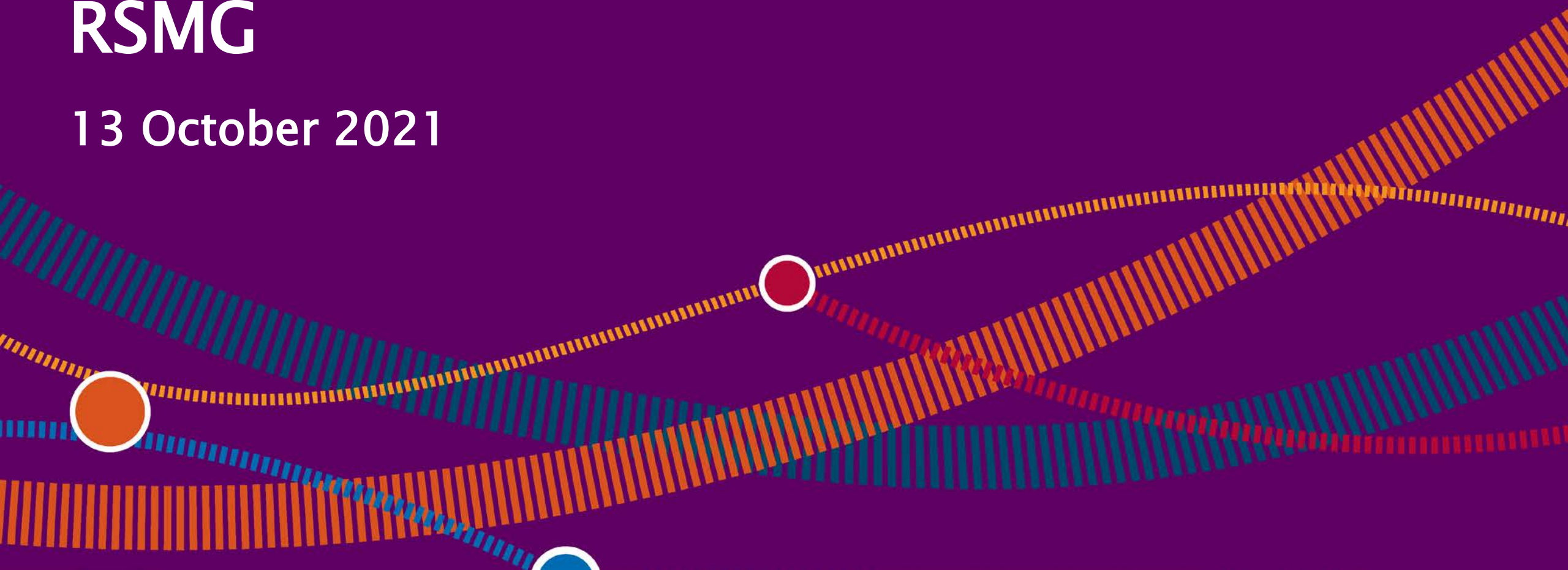


RSMG

13 October 2021



Rail emissions statistics

Lucy Charlton, Office of Rail and Road



What does this release cover?

<https://dataportal.orr.gov.uk/statistics/infrastructure-and-emissions/rail-emissions/>

Annual energy consumption for passenger and freight operators: traction electricity and diesel usage for financial year

The consumption figures are converted to carbon dioxide equivalent CO₂e emissions using industry standard emission factors

Emissions are normalised by passenger km and freight tonne km

We receive data from passenger operators and most freight operators and publish one aggregate passenger measure, and one freight measure

Do not include heritage/tram/London Underground but does include Eurostar usage in GB



Rail Emissions 2020-21

19 August 2021



Background:
This annual statistical release contains information on rail emissions for passenger and freight trains in Great Britain.

Energy consumption of electricity and diesel, and estimates of total and normalised CO₂e emissions from traction energy. Non-traction emissions are not included.

Passenger train data have been normalised to show the average CO₂e emissions per passenger kilometre. Freight train data have been normalised to show the average CO₂e emissions per net tonne kilometre of freight moved.

