

High Speed Rail (Crewe – Manchester)

Supplementary Environmental Statement 2 and Additional Provision 2 Environmental Statement

Volume 5: Appendix CL-003-00000

Climate change

Summary greenhouse gas calculation inputs and outputs

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Department for Transport

High Speed Two (HS2) Limited has been tasked by the Department for Transport (DfT) with managing the delivery of a new national high speed rail network. It is a non-departmental public body wholly owned by the DfT.

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1 Introduction

1.1 Structure of this appendix

- 1.1.1 This report is an appendix to the climate change assessment and forms part of Volume 5 of the Supplementary Environmental Statement 2 (SES2) and Additional Provision 2 Environmental Statement (AP2 ES).
- 1.1.2 This appendix provides an update to the greenhouse gas (GHG) assessment since the production of the High Speed Two (HS2) High Speed Rail (Crewe – Manchester) Environmental Statement (ES) published in 2022¹ (the main ES) and the Supplementary Environmental Statement 1 (SES1) and Additional Provision 1 Environmental Statement (AP1 ES) also published in 2022².
- 1.1.3 This appendix should be read in conjunction with SES2 and AP2 ES Volume 3, Route-wide effects, as well as the main ES and the SES1 and AP1 ES (see the respective Volume 5, Appendices: CL-003-00000 of the main ES, and SES1 and AP1 ES).
- 1.1.4 In order to differentiate between the original scheme and the subsequent changes, the following terms are used:
- ‘the original scheme’ – the Bill scheme submitted to Parliament in 2022, which was assessed in the main ES;
 - ‘the SES1 scheme’ – the original scheme with any changes described in SES1 that are within the existing powers of the Bill;
 - ‘the AP1 revised scheme’ – the original scheme as amended by SES1 changes and AP1 amendments;
 - ‘the SES2 scheme’ – the original scheme with any changes described in SES1 (submitted in July 2022) and the SES2; and
 - ‘the AP2 revised scheme’ – the original scheme as amended by SES1 and SES2 changes (as relevant) and AP2 amendments.
- 1.1.5 This report presents a more detailed breakdown of the GHG assessment of the AP2 revised scheme reported in the SES2 and AP2 ES Volume 3, Route-wide effects. The GHG impact of the AP2 revised scheme (i.e. SES2 changes and the AP2 amendments) compared to the AP1 revised scheme are reported together at a route-wide level in Section 2 below. This is because all GHG emissions, irrespective of their source, contribute to climate change. It is

¹ High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement*. Available online at: <https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement>.

² High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement*. Available online at: <https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-supplementary-environmental-statement-1-and-additional-provision-1-environmental-statement>.

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our professional judgment that reporting GHG emissions for SES2 changes and AP2 amendments separately would not make any discernible difference to the effects reported in SES2 and AP2 ES Volume 3, Route-wide effects.

2 Revised carbon footprint

2.1 Revised sources and assumptions

2.1.1 The GHG assessment includes emissions associated with electricity consumption throughout HS2's 120-year design life (particularly for the rolling stock operation). In 2021 the Department for Business, Energy and Industrial Strategy (BEIS) updated its Green Book guidance³ which helps evaluate energy usage and report on GHG emissions on projects. In this latest iteration of the guidance BEIS has updated its methodology and UK grid electricity GHG projections (gCO_{2e} per kWh) to reflect:

