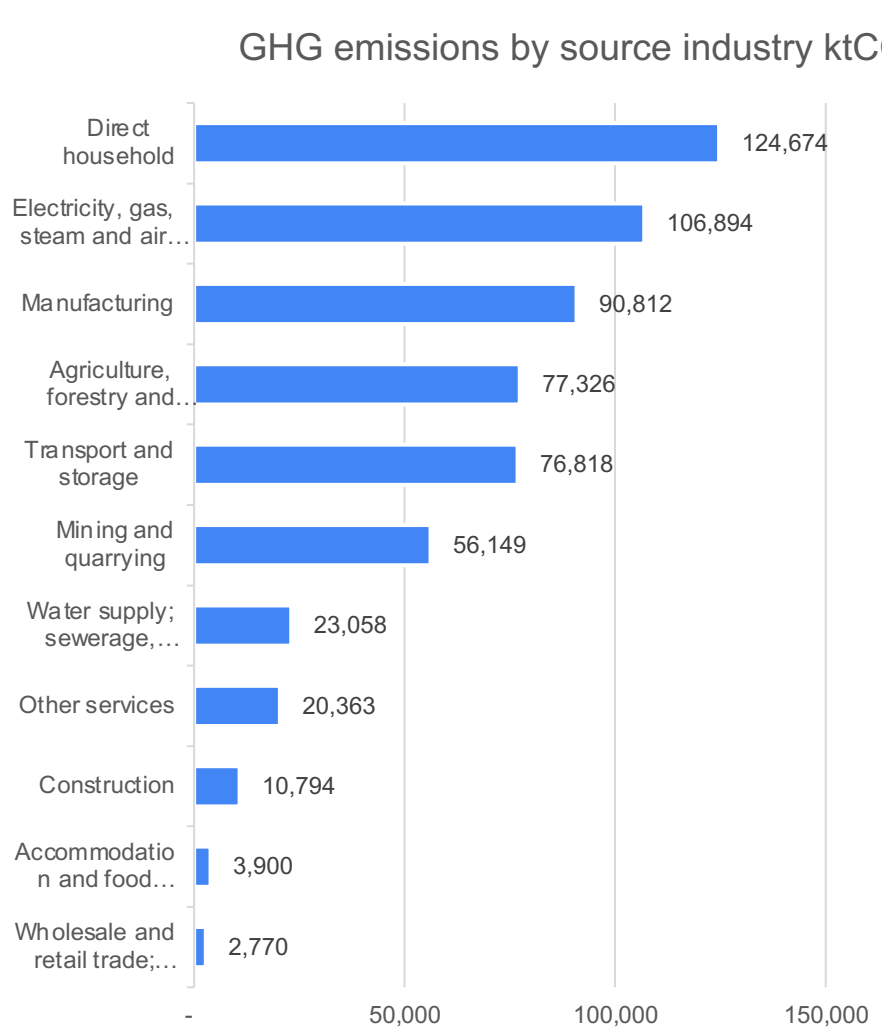
Source: Global Carbon Project

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY

Note: This measures CO_2 emissions from fossil fuels and cement production only – land use change is not included.


GHG emissions by source industry ktCO2e
Direct household
124,674
Electricity, gas, steam and air conditioning…
106,894
Manufacturing
90,812
Agriculture, forestry and fishing
77,326
Transport and storage
76,818
Mining and quarrying
56,149
Water supply; sewerage, waste management
23,058
Other services
20,363
Construction
10,794
Accommodation and food services
3,900
Wholesale and retail trade; repair of motor vehicles
2,770
-
50,000
100,000
150,000