Source: Passenger and freight operators

Latest year: 2020-21 (April 2020 to March 2021)

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Freight train emissions – p5
Transport emissions in context – p7
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August 2022

Total traction electricity consumption in 2020-21 fell to 3,733 million kilowatt hours (kWh), a decrease of 12% compared with 2019-20. Total traction diesel consumption fell to 507 million litres, a decrease of 22%.

The falls in energy consumption led to a reduction in estimated carbon dioxide equivalent (CO₂e) emissions, with a combined total from electricity and diesel of 2,282 kilotonnes. **This is the lowest emissions level since the start of the comparable time series in 2010-11.**



Passenger train emissions

Electricity consumption for passenger trains decreased by 12%, and diesel consumption decreased by 26% compared with 2019-20. Emissions from electricity and diesel combined were 1,845 kilotonnes, a decrease of 23%.

Due to the effects of the pandemic, passenger kilometres fell by 81% and trains planned fell by 22% compared with 2019-20. As a result, estimated normalised CO₂e emissions increased by 316% from 35.2g to **146.5g CO₂e per passenger kilometre.**

Freight train emissions

In 2020-21 freight train diesel consumption fell by 11% to 153 million litres. Traction electricity consumption decreased 9% to 64 million kWh, compared with 2019-20.

Freight rail usage was affected by the coronavirus pandemic, but there were smaller falls in energy consumption compared to passenger trains. Estimated normalised CO₂e emissions was **26.5g CO₂e per tonne kilometre**, a decrease of 4% from 27.5g CO₂e per tonne kilometre in 2019-20.

All data tables and a quality and methodology report associated with this release are published on the [rail emissions page](#) of the ORR data portal. Key definitions are in annex 1 of this release.

Key headlines for 2020–21

- Total traction electricity consumption in 2020–21 fell to 3,733 million kilowatt hours (kWh), a decrease of 12% compared with 2019–20. Total traction diesel consumption fell to 507 million litres, a decrease of 22%.
- The falls in energy consumption led to a reduction in estimated carbon dioxide equivalent (CO₂e) emissions, with a combined total from electricity and diesel of 2,282 kilotonnes. This is the lowest emissions level since the start of the comparable time series in 2010–11. Emissions are at lowest level since the start of the comparable time series in 2010–11.

Figure 1.3 CO₂e emissions from passenger trains traction electricity and diesel consumption, Great Britain, 2011-12 to 2020-21