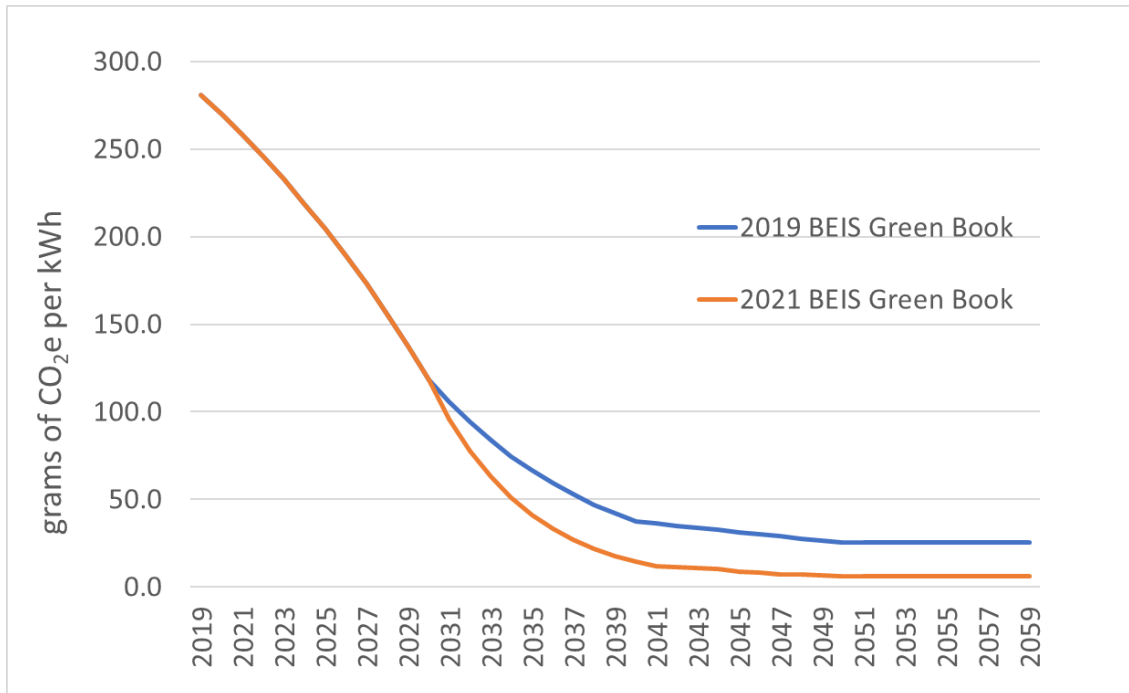
- changes in international targets: the UK signed the Paris Agreement in 2016 setting more ambitious goals to keep global temperature rise below pre-industrial levels;
- changes in domestic target: in June 2019 the UK adopted in law the recommendations of the Climate Change Committee, to achieve net zero GHG emissions by 2050 (compared to the previous target of an 80% reduction by 2050 on 1990 level);
- EU exit: the UK has left the EU Emissions Trading System (EU ETS) and from January 2021 introduced a UK Emissions Trading System (UK ETS); and
- new understanding of technology costs and availability: some of the key technologies for decarbonisation such as renewable power generation and batteries have seen larger than predicted price reductions over the last 10 years which should reduce abatement costs in relevant sectors.

2.1.2 The above updates have resulted in a material change in the GHG intensity and decarbonization projection of the UK grid (see Figure 1). Both the original scheme presented in the main ES and the AP1 revised scheme presented in the SES1 and AP1 ES assumed GHG UK grid intensity factor of 47gCO_{2e}/kWh in 2038 (proposed opening year) and 25gCO_{2e}/kWh in 2050. With the updated Green Book projections, the grid intensity factors used in the AP2 revised scheme are 18gCO_{2e}/kWh in 2039 (the latest proposed opening year) and 6gCO_{2e}/kWh in 2050.

2.1.3 The need for a correction to the contents of the SES1 and AP1 ES has been identified. There is a correction to the land use change assessment reported in Volume 3 of the SES1 and AP1 ES. The correction is reported in Section 4 of the SES2 and AP2 ES Volume 3, Route-wide effects and set out in the report: Corrections to Volume 5 of the January 2022 Environmental Statement and the July 2022 Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement, see SES2 and AP2 ES Volume 5, Appendix: CT-009-00000.

³ Department for Business, Energy and Industrial Strategy (2021), *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal*. Available online at: <https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal>.

Figure 1: BEIS Green Book UK grid electricity GHG intensity projections



The GHG UK grid projections in Figure 1 represent 'long-run marginal' generation-based electricity.

2.2 Overall results

Table 1 presents the GHG assessment of the AP2 revised scheme. Table 1 covers construction emissions ('Before use stage'), operational emissions ('Use stage') and modal shift impacts ('Benefits and loads associated with modal shift') covering the period between 2039 (proposed opening year) and 2050.

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Life cycle stage	Module	Description	AP1 revised scheme GHG emissions (tCO ₂ e)	AP2 revised scheme GHG emissions (tCO ₂ e)	Difference between the AP1 revised scheme and AP2 revised scheme GHG emissions (tCO ₂ e)
Before use stage	A1-A3	Product manufacturing	2,242,711	2,495,140	252,430
	A4	Transport of construction material to work site	167,235	188,602	21,367
	A5	Construction/installation process	1,548,149	2,074,512	526,362
Use stage	B1	Carbon sequestration from tree planting and wetland and grassland creation	-20,440	-13,684	6,756
	B2-B3	Repair and maintenance of infrastructure and rolling stock	11,307	10,005	- 1,302
	B4	Replacement of infrastructure and rolling stock	4,089	4,512	423
	B6	Operation of infrastructure	18,909	5,391	-13,518
	B7	Water use in infrastructure	319	293	-27
	B9	Operation of rolling stock	179,468	49,881	-129,587
Benefits and loads associated with mode shift	D	Conventional rail passengers	-6,160	3,303	9,463
		Car passengers	-206,798	-62,964	143,834
		Surface access journeys to access HS2	51,407	7,901	-43,506
		Freight	-199,038	0	199,038
		Aviation	-257,801	-10,024	247,777

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