Greenhouse gas emissions by sector, United Kingdom, 2019
Emissions are measured in carbon dioxide equivalents (CO2eq). This means non-CO2 gases are weighted by the amount of warming they cause over a 100-year timescale.
Our World in Data
Transport
121.64 million t
Electricity and heat
99.3 million t
Buildings
88.91 million t
Agriculture
50.59 million t
Aviation and shipping
43.12 million t
Manufacturing & Construction
31.82 million t
Industry
18.07 million t
Waste
17.01 million t
Fugitive emissions
6.79 million t
Other fuel combustion
5.95 million t
Land-use change and forestry
-10.96 million t
0 t
20 million t
60 million t
100 million t
Source: Our World in Data based on Climate Analysis Indicators Tool (CAIT).
Note: Greenhouse gases are weighted by their global warming potential value (GWP100). GWP100 measures the relative warming impact of one molecule of a greenhouse gas, relative to carbon dioxide, over 100 years.
OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY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Other services
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Construction
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Accommodation and food…
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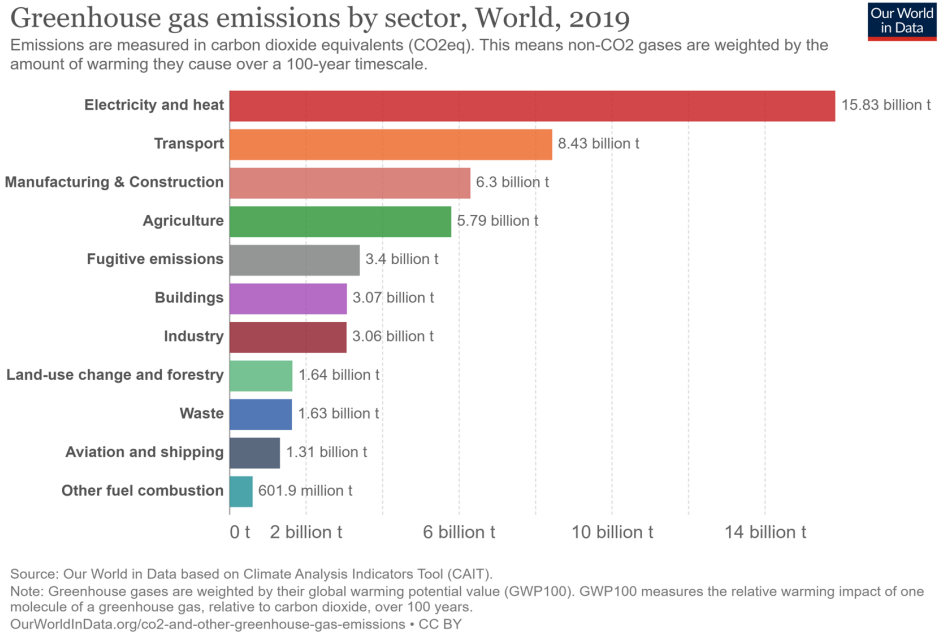
Wholesale and retail trade;…
2,770
-
50,000
100,000
150,000


Greenhouse gas emissions by sector, World, 2019
Our World in Data
Emissions are measured in carbon dioxide equivalents (CO2eq). This means non-CO2 gases are weighted by the amount of warming they cause over a 100-year timescale.
Electricity and heat
15.83 billion t
Transport
8.43 billion t
Manufacturing & Construction
6.3 billion t
Agriculture
5.79 billion t
Fugitive emissions
3.4 billion t
Buildings
3.07 billion t
Industry
3.06 billion t
Land-use change and forestry
1.64 billion t
Waste
1.63 billion t
Aviation and shipping
1.31 billion t
Other fuel combustion
601.9 million t
0 t
2 billion t
6 billion t
10 billion t
14 billion t
Source: Our World in Data based on Climate Analysis Indicators Tool (CAIT).
Note: Greenhouse gases are weighted by their global warming potential value (GWP100). GWP100 measures the relative warming impact of one molecule of a greenhouse gas, relative to carbon dioxide, over 100 years.
OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY

Summary of UK emissions

- >40% of emissions not accounted for in territorial emissions.
- Transport remains a priority domestically.
- Should be much more worried about Agricultural emissions, and less retail and packaging of food.
- Doing manufacturing elsewhere does not reduce emissions.
- Always ask if you’re counting consumption emissions.
- Energy grid is decarbonising (mostly due to less coal).

Road Transport
Emissions from road vehicles within your local authority.

Housing
Emissions from domestic energy consumption.

Aviation

Industrial and commercial
Emissions from industrial processes and energy consumption.

Shipping
Emissions from international shipping.

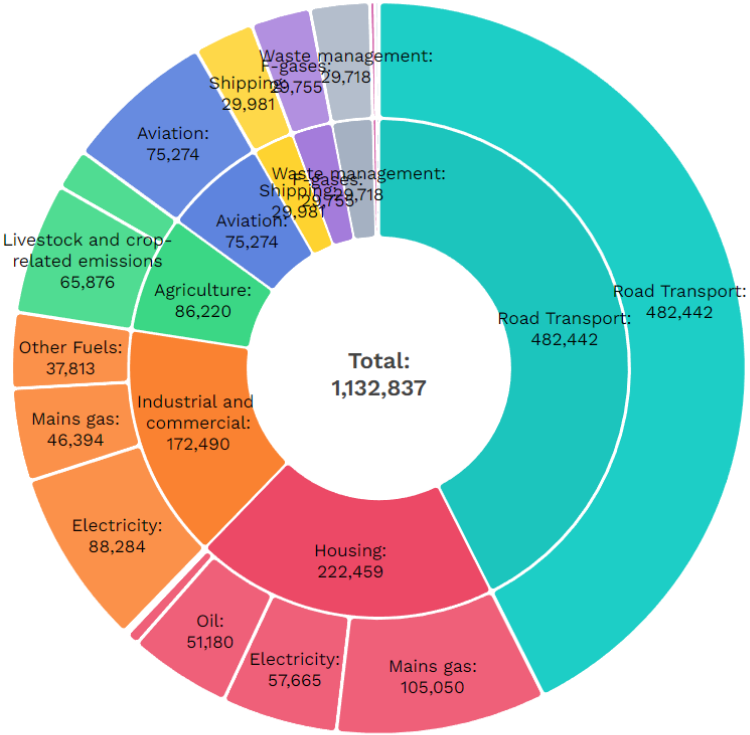
F-gases
Release of 'f-gases' into the atmosphere.