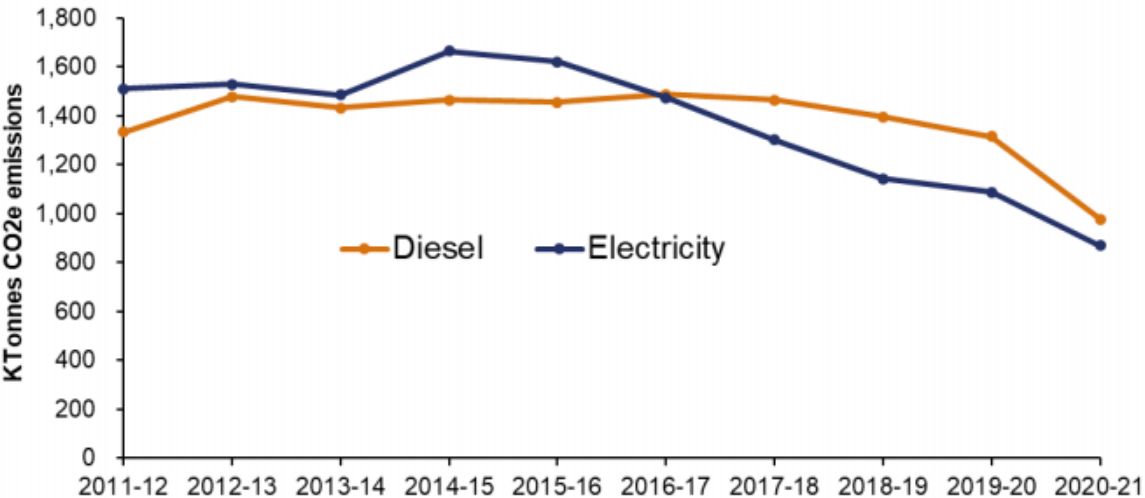
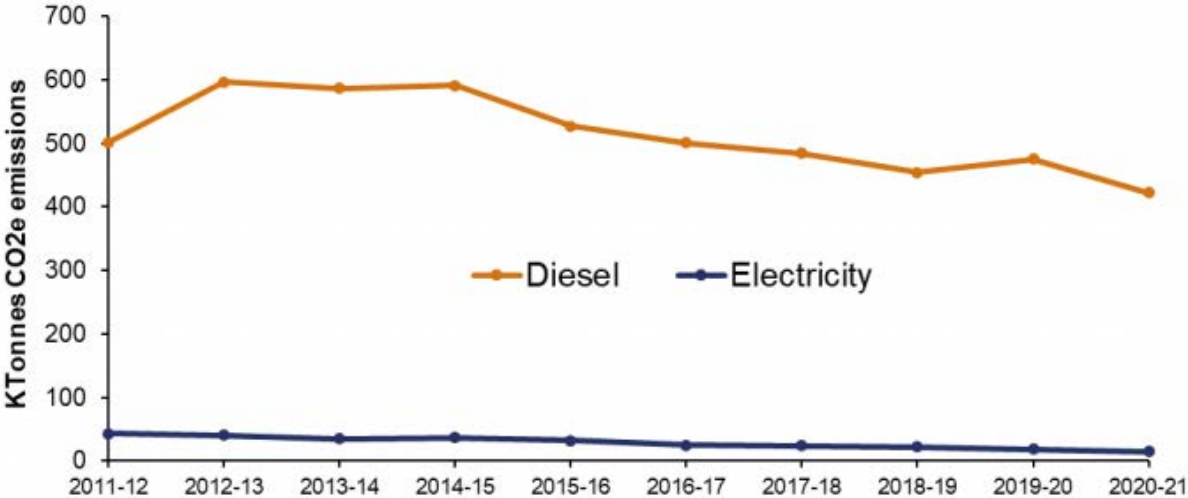
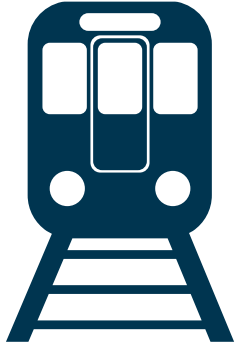


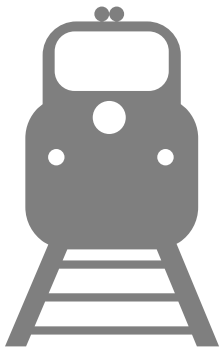
Figure 2.3 CO₂e emissions from diesel and electricity freight train traction consumption, Great Britain, 2011-12 to 2020-21



Key headlines for passenger and freight



- Diesel use by passenger trains fell in the last year to 354 million litres, which resulted in 977 kilotonnes of CO₂e emissions in 2020–21 – a **reduction of 26% on the previous year.**
- Electricity consumption for passenger trains decreased by 12%, and diesel consumption decreased by 26% compared with 2019–20. As a result, **passenger emissions fell 23% to 1,845 kilotonnes.**
- Due to the coronavirus pandemic and a reduction in passenger kilometres, CO₂e emissions for passenger trains have increased by 316% from 35.2g to 146.5g CO₂e per passenger km.