Waste management

Diesel fuelled railways

Other Transport

Agriculture
Emissions from livestock, crops and agricultural vehicles and machinery.



https://impact-tool.org.uk/

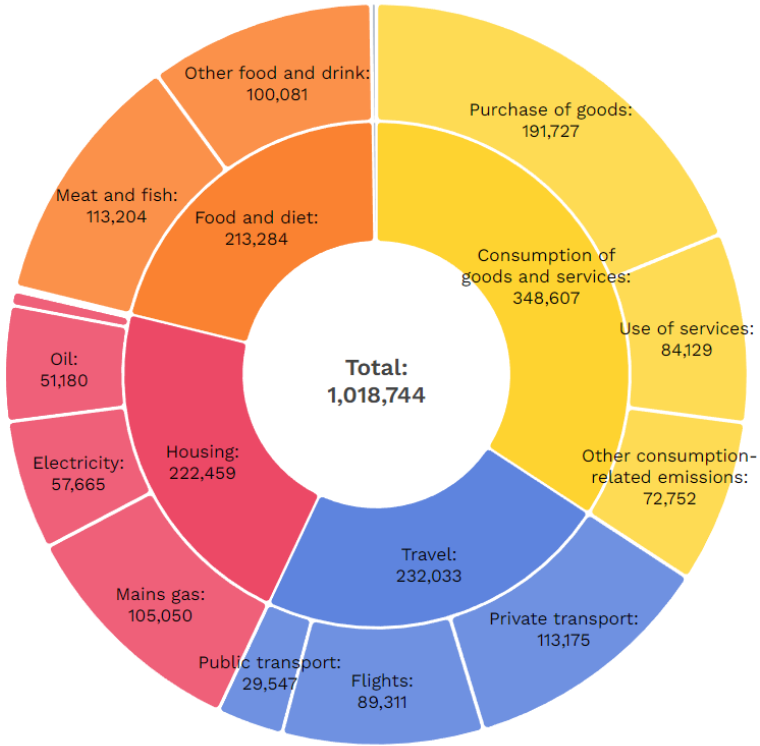
Housing
Emissions resulting from residents' use of energy in their homes.

Food and diet
Emissions resulting from the consumption of food and drink products by residents.

Travel
Emissions resulting from the transport choices & behaviours of residents.

Waste
Emissions resulting from the management of waste generated by residents.

Consumption of goods and services
Emissions resulting from the purchase of goods and the use of services by residents.



Goods – all household goods (not food), including homeware, toiletries, medicines, furnishings, electronic goods, appliances, & large items such as cars.

Services – use of services, including the maintenance and repair of home, vehicles and other equipment, banking and insurance, medical services, treatments, education costs, communications (e.g. TV, internet and phone contracts), and other fees and subscriptions.

Other – leisure, entertainment, sporting or social activities.