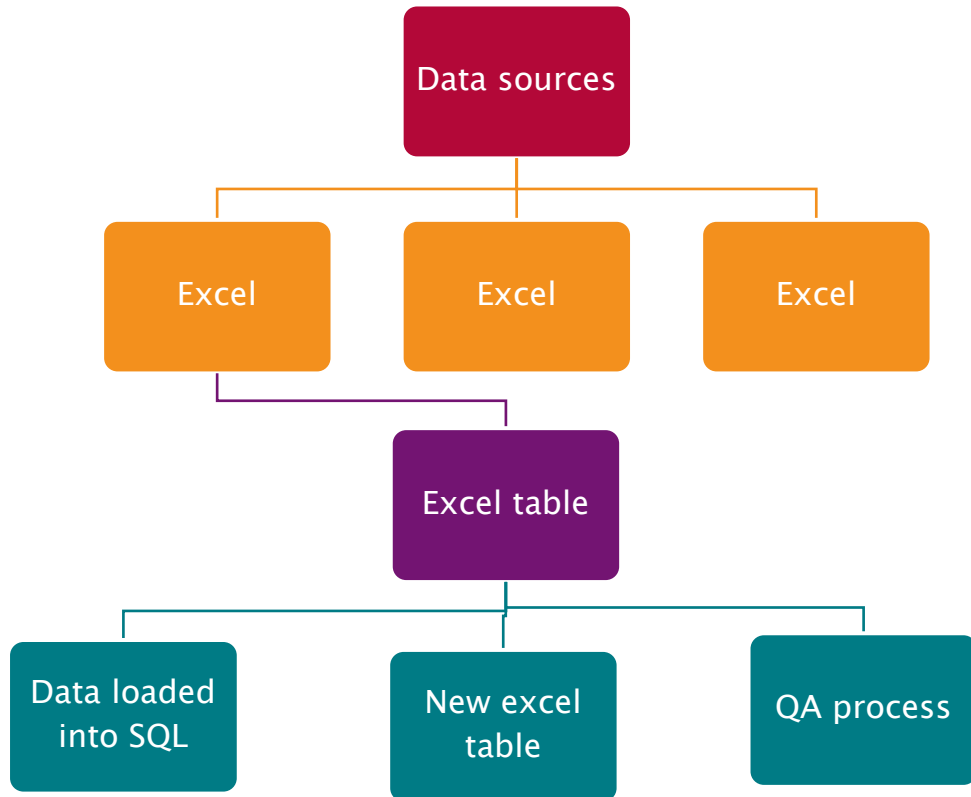
- Freight rail usage was affected by the coronavirus pandemic, but there were smaller falls in energy consumption compared to passenger trains
- Electricity consumption for freight trains decreased by 9%, and diesel consumption decreased by 11% compared with 2019–20. As a result, **freight emissions fell 11% to 437 kilotonnes.**

| Measure | 2019–20 | 2020–21 | Comparison with 2019–20 |
|---|---------|---------|-------------------------|
| Electricity consumption (million kWh) | 4,189 | 3,669 | -12% |
| Diesel consumption (million litres) | 476 | 354 | -26% |
| Electricity emissions (Ktonnes CO ₂ e) | 1,087 | 868 | -20% |
| Diesel emissions (Ktonnes CO ₂ e) | 1,313 | 977 | -26% |
| Trains planned (million) | 7.79 | 6.11 | -22% |
| Train kilometres (million) | 550.8 | 416.1 | -24% |
| Passenger kilometres (billion) | 66.8 | 12.5 | -81% |
| g/CO ₂ e per passenger kilometre | 35.2 | 146.5 | +316% |

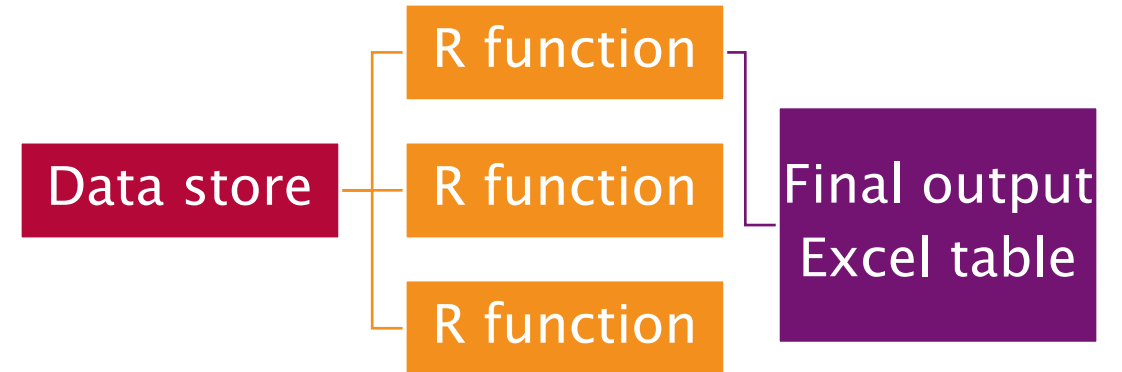
| Measure | 2019–20 | 2020–21 | Comparison with 2019–20 |
|---|---------|---------|-------------------------|
| Electricity consumption (million kWh) | 70 | 64 | -9% |
| Diesel consumption (million litres) | 172 | 153 | -11% |
| Electricity emissions (Ktonnes CO ₂ e) | 18 | 15 | -17% |
| Diesel emissions (Ktonnes CO ₂ e) | 977 | 422 | -11% |
| Trains ran | 209,475 | 189,371 | -10% |
| Freight train kilometres (million) | 33.2 | 29.9 | -10% |
| Freight net tonne kilometres (billion) | 16.6 | 15.2 | -9% |
| g/CO ₂ e per freight net tonne kilometre | 27.5 | 26.5 | -4% |

How did we improve analysis process?

Old process : Manual pasting of data from different tables. When data changes, have to redo analysis. Prone to error and many steps. Manual tasks carried out by highly skilled people.



Automated process: write R and SQL code to automate analysis so no manual filtering or updating. Figures update automatically so no need to copy numbers from Excel. Means more time to write report and carry out analysis.



Transport emissions in context

Using BEIS data (which is partly based on ORR data) rail emissions made up 0.4% of all UK CO₂e emissions in 2019

Rail made up 1.4% of the UK's transport CO₂e emissions in 2019, but 9.5% of all passenger kilometres.

Figure 3.1 Proportion of greenhouse gas emissions by sector, UK, 2019



Who else uses the data?

BEIS – report on UK’s total greenhouse gas emissions and send data to United Nations

Defra – calculate air quality and emissions of air pollutants

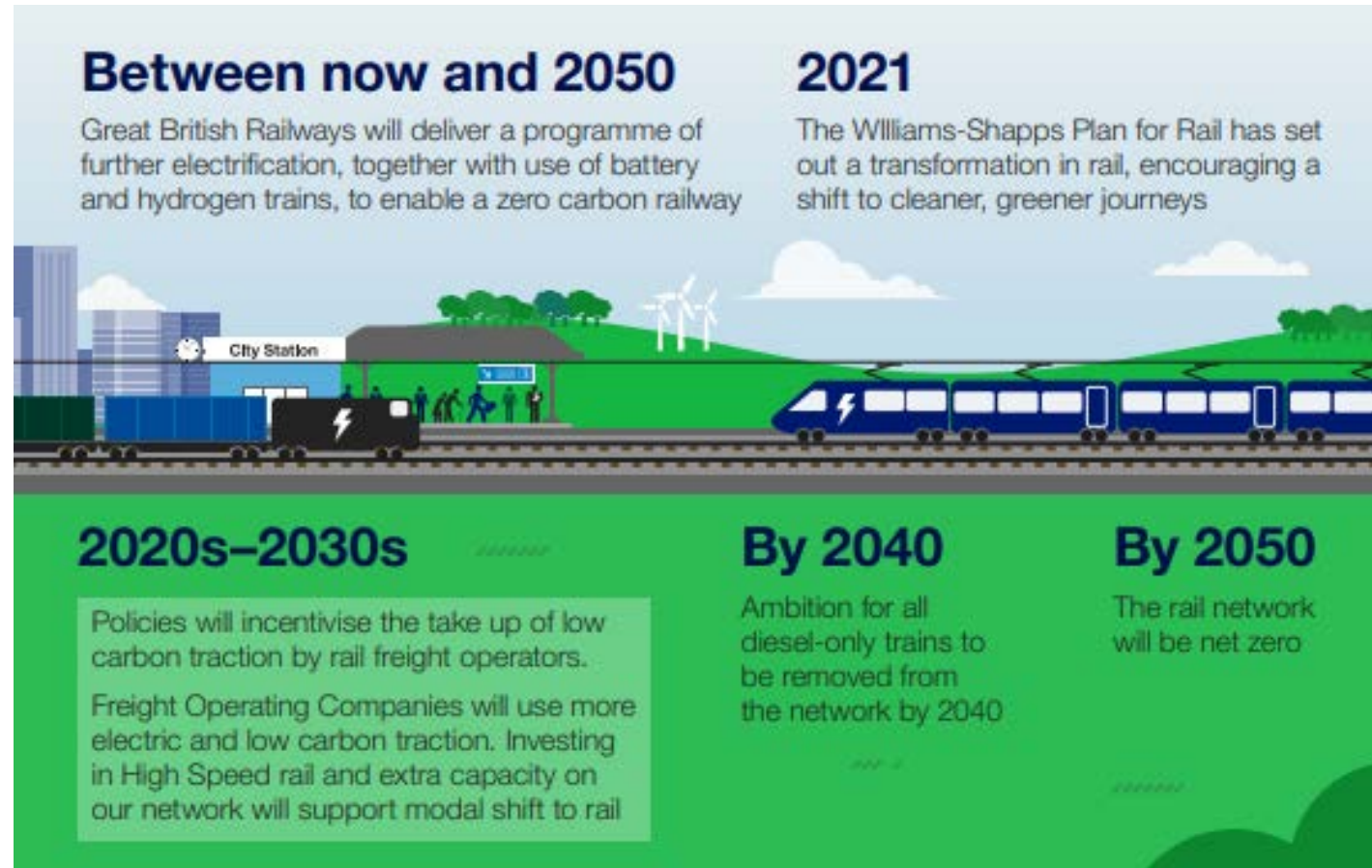
National Atmospheric Emissions Inventory (NAEI) – model emissions to produce rail emissions for England, Scotland, Wales and Northern Ireland