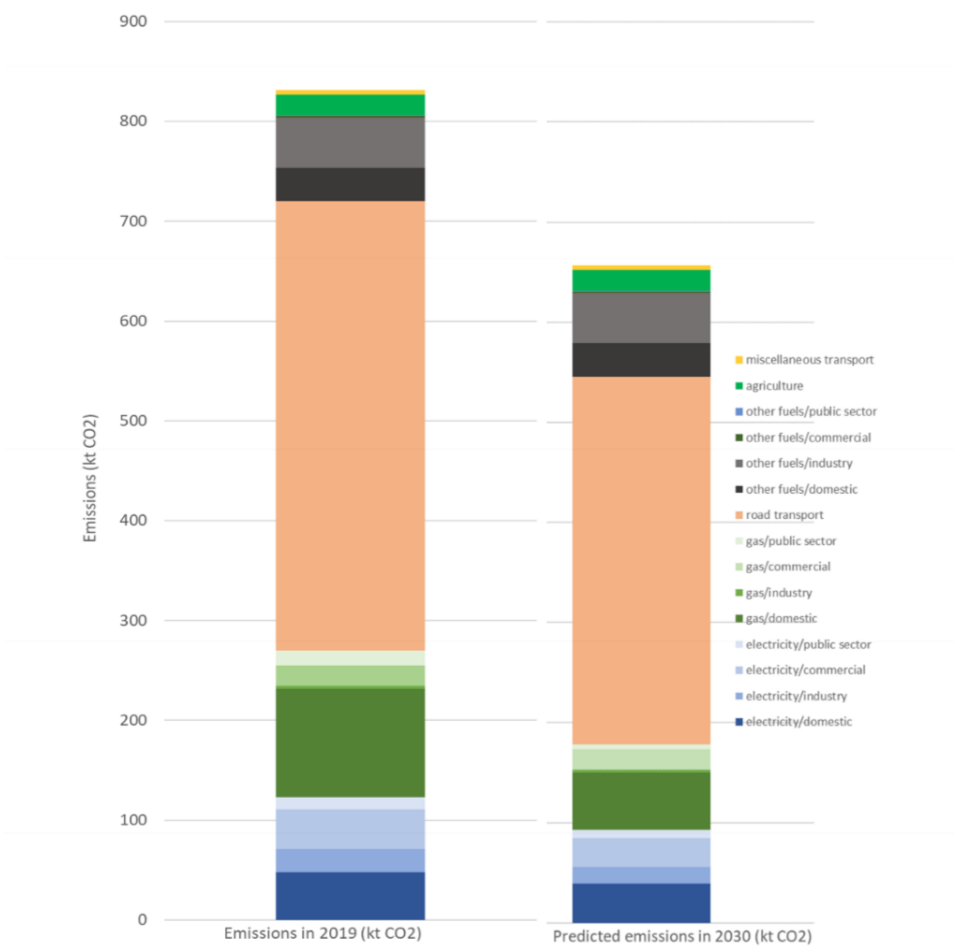
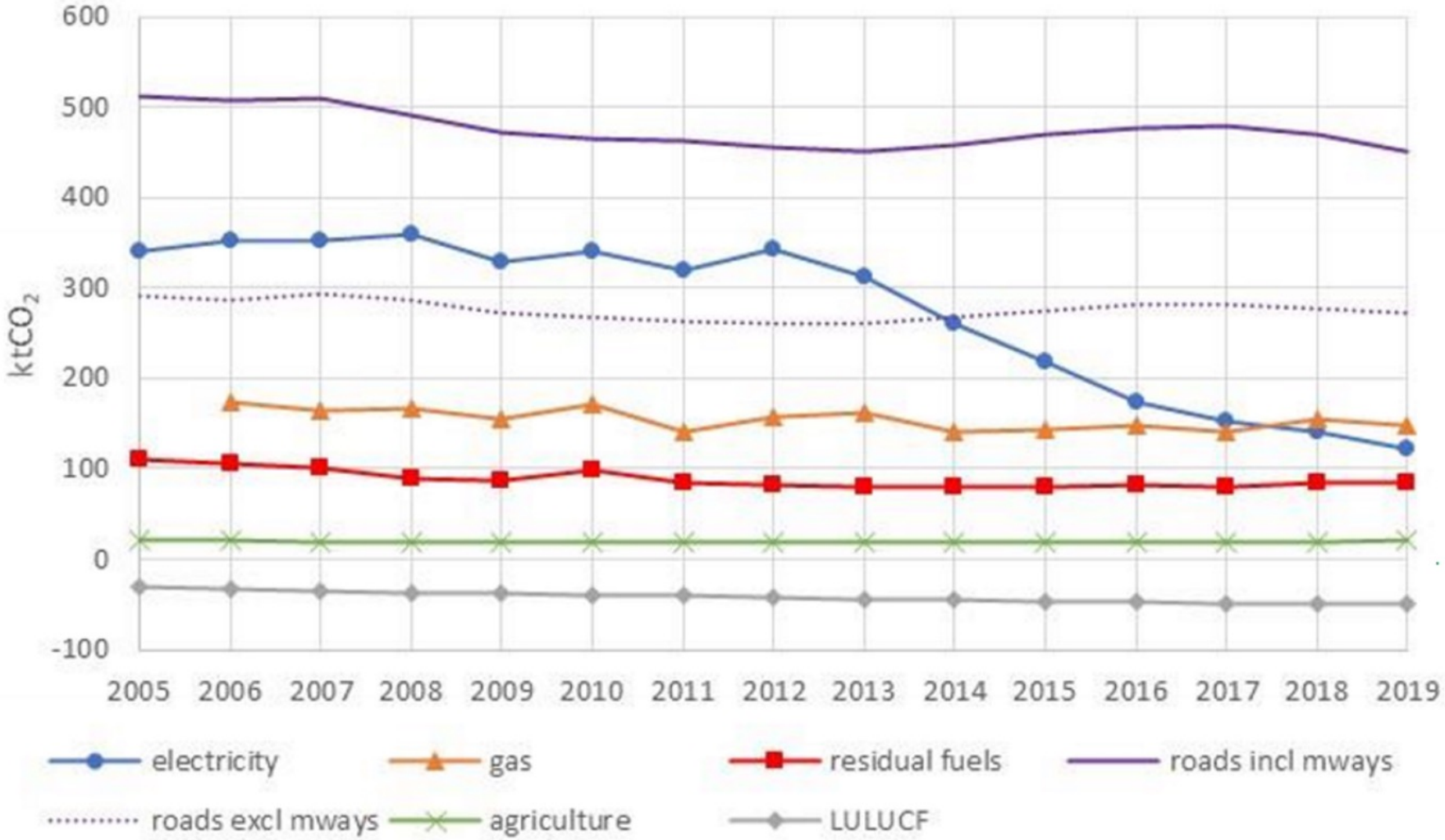
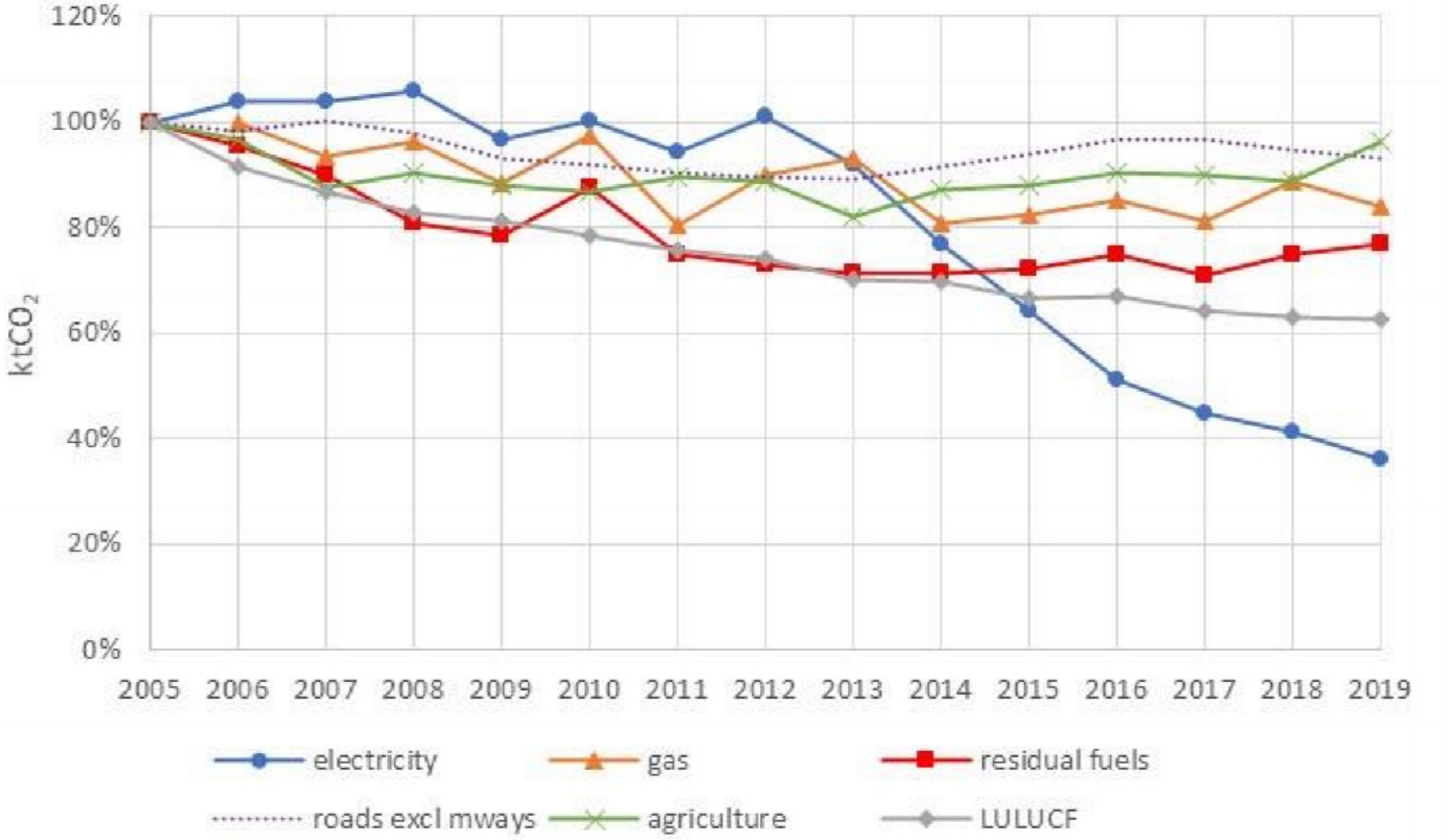