DfT – use data for Rail Emissions Modelling and [cross modal comparison](#) to compare emissions for different journeys (by rail, electric car, diesel car, coach etc)

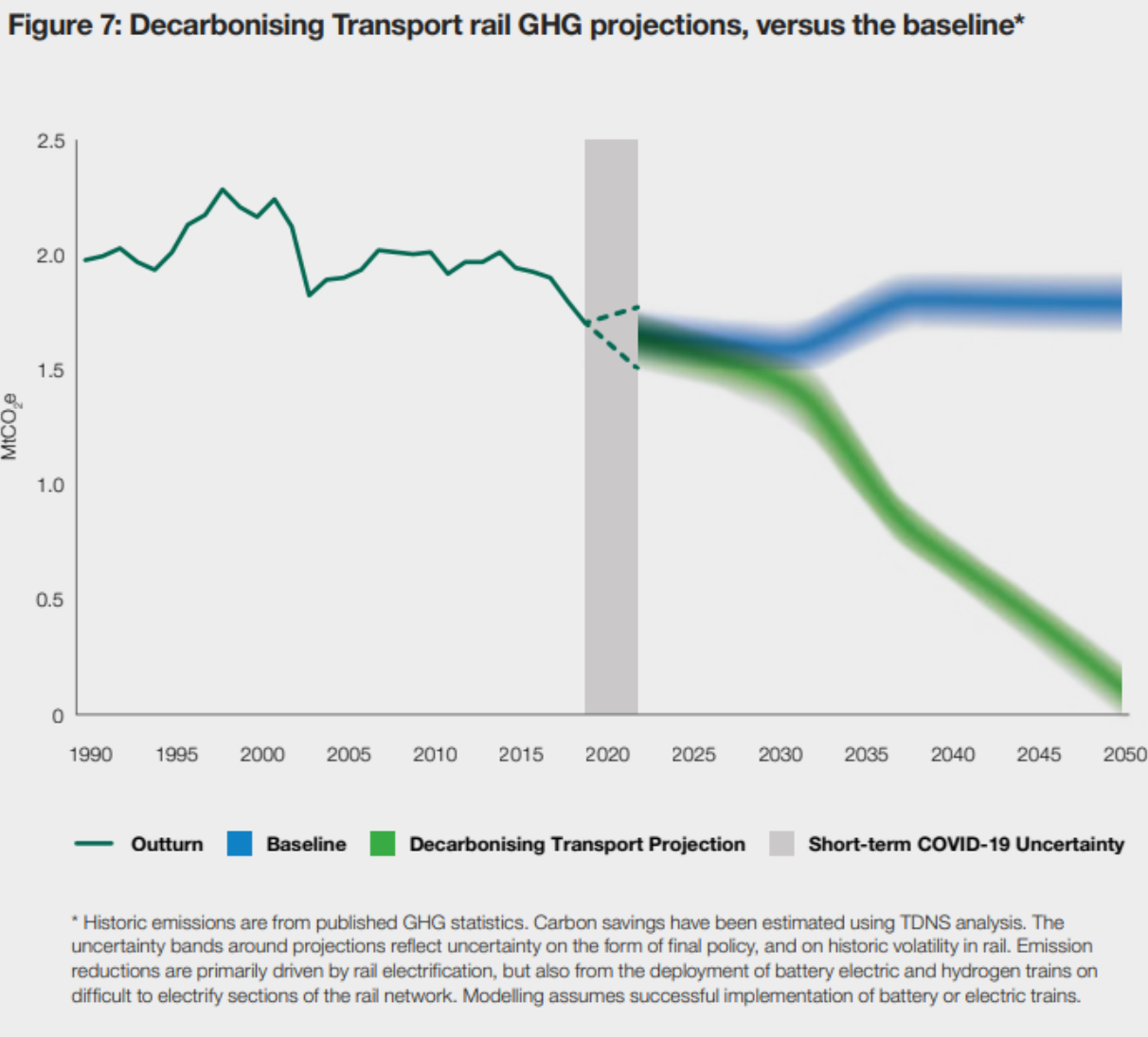
Net zero targets

The government has a legally binding Sixth Carbon Budget which aims to reduce all emissions by 78% by 2035 compared to 1990 levels, and reach net zero UK carbon emissions by 2050.

Scotland have emissions reduction targets set in law to reach net-zero greenhouse gas emissions by 2045.



DfT projections for GHG emissions from rail



Plans for future

Environment challenges continue to grow in importance and impact

Also need to consider sustainability– biodiversity loss, air quality, unsustainable resource use

Threat to rail and road networks– such as flooding

Launched consultation on ORR’s guidance for Environmental Arrangement for Railway Licence Holders

ORR is keen to improve availability and disaggregation of environmental data for rail

Will also bring together different data sources as already various data requirements for industry

Closes 9 November

<https://www.orr.gov.uk/search-consultations/consultation-developing-orr-approach-environment-and-sustainable-development>

Train Operating Company (TOC) Key Statistics 2020–21: Automation

Muhammad Ali Hashir, Office of Rail and Road