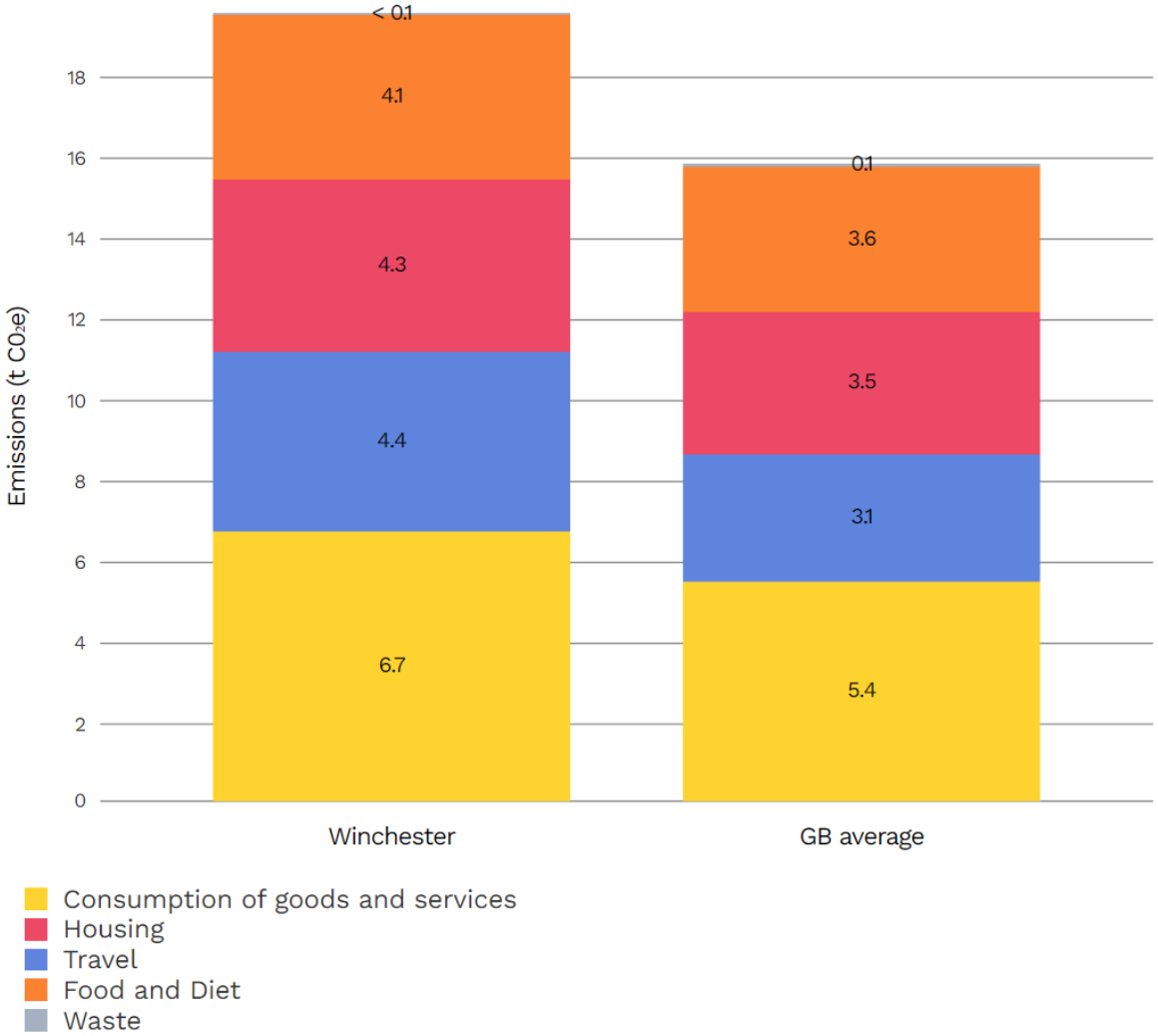


Figure 30. A graphical representation of possible emissions savings in BEIS sectors alone from quantified scenarios (excluding LULUCF changes and Unattributable emissions) by 2030.

https://www.winacc.org.uk/

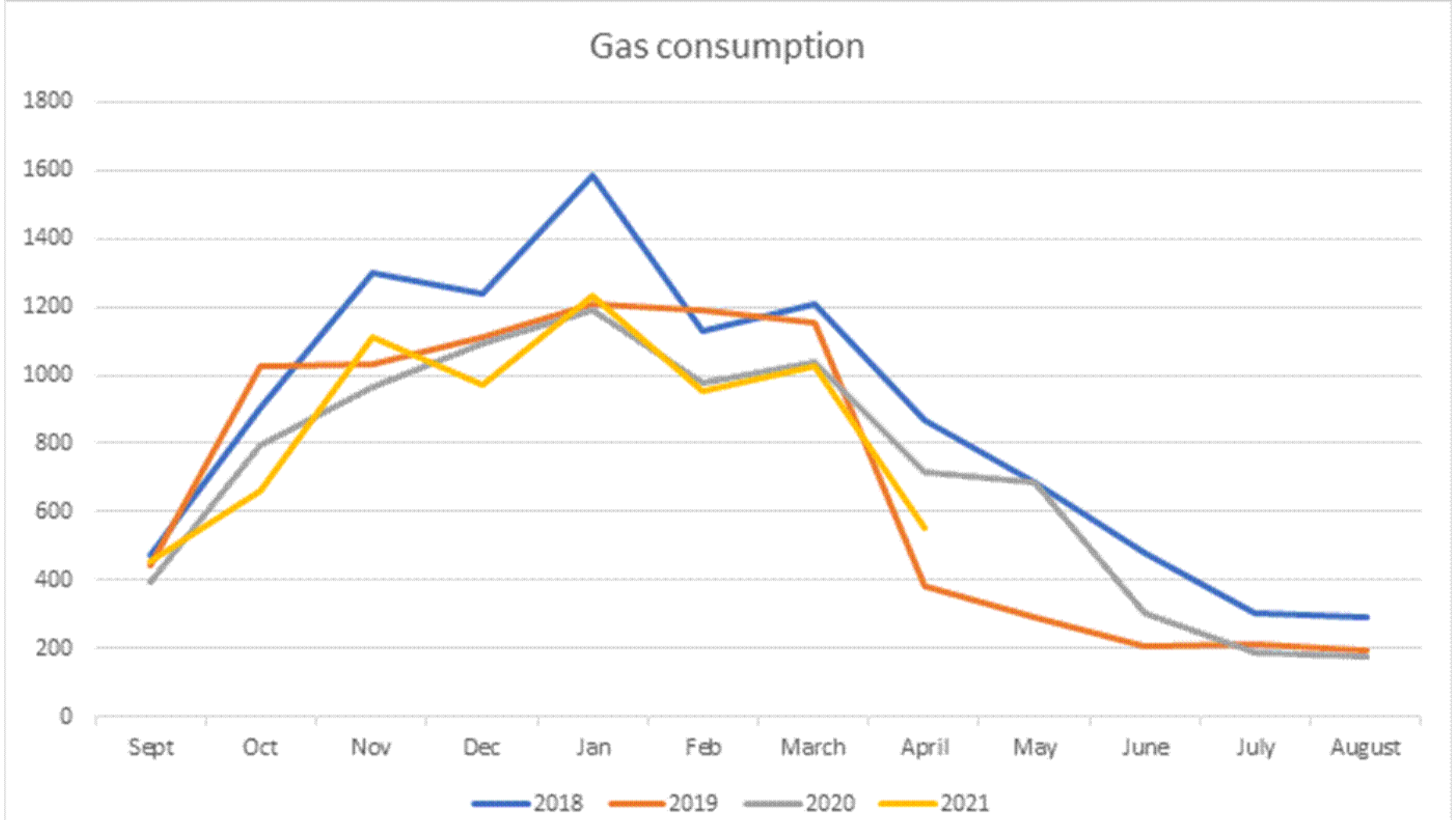

600
500
400
300
200
100
0
-100
ktCO2
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
electricity
gas
residual fuels
roads incl mways
roads excl mways
agriculture
LULUCF