The background features a dark red color with several wavy, horizontal lines in a lighter shade of red. These lines are composed of fine, parallel vertical stripes. Three white circles are scattered across the lower half of the image, partially overlapping the wavy lines.

Automation of TOC key stats factsheets – benefits

2019–20

1. Published pdf files (fact sheets) extracted from power BI dashboard
2. No alternative text
3. Manual process

2020–21

1. Legal requirement: Introducing dynamic alternative text
2. Automating fact sheets in word format
3. Saving time and reducing errors

Process of using Reproducible Analytical Pipelines (RAPs)

Reproducible Analytical Pipelines (RAPs) are automated statistical and analytical processes. They incorporate elements of software engineering best practice to ensure that the pipelines are reproducible, auditable, efficient, and high quality.

Process of using RAPs for TOC Key Stats factsheets:

1. Focused on chunks of the reports and produced these at the start. For example: Graphs, paragraphs, hyperlinks, colour themes
2. Used R Markdown to get output in word format
3. Introduced parameters and variables
4. Used a reference file for formatting
5. Defined every metric value for each year and glued it with the graph as caption
6. Made a base template manually with heading page, footers, page layout settings etc. and inserted (copy/paste) output file from R Markdown into the base template
7. Adjusted some issues manually such as removing warnings, extra spaces and section settings etc.