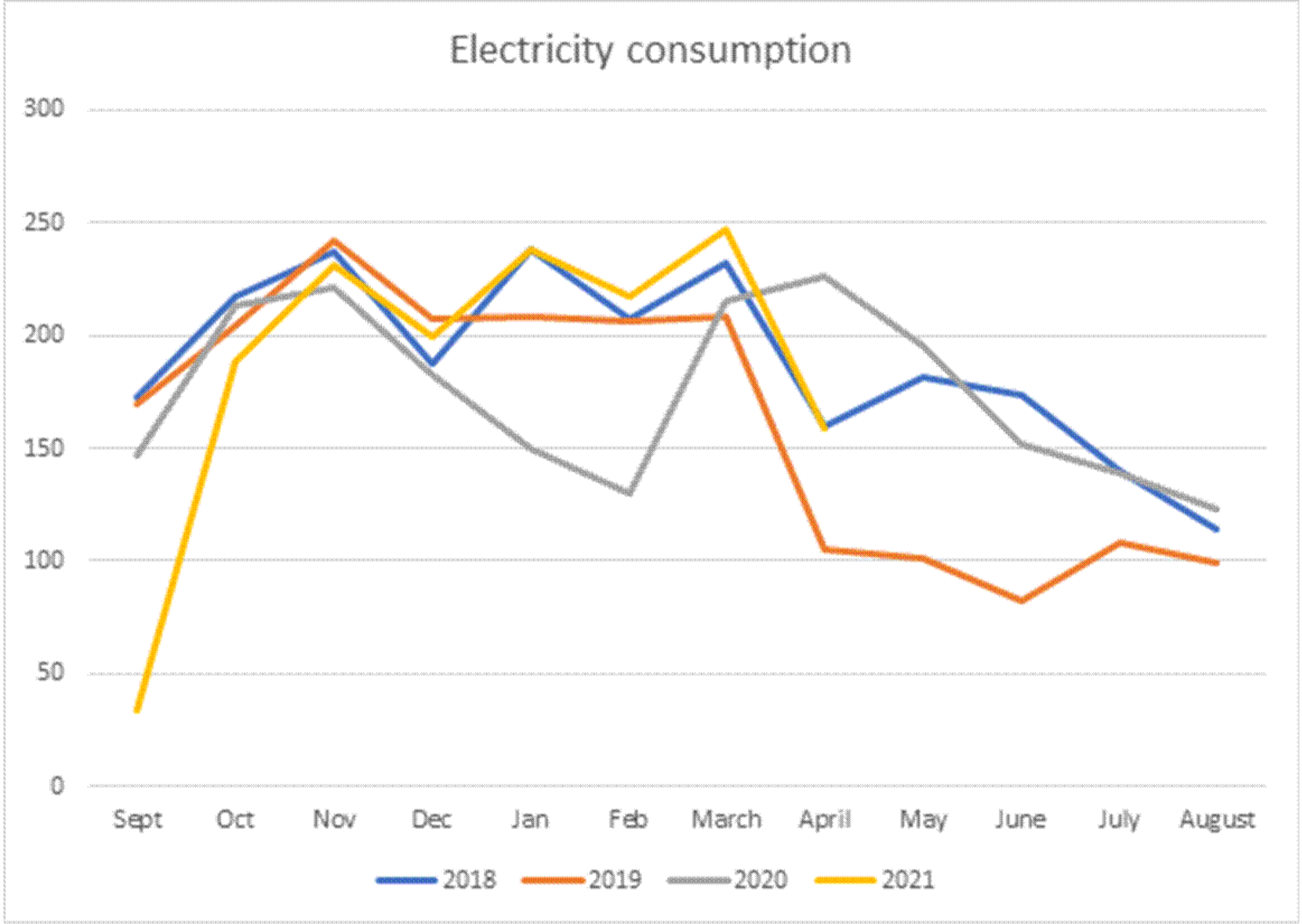

120%
100%
80%
60%
40%
20%
0%
ktCO2
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
electricity
gas
residual fuels
roads excl mways
agriculture
LULUCF


Emissions (t CO2e)
0
2
4
6
8
10
12
14
16
18
< 0.1
4.1
4.3
4.4
6.7
0.1
3.6
3.5
3.1
5.4
Winchester
GB average
Consumption of goods and services
Housing
Travel
Food and Diet
Waste

Summary of Winchester District's emissions

- Demand-side changes likely needed to reduce consumption emissions.
- Road transport by far the biggest section WCC could reduce.
- Emissions reductions from LULUCF steadily increasing.
- Housing emissions are high (need for improved energy efficiency).
- WCC cannot legislate for most important reductions, so will need help from UK Govt. to meet 2030 target.
- Read my article on WinACC's report! climatesoup.co.uk/20220523-winacc/


Gas consumption
1800
1600
1400
1200
1000
800
600
400
200
0
Sept
Oct
Nov
Dec
Jan
Feb
March
April
May
June
July
August
2018
2019
2020
2021


Electricity consumption
300
250
200
150
100
50
0
Sept
Oct
Nov
Dec
Jan
Feb
March
April
May
June
July
August
2018
2019
2020
2021

A few areas where the school is **currently** active:

- An advisory body to GoBo exists (ESAG) and meets termly.
- 60% of the investment portfolio has been moved into ESG screened or impact focused funds.
- ~50 Ha of ecologically sensitive land is maintained by the College within Winchester (Fallodon Reserve) with a further ~50 Ha leased to the Wildlife Trust and made publicly accessible (St. Catherine's Hill).
- Flint Court is heated by a biomass boiler.
- Emissions from energy have dropped ~25% (2430 to 2069 tonnes CO2eq) from 2019 to 2021 due to installation of better monitoring equipment and better management of areas not being used by pupils.
- Food waste is sent to an anaerobic digester.
- Student projects (Resilience, The Elizabeth Project) have been encouraged and actively supported.
- Areas of the campus grounds away from pitches have deliberately been dedicated to biodiversity enhancing management approaches.

https://climatesoup.co.uk/20220613-oil/

Summary of Wincoll’s emissions

- Better reporting expected soon.
- Lots of incentives to reduce energy consumption due to price increases.
- In 2021/2, Sept-April, 20% reduction in gas vs. 2018/9 Sept-April.
- In same time period, 8% reduction in electricity consumption.
- Wincoll pupils emit between 165%-210% of the average Brit’s emissions from food during term time.
- More progress probably needed to line up with WCC’s 2030 net zero goal.

- Welcome to sust soc I guess?!
  (hopefully there are some new people here; I'm writing this in the summer holidays so I've no idea)
- Take a look at Our World in Data

- How Sust soc works!
  Use Sust soc to get help or get started with any kind of environmental thing you'd like to do.
  There is a plan for the term, but it can change to facilitate new stuff.
  If there's something we're not doing that we should be, or something we could do better, talk to us or do it yourself!